# RECORD LINKAGE OF CENSUS AND MORTALITY 2001-06 RECORDS: UNLOCK RATIOS 2004-06, AND LINKAGE WEIGHTS 2001-06.

## New Zealand Census-Mortality Study Technical Report No.7.

**Lavinia Tan**
**Tony Blakely**
**June Atkinson**

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## Statistics New Zealand Security Statement

The New Zealand Census-Mortality Study was initiated by Professor Tony Blakely and his co-researchers from the University of Otago, Wellington. It was approved by the Government Statistician as a Data Laboratory project under the Microdata Access Protocols. All research publications are based on researcher initiated ideas.

Access to the data used in this study was provided by Statistics New Zealand under conditions designed to give effect to the security and confidentiality provisions of the Statistics Act 1975. The results presented in this study are the work of the author, not Statistics New Zealand

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# Introduction

This report outlines the process of linking mortality records from the years 2004 to 2006 to the 2001 Census data and updates the existing three-year follow-up period to five years.

The objectives of this report are to:
1. Describe the calculation of 'linkage weights' to adjust for linkage bias in the 2004-2006 and, retrospectively, the 2001-2004 cohorts in the New Zealand Census-Mortality Study, particularly focussing on any variation from the 2001-2004 method (Fawcett et al., 2008)
2. Describe any particularities for the updated 2001-06 linkage with respect to the calculation of mortality rates by ethnicity and income.
3. Describe the calculation of, and present, 'unlock ratios' to adjust for the undercounting of Maori and Pacific deaths in the NZ mortality records for the years 2004-2006 and 2001-2004.
4. Describe any particularities for the 2004-2006 linkage, including revised variable formats.

Data and analyses from this report contribute to the existing literature on linkage bias and the numerator-denominator bias in New Zealand census and mortality records. Previous technical documentation include Blakely, Salmond and Woodward (1999); Blakely and Atkinson (2001); Hill, Atkinson and Blakely (2002); Ajwani, Blakely, Robson, Atkinson, Fawcett and Kiro, C (2002); Fawcett, Blakely and Atkinson (2002); Ajwani, Blakely, Robson, Tobias and Bonne (2003); Fawcett, Atkinson, Herd and Blakely (2008). All reports are available at the website:
http://www.uow.otago.ac.nz/academic/dph/research/HIRP/nzcms/nzcmspubs.html

This report also aims to address the problems with the linkage weights for the 2001-2004 linkage; the secondary adjusted linkage weights (W_AgEthAdj) calculated for these years are less, rather than more, accurate estimates of the total number of eligible mortality records than the primary (W_Base) weights (see Table 9, Fawcett et al. 2008).

# Linkage Bias

Linkage bias occurs when the likelihood of a mortality record being linked to a census record is dependent on certain factors such as the age, ethnicity, and socio-economic status of the individual.

Previous studies have found incomplete linkage between census and mortality files. This incomplete linkage leads to the misclassification of some members of the census cohorts as not dead when they have died. When mortality and census records are stratified by sociodemographic variables, (e.g. age, sex ethnicity, NZ Deprivation) geographic distribution (rurality, RHA/DHB) and time since census, the proportion of mortality records that are linked vary by strata. This strata-dependent incomplete linkage can result in the bias of subsequent mortality rate-ratio calculations, as well as a general underestimation of rate differences.

To compensate for linkage bias, it is necessary to calculate weights that adjust for the misclassification of mortality outcome. Linkage weights were calculated using the bias dataset. The bias dataset contained the merged mortality records from 2001-2004 and 2004-2006, and included the variables:
- Sex
- Age at census
  Note that age was capped at 97 years for the 2001 dataset so it was consistent with the 2004 dataset.
- Ethnicity
  The ethnicity variable was derived according to the prioritised ethnicity grouping– Maori, Pacific, Asian, and NonMaoriNonPacificNonAsian (nonMPA). Prioritised ethnicity was used for the following analyses.
- Rurality
- NZ Deprivation Index
- Social fragmentation index
- Level of mobility in area (% of area unit residents that had moved since the 2001 census)
- Cause of death (International Cause of Death, ICD)
- A flag variable indicating whether the mortality record was linked to a census record.
- Regional/geographical variables
  In this report, territorial local authorities (TAs) were used as a geographical variable, whereas in previous years either district health board (DHB) or regional health authority (RHA) were used.
  In linkage for years 1981-84 to 1996-99, TAs were used for data examination but not for weighting. Fawcett et al. (2002) noted that none of the weights produced consistently good agreement between weighted linked deaths and actual deaths for RHA and TLA, and suggested new adjusted weightings were necessary using strata derived with geographic variables.
  The main rationale for using TAs as direct adjustment factors for linkage bias was the decrease in classification bias and increase in

validity provided by the greater geographic "resolution" of the TA variable relative to DHB or RHA; this is confirmed by the analyses revealing TA as a discriminating predictor of linkage (described below).

A summary of the variables included in the 2001-2006 bias dataset can be seen in Table 37 in Appendix A.

**The overall percentage of deaths linked for the combined years 2001-2004 and 2004-2006 was 80.81%.** This proportion is comparable to the linkage rate for the 2001-2004 cohort and is greater than the linkage rate for the preceding years; linkage rates for the cohorts 1981-1984 to 1996-1999 ranged from 71-78%. Please see previous reports for technical notes on the linkage process itself, which will not be detailed here.

Table 1 provides the number and percentage linked for individuals in the 2001-2004, 2004-2006 and the merged 2001-2006 datasets.
Excluding individuals with missing data, linkage rates were lowest for 15-34 year olds, Asian ethnicities, Suicide and Violent deaths, rural residents and higher NZ Deprivation deciles.

Linkage rate dropped in 2004-06 relative to 2001-04; this was particularly evident among individuals younger than 35 years, most likely due to increasing residential mobility.

**Table 1: Number of deaths and percentage of linked census- mortality records by sociodemographic variables for 2001-2004, 2004-2006 and merged 2001-2006 datasets.**

| Variable | | 2001-2004 | | 2004-2006 | | 2001-2006 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | % linked | | % linked | | N linked | | % linked | |
| | | Females | Males | Females | Males | Females | Males | Females | Males |
| Total | | 82.23 | 80.73 | 80.80 | 78.74 | 55803 | 53985 | 81.66 | 79.96 |
| Prioritised Ethnicity | Maori | 77.19 | 73.36 | 74.20 | 69.38 | 4377 | 5010 | 75.96 | 71.74 |
| | Pacific | 72.27 | 72.63 | 72.99 | 68.99 | 1281 | 1509 | 72.54 | 71.27 |
| | Asian | 73.10 | 70.70 | 70.96 | 68.81 | 642 | 729 | 72.30 | 69.90 |
| | NonMPA | 83.14 | 82.11 | 81.81 | 80.48 | 49482 | 46707 | 82.61 | 81.48 |
| | Missing | 90.48 | 59.52 | 100.00 | 77.78 | 21 | 33 | 91.67 | 62.75 |
| Age Group | 0-14 yrs | 77.19 | 73.13 | 66.67 | 63.84 | 321 | 480 | 72.95 | 69.02 |
| | 15-34 yrs | 68.53 | 59.26 | 62.94 | 51.55 | 909 | 1605 | 66.30 | 56.30 |
| | 35-49 yrs | 77.17 | 69.61 | 73.28 | 61.73 | 2478 | 3057 | 75.40 | 66.17 |
| | 50-64 yrs | 81.74 | 79.23 | 81.29 | 76.50 | 6789 | 9366 | 81.55 | 78.07 |
| | 65-74 yrs | 83.53 | 83.67 | 82.61 | 82.43 | 9801 | 13968 | 83.14 | 83.17 |
| | 75-84 yrs | 82.84 | 84.00 | 81.19 | 83.78 | 18885 | 17736 | 82.15 | 83.92 |
| | >=85 years | 82.75 | 82.03 | 82.13 | 83.51 | 16620 | 7770 | 82.54 | 82.47 |
| NZ | Missing Dep | 29.03 | 35.85 | 50.00 | 60.00 | 12 | 24 | 31.43 | 39.68 |

| Variable | | 2001-2004 | | 2004-2006 | | 2001-2006 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | % linked | | % linked | | N linked | | % linked | |
| | | Females | Males | Females | Males | Females | Males | Females | Males |
| Deprivation Index | Dep 1-2 | 82.91 | 81.93 | 80.13 | 79.74 | 8244 | 8055 | 81.82 | 81.06 |
| | Dep 3-4 | 82.32 | 81.44 | 80.87 | 81.43 | 10317 | 10257 | 81.74 | 81.43 |
| | Dep 5-6 | 83.03 | 82.02 | 82.66 | 79.33 | 12834 | 11631 | 82.88 | 80.94 |
| | Dep 7-8 | 82.32 | 80.46 | 80.56 | 78.29 | 13185 | 12486 | 81.63 | 79.63 |
| | Dep 9-10 | 80.85 | 78.68 | 79.44 | 75.73 | 11211 | 11532 | 80.28 | 77.53 |
| Percent Mobility | Missing | 4.55 | 12.90 | 87.50 | 45.45 | 9 | 9 | 26.67 | 21.43 |
| | 0-50% | 83.20 | 81.80 | 81.92 | 80.25 | 18672 | 19884 | 82.69 | 81.19 |
| | 51-55% | 83.15 | 81.36 | 81.44 | 79.77 | 13866 | 13272 | 82.47 | 80.75 |
| | 56-60% | 81.82 | 80.50 | 80.40 | 78.27 | 12189 | 10902 | 81.25 | 79.63 |
| | >60% | 80.21 | 78.42 | 78.59 | 75.12 | 11067 | 9915 | 79.57 | 77.13 |
| Rurality | Main Urban | 82.38 | 80.83 | 80.72 | 79.20 | 40125 | 36444 | 81.72 | 80.19 |
| | Secondary Urban Area | 83.75 | 82.76 | 82.07 | 79.45 | 5169 | 4929 | 83.07 | 81.46 |
| | Minor Urban Area | 83.23 | 83.02 | 81.98 | 79.73 | 6453 | 6729 | 82.74 | 81.70 |
| | Rural | 78.15 | 76.87 | 78.09 | 74.38 | 4032 | 5856 | 78.13 | 75.91 |
| | Missing | 30.23 | 24.07 | 100.00 | 71.43 | 21 | 21 | 41.18 | 33.82 |
| Cause of Death | Cancer | 82.58 | 82.31 | 81.73 | 80.35 | 14982 | 16581 | 82.24 | 81.54 |
| | CVD excl. IHD | 82.74 | 82.23 | 80.16 | 79.85 | 11883 | 8022 | 81.73 | 81.31 |
| | IHD | 83.61 | 82.58 | 82.54 | 80.41 | 11973 | 13047 | 83.20 | 81.73 |
| | Respiratory | 82.84 | 83.14 | 83.44 | 83.87 | 3744 | 4164 | 83.09 | 83.41 |
| | Congenital, Perinatal, SIDS | 79.62 | 72.63 | 75.58 | 74.73 | 189 | 207 | 78.19 | 73.31 |
| | Unintentional Injury | 77.87 | 66.97 | 75.39 | 63.58 | 1452 | 2121 | 76.95 | 65.69 |
| | Suicide | 67.68 | 63.43 | 64.79 | 56.04 | 438 | 1152 | 66.52 | 60.38 |
| | Violent | 70.00 | 56.60 | 62.07 | 51.85 | 60 | 90 | 67.42 | 55.00 |
| | Other incl. Not Dead/Linked | 80.99 | 80.29 | 79.25 | 79.03 | 11085 | 8604 | 80.28 | 79.78 |
| District Health Board | Auckland | 81.16 | 79.44 | 80.95 | 75.41 | 4911 | 4110 | 81.08 | 77.93 |
| | Waikato | 81.85 | 82.22 | 80.80 | 77.44 | 4560 | 4665 | 81.43 | 80.28 |
| | Southland | 82.57 | 80.56 | 84.60 | 80.05 | 1713 | 1671 | 83.37 | 80.37 |
| | Northland | 79.48 | 77.40 | 79.63 | 74.28 | 2208 | 2466 | 79.54 | 76.22 |
| | Waitemata | 82.26 | 80.41 | 80.52 | 77.20 | 5154 | 4833 | 81.57 | 79.18 |
| | Counties Manukau | 78.21 | 76.89 | 77.89 | 76.43 | 3867 | 4014 | 78.09 | 76.72 |

|  | Variable | 2001-2004 | | 2004-2006 | | 2001-2006 | | | |
|---|---|---|---|---|---|---|---|---|---|
|  |  | % linked | | % linked | | N linked | | % linked | |
|  |  | Females | Males | Females | Males | Females | Males | Females | Males |
|  | Lakes | 81.47 | 78.38 | 81.03 | 77.52 | 1386 | 1437 | 81.29 | 78.06 |
|  | Bay of Plenty | 81.50 | 80.75 | 79.84 | 78.88 | 2919 | 3216 | 80.81 | 80.00 |
|  | Tairawhiti | 79.61 | 77.49 | 81.38 | 78.01 | 750 | 741 | 80.32 | 77.67 |
|  | Taranaki | 85.68 | 84.25 | 84.18 | 80.72 | 1905 | 1812 | 85.09 | 82.85 |
|  | Hawke's Bay | 83.75 | 81.20 | 79.37 | 80.82 | 2634 | 2454 | 82.03 | 81.05 |
|  | Whanganui | 84.07 | 81.87 | 84.78 | 79.70 | 1266 | 1191 | 84.34 | 80.99 |
|  | Midcentral | 82.28 | 81.58 | 80.44 | 77.12 | 2691 | 2607 | 81.55 | 79.83 |
|  | Hutt | 84.07 | 83.27 | 81.23 | 82.90 | 1971 | 1806 | 82.96 | 83.13 |
|  | Capital and Coast | 80.36 | 79.61 | 79.02 | 81.57 | 3045 | 2877 | 79.85 | 80.39 |
|  | Wairarapa | 84.48 | 81.71 | 84.27 | 84.31 | 705 | 720 | 84.39 | 82.78 |
|  | Nelson Marlborough | 83.00 | 80.93 | 80.09 | 78.87 | 2118 | 2064 | 81.81 | 80.07 |
|  | West Coast | 75.97 | 76.92 | 76.23 | 75.86 | 444 | 558 | 76.07 | 76.54 |
|  | Canterbury | 84.94 | 82.23 | 81.68 | 81.23 | 7269 | 6684 | 83.61 | 81.83 |
|  | South Canterbury | 85.64 | 85.80 | 82.75 | 81.52 | 1125 | 1110 | 84.47 | 84.10 |
|  | Otago | 83.31 | 83.81 | 81.26 | 80.32 | 3159 | 2946 | 82.53 | 82.47 |
|  | Area outside DHB | 0 | 7.14 | 0 | 0 | 0 | 6 | 0 | 7.14 |
| Territorial Authority | Far North | 74.27 | 72.87 | 76.53 | 73.13 | 735 | 933 | 75.18 | 72.97 |
|  | Whangarei | 81.58 | 80.86 | 80.78 | 72.79 | 1203 | 1194 | 81.27 | 77.82 |
|  | Kaipara | 84.95 | 78.86 | 84.48 | 82.29 | 273 | 339 | 84.78 | 80.29 |
|  | Rodney | 83.33 | 82.18 | 77.86 | 75.22 | 1089 | 1167 | 81.09 | 79.48 |
|  | North Shore | 82.47 | 80.96 | 81.28 | 80.15 | 2358 | 1977 | 82.00 | 80.65 |
|  | Waitakere | 81.29 | 78.61 | 81.25 | 75.24 | 1707 | 1692 | 81.28 | 77.32 |
|  | Auckland | 81.16 | 79.44 | 80.95 | 75.41 | 4911 | 4110 | 81.08 | 77.93 |
|  | Manukau | 78.46 | 75.95 | 77.83 | 76.50 | 2763 | 2874 | 78.22 | 76.16 |
|  | Papakura | 78.44 | 79.68 | 75.17 | 76.62 | 567 | 516 | 77.17 | 78.39 |
|  | Franklin | 76.56 | 79.30 | 80.92 | 75.95 | 537 | 624 | 78.36 | 77.97 |
|  | Thames Coromandel | 84.70 | 81.60 | 80.15 | 76.30 | 519 | 543 | 82.80 | 79.50 |
|  | Hauraki | 83.92 | 82.53 | 82.73 | 80.00 | 282 | 321 | 83.43 | 81.47 |
|  | Waikato | 82.17 | 83.97 | 81.59 | 79.69 | 513 | 558 | 81.95 | 82.33 |
|  | Matamata-Piako | 81.93 | 79.88 | 85.53 | 80.26 | 456 | 459 | 83.42 | 80.04 |
|  | Hamilton | 81.88 | 82.79 | 80.96 | 75.03 | 1533 | 1419 | 81.50 | 79.55 |
|  | Waipa | 80.36 | 80.79 | 75.56 | 80.79 | 636 | 633 | 78.52 | 80.79 |

| Variable | 2001-2004 | | 2004-2006 | | 2001-2006 | | | |
|---|---|---|---|---|---|---|---|---|
| | % linked | | % linked | | N linked | | % linked | |
| | Females | Males | Females | Males | Females | Males | Females | Males |
| Otorohanga | 85.07 | 79.49 | 87.23 | 74.00 | 99 | 99 | 85.96 | 77.34 |
| South Waikato | 82.81 | 82.82 | 78.99 | 78.24 | 267 | 321 | 81.21 | 80.86 |
| Waitomo | 76.04 | 84.17 | 81.25 | 75.00 | 126 | 147 | 78.13 | 80.98 |
| Taupo | 82.17 | 76.20 | 84.65 | 76.19 | 438 | 462 | 83.18 | 76.20 |
| Western Bay of Plenty | 79.90 | 80.08 | 82.82 | 74.77 | 540 | 669 | 81.05 | 78.06 |
| Tauranga | 81.22 | 80.25 | 78.56 | 80.07 | 1674 | 1749 | 80.11 | 80.17 |
| Rotorua | 81.16 | 79.43 | 79.42 | 78.19 | 945 | 975 | 80.44 | 78.96 |
| Whakatane | 85.76 | 81.79 | 80.08 | 80.81 | 483 | 540 | 83.45 | 81.39 |
| Kawerau | 84.44 | 89.04 | 81.82 | 70.37 | 72 | 84 | 83.15 | 84.00 |
| Opotiki | 75.93 | 80.80 | 82.28 | 79.57 | 147 | 174 | 78.61 | 80.28 |
| Gisborne | 79.61 | 77.49 | 81.38 | 78.01 | 753 | 741 | 80.32 | 77.67 |
| Wairoa | 80.33 | 77.95 | 74.19 | 81.01 | 144 | 162 | 78.26 | 79.13 |
| Hastings | 84.18 | 80.44 | 77.85 | 79.78 | 1209 | 1101 | 81.63 | 80.17 |
| Napier | 83.80 | 82.23 | 80.80 | 82.45 | 1086 | 987 | 82.60 | 82.32 |
| Central Hawkes Bay | 83.44 | 82.69 | 86.30 | 80.23 | 189 | 198 | 84.38 | 81.82 |
| New Plymouth | 85.06 | 84.53 | 85.09 | 81.14 | 1311 | 1158 | 85.07 | 83.20 |
| Stratford | 86.54 | 80.73 | 86.11 | 78.31 | 150 | 153 | 86.36 | 79.69 |
| South Taranaki | 87.16 | 84.66 | 80.61 | 80.59 | 444 | 501 | 84.70 | 83.06 |
| Ruapehu | 74.14 | 81.88 | 81.25 | 70.99 | 165 | 216 | 77.36 | 76.79 |
| Wanganui | 84.62 | 82.81 | 84.49 | 81.18 | 981 | 885 | 84.57 | 82.14 |
| Rangitikei | 83.15 | 80.00 | 87.04 | 78.81 | 246 | 255 | 84.59 | 79.57 |
| Manawatu | 80.58 | 78.70 | 78.72 | 73.63 | 399 | 405 | 79.88 | 76.76 |
| Palmerston North | 82.15 | 80.61 | 81.39 | 77.15 | 1116 | 939 | 81.83 | 79.16 |
| Tararua | 84.07 | 83.97 | 83.11 | 77.04 | 312 | 303 | 83.69 | 81.45 |
| Horowhenua | 82.82 | 82.24 | 78.26 | 79.78 | 723 | 783 | 81.05 | 81.31 |
| Kapiti Coast | 73.43 | 74.86 | 74.38 | 77.62 | 855 | 900 | 73.79 | 75.97 |
| Porirua | 82.90 | 82.72 | 82.78 | 79.25 | 492 | 507 | 82.86 | 81.38 |
| Upper Hutt | 84.12 | 83.64 | 78.14 | 82.82 | 609 | 510 | 81.88 | 83.33 |
| Lower Hutt | 84.04 | 83.13 | 82.56 | 82.94 | 1362 | 1293 | 83.46 | 83.06 |
| Wellington | 83.36 | 82.13 | 80.77 | 83.89 | 1836 | 1653 | 82.37 | 82.82 |
| Masterton | 82.95 | 84.10 | 84.23 | 81.50 | 438 | 459 | 83.49 | 83.03 |
| Carterton | 87.36 | 84.51 | 87.93 | 96.61 | 126 | 117 | 87.59 | 90.00 |

| Variable | 2001-2004 % linked | | 2004-2006 % linked | | 2001-2006 N linked | | 2001-2006 % linked | |
|---|---|---|---|---|---|---|---|---|
| | Females | Males | Females | Males | Females | Males | Females | Males |
| South Wairarapa | 86.54 | 73.28 | 80.70 | 83.10 | 135 | 144 | 84.47 | 77.01 |
| Tasman | 84.63 | 79.23 | 77.74 | 77.09 | 573 | 618 | 81.77 | 78.35 |
| Nelson | 82.43 | 80.87 | 80.89 | 81.27 | 780 | 705 | 81.81 | 81.03 |
| Marlborough | 82.36 | 82.51 | 81.09 | 78.12 | 765 | 741 | 81.84 | 80.63 |
| Kaikoura | 82.86 | 72.09 | 83.87 | 84.85 | 54 | 57 | 83.33 | 77.63 |
| Buller | 69.17 | 74.82 | 74.16 | 74.42 | 147 | 168 | 71.29 | 74.67 |
| Grey | 81.21 | 81.95 | 79.52 | 74.31 | 198 | 249 | 80.65 | 79.30 |
| Westland | 75.32 | 70.97 | 74.51 | 80.30 | 96 | 141 | 75.00 | 74.21 |
| Hurunui | 78.57 | 82.41 | 81.48 | 80.82 | 99 | 147 | 79.84 | 81.77 |
| Waimakariri | 82.24 | 84.99 | 82.79 | 77.56 | 465 | 552 | 82.48 | 81.66 |
| Christchurch | 85.66 | 82.72 | 81.53 | 82.05 | 5883 | 5070 | 83.98 | 82.45 |
| Banks Peninsula | 80.00 | 82.98 | 68.42 | 73.17 | 66 | 108 | 75.00 | 80.00 |
| Selwyn | 75.00 | 70.20 | 81.82 | 76.87 | 177 | 252 | 77.97 | 73.04 |
| Ashburton | 84.80 | 81.98 | 84.02 | 81.13 | 522 | 495 | 84.49 | 81.68 |
| Timaru | 85.84 | 86.01 | 83.62 | 81.44 | 951 | 900 | 84.92 | 84.16 |
| Mackenzie | 73.68 | 81.82 | 83.33 | 86.21 | 30 | 60 | 78.38 | 83.56 |
| Waimate | 86.44 | 86.21 | 75.44 | 80.00 | 144 | 150 | 82.86 | 83.98 |
| Chatham Islands | 100.00 | 87.50 | 66.67 | 0 | 6 | 9 | 83.33 | 70.00 |
| Waitaki | 85.68 | 84.05 | 74.55 | 79.00 | 483 | 468 | 81.48 | 82.11 |
| Central Otago | 84.95 | 86.00 | 84.03 | 81.56 | 258 | 288 | 84.59 | 84.16 |
| Queenstown-Lakes | 78.43 | 76.06 | 82.26 | 66.25 | 132 | 162 | 79.88 | 72.52 |
| Dunedin | 83.19 | 83.53 | 81.67 | 81.63 | 2127 | 1827 | 82.61 | 82.82 |
| Clutha | 79.35 | 85.20 | 86.49 | 77.33 | 243 | 285 | 82.03 | 81.79 |
| Southland | 79.90 | 80.14 | 71.79 | 76.97 | 246 | 351 | 76.95 | 78.96 |
| Gore | 81.40 | 82.63 | 87.70 | 81.74 | 246 | 252 | 84.01 | 82.30 |
| Invercargill | 83.72 | 80.82 | 87.24 | 81.95 | 1137 | 987 | 85.10 | 81.27 |
| TLA Not Applicable | 0 | 7.14 | 0 | 0 | 0 | 6 | 0 | 6.90 |
| Months Since Census — negative, 0-6 mths | 80.30 | 78.96 | 0 | 0 | 6171 | 6204 | 80.30 | 78.96 |
| 7-12 mths | 82.83 | 81.45 | 0 | 0 | 5340 | 5319 | 82.83 | 81.45 |
| 13-18 mths | 83.41 | 81.20 | 0 | 0 | 5982 | 5937 | 83.41 | 81.20 |
| 19-24 mths | 82.14 | 80.79 | 0 | 0 | 5292 | 5040 | 82.14 | 80.79 |

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| | 2001-2004 | | 2004-2006 | | 2001-2006 | | | |
|---|---|---|---|---|---|---|---|---|
| **Variable** | **% linked** | | **% linked** | | **N linked** | | **% linked** | |
| | **Females** | **Males** | **Females** | **Males** | **Females** | **Males** | **Females** | **Males** |
| 25-30 mths | 82.86 | 81.42 | 0 | 0 | 6090 | 5931 | 82.86 | 81.42 |
| 31-36 mths | 81.97 | 80.80 | 80.88 | 77.15 | 5451 | 5169 | 81.88 | 80.53 |
| 37-42 mths | 0 | 0 | 81.49 | 79.93 | 5895 | 5607 | 81.49 | 79.93 |
| 43-48 mths | 0 | 0 | 80.00 | 78.37 | 5301 | 5076 | 80.00 | 78.37 |
| 49-54 mths | 0 | 0 | 80.80 | 79.15 | 5508 | 5196 | 80.80 | 79.15 |
| 55+ mths[1] | 0 | 0 | 80.83 | 77.40 | 4776 | 4518 | 80.83 | 77.40 |

All the numbers are random rounded to a multiple of three as per Statistics New Zealand protocol. Minimum cell size is 6.
[1] 55-60 mths and 61+ mths were combined; due to the method of month calculation, the 61+ month category consisted of the last day of census follow up and linkage rate was 100%.

Logistic regression analyses were conducted to determine which variables were independent predictors of linkage. These variables were later used to create strata for the weighting and to assist in determining the order of collapsing strata; weaker predictors of linkage were collapsed first.

The variables included in the regression model were age, sex, prioritised ethnicity, NZ deprivation quintiles, TA, rurality, mobility, months since census, ICD and an age x sex interaction. Missing values were excluded. Several models were investigated and Table 2 below shows the parameter estimates and standard errors for the final model.

**Table 2: Parameter estimates and standard errors from logistic regression predicting linkage, 2001-2006.**

| | | **Estimate** | **Std Error** |
|---|---|---|---|
| Sex | Females | 0.013 | 0.033 |
| | Males (reference) | 1 | 0 |
| Prioritised Ethnicity | Asian | -0.481 | 0.053 |
| | Maori | -0.274 | 0.025 |
| | Pacific | -0.424 | 0.040 |
| | NonMPA | 1 | 0 |
| Age Group | 0-14 yrs | -0.353 | 0.093 |
| | 15-34 yrs | -0.927 | 0.053 |
| | 35-49 yrs | -0.660 | 0.044 |
| | 50-64 yrs | -0.175 | 0.036 |
| | 65-74 yrs | 0.091 | 0.035 |
| | 75-84 yrs | 0.119 | 0.033 |
| | 85+ (reference) | 1 | 0 |
| Percent Mobility | 0-50% Mobility (reference) | 1 | 0 |

|  |  | Estimate | Std Error |
|---|---|---|---|
|  | 51-55% Mobility | -0.025 | 0.022 |
|  | 56-60% Mobility | -0.086 | 0.025 |
|  | >60% Mobility | -0.220 | 0.026 |
| Rurality | Rural | -0.205 | 0.027 |
|  | Urban (reference) | 1 | 0 |
| NZ Deprivation Index | Dep 1-2 (reference) | 1 | 0 |
|  | Dep 3-4 | 0.031 | 0.025 |
|  | Dep 5-6 | 0.050 | 0.025 |
|  | Dep 7-8 | -0.007 | 0.025 |
|  | Dep 9-10 | 0.003 | 0.026 |
| Months Since Census | 0-18 mths (reference) | 1 | 0 |
|  | 19-36 mths | 0.031 | 0.018 |
|  | 37-high mths | -0.092 | 0.017 |
| Cause of Death (detailed) | Stomach Cancer | 0.080 | 0.071 |
|  | Colorectal Cancer | -0.051 | 0.038 |
|  | Pancreas Cancer | 0.045 | 0.069 |
|  | Lung/Bronchus Cancer | 0.009 | 0.035 |
|  | Melanoma | 0.035 | 0.076 |
|  | Breast Cancer | 0.050 | 0.052 |
|  | Prostate Cancer | -0.014 | 0.053 |
|  | Brain/Nervous System Cancer | -0.088 | 0.077 |
|  | Other Cancer | 0.007 | 0.027 |
|  | IHD (reference) | 1 | 0 |
|  | Other Heart Disease | -0.013 | 0.033 |
|  | Cerebrovascular Disease | -0.106 | 0.027 |
|  | Other Cardiovascular Disease | 0.058 | 0.050 |
|  | Unintentional Injury other than RTC | -0.261 | 0.046 |
|  | RTC | -0.306 | 0.055 |
|  | Suicide | -0.447 | 0.049 |
|  | Violent | -0.458 | 0.135 |
|  | Communicable Diseases | -0.104 | 0.076 |
|  | Diabetes | -0.031 | 0.043 |
|  | Pnuemonia/Influenza | -0.113 | 0.059 |
|  | COPD | 0.017 | 0.034 |
|  | Asthma | 0.087 | 0.142 |
|  | Other Respiratory | 0.149 | 0.088 |
|  | Congenital | 0.042 | 0.112 |
|  | Perinatal | -1.552 | 0.577 |

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| | | Estimate | Std Error |
|---|---|---|---|
| | SIDS | -0.438 | 0.517 |
| | Other Causes | -0.141 | 0.025 |
| | Not Dead/Linked | -1.117 | 0.678 |
| Territorial Authority | Far North | -0.226 | 0.059 |
| | Whangarei | -0.017 | 0.053 |
| | Kaipara | 0.150 | 0.103 |
| | Rodney | -0.096 | 0.055 |
| | North Shore | 0.002 | 0.043 |
| | Waitakere | -0.002 | 0.045 |
| | Auckland (reference) | 1 | 0 |
| | Manukau | -0.054 | 0.038 |
| | Papakura | -0.079 | 0.070 |
| | Franklin | -0.110 | 0.070 |
| | Thames Coromandel | -0.062 | 0.078 |
| | Hauraki | 0.044 | 0.104 |
| | Waikato | 0.128 | 0.080 |
| | Matamata-Piako | 0.006 | 0.084 |
| | Hamilton | 0.082 | 0.049 |
| | Waipa | -0.140 | 0.068 |
| | Otorohanga | 0.148 | 0.171 |
| | South Waikato | 0.074 | 0.101 |
| | Waitomo | -0.020 | 0.140 |
| | Taupo | 0.060 | 0.079 |
| | Western Bay of Plenty | -0.091 | 0.071 |
| | Tauranga | -0.029 | 0.046 |
| | Rotorua | 0.016 | 0.057 |
| | Whakatane | 0.177 | 0.082 |
| | Kawerau | 0.261 | 0.203 |
| | Opotiki | 0.030 | 0.130 |
| | Gisborne | -0.046 | 0.065 |
| | Wairoa | 0.014 | 0.131 |
| | Hastings | -0.018 | 0.055 |
| | Napier | 0.041 | 0.060 |
| | Central Hawkes Bay | 0.134 | 0.130 |
| | New Plymouth | 0.139 | 0.058 |
| | Stratford | 0.034 | 0.143 |
| | South Taranaki | 0.193 | 0.088 |
| | Ruapehu | -0.122 | 0.114 |

|  | Estimate | Std Error |
|---|---|---|
| Wanganui | 0.112 | 0.064 |
| Rangitikei | 0.059 | 0.111 |
| Manawatu | -0.209 | 0.083 |
| Palmerston North | 0.008 | 0.056 |
| Tararua | 0.056 | 0.103 |
| Horowhenua | -0.076 | 0.068 |
| Kapiti Coast | -0.461 | 0.055 |
| Porirua | 0.181 | 0.081 |
| Upper Hutt | 0.029 | 0.077 |
| Lower Hutt | 0.123 | 0.055 |
| Wellington | 0.132 | 0.048 |
| Masterton | 0.074 | 0.087 |
| Carterton | 0.492 | 0.195 |
| South Wairarapa | -0.092 | 0.141 |
| Tasman | -0.135 | 0.072 |
| Nelson | -0.013 | 0.066 |
| Marlborough | -0.067 | 0.066 |
| Kaikoura | -0.149 | 0.215 |
| Buller | -0.490 | 0.115 |
| Grey | -0.146 | 0.111 |
| Westland | -0.370 | 0.135 |
| Hurunui | 0.081 | 0.153 |
| Waimakariri | 0.004 | 0.079 |
| Christchurch | 0.112 | 0.034 |
| Banks Peninsula | -0.222 | 0.166 |
| Selwyn | -0.134 | 0.113 |
| Ashburton | 0.045 | 0.083 |
| Timaru | 0.123 | 0.067 |
| Mackenzie | 0.094 | 0.253 |
| Waimate | 0.044 | 0.147 |
| Chatham Islands | 7.656 | 80.784 |
| Waitaki | -0.071 | 0.083 |
| Central Otago | 0.170 | 0.114 |
| Queenstown-Lakes | -0.250 | 0.123 |
| Dunedin | 0.025 | 0.047 |
| Clutha | 0.027 | 0.109 |
| Southland | -0.147 | 0.096 |
| Gore | 0.043 | 0.115 |

|  |  | Estimate | Std Error |
|---|---|---|---|
|  | Invercargill | 0.047 | 0.061 |
|  | TLA Not Applicable | 7.660 | 80.784 |
| Age X Sex Interaction | Female  0-14 yrs | 0.128 | 0.141 |
|  | Female  15-34 yrs | 0.340 | 0.077 |
|  | Female 35-49 yrs | 0.386 | 0.062 |
|  | Female  50-64 yrs | 0.195 | 0.049 |
|  | Female  65-74 yrs | -0.013 | 0.046 |
|  | Female  75-84 yrs | -0.140 | 0.042 |

# WEIGHTING OF MORTALITY RECORDS

The incomplete linkage process results in only a proportion of mortality records in any given sociodemographic strata being linked to a respective census record.  By weighting the number of linked mortality records in each stratum, it is possible to estimate the number of deaths in that stratum if all records were successfully linked.

Linkage weight calculation involved two separate processes for the linked and unlinked cohort records:
1) Weighting linked census-mortality records (n =109,789) by the inverse probability of linkage to estimate the total number of mortality records (N=135,853)
2) Weighting unlinked census records (n = 3,520,743) to adjust for nonlinkage of some mortality records.

The weights were transferred to the Cohort dataset (which includes all eligible census records) using the individual ID numbers in the Bias and Cohort datasets.  Statistics New Zealand staff carried out the transfer of weights.

Weights were calculated separately for strata based on the sociodemographic variables that were predictors of linkage in the regression analyses:
- Age (age at census; 0-14, 15-34, 35-49, 50-64, 65-74, 75-84, 85+ yrs)
- Sex (male, female)
- Prioritised ethnicity (Maori, Pacific, Asian, nonMPA including missing)
- Rurality (missing, rural, urban)
- Mobility (missing, 0-50, 51-55, 56-60, 60+ percentiles- i.e. % of area unit residents that had moved since the 2001 census)
- TA (4 groups, see below)
- Months since census (0-18, 18-36, 36+ months)
- NZ Deprivation Index 2001 (missing NZDep, quintiles)
- Cause of death (ICD: Cancer, CVD excl. IHD, IHD, Respiratory, Congenital /Perinatal/SIDS, Suicide, Unintentional Injury, Violent, Other/Not dead).

Cluster analysis was used to group TAs systematically, based on the beta values obtained from the regression analysis.  Six and four clusters were created, and four clusters were used for the final strata.  The clustered TAs, associated betas and standard errors are shown in Table 3.

**Table 3: Parameter estimates, standard errors for TA clusters**

| | Cluster Number | | Parameter | Standard |
|---|---|---|---|---|
| **Territorial Authority** | **6 clusters** | **4 clusters** | **Estimate** | **Error** |
| Auckland (Reference) | 4 | 2 | 0 | - |
| Buller | 1 | 1 | -0.471 | 0.115 |
| Kapiti Coast | 1 | 1 | -0.455 | 0.055 |
| Westland | 1 | 1 | -0.368 | 0.135 |
| Queenstown-Lakes | 2 | 1 | -0.254 | 0.123 |

| | | | | |
|---|---|---|---|---|
| Banks Peninsula | 2 | 1 | -0.214 | 0.166 |
| Far North | 2 | 1 | -0.208 | 0.058 |
| Manawatu | 2 | 1 | -0.204 | 0.083 |
| Grey | 2 | 1 | -0.146 | 0.111 |
| Southland | 2 | 1 | -0.142 | 0.095 |
| Waipa | 2 | 1 | -0.139 | 0.068 |
| Selwyn | 2 | 1 | -0.138 | 0.113 |
| Tasman | 2 | 1 | -0.131 | 0.072 |
| Kaikoura | 2 | 1 | -0.125 | 0.215 |
| Ruapehu | 3 | 1 | -0.109 | 0.114 |
| Franklin | 3 | 1 | -0.097 | 0.070 |
| Rodney | 3 | 1 | -0.086 | 0.055 |
| South Wairarapa | 3 | 1 | -0.085 | 0.140 |
| Western Bay of Plenty | 3 | 2 | -0.076 | 0.071 |
| Papakura | 3 | 2 | -0.075 | 0.070 |
| Waitaki | 3 | 2 | -0.062 | 0.083 |
| Horowhenua | 3 | 2 | -0.059 | 0.068 |
| Marlborough | 3 | 2 | -0.058 | 0.066 |
| Thames Coromandel | 3 | 2 | -0.051 | 0.078 |
| Manukau | 3 | 2 | -0.042 | 0.038 |
| Gisborne | 3 | 2 | -0.030 | 0.065 |
| Tauranga | 4 | 2 | -0.015 | 0.046 |
| Hastings | 4 | 2 | -0.015 | 0.055 |
| Nelson | 4 | 2 | -0.009 | 0.066 |
| Whangarei | 4 | 2 | -0.006 | 0.053 |
| Waitomo | 4 | 2 | -0.006 | 0.140 |
| North Shore | 4 | 2 | -0.003 | 0.043 |
| Waimakariri | 4 | 2 | 0.004 | 0.079 |
| Palmerston North | 4 | 2 | 0.006 | 0.056 |
| Matamata-Piako | 4 | 2 | 0.009 | 0.084 |
| Waitakere | 4 | 2 | 0.009 | 0.045 |
| Wairoa | 4 | 2 | 0.011 | 0.131 |
| Rotorua | 4 | 3 | 0.021 | 0.057 |
| Upper Hutt | 4 | 3 | 0.028 | 0.077 |
| Stratford | 4 | 3 | 0.028 | 0.143 |
| Dunedin | 4 | 3 | 0.028 | 0.047 |
| Clutha | 4 | 3 | 0.039 | 0.109 |
| Opotiki | 4 | 3 | 0.041 | 0.130 |
| Napier | 4 | 3 | 0.044 | 0.059 |
| Gore | 4 | 3 | 0.046 | 0.115 |
| Ashburton | 4 | 3 | 0.051 | 0.083 |
| Waimate | 4 | 3 | 0.055 | 0.147 |
| Invercargill | 4 | 3 | 0.058 | 0.061 |
| Tararua | 4 | 3 | 0.061 | 0.103 |
| Hauraki | 4 | 3 | 0.061 | 0.104 |
| Rangitikei | 4 | 3 | 0.066 | 0.111 |
| Taupo | 4 | 3 | 0.066 | 0.079 |
| Mackenzie | 4 | 3 | 0.067 | 0.253 |
| Masterton | 4 | 3 | 0.074 | 0.087 |
| South Waikato | 4 | 3 | 0.078 | 0.100 |
| Hamilton | 5 | 3 | 0.093 | 0.049 |
| Hurunui | 5 | 4 | 0.115 | 0.153 |
| Christchurch | 5 | 4 | 0.117 | 0.034 |
| Timaru | 5 | 4 | 0.125 | 0.067 |

| | | | | |
|---|---|---|---|---|
| Wanganui | 5 | 4 | 0.127 | 0.064 |
| Wellington | 5 | 4 | 0.131 | 0.048 |
| Central Hawkes Bay | 5 | 4 | 0.134 | 0.129 |
| Waikato | 5 | 4 | 0.137 | 0.080 |
| Lower Hutt | 5 | 4 | 0.137 | 0.055 |
| New Plymouth | 5 | 4 | 0.146 | 0.058 |
| Kaipara | 5 | 4 | 0.157 | 0.103 |
| Otorohanga | 5 | 4 | 0.163 | 0.171 |
| Central Otago | 5 | 4 | 0.178 | 0.114 |
| Porirua | 5 | 4 | 0.179 | 0.081 |
| Whakatane | 5 | 4 | 0.188 | 0.081 |
| South Taranaki | 5 | 4 | 0.202 | 0.088 |
| Kawerau | 5 | 4 | 0.269 | 0.202 |
| Carterton | 5 | 4 | 0.497 | 0.194 |
| TLA Not Applicable | 6 | 4 | 7.710 | 80.711 |
| Chatham Islands | 6 | 4 | 7.716 | 80.711 |

Some linkage variables had to be re-derived due to inconsistencies between the 2001-2004 and 2004-2006 datasets, e.g. age, months since census (based on age at census night and age at death). Additionally, different variables were used in the strata for the linkage weighting than those used in 2001-2004, partially for practicality but also due to differences in the results of the logistic regression used to determine strata variables. NZ deprivation was included in the strata as it was found to be a significantly related to linkage, though NZ Deprivation was not an important predictor of linkage for the 2001-2004 cohort. Additionally, the number of months since census for death date was also included in strata as it was a strong predictor of linkage; these were also grouped into 18 month blocks to investigate potential differences between the 2001-2004 and 2004-2006 cohorts. Territorial Authority (TA), rather than Regional Health Authority (RHA) was used as a geographic variable in the strata to improve sensitivity to differences in linkage as a function of geographic location. The cut-off values for the mobility groups were also altered slightly from the groupings used for the 2001-2004 cohort to ensure an even distribution of individuals across levels.

Complete cross-classification of the bias dataset by the strata variables resulted in 7[Age] x 2[Sex] x 4[Ethnicity] x 5[Mobility] x 3[Rurality] x 4[TA] x 3[Months since Census] x 6[NZ Dep] x 9[ICD] = 544,320 strata. The number of strata eligible for collapsing was 28,975 strata at the maximum detail level. Many strata had no observations or few observations; therefore some strata (n= 24,024) were collapsed to ensure sufficient cell sizes and linkage rates, to avoid weights of zero (due to no deaths in strata) or undefined weights (due to no linked census-mortality records).

For the linkage (and unlock) weighting, the method of collapsing strata to obtain sufficient cell sizes for weight derivation differed considerably from previous years. Whereas collapsing had previously been done manually and was based on the number and proportion linked within each stratum, the methodology used here was automated and based on pre-defined acceptance criteria. Instead of collapsing individual cells within strata if linkage rate or cell numbers were too low, the criteria used for acceptance for linkage weight

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calculation was **> 5 records linked**. That is, any strata, including those created by aggregation, with more than 5 links was removed and assigned its own independent weight. The remaining strata that did not meet criteria were separated and then collapsed, variable-by variable, in an order based on the results of logistic regression analyses.

The number-based acceptance criteria (rather than rate-based criteria for acceptance used in the previous 2001-04 linkage weights) and the separate calculation of weights for the collapsed strata eliminated any underestimation of linkage rate in the weighted estimates. This provided a faster and more systematic, statistical approach to collapsing that was also easily applied to the unlock weighting.

The order for collapsing/aggregating strata was based on the strength of the relationship between the variables and linkage. The different steps in the collapsing process were:
1) a) Combine sex for 0-14years,
   b) Combine Maori and Pacific ethnicities for $\geq$ 75years,
   c) Group missing ethnicity into nonMPA
   d) Combine rural/urban for Pacific and Asian ethnicities (all urban),
2) Collapse ICD from 8 to 6 groups
3) Collapse NZdep from quintiles to two-level decile grouping 1-6, 7-10
4) Collapse months since census from 0-18,18-35, 36+ to 0-35, 36+
5) Collapse mobility from 0-50, 51-55, 56-60, 61+ to 0-55, 56+
6) Drop ICD
7) Drop NZdep
8) Drop months since census
9) Drop TA
10) Drop rurality
11) Drop mobility
12) Collapse ethnicity from four groups to Maori and nonMaori
13) Drop ethnicity
14) Drop sex
15) Drop age

Table 4 shows the number of acceptable and unacceptable strata, and the proportion of total strata at each collapsing step. The initial step made manual adjustments to the levels within strata prior to the collapsing process (see Steps 1a-1d). This resulted in a decrease in the total number of strata at the maximum-detail level. Each panel in Table 4 shows shows the number of acceptable and unacceptable strata after that collapsing step and the proportion of the total number of strata. The unacceptable strata go on to be collapsed at the next step so that the total number of strata for Steps 2-15 equals the number of acceptable strata at the previous step.

The actual number of mortality records in the acceptable and unacceptable strata decrease markedly at each step of the collapsing process. After Step 1, there are 65% and 35% of the total mortality records (n= 135,853) in acceptable and unacceptable strata, respectively. At Step 5, this drops to 10% in the acceptable and 3% in the unacceptable strata. By Step 14 there

are 0.03 and 0.01% of the total mortality records in the acceptable and unacceptable strata, respectively.

The SAS code for stratification and collapsing of strata can be seen in Appendix C.

**Table 4: Number of acceptable and unacceptable strata before and after collapsing of variables for linkage weight calculation 2001-2006.**

| INITIAL VALUES | N | % Total Strata |
|---|---|---|
| Acceptable | 4932 | 16.75% |
| Unacceptable | 24505 | 83.25% |
| Total | 29437 | |
| Step 1 | N | % Total |
| Acceptable | 4946 | 17.07% |
| Unacceptable | 24029 | 82.93% |
| Total | 28975 | |

| 2) collapse ICD | N | % Total |
|---|---|---|
| Acceptable | 817 | 3.40% |
| Unacceptable | 23212 | 96.60% |
| Total | 24029 | |
| **3) collapse NZDep** | N | % Total |
| Acceptable | 4206 | 18.12% |
| Unacceptable | 19006 | 81.88% |
| Total | 23212 | |
| **4) collapse MthsSinceCen** | N | % Total |
| Acceptable | 2663 | 14.01 |
| Unacceptable | 16343 | 85.99 |
| Total | 19006 | |
| **5) collapse Mobility** | N | % Total |
| Acceptable | 3884 | 23.77 |
| Unacceptable | 12459 | 76.23 |
| Total | 16343 | |
| **6) drop ICD** | N | % Total |
| Acceptable | 8796 | 70.60 |
| Unacceptable | 3663 | 29.40 |
| Total | 12459 | |
| **7) drop NZDep** | N | % Total |
| Acceptable | 1036 | 28.28 |
| Unacceptable | 2627 | 71.72 |
| Total | 3663 | |
| **8) drop MthsSinceCen** | N | % Total |
| Acceptable | 1062 | 40.43 |
| Unacceptable | 1565 | 59.57 |
| Total | 2627 | |

| 9) drop TA | N | % Total |
|---|---|---|
| Acceptable | 1235 | 78.91 |
| Unacceptable | 330 | 21.09 |
| Total | 1565 | |
| **10) drop Rurality** | **N** | **% Total** |
| Acceptable | 71 | 21.52 |
| Unacceptable | 659 | 78.48 |
| Total | 330 | |
| **11) drop Mobility** | **N** | **% Total** |
| Acceptable | 109 | 42.08 |
| Unacceptable | 150 | 57.92 |
| Total | 259 | |
| **12) Collapse Ethnicity** | **N** | **% Total** |
| Acceptable | 54 | 36.00 |
| Unacceptable | 96 | 64.00 |
| Total | 150 | |
| **13) drop Ethnicity** | **N** | **% Total** |
| Acceptable | 43 | 44.79 |
| Unacceptable | 53 | 55.21 |
| Total | 96 | |
| **14) Drop Sex** | **N** | **% Total** |
| Acceptable | 38 | 71.70 |
| Unacceptable | 15 | 28.30 |
| Total | 53 | |
| **15) Drop Age** | **N** | **% Total** |
| Acceptable | 15 | 100 |
| Unacceptable | 0 | |
| Total | 15 | |

### Weighting of linked records within n = 28,975 'acceptable' strata

First, a base weight (**W_base**) was calculated, based on the number of eligible deaths/mortality records and the number of linked deaths of the final strata (after collapsing), using the formula:

$$\mathbf{W_L}^i = \mathbf{N_D}^i / \mathbf{N_L}^i$$

Where $\mathbf{W_L}^i$ = **W_base**, base weight for strata $i$,
  $\mathbf{N_D}^i$ = total number of mortality records in strata $i$,
  $\mathbf{N_L}^i$ = number of mortality records linked to a census record in strata $i$.

We then determined the number of weighted linked records for each of the acceptable strata, $\mathbf{N_W}^i$ **by multiplying the number of linked records by the base weight,** i.e.:

$$\mathbf{N_W}^i = \mathbf{W_L}^i \times \mathbf{N_L}^i$$

*For example if 121 of 200 mortality records for Pacific females aged 15-34 were linked to a census record then applying a weight of 200/121 = 1.653 to all linked mortality records for Pacific females aged 25-44 years will weight up the linked deaths to approximate the known actual number of deaths. That is 1.643 x 121 = 200.*

Using this methodology, weights were calculated for strata that often had much broader variable groupings than the cells to which they were eventually applied. This results in some discrepancies between the weighted estimates and actual number of linked census-mortality records within different strata. Consequently, to obtain weighted estimates that accurately represented the total number of mortality records when analysed for ethnicity and cause of death (ICD), we performed a secondary adjustment to the original weightings, consistent with previous methodology. The linked weighted death values were multiplied by the adjustment factors to obtain adjusted weighted number of deaths. This ensured that the weighted values accurately estimated the total number of deaths for prioritised ethnicity and cause of death.

An adjustment factor was calculated for the [Age x [Sex] x [Ethnicity] strata using the formula:

$$\mathbf{W\_AgeEthAdj} = \mathbf{N_A}^i / \mathbf{N_{LW}}^i$$

Where $\mathbf{N_A}^i$ = the number of deaths in strata $i$,
  $\mathbf{N_{LW}}^i$ = the number of weighted linked mortality records in strata $i$.
A different adjustment factor, **W_AgeICDAdj,** was also calculated for the [Age] x [Sex] x [Cause of death] strata, using 9 ICD categories.

*For example, if the weighted number of linked mortality records for the stratum of the 5yr age group 25-29yr old Pacific females was 38, but the actual number of total deaths for that stratum was 42, then a second weighted estimate would be calculated by applying the weight 42/38 = 1.105 to all the linked mortality records so that they would approximate the total number of actual deaths.*

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For some strata, there were some eligible, but no linked deaths at the end of the collapsing process, due to the different groupings of variables used for strata and weighting. These strata were Pacific 5-9yr old females, and 20-24yr old males with ICD = IHD, 75-79yr old males with ICD = Violent, 90-95yr old males with ICD = Congenital, Perinatal, SIDS. This meant that adjustment factors for these strata could not be applied to the base weights. To remedy this, these individuals were assigned a link in the bias file prior to the collapsing of strata and a W_base = 1 (due to the linkage rate of 100%). This "knowledge" was also applied in the cohort file by randomly selecting the same number of people in their respective age and sex strata, and assigning them as linked.

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**Figure 1: Diagram of collapsing of strata and weight calculation**

**a)**

| Mobility | 0-50% | 51-55% | 56-60% | 61+ |
|---|---|---|---|---|
| Maori | 6 out of 10 linked | 7 out of 15 linked | 4 out of 5 linked | 2 out of 10 linked |

In Figure 1.A, four different cells within the Maori and mobility strata are represented. Of these, the 0-50% and 51-55% mobility cells are acceptable (both have 5+ mortality records linked to census records). Base weights (**W_base**) are then calculated for these by dividing the total number of eligible mortality records for that stratum ($N_D$) by the number of linked records in that stratum ($N_L$). For example, the weight for the cell with 0-50% mobility would be 10/6 or 1.667. The remaining strata are collapsed.

**b)**

| Mobility | 0-55% | 56+% |
|---|---|---|
| Maori | | 6 out of 15 linked |

In Figure 1.B, the unacceptable strata have been collapsed. Now the new collapsed stratum has an acceptable number of linked records and a weight can be calculated (**W_base** = 15/6 or 2.5). Note that weights are calculated for the collapsed strata separately to the acceptable, non-collapsed strata.

After all strata contain an acceptable number of linked records, the final weights for each stratum are then applied to each of the individual linked records within that stratum. Unlinked records are not weighted.

The total number of weighted deaths can then calculated by multiplying the number linked deaths by the weights for each of the strata and summing the products; e.g. 6 x 1.667 + 7 x 2.14 +and 6 x 2.5 = 40. This is equal to the total number of eligible mortality records.

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The success of weighting was assessed by comparing the weighted number of linked deaths and the known number of actual deaths, by the different demographic variables. The distribution of W_AgeEthAdj adjusted linkage weights can be seen in Table 5. Note that some of these weights were less than <1.0; this is a result of having to adjust the W_Base weighted estimates

to account for the overestimation of the number of eligible mortality records in the finer 5-year age group strata.

**Table 5: Distribution of linkage weights**

| Statistic | W_AgeEthAdj Weight |
|---|---|
| Mean | 1.24 |
| Standard deviation | 0.22 |
| Maximum | 4.24 |
| Mininimum | 0.74 |
| Percentile 1 | 0.98 |
| 5 | 1.00 |
| 10 | 1.02 |
| 25 | 1.11 |
| 50 | 1.19 |
| 75 | 1.31 |
| 90 | 1.48 |
| 95 | 1.63 |
| 99 | 2.04 |

Weighted counts adjusted for age, sex, ethnicity by demographic variables are shown in Table 6. Generally, there is good agreement between the weighted estimates of deaths and the known number of actual deaths; as intended, the numbers agree exactly by the strata sex, age and ethnicity for the W_AgeEthAdj deaths, and sex, age and ICD for the W_AgeICDAdj deaths. Most other estimates were located within $\pm$ 3% of the actual number of deaths. Large disparities between the estimated and actual number of deaths were mostly limited to strata with small cell sizes (less than 100) or missing values. Note also that accurate estimates for the geographic variable TA were obtained, showing that it is possible to accurately weight based on these variables if they are included within the weighting strata (cf. Fawcett et al., 2008). Nevertheless, a few instances of discrepancy exist which should be noted for future cohort analyses:

- Weighted (W_AgeEthAdj) deaths are 4% lower in Kapiti than actual
- Weighted deaths for Asthma are 5% higher than actual
- Weighted deaths for Violent causes of death are 7% lower than actual.

**Table 6: Actual, linked and weighted deaths for 2001-2006 bias dataset (all numbers random rounded to near multiple of 3).**

| | | Deaths | | Weighted Deaths | | Ratio |
|---|---|---|---|---|---|---|
| | | | | | | W_AgeEthAdj/ |
| | | Linked | Actual | W_base | W_AgeEthAdj | Actual Deaths** |
| Sex | Males | 53985 | 67515 | 67497 | 67518 | 1.00 |
| | Females | 55806 | 68337 | 68355 | 68334 | 1.00 |
| Prioritised Ethnicity | Maori | 9384 | 12744 | 12795 | 12744 | 1.00 |
| | Pacific | 2793 | 3885 | 3837 | 3885 | 1.00 |
| | Asian | 1368 | 1929 | 1932 | 1929 | 1.00 |

|  |  | Deaths | | Weighted Deaths | | Ratio |
|---|---|---|---|---|---|---|
|  |  | Linked | Actual | W_base | W_AgeEthAdj | **W_AgeEthAdj/ Actual Deaths**\*\* |
|  | NonMPAandMissing | 96243 | 117294 | 117285 | 117294 | 1.00 |
| Age Group | 0-14 yrs | 804 | 1134 | 1137 | 1134 | 1.00 |
|  | 15-34 yrs | 2511 | 4218 | 4218 | 4218 | 1.00 |
|  | 35-49 yrs | 5535 | 7905 | 7905 | 7908 | 1.00 |
|  | 50-64 yrs | 16158 | 20325 | 20325 | 20325 | 1.00 |
|  | 65-74 yrs | 23769 | 28584 | 28584 | 28584 | 1.00 |
|  | 75-84 yrs | 36624 | 44127 | 44124 | 44127 | 1.00 |
|  | 85+ years | 24393 | 29559 | 29559 | 29559 | 1.00 |
| Age Group (detailed) | 0- 4 yrs | 243 | 327 | 339 | 327 | 1.00 |
|  | 5- 9 yrs | 147 | 207 | 213 | 207 | 1.00 |
|  | 10-14 yrs | 411 | 600 | 585 | 600 | 1.00 |
|  | 15-19 yrs | 618 | 960 | 1056 | 960 | 1.00 |
|  | 20-24 yrs | 468 | 849 | 807 | 852 | 1.00 |
|  | 25-29 yrs | 552 | 1005 | 903 | 1005 | 1.00 |
|  | 30-34 yrs | 873 | 1401 | 1455 | 1401 | 1.00 |
|  | 35-39 yrs | 1155 | 1857 | 1689 | 1854 | 1.00 |
|  | 40-44 yrs | 1866 | 2658 | 2661 | 2658 | 1.00 |
|  | 45-49 yrs | 2514 | 3393 | 3555 | 3393 | 1.00 |
|  | 50-54 yrs | 3984 | 5241 | 5025 | 5241 | 1.00 |
|  | 55-59 yrs | 5052 | 6375 | 6372 | 6372 | 1.00 |
|  | 60-64 yrs | 7119 | 8709 | 8928 | 8709 | 1.00 |
|  | 65-69 yrs | 9636 | 11634 | 11634 | 11634 | 1.00 |
|  | 70-74 yrs | 14133 | 16947 | 16947 | 16950 | 1.00 |
|  | 75-79 yrs | 18396 | 21975 | 22149 | 21975 | 1.00 |
|  | 80-84 yrs | 18228 | 22149 | 21975 | 22152 | 1.00 |
|  | 85-89 yrs | 15102 | 18420 | 18300 | 18420 | 1.00 |
|  | 90-94 yrs | 7119 | 8628 | 8625 | 8631 | 1.00 |
|  | 95+ yrs | 2172 | 2508 | 2634 | 2511 | 1.00 |
| NZ Deprivation Index | Missing | 36 | 99 | 51 | 48 | 0.48 |
|  | Dep 1-2 | 16302 | 20013 | 20037 | 20037 | 1.00 |
|  | Dep 3-4 | 20574 | 25215 | 25191 | 25188 | 1.00 |
|  | Dep 5-6 | 24465 | 29853 | 29880 | 29877 | 1.00 |
|  | Dep 7-8 | 25671 | 31833 | 31857 | 31857 | 1.00 |
|  | Dep 9-10 | 22746 | 28836 | 28833 | 28842 | 1.00 |
| Percent Mobility | Missing | 15 | 72 | 33 | 33 | 0.46 |
|  | 0-50% Mobility | 38562 | 47073 | 47082 | 47055 | 1.00 |

| | | Deaths | | Weighted Deaths | | Ratio |
|---|---|---|---|---|---|---|
| | | Linked | Actual | W_base | W_AgeEthAdj | W_AgeEthAdj/ Actual Deaths** |
| | 51-55% Mobility | 27138 | 33246 | 33255 | 33267 | 1.00 |
| | 56-60% Mobility | 23094 | 28695 | 28788 | 28785 | 1.00 |
| | >60% Mobility | 20988 | 26766 | 26694 | 26712 | 1.00 |
| Rurality | Missing | 42 | 117 | 81 | 81 | 0.69 |
| | Urban | 99903 | 122919 | 122955 | 122964 | 1.00 |
| | Rural | 9846 | 12813 | 12813 | 12804 | 1.00 |
| Cause of Death | Cancer | 31563 | 38553 | 38577 | 38541 | 1.00 |
| | CVD excl. IHD | 19902 | 24405 | 24378 | 24378 | 1.00 |
| | IHD | 25020 | 30354 | 30390 | 30384 | 1.00 |
| | Respiratory | 7908 | 9498 | 9564 | 9555 | 1.01 |
| | Congenital,Perinatal, SIDS | 399 | 525 | 579 | 582 | 1.11 |
| | Unintentional Injury | 3573 | 5115 | 5040 | 5055 | 0.99 |
| | Suicide | 1593 | 2568 | 2454 | 2484 | 0.97 |
| | Violent | 150 | 249 | 225 | 231 | 0.93 |
| | Other, Not Dead | 19689 | 24588 | 24645 | 24642 | 1.00 |
| Cause of Death (detailed) | IHD | 25020 | 30351 | 30387 | 30384 | 1.00 |
| | Suicide | 1593 | 2568 | 2454 | 2484 | 0.97 |
| | Violent | 150 | 249 | 225 | 231 | 0.93 |
| | Stomach Cancer | 1176 | 1434 | 1458 | 1458 | 1.02 |
| | Colorectal Cancer | 4695 | 5742 | 5682 | 5673 | 0.99 |
| | Pancreas Cancer | 1308 | 1584 | 1599 | 1599 | 1.01 |
| | Lung/Bronchus Cancer | 5949 | 7260 | 7287 | 7269 | 1.00 |
| | Melanoma | 1032 | 1263 | 1269 | 1272 | 1.01 |
| | Breast Cancer | 2544 | 3093 | 3135 | 3129 | 1.01 |
| | Prostate Cancer | 2358 | 2838 | 2823 | 2820 | 0.99 |
| | Brain/Nervous System Cancer | 843 | 1083 | 1068 | 1071 | 0.99 |
| | Other Cancer | 11661 | 14262 | 14259 | 14250 | 1.00 |
| | Other Heart Disease | 6297 | 7731 | 7767 | 7764 | 1.00 |
| | Cerebrovascular Disease | 10935 | 13461 | 13323 | 13332 | 0.99 |
| | Other Cardiovascular Disease | 2673 | 3213 | 3288 | 3282 | 1.02 |
| | Unintentional Injury oth | 2208 | 3030 | 2976 | 2988 | 0.99 |
| | RTC | 1365 | 2088 | 2064 | 2067 | 0.99 |

| | | Deaths | | Weighted Deaths | | Ratio |
|---|---|---|---|---|---|---|
| | | Linked | Actual | W_base | W_AgeEthAdj | W_AgeEthAdj/ Actual Deaths** |
| | Communicable Diseases | 843 | 1083 | 1092 | 1092 | 1.01 |
| | Diabetes | 3240 | 4026 | 4101 | 4095 | 1.02 |
| | Pnuemonia/Influenza | 1674 | 2058 | 2058 | 2052 | 1.00 |
| | COPD | 6768 | 8130 | 8160 | 8151 | 1.00 |
| | Asthma | 270 | 336 | 351 | 354 | 1.05 |
| | Other Respiratory | 867 | 1032 | 1053 | 1050 | 1.02 |
| | Congenital | 381 | 495 | 558 | 558 | 1.13 |
| | Perinatal | 6 | 15 | 9 | 6 | 0.40 |
| | SIDS | 9 | 18 | 15 | 12 | 0.67 |
| | Other Causes | 13929 | 17412 | 17385 | 17394 | 1.00 |
| | Not Dead/Linked | 6 | 9 | 9 | 9 | 1.00 |
| District Health Board | Northland | 4674 | 6012 | 6039 | 6033 | 1.00 |
| | Waitemata | 9990 | 12423 | 12363 | 12378 | 1.00 |
| | Auckland | 9024 | 11334 | 11319 | 11331 | 1.00 |
| | Counties Manukau | 7878 | 10182 | 10179 | 10191 | 1.00 |
| | Waikato | 9225 | 11412 | 11439 | 11427 | 1.00 |
| | Lakes | 2823 | 3546 | 3567 | 3567 | 1.01 |
| | Bay of Plenty | 6138 | 7635 | 7617 | 7611 | 1.00 |
| | Tairawhiti | 1491 | 1887 | 1899 | 1899 | 1.01 |
| | Taranaki | 3717 | 4425 | 4425 | 4428 | 1.00 |
| | Hawke's Bay | 5088 | 6240 | 6219 | 6219 | 1.00 |
| | Whanganui | 2454 | 2967 | 2970 | 2964 | 1.00 |
| | Midcentral | 5298 | 6567 | 6630 | 6624 | 1.01 |
| | Hutt | 3777 | 4548 | 4542 | 4542 | 1.00 |
| | Capital and Coast | 5922 | 7392 | 7326 | 7326 | 0.99 |
| | Wairarapa | 1425 | 1704 | 1719 | 1722 | 1.01 |
| | Nelson Marlborough | 4182 | 5169 | 5226 | 5226 | 1.01 |
| | West Coast | 1002 | 1314 | 1305 | 1302 | 0.99 |
| | Canterbury | 13950 | 16860 | 16860 | 16860 | 1.00 |
| | South Canterbury | 2238 | 2652 | 2655 | 2655 | 1.00 |
| | Otago | 6105 | 7401 | 7383 | 7386 | 1.00 |
| | Southland | 3384 | 4134 | 4158 | 4152 | 1.00 |
| | Area outside DHB | 6 | 48 | 6 | 6 | 0.13 |
| Territorial Authority | Missing | 6 | 48 | 6 | 6 | 0.13 |
| | Auckland | 9024 | 11334 | 11319 | 11331 | 1.00 |
| | Waikato | 1074 | 1305 | 1305 | 1308 | 1.00 |

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|  | Deaths | | Weighted Deaths | | Ratio |
|  | Linked | Actual | W_base | W_AgeEthAdj | W_AgeEthAdj/ Actual Deaths** |
|---|---|---|---|---|---|
| Southland | 594 | 762 | 771 | 771 | 1.01 |
| Far North | 1668 | 2256 | 2283 | 2277 | 1.01 |
| Whangarei | 2394 | 3012 | 3018 | 3018 | 1.00 |
| Kaipara | 609 | 741 | 741 | 738 | 1.00 |
| Rodney | 2253 | 2808 | 2775 | 2775 | 0.99 |
| North Shore | 4338 | 5328 | 5313 | 5316 | 1.00 |
| Waitakere | 3396 | 4287 | 4278 | 4290 | 1.00 |
| Manukau | 5637 | 7305 | 7311 | 7329 | 1.00 |
| Papakura | 1083 | 1392 | 1389 | 1386 | 1.00 |
| Franklin | 1161 | 1485 | 1482 | 1479 | 1.00 |
| Thames Coromandel | 1062 | 1311 | 1302 | 1299 | 0.99 |
| Hauraki | 603 | 732 | 741 | 741 | 1.01 |
| Matamata-Piako | 915 | 1119 | 1119 | 1122 | 1.00 |
| Hamilton | 2952 | 3666 | 3663 | 3660 | 1.00 |
| Waipa | 1266 | 1590 | 1620 | 1620 | 1.02 |
| Otorohanga | 195 | 240 | 243 | 243 | 1.01 |
| South Waikato | 588 | 726 | 726 | 723 | 1.00 |
| Waitomo | 276 | 345 | 345 | 342 | 0.99 |
| Taupo | 900 | 1134 | 1152 | 1152 | 1.02 |
| Western Bay of Plenty | 1209 | 1524 | 1512 | 1509 | 0.99 |
| Tauranga | 3426 | 4275 | 4257 | 4254 | 1.00 |
| Rotorua | 1920 | 2412 | 2418 | 2415 | 1.00 |
| Whakatane | 1020 | 1239 | 1254 | 1254 | 1.01 |
| Kawerau | 156 | 189 | 189 | 189 | 1.00 |
| Opotiki | 321 | 405 | 408 | 405 | 1.00 |
| Gisborne | 1494 | 1887 | 1899 | 1899 | 1.01 |
| Wairoa | 309 | 390 | 390 | 390 | 1.00 |
| Hastings | 2310 | 2853 | 2829 | 2829 | 0.99 |
| Napier | 2073 | 2514 | 2520 | 2523 | 1.00 |
| Central Hawkes Bay | 387 | 465 | 465 | 465 | 1.00 |
| New Plymouth | 2469 | 2934 | 2931 | 2931 | 1.00 |
| Stratford | 306 | 369 | 372 | 369 | 1.00 |
| South Taranaki | 942 | 1125 | 1125 | 1125 | 1.00 |
| Ruapehu | 378 | 492 | 492 | 489 | 0.99 |
| Wanganui | 1863 | 2235 | 2226 | 2223 | 0.99 |
| Rangitikei | 504 | 615 | 627 | 627 | 1.02 |

|  | Deaths | | Weighted Deaths | | Ratio |
|---|---|---|---|---|---|
|  | Linked | Actual | W_base | W_AgeEthAdj | W_AgeEthAdj/ Actual Deaths** |
| Manawatu | 798 | 1020 | 1041 | 1041 | 1.02 |
| Palmerston North | 2055 | 2550 | 2553 | 2550 | 1.00 |
| Tararua | 615 | 744 | 756 | 753 | 1.01 |
| Horowhenua | 1506 | 1857 | 1872 | 1869 | 1.01 |
| Kapiti Coast | 1755 | 2340 | 2247 | 2244 | 0.96 |
| Porirua | 1002 | 1218 | 1236 | 1239 | 1.02 |
| Upper Hutt | 1119 | 1359 | 1356 | 1356 | 1.00 |
| Lower Hutt | 2658 | 3192 | 3186 | 3189 | 1.00 |
| Wellington | 3492 | 4224 | 4251 | 4254 | 1.01 |
| Masterton | 900 | 1080 | 1086 | 1086 | 1.01 |
| Carterton | 246 | 276 | 282 | 282 | 1.02 |
| South Wairarapa | 279 | 348 | 348 | 351 | 1.01 |
| Tasman | 1191 | 1491 | 1518 | 1518 | 1.02 |
| Nelson | 1482 | 1821 | 1815 | 1815 | 1.00 |
| Marlborough | 1506 | 1857 | 1890 | 1893 | 1.02 |
| Kaikoura | 114 | 141 | 141 | 141 | 1.00 |
| Buller | 318 | 435 | 411 | 414 | 0.95 |
| Grey | 447 | 564 | 579 | 579 | 1.03 |
| Westland | 237 | 318 | 318 | 315 | 0.99 |
| Hurunui | 249 | 306 | 300 | 297 | 0.97 |
| Waimakariri | 1017 | 1239 | 1236 | 1236 | 1.00 |
| Christchurch | 10953 | 13152 | 13134 | 13128 | 1.00 |
| Banks Peninsula | 174 | 225 | 228 | 228 | 1.01 |
| Selwyn | 429 | 570 | 603 | 603 | 1.06 |
| Ashburton | 1017 | 1224 | 1224 | 1224 | 1.00 |
| Timaru | 1851 | 2190 | 2184 | 2184 | 1.00 |
| Mackenzie | 90 | 108 | 114 | 114 | 1.06 |
| Waimate | 297 | 354 | 357 | 357 | 1.01 |
| Chatham Islands | 12 | 18 | 15 | 15 | 0.83 |
| Waitaki | 954 | 1164 | 1164 | 1161 | 1.00 |
| Central Otago | 546 | 648 | 642 | 639 | 0.99 |
| Queenstown-Lakes | 291 | 387 | 381 | 381 | 0.98 |
| Dunedin | 3954 | 4782 | 4785 | 4788 | 1.00 |
| Clutha | 525 | 639 | 633 | 633 | 0.99 |
| Gore | 498 | 597 | 597 | 594 | 0.99 |
| Invercargill | 2127 | 2553 | 2571 | 2568 | 1.01 |

**ratios very unstable due to random rounding when either/both W_AgeEthAdj and Actual Deaths less than 20.

### *Weighting of nonlinked census records (n =3,520,743)*

Linked census-mortality records only account for approx 1% of the total number of census records. Additionally there will be some unlinked census records for people who actually died, but where the mortality outcome is misclassified as still alive. In order for of the weighted sum of ALL census records in each cohort to equal the total number of census records, each unlinked census record must be weighted with a value slightly less than 1.0 to account for the fact that some individuals did die during follow up although they were not classified as such. This can be conceptualised as:

$$\mathbf{N_C}^i = \mathbf{N_{LW}}^i + \mathbf{N_{UW}}^i$$

Where $\mathbf{N_C}^i$ = total number of cohort members in strata *i*.
$\mathbf{N_{LW}}^i = \mathbf{N_L}^i \times \mathbf{W_L}^i$ or the weighted num. linked cohort members.
$\mathbf{N_{UW}}^i = \mathbf{N_u}^i \times \mathbf{W_u}^i$ or the weighted num. unlinked cohort members.

Therefore, the weight for unlinked records, $\mathbf{W_U}^i$, can be calculated thusly:

$$\mathbf{W_U}^i = (\mathbf{N_C}^i - \mathbf{N_{Lw}}^i) / \mathbf{N_U}^i$$

That is, by dividing the difference between the number of cohort members and weighted number of linked cohort members for each strata by the number of unlinked cohort members.

Data was stratified by 5-year age groups, sex, prioritised ethnicity, NZDep and rurality. As with linked records, two weights were calculated for these strata- W_Base and W_AgeEthAdj, which were applied to all unlinked records.

The weighted and actual counts for the linked and unlinked records for 2001-2004 and 2001-2006 are shown in Table 7.
Proportion error was calculated as:

weighted unlinked census records
(unlinked census records- (weighted linked deaths – unweighted linked deaths))

Weighted cohort estimates for the 2001-2006 cohort was more accurate than for 2001-2004. For the 2001-2004 data, error rate appeared to differ by age group; weighted estimates were least accurate for age groups less than 20 years old (proportion error = 0.96) and over 75 years old (proportion error > 1.03).

**Table 7: Actual deaths, weighted counts and differences for census records, 2001-2004 and 2001-2006 cohorts.**

| | | | 01-04 | | | | | 01-06 | | | | |
| | | | Linked Deaths | | Unlinked Census Records | | | Linked Deaths | | Unlinked Census Records | | |
| Sex | Ethnicity | Age | Eligible | W_Age EthAdj | Eligible | W_Age EthAdj | Proportion Error | Eligible | W_Age EthAdj | Eligible | W_Age EthAdj | Proportion Error |
|------|----------|-----------|------|------|-------|-------|------|------|------|-------|-------|------|
| Males | NZ Maori | 0- 4 yrs | 39 | 60 | 33660 | 32460 | 0.96 | 54 | 75 | 33648 | 33624 | 1.00 |
| | | 5- 9 yrs | 24 | 36 | 33288 | 32103 | 0.96 | 36 | 54 | 33276 | 33258 | 1.00 |
| | | 10-14 yrs | 33 | 48 | 30996 | 29892 | 0.96 | 78 | 132 | 30954 | 30912 | 1.00 |
| | | 15-19 yrs | 66 | 117 | 24003 | 23148 | 0.97 | 105 | 195 | 23964 | 23865 | 1.00 |
| | | 20-24 yrs | 57 | 102 | 19647 | 19386 | 0.99 | 90 | 165 | 19614 | 19533 | 1.00 |
| | | 25-29 yrs | 60 | 111 | 18126 | 17886 | 0.99 | 96 | 195 | 18093 | 18018 | 1.00 |
| | | 30-34 yrs | 78 | 129 | 17754 | 17517 | 0.99 | 123 | 219 | 17709 | 17610 | 1.00 |
| | | 35-39 yrs | 96 | 144 | 17517 | 17286 | 0.99 | 165 | 309 | 17448 | 17349 | 1.00 |
| | | 40-44 yrs | 147 | 207 | 15021 | 14823 | 0.99 | 255 | 399 | 14910 | 14772 | 1.00 |
| | | 45-49 yrs | 201 | 285 | 11676 | 11520 | 0.99 | 345 | 495 | 11532 | 11340 | 1.00 |
| | | 50-54 yrs | 279 | 360 | 9006 | 8820 | 0.99 | 468 | 645 | 8817 | 8679 | 1.00 |
| | | 55-59 yrs | 297 | 378 | 6252 | 6120 | 0.99 | 513 | 678 | 6039 | 5889 | 1.00 |
| | | 60-64 yrs | 411 | 519 | 5061 | 4950 | 1.00 | 693 | 864 | 4779 | 4566 | 0.99 |
| | | 65-69 yrs | 417 | 525 | 3318 | 3240 | 1.01 | 663 | 831 | 3075 | 2901 | 1.00 |
| | | 70-74 yrs | 336 | 423 | 1887 | 1863 | 1.04 | 558 | 711 | 1668 | 1530 | 1.01 |
| | | 75-79 yrs | 228 | 282 | 855 | 825 | 1.03 | 369 | 468 | 714 | 621 | 1.01 |
| | | 80-84 yrs | 126 | 159 | 312 | 303 | 1.09 | 195 | 237 | 246 | 198 | 0.97 |

| Sex | Ethnicity | Age | 01-04 | | | | | | 01-06 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Linked Deaths | | Unlinked Census Records | | | | Linked Deaths | | Unlinked Census Records | | |
| | | | Eligible | W_Age EthAdj | Eligible | W_Age EthAdj | Proportion Error | | Eligible | W_Age EthAdj | Eligible | W_Age EthAdj | Proportion Error |
| | | 85-89 yrs | 66 | 84 | 102 | 99 | 1.18 | | 84 | 111 | 84 | 63 | 1.11 |
| | | 90-94 yrs | 15 | 18 | 27 | 27 | 1.13 | | 21 | 24 | 18 | 12 | 0.80 |
| | | 95+ yrs | 24 | 30 | 4518 | 4359 | 0.97 | | 33 | 42 | 4512 | 4455 | 0.99 |
| | Pacific | 0- 4 yrs | 18 | 18 | 12024 | 11595 | 0.96 | | 18 | 18 | 12027 | 12024 | 1.00 |
| | | 5- 9 yrs | 6 | 6 | 11988 | 11559 | 0.96 | | 9 | 12 | 11982 | 11979 | 1.00 |
| | | 10-14 yrs | 12 | 15 | 10851 | 10464 | 0.96 | | 18 | 27 | 10845 | 10839 | 1.00 |
| | | 15-19 yrs | 24 | 42 | 8805 | 8490 | 0.97 | | 39 | 54 | 8790 | 8760 | 1.00 |
| | | 20-24 yrs | 21 | 36 | 8094 | 7983 | 0.99 | | 30 | 60 | 8085 | 8058 | 1.00 |
| | | 25-29 yrs | 15 | 24 | 7731 | 7626 | 0.99 | | 24 | 51 | 7722 | 7704 | 1.00 |
| | | 30-34 yrs | 24 | 39 | 7620 | 7515 | 0.99 | | 39 | 75 | 7605 | 7572 | 1.00 |
| | | 35-39 yrs | 30 | 42 | 6990 | 6894 | 0.99 | | 48 | 87 | 6972 | 6945 | 1.00 |
| | | 40-44 yrs | 48 | 66 | 5601 | 5526 | 0.99 | | 81 | 114 | 5571 | 5529 | 1.00 |
| | | 45-49 yrs | 51 | 69 | 4704 | 4638 | 0.99 | | 81 | 111 | 4674 | 4638 | 1.00 |
| | | 50-54 yrs | 90 | 123 | 3636 | 3588 | 1.00 | | 138 | 192 | 3588 | 3540 | 1.00 |
| | | 55-59 yrs | 78 | 105 | 2532 | 2499 | 1.00 | | 138 | 189 | 2475 | 2424 | 1.00 |
| | | 60-64 yrs | 105 | 144 | 1932 | 1905 | 1.01 | | 168 | 219 | 1866 | 1812 | 1.00 |
| | | 65-69 yrs | 117 | 153 | 1224 | 1209 | 1.02 | | 198 | 264 | 1146 | 1077 | 1.00 |
| | | 70-74 yrs | 111 | 147 | 828 | 819 | 1.03 | | 162 | 219 | 777 | 723 | 1.00 |
| | | 75-79 yrs | 99 | 135 | 390 | 375 | 1.06 | | 153 | 204 | 339 | 297 | 1.03 |

| | | | 01-04 | | | | | 01-06 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Linked Deaths | | Unlinked Census Records | | | Linked Deaths | | Unlinked Census Records | | |
| Sex | Ethnicity | Age | Eligible | W_Age EthAdj | Eligible | W_Age EthAdj | Proportion Error | Eligible | W_Age EthAdj | Eligible | W_Age EthAdj | Proportion Error |
| | | 80-84 yrs | 54 | 75 | 150 | 144 | 1.12 | 75 | 105 | 129 | 108 | 1.09 |
| | | 85-89 yrs | 24 | 33 | 36 | 33 | 1.22 | 30 | 39 | 30 | 21 | 1.00 |
| | | 90-94 yrs | 12 | 12 | 9 | 9 | 1.00 | 12 | 12 | 9 | 9 | 1.00 |
| | | 95+ yrs | 15 | 18 | 1971 | 1899 | 0.96 | 21 | 30 | 1962 | 1941 | 0.99 |
| | Asian | 0- 4 yrs | 6 | 6 | 8061 | 7773 | 0.96 | 6 | 6 | 8061 | 8058 | 1.00 |
| | | 5- 9 yrs | 6 | 6 | 8433 | 8130 | 0.96 | 6 | 9 | 8430 | 8427 | 1.00 |
| | | 10-14 yrs | 6 | 6 | 9168 | 8841 | 0.96 | 6 | 9 | 9168 | 9165 | 1.00 |
| | | 15-19 yrs | 18 | 30 | 13065 | 12600 | 0.97 | 18 | 33 | 13062 | 13047 | 1.00 |
| | | 20-24 yrs | 15 | 24 | 11064 | 10914 | 0.99 | 18 | 36 | 11058 | 11043 | 1.00 |
| | | 25-29 yrs | 6 | 9 | 7470 | 7368 | 0.99 | 9 | 21 | 7464 | 7461 | 1.00 |
| | | 30-34 yrs | 12 | 21 | 7917 | 7812 | 0.99 | 15 | 30 | 7914 | 7899 | 1.00 |
| | | 35-39 yrs | 12 | 18 | 9807 | 9675 | 0.99 | 15 | 30 | 9804 | 9795 | 1.00 |
| | | 40-44 yrs | 21 | 33 | 8397 | 8286 | 0.99 | 36 | 54 | 8385 | 8364 | 1.00 |
| | | 45-49 yrs | 21 | 30 | 6795 | 6702 | 0.99 | 48 | 66 | 6771 | 6750 | 1.00 |
| | | 50-54 yrs | 30 | 42 | 5196 | 5127 | 0.99 | 60 | 75 | 5169 | 5151 | 1.00 |
| | | 55-59 yrs | 33 | 45 | 3180 | 3135 | 0.99 | 63 | 78 | 3150 | 3132 | 1.00 |
| | | 60-64 yrs | 45 | 60 | 2880 | 2841 | 0.99 | 78 | 111 | 2847 | 2820 | 1.00 |
| | | 65-69 yrs | 48 | 69 | 2046 | 2019 | 1.00 | 90 | 135 | 2004 | 1968 | 1.00 |
| | | 70-74 yrs | 57 | 75 | 1134 | 1119 | 1.00 | 93 | 129 | 1095 | 1053 | 0.99 |

| Sex | Ethnicity | Age | 01-04 | | | | | | 01-06 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Linked Deaths | | Unlinked Census Records | | | | Linked Deaths | | Unlinked Census Records | | |
| | | | Eligible | W_Age EthAdj | Eligible | W_Age EthAdj | Proportion Error | | Eligible | W_Age EthAdj | Eligible | W_Age EthAdj | Proportion Error |
| | | 75-79 yrs | 63 | 81 | 546 | 528 | 1.00 | | 99 | 135 | 507 | 480 | 1.02 |
| | | 80-84 yrs | 39 | 54 | 252 | 243 | 1.03 | | 69 | 87 | 225 | 201 | 0.97 |
| | | 85-89 yrs | 15 | 21 | 87 | 84 | 1.04 | | 27 | 39 | 75 | 66 | 1.05 |
| | | 90-94 yrs | 9 | 6 | 27 | 27 | 0.90 | | 9 | 15 | 24 | 21 | 1.17 |
| | | 95+ yrs | 9 | 9 | 1332 | 1284 | 0.96 | | 9 | 15 | 1332 | 1323 | 1.00 |
| | nonMPA | 0- 4 yrs | 45 | 60 | 79350 | 76524 | 0.96 | | 60 | 84 | 79338 | 79314 | 1.00 |
| | | 5- 9 yrs | 24 | 33 | 88572 | 85416 | 0.96 | | 39 | 54 | 88560 | 88545 | 1.00 |
| | | 10-14 yrs | 75 | 93 | 92583 | 89286 | 0.96 | | 162 | 216 | 92496 | 92436 | 1.00 |
| | | 15-19 yrs | 174 | 285 | 83748 | 80763 | 0.97 | | 276 | 399 | 83646 | 83451 | 1.00 |
| | | 20-24 yrs | 129 | 213 | 74304 | 73323 | 0.99 | | 204 | 375 | 74229 | 74079 | 1.00 |
| | | 25-29 yrs | 144 | 237 | 78747 | 77706 | 0.99 | | 213 | 390 | 78681 | 78540 | 1.00 |
| | | 30-34 yrs | 198 | 315 | 92412 | 91191 | 0.99 | | 306 | 549 | 92304 | 92079 | 1.00 |
| | | 35-39 yrs | 267 | 384 | 101673 | 100329 | 0.99 | | 411 | 714 | 101529 | 101325 | 1.00 |
| | | 40-44 yrs | 369 | 528 | 102945 | 101583 | 0.99 | | 639 | 969 | 102675 | 102363 | 1.00 |
| | | 45-49 yrs | 543 | 744 | 94125 | 92880 | 0.99 | | 936 | 1272 | 93732 | 93300 | 1.00 |
| | | 50-54 yrs | 942 | 1176 | 92757 | 90966 | 0.98 | | 1608 | 2160 | 92094 | 91662 | 1.00 |
| | | 55-59 yrs | 1287 | 1599 | 72738 | 71316 | 0.98 | | 2199 | 2781 | 71826 | 71235 | 1.00 |
| | | 60-64 yrs | 1863 | 2298 | 60336 | 59142 | 0.99 | | 3219 | 3975 | 58977 | 58128 | 1.00 |
| | | 65-69 yrs | 2814 | 3324 | 49758 | 48765 | 0.99 | | 4767 | 5703 | 47805 | 46899 | 1.00 |

| | | | 01-04 | | | | | 01-06 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Linked Deaths | | Unlinked Census Records | | | Linked Deaths | | Unlinked Census Records | | |
| Sex | Ethnicity | Age | Eligible | W_Age EthAdj | Eligible | W_Age EthAdj | Proportion Error | Eligible | W_Age EthAdj | Eligible | W_Age EthAdj | Proportion Error |
| | | 70-74 yrs | 4446 | 5241 | 45036 | 44163 | 1.00 | 7401 | 8763 | 42081 | 40713 | 1.00 |
| | | 75-79 yrs | 5355 | 6324 | 31425 | 30306 | 1.00 | 9024 | 10665 | 27759 | 26106 | 1.00 |
| | | 80-84 yrs | 4776 | 5646 | 15945 | 15375 | 1.02 | 7656 | 9120 | 13065 | 11679 | 1.01 |
| | | 85-89 yrs | 3513 | 4260 | 6372 | 6144 | 1.09 | 5259 | 6366 | 4626 | 3570 | 1.01 |
| | | 90-94 yrs | 1395 | 1689 | 1395 | 1347 | 1.22 | 1860 | 2253 | 933 | 570 | 1.06 |
| | | 95+ yrs | 426 | 516 | 16014 | 15444 | 0.97 | 555 | 660 | 15885 | 15567 | 0.99 |
| Females | NZ Mäori | 0- 4 yrs | 30 | 39 | 31998 | 30858 | 0.96 | 33 | 42 | 31992 | 31974 | 1.00 |
| | | 5- 9 yrs | 12 | 18 | 31173 | 30063 | 0.96 | 18 | 24 | 31167 | 31158 | 1.00 |
| | | 10-14 yrs | 24 | 30 | 30243 | 29166 | 0.96 | 57 | 87 | 30213 | 30186 | 1.00 |
| | | 15-19 yrs | 33 | 54 | 24405 | 23535 | 0.97 | 45 | 78 | 24396 | 24369 | 1.00 |
| | | 20-24 yrs | 21 | 33 | 21666 | 21381 | 0.99 | 36 | 63 | 21654 | 21633 | 1.00 |
| | | 25-29 yrs | 42 | 63 | 21216 | 20934 | 0.99 | 66 | 99 | 21195 | 21162 | 1.00 |
| | | 30-34 yrs | 51 | 69 | 20667 | 20394 | 0.99 | 105 | 147 | 20613 | 20550 | 1.00 |
| | | 35-39 yrs | 84 | 111 | 19866 | 19602 | 0.99 | 150 | 213 | 19794 | 19740 | 1.00 |
| | | 40-44 yrs | 129 | 171 | 16932 | 16707 | 0.99 | 234 | 312 | 16824 | 16743 | 1.00 |
| | | 45-49 yrs | 147 | 195 | 12546 | 12381 | 0.99 | 258 | 357 | 12438 | 12345 | 1.00 |
| | | 50-54 yrs | 195 | 249 | 9630 | 9435 | 0.99 | 324 | 441 | 9501 | 9414 | 1.00 |
| | | 55-59 yrs | 231 | 291 | 6747 | 6606 | 0.99 | 429 | 549 | 6549 | 6426 | 1.00 |
| | | 60-64 yrs | 339 | 429 | 5475 | 5358 | 0.99 | 564 | 699 | 5253 | 5091 | 0.99 |

| Sex | Ethnicity | Age | 01-04 | | | | | | 01-06 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Linked Deaths** | | **Unlinked Census Records** | | | **Linked Deaths** | | **Unlinked Census Records** | | |
| | | | Eligible | W_Age EthAdj | Eligible | W_Age EthAdj | Proportion Error | Eligible | W_Age EthAdj | Eligible | W_Age EthAdj | Proportion Error |
| | | 65-69 yrs | 339 | 420 | 3654 | 3573 | 1.00 | 549 | 696 | 3438 | 3300 | 1.00 |
| | | 70-74 yrs | 303 | 375 | 2367 | 2337 | 1.02 | 510 | 627 | 2166 | 2043 | 1.00 |
| | | 75-79 yrs | 255 | 321 | 1242 | 1197 | 1.02 | 396 | 519 | 1098 | 966 | 0.99 |
| | | 80-84 yrs | 147 | 186 | 570 | 549 | 1.03 | 258 | 333 | 462 | 387 | 1.00 |
| | | 85-89 yrs | 99 | 126 | 213 | 207 | 1.11 | 156 | 204 | 156 | 117 | 1.08 |
| | | 90-94 yrs | 33 | 42 | 57 | 54 | 1.13 | 42 | 51 | 48 | 39 | 1.00 |
| | | 95+ yrs | 30 | 39 | 3789 | 3657 | 0.97 | 51 | 66 | 3771 | 3729 | 0.99 |
| | Pacific | 0- 4 yrs | 9 | 12 | 11697 | 11280 | 0.96 | 12 | 15 | 11691 | 11691 | 1.00 |
| | | 5- 9 yrs | 6 | 6 | 11133 | 10734 | 0.96 | 6 | 6 | 11133 | 11133 | 1.00 |
| | | 10-14 yrs | 6 | 9 | 10413 | 10044 | 0.96 | 9 | 9 | 10410 | 10410 | 1.00 |
| | | 15-19 yrs | 12 | 18 | 8961 | 8643 | 0.97 | 18 | 27 | 8955 | 8946 | 1.00 |
| | | 20-24 yrs | 9 | 15 | 8892 | 8778 | 0.99 | 15 | 18 | 8889 | 8880 | 1.00 |
| | | 25-29 yrs | 9 | 12 | 8418 | 8304 | 0.99 | 15 | 21 | 8409 | 8403 | 1.00 |
| | | 30-34 yrs | 15 | 21 | 8742 | 8625 | 0.99 | 27 | 42 | 8730 | 8718 | 1.00 |
| | | 35-39 yrs | 27 | 36 | 7710 | 7608 | 0.99 | 42 | 54 | 7695 | 7677 | 1.00 |
| | | 40-44 yrs | 30 | 39 | 6090 | 6009 | 0.99 | 48 | 63 | 6072 | 6057 | 1.00 |
| | | 45-49 yrs | 45 | 57 | 4725 | 4662 | 0.99 | 72 | 96 | 4698 | 4680 | 1.00 |
| | | 50-54 yrs | 45 | 60 | 3774 | 3723 | 0.99 | 87 | 111 | 3732 | 3705 | 1.00 |
| | | 55-59 yrs | 63 | 84 | 2706 | 2670 | 0.99 | 114 | 144 | 2655 | 2622 | 1.00 |

| Sex | Ethnicity | Age | 01-04 | | | | | | 01-06 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Linked Deaths | | Unlinked Census Records | | | Linked Deaths | | Unlinked Census Records | | |
| | | | Eligible | W_Age EthAdj | Eligible | W_Age EthAdj | Proportion Error | Eligible | W_Age EthAdj | Eligible | W_Age EthAdj | Proportion Error |
| | | 60-64 yrs | 81 | 105 | 2145 | 2115 | 1.00 | 123 | 168 | 2100 | 2067 | 1.01 |
| | | 65-69 yrs | 99 | 135 | 1542 | 1521 | 1.01 | 153 | 204 | 1488 | 1431 | 1.00 |
| | | 70-74 yrs | 90 | 123 | 1104 | 1089 | 1.02 | 144 | 204 | 1047 | 999 | 1.01 |
| | | 75-79 yrs | 81 | 117 | 621 | 600 | 1.03 | 123 | 186 | 576 | 525 | 1.02 |
| | | 80-84 yrs | 75 | 108 | 312 | 303 | 1.09 | 123 | 174 | 264 | 222 | 1.04 |
| | | 85-89 yrs | 39 | 54 | 96 | 93 | 1.15 | 57 | 78 | 78 | 60 | 1.05 |
| | | 90-94 yrs | 15 | 18 | 39 | 39 | 1.08 | 24 | 30 | 33 | 27 | 1.00 |
| | | 95+ yrs | 21 | 24 | 1860 | 1794 | 0.97 | 24 | 36 | 1854 | 1836 | 1.00 |
| | Asian | 0- 4 yrs | 6 | 6 | 7896 | 7617 | 0.96 | 6 | 6 | 7893 | 7890 | 1.00 |
| | | 5- 9 yrs | 6 | 6 | 8022 | 7734 | 0.96 | 6 | 6 | 8022 | 8022 | 1.00 |
| | | 10-14 yrs | 6 | 6 | 8718 | 8406 | 0.96 | 9 | 9 | 8715 | 8709 | 1.00 |
| | | 15-19 yrs | 9 | 9 | 12618 | 12165 | 0.96 | 6 | 12 | 12618 | 12615 | 1.00 |
| | | 20-24 yrs | 9 | 12 | 11640 | 11487 | 0.99 | 9 | 12 | 11640 | 11634 | 1.00 |
| | | 25-29 yrs | 6 | 6 | 9414 | 9285 | 0.99 | 6 | 9 | 9414 | 9411 | 1.00 |
| | | 30-34 yrs | 12 | 15 | 11004 | 10857 | 0.99 | 18 | 21 | 11001 | 10989 | 1.00 |
| | | 35-39 yrs | 12 | 18 | 12006 | 11844 | 0.99 | 18 | 30 | 12003 | 11991 | 1.00 |
| | | 40-44 yrs | 18 | 24 | 10611 | 10464 | 0.99 | 30 | 39 | 10599 | 10587 | 1.00 |
| | | 45-49 yrs | 18 | 21 | 8241 | 8130 | 0.99 | 30 | 39 | 8229 | 8217 | 1.00 |
| | | 50-54 yrs | 18 | 24 | 5721 | 5643 | 0.99 | 39 | 51 | 5700 | 5685 | 1.00 |

| Sex | Ethnicity | Age | 01-04 | | | | | 01-06 | | | | |
| | | | Linked Deaths | | Unlinked Census Records | | | Linked Deaths | | Unlinked Census Records | | |
| | | | Eligible | W_Age EthAdj | Eligible | W_Age EthAdj | Proportion Error | Eligible | W_Age EthAdj | Eligible | W_Age EthAdj | Proportion Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 55-59 yrs | 18 | 24 | 3558 | 3510 | 0.99 | 30 | 42 | 3546 | 3537 | 1.00 |
| | | 60-64 yrs | 30 | 39 | 3009 | 2967 | 0.99 | 48 | 63 | 2991 | 2976 | 1.00 |
| | | 65-69 yrs | 39 | 54 | 2082 | 2055 | 0.99 | 66 | 93 | 2058 | 2034 | 1.00 |
| | | 70-74 yrs | 42 | 54 | 1230 | 1215 | 1.00 | 69 | 99 | 1206 | 1176 | 1.00 |
| | | 75-79 yrs | 54 | 72 | 744 | 717 | 0.99 | 84 | 117 | 714 | 681 | 1.00 |
| | | 80-84 yrs | 48 | 69 | 375 | 363 | 1.03 | 66 | 90 | 357 | 336 | 1.01 |
| | | 85-89 yrs | 36 | 48 | 165 | 159 | 1.04 | 54 | 75 | 147 | 129 | 1.02 |
| | | 90-94 yrs | 18 | 21 | 51 | 48 | 1.00 | 24 | 33 | 42 | 36 | 1.09 |
| | | 95+ yrs | 21 | 24 | 1605 | 1548 | 0.97 | 24 | 27 | 1602 | 1590 | 0.99 |
| | nonMPA | 0- 4 yrs | 51 | 63 | 75294 | 72609 | 0.96 | 66 | 84 | 75276 | 75255 | 1.00 |
| | | 5- 9 yrs | 27 | 33 | 83598 | 80619 | 0.96 | 39 | 54 | 83586 | 83574 | 1.00 |
| | | 10-14 yrs | 39 | 48 | 88089 | 84951 | 0.96 | 75 | 105 | 88053 | 88026 | 1.00 |
| | | 15-19 yrs | 66 | 99 | 79920 | 77073 | 0.96 | 102 | 159 | 79884 | 79833 | 1.00 |
| | | 20-24 yrs | 39 | 57 | 73830 | 72855 | 0.99 | 69 | 120 | 73803 | 73770 | 1.00 |
| | | 25-29 yrs | 81 | 117 | 84252 | 83139 | 0.99 | 132 | 213 | 84204 | 84138 | 1.00 |
| | | 30-34 yrs | 147 | 204 | 100203 | 98880 | 0.99 | 240 | 315 | 100113 | 99999 | 1.00 |
| | | 35-39 yrs | 183 | 234 | 108510 | 107076 | 0.99 | 303 | 423 | 108390 | 108285 | 1.00 |
| | | 40-44 yrs | 291 | 363 | 106929 | 105516 | 0.99 | 543 | 708 | 106680 | 106515 | 1.00 |
| | | 45-49 yrs | 405 | 507 | 96675 | 95397 | 0.99 | 750 | 960 | 96330 | 96111 | 1.00 |

| | | | 01-04 | | | | | | 01-06 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Linked Deaths | | Unlinked Census Records | | | Linked Deaths | | Unlinked Census Records | | |
| Sex | Ethnicity | Age | Eligible | W_Age EthAdj | Eligible | W_Age EthAdj | Proportion Error | Eligible | W_Age EthAdj | Eligible | W_Age EthAdj | Proportion Error |
| | | 50-54 yrs | 720 | 864 | 94062 | 92286 | 0.98 | 1251 | 1551 | 93531 | 93270 | 1.00 |
| | | 55-59 yrs | 894 | 1068 | 73983 | 72570 | 0.98 | 1554 | 1893 | 73320 | 73002 | 1.00 |
| | | 60-64 yrs | 1284 | 1527 | 62937 | 61725 | 0.98 | 2208 | 2595 | 62016 | 61584 | 1.00 |
| | | 65-69 yrs | 1773 | 2091 | 52977 | 51978 | 0.99 | 3114 | 3672 | 51636 | 51075 | 1.00 |
| | | 70-74 yrs | 2961 | 3489 | 51375 | 50436 | 0.99 | 5145 | 6138 | 49194 | 48225 | 1.00 |
| | | 75-79 yrs | 4644 | 5538 | 43758 | 42198 | 0.98 | 8088 | 9615 | 40311 | 38670 | 1.00 |
| | | 80-84 yrs | 5688 | 6810 | 29217 | 28176 | 1.00 | 9681 | 11868 | 25224 | 23223 | 1.01 |
| | | 85-89 yrs | 5880 | 7065 | 15207 | 14664 | 1.05 | 9297 | 11337 | 11787 | 9912 | 1.02 |
| | | 90-94 yrs | 3573 | 4299 | 4716 | 4548 | 1.14 | 5076 | 6141 | 3213 | 2193 | 1.02 |
| | | 95+ yrs | 1479 | 1779 | 16446 | 15861 | 0.98 | 1938 | 2241 | 15990 | 15375 | 0.98 |

# MORTALITY RATES

Following the weighting of linked and unlinked cohort records, mortality rates were calculated by ethnicity and income group for the periods 2001-03 and 2003-06 for all-cause and cause specific mortality for all ages (1-74 yrs) as well as by separate age groups (1-14, 15-24, 25-44, 45-64, 65-74 yrs).  These were compared with mortality rates from previous years (1981-84, 1986-89, 1991-94, 1996-99, 2001-04), with a particular focus on changes and differences since 1996-99 and 2001-04.  Note that these two periods consisted of a 3 year follow-up after each census, whereas the 2001-03 and 2003-06 periods consisted of a 5 year follow-up divided into two equal 2.5 year periods.

## Investigating why mortality rates drop more than expected between 2001-03 and 2004-06

When examining the results of these analyses, it became apparent that observed mortality rates for the 2003-2006 period showed a general tendency to be much lower than mortality rates for the 2001-03 and other preceding periods (Tan et al., in preparation).  In particular, the decline in mortality rates from 2001-03 to 2003-06 using the revised weights were implausibly large, especially for Pacific, Asian and low-income groups.  The two main contenders for bias causing this were:

Residual linkage bias, whereby the linkage weights calculated above did not adequately correct for lower linkage rates with increasing times since census night.
Emigration, meaning that 'eligible' deaths among those 2001 census respondents are increasingly missed with increasing time since census.  Theoretically, this could be avoided if censoring occurred as census respondents emigrated, but this is beyond the scope of the NZCMS.  In the absence of being able to correctly census person-time, rates are increasingly underestimated with increasing time since census causing a misclassification bias of the mortality outcome.

What follows is a detailed investigation of option 1, which we rule out.  We do not have sufficient data to directly assess option 2, but in the following section we conclude on the basis of limited data, theory, and having ruled out option 1 that option 2 is the likely bias that affects comparisons of mortality rates over time.

## *Option 1: Residual linkage bias by time since census*

It was possible that our automated weighting algorithms, which differed to previous weighting methods, systematically under-adjusted for decreasing linkage over time. This could have arisen if the number of eligible deaths in the existing dataset was insufficient for separate and stable calculation, and subsequent aggregation of some cells by time since census inadvertently removed the ability to correct for any bias by time since census.

To check for underlying bias in the linkage weights by time since census for the cohort 2001-06 (using the periods 0-30 and 30-60 months after census), we conducted an additional adjustment to our W_AgeEthAdj weights (adjusted by age, sex and ethnicity), in the same manner that the W_AgeEthAdj weights were calculated: an adjustment factor was calculated for the [Age] x [Sex] x [Months Since Census] Strata using the formula:

$$\textbf{W\_AgeEthMthAdj} = \textbf{N}_A{}^i / \textbf{N}_{LW}{}^i$$

Where $\textbf{N}_A{}^i$ = the number of deaths in strata *i*,
     $\textbf{N}_{LW}{}^i$ = the number of weighted linked mortality records in strata *i*.

The ratio of the mean weights within strata of sex by age by ethnicity (and sex by age by deprivation) for 30-60 months compared to 0-30 months since census was calculated for both the W_AgeEthMthAdj and W_AgeEthAdj weights. Next, the ratio of the W_AgeEthMthAdj ratio to the W_AgeEthADj ratio was calculated. These calculations were conducted on the Bias data-set only (i.e. all eligible mortality records, with a dummy variable for linkage to the census). The age groups 1-14, 15-24, 25-44, 45-64, and 65-74 years were used to form the strata, as well as prioritised ethnicity or NZ deprivation index was used (the latter as a proxy variable for income). These values are shown for sex, age and months since census and prioritised ethnicity in Table 8.

By way of example, consider New Zealand Māori males aged 1-14 years. The mean W_AgeEthAdj in the first 30 months was 1.50, and for the 30-60 month period was 1.70 – a ratio of 1.13. Post-hoc forced adjustment to give 'exact' counts by time since census gave mean weights of 1.40 and 1.67 – a ratio of 1.19. If we presume the latter weights are 'more correct' for comparing mortality rates over time, then it is the comparison of the 1.13 and 1.19 ratios that is key, and the AEM:AE ratio of 1.05 represents this comparison. Thus, for this example strata of Māori males aged 1-14, it would appear that using forced weights to correct for time since will weight deaths in the second 30 months more so, and mean that any apparent reduction in mortality rates over time would be less.

However, if we examine all other AEM:AE ratios, they tend to be close to 1.00 and appear to randomly very between just less, the same and just more than 1.00. That is, there is no evidence overall (and on average) of inadequacy of the W_AgeEthAdj weights, nor of any systematic bias by sex, age or ethnicity.

**Table 8: Average AgeEthAdj and AgeEthMthAdj weights for 2001-06 cohort by Priotritised ethnicity, age and months since census, including ratios for 0-30:30-60 months since census periods and Ratio for AgeEthMthAdj ratio: AgeEthAdj ratio.**

| Ethnicity | Age | Months Since Census | Males | | | Females | | |
|---|---|---|---|---|---|---|---|---|
| | | | Mean W_AgeEthAdj (AE) | Mean W_AgeEthMthAdj (AEM) | AEM ratio : AE ratio | Mean W_AgeEthAdj (AE) | Mean W_AgeEthMthAdj (AEM) | AEM ratio : AE ratio |
| NZ Mäori | 1-14 | 0-30 | 1.50 | 1.40 | . | 1.33 | 1.38 | . |
| | | 30-60 | 1.70 | 1.67 | . | 1.48 | 1.51 | . |
| | | Ratio | 1.13 | 1.19 | 1.05 | 1.11 | 1.09 | 0.98 |
| | 15-24 | 0-30 | 1.77 | 1.73 | . | 1.78 | 2.21 | . |
| | | 30-60 | 1.92 | 1.87 | . | 1.82 | 2.28 | . |
| | | Ratio | 1.08 | 1.08 | 1.00 | 1.02 | 1.03 | 1.01 |
| | 25-44 | 0-30 | 1.69 | 1.72 | . | 1.34 | 1.35 | . |
| | | 30-60 | 1.88 | 1.92 | . | 1.41 | 1.41 | . |
| | | Ratio | 1.11 | 1.12 | 1.00 | 1.05 | 1.04 | 0.99 |
| | 45-64 | 0-30 | 1.31 | 1.30 | . | 1.29 | 1.30 | . |
| | | 30-60 | 1.35 | 1.34 | . | 1.32 | 1.33 | . |
| | | Ratio | 1.03 | 1.03 | 1.00 | 1.02 | 1.02 | 1.00 |
| | 65-74 | 0-30 | 1.28 | 1.28 | . | 1.25 | 1.24 | . |
| | | 30-60 | 1.27 | 1.28 | . | 1.26 | 1.26 | . |
| | | Ratio | 0.99 | 1.00 | 1.01 | 1.01 | 1.02 | 1.01 |
| | 75-84 | 0-30 | 1.26 | 1.26 | . | 1.29 | 1.29 | . |
| | | 30-60 | 1.24 | 1.25 | . | 1.36 | 1.36 | . |
| | | Ratio | 0.98 | 0.99 | 1.01 | 1.05 | 1.05 | 1.00 |
| | 85+ | 0-30 | 1.28 | 1.22 | . | 1.27 | 1.32 | . |
| | | 30-60 | 1.31 | 1.24 | . | 1.36 | 1.36 | . |
| | | Ratio | 1.02 | 1.02 | 0.99 | 1.07 | 1.03 | 0.96 |
| Pacific | 1-14 | 0-30 | 1.24 | 1.57 | . | 1.16 | 1.16 | . |
| | | 30-60 | 1.42 | 1.50 | . | 1.32 | 1.33 | . |
| | | Ratio | 1.15 | 0.96 | 0.83 | 1.14 | 1.15 | 1.01 |
| | 15-24 | 0-30 | 1.63 | 1.88 | . | 1.51 | 1.55 | . |
| | | 30-60 | 1.56 | 1.73 | . | 1.42 | 1.42 | . |
| | | Ratio | 0.96 | 0.92 | 0.96 | 0.94 | 0.92 | 0.97 |
| | 25-44 | 0-30 | 1.62 | 1.65 | . | 1.37 | 1.44 | . |
| | | 30-60 | 1.81 | 1.84 | . | 1.35 | 1.40 | . |

| Ethnicity | Age | Months Since Census | Males Mean W_AgeEthAdj (AE) | Males Mean W_AgeEthMthAdj (AEM) | Males AEM ratio : AE ratio | Females Mean W_AgeEthAdj (AE) | Females Mean W_AgeEthMthAdj (AEM) | Females AEM ratio : AE ratio |
|---|---|---|---|---|---|---|---|---|
| | | Ratio | 1.12 | 1.12 | 1.00 | 0.99 | 0.97 | 0.99 |
| | 45-64 | 0-30 | 1.36 | 1.39 | . | 1.36 | 1.37 | . |
| | | 30-60 | 1.37 | 1.39 | . | 1.27 | 1.28 | . |
| | | Ratio | 1.01 | 1.00 | 0.99 | 0.93 | 0.93 | 1.00 |
| | 65-74 | 0-30 | 1.33 | 1.31 | . | 1.34 | 1.29 | . |
| | | 30-60 | 1.36 | 1.33 | . | 1.40 | 1.35 | . |
| | | Ratio | 1.02 | 1.02 | 0.99 | 1.04 | 1.05 | 1.00 |
| | 75-84 | 0-30 | 1.37 | 1.41 | . | 1.46 | 1.41 | . |
| | | 30-60 | 1.35 | 1.39 | . | 1.48 | 1.43 | . |
| | | Ratio | 0.99 | 0.99 | 1.00 | 1.01 | 1.01 | 1.00 |
| | 85+ | 0-30 | 1.32 | 1.26 | . | 1.38 | 1.37 | . |
| | | 30-60 | 1.34 | 1.28 | . | 1.43 | 1.36 | . |
| | | Ratio | 1.02 | 1.02 | 1.00 | 1.04 | 0.99 | 0.96 |
| Asian | 1-14 | 0-30 | 1.41 | 1.75 | . | 1.54 | 1.13 | . |
| | | 30-60 | 1.71 | 1.70 | . | 1.14 | 0.96 | . |
| | | Ratio | 1.21 | 0.97 | 0.80 | 0.74 | 0.85 | 1.15 |
| | 15-24 | 0-30 | 1.70 | 2.62 | . | 1.38 | 1.98 | . |
| | | 30-60 | 1.87 | 2.87 | . | 1.63 | 2.62 | . |
| | | Ratio | 1.10 | 1.10 | 1.00 | 1.18 | 1.32 | 1.12 |
| | 25-44 | 0-30 | 1.68 | 1.94 | . | 1.43 | 1.51 | . |
| | | 30-60 | 1.73 | 2.02 | . | 1.46 | 1.50 | . |
| | | Ratio | 1.03 | 1.04 | 1.01 | 1.02 | 0.99 | 0.97 |
| | 45-64 | 0-30 | 1.37 | 1.38 | . | 1.41 | 1.52 | . |
| | | 30-60 | 1.33 | 1.32 | . | 1.28 | 1.33 | . |
| | | Ratio | 0.97 | 0.96 | 0.99 | 0.91 | 0.88 | 0.96 |
| | 65-74 | 0-30 | 1.38 | 1.35 | . | 1.36 | 1.43 | . |
| | | 30-60 | 1.51 | 1.47 | . | 1.46 | 1.52 | . |
| | | Ratio | 1.09 | 1.09 | 1.00 | 1.07 | 1.06 | 0.99 |
| | 75-84 | 0-30 | 1.35 | 1.39 | . | 1.42 | 1.51 | . |
| | | 30-60 | 1.30 | 1.35 | . | 1.38 | 1.46 | . |
| | | Ratio | 0.96 | 0.97 | 1.01 | 0.97 | 0.97 | 0.99 |
| | 85+ | 0-30 | 1.34 | 1.22 | . | 1.30 | 1.23 | . |
| | | 30-60 | 1.47 | 1.36 | . | 1.38 | 1.31 | . |

| Ethnicity | Age | Months Since Census | Males | | | Females | | |
|---|---|---|---|---|---|---|---|---|
| | | | Mean W_AgeEthAdj (AE) | Mean W_AgeEthMthAdj (AEM) | AEM ratio : AE ratio | Mean W_AgeEthAdj (AE) | Mean W_AgeEthMthAdj (AEM) | AEM ratio : AE ratio |
| | | Ratio | 1.10 | 1.11 | 1.02 | 1.06 | 1.07 | 1.00 |
| nonMPA | 1-14 | 0-30 | 1.31 | 1.33 | . | 1.29 | 1.32 | . |
| | | 30-60 | 1.44 | 1.47 | . | 1.40 | 1.43 | . |
| | | Ratio | 1.10 | 1.11 | 1.01 | 1.09 | 1.08 | 1.00 |
| | 15-24 | 0-30 | 1.57 | 1.60 | . | 1.59 | 1.52 | . |
| | | 30-60 | 1.70 | 1.73 | . | 1.65 | 1.56 | . |
| | | Ratio | 1.08 | 1.08 | 1.00 | 1.04 | 1.03 | 0.99 |
| | 25-44 | 0-30 | 1.61 | 1.64 | . | 1.33 | 1.37 | . |
| | | 30-60 | 1.74 | 1.76 | . | 1.40 | 1.43 | . |
| | | Ratio | 1.08 | 1.07 | 0.99 | 1.05 | 1.04 | 0.99 |
| | 45-64 | 0-30 | 1.25 | 1.25 | . | 1.21 | 1.20 | . |
| | | 30-60 | 1.31 | 1.31 | . | 1.22 | 1.22 | . |
| | | Ratio | 1.05 | 1.05 | 1.00 | 1.01 | 1.02 | 1.01 |
| | 65-74 | 0-30 | 1.18 | 1.18 | . | 1.18 | 1.18 | . |
| | | 30-60 | 1.19 | 1.19 | . | 1.19 | 1.19 | . |
| | | Ratio | 1.01 | 1.01 | 1.00 | 1.01 | 1.01 | 1.00 |
| | 75-84 | 0-30 | 1.19 | 1.19 | . | 1.20 | 1.09 | . |
| | | 30-60 | 1.19 | 1.19 | . | 1.22 | 1.11 | . |
| | | Ratio | 1.00 | 1.00 | 1.00 | 1.02 | 1.02 | 1.00 |
| | 85+ | 0-30 | 1.22 | 1.22 | . | 1.21 | 1.20 | . |
| | | 30-60 | 1.20 | 1.20 | . | 1.21 | 1.21 | . |
| | | Ratio | 0.98 | 0.98 | 1.00 | 1.00 | 1.01 | 1.01 |

As a further check of whether there was any systematic residual bias, Figure 2 plots the AEM:AE ratios by ethnicity and age group, for male and females. Linear regressions by age found no significant linear relationship with AEM:AE ratio. Note that the most deviant points are for the 1-14 and 15-24 age groups; this is most likely due to the small cell sizes and subsequent greater aggregation for weighting of these strata.

**Figure 2: Plots of the ratio of the AgeEthMthAdj 0-30:30-60mth ratio to AgeEthAdj 0-30:30-60mth ratio by age and ethnicity.**
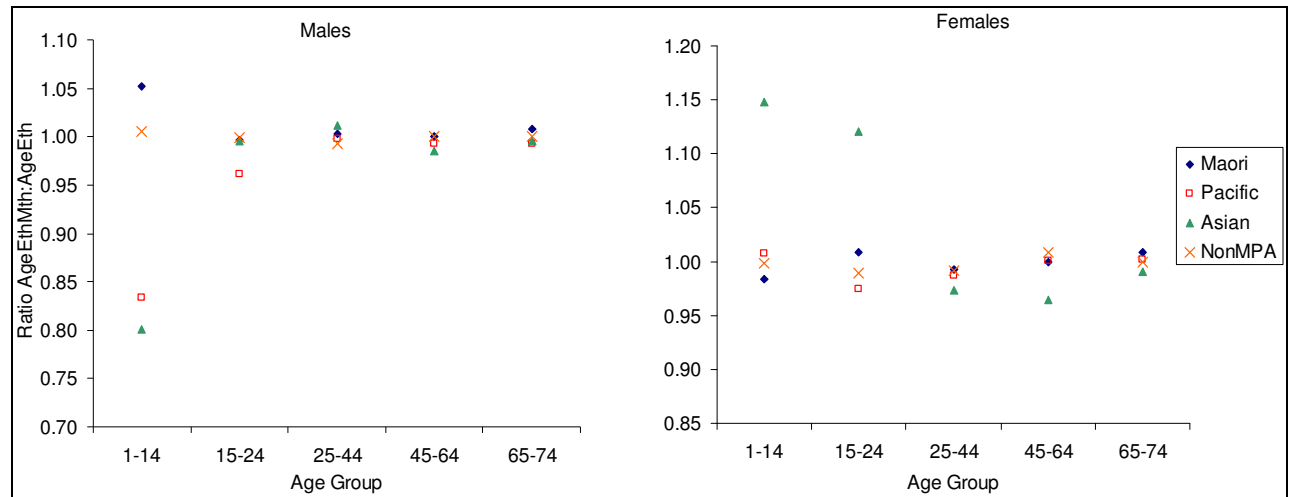


In addition to larger than expected declines in the mortality rates overall for 30-60 months post census compared to 0-30 months, the declines were even more marked for Pacific people. If our linkage weights were unsuccessful in fully adjusting for decay in linkage in the 30-60 month period after census relative to the 0-30 month period, then we would have expected the forced AgeEthMth ratio to be higher than the AgeEth ratio for Pacific; but rather we see instability, or perhaps even lower ratios. This further suggests that our linkage weights did not introduce any bias based on linkage over time, although they may be unstable due to small cell sizes at younger ages.

**Table 9: Average AgeEthAdj and AgeEthMthAdj weights for 2001-06 cohort by NZ Deprivation Index, age and months since census, including ratios for 0-30:30-60 months since census periods and Ratio for AgeEthMthAdj ratio: AgeEthAdj ratio.**

| NZ Deprivation | Age | Months Since Census | Males | | | Females | | |
|---|---|---|---|---|---|---|---|---|
| | | | Mean W_AgeEthAdj (AE) | Mean W_AgeEthMthAdj (AEM) | AEM ratio : AE ratio | Mean W_AgeEthAdj (AE) | Mean W_AgeEthMthAdj (AEM) | AEM ratio : AE ratio |
| Dep 1-2 | 1-14 | 0-30 | 1.27 | 1.27 | . | 1.21 | 1.23 | . |
| | | 30-60 | 1.41 | 1.44 | . | 1.35 | 1.37 | . |
| | | Ratio | 1.11 | 1.13 | 1.02 | 1.12 | 1.11 | 1.00 |
| | 15-24 | 0-30 | 1.61 | 1.69 | . | 1.60 | 1.66 | . |
| | | 30-60 | 1.66 | 1.71 | . | 1.78 | 1.71 | . |
| | | Ratio | 1.03 | 1.01 | 0.98 | 1.11 | 1.03 | 0.93 |
| | 25-44 | 0-30 | 1.60 | 1.64 | . | 1.30 | 1.32 | . |
| | | 30-60 | 1.67 | 1.69 | . | 1.43 | 1.44 | . |
| | | Ratio | 1.04 | 1.03 | 0.99 | 1.10 | 1.09 | 0.99 |
| | 45-64 | 0-30 | 1.26 | 1.26 | . | 1.19 | 1.19 | . |
| | | 30-60 | 1.32 | 1.32 | . | 1.24 | 1.24 | . |
| | | Ratio | 1.05 | 1.05 | 1.00 | 1.04 | 1.04 | 1.00 |
| | 65-74 | 0-30 | 1.18 | 1.18 | . | 1.21 | 1.21 | . |
| | | 30-60 | 1.20 | 1.20 | . | 1.23 | 1.24 | . |
| | | Ratio | 1.02 | 1.02 | 1.00 | 1.02 | 1.02 | 1.01 |
| | 75-84 | 0-30 | 1.18 | 1.18 | . | 1.20 | 1.10 | . |
| | | 30-60 | 1.18 | 1.18 | . | 1.50 | 1.13 | . |
| | | Ratio | 1.00 | 1.00 | 1.00 | 1.25 | 1.03 | 0.82 |
| | 85+ | 0-30 | 1.24 | 1.24 | . | 1.20 | 1.20 | . |
| | | 30-60 | 1.20 | 1.19 | . | 1.21 | 1.20 | . |
| | | Ratio | 0.97 | 0.96 | 0.99 | 1.01 | 1.00 | 0.99 |
| Dep 3-4 | 1-14 | 0-30 | 1.26 | 1.32 | . | 1.26 | 1.28 | . |
| | | 30-60 | 1.47 | 1.51 | . | 1.53 | 1.53 | . |
| | | Ratio | 1.17 | 1.14 | 0.98 | 1.21 | 1.20 | 0.98 |
| | 15-24 | 0-30 | 1.54 | 1.68 | . | 1.59 | 1.65 | . |
| | | 30-60 | 1.63 | 1.68 | . | 1.77 | 1.72 | . |
| | | Ratio | 1.06 | 1.00 | 0.94 | 1.11 | 1.04 | 0.94 |
| | 25-44 | 0-30 | 1.57 | 1.61 | . | 1.32 | 1.34 | . |
| | | 30-60 | 1.73 | 1.77 | . | 1.42 | 1.46 | . |

| NZ Deprivation | Age | Months Since Census | Males | | | Females | | |
|---|---|---|---|---|---|---|---|---|
| | | | Mean W_AgeEthAdj (AE) | Mean W_AgeEthMthAdj (AEM) | AEM ratio : AE ratio | Mean W_AgeEthAdj (AE) | Mean W_AgeEthMthAdj (AEM) | AEM ratio : AE ratio |
| | | Ratio | 1.10 | 1.10 | 1.00 | 1.08 | 1.09 | 1.01 |
| | 45-64 | 0-30 | 1.24 | 1.24 | . | 1.21 | 1.21 | . |
| | | 30-60 | 1.29 | 1.29 | . | 1.21 | 1.21 | . |
| | | Ratio | 1.04 | 1.04 | 1.00 | 1.00 | 1.00 | 1.00 |
| | 65-74 | 0-30 | 1.19 | 1.19 | . | 1.20 | 1.20 | . |
| | | 30-60 | 1.19 | 1.19 | . | 1.19 | 1.19 | . |
| | | Ratio | 1.00 | 1.00 | 1.00 | 0.99 | 0.99 | 1.00 |
| | 75-84 | 0-30 | 1.20 | 1.20 | . | 1.19 | 1.08 | . |
| | | 30-60 | 1.19 | 1.19 | . | 1.23 | 1.12 | . |
| | | Ratio | 0.99 | 0.99 | 1.00 | 1.03 | 1.04 | 1.00 |
| | 85+ | 0-30 | 1.22 | 1.22 | . | 1.22 | 1.22 | . |
| | | 30-60 | 1.16 | 1.16 | . | 1.23 | 1.23 | . |
| | | Ratio | 0.95 | 0.95 | 1.00 | 1.01 | 1.01 | 1.00 |
| Dep 5-6 | 1-14 | 0-30 | 1.29 | 1.33 | . | 1.17 | 1.20 | . |
| | | 30-60 | 1.51 | 1.54 | . | 1.37 | 1.39 | . |
| | | Ratio | 1.17 | 1.16 | 0.99 | 1.17 | 1.16 | 0.99 |
| | 15-24 | 0-30 | 1.55 | 1.68 | . | 1.53 | 1.59 | . |
| | | 30-60 | 1.76 | 1.82 | . | 1.60 | 1.78 | . |
| | | Ratio | 1.14 | 1.08 | 0.95 | 1.05 | 1.12 | 1.07 |
| | 25-44 | 0-30 | 1.63 | 1.66 | . | 1.32 | 1.36 | . |
| | | 30-60 | 1.68 | 1.72 | . | 1.37 | 1.42 | . |
| | | Ratio | 1.03 | 1.04 | 1.01 | 1.04 | 1.04 | 1.01 |
| | 45-64 | 0-30 | 1.26 | 1.26 | . | 1.22 | 1.22 | . |
| | | 30-60 | 1.30 | 1.30 | . | 1.22 | 1.23 | . |
| | | Ratio | 1.03 | 1.03 | 1.00 | 1.00 | 1.01 | 1.01 |
| | 65-74 | 0-30 | 1.18 | 1.18 | . | 1.20 | 1.19 | . |
| | | 30-60 | 1.22 | 1.21 | . | 1.17 | 1.19 | . |
| | | Ratio | 1.03 | 1.03 | 0.99 | 0.98 | 1.00 | 1.03 |
| | 75-84 | 0-30 | 1.19 | 1.19 | . | 1.20 | 1.10 | . |
| | | 30-60 | 1.19 | 1.19 | . | 1.21 | 1.10 | . |
| | | Ratio | 1.00 | 1.00 | 1.00 | 1.01 | 1.00 | 0.99 |
| | 85+ | 0-30 | 1.19 | 1.19 | . | 1.21 | 1.21 | . |
| | | 30-60 | 1.19 | 1.19 | . | 1.19 | 1.19 | . |

| NZ Deprivation | Age | Months Since Census | Males | | | Females | | |
|---|---|---|---|---|---|---|---|---|
| | | | Mean W_AgeEthAdj (AE) | Mean W_AgeEthMthAdj (AEM) | AEM ratio : AE ratio | Mean W_AgeEthAdj (AE) | Mean W_AgeEthMthAdj (AEM) | AEM ratio : AE ratio |
| | | Ratio | 1.00 | 1.00 | 1.00 | 0.98 | 0.98 | 1.00 |
| Dep 7-8 | 1-14 | 0-30 | 1.44 | 1.47 | . | 1.48 | 1.45 | . |
| | | 30-60 | 1.63 | 1.63 | . | 1.38 | 1.41 | . |
| | | Ratio | 1.13 | 1.11 | 0.98 | 0.93 | 0.97 | 1.04 |
| | 15-24 | 0-30 | 1.68 | 1.76 | . | 1.62 | 1.90 | . |
| | | 30-60 | 1.75 | 1.79 | . | 1.59 | 1.65 | . |
| | | Ratio | 1.04 | 1.02 | 0.98 | 0.98 | 0.87 | 0.88 |
| | 25-44 | 0-30 | 1.64 | 1.68 | . | 1.37 | 1.41 | . |
| | | 30-60 | 1.84 | 1.87 | . | 1.42 | 1.44 | . |
| | | Ratio | 1.12 | 1.11 | 0.99 | 1.04 | 1.02 | 0.99 |
| | 45-64 | 0-30 | 1.27 | 1.26 | . | 1.24 | 1.25 | . |
| | | 30-60 | 1.33 | 1.33 | . | 1.27 | 1.28 | . |
| | | Ratio | 1.05 | 1.06 | 1.01 | 1.02 | 1.02 | 1.00 |
| | 65-74 | 0-30 | 1.21 | 1.21 | . | 1.19 | 1.19 | . |
| | | 30-60 | 1.21 | 1.21 | . | 1.21 | 1.21 | . |
| | | Ratio | 1.00 | 1.00 | 1.00 | 1.02 | 1.02 | 1.00 |
| | 75-84 | 0-30 | 1.20 | 1.20 | . | 1.21 | 1.10 | . |
| | | 30-60 | 1.19 | 1.19 | . | 1.22 | 1.11 | . |
| | | Ratio | 0.99 | 0.99 | 1.00 | 0.98 | 1.01 | 1.03 |
| | 85+ | 0-30 | 1.23 | 1.23 | . | 1.20 | 1.19 | . |
| | | 30-60 | 1.23 | 1.23 | . | 1.23 | 1.23 | . |
| | | Ratio | 1.00 | 1.00 | 1.00 | 1.03 | 1.03 | 1.01 |
| Dep 9-10 | 1-14 | 0-30 | 1.42 | 1.45 | . | 1.33 | 1.37 | . |
| | | 30-60 | 1.55 | 1.57 | . | 1.43 | 1.44 | . |
| | | Ratio | 1.09 | 1.08 | 0.99 | 1.08 | 1.05 | 0.98 |
| | 15-24 | 0-30 | 1.67 | 1.73 | . | 1.68 | 1.87 | . |
| | | 30-60 | 1.84 | 1.88 | . | 1.65 | 1.84 | . |
| | | Ratio | 1.10 | 1.09 | 0.99 | 0.98 | 0.98 | 1.00 |
| | 25-44 | 0-30 | 1.67 | 1.72 | . | 1.35 | 1.38 | . |
| | | 30-60 | 1.85 | 1.89 | . | 1.38 | 1.40 | . |
| | | Ratio | 1.11 | 1.10 | 0.99 | 1.02 | 1.01 | 0.99 |
| | 45-64 | 0-30 | 1.30 | 1.30 | . | 1.28 | 1.28 | . |
| | | 30-60 | 1.34 | 1.34 | . | 1.25 | 1.25 | . |

| NZ Deprivation | Age | Months Since Census | Males | | | Females | | |
|---|---|---|---|---|---|---|---|---|
| | | | Mean W_AgeEthAdj (AE) | Mean W_AgeEthMthAdj (AEM) | AEM ratio : AE ratio | Mean W_AgeEthAdj (AE) | Mean W_AgeEthMthAdj (AEM) | AEM ratio : AE ratio |
| | | Ratio | 1.03 | 1.03 | 1.00 | 0.98 | 0.98 | 1.00 |
| | 65-74 | 0-30 | 1.21 | 1.21 | . | 1.21 | 1.21 | . |
| | | 30-60 | 1.22 | 1.22 | . | 1.22 | 1.22 | . |
| | | Ratio | 1.01 | 1.01 | 1.00 | 1.01 | 1.01 | 1.00 |
| | 75-84 | 0-30 | 1.19 | 1.19 | . | 1.23 | 1.13 | . |
| | | 30-60 | 1.21 | 1.21 | . | 1.25 | 1.15 | . |
| | | Ratio | 1.02 | 1.02 | 1.00 | 1.02 | 1.02 | 1.00 |
| | 85+ | 0-30 | 1.22 | 1.21 | . | 1.21 | 1.21 | . |
| | | 30-60 | 1.23 | 1.23 | . | 1.23 | 1.23 | . |
| | | Ratio | 1.01 | 1.02 | 1.01 | 1.02 | 1.02 | 1.00 |

Table 9 shows the similar ratios for sex by age by deprivation. 3 shows scatterplots of the ratios by sex, age and NZ Deprivation Index . Once again, there doesn't appear to be any consistent linear relationship between the change in ratios and NZ deprivation index or age group. Linear regression analyses found no significant change in ratios by NZ deprivation index.

**Figure 3: Plots of the ratio of the AgeEthMthAdj 0-30:30-60mth ratio to AgeEthAdj 0-30:30-60mth ratio by age and NZ Deprivation.**



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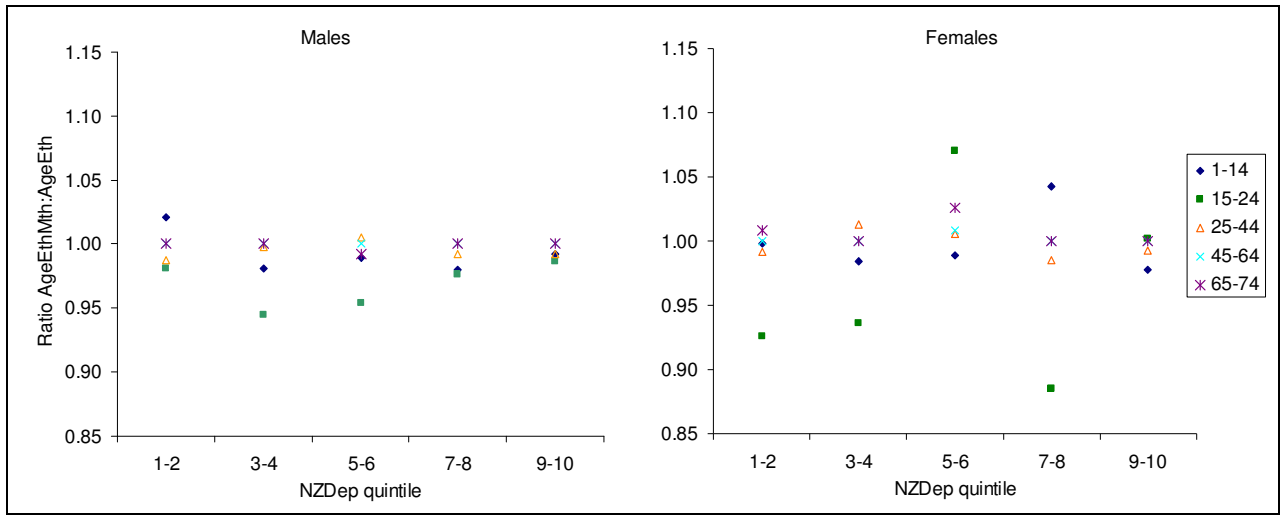
### *Option 2: Emigration*

About 75,000 New Zealanders permanently emigrate each year. As the NZCMS is a closed cohort, with no ability to censor census respondents when they emigrate (we do not link NZCMS data to immigration data), we therefore fail to observe deaths among those census respondents who subsequently emigrate. The midpoints of the 2001-03 to 2003-06 periods are 2.5 years apart. Assuming the 75,000 emigrants per year do not re-immigrate before death, and that their age and death rates are roughly comparable to the remaining census respondents, then this might suggest that mortality rates are 5% less in 2003-06 compared to 2001-03 – all else constant. Due to varying age distribution among emigrants, and probably varying death rates within these age groups (e.g. due to healthy migrant effect), the 5% estimate is tenuous; however, it seems likely that some increasing underestimation over time is occurring due to emigration.

In epidemiological terms, this diminishes sensitivity of ascertainment of the mortality outcome over time; i.e. we have misclassification bias of the mortality bias that is not corrected. This will result in increasing underestimation of all ethnic and socioeconomic groups' mortality rates since census, and presumably the standardised rate differences (SRDs) too.

Additionally, Pacific mortality rates appear to decrease much faster than expected, relative to other ethnicities. This is consistent with the possibility of many Pacific people returning home (out of New Zealand) and dying, resulting in misclassification of the mortality outcome which is differential by ethnicity, which results in the underestimation of Pacific-nonMPA standardised rate ratios.

Although we cannot prove it, it is likely that Maori-nonMPA, income SRRs and possibly Asian-nonMPA SRRs will still remain valid over time, based on the assumption that percentage falls in their rates (due to emigrant bias) is comparable over time..

Note that the existing time series of 3-year cohort studies should be valid for comparing SRRs over time, as it is the same three-year period after each census that is being compared over time and we assume any biases occurring within this three-year follow-up are constant over time.

## *Future Directions*

The next linkage of 2006-11 mortality data will allow closer examination of the increased mortality rates in 2006-07 compared to the 2005-06 year. It is expected that this will vary most in percentage terms for Pacific people. We think this linkage will then permit additional internal adjustments to the dataset to account for the above emigrant bias. For example, we could use a parametric regression model to estimate the 'step change' from the 2005-06 to 2006-07 year that is 'beyond' secular trends in mortality, and use the magnitude of this step change by sex, age, ethnicity (and income) to additionally weight mortality records over time since census.

We could also examine emigration data by ethnicity and socioeconomic position. However, this is problematic for two reasons. First, data on ethnicity and socioeconomic position is not recorded on emigrants. Second, even if we could estimate the former distribution, we do not have direct estimates of their mortality rates once emigrating. Thus, we do not believe that this is a particularly productive line of analysis.

Ideally, we would link the NZCMS data to migration data, and therefore 'properly' censor the person time of follow-up. However, this would be a large undertaking in resources, and may not be of sufficient added value to be approved by Statistics New Zealand (and potential funders of the NZCMS).

Assuming the first 'step change' method can be implemented, we will be in a better position to report accurate NZCMS mortality rates by time since census after the 2006-11 linkage has been undertaken.

# UNLOCK RATIOS FOR 2004-2006

Unlock ratios are the adjustment ratios used to correct for the numerator-denominator bias in the calculation of ethnic-specific mortality rates. The numerator-denominator bias arises from differences in the collection and recording of ethnicity data on census and mortality records. This results in individuals being counted in different ethnicity strata in the census population and the individual mortality data, and consequently creates a bias in the calculation of mortality rates using unlinked data. This generally emerges as the substantial undercounting of Maori and/or Pacific deaths relative to census data.

Unlock ratios were calculated to compare the extent of bias between ethnicity counts in the census and mortality data, as well as the census and NHI data. This was done with the unlock or highly probable link (HPL) dataset, a subset of linked mortality-census records for which there is a high probability of actual true links. These records agreed exactly on sex, date of birth and country of birth, and were files in which ethnicity was not involved in the linkage process. A summary of the variables included in the 2004-2006 unlock dataset can be seen in Table 58 in Appendix A.

Ethnicity could be classified using one of three definitions:
1) **SOLE**:
   An individual was assigned as Maori if Maori was the only ethnic group self identified. Similarly, an individual was assigned as Pacific or Asian if it was the only self-identified ethnic group. All others were assigned as non-Maori non-Pacific non-Asian (nonMPA). The nonMPA group also included some extra decedents that, for example, self-identified multiple ethnic groups.
2) **PRIORITISED**:
   An individual was assigned as Maori if any of the three possible self-identified ethnicity responses was Maori. For non-Maori, an individual was assigned as Pacific if one of the self-identified ethnic groups was Pacific. For non-Maori non-Pacific, an individual was assigned as Asian if one of the self-identified ethnic groups was Asian. The remaining individuals were assigned as nonMPA (equivalent to sole nonMPA).
3) **TOTAL**:
   An individual was assigned as Maori if any ethnic group identified on the census or mortality record was Maori. The same was done for Pacific, Asian, nonMPA ethnicities; individuals could be assigned multiple ethnic groups and consequently the sum of counts across ethnic groups will be greater than actual number of decedents.

### Weighting of unlock dataset to represent all mortality records

The proportions of ethnicities in the HPL and mortality (bias) dataset were different and so a simple cross-classification of mortality and census data ethnicity would have been considerably biased. Thus, it was necessary to weight up the ethnicity counts in the HPL dataset (n = 53,446 deaths), to represent the full mortality dataset (n = 135,853).

*For example, if there were 25 mortality records of 15-29 Asian females living in the Southern RHA and of these, 16 were included in the HPL data set, each of these 20 records would be weighted by 25/11 = 1.56 to make them representative of all the eligible mortality records for that strata.*

Weighting occurred within the strata of:
- Sex (male, female)
- Age group (based on age at census night: 0-14, 15-34, 35-49, 50-64, 65-74, 75-84, 85+ yrs)
- Ethnicity (prioritised; Māori, Pacific, Asian, nonMPA including missing).
- Rurality (rural including missing, urban)
- Level of Mobility in the area unit (individuals with missing mobility, $\leq$50%, 51-55%, 56-60%, 61+)
- Cause of death (9 groups Cancer; CVD excl IHD; IHD; Respiratory; Congenital/Perinatal/SIDS; Unintentional injury; Suicide; Violent; Other Causes including missing)
- NZ Deprivation Index (1-2, 3-4, 5-6 + missing, 7-8, 9-10)
- Regional Health Authority (Northern, Midland, Central and Southern)

*Note that a critical assumption for the validity of the adjustment ratios is that within each stratum of [sex] by [age] by [ethnicity] by [mobility] by [ICD] by [rurality] by [NZDep] by [RHA], the distribution of census ethnicity was the same for the HPL and the full mortality dataset, and consequently any biases affecting an individuals' self-identified ethnicity on the census between HPL and mortality datasets are controlled for by the strata.*

There were some differences in the variables used for the calculation of the unlock ratios compared to the 2001-2004 cohort; the grouping of the age variable was less detailed than the 2001-2004 cohort, however it is expected that this will make little difference as weights were adjusted for age (and ethnicity) using the 5-year age groups, which was not done for the 2001-2004 cohort and would eliminate any discrepancies in estimates. RHA and NZ Deprivation were also included in the strata, based on the results of the logistic regression analysis predicting HPL; these were not significant in the 2001-2004 analyses. TA was not included in the strata as it was too disaggregated for the HPL 2004-2006 dataset to permit sufficient cell sizes.

Logistic regression was used with the strata variables predicting HPL to determine the order of collapsing strata for these variables, similar to that

done for the linkage weights. Betas and standard errors are shown in Table 10.

**Table 10: Parameter estimates and standard errors from HPL logistic regression.**

| Parameter | | Estimate | Standard Error |
|---|---|---|---|
| Age | 0-14 years | -0.739 | 0.114 |
| | 15-34 years | -1.055 | 0.074 |
| | 35-49 years | -0.672 | 0.056 |
| | 50-64 years | -0.174 | 0.045 |
| | 65-74 years | 0.040 | 0.039 |
| | 75-84 years | 0.033 | 0.033 |
| | 85 years+ (reference) | 1 | 0 |
| Sex | Females | 0.611 | 0.076 |
| | Males (reference) | 1 | 0 |
| Ethnicity | Maori | -0.357 | 0.036 |
| | Pacific | -0.504 | 0.060 |
| | Asian | -0.496 | 0.079 |
| | NonMPA incl. missing (reference) | 1 | 0 |
| Rurality | Rural (including missing) | -0.197 | 0.036 |
| | Urban (reference) | 1 | 0 |
| RHA | Northern (reference) | 1 | 0 |
| | Midland | 0.035 | 0.030 |
| | Central | 0.067 | 0.029 |
| | Southern | 0.053 | 0.031 |
| Mobility | | 0.002 | 0.00 |
| Cause of Death | Cancer | 0.066 | 0.031 |
| | CVD excl. IHD | -0.089 | 0.033 |
| | IHD (Reference) | 1 | 0 |
| | Respiratory | 0.106 | 0.047 |
| | Congenital, Perinatal, SIDS | 0.234 | 0.180 |
| | Unintentional Injury | -0.217 | 0.058 |
| | Suicide | -0.362 | 0.075 |
| | Violent | -0.351 | 0.229 |
| | Other incl. not dead | -0.136 | 0.032 |
| NZ Deprivation Index | 1-2 (reference) | 1 | 0 |
| | 3-4 | 0.074 | 0.037 |
| | 5-6 (including missing) | 0.047 | 0.035 |
| | 7-8 | -0.031 | 0.036 |
| | 9-10 | -0.022 | 0.036 |

Aside from sex and ethnicity, results showed that RHA, NZDep, ICD and mobility were the weakest predictors of an HPL (in that order), and consequently it was decided to collapse strata variables in that order. The criterion for acceptance was $n > 3$ for each cell. A total of $n = 10,533$ maximum detail strata were collapsed to ensure sufficient cell sizes for weight calculation. The method of collapsing was the same as that used for calculating linkage weights. The number of acceptable and unacceptable strata at each step is shown in Table 11.

The order of collapsing of strata variables was as follows:

1) a) Combine sex for children 0-14 years
   b) Combine ethnicity for Maori and Pacific aged $\geq$ 75 years
      (Both set to Maori)
   c) Combine rurality for Pacific and Asian ethnicities (all urban)
2) Collapse RHA to 2 categories: Northern/Midland and Central/Southern
3) Collapse NZDep from quintiles to 1-6, 7-10.
4) Collapse ICD to 6 categories: CVD and IHD, Cancer, Respiratory,
   Congenital/Perinatal/SIDS, Injury/Suicide/Intentional, Other/Not dead
5) Collapse mobility from 0-50, 51-55, 56-60, 60+ to 0-55, 56+
6) Drop RHA
7) Drop NZDep
8) Drop ICD
9) Drop mobility
10) Drop rurality
11) Collapse ethnicity
12) Drop ethnicity
13) Drop age

Note that dropping the sex variable had no effect on the number of acceptable and unacceptable strata, and therefore this step was not included in the final collapsing process.

**Table 11: Number of acceptable and unacceptable strata before and after collapsing of variables for weight calculation for Unlock 2004-2006 cohort.**

| INITIAL VALUES | N | % Total |
|---|---|---|
| Acceptable | 2698 | 25.24 |
| Unacceptable | 7993 | 74.76 |
| Total | 10691 | |
| Step 1 | N | % Total |
| Acceptable | 2714 | 25.77 |
| Unacceptable | 7819 | 74.23 |
| Total | 10533 | |

| 2) collapse RHA | N | % Total |
|---|---|---|
| Acceptable | 722 | 9.23 |
| Unacceptable | 7097 | 90.77 |
| Total | 7819 | |
| 3) collapse NZDep | N | % Total |
| Acceptable | 1885 | 26.56 |
| Unacceptable | 5212 | 73.44 |
| Total | 7097 | |
| 4) collapse ICD | N | % Total |
| Acceptable | 697 | 13.37 |
| Unacceptable | 4515 | 86.63 |
| Total | 5212 | |
| 5) collapse Mobility | N | % Total |
| Acceptable | 1307 | 28.95 |
| Unacceptable | 3208 | 71.05 |
| Total | 4515 | |

| 6) drop RHA | N | % Total |
|---|---|---|
| Acceptable | 1104 | 34.41 |
| Unacceptable | 2104 | 65.59 |
| Total | 3208 | |
| 7) drop NZDep | N | % Total |
| Acceptable | 718 | 34.13 |
| Unacceptable | 1386 | 65.87 |
| Total | 2104 | |
| 8) drop ICD | N | % Total |
| Acceptable | 1260 | 90.91 |
| Unacceptable | 126 | 9.09 |
| Total | 1386 | |
| 9) drop Mobility | N | % Total |
| Acceptable | 4 | 3.17 |
| Unacceptable | 122 | 96.83 |
| Total | 126 | |

| 10) drop Rurality | N | % Total |
|---|---|---|
| Acceptable | 254 | 72.36 |
| Unacceptable | 97 | 27.64 |
| Total | 351 | |
| 11) Collapse Ethnicity | N | % Total |
| Acceptable | 5 | 5.15 |
| Unacceptable | 92 | 94.85 |
| Total | 97 | |

| 12) drop Ethnicity | N | % Total |
|---|---|---|
| Acceptable | 65 | 70.65 |
| Unacceptable | 27 | 29.35 |
| Total | 92 | |
| 13) drop Age | N | % Total |
| Acceptable | 27 | 100.00 |
| Total | 27 | |

Weights were calculated using the same methodology as that used for calculating linkage weights. The distribution of unlock weights can be seen in Table 12. Weighted estimates and actual numbers of deaths for the main sociodemographic variables can be seen in Table 13 below, and agree very well (given random rounding to a near multiple of three).

There were two strata, 5-9yr old Pacific and Asian females, in which there were some individuals dead but none in the HPL data set and none linked. All these individuals were assigned an unlock flag = 1 so that weights and adjustment factors could be calculated for these strata. These individuals were also assigned an unlock flag = 1 and included in the unlock ratio calculations.

**Table 12: Distribution of Unlock weights for 2004-2006 cohort**

| Statistic | W_AgeEthAdj Weight |
|---|---|
| Mean | 1.31 |
| Standard deviation | 0.30 |
| Maximum | 6.19 |
| Minimum | 0.57 |
| Percentile 1 | 0.96 |
| 5 | 1.00 |
| 10 | 1.04 |
| 25 | 1.14 |
| 50 | 1.24 |
| 75 | 1.40 |
| 90 | 1.62 |
| 95 | 1.83 |
| 99 | 2.52 |

**Table 13: Sex-Age-Ethnicity-adjusted weighted and actual deaths for 2004-2006 unlock cohort.**

| | | Deaths | | Weighted Deaths | | Ratio |
|---|---|---|---|---|---|---|
| | | HPL | Actual | W_base | W_AgeEthAdj | W_AgeEthAdj/ Actual Deaths |
| Sex | Males | 19965 | 26361 | 26358 | 26364 | 1.00 |
| | Females | 20733 | 27078 | 27084 | 27078 | 1.00 |
| Prioritised Ethnicity | Maori | 3462 | 5205 | 5235 | 5205 | 1.00 |
| | Pacific | 930 | 1449 | 1422 | 1449 | 1.00 |
| | Asian | 507 | 771 | 768 | 768 | 1.00 |
| | NonMPAandMissing | 35799 | 46020 | 46020 | 46017 | 1.00 |
| Age Group | 0-14 yrs | 303 | 486 | 483 | 483 | 0.99 |
| | 15-34 yrs | 873 | 1641 | 1638 | 1641 | 1.00 |
| | 35-49 yrs | 2274 | 3519 | 3519 | 3519 | 1.00 |
| | 50-64 yrs | 6510 | 8604 | 8604 | 8601 | 1.00 |
| | 65-74 yrs | 9348 | 11766 | 11769 | 11769 | 1.00 |
| | 75-84 yrs | 14133 | 17949 | 17949 | 17949 | 1.00 |
| | 85+ years | 7257 | 9483 | 9480 | 9483 | 1.00 |
| Age Group (detailed) | 0- 4 yrs | 54 | 75 | 81 | 75 | 1.00 |
| | 5- 9 yrs | 45 | 72 | 69 | 75 | 1.04 |
| | 10-14 yrs | 204 | 333 | 333 | 333 | 1.00 |
| | 15-19 yrs | 204 | 360 | 381 | 360 | 1.00 |
| | 20-24 yrs | 162 | 315 | 318 | 318 | 1.01 |
| | 25-29 yrs | 186 | 390 | 351 | 387 | 0.99 |
| | 30-34 yrs | 324 | 573 | 588 | 576 | 1.01 |
| | 35-39 yrs | 432 | 792 | 696 | 789 | 1.00 |
| | 40-44 yrs | 783 | 1209 | 1209 | 1209 | 1.00 |
| | 45-49 yrs | 1059 | 1518 | 1614 | 1518 | 1.00 |
| | 50-54 yrs | 1608 | 2226 | 2154 | 2229 | 1.00 |
| | 55-59 yrs | 2061 | 2745 | 2724 | 2748 | 1.00 |
| | 60-64 yrs | 2838 | 3630 | 3726 | 3630 | 1.00 |
| | 65-69 yrs | 3816 | 4791 | 4833 | 4791 | 1.00 |
| | 70-74 yrs | 5532 | 6978 | 6936 | 6975 | 1.00 |
| | 75-79 yrs | 7272 | 9144 | 9207 | 9141 | 1.00 |
| | 80-84 yrs | 6861 | 8805 | 8742 | 8805 | 1.00 |
| | 85-89 yrs | 4989 | 6507 | 6507 | 6507 | 1.00 |
| | 90-94 yrs | 1833 | 2433 | 2400 | 2433 | 1.00 |
| | 95+ yrs | 432 | 543 | 573 | 543 | 1.00 |
| NZ | Dep 1-2 | 6051 | 7878 | 7902 | 7896 | 1.00 |

| | | Deaths | | Weighted Deaths | | Ratio |
|---|---|---|---|---|---|---|
| | | HPL | Actual | W_base | W_AgeEthAdj | **W_AgeEthAdj/ Actual Deaths** |
| Deprivation Index | Dep 3-4 | 7737 | 9906 | 9945 | 9945 | 1.00 |
| | Dep 5-6 | 9255 | 11961 | 11961 | 11952 | 1.00 |
| | Dep 7-8 | 9330 | 12327 | 12312 | 12318 | 1.00 |
| | Dep 9-10 | 8325 | 11367 | 11322 | 11331 | 1.00 |
| Percent Mobility | Missing | 12 | 21 | 21 | 21 | 1.00 |
| | 0-50% Mobility | 14448 | 18618 | 18597 | 18588 | 1.00 |
| | 51-55% Mobility | 9990 | 12981 | 12999 | 13002 | 1.00 |
| | 56-60% Mobility | 8571 | 11367 | 11442 | 11448 | 1.01 |
| | >60% Mobility | 7674 | 10458 | 10383 | 10386 | 0.99 |
| Rurality | Missing | 15 | 21 | 27 | 24 | 1.14 |
| | Urban | 37053 | 48408 | 48408 | 48417 | 1.00 |
| | Rural | 3627 | 5010 | 5007 | 4998 | 1.00 |
| Cause of Death | Cancer | 11979 | 15309 | 15312 | 15291 | 1.00 |
| | CVD excl. IHD | 7221 | 9513 | 9453 | 9459 | 0.99 |
| | IHD | 9144 | 11778 | 11811 | 11811 | 1.00 |
| | Respiratory | 2943 | 3684 | 3690 | 3684 | 1.00 |
| | Congenital, Perinatal, SIDS | 132 | 177 | 195 | 195 | 1.10 |
| | Unintentional Injury | 1254 | 1926 | 1881 | 1884 | 0.98 |
| | Suicide | 597 | 1056 | 1071 | 1083 | 1.03 |
| | Violent | 45 | 81 | 90 | 90 | 1.11 |
| | Other incl. Not Dead/Linked | 7383 | 9921 | 9945 | 9942 | 1.00 |
| Cause of Death (detailed) | IHD | 9144 | 11778 | 11811 | 11811 | 1.00 |
| | Suicide | 600 | 1056 | 1071 | 1083 | 1.03 |
| | Violent | 42 | 81 | 90 | 93 | 1.15 |
| | Stomach Cancer | 405 | 516 | 525 | 525 | 1.02 |
| | Colorectal Cancer | 1854 | 2346 | 2334 | 2328 | 0.99 |
| | Pancreas Cancer | 546 | 696 | 696 | 696 | 1.00 |
| | Lung/Bronchus Cancer | 2259 | 2901 | 2907 | 2898 | 1.00 |
| | Melanoma | 381 | 498 | 489 | 492 | 0.99 |
| | Breast Cancer | 966 | 1233 | 1242 | 1239 | 1.00 |
| | Prostate Cancer | 888 | 1119 | 1107 | 1104 | 0.99 |
| | Brain/Nervous System Can | 321 | 429 | 426 | 429 | 1.00 |
| | Other Cancer | 4359 | 5571 | 5580 | 5577 | 1.00 |
| | Other Heart Disease | 2277 | 3012 | 3006 | 3009 | 1.00 |

|  |  | Deaths | | Weighted Deaths | | Ratio |
|  |  | HPL | Actual | W_base | W_AgeEthAdj | W_AgeEthAdj/ Actual Deaths |
|---|---|---|---|---|---|---|
|  | Cerebrovascular Disease | 3966 | 5247 | 5169 | 5175 | 0.99 |
|  | Other Cardiovascular Disease | 978 | 1257 | 1275 | 1275 | 1.01 |
|  | Unintentional Injury other than RTC | 789 | 1149 | 1113 | 1116 | 0.97 |
|  | RTC | 465 | 777 | 768 | 765 | 0.98 |
|  | Communicable Diseases | 294 | 411 | 408 | 408 | 0.99 |
|  | Diabetes | 1245 | 1635 | 1692 | 1689 | 1.03 |
|  | Pnuemonia/Influenza | 624 | 819 | 828 | 825 | 1.01 |
|  | COPD | 2523 | 3141 | 3156 | 3150 | 1.00 |
|  | Asthma | 87 | 120 | 117 | 120 | 1.00 |
|  | Other Respiratory | 339 | 423 | 414 | 417 | 0.99 |
|  | Congenital | 132 | 177 | 195 | 195 | 1.10 |
|  | Other Causes | 5217 | 7053 | 7017 | 7014 | 0.99 |
|  | Not Dead/Linked | 6 | 6 | 6 | 6 | 1.00 |
| RHA | Northern | 11403 | 15393 | 15321 | 15333 | 1.00 |
|  | Midland | 8769 | 11586 | 11622 | 11613 | 1.00 |
|  | Central | 10539 | 13650 | 13722 | 13716 | 1.00 |
|  | Southern | 9987 | 12816 | 12777 | 12783 | 1.00 |

Note: Age calculated as Age at Census not Age at Death.

In order to calculate the ratios to adjust for the numerator-denominator bias, we first determined the extent of the bias by cross-classifying census ethnicity by death registration form and NHI database ethnicities. Those individuals that were not linked but assigned an unlock flag = 1 had census ethnicity imputed from mortality data.

The heterogeneity of the numerator-denominator bias was assessed by further cross-classifying census, mortality and NHI ethnicity by the sociodemographic variables: sex, age at death, NZ deprivation, Territorial Authority, rurality and ICD. This was performed for the total, prioritised and sole ethnicity classifications separately.

Adjustment or unlock ratios were then calculated for each of the ethnicity classifications as the ratio of estimated census ethnicity counts to the weighted estimate of mortality (or NHI) ethnicity counts. These counts and ratios have been random rounded so will not necessarily add up exactly.

## Unlock Ratios for Mortality Data

The tables below show the number of deaths by census and mortality record ethnicity using the Total (Table 14), Prioritised (Table 15) and Sole (Table16) definitions.  The results are similar to that obtained for the 2001-2004 cohort.

For the total ethnicity counts, there is very little difference between census and mortality estimated deaths.  Note that the different ethnicity groups are not mutually exclusive (e.g. an individual identified as nonAsian could also be counted as Maori and nonPacific).  The ratio for individuals identified as nonMPA group is close to 1, whereas for the corresponding group who reported only ethnicity within the three Maori, Pacific or Asian cateogiries, there were notably fewer in the census data (a ratio of 0.89).  This is a result of more people self-identifying as two or more ethnicity in the census data more than in the mortality data.

Using the prioritised and sole ethnicity definitions, there is a general trend for mortality ethnicity data to overestimate the number of deaths for Pacific and Maori, and slightly underestimate the number of deaths for Asian and NonMPA ethnicities.  These biases tend to increase as more restrictive ethnicity defintions are used, i.e. from total to prioritised to sole ethnicity.

**Table 14: Census Total Ethnicity by Mortality Total Ethnicity, 2004-06.**

| Total Ethnicity | Census Deaths | Mortality Deaths | Census to Mortality Ratio |
|---|---|---|---|
| Maori | 5,136 | 5,205 | 0.99 |
| Non Maori | 48,306 | 48,240 | 1.00 |
| Pacific | 1,449 | 1,482 | 0.98 |
| Non Pacific | 51,993 | 51,963 | 1.00 |
| Asian | 804 | 816 | 0.99 |
| Non Asian | 52,638 | 52,626 | 1.00 |
| Non MPA | 47,262 | 46,530 | 1.02 |
| Maori/Pacific/Asian | 6,180 | 6,912 | 0.89 |

**Table 15: Census Prioritised Ethnicity by Mortality Prioritised Ethnicity, 2004-06.**

| Census Prioritised Ethnicity | Mortality Prioritised Ethnicity | | | | Total Census Deaths | Census to Mortality Ratio |
|---|---|---|---|---|---|---|
| | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
| Maori | 4,692 | 12 | 6 | 429 | **5,136** | 0.99 |
| Pacific | 18 | 1,317 | 6 | 51 | **1,386** | 0.96 |
| Asian | . | 33 | 714 | 30 | **777** | 1.01 |
| Non MPA | 495 | 84 | 48 | 45,513 | **46,143** | 1.00 |
| **Total** | **5,205** | **1,449** | **771** | **46,020** | | |

**Table 16:Census Sole Ethnicity by Mortality Sole Ethnicity, 2004-06.**

| Census Sole Ethnicity | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | **Total Census Deaths** | Census to Mortality Ratio |
|---|---|---|---|---|---|---|
| | | | Mortality Sole Ethnicity | | | |
| Maori | 4,386 | 12 | 6 | 738 | **4,095** | 0.86 |
| Pacific | 18 | 1,263 | 6 | 108 | **1,284** | 0.96 |
| Asian | . | 6 | 690 | 84 | **744** | 1.01 |
| Remainder[1] | 363 | 60 | 39 | 45,678 | **47,322** | 1.02 |
| **Total** | **4,764** | **1,338** | **735** | **46,602** | | |

[1] The "remainder" group includes any individuals that reported a nonMaori NonPacific NonAsian ethnic group, as well as extra decedents or census respondednts that self-identified multiple ethnic groups and consequently was not eligible for a sole ethnic group classification.

The tables below present count of of deaths by census and mortality ethnicity for the strata variables sex, age, NZ deprivation, RHA, rurality and cause of death.

# Sex

Census to mortality ratios for total, prioritised and sole ethnicity by sex are all very close to 1, with the exception of Maori sole ethnicity which was lower.

**Table 17:Census Total Ethnicity by Mortality Total Ethnicity stratified by Sex, 2004-06.**

| Sex | Total Ethnicity | Census Deaths | Mortality Deaths | Census to Mortality Ratio |
|---|---|---|---|---|
| Males | Maori | 2,793 | 2,841 | 0.98 |
| | Non Maori | 23,571 | 23,523 | 1.00 |
| | Pacific | 798 | 810 | 0.99 |
| | Non Pacific | 25,563 | 25,551 | 1.00 |
| | Asian | 459 | 459 | 1.00 |
| | Non Asian | 25,905 | 25,902 | 1.00 |
| | Non MPA | 22,932 | 22,560 | 1.02 |
| | Maori/Pacific/Asian | 3,429 | 3,804 | 0.90 |
| Females | Maori | 2,343 | 2,364 | 0.99 |
| | Non Maori | 24,735 | 24,717 | 1.00 |
| | Pacific | 651 | 669 | 0.97 |
| | Non Pacific | 26,430 | 26,409 | 1.00 |
| | Asian | 348 | 357 | 0.97 |
| | Non Asian | 26,733 | 26,724 | 1.00 |
| | Non MPA | 24,333 | 23,970 | 1.02 |
| | Maori/Pacific/Asian | 2,748 | 3,111 | 0.88 |

**Table 18: Census Prioritised Ethnicity by Mortality Prioritised Ethnicity stratified by Sex, 2004-06.**

| Sex | Census Prioritised Ethnicity | Mortality Prioritised Ethnicity | | | | Total Census Deaths | Census to Mortality Ratio |
| | | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
|---|---|---|---|---|---|---|---|
| Males | Maori | 2,556 | 9 | 6 | 222 | **2,793** | 0.98 |
| | Pacific | 9 | 723 | 6 | 27 | **756** | 0.96 |
| | Asian | . | 18 | 405 | 18 | **444** | 1.02 |
| | Non MPA | 276 | 39 | 30 | 22,023 | **22,368** | 1.00 |
| | **Total** | **2,841** | **789** | **435** | **22,296** | | |
| Females | Maori | 2,133 | 6 | . | 204 | **2,343** | 0.99 |
| | Pacific | 12 | 594 | 6 | 21 | **630** | 0.95 |
| | Asian | . | 15 | 312 | 9 | **336** | 1.01 |
| | Non MPA | 219 | 45 | 18 | 23,487 | **23,772** | 1.00 |
| | **Total** | **2,364** | **660** | **333** | **23,724** | | |

**Table 19: Census Sole Ethnicity by Mortality Sole Ethnicity stratified by Sex, 2004-06.**

| Sex | Census Sole Ethnicity | Mortality Sole Ethnicity | | | | Total Census Deaths | Census to Mortality Ratio |
| | | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
|---|---|---|---|---|---|---|---|
| Males | Maori | 2,394 | 6 | 6 | 390 | **2,268** | 0.87 |
| | Pacific | 9 | 693 | 6 | 60 | **714** | 0.98 |
| | Asian | . | 6 | 396 | 42 | **417** | 0.98 |
| | Remainder | 204 | 27 | 24 | 22,110 | **22,965** | 1.02 |
| | **Total** | **2,604** | **732** | **426** | **22,602** | | |
| Females | Maori | 1,992 | 6 | . | 345 | **1,827** | 0.85 |
| | Pacific | 9 | 570 | 6 | 48 | **570** | 0.94 |
| | Asian | . | 6 | 294 | 39 | **324** | 1.04 |
| | Remainder | 159 | 33 | 12 | 23,568 | **24,357** | 1.01 |
| | **Total** | **2,160** | **609** | **312** | **24,003** | | |

# Age

For individuals greater than 35 years, there appears to be relatively little difference between ethnic counts on the census and mortality data.

Mortality ethnicity counts for the younger age groups (<35 years) appear to underestimate census ethnicity counts; census to mortality ratios for Maori Pacific and nonMPA are all considerably larger than 1.0 for total ethnicity. Using a prioritised ethnicity definition, ratios are closer to 1.0. This suggests some of this underestimation is due to differential classification of multiple ethnicities in the census and mortality data; for instance approximately 15 Pacific individuals on the mortality data were also classified as Maori, compared to approximately 20 on the census data. Note that the ratio decreases even further when a sole ethnicity definition is used.

**Table 20: Census Total Ethnicity by Mortality Total Ethnicity stratified by Age, 2004-06.**

| Age | Total Ethnicity | Census Deaths | Mortality Deaths | Census to Mortality Ratio |
|---|---|---|---|---|
| 0-14 years | Maori | 69 | 63 | 1.10 |
| | Non Maori | 120 | 126 | 0.95 |
| | Pacific | 21 | 15 | 1.40 |
| | Non Pacific | 171 | 177 | 0.97 |
| | Asian | 18 | 12 | 1.50 |
| | Non Asian | 177 | 177 | 1.00 |
| | Non MPA | 126 | 105 | 1.20 |
| | Maori/Pacific/Asian | 66 | 87 | 0.76 |
| 15-34 years | Maori | 459 | 483 | 0.95 |
| | Non Maori | 987 | 960 | 1.03 |
| | Pacific | 132 | 111 | 1.19 |
| | Non Pacific | 1,311 | 1,329 | 0.99 |
| | Asian | 39 | 27 | 1.44 |
| | Non Asian | 1,407 | 1,413 | 1.00 |
| | Non MPA | 1,017 | 912 | 1.12 |
| | Maori/Pacific/Asian | 426 | 531 | 0.80 |
| 35-49 years | Maori | 765 | 780 | 0.98 |
| | Non Maori | 1,980 | 1,965 | 1.01 |
| | Pacific | 186 | 180 | 1.03 |
| | Non Pacific | 2,562 | 2,571 | 1.00 |
| | Asian | 87 | 96 | 0.91 |
| | Non Asian | 2,658 | 2,652 | 1.00 |
| | Non MPA | 1,890 | 1,779 | 1.06 |
| | Maori/Pacific/Asian | 858 | 969 | 0.89 |
| 50-64 years | Maori | 1,443 | 1,458 | 0.99 |
| | Non Maori | 5,445 | 5,427 | 1.00 |
| | Pacific | 363 | 375 | 0.97 |
| | Non Pacific | 6,525 | 6,513 | 1.00 |
| | Asian | 171 | 168 | 1.02 |
| | Non Asian | 6,717 | 6,720 | 1.00 |
| | Non MPA | 5,157 | 4,989 | 1.03 |
| | Maori/Pacific/Asian | 1,728 | 1,899 | 0.91 |
| 65-74 years | Maori | 1,251 | 1,257 | 1.00 |
| | Non Maori | 7,836 | 7,824 | 1.00 |
| | Pacific | 339 | 345 | 0.98 |
| | Non Pacific | 8,748 | 8,745 | 1.00 |
| | Asian | 192 | 201 | 0.96 |
| | Non Asian | 8,895 | 8,886 | 1.00 |
| | Non MPA | 7,512 | 7,383 | 1.02 |
| | Maori/Pacific/Asian | 1,575 | 1,701 | 0.93 |
| 75-84 years | Maori | 840 | 852 | 0.99 |
| | Non Maori | 16,041 | 16,026 | 1.00 |
| | Pacific | 294 | 321 | 0.92 |

| Age | Total Ethnicity | Census Deaths | Mortality Deaths | Census to Mortality Ratio |
|---|---|---|---|---|
| | Non Pacific | 16,584 | 16,554 | 1.00 |
| | Asian | 189 | 198 | 0.95 |
| | Non Asian | 16,689 | 16,680 | 1.00 |
| | Non MPA | 15,765 | 15,636 | 1.01 |
| | Maori/Pacific/Asian | 1,113 | 1,242 | 0.90 |
| >=85 years | Maori | 315 | 306 | 1.03 |
| | Non Maori | 15,900 | 15,906 | 1.00 |
| | Pacific | 120 | 138 | 0.87 |
| | Non Pacific | 16,092 | 16,077 | 1.00 |
| | Asian | 111 | 114 | 0.97 |
| | Non Asian | 16,101 | 16,098 | 1.00 |
| | Non MPA | 15,804 | 15,726 | 1.00 |
| | Maori/Pacific/Asian | 411 | 486 | 0.85 |

**Table 21: Census Prioritised Ethnicity by Mortality Prioritised Ethnicity stratified by Age, 2004-06.**

| Age | Census Prioritised Ethnicity | Mortality Prioritised Ethnicity | | | | Total Census Deaths | Census to Mortality Ratio |
|---|---|---|---|---|---|---|---|
| | | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
| 0-14 years | Maori | 60 | 6 | . | 6 | **69** | 1.10 |
| | Pacific | . | 9 | . | . | **12** | 1.00 |
| | Asian | . | . | 12 | 6 | **18** | 1.50 |
| | Non MPA | 6 | . | . | 93 | **96** | 0.97 |
| | **Total** | **63** | **12** | **12** | **99** | | |
| 15-34 years | Maori | 423 | 6 | . | 36 | **459** | 0.95 |
| | Pacific | 9 | 96 | . | 12 | **111** | 1.16 |
| | Asian | . | 6 | 27 | 6 | **30** | 1.11 |
| | Non MPA | 54 | 6 | 6 | 786 | **846** | 1.01 |
| | **Total** | **483** | **96** | **27** | **834** | | |
| 35-49 years | Maori | 711 | 6 | 6 | 51 | **765** | 0.98 |
| | Pacific | 6 | 159 | . | 6 | **171** | 1.00 |
| | Asian | . | 6 | 78 | 6 | **84** | 0.97 |
| | Non MPA | 63 | 9 | 6 | 1,647 | **1,722** | 1.01 |
| | **Total** | **780** | **171** | **87** | **1,710** | | |
| 50-64 years | Maori | 1,338 | 6 | 6 | 99 | **1,443** | 0.99 |
| | Pacific | 6 | 342 | 6 | 9 | **354** | 0.96 |
| | Asian | . | 9 | 147 | 6 | **162** | 1.06 |
| | Non MPA | 120 | 12 | 6 | 4,791 | **4,929** | 1.00 |
| | **Total** | **1,458** | **369** | **153** | **4,905** | | |
| 65-74 years | Maori | 1,161 | 6 | . | 87 | **1,251** | 0.99 |
| | Pacific | 6 | 321 | 6 | 6 | **330** | 0.96 |
| | Asian | . | 6 | 180 | 6 | **189** | 1.00 |
| | Non MPA | 96 | 15 | 9 | 7,197 | **7,317** | 1.00 |
| | **Total** | **1,260** | **342** | **189** | **7,293** | | |
| 75-84 years | Maori | 744 | 6 | . | 93 | **840** | 0.99 |
| | Pacific | 6 | 279 | 6 | 9 | **288** | 0.91 |

| Age | Census Prioritised Ethnicity | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | Total Census Deaths | Census to Mortality Ratio |
|---|---|---|---|---|---|---|---|
| | | | | Mortality Prioritised Ethnicity | | | |
| | Asian | . | 9 | 171 | 6 | **186** | 0.98 |
| | Non MPA | 105 | 27 | 18 | 15,414 | **15,564** | 1.00 |
| | **Total** | **852** | **318** | **189** | **15,519** | | |
| >=85 years | Maori | 255 | . | . | 60 | **315** | 1.03 |
| | Pacific | . | 111 | . | 9 | **120** | 0.87 |
| | Asian | . | 6 | 99 | 6 | **108** | 0.97 |
| | Non MPA | 51 | 24 | 9 | 15,585 | **15,672** | 1.00 |
| | **Total** | **306** | **138** | **111** | **15,657** | | |

### Table 22: Census Sole Ethnicity by Mortality Sole Ethnicity stratified by Age, 2004-06.

| Age | Census Sole Ethnicity | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | Total Census Deaths | Census to Mortality Ratio |
|---|---|---|---|---|---|---|---|
| | | | | Mortality Sole Ethnicity | | | |
| 0-14 years | Maori | 54 | 6 | . | 12 | **39** | 0.68 |
| | Pacific | . | 9 | . | 6 | **9** | 0.75 |
| | Asian | . | . | 12 | 6 | **18** | 1.50 |
| | Remainder | 6 | . | . | 93 | **129** | 1.19 |
| | **Total** | **57** | **12** | **12** | **108** | | |
| 15-34 years | Maori | 360 | 6 | . | 96 | **294** | 0.72 |
| | Pacific | 9 | 84 | . | 21 | **87** | 1.04 |
| | Asian | . | . | 24 | 6 | **27** | 1.13 |
| | Remainder | 39 | 6 | 6 | 801 | **1,032** | 1.12 |
| | **Total** | **408** | **84** | **24** | **924** | | |
| 35-49 years | Maori | 663 | 6 | 6 | 102 | **609** | 0.84 |
| | Pacific | 6 | 150 | . | 15 | **162** | 1.06 |
| | Asian | . | 6 | 72 | 15 | **78** | 1.00 |
| | Remainder | 54 | 6 | 6 | 1,659 | **1,899** | 1.06 |
| | **Total** | **723** | **153** | **78** | **1,788** | | |
| 50-64 years | Maori | 1,284 | 6 | 6 | 153 | **1,215** | 0.88 |
| | Pacific | 6 | 339 | 6 | 15 | **342** | 0.96 |
| | Asian | . | 6 | 144 | 18 | **159** | 1.06 |
| | Remainder | 93 | 9 | 6 | 4,821 | **5,172** | 1.03 |
| | **Total** | **1,377** | **357** | **150** | **5,004** | | |
| 65-74 years | Maori | 1,110 | 6 | . | 141 | **1,074** | 0.91 |
| | Pacific | 6 | 312 | 6 | 15 | **312** | 0.97 |
| | Asian | . | . | 180 | 12 | **183** | 0.97 |
| | Remainder | 69 | 9 | 9 | 7,230 | **7,515** | 1.02 |
| | **Total** | **1,179** | **321** | **189** | **7,395** | | |
| 75-84 years | Maori | 684 | 6 | . | 156 | **657** | 0.87 |
| | Pacific | 6 | 264 | 6 | 24 | **267** | 0.92 |
| | Asian | . | 6 | 162 | 21 | **183** | 1.02 |
| | Remainder | 72 | 21 | 18 | 15,453 | **15,774** | 1.01 |
| | **Total** | **756** | **291** | **180** | **15,651** | | |
| >=85 years | Maori | 234 | . | . | 78 | **207** | 0.79 |
| | Pacific | . | 102 | . | 15 | **102** | 0.85 |

| Age | Census Sole Ethnicity | Mortality Sole Ethnicity | | | | Total Census Deaths | Census to Mortality Ratio |
|---|---|---|---|---|---|---|---|
| | | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
| | Asian | . | 6 | 96 | 12 | **99** | 0.97 |
| | Remainder | 27 | 15 | 6 | 15,627 | **15,804** | 1.00 |
| | **Total** | **261** | **120** | **102** | **15,732** | | |

## NZ Deprivation

Most ethnicity counts are close to 1.00, although there appears to be an overestimation in the mortality records, relative to the census data, for the lower NZdep deciles for total and prioritised Pacific ethnicity as well as sole Maori ethnicity (i.e. ratios < 1.0).

**Table 23: Census Total Ethnicity by Mortality Total Ethnicity stratified by NZdeprivation, 2004-06.**

| NZ Deprivation Index | Total Ethnicity | Census Deaths | Mortality Deaths | Census to Mortality Ratio |
|---|---|---|---|---|
| Dep 1-4 | Maori | 696 | 672 | 1.04 |
| | Non Maori | 17,145 | 17,169 | 1.00 |
| | Pacific | 147 | 174 | 0.84 |
| | Non Pacific | 17,691 | 17,667 | 1.00 |
| | Asian | 303 | 318 | 0.95 |
| | Non Asian | 17,538 | 17,523 | 1.00 |
| | Non MPA | 16,977 | 16,824 | 1.01 |
| | Maori/Pacific/Asian | 864 | 1,014 | 0.85 |
| Dep 5-6 & Missing | Maori | 687 | 678 | 1.01 |
| | Non Maori | 11,268 | 11,274 | 1.00 |
| | Pacific | 183 | 189 | 0.97 |
| | Non Pacific | 11,772 | 11,763 | 1.00 |
| | Asian | 180 | 171 | 1.05 |
| | Non Asian | 11,772 | 11,781 | 1.00 |
| | Non MPA | 11,118 | 11,022 | 1.01 |
| | Maori/Pacific/Asian | 834 | 930 | 0.90 |
| Dep 7-8 | Maori | 1,140 | 1,164 | 0.98 |
| | Non Maori | 11,178 | 11,154 | 1.00 |
| | Pacific | 276 | 282 | 0.98 |
| | Non Pacific | 12,039 | 12,036 | 1.00 |
| | Asian | 171 | 177 | 0.97 |
| | Non Asian | 12,147 | 12,141 | 1.00 |
| | Non MPA | 10,992 | 10,839 | 1.01 |
| | Maori/Pacific/Asian | 1,326 | 1,479 | 0.90 |
| Dep 9-10 | Maori | 2,616 | 2,691 | 0.97 |
| | Non Maori | 8,718 | 8,640 | 1.01 |
| | Pacific | 840 | 834 | 1.01 |
| | Non Pacific | 10,491 | 10,497 | 1.00 |

| NZ Deprivation Index | Total Ethnicity | Census Deaths | Mortality Deaths | Census to Mortality Ratio |
|---|---|---|---|---|
| | Asian | 150 | 153 | 0.98 |
| | Non Asian | 11,184 | 11,181 | 1.00 |
| | Non MPA | 8,175 | 7,845 | 1.04 |
| | Maori/Pacific/Asian | 3,156 | 3,489 | 0.90 |

**Table 24: Census Prioritised Ethnicity by Mortality Prioritised Ethnicity stratified by NZdeprivation, 2004-06.**

| | | Mortality Prioritised Ethnicity | | | | | |
|---|---|---|---|---|---|---|---|
| NZ Deprivation Index | Census Prioritised Ethnicity | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | **Total Census Deaths** | Census to Mortality Ratio |
| Dep 1-4 | Maori | 576 | 6 | 6 | 111 | **696** | 1.04 |
| | Pacific | 6 | 132 | . | 12 | **144** | 0.86 |
| | Asian | . | 15 | 276 | 6 | **297** | 0.98 |
| | Non MPA | 96 | 21 | 24 | 16,566 | **16,707** | 1.00 |
| | **Total** | **672** | **168** | **303** | **16,698** | | |
| Dep 5-6 & Missing | Maori | 594 | . | . | 90 | **687** | 1.01 |
| | Pacific | 6 | 156 | 6 | 9 | **168** | 0.90 |
| | Asian | . | 15 | 150 | 9 | **174** | 1.12 |
| | Non MPA | 78 | 15 | 9 | 10,821 | **10,923** | 1.00 |
| | **Total** | **678** | **186** | **156** | **10,935** | | |
| Dep 7-8 | Maori | 1,038 | 6 | . | 102 | **1,140** | 0.98 |
| | Pacific | 6 | 249 | 6 | 18 | **267** | 0.96 |
| | Asian | . | 6 | 159 | 6 | **171** | 1.00 |
| | Non MPA | 126 | 24 | 9 | 10,581 | **10,743** | 1.00 |
| | **Total** | **1,164** | **279** | **171** | **10,704** | | |
| Dep 9-10 | Maori | 2,484 | 6 | 6 | 123 | **2,616** | 0.97 |
| | Pacific | 12 | 783 | 6 | 15 | **810** | 0.99 |
| | Asian | . | 6 | 132 | 9 | **141** | 1.00 |
| | Non MPA | 195 | 27 | 9 | 7,542 | **7,767** | 1.01 |
| | **Total** | **2,691** | **816** | **141** | **7,686** | | |

**Table 25: Census Sole Ethnicity by Mortality Sole Ethnicity stratified by NZdeprivation, 2004-06.**

| | | Mortality Sole Ethnicity | | | | | |
|---|---|---|---|---|---|---|---|
| NZ Deprivation Index | Census Sole Ethnicity | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | **Total Census Deaths** | Census to Mortality Ratio |
| Dep 1-4 | Maori | 504 | 6 | 6 | 186 | **465** | 0.82 |
| | Pacific | 6 | 120 | . | 24 | **111** | 0.79 |
| | Asian | . | 6 | 264 | 33 | **285** | 0.99 |
| | Remainder | 66 | 18 | 18 | 16,602 | **16,980** | 1.01 |
| | **Total** | **570** | **141** | **288** | **16,845** | | |
| Dep 5-6 & Missing | Maori | 549 | . | . | 138 | **510** | 0.84 |
| | Pacific | 6 | 144 | 6 | 21 | **144** | 0.91 |
| | Asian | . | 6 | 141 | 27 | **159** | 1.06 |

| NZ Deprivation Index | Census Sole Ethnicity | Mortality Sole Ethnicity | | | | Total Census Deaths | Census to Mortality Ratio |
|---|---|---|---|---|---|---|---|
| | | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
| | Remainder | 54 | 12 | 9 | 10,854 | **11,133** | 1.01 |
| | **Total** | **606** | **159** | **150** | **11,040** | | |
| Dep 7-8 | Maori | 963 | 6 | . | 177 | **912** | 0.87 |
| | Pacific | 6 | 234 | 6 | 30 | **240** | 0.94 |
| | Asian | . | 6 | 156 | 12 | **162** | 1.00 |
| | Remainder | 87 | 21 | 6 | 10,629 | **11,001** | 1.01 |
| | **Total** | **1,053** | **255** | **162** | **10,848** | | |
| Dep 9-10 | Maori | 2,370 | 6 | 6 | 237 | **2,205** | 0.87 |
| | Pacific | 9 | 765 | 6 | 30 | **786** | 1.00 |
| | Asian | . | 6 | 129 | 9 | **132** | 0.96 |
| | Remainder | 156 | 15 | 9 | 7,590 | **8,205** | 1.04 |
| | **Total** | **2,538** | **789** | **138** | **7,869** | | |

## RHA

Ethnicity counts in the census and mortality data are largely concordant when stratified by regional health authority.  However, Maori ethnicitiy counts are are approximately equal for the census and mortality data across all RHAs when using total or prioritised ethnicity definitions, but are largely overestimated for sole ethnicity in the mortality data relative to census data, especially so in the Southern RHA (ratio = 0.77; Table 29).  This suggests, similar to the 2001-2004 cohort, underrecording of mnultiple ethnicities on mortality data relative to census data is most prominent in Southern New Zealand.

**Table 26: Census Total Ethnicity by Mortality Total Ethnicity stratified by RHA, 2004-06.**

| RHA | Total Ethnicity | Census Deaths | Mortality Deaths | Census to Mortality Ratio |
|---|---|---|---|---|
| Northern | Maori | 1,566 | 1,596 | 0.98 |
| | Non Maori | 13,764 | 13,734 | 1.00 |
| | Pacific | 1,023 | 1,059 | 0.97 |
| | Non Pacific | 14,310 | 14,271 | 1.00 |
| | Asian | 459 | 471 | 0.97 |
| | Non Asian | 14,877 | 14,862 | 1.00 |
| | Non MPA | 12,681 | 12,486 | 1.02 |
| | Maori/Pacific/Asian | 2,649 | 2,844 | 0.93 |
| Midland | Maori | 1,965 | 1,989 | 0.99 |
| | Non Maori | 9,651 | 9,624 | 1.00 |
| | Pacific | 102 | 84 | 1.21 |
| | Non Pacific | 11,514 | 11,529 | 1.00 |
| | Asian | 63 | 69 | 0.91 |
| | Non Asian | 11,553 | 11,547 | 1.00 |
| | Non MPA | 9,831 | 9,591 | 1.03 |

| RHA | Total Ethnicity | Census Deaths | Mortality Deaths | Census to Mortality Ratio |
|---|---|---|---|---|
| | Maori/Pacific/Asian | 1,782 | 2,022 | 0.88 |
| Central | Maori | 1,200 | 1,227 | 0.98 |
| | Non Maori | 12,516 | 12,486 | 1.00 |
| | Pacific | 246 | 255 | 0.96 |
| | Non Pacific | 13,467 | 13,461 | 1.00 |
| | Asian | 198 | 189 | 1.05 |
| | Non Asian | 13,518 | 13,527 | 1.00 |
| | Non MPA | 12,390 | 12,186 | 1.02 |
| | Maori/Pacific/Asian | 1,323 | 1,530 | 0.86 |
| Southern | Maori | 405 | 393 | 1.03 |
| | Non Maori | 12,378 | 12,390 | 1.00 |
| | Pacific | 78 | 84 | 0.93 |
| | Non Pacific | 12,702 | 12,699 | 1.00 |
| | Asian | 90 | 90 | 1.00 |
| | Non Asian | 12,693 | 12,693 | 1.00 |
| | Non MPA | 12,357 | 12,267 | 1.01 |
| | Maori/Pacific/Asian | 423 | 516 | 0.82 |

**Table 27: Census Prioritised Ethnicity by Mortality Prioritised Ethnicity stratified by RHA, 2004-06.**

| RHA | Census Prioritised Ethnicity | Mortality Prioritised Ethnicity | | | | Total Census Deaths | Census to Mortality Ratio |
|---|---|---|---|---|---|---|---|
| | | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
| Northern | Maori | 1,428 | 6 | 6 | 135 | **1,566** | 0.98 |
| | Pacific | 15 | 960 | 6 | 18 | **993** | 0.96 |
| | Asian | . | 24 | 411 | 9 | **447** | 1.03 |
| | Non MPA | 156 | 51 | 18 | 12,099 | **12,327** | 1.01 |
| | **Total** | **1,596** | **1,038** | **435** | **12,264** | | |
| Midland | Maori | 1,830 | 6 | . | 129 | **1,965** | 0.99 |
| | Pacific | 6 | 72 | 6 | 15 | **87** | 1.07 |
| | Asian | . | 6 | 54 | 6 | **60** | 0.95 |
| | Non MPA | 159 | 6 | 12 | 9,330 | **9,504** | 1.00 |
| | **Total** | **1,992** | **81** | **63** | **9,477** | | |
| Central | Maori | 1,110 | 6 | . | 87 | **1,200** | 0.98 |
| | Pacific | 6 | 219 | 6 | 6 | **231** | 0.94 |
| | Asian | . | 6 | 177 | 9 | **189** | 1.03 |
| | Non MPA | 114 | 18 | 6 | 11,955 | **12,096** | 1.00 |
| | **Total** | **1,227** | **246** | **183** | **12,057** | | |
| Southern | Maori | 324 | 6 | 6 | 75 | **405** | 1.04 |
| | Pacific | . | 69 | . | 9 | **78** | 0.93 |
| | Asian | . | 6 | 72 | 9 | **87** | 1.04 |
| | Non MPA | 69 | 12 | 12 | 12,126 | **12,216** | 1.00 |
| | **Total** | **390** | **84** | **84** | **12,222** | | |

**Table 28: Census Sole Ethnicity by Mortality Sole Ethnicity stratified by RHA, 2004-06.**

| RHA | Census Sole Ethnicity | Mortality Sole Ethnicity | | | | Total Census Deaths | Census to Mortality Ratio |
|---|---|---|---|---|---|---|---|
| | | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
| Northern | Maori | 1,290 | 6 | 6 | 273 | **1,236** | 0.88 |
| | Pacific | 15 | 924 | 6 | 57 | **936** | 0.97 |
| | Asian | . | 6 | 408 | 36 | **441** | 1.04 |
| | Remainder | 102 | 36 | 15 | 12,177 | **12,717** | 1.01 |
| | **Total** | **1,407** | **966** | **426** | **12,540** | | |
| Midland | Maori | 1,761 | 6 | . | 201 | **1,647** | 0.88 |
| | Pacific | 6 | 66 | 6 | 18 | **72** | 1.00 |
| | Asian | . | . | 51 | 6 | **51** | 0.81 |
| | Remainder | 117 | 6 | 12 | 9,375 | **9,840** | 1.03 |
| | **Total** | **1,881** | **72** | **63** | **9,597** | | |
| Central | Maori | 1,032 | 6 | . | 165 | **933** | 0.83 |
| | Pacific | 6 | 204 | 6 | 24 | **204** | 0.91 |
| | Asian | . | 6 | 165 | 21 | **177** | 1.04 |
| | Remainder | 87 | 15 | 6 | 11,985 | **12,402** | 1.02 |
| | **Total** | **1,122** | **225** | **171** | **12,198** | | |
| Southern | Maori | 303 | 6 | 6 | 96 | **276** | 0.77 |
| | Pacific | . | 69 | . | 9 | **69** | 0.88 |
| | Asian | . | . | 69 | 18 | **72** | 0.92 |
| | Remainder | 54 | 9 | 12 | 12,144 | **12,360** | 1.01 |
| | **Total** | **357** | **78** | **78** | **12,267** | | |

# Rurality

Ethnicity counts in the census and mortality data are largely concordant when stratified by rurality for Maori and nonMPA individuals.  Numbers are too small for Asian and Pacific ethnicities in rural areas for any strong conclusions to be drawn.

**Table 29: Census Total Ethnicity by Mortality Total Ethnicity stratified by Rurality, 2004-06.**

| Rurality | Total Ethnicity | Census Deaths | Mortality Deaths | Census to Mortality Ratio |
|---|---|---|---|---|
| All Urban | Maori | 4,107 | 4,149 | 0.99 |
| | Non Maori | 44,007 | 43,962 | 1.00 |
| | Pacific | 1,428 | 1,458 | 0.98 |
| | Non Pacific | 46,689 | 46,656 | 1.00 |
| | Asian | 792 | 807 | 0.98 |
| | Non Asian | 47,322 | 47,307 | 1.00 |
| | Non MPA | 42,840 | 42,219 | 1.01 |
| | Maori/Pacific/Asian | 5,274 | 5,898 | 0.89 |
| NonUrban or Missing | Maori | 1,029 | 1,056 | 0.97 |

| Rurality | Total Ethnicity | Census Deaths | Mortality Deaths | Census to Mortality Ratio |
|---|---|---|---|---|
| | Non Maori | 4,299 | 4,275 | 1.01 |
| | Pacific | 27 | 24 | 1.13 |
| | Non Pacific | 5,304 | 5,304 | 1.00 |
| | Asian | 15 | 9 | 1.67 |
| | Non Asian | 5,316 | 5,319 | 1.00 |
| | Non MPA | 4,422 | 4,311 | 1.03 |
| | Maori/Pacific/Asian | 906 | 1,017 | 0.89 |

**Table 30: Census Prioritised Ethnicity by Mortality Prioritised Ethnicity stratified by Rurality, 2004-06.**

| Rurality | Census Prioritised Ethnicity | Mortality Prioritised Ethnicity | | | | Total Census Deaths | Census to Mortality Ratio |
|---|---|---|---|---|---|---|---|
| | | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
| All Urban | Maori | 3,732 | 12 | 6 | 360 | **4,107** | 0.99 |
| | Pacific | 18 | 1,299 | 6 | 45 | **1,365** | 0.96 |
| | Asian | . | 33 | 708 | 27 | **768** | 1.01 |
| | Non MPA | 399 | 84 | 45 | 41,343 | **41,874** | 1.00 |
| | **Total** | **4,152** | **1,425** | **762** | **41,775** | | |
| NonUrban or Missing | Maori | 960 | 6 | . | 69 | **1,029** | 0.98 |
| | Pacific | 6 | 18 | . | 6 | **24** | 1.00 |
| | Asian | . | . | 6 | 6 | **9** | 1.00 |
| | Non MPA | 93 | 6 | 6 | 4,170 | **4,269** | 1.01 |
| | **Total** | **1,053** | **24** | **9** | **4,245** | | |

**Table 31: Census Sole Ethnicity by Mortality Sole Ethnicity stratified by Rurality, 2004-06.**

| Rurality | Census Sole Ethnicity | Mortality Sole Ethnicity | | | | Total Census Deaths | Census to Mortality Ratio |
|---|---|---|---|---|---|---|---|
| | | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
| All Urban | Maori | 3,465 | 12 | 6 | 627 | **3,213** | 0.85 |
| | Pacific | 18 | 1,242 | 6 | 102 | **1,266** | 0.96 |
| | Asian | . | 6 | 684 | 78 | **735** | 1.01 |
| | Remainder | 294 | 60 | 36 | 41,484 | **42,903** | 1.01 |
| | **Total** | **3,777** | **1,320** | **729** | **42,291** | | |
| NonUrban or Missing | Maori | 918 | . | . | 111 | **882** | 0.89 |
| | Pacific | 6 | 18 | . | 6 | **21** | 1.17 |
| | Asian | . | . | 6 | 6 | **9** | 1.00 |
| | Remainder | 69 | 6 | 6 | 4,197 | **4,422** | 1.03 |
| | **Total** | **987** | **18** | **9** | **4,314** | | |

## Cause of Death

Ethnicity counts in the census and mortality data are largely concordant when stratified by cause of death. Note that a similar pattern to that found with RHA stratification can be seen for the Maori unlock ratios; greater overestimation of Maori in mortality relative to census data, across all ICDs for sole ethnicity compared to total or prioritised ethnicity.

**Table 32: Census Total Ethnicity by Mortality Total Ethnicity stratified by ICD, 2004-06.**

| Cause of Death | Total Ethnicity | Census Deaths | Mortality Deaths | Census to Mortality Ratio |
|---|---|---|---|---|
| Cancer | Maori | 1,545 | 1,515 | 1.02 |
| | Non Maori | 13,746 | 13,776 | 1.00 |
| | Pacific | 372 | 381 | 0.98 |
| | Non Pacific | 14,919 | 14,910 | 1.00 |
| | Asian | 270 | 279 | 0.97 |
| | Non Asian | 15,024 | 15,012 | 1.00 |
| | Non MPA | 13,485 | 13,275 | 1.02 |
| | Maori/Pacific/Asian | 1,806 | 2,013 | 0.90 |
| CVD & IHD | Maori | 1,683 | 1,695 | 0.99 |
| | Non Maori | 19,587 | 19,575 | 1.00 |
| | Pacific | 528 | 558 | 0.95 |
| | Non Pacific | 20,742 | 20,712 | 1.00 |
| | Asian | 282 | 279 | 1.01 |
| | Non Asian | 20,988 | 20,991 | 1.00 |
| | Non MPA | 19,131 | 18,912 | 1.01 |
| | Maori/Pacific/Asian | 2,139 | 2,358 | 0.91 |
| Respiratory | Maori | 375 | 396 | 0.95 |
| | Non Maori | 3,312 | 3,291 | 1.01 |
| | Pacific | 72 | 78 | 0.92 |
| | Non Pacific | 3,612 | 3,606 | 1.00 |
| | Asian | 30 | 30 | 1.00 |
| | Non Asian | 3,654 | 3,654 | 1.00 |
| | Non MPA | 3,288 | 3,213 | 1.02 |
| | Maori/Pacific/Asian | 399 | 471 | 0.85 |
| Unintentional Injury, Suicide, Violent | Maori | 621 | 657 | 0.95 |
| | Non Maori | 2,436 | 2,403 | 1.01 |
| | Pacific | 129 | 108 | 1.19 |
| | Non Pacific | 2,931 | 2,952 | 0.99 |
| | Asian | 72 | 60 | 1.20 |
| | Non Asian | 2,988 | 2,997 | 1.00 |
| | Non MPA | 2,454 | 2,337 | 1.05 |
| | Maori/Pacific/Asian | 606 | 723 | 0.84 |
| Other Causes | Maori | 912 | 942 | 0.97 |

| Cause of Death | Total Ethnicity | Census Deaths | Mortality Deaths | Census to Mortality Ratio |
|---|---|---|---|---|
| | Non Maori | 9,225 | 9,195 | 1.00 |
| | Pacific | 351 | 357 | 0.98 |
| | Non Pacific | 9,786 | 9,783 | 1.00 |
| | Asian | 156 | 165 | 0.95 |
| | Non Asian | 9,981 | 9,972 | 1.00 |
| | Non MPA | 8,904 | 8,790 | 1.01 |
| | Maori/Pacific/Asian | 1,233 | 1,347 | 0.92 |

**Table 33: Census Prioritised Ethnicity by Mortality Prioritised Ethnicity stratified by ICD, 2004-06.**

| Cause of Death | Census Prioritised Ethnicity | Mortality Prioritised Ethnicity | | | | **Total Census Deaths** | Census to Mortality Ratio |
|---|---|---|---|---|---|---|---|
| | | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
| Cancer | Maori | 1,374 | 6 | 6 | 168 | **1,545** | 1.02 |
| | Pacific | 6 | 345 | 6 | 12 | **360** | 0.96 |
| | Asian | . | 9 | 240 | 12 | **264** | 1.00 |
| | Non MPA | 141 | 18 | 21 | 12,945 | **13,125** | 1.00 |
| | **Total** | **1,515** | **375** | **264** | **13,140** | | |
| CVD & IHD | Maori | 1,545 | 6 | . | 129 | **1,683** | 0.99 |
| | Pacific | 6 | 501 | 6 | 9 | **516** | 0.93 |
| | Asian | . | 15 | 258 | 6 | **273** | 1.02 |
| | Non MPA | 144 | 33 | 12 | 18,612 | **18,801** | 1.00 |
| | **Total** | **1,695** | **555** | **267** | **18,756** | | |
| Respiratory | Maori | 342 | 6 | . | 30 | **375** | 0.95 |
| | Pacific | . | 66 | . | 6 | **69** | 0.88 |
| | Asian | . | 6 | 24 | 6 | **27** | 1.00 |
| | Non MPA | 51 | 9 | 6 | 3,150 | **3,213** | 1.01 |
| | **Total** | **396** | **78** | **27** | **3,186** | | |
| Unintentional Injury, Suicide, Violent | Maori | 573 | 6 | . | 48 | **621** | 0.95 |
| | Pacific | 6 | 81 | . | 15 | **102** | 1.06 |
| | Asian | . | 6 | 54 | 6 | **66** | 1.16 |
| | Non MPA | 78 | 9 | 6 | 2,181 | **2,268** | 1.01 |
| | **Total** | **657** | **96** | **57** | **2,247** | | |
| Other Causes | Maori | 858 | 6 | 6 | 51 | **912** | 0.97 |
| | Pacific | 6 | 324 | 6 | 12 | **342** | 0.99 |
| | Asian | . | 6 | 138 | 6 | **150** | 0.94 |
| | Non MPA | 81 | 15 | 15 | 8,622 | **8,733** | 1.00 |
| | **Total** | **945** | **345** | **159** | **8,691** | | |

**Table 34: Census Sole Ethnicity by Mortality Sole Ethnicity stratified by ICD, 2004-06.**

| Cause of Death | Census Sole Ethnicity | Mortality Sole Ethnicity | | | | **Total Census Deaths** | Census to Mortality Ratio |
|---|---|---|---|---|---|---|---|
| | | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |

| Cause of Death | Census Sole Ethnicity | Mortality Sole Ethnicity | | | | Total Census Deaths | Census to Mortality Ratio |
|---|---|---|---|---|---|---|---|
| | | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
| Cancer | Maori | 1,296 | 6 | 6 | 249 | **1,215** | 0.87 |
| | Pacific | 6 | 333 | 6 | 24 | **330** | 0.95 |
| | Asian | . | 6 | 234 | 27 | **246** | 0.98 |
| | Remainder | 96 | 12 | 15 | 12,996 | **13,503** | 1.02 |
| | **Total** | **1,395** | **348** | **252** | **13,299** | | |
| CVD & IHD | Maori | 1,461 | 6 | . | 216 | **1,380** | 0.88 |
| | Pacific | 6 | 483 | 6 | 27 | **483** | 0.94 |
| | Asian | . | 6 | 243 | 27 | **267** | 1.07 |
| | Remainder | 105 | 24 | 6 | 18,663 | **19,143** | 1.01 |
| | **Total** | **1,575** | **516** | **249** | **18,930** | | |
| Respiratory | Maori | 330 | 6 | . | 45 | **303** | 0.82 |
| | Pacific | . | 66 | . | 6 | **66** | 0.92 |
| | Asian | . | 6 | 24 | 6 | **24** | 0.89 |
| | Remainder | 39 | 6 | 6 | 3,165 | **3,294** | 1.02 |
| | **Total** | **369** | **72** | **27** | **3,216** | | |
| Unintentional Injury, Suicide, Violent | Maori | 507 | . | . | 111 | **444** | 0.77 |
| | Pacific | 6 | 69 | . | 24 | **81** | 1.04 |
| | Asian | . | 6 | 51 | 15 | **60** | 1.18 |
| | Remainder | 60 | 6 | 6 | 2,202 | **2,469** | 1.05 |
| | **Total** | **576** | **78** | **51** | **2,352** | | |
| Other Causes | Maori | 792 | 6 | 6 | 117 | **753** | 0.88 |
| | Pacific | 6 | 309 | 6 | 30 | **324** | 1.00 |
| | Asian | . | 6 | 138 | 12 | **144** | 0.94 |
| | Remainder | 60 | 12 | 15 | 8,652 | **8,913** | 1.01 |
| | **Total** | **855** | **324** | **153** | **8,808** | | |

## Unlock Ratios for NHI data

As some researchers and health analysts use NHI ethnicity, unlock ratios from census and NHI data were calculated and shown below.  Note these analyses use NHI ethnicity at event of death

There is considerably greater overestimation of mortality total and prioritised counts using NHI ethnicity data, compared to census, for Maori, Pacific and Asian ethnicities (ratios ranging from 1.01-1.20)

**Table 35: Census Total Ethnicity by NHI Total Ethnicity, 2004-06.**

| Total Ethnicity | Census Deaths | NHI Deaths | Census to NHI Ratio |
|---|---|---|---|
| Maori | 5,136 | 4,536 | 1.13 |
| Non Maori | 48,306 | 48,909 | 0.99 |
| Pacific | 1,449 | 1,293 | 1.12 |
| Non Pacific | 51,993 | 52,149 | 1.00 |
| Asian | 804 | 681 | 1.18 |

| Total Ethnicity | Census Deaths | NHI Deaths | Census to NHI Ratio |
|---|---|---|---|
| Non Asian | 52,638 | 52,761 | 1.00 |
| Non MPA | 47,262 | 47,328 | 1.00 |
| Maori/Pacific/Asian | 6,180 | 6,114 | 1.01 |

# Conclusions

These results generally resemble that obtained with the 2001-2004 unlock data; there is little difference in the Census and Mortality ethnicity counts when using the Total and Prioritised definitions. Sole ethnicity counts for census and mortality data, and ethnicity counts for all three definitions when comparing census and NHI data appear to be less congruent.

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# Appendix A

**Table 36: Variables and formats in Bias dataset**

| Variable | Type | Format | Description |
|---|---|---|---|
| AgeAtCensus_mths_m | Num | | Age at Census (Mortality) |
| DHB_m | Char | | District Health Board 2001 (Mortality) |
| Eth_A_Mort | Num | FEETH. | Asian recorded on Mortality [.,0,4] |
| Eth_A_NHI | Num | FEETH. | Asian recorded on NHI [.,0,4] |
| Eth_E_Mort | Num | FEETH. | NZ European/Pakeha recorded on Mortality [.,0,6] |
| Eth_E_NHI | Num | FEETH. | NZ European/Pakeha recorded on NHI [.,0,6] |
| Eth_M_Mort | Num | FEETH. | NZ Maori recorded on Mortality [.,0,1] |
| Eth_M_NHI | Num | FEETH. | NZ Maori recorded on NHI [.,0,1] |
| Eth_O_Mort | Num | FEETH. | nonMaori nonPacific nonAsian recorded on Mortality [.,0,5] |
| Eth_O_NHI | Num | FEETH. | nonMaori nonPacific nonAsian recorded on NHI [0,5] |
| Eth_P_Mort | Num | FEETH. | Pacific recorded on Mortality [.,0,2] |
| Eth_P_NHI | Num | FEETH. | Pacific recorded on NHI [.,0,2] |
| EthnicG1_m | Char | | Detailed Ethnicity Option 1 (Mortality) |
| EthnicG2_m | Char | | Detailed Ethnicity Option 2 (Mortality) |
| EthnicG3_m | Char | | Detailed Ethnicity Option 3 (Mortality) |
| EthnicGp_m | Char | | Detailed Ethnicity Prioritised (Mortality) |
| G_Rurality_mort | Num | F6RUR. | Rurality Indicator (Mortality) |
| ICD_Gp | Char | $FMAJIC | Underlying Cause of Death |
| ID_BiasNew | Char | | Unique Bias ID for NZCMS 2004-6 linkage |
| Link | Num | FLINK. | Matching Flag 1=Linked, 0=Not |
| MobilityGp_mort | Num | | AU Mobility Indicator (% of AU moved since 5 years ago) (Mortality) |
| MthsSinceCen_m | Num | | Months Since Census at Death |
| MthsSince_Diff | Num | | |
| NZDep2001_m | Num | FDEPS. | NZ 2001 Deprivation Deciles (Mortality) |
| PriorEth_A_m | Num | | Prioritised Ethnicity Asian (Mortality) |
| PriorEth_M_m | Num | | Prioritised Ethnicity Maori (Mortality) |
| PriorEth_O_m | Num | | Prioritised Ethnicity NonMPA (Mortality) |
| PriorEth_P_m | Num | | Prioritised Ethnicity Pacific (Mortality) |
| PriorEth_m | Num | FEETH. | Prioritised Ethnicity (Mortality) |
| Sex_Mort | Num | FVSEX. | Sex from Mortality dataset |
| Source | Num | | Dataset Source (2001 or 2004) |
| TA_mort | Num | F95TLA. | TLA (Mortality) |
| Unlock | Num | | Flag whether in unlock dataset |
| cenage_months | Num | | Age at Census (months) using Census Date of Birth |
| id_bias | Char | | ID variable |
| sf01_fdec_mort | Num | | 2001 full socfrag decile (Mortality) |

**Table 37: Variables and Formats in Unlock (04-06) dataset**

| Variable | Type | Format | Description |
|---|---|---|---|
| AgeC_mths_m | Num | | Age at Census (months) using Mortality Date of Birth |
| AgeCen_Cen | Num | | Age at Census (yrs) using Census Date of Birth |
| AgeCen_m | Num | | Age at Census using Mortality Date of Birth |
| DHB_m | Char | | District Health Board 2001 (Mortality) |
| Eth_A_Mort | Num | FEETH. | Asian recorded on Mortality [.,0,4] |
| Eth_A_NHI | Num | FEETH. | Asian recorded on NHI [.,0,4] |
| Eth_E_Mort | Num | FEETH. | NZ European/Pakeha recorded on Mortality [.,0,6] |
| Eth_E_NHI | Num | FEETH. | NZ European/Pakeha recorded on NHI [.,0,6] |
| Eth_M_Mort | Num | FEETH. | NZ Maori recorded on Mortality [.,0,1] |
| Eth_M_NHI | Num | FEETH. | NZ Maori recorded on NHI [.,0,1] |
| Eth_O_Mort | Num | FEETH. | nonMaori nonPacific nonAsian recorded on Mortality [.,0,5] |
| Eth_O_NHI | Num | FEETH. | nonMaori nonPacific nonAsian recorded on NHI [.,0,5] |
| Eth_P_Mort | Num | FEETH. | Pacific recorded on Mortality [.,0,2] |
| Eth_P_NHI | Num | FEETH. | Pacific recorded on NHI [.,0,2] |
| EthnicG1_m | Char | | Detailed Ethnicity Option 1 (Mortality) |
| EthnicG2_m | Char | | Detailed Ethnicity Option 2 (Mortality) |
| EthnicG3_m | Char | | Detailed Ethnicity Option 3 (Mortality) |
| EthnicGp_m | Char | | Detailed Ethnicity Prioritised (Mortality) |
| G_Rurality | Num | | Rurality Indicator |
| G_TA2001 | Num | | Territorial Authority |
| G_URProfile | Num | | Usual Residence Profile |
| ICD_Dt | Char | $FICDDT | ICD Cause of Death Further Details |
| ICD_Gp | Char | $FNICD. | Underlying Cause of Death |
| Link | Num | | Matching Flag 1=Linked, 0=Not |
| MBAU | Char | | MB=Meshblock pass, AU=AreaUnit Pass, CM=CR MB pass, CA= CR AU pass |
| MobilityGp | Num | | AU Mobility Indicator (% of AU moved since 5 years ago |
| MthsSinceCen | Num | | Months since census before death |
| NZDep2001_m | Num | | NZ 2001 Deprivation Deciles (Mortality) |
| PassGp | Num | | Pass for NZCMS 2004-6 (Grpd: 7 & 8 -> 708, 11 & 13 -->1113) |
| RC_m | Char | | Regional Council 2001 (Mortality) |
| RHA_m | Char | | RHA 2001 (Mortality) |
| SameBirthDate | Char | | Census and Mortality agree on Birthdate |
| Sex_Mort | Num | FVSEX. | Sex from Mortality dataset |
| UnLockFlag | Num | | UnlockFlag 1=Exact for Sex, Day, Mth, Year, COB, otherwise = 0 |
| cenage_months | Num | | Age at Census (months) using Census Date of Birth |
| cob_cen | Num | | Country of Birth using Census |
| dthage_cen | Num | | Death Age using Census date of birth |
| dthage_months_cen | Num | | Death Age (months) using Census date of birth |
| dthage_months_mort | Num | | Death Age (months) using Mortality date of birth |
| eth_asian_cen | Num | | Asian recorded on Census |
| eth_nonmpa_cen | Num | | NonMaoriNonPacificNonAsian recorded on Census |
| eth_pacific_cen | Num | | Pacific recorded on Census |
| ethnic_grp1_code | Char | $5 | ethnic_grp1_code |
| ethnic_grp2_code | Char | $5 | ethnic_grp2_code |
| ethnic_grp3_code | Char | $5 | ethnic_grp3_code |
| ethnic_grp4_code | Char | $5 | ethnic_grp4_code |
| ethnic_grp5_code | Char | $5 | ethnic_grp5_code |

| ethnic_grp6_code | Char | $5 | ethnic_grp6_code |
|---|---|---|---|
| ethnicity_cen | Num | | Census ethnicity |
| id_unlock | Char | | Unique Unlock id |
| sex_cen | Num | | Sex from Census dataset |
| sf01_fdec | Num | | 2001 full socfrag decile |

# Appendix B

**Table 38: Census Prioritised Ethnicity by NHI Prioritised Ethnicity, 2004-06.**

| Census Prioritised Ethnicity | NHI Prioritised Ethnicity | | | | Total Census Deaths | Census to NHI Ratio |
|---|---|---|---|---|---|---|
| | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
| Maori | 4,161 | 9 | 6 | 963 | **5,136** | 1.13 |
| Pacific | 30 | 1,188 | 6 | 162 | **1,386** | 1.08 |
| Asian | . | 33 | 627 | 120 | **777** | 1.20 |
| Non MPA | 342 | 45 | 18 | 45,735 | **46,143** | 0.98 |
| **Total** | **4,533** | **1,278** | **648** | **46,983** | | |

**Table 39: Census Sole Ethnicity by NHI Sole Ethnicity, 2004-06.**

| Census Sole Ethnicity | NHI Sole Ethnicity | | | | Total Census Deaths | Census to NHI Ratio |
|---|---|---|---|---|---|---|
| | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
| Maori | 3,912 | 9 | 6 | 1,215 | **4,095** | 0.97 |
| Pacific | 30 | 1,167 | 6 | 183 | **1,284** | 1.05 |
| Asian | . | 9 | 621 | 150 | **744** | 1.16 |
| Remainder | 264 | 33 | 12 | 45,828 | **47,322** | 1.00 |
| **Total** | **4,206** | **1,221** | **642** | **47,376** | | |

**Table 40: Census Prioritised Ethnicity by NHI Prioritised Ethnicity, 2004-06.**

| Census Prioritised Ethnicity | NHI Prioritised Ethnicity | | | | Total Census Deaths | Census to NHI Ratio |
|---|---|---|---|---|---|---|
| | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
| Maori | 4,161 | 9 | 6 | 963 | **5,136** | 1.13 |
| Pacific | 30 | 1,188 | 6 | 162 | **1,386** | 1.08 |
| Asian | . | 33 | 627 | 120 | **777** | 1.20 |
| Non MPA | 342 | 45 | 18 | 45,735 | **46,143** | 0.98 |
| **Total** | **4,533** | **1,278** | **648** | **46,983** | | |

**Table 41: Census Sole Ethnicity by NHI Sole Ethnicity, 2004-06.**

| Census Sole Ethnicity | NHI Sole Ethnicity | | | | Total Census Deaths | Census to NHI Ratio |
|---|---|---|---|---|---|---|
| | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
| Maori | 3,912 | 9 | 6 | 1,215 | **4,095** | 0.97 |
| Pacific | 30 | 1,167 | 6 | 183 | **1,284** | 1.05 |
| Asian | . | 9 | 621 | 150 | **744** | 1.16 |
| Remainder | 264 | 33 | 12 | 45,828 | **47,322** | 1.00 |
| **Total** | **4,206** | **1,221** | **642** | **47,376** | | |

# Sex

**Table 42: Census Total Ethnicity by NHI Total Ethnicity stratified by Sex, 2004-06.**

| Sex | Total Ethnicity | Census Deaths | NHI Deaths | Census to NHI Ratio |
|-----|-----------------|--------------:|-----------:|--------------------:|
| Males | Maori | 2,793 | 2,397 | 1.17 |
| | Non Maori | 23,571 | 23,967 | 0.98 |
| | Pacific | 798 | 699 | 1.14 |
| | Non Pacific | 25,563 | 25,662 | 1.00 |
| | Asian | 459 | 384 | 1.20 |
| | Non Asian | 25,905 | 25,980 | 1.00 |
| | Non MPA | 22,932 | 23,064 | 0.99 |
| | Maori/Pacific/Asian | 3,429 | 3,300 | 1.04 |
| Females | Maori | 2,343 | 2,136 | 1.10 |
| | Non Maori | 24,735 | 24,942 | 0.99 |
| | Pacific | 651 | 594 | 1.10 |
| | Non Pacific | 26,430 | 26,487 | 1.00 |
| | Asian | 348 | 294 | 1.18 |
| | Non Asian | 26,733 | 26,784 | 1.00 |
| | Non MPA | 24,333 | 24,267 | 1.00 |
| | Maori/Pacific/Asian | 2,748 | 2,814 | 0.98 |

**Table 43: Census Prioritised Ethnicity by NHI Prioritised Ethnicity stratified by Sex, 2004-06.**

| Sex | Census Prioritised Ethnicity | NHI Prioritised Ethnicity Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | Total Census Deaths | Census to NHI Ratio |
|-----|------------------------------|------:|------:|-----:|-------:|-------:|-----:|
| Males | Maori | 2,190 | 6 | 6 | 597 | **2,793** | 1.17 |
| | Pacific | 15 | 636 | 6 | 102 | **756** | 1.10 |
| | Asian | . | 24 | 348 | 69 | **444** | 1.22 |
| | Non MPA | 189 | 24 | 6 | 22,152 | **22,368** | 0.98 |
| | **Total** | **2,397** | **690** | **363** | **22,917** | | |
| Females | Maori | 1,968 | 6 | . | 369 | **2,343** | 1.10 |
| | Pacific | 15 | 552 | 6 | 63 | **630** | 1.08 |
| | Asian | . | 9 | 276 | 51 | **336** | 1.17 |
| | Non MPA | 153 | 24 | 12 | 23,583 | **23,772** | 0.99 |
| | **Total** | **2,136** | **585** | **288** | **24,066** | | |

**Table 44: Census Sole Ethnicity by NHI Sole Ethnicity stratified by Sex, 2004-06.**

| Sex | Census Sole Ethnicity | NHI Sole Ethnicity | | | | Total Census Deaths | Census to NHI Ratio |
|---|---|---|---|---|---|---|---|
| | | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
| Males | Maori | 2,085 | 6 | 6 | 702 | **2,268** | 1.01 |
| | Pacific | 15 | 624 | 6 | 108 | **714** | 1.09 |
| | Asian | . | 9 | 345 | 90 | **417** | 1.18 |
| | Remainder | 150 | 15 | 6 | 22,200 | **22,965** | 0.99 |
| | **Total** | **2,250** | **654** | **354** | **23,100** | | |
| Females | Maori | 1,827 | 6 | . | 510 | **1,827** | 0.94 |
| | Pacific | 9 | 543 | 6 | 75 | **570** | 1.01 |
| | Asian | . | 6 | 273 | 60 | **324** | 1.15 |
| | Remainder | 114 | 18 | 9 | 23,628 | **24,357** | 1.00 |
| | **Total** | **1,953** | **567** | **282** | **24,276** | | |

# Age

**Table 45: Census Total Ethnicity by NHI Total Ethnicity stratified by Age, 2004-06.**

| Age | Total Ethnicity | Census Deaths | NHI Deaths | Census to NHI Ratio |
|---|---|---|---|---|
| 0-14 years | Maori | 69 | 66 | 1.05 |
| | Non Maori | 120 | 126 | 0.95 |
| | Pacific | 21 | 15 | 1.40 |
| | Non Pacific | 171 | 174 | 0.98 |
| | Asian | 18 | 15 | 1.20 |
| | Non Asian | 177 | 177 | 1.00 |
| | Non MPA | 126 | 108 | 1.17 |
| | Maori/Pacific/Asian | 66 | 84 | 0.79 |
| 15-34 years | Maori | 459 | 384 | 1.20 |
| | Non Maori | 987 | 1,059 | 0.93 |
| | Pacific | 132 | 90 | 1.47 |
| | Non Pacific | 1,311 | 1,353 | 0.97 |
| | Asian | 39 | 24 | 1.63 |
| | Non Asian | 1,407 | 1,419 | 0.99 |
| | Non MPA | 1,017 | 978 | 1.04 |
| | Maori/Pacific/Asian | 426 | 465 | 0.92 |
| 35-49 years | Maori | 765 | 699 | 1.09 |
| | Non Maori | 1,980 | 2,049 | 0.97 |
| | Pacific | 186 | 159 | 1.17 |
| | Non Pacific | 2,562 | 2,589 | 0.99 |
| | Asian | 87 | 75 | 1.16 |
| | Non Asian | 2,658 | 2,670 | 1.00 |
| | Non MPA | 1,890 | 1,875 | 1.01 |
| | Maori/Pacific/Asian | 858 | 873 | 0.98 |

| Age | Total Ethnicity | Census Deaths | NHI Deaths | Census to NHI Ratio |
|---|---|---|---|---|
| 50-64 years | Maori | 1,443 | 1,266 | 1.14 |
| | Non Maori | 5,445 | 5,622 | 0.97 |
| | Pacific | 363 | 345 | 1.05 |
| | Non Pacific | 6,525 | 6,543 | 1.00 |
| | Asian | 171 | 141 | 1.21 |
| | Non Asian | 6,717 | 6,744 | 1.00 |
| | Non MPA | 5,157 | 5,238 | 0.98 |
| | Maori/Pacific/Asian | 1,728 | 1,647 | 1.05 |
| 65-74 years | Maori | 1,251 | 1,131 | 1.11 |
| | Non Maori | 7,836 | 7,956 | 0.98 |
| | Pacific | 339 | 315 | 1.08 |
| | Non Pacific | 8,748 | 8,775 | 1.00 |
| | Asian | 192 | 168 | 1.14 |
| | Non Asian | 8,895 | 8,916 | 1.00 |
| | Non MPA | 7,512 | 7,554 | 0.99 |
| | Maori/Pacific/Asian | 1,575 | 1,530 | 1.03 |
| 75-84 years | Maori | 840 | 741 | 1.13 |
| | Non Maori | 16,041 | 16,140 | 0.99 |
| | Pacific | 294 | 267 | 1.10 |
| | Non Pacific | 16,584 | 16,611 | 1.00 |
| | Asian | 189 | 165 | 1.15 |
| | Non Asian | 16,689 | 16,716 | 1.00 |
| | Non MPA | 15,765 | 15,786 | 1.00 |
| | Maori/Pacific/Asian | 1,113 | 1,095 | 1.02 |
| 85+ years | Maori | 315 | 255 | 1.24 |
| | Non Maori | 15,900 | 15,957 | 1.00 |
| | Pacific | 120 | 108 | 1.11 |
| | Non Pacific | 16,092 | 16,104 | 1.00 |
| | Asian | 111 | 96 | 1.16 |
| | Non Asian | 16,101 | 16,116 | 1.00 |
| | Non MPA | 15,804 | 15,792 | 1.00 |
| | Maori/Pacific/Asian | 411 | 423 | 0.97 |

**Table 46: Census Prioritised Ethnicity by NHI Prioritised Ethnicity stratified by Age, 2004-06.**

| Age | Census Prioritised Ethnicity | NHI Prioritised Ethnicity | | | | Total Census Deaths | Census to NHI Ratio |
|---|---|---|---|---|---|---|---|
| | | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
| 0-14 years | Maori | 60 | 6 | . | 6 | **69** | 1.05 |
| | Pacific | . | 12 | . | . | **12** | 0.80 |
| | Asian | . | . | 15 | 6 | **18** | 1.20 |
| | Non MPA | 6 | . | . | 93 | **96** | 0.97 |
| | **Total** | **66** | **15** | **15** | **99** | | |
| 15-34 years | Maori | 330 | 6 | . | 126 | **459** | 1.20 |
| | Pacific | 12 | 78 | . | 21 | **111** | 1.32 |
| | Asian | . | 6 | 18 | 6 | **30** | 1.43 |

| | | NHI Prioritised Ethnicity | | | | | |
|---|---|---|---|---|---|---|---|
| Age | Census Prioritised Ethnicity | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | **Total Census Deaths** | Census to NHI Ratio |
| | Non MPA | 42 | 6 | 6 | 798 | **846** | 0.89 |
| | **Total** | **384** | **84** | **21** | **954** | | |
| 35-49 years | Maori | 642 | 6 | 6 | 126 | **765** | 1.09 |
| | Pacific | 9 | 144 | . | 21 | **171** | 1.12 |
| | Asian | . | 6 | 69 | 12 | **84** | 1.22 |
| | Non MPA | 48 | 9 | 6 | 1,665 | **1,722** | 0.94 |
| | **Total** | **699** | **153** | **69** | **1,824** | | |
| 50-64 years | Maori | 1,179 | 6 | 6 | 258 | **1,443** | 1.14 |
| | Pacific | 6 | 315 | 6 | 36 | **354** | 1.04 |
| | Asian | . | 12 | 126 | 27 | **162** | 1.23 |
| | Non MPA | 81 | 9 | 6 | 4,830 | **4,929** | 0.96 |
| | **Total** | **1,266** | **339** | **132** | **5,151** | | |
| 65-74 years | Maori | 1,053 | 6 | . | 195 | **1,251** | 1.11 |
| | Pacific | 6 | 300 | 6 | 27 | **330** | 1.06 |
| | Asian | . | 6 | 150 | 27 | **189** | 1.21 |
| | Non MPA | 72 | 6 | 6 | 7,233 | **7,317** | 0.98 |
| | **Total** | **1,131** | **312** | **156** | **7,485** | | |
| 75-84 years | Maori | 672 | 6 | . | 165 | **840** | 1.13 |
| | Pacific | 6 | 243 | 6 | 39 | **288** | 1.08 |
| | Asian | . | 6 | 156 | 27 | **186** | 1.17 |
| | Non MPA | 63 | 15 | 6 | 15,480 | **15,564** | 0.99 |
| | **Total** | **741** | **267** | **159** | **15,714** | | |
| 85+ years | Maori | 228 | . | . | 87 | **315** | 1.25 |
| | Pacific | . | 99 | . | 21 | **120** | 1.11 |
| | Asian | . | 6 | 90 | 15 | **108** | 1.16 |
| | Non MPA | 27 | 9 | 6 | 15,636 | **15,672** | 0.99 |
| | **Total** | **252** | **108** | **93** | **15,756** | | |

**Table 47: Census Sole Ethnicity by NHI Sole Ethnicity stratified by Age, 2004-06.**

| | | NHI Sole Ethnicity | | | | | |
|---|---|---|---|---|---|---|---|
| Age | Census Sole Ethnicity | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | **Total Census Deaths** | Census to NHI Ratio |
| 0-14 years | Maori | 51 | 6 | . | 18 | **39** | 0.68 |
| | Pacific | . | 12 | . | 6 | **9** | 0.60 |
| | Asian | . | . | 15 | 6 | **18** | 1.20 |
| | Remainder | 6 | . | . | 93 | **129** | 1.19 |
| | **Total** | **57** | **15** | **15** | **108** | | |
| 15-34 years | Maori | 309 | 6 | . | 150 | **294** | 0.83 |
| | Pacific | 12 | 78 | . | 21 | **87** | 1.04 |
| | Asian | . | . | 18 | 9 | **27** | 1.50 |
| | Remainder | 36 | 6 | 6 | 810 | **1,032** | 1.05 |
| | **Total** | **354** | **84** | **18** | **987** | | |
| 35-49 years | Maori | 594 | 6 | 6 | 171 | **609** | 0.94 |
| | Pacific | 6 | 138 | . | 24 | **162** | 1.10 |
| | Asian | . | 6 | 69 | 12 | **78** | 1.13 |

| Age | Census Sole Ethnicity | NHI Sole Ethnicity | | | | Total Census Deaths | Census to NHI Ratio |
|---|---|---|---|---|---|---|---|
| | | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
| | Remainder | 45 | 6 | 6 | 1,671 | **1,899** | 1.01 |
| | **Total** | **645** | **147** | **69** | **1,881** | | |
| 50-64 years | Maori | 1,107 | 6 | 6 | 330 | **1,215** | 1.03 |
| | Pacific | 6 | 312 | 6 | 36 | **342** | 1.04 |
| | Asian | . | 6 | 126 | 33 | **159** | 1.20 |
| | Remainder | 63 | 9 | 6 | 4,848 | **5,172** | 0.99 |
| | **Total** | **1,176** | **330** | **132** | **5,250** | | |
| 65-74 years | Maori | 1,014 | 6 | . | 237 | **1,074** | 1.01 |
| | Pacific | 6 | 291 | 6 | 36 | **312** | 1.07 |
| | Asian | . | . | 150 | 39 | **183** | 1.17 |
| | Remainder | 51 | 6 | 6 | 7,257 | **7,515** | 0.99 |
| | **Total** | **1,068** | **291** | **156** | **7,569** | | |
| 75-84 years | Maori | 636 | 6 | . | 204 | **657** | 0.96 |
| | Pacific | 6 | 240 | 6 | 42 | **267** | 1.05 |
| | Asian | . | 6 | 150 | 36 | **183** | 1.17 |
| | Remainder | 45 | 9 | 6 | 15,504 | **15,774** | 1.00 |
| | **Total** | **681** | **255** | **156** | **15,786** | | |
| 85+ years | Maori | 207 | . | . | 105 | **207** | 0.92 |
| | Pacific | . | 93 | . | 24 | **102** | 1.03 |
| | Asian | . | 6 | 90 | 18 | **99** | 1.06 |
| | Remainder | 18 | 6 | 6 | 15,642 | **15,804** | 1.00 |
| | **Total** | **225** | **99** | **93** | **15,792** | | |

# NZ Deprivation Index

**Table 48: Census Total Ethnicity by NHI Total Ethnicity stratified by NZ Deprivation, 2004-06.**

| NZ Deprivation Index | Total Ethnicity | Census Deaths | NHI Deaths | Census to NHI Ratio |
|---|---|---|---|---|
| Dep 1-4 | Maori | 696 | 501 | 1.39 |
| | Non Maori | 17,145 | 17,340 | 0.99 |
| | Pacific | 147 | 135 | 1.09 |
| | Non Pacific | 17,691 | 17,709 | 1.00 |
| | Asian | 303 | 267 | 1.13 |
| | Non Asian | 17,538 | 17,574 | 1.00 |
| | Non MPA | 16,977 | 17,013 | 1.00 |
| | Maori/Pacific/Asian | 864 | 825 | 1.05 |
| Dep 5-6 & Missing | Maori | 687 | 570 | 1.21 |
| | Non Maori | 11,268 | 11,382 | 0.99 |
| | Pacific | 183 | 147 | 1.24 |
| | Non Pacific | 11,772 | 11,802 | 1.00 |
| | Asian | 180 | 144 | 1.25 |
| | Non Asian | 11,772 | 11,808 | 1.00 |
| | Non MPA | 11,118 | 11,148 | 1.00 |
| | Maori/Pacific/Asian | 834 | 804 | 1.04 |

| NZ Deprivation Index | Total Ethnicity | Census Deaths | NHI Deaths | Census to NHI Ratio |
|---|---|---|---|---|
| Dep 7-8 | Maori | 1,140 | 1,056 | 1.08 |
| | Non Maori | 11,178 | 11,262 | 0.99 |
| | Pacific | 276 | 249 | 1.11 |
| | Non Pacific | 12,039 | 12,069 | 1.00 |
| | Asian | 171 | 147 | 1.16 |
| | Non Asian | 12,147 | 12,171 | 1.00 |
| | Non MPA | 10,992 | 10,962 | 1.00 |
| | Maori/Pacific/Asian | 1,326 | 1,356 | 0.98 |
| Dep 9-10 | Maori | 2,616 | 2,406 | 1.09 |
| | Non Maori | 8,718 | 8,928 | 0.98 |
| | Pacific | 840 | 765 | 1.10 |
| | Non Pacific | 10,491 | 10,569 | 0.99 |
| | Asian | 150 | 123 | 1.22 |
| | Non Asian | 11,184 | 11,211 | 1.00 |
| | Non MPA | 8,175 | 8,202 | 1.00 |
| | Maori/Pacific/Asian | 3,156 | 3,126 | 1.01 |

**Table 49: Census Prioritised Ethnicity by NHI Prioritised Ethnicity stratified by NZ Deprivation, 2004-06.**

| NZ Deprivation Index | Census Prioritised Ethnicity | NHI Prioritised Ethnicity | | | | Total Census Deaths | Census to NHI Ratio |
|---|---|---|---|---|---|---|---|
| | | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
| Dep 1-4 | Maori | 450 | 6 | 6 | 243 | **696** | 1.39 |
| | Pacific | 6 | 108 | . | 33 | **144** | 1.12 |
| | Asian | . | 9 | 249 | 36 | **297** | 1.14 |
| | Non MPA | 51 | 9 | 12 | 16,635 | **16,707** | 0.99 |
| | **Total** | **501** | **129** | **261** | **16,947** | | |
| Dep 5-6 & Missing | Maori | 519 | . | . | 168 | **687** | 1.21 |
| | Pacific | 6 | 132 | 6 | 27 | **168** | 1.14 |
| | Asian | . | 6 | 141 | 30 | **174** | 1.21 |
| | Non MPA | 48 | 9 | 6 | 10,863 | **10,923** | 0.98 |
| | **Total** | **570** | **147** | **144** | **11,094** | | |
| Dep 7-8 | Maori | 945 | 6 | . | 198 | **1,140** | 1.08 |
| | Pacific | 12 | 222 | 6 | 30 | **267** | 1.07 |
| | Asian | . | 9 | 129 | 30 | **171** | 1.24 |
| | Non MPA | 102 | 15 | 6 | 10,620 | **10,743** | 0.99 |
| | **Total** | **1,056** | **249** | **138** | **10,878** | | |
| Dep 9-10 | Maori | 2,253 | 9 | 6 | 354 | **2,616** | 1.09 |
| | Pacific | 15 | 726 | 6 | 72 | **810** | 1.08 |
| | Asian | . | 9 | 105 | 24 | **141** | 1.31 |
| | Non MPA | 141 | 12 | 6 | 7,614 | **7,767** | 0.96 |
| | **Total** | **2,406** | **750** | **108** | **8,064** | | |

**Table 50: Census Sole Ethnicity by NHI Sole Ethnicity stratified by NZ Deprivation, 2004-06.**

| NZ Deprivation Index | Census Sole Ethnicity | NHI Sole Ethnicity | | | | Total Census Deaths | Census to NHI Ratio |
|---|---|---|---|---|---|---|---|
| | | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
| Dep 1-4 | Maori | 399 | 6 | 6 | 294 | **465** | 1.06 |
| | Pacific | 6 | 102 | . | 36 | **111** | 0.93 |
| | Asian | . | 6 | 249 | 42 | **285** | 1.10 |
| | Remainder | 39 | 9 | 12 | 16,647 | **16,980** | 1.00 |
| | **Total** | **438** | **120** | **258** | **17,025** | | |
| Dep 5-6 & Missing | Maori | 480 | . | . | 204 | **510** | 0.98 |
| | Pacific | 6 | 129 | 6 | 30 | **144** | 1.02 |
| | Asian | . | 6 | 141 | 33 | **159** | 1.13 |
| | Remainder | 33 | 9 | 6 | 10,881 | **11,133** | 1.00 |
| | **Total** | **519** | **141** | **141** | **11,151** | | |
| Dep 7-8 | Maori | 894 | 6 | . | 246 | **912** | 0.93 |
| | Pacific | 12 | 222 | 6 | 30 | **240** | 1.01 |
| | Asian | . | 6 | 126 | 42 | **162** | 1.23 |
| | Remainder | 75 | 12 | 6 | 10,653 | **11,001** | 1.00 |
| | **Total** | **978** | **237** | **132** | **10,971** | | |
| Dep 9-10 | Maori | 2,139 | 9 | 6 | 468 | **2,205** | 0.97 |
| | Pacific | 12 | 714 | 6 | 84 | **786** | 1.08 |
| | Asian | . | 6 | 105 | 30 | **132** | 1.22 |
| | Remainder | 120 | 6 | 6 | 7,647 | **8,205** | 1.00 |
| | **Total** | **2,271** | **729** | **108** | **8,229** | | |

# RHA

**Table 51: Census Total Ethnicity by NHI Total Ethnicity stratified by RHA, 2004-06.**

| RHA | Total Ethnicity | Census Deaths | NHI Deaths | Census to NHI Ratio |
|---|---|---|---|---|
| Northern | Maori | 1,566 | 1,374 | 1.14 |
| | Non Maori | 13,764 | 13,959 | 0.99 |
| | Pacific | 1,023 | 951 | 1.08 |
| | Non Pacific | 14,310 | 14,382 | 0.99 |
| | Asian | 459 | 405 | 1.13 |
| | Non Asian | 14,877 | 14,925 | 1.00 |
| | Non MPA | 12,681 | 12,759 | 0.99 |
| | Maori/Pacific/Asian | 2,649 | 2,574 | 1.03 |
| Midland | Maori | 1,965 | 1,839 | 1.07 |
| | Non Maori | 9,651 | 9,777 | 0.99 |
| | Pacific | 102 | 72 | 1.42 |
| | Non Pacific | 11,514 | 11,541 | 1.00 |
| | Asian | 63 | 54 | 1.17 |
| | Non Asian | 11,553 | 11,559 | 1.00 |

| RHA | Total Ethnicity | Census Deaths | NHI Deaths | Census to NHI Ratio |
|---|---|---|---|---|
| | Non MPA | 9,831 | 9,762 | 1.01 |
| | Maori/Pacific/Asian | 1,782 | 1,854 | 0.96 |
| Central | Maori | 1,200 | 1,014 | 1.18 |
| | Non Maori | 12,516 | 12,702 | 0.99 |
| | Pacific | 246 | 207 | 1.19 |
| | Non Pacific | 13,467 | 13,506 | 1.00 |
| | Asian | 198 | 150 | 1.32 |
| | Non Asian | 13,518 | 13,563 | 1.00 |
| | Non MPA | 12,390 | 12,414 | 1.00 |
| | Maori/Pacific/Asian | 1,323 | 1,302 | 1.02 |
| Southern | Maori | 405 | 309 | 1.31 |
| | Non Maori | 12,378 | 12,474 | 0.99 |
| | Pacific | 78 | 66 | 1.18 |
| | Non Pacific | 12,702 | 12,717 | 1.00 |
| | Asian | 90 | 69 | 1.30 |
| | Non Asian | 12,693 | 12,711 | 1.00 |
| | Non MPA | 12,357 | 12,393 | 1.00 |
| | Maori/Pacific/Asian | 423 | 387 | 1.09 |

**Table 52: Census Prioritised Ethnicity by NHI Prioritised Ethnicity stratified by RHA, 2004-06.**

| RHA | Census Prioritised Ethnicity | NHI Prioritised Ethnicity | | | | Total Census Deaths | Census to NHI Ratio |
|---|---|---|---|---|---|---|---|
| | | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
| Northern | Maori | 1,260 | 6 | 6 | 306 | **1,566** | 1.14 |
| | Pacific | 21 | 879 | 6 | 90 | **993** | 1.05 |
| | Asian | . | 21 | 372 | 51 | **447** | 1.16 |
| | Non MPA | 96 | 42 | 6 | 12,183 | **12,327** | 0.98 |
| | **Total** | **1,374** | **942** | **384** | **12,636** | | |
| Midland | Maori | 1,707 | 6 | . | 255 | **1,965** | 1.07 |
| | Pacific | 6 | 63 | 6 | 18 | **87** | 1.32 |
| | Asian | . | 6 | 42 | 12 | **60** | 1.18 |
| | Non MPA | 129 | 6 | 6 | 9,375 | **9,504** | 0.98 |
| | **Total** | **1,839** | **66** | **51** | **9,660** | | |
| Central | Maori | 921 | 6 | . | 273 | **1,200** | 1.18 |
| | Pacific | 6 | 192 | 6 | 33 | **231** | 1.13 |
| | Asian | . | 6 | 144 | 42 | **189** | 1.26 |
| | Non MPA | 84 | 6 | 6 | 11,997 | **12,096** | 0.98 |
| | **Total** | **1,014** | **204** | **150** | **12,348** | | |
| Southern | Maori | 273 | 6 | 6 | 129 | **405** | 1.31 |
| | Pacific | . | 57 | . | 21 | **78** | 1.18 |
| | Asian | . | 6 | 66 | 18 | **87** | 1.32 |
| | Non MPA | 33 | 6 | 6 | 12,180 | **12,216** | 0.99 |
| | **Total** | **309** | **66** | **66** | **12,345** | | |

**Table 53: Census Sole Ethnicity by NHI Sole Ethnicity stratified by RHA, 2004-06.**

| RHA | Census Sole Ethnicity | NHI Sole Ethnicity Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | Total Census Deaths | Census to NHI Ratio |
|---|---|---|---|---|---|---|---|
| Northern | Maori | 1,176 | 6 | 6 | 393 | **1,236** | 0.98 |
| | Pacific | 18 | 867 | 6 | 105 | **936** | 1.03 |
| | Asian | . | 9 | 372 | 63 | **441** | 1.17 |
| | Remainder | 66 | 27 | 6 | 12,228 | **12,717** | 0.99 |
| | **Total** | **1,260** | **906** | **378** | **12,792** | | |
| Midland | Maori | 1,635 | 6 | . | 327 | **1,647** | 0.95 |
| | Pacific | 6 | 60 | 6 | 21 | **72** | 1.20 |
| | Asian | . | . | 42 | 12 | **51** | 1.00 |
| | Remainder | 93 | 6 | 6 | 9,408 | **9,840** | 1.01 |
| | **Total** | **1,731** | **60** | **51** | **9,771** | | |
| Central | Maori | 861 | 6 | . | 333 | **933** | 0.98 |
| | Pacific | 6 | 186 | 6 | 39 | **204** | 1.03 |
| | Asian | . | 6 | 144 | 45 | **177** | 1.18 |
| | Remainder | 78 | 6 | 6 | 12,006 | **12,402** | 1.00 |
| | **Total** | **948** | **198** | **150** | **12,417** | | |
| Southern | Maori | 243 | 6 | 6 | 162 | **276** | 1.03 |
| | Pacific | . | 54 | . | 21 | **69** | 1.21 |
| | Asian | . | . | 57 | 27 | **72** | 1.20 |
| | Remainder | 27 | 6 | 6 | 12,189 | **12,360** | 1.00 |
| | **Total** | **267** | **57** | **60** | **12,396** | | |

# Rurality

**Table 54: Census Total Ethnicity by NHI Total Ethnicity stratified by Rurality, 2004-06.**

| Rurality | Total Ethnicity | Census Deaths | NHI Deaths | Census to NHI Ratio |
|---|---|---|---|---|
| All Urban | Maori | 4,107 | 3,603 | 1.14 |
| | Non Maori | 44,007 | 44,511 | 0.99 |
| | Pacific | 1,428 | 1,275 | 1.12 |
| | Non Pacific | 46,689 | 46,839 | 1.00 |
| | Asian | 792 | 672 | 1.18 |
| | Non Asian | 47,322 | 47,442 | 1.00 |
| | Non MPA | 42,840 | 42,903 | 1.00 |
| | Maori/Pacific/Asian | 5,274 | 5,211 | 1.01 |
| NonUrban or Missing | Maori | 1,029 | 930 | 1.11 |
| | Non Maori | 4,299 | 4,398 | 0.98 |
| | Pacific | 27 | 18 | 1.50 |
| | Non Pacific | 5,304 | 5,310 | 1.00 |
| | Asian | 15 | 9 | 1.67 |
| | Non Asian | 5,316 | 5,319 | 1.00 |

| Rurality | Total Ethnicity | Census Deaths | NHI Deaths | Census to NHI Ratio |
|---|---|---|---|---|
| | Non MPA | 4,422 | 4,425 | 1.00 |
| | Maori/Pacific/Asian | 906 | 903 | 1.00 |

**Table 55: Census Prioritised Ethnicity by NHI Prioritised Ethnicity stratified by Rurality, 2004-06.**

| | | NHI Prioritised Ethnicity | | | | | |
|---|---|---|---|---|---|---|---|
| Rurality | Census Prioritised Ethnicity | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | **Total Census Deaths** | Census to NHI Ratio |
| All Urban | Maori | 3,291 | 9 | 6 | 807 | **4,107** | 1.14 |
| | Pacific | 30 | 1,173 | 6 | 156 | **1,365** | 1.09 |
| | Asian | . | 33 | 621 | 120 | **768** | 1.20 |
| | Non MPA | 282 | 45 | 18 | 41,529 | **41,874** | 0.98 |
| | **Total** | **3,603** | **1,257** | **639** | **42,609** | | |
| NonUrban or Missing | Maori | 873 | 6 | . | 156 | **1,029** | 1.11 |
| | Pacific | 6 | 18 | . | 6 | **24** | 1.33 |
| | Asian | . | . | 6 | 6 | **9** | 1.00 |
| | Non MPA | 57 | 6 | 6 | 4,206 | **4,269** | 0.98 |
| | **Total** | **930** | **18** | **9** | **4,374** | | |

**Table 56: Census Sole Ethnicity by NHI Sole Ethnicity stratified by Rurality, 2004-06.**

| | | NHI Sole Ethnicity | | | | | |
|---|---|---|---|---|---|---|---|
| Rurality | Census Sole Ethnicity | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | **Total Census Deaths** | Census to NHI Ratio |
| All Urban | Maori | 3,084 | 9 | 6 | 1,017 | **3,213** | 0.96 |
| | Pacific | 27 | 1,155 | 6 | 177 | **1,266** | 1.05 |
| | Asian | . | 9 | 615 | 147 | **735** | 1.17 |
| | Remainder | 219 | 33 | 12 | 41,610 | **42,903** | 1.00 |
| | **Total** | **3,330** | **1,206** | **630** | **42,948** | | |
| NonUrban or Missing | Maori | 828 | . | . | 198 | **882** | 1.00 |
| | Pacific | 6 | 15 | . | 9 | **21** | 1.40 |
| | Asian | . | . | 6 | 6 | **9** | 1.00 |
| | Remainder | 48 | 6 | 6 | 4,218 | **4,422** | 1.00 |
| | **Total** | **879** | **15** | **9** | **4,425** | | |

## Cause of Death

**Table 57: Census Total Ethnicity by NHI Total Ethnicity stratified by ICD, 2004-06.**

| | | NHI Prioritised Ethnicity | | | | | |
|---|---|---|---|---|---|---|---|
| Cause of Death | Census Prioritised Ethnicity | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | **Total Census Deaths** | Census to NHI Ratio |
| Cancer | Maori | 1,260 | 6 | 6 | 285 | **1,545** | 1.13 |

| Cause of Death | Census Prioritised Ethnicity | NHI Prioritised Ethnicity | | | | Total Census Deaths | Census to NHI Ratio |
| | | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
|---|---|---|---|---|---|---|---|
| | Pacific | 6 | 315 | 6 | 39 | **360** | 1.08 |
| | Asian | . | 6 | 225 | 30 | **264** | 1.14 |
| | Non MPA | 105 | 9 | 6 | 13,005 | **13,125** | 0.98 |
| | **Total** | **1,371** | **333** | **231** | **13,356** | | |
| CVD & IHD | Maori | 1,350 | 6 | . | 327 | **1,683** | 1.15 |
| | Pacific | 6 | 444 | 6 | 63 | **516** | 1.07 |
| | Asian | . | 9 | 219 | 42 | **273** | 1.21 |
| | Non MPA | 99 | 24 | 6 | 18,675 | **18,801** | 0.98 |
| | **Total** | **1,458** | **483** | **225** | **19,104** | | |
| Respiratory | Maori | 312 | 6 | . | 60 | **375** | 1.10 |
| | Pacific | . | 60 | . | 9 | **69** | 1.05 |
| | Asian | . | 6 | 18 | 9 | **27** | 1.29 |
| | Non MPA | 30 | 6 | 6 | 3,177 | **3,213** | 0.99 |
| | **Total** | **342** | **66** | **21** | **3,255** | | |
| Unintentional Injury, Suicide, Violent | Maori | 456 | 6 | . | 165 | **621** | 1.20 |
| | Pacific | 12 | 66 | . | 24 | **102** | 1.36 |
| | Asian | . | 6 | 42 | 18 | **66** | 1.47 |
| | Non MPA | 54 | 6 | 6 | 2,211 | **2,268** | 0.94 |
| | **Total** | **519** | **75** | **45** | **2,418** | | |
| Other Causes | Maori | 783 | 6 | 6 | 129 | **912** | 1.08 |
| | Pacific | 6 | 303 | 6 | 27 | **342** | 1.07 |
| | Asian | . | 9 | 120 | 21 | **150** | 1.16 |
| | Non MPA | 51 | 6 | 6 | 8,670 | **8,733** | 0.99 |
| | **Total** | **843** | **321** | **129** | **8,850** | | |

**Table 58: Census Prioritised Ethnicity by NHI Prioritised Ethnicity stratified by ICD, 2004-06.**

| Cause of Death | Census Prioritised Ethnicity | NHI Prioritised Ethnicity | | | | Total Census Deaths | Census to NHI Ratio |
| | | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
|---|---|---|---|---|---|---|---|
| Cancer | Maori | 1,260 | 6 | 6 | 285 | **1,545** | 1.13 |
| | Pacific | 6 | 315 | 6 | 39 | **360** | 1.08 |
| | Asian | . | 6 | 225 | 30 | **264** | 1.14 |
| | Non MPA | 105 | 9 | 6 | 13,005 | **13,125** | 0.98 |
| | **Total** | **1,371** | **333** | **231** | **13,356** | | |
| CVD & IHD | Maori | 1,350 | 6 | . | 327 | **1,683** | 1.15 |
| | Pacific | 6 | 444 | 6 | 63 | **516** | 1.07 |
| | Asian | . | 9 | 219 | 42 | **273** | 1.21 |
| | Non MPA | 99 | 24 | 6 | 18,675 | **18,801** | 0.98 |
| | **Total** | **1,458** | **483** | **225** | **19,104** | | |
| Respiratory | Maori | 312 | 6 | . | 60 | **375** | 1.10 |
| | Pacific | . | 60 | . | 9 | **69** | 1.05 |
| | Asian | . | 6 | 18 | 9 | **27** | 1.29 |
| | Non MPA | 30 | 6 | 6 | 3,177 | **3,213** | 0.99 |
| | **Total** | **342** | **66** | **21** | **3,255** | | |
| Unintentional Injury, | Maori | 456 | 6 | . | 165 | **621** | 1.20 |

| Cause of Death | Census Prioritised Ethnicity | NHI Prioritised Ethnicity | | | | Total Census Deaths | Census to NHI Ratio |
|---|---|---|---|---|---|---|---|
| | | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
| Suicide, Violent | Pacific | 12 | 66 | . | 24 | **102** | 1.36 |
| | Asian | . | 6 | 42 | 18 | **66** | 1.47 |
| | Non MPA | 54 | 6 | 6 | 2,211 | **2,268** | 0.94 |
| | **Total** | **519** | **75** | **45** | **2,418** | | |
| Other Causes | Maori | 783 | 6 | 6 | 129 | **912** | 1.08 |
| | Pacific | 6 | 303 | 6 | 27 | **342** | 1.07 |
| | Asian | . | 9 | 120 | 21 | **150** | 1.16 |
| | Non MPA | 51 | 6 | 6 | 8,670 | **8,733** | 0.99 |
| | **Total** | **843** | **321** | **129** | **8,850** | | |

**Table 59: Census Sole Ethnicity by NHI Sole Ethnicity stratified by ICD, 2004-06.**

| Cause of Death | Census Sole Ethnicity | NHI Sole Ethnicity | | | | Total Census Deaths | Census to NHI Ratio |
|---|---|---|---|---|---|---|---|
| | | Maori Deaths | Pacific Deaths | Asian Deaths | NonMPA Deaths | | |
| Cancer | Maori | 1,173 | 6 | 6 | 372 | **1,215** | 0.97 |
| | Pacific | 6 | 309 | 6 | 42 | **330** | 1.05 |
| | Asian | . | 6 | 222 | 39 | **246** | 1.06 |
| | Remainder | 75 | 9 | 6 | 13,032 | **13,503** | 1.00 |
| | **Total** | **1,257** | **315** | **231** | **13,485** | | |
| CVD & IHD | Maori | 1,287 | 6 | . | 387 | **1,380** | 1.00 |
| | Pacific | 6 | 438 | 6 | 72 | **483** | 1.05 |
| | Asian | . | 6 | 216 | 54 | **267** | 1.22 |
| | Remainder | 78 | 12 | 6 | 18,708 | **19,143** | 1.00 |
| | **Total** | **1,374** | **459** | **219** | **19,218** | | |
| Respiratory | Maori | 294 | 6 | . | 78 | **303** | 0.95 |
| | Pacific | . | 54 | . | 9 | **66** | 1.10 |
| | Asian | . | 6 | 18 | 9 | **24** | 1.14 |
| | Remainder | 24 | 6 | 6 | 3,186 | **3,294** | 1.00 |
| | **Total** | **318** | **60** | **21** | **3,285** | | |
| Unintentional Injury, Suicide, Violent | Maori | 426 | . | . | 198 | **444** | 0.93 |
| | Pacific | 12 | 66 | . | 27 | **81** | 1.13 |
| | Asian | . | 6 | 42 | 18 | **60** | 1.43 |
| | Remainder | 42 | 6 | 6 | 2,220 | **2,469** | 1.00 |
| | **Total** | **477** | **72** | **42** | **2,463** | | |
| Other Causes | Maori | 732 | 6 | 6 | 183 | **753** | 0.97 |
| | Pacific | 6 | 303 | 6 | 30 | **324** | 1.05 |
| | Asian | . | 6 | 120 | 27 | **144** | 1.14 |
| | Remainder | 42 | 6 | 6 | 8,682 | **8,913** | 1.00 |
| | **Total** | **777** | **309** | **126** | **8,922** | | |

# Appendix C

## SAS Programme for collapsing (linkage) strata

```
DATA N2001._4Strata ;
   SET N2001._4Regression ;
   ATTRIB
    TA_Cluster_L1c              LABEL = 'Level 1 Territorial Authority 2001
(Mortality) Cluster'
       Sex_L1c                  FORMAT = $fwsex.       LABEL = 'Level 1
Sex (Mortality)'
       Sex_L2c                  FORMAT = $fwsex.       LABEL = 'Level 2
Sex (Mortality)'
       ICD_Gp_L1                FORMAT = $fICDJF.
       ICD_Gp_L2                FORMAT = $fICDJF.
       Strata_orig              LENGTH = $15.
   ;
   * Derive TA_Cluster_L1 – TA_mort Clusters based on TA betas
      (refer LE Create TA_mort Clusters 091216.sas) ;
   TA_Cluster_L1 = INPUT(PUT(TA_mort,Z3.),iTA_Clus.) ;
   * Reassign Clusters ;
   IF TA_Cluster_L1 IN (4, 6) THEN TA_Cluster_L1 = 4 ; /* Collapse
Buller, Kapiti Coast Westland into Clus 4 */
   IF TA_Cluster_L1 IN (5, 2) THEN TA_Cluster_L1 = 2 ; /* Collapse
Chatham Islands & TLA N/A to Clus 2*/
   TA_Cluster_L1c = PUT(TA_Cluster_L1,TACLus4L.) ;

   * Derive Sex_L1c     – Level 1 Sex (Mortality) (Char) ;
   * Derive Sex_L2c     – Level 2 Sex (Mortality) (Char) ;
   Sex_L1c = PUT(Sex_mort,fvsex1L.) ;
   Sex_L2c = PUT(Sex_L1c,$fvsex2L.) ; * Combined Sex ;

   * Derive ICD_Gp_L1 – ICD Group ;
   * Derive ICD_Gp_L0 – Detailed ICD Group ;
   ICD_Gp_L1 = INPUT(ICD_Gp,$iICDJF.) ;
   ICD_Gp_L0 = PUT(ICD_Gp,$fnicd.) ;
   ICD_Gp_L2 = INPUT(ICD_Gp_L1,$iICD2JF.);

   * Specific aggregations;
   * Collapse AgeC_yrsJFc for Child ;
   IF AgeC_yrsJF = 0 THEN Sex_L1c = Sex_L2c ;

   * Collapse Maori & Pacific for 75+ age groups ;
   IF AgeC_yrsJF GE 75 THEN DO ;
      IF PriorEth_m_L1c IN ('G','C') THEN DO ;
      PriorEth_m_L1c = 'C' ; *Set Pacific Ethinicity = Maori for 75+;
      PriorEth_m_L2c = PUT(PriorEth_m_L1c,$f3eth.) ;
      END ;
   END ;

   * Collapse Missing Ethnicity ;
   IF PriorEth_m_L1c IN ('M','O') THEN PriorEth_m_L1c = 'P' ;
   IF PriorEth_m_L2c IN ('E','O') THEN PriorEth_m_L2c = 'F' ;

   * Collapse Rurality for Pacific and Asian ethnicities ;
   IF PriorEth_m_L1c IN ('G','K') THEN DO ;
      IF G_Rurality_m_L1c NE 'Q' THEN DO ;
       G_Rurality_m_L1c = 'C' ;  * Set Rurality = All Urban (assuming
there are no Rural Pacific and Asian ethnicities);
```

```
         G_Rurality_m_L2c = 'C' ;   * Set Rurality = All Urban (assuming
there are no Rural Pacific and Asian ethnicities);
      END ;
   END ;


* Adjustment where no links were able to be found when deriving
W_AgeEthAdj ;
    * Pacific, Females, 5-9 years - assigned Link=1 ;
IF Sex_mort = 2 AND Agec_5yrs = 5 AND PriorEth_m_L1c = 'G' THEN Link = 1;


* Adjustment where no links were able to be found when deriving
W_AgeICDAdj ;
    * Males, 20-24 years, IHD deaths- assigned Link=1 ;
IF Sex_mort = 1 AND Agec_5yrs = 20 AND PUT(ICD_Gp_L1,$FICDJF.) = 'IHD'
THEN Link = 1 ;


* Males, 75-79 years, Violent deaths - assigned Link=1 ;
IF Sex_mort = 1 AND Agec_5yrs = 75 AND PUT(ICD_Gp_L1,$FICDJF.) =
'Violent' THEN Link = 1 ;


* Males, 90-95 years, Congenital, Perinatal, SIDS - assigned Link=1 ;
IF Sex_mort = 1 AND Agec_5yrs = 90 AND PUT(ICD_Gp_L1,$FICDJF.) =
'Congenital, Perinatal, SIDS' THEN Link = 1 ;


   * Create Strata_orig ;
   * NOTE:   THE ORDER OF THE VARIABLES IN THE Strata_Str MUST BE THE
SAME AS THAT USED  BELOW WHEN RUNNING THE SUMMARY ;
   Strata_orig = COMPRESS(AgeC_yrsJFc,' ')
               ||COMPRESS(Sex_L1c,' ')
               ||'_'
               ||COMPRESS(PriorEth_m_L1c,' ')
               ||'_'
               ||COMPRESS(MobilityGp_L1c,' ')
               ||COMPRESS(G_Rurality_m_L2c,' ')
               ||COMPRESS(TA_Cluster_L1c,' ')
               ||'_'
               ||COMPRESS(MthsSinceCen_L2c,' ')
               ||'_'
               ||COMPRESS(NZDep2001_L1c,' ')
               ||'_'
               ||COMPRESS(ICD_Gp_L1,' ')
;
RUN ;


* Produce the Summaries...;
%MACRO StrataIt(dname=N2001._4Strata,YVar=Link,Set=1) ;
PROC SORT DATA = &dname. ;
   BY &&StrataVars_&Set. &YVar. ;
RUN ;

PROC SUMMARY DATA = &dname. CHARTYPE NWAY ;
   CLASS &&StrataVars_&Set. ;
   VAR &YVar. ;
   OUTPUT SUM(&YVar.)=Deaths_Linked
          OUT = Strata_&Set.
   ;
RUN ;


DATA N2001.Strata_&Set. ;
   ATTRIB
```

```sas
        Flag                    LENGTH = $4
        Deaths_Linked           FORMAT = 8.
          Deaths_Total          FORMAT = 8.
          Deaths_LinkedPct      FORMAT = 8.4
     ;
     SET Strata_&Set.(RENAME=(_FREQ_= Deaths_Total)) ;

     Deaths_LinkedPct = Deaths_Linked / Deaths_Total ;

     IF Deaths_Linked GT 5 THEN Flag = 'A001' ;
     ELSE IF Deaths_LinkedPct = 1 THEN Flag = 'A002' ;
     ELSE Flag = 'C000' ;
RUN ;


%MEND StrataIt ;

%LET StrataVars_orig = Strata_orig
                       AgeC_yrsJFc
                       Sex_L1c
/*                            PriorEth_m_L2c*/
                            PriorEth_m_L1c
/*                            MobilityGp_L2c*/
                            MobilityGp_L1c
                            G_Rurality_m_L2c
                            TA_Cluster_L1c
/*                            MthsSinceCen_L3c */
                            MthsSinceCen_L2c
/*                            NZDep2001_L2c */
                            NZDep2001_L1c
/*                              ICD_Gp_L2*/
                              ICD_Gp_L1
;
%StrataIt(dname=N2001._4Strata,YVar=Link,Set=orig) ;


/**************************************************************************/
* Refer to the spreadsheet: Collapse _TYPE_ 091217.xlsx ;
%LET _TYPEi1_ = 11010111010101 ; /* maximum detail */
%LET _TYPEi2_ = 11010111010110 ; /* + collapse ICD_Gp' */
%LET _TYPEi3_ = 11010111011010 ; /* + collapse NZDep */
%LET _TYPEi4_ = 11010111101010 ; /* + collapse MonthsSinceCen */
%LET _TYPEi5_ = 11011011101010 ; /* + collapse Mobility (TA and
G_Rurality unchanged) */
%LET _TYPEi6_ = 11011011101000 ; /* + drop ICD_Gp */
%LET _TYPEi7_ = 11011011100000 ; /* + drop collapsed NZDep */
%LET _TYPEi8_ = 11011011000000 ; /* + drop collapsed MonthsSinceCen */
%LET _TYPEi9_ = 11011010000000 ; /* + drop TA */
%LET _TYPEi10_ = 11011000000000 ; /* + drop Rurality */
%LET _TYPEi11_ = 11010000000000 ; /* + drop collapsed Mobility */
%LET _TYPEi12_ = 11100000000000 ; /* + collapse Ethnicity */
%LET _TYPEi13_ = 11000000000000 ; /* + drop Ethnicity */
%LET _TYPEi14_ = 10000000000000 ; /* + drop Sex */
%LET _TYPEi15_ = 00000000000000 ; /* + drop Age */

%LET StrataVars = Link AgeC_yrsJFc Sex_L1c PriorEth_m_L2c PriorEth_m_L1c
MobilityGp_L2c MobilityGp_L1c G_Rurality_m_L2c TA_Cluster_L1c
MthsSinceCen_L3c MthsSinceCen_L2c NZDep2001_L2c NZDep2001_L1c ICD_Gp_L2
ICD_Gp_L1 ;

* Create dataset of the Maximum detail strata that we can link back to ;
DATA N2001.Strata_Str ;
```

```
    SET N2001.Strata_orig(KEEP = Strata_orig Flag Deaths_Linked
Deaths_LinkedPct
                RENAME=(Flag=Flag_orig Deaths_Linked=Linked_orig
Deaths_LinkedPct=LinkedPct_orig)) ;
    _TYPE_ = &_TYPEi1_. ;
RUN ;


%MACRO SortIt(dname=,byvar=,sortoptions=) ;
PROC SORT DATA = &dname. &sortoptions. ;
    BY &byvar. ;
RUN ;
%MEND SortIt ;


%MACRO Collapse01(TYPE_=&_TYPEi2_.) ;
* Flag the summarised dataset ;
DATA N2001.Lx100_StrataFinal_&TYPE_.(KEEP=Flag_Final Strata_Final
Linked_Final Deaths_Final LinkedPct_Final)
     _4Collapse_Strata_&TYPE_.(KEEP=Strata_&TYPE_. Linked_&TYPE_.
LinkedPct_&TYPE_.)
     _4Freq_&TYPE_.(KEEP=Flag Strata_&TYPE_.) ;

    SET N2001.Strata_&TYPE_.(RENAME=(Deaths_Total = Total_&TYPE_.
Deaths_Linked = Linked_&TYPE_. Deaths_LinkedPct = LinkedPct_&TYPE_. )) ;

    IF Flag IN ('A001') THEN DO ;
        Strata_Final = Strata_&TYPE_. ;
          Deaths_Final = Total_&TYPE_. ;
          Linked_Final = Linked_&TYPE_. ;
          LinkedPct_Final = LinkedPct_&TYPE_. ;
          Flag_Final = Flag ;
          OUTPUT _4Freq_&TYPE_. ;
          OUTPUT N2001.Lx100_StrataFinal_&TYPE_. ; * Cellsize acceptable ;
    END ;

    * Collapse further ;
    IF Flag IN ('C000','A002') THEN DO ;
        OUTPUT _4Freq_&TYPE_. ;
        OUTPUT _4Collapse_Strata_&TYPE_. ; * Need further attention ;
    END ;
RUN ;

* Attach the original strata information to these strata ;
%SortIt(dname=N2001.Lx100_StrataFinal_&TYPE_.,byvar=Strata_Final) ;
%SortIt(dname=_4Collapse_Strata_&TYPE_.,byvar=Strata_&TYPE_.) ;
%SortIt(dname=_4Summary_Deaths_&TYPE_.,byvar=Strata_&TYPE_.) ;

DATA N2001.Lx100_StrataFinal_&TYPE_.(KEEP=Strata_orig Flag_Final
Strata_&TYPE_. Linked_Final Deaths_Final LinkedPct_Final
                                RENAME=(Strata_&TYPE_.=Strata_Final))
     _4Collapse_Strata_&TYPE_.(KEEP=Strata_orig Strata_&TYPE_.
Linked_&TYPE_. LinkedPct_&TYPE_.) ;
    MERGE N2001.Lx100_StrataFinal_&TYPE_.(IN=A
RENAME=(Strata_Final=Strata_&TYPE_.))
        _4Collapse_Strata_&TYPE_.(IN=B)
        _4Summary_Deaths_&TYPE_.(KEEP=Strata_&TYPE_. Strata_orig
&StrataVars.) ;
    BY Strata_&TYPE_. ;
    IF A THEN OUTPUT N2001.Lx100_StrataFinal_&TYPE_. ;
    IF B THEN OUTPUT _4Collapse_Strata_&TYPE_. ;
RUN ;
```

```
%SortIt(dname=N2001.Lx100_StrataFinal_&TYPE_.,byvar=Strata_orig,sortoptio
ns=NODUPKEY) ;

%SortIt(dname=_4Freq_&TYPE_.,byvar=Strata_&TYPE_.) ;
%SortIt(dname=_4Summary_Deaths_&TYPE_.,byvar=Strata_&TYPE_.
Strata_orig,sortoptions=NODUPKEY OUT = NODUPKEY_Strata_&TYPE_.) ;
DATA _4Freq_&TYPE_.(KEEP=Flag Strata_&TYPE_.) ;
   MERGE _4Freq_&TYPE_.(IN=C)
         NODUPKEY_Strata_&TYPE_.(KEEP=Strata_&TYPE_. Strata_orig) ;
   BY Strata_&TYPE_. ;
RUN ;

PROC FREQ DATA = _4Freq_&TYPE_. ;
   TABLE Flag / LIST MISSING ;
   TITLE2 "_TYPE_: &TYPE_." ;
RUN ;

%MEND Collapse01 ;

%MACRO StrataIt(dname=N2001._4Strata,YVar=Link,Set=1) ;
PROC SORT DATA = &dname. ;
   BY &&StrataVars_&Set. &YVar. ;
RUN ;

PROC SUMMARY DATA = &dname. CHARTYPE NWAY ;
   CLASS &&StrataVars_&Set. ;
   VAR &YVar. ;
   OUTPUT SUM(&YVar.)=Deaths_Linked
          OUT = Strata_&Set.
   ;
RUN ;

DATA N2001.Strata_&Set. ;
   ATTRIB
      Flag                    LENGTH = $4
      Deaths_Linked           FORMAT = 8.
        Deaths_Total          FORMAT = 8.
        Deaths_LinkedPct      FORMAT = 8.4
   ;
   SET Strata_&Set.(RENAME=(_FREQ_= Deaths_Total)) ;

   Deaths_LinkedPct = Deaths_Linked / Deaths_Total ;

   IF Deaths_Linked GT 5 THEN Flag = 'A001' ;
   ELSE IF Deaths_LinkedPct = 1 THEN Flag = 'A002' ;
   ELSE Flag = 'C000' ;
RUN ;


%MEND StrataIt ;

*************************************************************************;
* Iteration #1: Separate maximum detail strata with acceptable cell size
from the remainder ;
DATA _4Collapse_Strata_&_TYPEi1_.(KEEP=Strata_orig Flag_orig Strata_orig
Linked_orig LinkedPct_orig)
     N2001.Lx100_StrataFinal_&_TYPEi1_.(KEEP=Flag_Final Strata_Final
Linked_Final LinkedPct_Final Deaths_Final Strata_orig Linked_orig
LinkedPct_orig)
     _4Freq_&_TYPEi1_.(KEEP=Flag Strata_&_TYPEi1_.) ;
```

```
    ;
    ATTRIB
        Strata_Final                      LENGTH = $15
        Flag                              LENGTH = $4
    ;
    SET N2001.Strata_orig ;

    Linked_orig = Deaths_Linked ;
    LinkedPct_orig = Deaths_LinkedPct ;
    Flag_orig = Flag ;

    Strata_&_TYPEi1_. = Strata_orig ;
    IF Flag IN ('A001') THEN DO ;
        Strata_Final = Strata_orig ;
          Deaths_Final = Deaths_Total ;
          Linked_Final = Linked_orig ;
          LinkedPct_Final = LinkedPct_orig ;
          Flag_Final = Flag ;
          OUTPUT _4Freq_&_TYPEi1_. ;
          OUTPUT N2001.Lx100_StrataFinal_&_TYPEi1_. ;
    END ;
    ELSE DO ;
          OUTPUT _4Freq_&_TYPEi1_. ;
        OUTPUT _4Collapse_Strata_&_TYPEi1_. ;
    END ;
RUN ;

PROC FREQ DATA = _4Freq_&_TYPEi1_. ;
    TABLE Flag / LIST MISSING ;
    TITLE2 "_TYPE_: &TYPEi1_." ;
RUN ;

****************************************************************************
Iteration #2: Separate +collapse ICD_Gp strata with acceptable cell size
from the remainder ;
%SortIt(dname=_4Collapse_Strata_&_TYPEi1_.,byvar=Strata_orig,sortoptions=
NODUPKEY) ;
%SortIt(dname=N2001._4Strata,byvar=Strata_orig) ;

DATA _4Summary_Deaths_&_TYPEi2_. ;
    MERGE _4Collapse_Strata_&_TYPEi1_.(KEEP = Strata_orig IN = Incl)
          N2001._4Strata(KEEP = Strata_orig &StrataVars.) ;
    BY Strata_orig ;

    IF Incl THEN DO ;
    * Derive the Strata_Str with the collapsed ICD_Gp ;
        Strata_&_TYPEi2_. = Strata_orig ;
          IF SUBSTR(Strata_&_TYPEi2_.,14,1) IN ('A') THEN
SUBSTR(Strata_&_TYPEi2_.,13,2) = 'A_' ;
          ELSE IF SUBSTR(Strata_&_TYPEi2_.,14,1) IN ('H') THEN
SUBSTR(Strata_&_TYPEi2_.,13,2) = 'H_' ;
          ELSE IF SUBSTR(Strata_&_TYPEi2_.,14,1) IN ('I') THEN
SUBSTR(Strata_&_TYPEi2_.,13,2) = 'I_' ;
          ELSE IF SUBSTR(Strata_&_TYPEi2_.,14,1) IN ('M') THEN
SUBSTR(Strata_&_TYPEi2_.,13,2) = 'M_' ;
          ELSE IF SUBSTR(Strata_&_TYPEi2_.,14,1) IN ('F','G') THEN
SUBSTR(Strata_&_TYPEi2_.,13,2) = 'P_' ;
          ELSE IF SUBSTR(Strata_&_TYPEi2_.,14,1) IN ('J','K','L') THEN
SUBSTR(Strata_&_TYPEi2_.,13,2) = 'O_' ;
          OUTPUT ;
    END ;
```

```sas
RUN ;

* Summarise the dataset with exclusions ;
%LET StrataVars_&_TYPEi2_.  = Strata_&_TYPEi2_.

                                AgeC_yrsJFc
                                Sex_L1c
/*                              PriorEth_m_L2c*/
                                PriorEth_m_L1c
/*                              MobilityGp_L2c*/
                                MobilityGp_L1c
                                G_Rurality_m_L2c
                                TA_Cluster_L1c
/*                              MthsSinceCen_L3c */
                                MthsSinceCen_L2c
/*                              NZDep2001_L2c */
                                NZDep2001_L1c
                                ICD_Gp_L2
/*                              ICD_Gp_L1 ;*/
                        ;
%StrataIt(dname=_4Summary_Deaths_&_TYPEi2_.,YVar=Link,Set=&_TYPEi2_. ) ;
%Collapse01(TYPE_=&_TYPEi2_.) ; * +collapse ICD_Gp ;

*************************************************************************;
* Iteration #3: Separate +collapse NZDep strata with acceptable cell size
from the remainder ;
%SortIt(dname=_4Collapse_Strata_&_TYPEi2_.,byvar=Strata_orig,sortoptions=
NODUPKEY) ;
%SortIt(dname=_4Summary_Deaths_&_TYPEi2_.,byvar=Strata_orig) ;


DATA _4Summary_Deaths_&_TYPEi3_. ;
   MERGE _4Collapse_Strata_&_TYPEi2_.(IN = Incl)
         _4Summary_Deaths_&_TYPEi2_.(KEEP = Strata_Orig &StrataVars.) ;
   BY Strata_orig ;

   IF Incl THEN DO ;
      Strata_&_TYPEi3_. = Strata_&_TYPEi2_. ;
      * Derive the Strata_Str with the collapsed NZDep (1-6,7-10,Missing)
;
        IF SUBSTR(Strata_&_TYPEi3_.,12,1) IN ('K','M') THEN
SUBSTR(Strata_&_TYPEi3_.,11,2) = 'P_' ;
        ELSE IF SUBSTR(Strata_&_TYPEi3_.,12,1) IN ('F','H','J') THEN
SUBSTR(Strata_&_TYPEi3_.,11,2) = 'I_' ;
      ELSE IF SUBSTR(Strata_&_TYPEi3_.,12,1) IN ('C') THEN
SUBSTR(Strata_&_TYPEi3_.,11,2) = 'C_' ;
        OUTPUT ;
   END ;
RUN ;

* Summarise the dataset with exclusions ;
%LET StrataVars_&_TYPEi3_.  =
                                Strata_&_TYPEi3_.
                                AgeC_yrsJFc
                                Sex_L1c
/*                              PriorEth_m_L2c*/
                                PriorEth_m_L1c
/*                              MobilityGp_L2c*/
                                MobilityGp_L1c
                                G_Rurality_m_L2c
                                TA_Cluster_L1c
```

```
/*                                  MthsSinceCen_L3c */
                                    MthsSinceCen_L2c
                                    NZDep2001_L2c
/*                                  NZDep2001_L1c*/
                                       ICD_Gp_L2
/*                                  ICD_Gp_L1 ;*/
                       ;
%StrataIt(dname=_4Summary_Deaths_&_TYPEi3_.,YVar=Link,Set=&_TYPEi3_. ) ;
%Collapse01(TYPE_=&_TYPEi3_.) ; * +collapse NZ Dep ;

***********************************************************************;
* Iteration #4: Separate +collapse MonthsSinceCen strata with acceptable
cell size from the remainder ;
%SortIt(dname=_4Collapse_Strata_&_TYPEi3_.,byvar=Strata_orig,sortoptions=
NODUPKEY) ;
%SortIt(dname=_4Summary_Deaths_&_TYPEi3_.,byvar=Strata_orig) ;


DATA _4Summary_Deaths_&_TYPEi4_. ;
   MERGE _4Collapse_Strata_&_TYPEi3_.(IN = Incl)
         _4Summary_Deaths_&_TYPEi3_.(KEEP = Strata_Orig &StrataVars.) ;
   BY Strata_orig ;

   IF Incl THEN DO ;
      Strata_&_TYPEi4_. = Strata_&_TYPEi3_. ;
      * Derive the Strata_Str with the +collapse MonthsSinceCen (0-
36,37+,Missing) ;
      IF SUBSTR(Strata_&_TYPEi4_.,10,1) IN ('F','N') THEN
SUBSTR(Strata_&_TYPEi4_.,9,2) = 'D_' ;
      ELSE IF SUBSTR(Strata_&_TYPEi4_.,10,1) IN ('V') THEN
SUBSTR(Strata_&_TYPEi4_.,9,2) = 'V_' ;
      ELSE IF SUBSTR(Strata_&_TYPEi4_.,10,1) IN ('Z') THEN
SUBSTR(Strata_&_TYPEi4_.,9,2) = 'Z_' ;
         OUTPUT ;
   END ;
RUN ;

* Summarise the dataset with exclusions ;
%LET StrataVars_&_TYPEi4_. =
                             Strata_&_TYPEi4_.
                             AgeC_yrsJFc
                             Sex_L1c
/*                           PriorEth_m_L2c*/
                             PriorEth_m_L1c
/*                           MobilityGp_L2c*/
                             MobilityGp_L1c
                             G_Rurality_m_L2c
                             TA_Cluster_L1c
                             MthsSinceCen_L3c
/*                           MthsSinceCen_L2c */
                             NZDep2001_L2c
/*                           NZDep2001_L1c*/
                                ICD_Gp_L2
/*                             ICD_Gp_L1 ;*/
                       ;
%StrataIt(dname=_4Summary_Deaths_&_TYPEi4_.,YVar=Link,Set=&_TYPEi4_. ) ;
%Collapse01(TYPE_=&_TYPEi4_.) ;

***********************************************************************;
* Iteration #5 Separate +collapse Mobility strata with acceptable cell
size from the remainder ;
```

```
%SortIt(dname=_4Collapse_Strata_&_TYPEi4_.,byvar=Strata_orig,sortoptions=
NODUPKEY) ;
%SortIt(dname=_4Summary_Deaths_&_TYPEi4_.,byvar=Strata_orig) ;

DATA _4Summary_Deaths_&_TYPEi5_. ;
   MERGE _4Collapse_Strata_&_TYPEi4_.(IN = Incl)
         _4Summary_Deaths_&_TYPEi4_.(KEEP = Strata_Orig &StrataVars.) ;
   BY Strata_orig ;

   IF Incl THEN DO ;
      Strata_&_TYPEi5_. = Strata_&_TYPEi4_. ;
      * Derive the Strata_Str with the +collapse Moblity (1-
55,56+,Missing) ;
      IF SUBSTR(Strata_&_TYPEi5_.,6,1) IN ('R','S') THEN
SUBSTR(Strata_&_TYPEi5_.,5,2) = 'V_' ;
      ELSE IF SUBSTR(Strata_&_TYPEi5_.,6,1) IN ('T','U') THEN
SUBSTR(Strata_&_TYPEi5_.,5,2) = 'W_' ;
      ELSE IF SUBSTR(Strata_&_TYPEi5_.,6,1) IN ('E') THEN
SUBSTR(Strata_&_TYPEi5_.,5,2) = 'E_' ;
         OUTPUT ;
   END ;
RUN ;

* Summarise the dataset with exclusions ;
%LET StrataVars_&_TYPEi5_.  =
                              Strata_&_TYPEi5_.
                              AgeC_yrsJFc
                              Sex_L1c
/*                             PriorEth_m_L2c*/
                              PriorEth_m_L1c
                              MobilityGp_L2c
/*                             MobilityGp_L1c*/
                              G_Rurality_m_L2c
                              TA_Cluster_L1c
                              MthsSinceCen_L3c
/*                             MthsSinceCen_L2c */
                              NZDep2001_L2c
/*                             NZDep2001_L1c */
                                ICD_Gp_L2
/*                               ICD_Gp_L1 */
                    ;
%StrataIt(dname=_4Summary_Deaths_&_TYPEi5_.,YVar=Link,Set=&_TYPEi5_. ) ;
%Collapse01(TYPE_=&_TYPEi5_.) ;

*************************************************************************;
* Iteration #6: Separate +drop ICD_Gp strata with acceptable cell size
from the remainder ;
%SortIt(dname=_4Collapse_Strata_&_TYPEi5_.,byvar=Strata_orig,sortoptions=
NODUPKEY) ;
%SortIt(dname=_4Summary_Deaths_&_TYPEi5_.,byvar=Strata_orig) ;

DATA _4Summary_Deaths_&_TYPEi6_. ;
   MERGE _4Collapse_Strata_&_TYPEi5_.(IN = Incl)
         _4Summary_Deaths_&_TYPEi5_.(KEEP = Strata_Orig &StrataVars.) ;
   BY Strata_orig ;

   IF Incl THEN DO ;
      Strata_&_TYPEi6_. = Strata_&_TYPEi5_. ;
      * Derive the Strata_Str with the +drop ICD_Gp ;
      SUBSTR(Strata_&_TYPEi6_.,13,2) = '__' ;
         OUTPUT ;
```

```
      END ;
   RUN ;

   * Summarise the dataset with exclusions ;
   %LET StrataVars_&_TYPEi6_.  =
                        Strata_&_TYPEi6_.
                        AgeC_yrsJFc
                        Sex_L1c
/*                      PriorEth_m_L2c*/
                        PriorEth_m_L1c
                        MobilityGp_L2c
/*                      MobilityGp_L1c*/
                        G_Rurality_m_L2c
                        TA_Cluster_L1c
                        MthsSinceCen_L3c
/*                      MthsSinceCen_L2c */
                        NZDep2001_L2c
/*                      NZDep2001_L1c */
/*                      ICD_Gp_L2*/
/*                      ICD_Gp_L1 */
                            ;
   %StrataIt(dname=_4Summary_Deaths_&_TYPEi6_.,YVar=Link,Set=&_TYPEi6_. ) ;
   %Collapse01(TYPE_=&_TYPEi6_.) ;

   ************************************************************************;
   * Iteration #7: Separate +drop NZDep strata with acceptable cell size
   from the remainder ;
   %SortIt(dname=_4Collapse_Strata_&_TYPEi6_.,byvar=Strata_orig,sortoptions=
   NODUPKEY) ;
   %SortIt(dname=_4Summary_Deaths_&_TYPEi6_.,byvar=Strata_orig) ;

   DATA _4Summary_Deaths_&_TYPEi7_. ;
      MERGE _4Collapse_Strata_&_TYPEi6_.(IN = Incl)
            _4Summary_Deaths_&_TYPEi6_.(KEEP = Strata_Orig &StrataVars.) ;
      BY Strata_orig ;

      IF Incl THEN DO ;
         Strata_&_TYPEi7_. = Strata_&_TYPEi6_. ;
         * Derive the Strata_Str with the +drop NZDep ;
         SUBSTR(Strata_&_TYPEi7_.,11,2) = '__' ;
           OUTPUT ;
      END ;
   RUN ;

   * Summarise the dataset with exclusions ;
   %LET StrataVars_&_TYPEi7_.  =
                        Strata_&_TYPEi7_.
                        AgeC_yrsJFc
                        Sex_L1c
/*                          PriorEth_m_L2c*/
                            PriorEth_m_L1c
                            MobilityGp_L2c
/*                          MobilityGp_L1c*/
                            G_Rurality_m_L2c
                            TA_Cluster_L1c
                            MthsSinceCen_L3c
/*                          MthsSinceCen_L2c */
/*                          NZDep2001_L2c */
/*                          NZDep2001_L1c */
/*                            ICD_Gp_L2*/
/*                            ICD_Gp_L1 */
```

```
                               ;
%StrataIt(dname=_4Summary_Deaths_&_TYPEi7_.,YVar=Link,Set=&_TYPEi7_. ) ;
%Collapse01(TYPE_=&_TYPEi7_.) ;


**************************************************************************;
* Iteration #8: Separate +drop MonthsSinceCen strata with acceptable cell
size from the remainder ;
%SortIt(dname=_4Collapse_Strata_&_TYPEi7_.,byvar=Strata_orig,sortoptions=
NODUPKEY) ;
%SortIt(dname=_4Summary_Deaths_&_TYPEi7_.,byvar=Strata_orig) ;

DATA _4Summary_Deaths_&_TYPEi8_. ;
   MERGE _4Collapse_Strata_&_TYPEi7_.(IN = Incl)
         _4Summary_Deaths_&_TYPEi7_.(KEEP = Strata_Orig &StrataVars.) ;
   BY Strata_orig ;

   IF Incl THEN DO ;
      Strata_&_TYPEi8_. = Strata_&_TYPEi7_. ;
      * Derive the Strata_Str with the +drop MonthsSinceCen ;
      SUBSTR(Strata_&_TYPEi8_.,9,2) = '__' ;
        OUTPUT ;
   END ;
RUN ;

* Summarise the dataset with exclusions ;
%LET StrataVars_&_TYPEi8_.  =
                        Strata_&_TYPEi8_.
                        AgeC_yrsJFc
                        Sex_L1c
/*                              PriorEth_m_L2c*/
                                PriorEth_m_L1c
                                MobilityGp_L2c
/*                              MobilityGp_L1c*/
                                G_Rurality_m_L2c
                                TA_Cluster_L1c
/*                              MthsSinceCen_L3c */
/*                              MthsSinceCen_L2c */
/*                              NZDep2001_L2c */
/*                              NZDep2001_L1c */
/*                                ICD_Gp_L2*/
/*                                ICD_Gp_L1 */
                              ;
%StrataIt(dname=_4Summary_Deaths_&_TYPEi8_.,YVar=Link,Set=&_TYPEi8_. ) ;
%Collapse01(TYPE_=&_TYPEi8_.) ;


**************************************************************************
Iteration #9: Separate +drop TA strata with acceptable cell size from the
remainder ;
%SortIt(dname=_4Collapse_Strata_&_TYPEi8_.,byvar=Strata_orig,sortoptions=
NODUPKEY) ;
%SortIt(dname=_4Summary_Deaths_&_TYPEi8_.,byvar=Strata_orig) ;

DATA _4Summary_Deaths_&_TYPEi9_. ;
   MERGE _4Collapse_Strata_&_TYPEi8_.(IN = Incl)
         _4Summary_Deaths_&_TYPEi8_.(KEEP = Strata_Orig &StrataVars.) ;
   BY Strata_orig ;

   IF Incl THEN DO ;
      Strata_&_TYPEi9_. = Strata_&_TYPEi8_. ;
      * Derive the Strata_Str with the +drop TA ;
      SUBSTR(Strata_&_TYPEi9_.,8,1) = '_' ;
```

```
        OUTPUT ;
     END ;
  RUN ;

  * Summarise the dataset with exclusions ;
  %LET StrataVars_&_TYPEi9_.  =
                        Strata_&_TYPEi9_.
                        AgeC_yrsJFc
                        Sex_L1c
  /*                        PriorEth_m_L2c*/
                            PriorEth_m_L1c
                            MobilityGp_L2c
  /*                        MobilityGp_L1c*/
                            G_Rurality_m_L2c
  /*                        TA_Cluster_L1c*/
  /*                        MthsSinceCen_L3c */
  /*                        MthsSinceCen_L2c */
  /*                        NZDep2001_L2c */
  /*                        NZDep2001_L1c */
  /*                           ICD_Gp_L2*/
  /*                           ICD_Gp_L1 */
  ;
  %StrataIt(dname=_4Summary_Deaths_&_TYPEi9_.,YVar=Link,Set=&_TYPEi9_. ) ;
  %Collapse01(TYPE_=&_TYPEi9_.) ;

  *************************************************************************;
  * Iteration #10: Separate +drop Rurality strata with acceptable cell size
  from the remainder ;
  %SortIt(dname=_4Collapse_Strata_&_TYPEi9_.,byvar=Strata_orig,sortoptions=
  NODUPKEY) ;
  %SortIt(dname=_4Summary_Deaths_&_TYPEi9_.,byvar=Strata_orig) ;

  DATA _4Summary_Deaths_&_TYPEi10_. ;
     MERGE _4Collapse_Strata_&_TYPEi9_.(IN = Incl)
           _4Summary_Deaths_&_TYPEi9_.(KEEP = Strata_Orig &StrataVars.) ;
     BY Strata_orig ;

     IF Incl THEN DO ;
        Strata_&_TYPEi10_. = Strata_&_TYPEi9_. ;
        * Derive the Strata_Str with the +drop Rurality ;
        SUBSTR(Strata_&_TYPEi10_.,7,1) = '_' ;
        OUTPUT ;
     END ;
  RUN ;

  * Summarise the dataset with exclusions ;
  %LET StrataVars_&_TYPEi10_.  =
                        Strata_&_TYPEi10_.
                        AgeC_yrsJFc
                        Sex_L1c
  /*                        PriorEth_m_L2c*/
                            PriorEth_m_L1c
                            MobilityGp_L2c
  /*                        MobilityGp_L1c*/
  /*                        G_Rurality_m_L2c*/
  /*                      TA_Cluster_L1c*/
  /*                        MthsSinceCen_L3c */
  /*                        MthsSinceCen_L2c */
  /*                        NZDep2001_L2c */
  /*                        NZDep2001_L1c */
  /*                           ICD_Gp_L2*/
```

```
/*                                    ICD_Gp_L1 */
;
%StrataIt(dname=_4Summary_Deaths_&_TYPEi10_.,YVar=Link,Set=&_TYPEi10_. )
;
%Collapse01(TYPE_=&_TYPEi10_.) ;


*********************************************************************;
* Iteration #11: Separate +drop collapsed Mobility strata with acceptable
cell size from the remainder ;
%SortIt(dname=_4Collapse_Strata_&_TYPEi10_.,byvar=Strata_orig,sortoptions
=NODUPKEY) ;
%SortIt(dname=_4Summary_Deaths_&_TYPEi10_.,byvar=Strata_orig) ;

DATA _4Summary_Deaths_&_TYPEi11_. ;
    MERGE _4Collapse_Strata_&_TYPEi10_.(IN = Incl)
         _4Summary_Deaths_&_TYPEi10_.(KEEP = Strata_Orig &StrataVars.) ;
    BY Strata_orig ;

    IF Incl THEN DO ;
        Strata_&_TYPEi11_. = Strata_&_TYPEi10_. ;
        * Derive the Strata_Str with the +drop collapsed Mobility ;
        SUBSTR(Strata_&_TYPEi11_.,5,1) = '_' ;
         OUTPUT ;
    END ;
RUN ;

* Summarise the dataset with exclusions ;
%LET StrataVars_&_TYPEi11_.  =
                      Strata_&_TYPEi11_.
                      AgeC_yrsJFc
                      Sex_L1c
/*                    PriorEth_m_L2c*/
                      PriorEth_m_L1c
/*                    MobilityGp_L2c*/
/*                    MobilityGp_L1c*/
/*                    G_Rurality_m_L2c*/
/*                    TA_Cluster_L1c*/
/*                    MthsSinceCen_L3c */
/*                    MthsSinceCen_L2c */
/*                    NZDep2001_L2c */
/*                    NZDep2001_L1c */
/*                      ICD_Gp_L2*/
/*                      ICD_Gp_L1 */
;
%StrataIt(dname=_4Summary_Deaths_&_TYPEi11_.,YVar=Link,Set=&_TYPEi11_. )
;
%Collapse01(TYPE_=&_TYPEi11_.) ;


*********************************************************************;
* Iteration #12: Separate +collapse Ethnicity strata with acceptable cell
size from the remainder  ;
%SortIt(dname=_4Collapse_Strata_&_TYPEi11_.,byvar=Strata_orig,sortoptions
=NODUPKEY) ;
%SortIt(dname=_4Summary_Deaths_&_TYPEi11_.,byvar=Strata_orig) ;

DATA _4Summary_Deaths_&_TYPEi12_. ;
    MERGE _4Collapse_Strata_&_TYPEi11_.(IN = Incl)
         _4Summary_Deaths_&_TYPEi11_.(KEEP = Strata_Orig &StrataVars.) ;
    BY Strata_orig ;

    IF Incl THEN DO ;
```

```
        Strata_&_TYPEi12_. = Strata_&_TYPEi11_. ;
        * Derive the Strata_Str with the +collapse Ethnicity
(Maori,NonMaori,missing);
        IF SUBSTR(Strata_&_TYPEi12_.,4,1) IN ('C') THEN
SUBSTR(Strata_&_TYPEi12_.,3,2) = 'C_' ;
        ELSE IF SUBSTR(Strata_&_TYPEi12_.,4,1) IN ('G','K','M','P') THEN
SUBSTR(Strata_&_TYPEi12_.,3,2) = 'E_' ;
        ELSE IF SUBSTR(Strata_&_TYPEi12_.,4,1) IN ('O') THEN
SUBSTR(Strata_&_TYPEi12_.,3,2) = 'O_' ;
          OUTPUT ;
    END ;
RUN ;

* Summarise the dataset with exclusions ;
%LET StrataVars_&_TYPEi12_.  =
                        Strata_&_TYPEi12_.
                        AgeC_yrsJFc
                        Sex_L1c
                                PriorEth_m_L2c
/*                              PriorEth_m_L1c*/
/*                              MobilityGp_L2c*/
/*                              MobilityGp_L1c*/
/*                              G_Rurality_m_L2c*/
/*                              TA_Cluster_L1c*/
/*                              MthsSinceCen_L3c */
/*                              MthsSinceCen_L2c */
/*                              NZDep2001_L2c */
/*                              NZDep2001_L1c */
/*                                ICD_Gp_L2*/
/*                                ICD_Gp_L1 */
;

%StrataIt(dname=_4Summary_Deaths_&_TYPEi12_.,YVar=Link,Set=&_TYPEi12_. )
;
%Collapse01(TYPE_=&_TYPEi12_.) ; * +collapse Ethnicity
(Maori,NonMaori,missing);




********************************************************************;
* Iteration #13: Separate +drop Ethnicity strata with acceptable cell
size from the remainder  ;
%SortIt(dname=_4Collapse_Strata_&_TYPEi12_.,byvar=Strata_orig,sortoptions
=NODUPKEY) ;
%SortIt(dname=_4Summary_Deaths_&_TYPEi12_.,byvar=Strata_orig) ;

DATA _4Summary_Deaths_&_TYPEi13_. ;
   MERGE _4Collapse_Strata_&_TYPEi12_.(IN = Incl)
         _4Summary_Deaths_&_TYPEi12_.(KEEP = Strata_Orig &StrataVars.) ;
   BY Strata_orig ;

   IF Incl THEN DO ;
      Strata_&_TYPEi13_. = Strata_&_TYPEi12_. ;
      * Derive the Strata_Str with the +drop Ethnicity ;
      SUBSTR(Strata_&_TYPEi13_.,3,1) = '_' ;
        OUTPUT ;
    END ;
RUN ;

* Summarise the dataset with exclusions ;
```

```
%LET StrataVars_&_TYPEi13_.  =
                            Strata_&_TYPEi13_.
                            AgeC_yrsJFc
                            Sex_L1c
/*                          PriorEth_m_L2c*/
/*                           PriorEth_m_L1c*/
/*                           MobilityGp_L2c*/
/*                           MobilityGp_L1c*/
/*                           G_Rurality_m_L2c*/
/*                           TA_Cluster_L1c*/
/*                           mthsSinceCen_L3c */
/*                           MthsSinceCen_L2c */
/*                           NZDep2001_L2c */
/*                           NZDep2001_L1c */
/*                           ICD_Gp_L2*/
/*                           ICD_Gp_L1 */;
%StrataIt(dname=_4Summary_Deaths_&_TYPEi13_.,YVar=Link,Set=&_TYPEi13_. )
;
%Collapse01(TYPE_=&_TYPEi13_.) ; * +drop Ethnicity ;

**********************************************************************;
* Iteration #14: Separate +drop Sex strata with acceptable cell size from
the remainder  ;
%SortIt(dname=_4Collapse_Strata_&_TYPEi13_.,byvar=Strata_orig,sortoptions
=NODUPKEY) ;
%SortIt(dname=_4Summary_Deaths_&_TYPEi13_.,byvar=Strata_orig) ;

DATA _4Summary_Deaths_&_TYPEi14_. ;
   MERGE _4Collapse_Strata_&_TYPEi13_.(IN = Incl)
         _4Summary_Deaths_&_TYPEi13_.(KEEP = Strata_Orig &StrataVars.) ;
   BY Strata_orig ;

   IF Incl THEN DO ;
       Strata_&_TYPEi14_. = Strata_&_TYPEi13_. ;
       * Derive the Strata_Str with the +drop Sex ;
       SUBSTR(Strata_&_TYPEi14_.,2,1) = '_' ;
         OUTPUT ;
   END ;
RUN ;

* Summarise the dataset with exclusions ;
%LET StrataVars_&_TYPEi14_.  =
                       Strata_&_TYPEi14_.
                       AgeC_yrsJFc
/*                      Sex_L1c*/
/*                      PriorEth_m_L2c*/
/*                      PriorEth_m_L1c*/
/*                      MobilityGp_L2c*/
/*                      MobilityGp_L1c*/
/*                      G_Rurality_m_L2c*/
/*                      TA_Cluster_L1c*/
/*                      MthsSinceCen_L3c */
/*                      MthsSinceCen_L2c */
/*                      NZDep2001_L2c */
/*                      NZDep2001_L1c */
/*                      ICD_Gp_L2*/
/*                      ICD_Gp_L1 */
;
%StrataIt(dname=_4Summary_Deaths_&_TYPEi14_.,YVar=Link,Set=&_TYPEi14_. )
;
%Collapse01(TYPE_=&_TYPEi14_.) ;
```

```
***********************************************************************;
* Iteration #15: Separate +drop Age strata with acceptable cell size from
the remainder  ;
%SortIt(dname=_4Collapse_Strata_&_TYPEi14_.,byvar=Strata_orig,sortoptions
=NODUPKEY) ;
%SortIt(dname=_4Summary_Deaths_&_TYPEi14_.,byvar=Strata_orig) ;

DATA _4Summary_Deaths_&_TYPEi15_. ;
   MERGE _4Collapse_Strata_&_TYPEi14_.(IN = Incl)
         _4Summary_Deaths_&_TYPEi14_.(KEEP = Strata_Orig &StrataVars.) ;
   BY Strata_orig ;

   IF Incl THEN DO ;
      Strata_&_TYPEi15_. = Strata_&_TYPEi14_. ;
      * Derive the Strata_Str with the +drop Age ;
      SUBSTR(Strata_&_TYPEi15_.,1,1) = '_' ;
        OUTPUT ;
   END ;
RUN ;

* Summarise the dataset with exclusions ;
%LET StrataVars_&_TYPEi15_.  =
                      Strata_&_TYPEi15_.
/*                    AgeC_yrsJFc*/
/*                    Sex_L1c*/
/*                    PriorEth_m_L2c*/
/*                    PriorEth_m_L1c*/
/*                    MobilityGp_L2c*/
/*                    MobilityGp_L1c*/
/*                    G_Rurality_m_L2c*/
/*                    TA_Cluster_L1c*/
/*                    MthsSinceCen_L3c */
/*                    MthsSinceCen_L2c */
/*                    NZDep2001_L2c */
/*                    NZDep2001_L1c */
/*                    ICD_Gp_L2*/
/*                    ICD_Gp_L1 */
;
%StrataIt(dname=_4Summary_Deaths_&_TYPEi15_.,YVar=Link,Set=&_TYPEi15_. );
%Collapse01(TYPE_=&_TYPEi15_.) ;
```