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The epidemiology of breast cancer in Maori women in Aotearoa New Zealand: implications for ethnicity data analysis

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Abstract

Aim To describe the methods used to estimate breast cancer incidence and mortality in Maori and non-Maori women using multiple adjustors to assign ethnicity.

Methods Age-specific incidence and mortality rates for breast cancer in Maori and non-Maori were calculated using registration and deaths data obtained from New Zealand Health Information Service (NZHIS) for 1996–2000. Four different methods were used to assign total and sole ethnicity: New Zealand Census Mortality Study (NZCMS)-adjusted, ever Maori-adjusted, National Health Index (NHI)-adjusted, and unadjusted source information.

Results Unadjusted and NHI-adjusted estimates were least similar to the NZCMS-adjusted estimate used as the 'gold standard' in this study. Ever Maori–adjusted results closely approximated NZCMS-adjusted results in both incidence and mortality data. Sole Maori breast cancer incidence and mortality estimates were generally higher than total Maori estimates.

Discussion Using four different estimates to assign ethnicity confirms previous findings showing poor quality of ethnicity data in routinely collected datasets. Future calculations of breast cancer incidence and mortality rates should assign total and sole ethnicity and reduce ethnicity misclassification by using NZCMS or ever Maori-adjusted estimates. This paper supports the need to collect better quality ethnicity data in order to identify and monitor Maori vs non-Maori cancer inequalities.

The epidemiology of breast cancer in New Zealand women has been well described from a total population perspective, but Maori specific analyses have produced inconsistent results.[1–8] This paper presents the methods used to analyse breast cancer incidence and mortality in Maori and non-Maori women for a 5-year period (1996–2000). A full discussion of the ethnic disparities identified by this analysis is presented in an accompanying paper.[9]

Background

Breast cancer is a major cause of death for women both internationally and in New Zealand.[2,10] Ethnic disparities in breast cancer mortality have been consistently documented with Maori women having a higher mortality rate than non-Maori.[2,11,12] In contrast, ethnic differences in breast cancer incidence rates between Maori and non-Maori are less consistent with conflicting estimates stating Maori risk as similar, higher and/or lower than non-Maori.[2–5,7] Explanations for these findings may include: variations in the analytical frameworks used to explore ethnic differences, such as sole versus total ethnic group analyses (the latter includes people who identify with

only one ethnic group plus those people who identify with more than one ethnic group, where ethnicity is assigned by application of a prioritisation rule—i.e. Maori first, then Pacific Island, European and Other)[2,4,7]; blood quantum versus cultural affiliation definitions of ethnicity,[4] and a lack of equal explanatory power—i.e. small sample sizes for Maori compared to non-Maori.[3,5]

In addition, there are problems with ethnicity data within cancer registration and death records in New Zealand. Cancer registration data come primarily from laboratory information or hospital records. Although ethnicity is supposed to be self-defined in these records, reviews have shown that this is not always the case, particularly in the hospital setting.[13] Furthermore, although it has been possible to record multiple ethnic groups since July 1996, less than 2% of hospital records had ethnicity recorded as including more than one ethnic group during 1997–1998, suggesting that this option was either not given or not recorded by hospital staff.[14] Approximately 10% of breast cancer registrations in 1999 had ethnicity recorded as 'not stated'.[15]

There are similar issues with cancer mortality data. Prior to September 1995, deaths were officially registered as Maori, usually by funeral directors, if the deceased was determined to be of half or more Maori ancestry based on the descent of their parents.[13] This led to an under-reporting of Maori deaths prior to 1995.[16,17] Since 1995, the classification of ethnicity on death records has changed to determine the ethnicity (rather than ancestry) of all deceased with multiple options available as in the census.[13] Although this has led to an increased recording of Maori in mortality datasets, there is still evidence of undercounting.[12,13]

This paper recognises the need to review the quality of ethnicity data within cancer registration and mortality datasets when considering Maori vs non-Maori disparities in breast cancer incidence and mortality. This is consistent with the recently released *New Zealand Cancer Control Strategy*, which aims to reduce both the incidence and impact of cancer and inequalities with respect to cancer.[18]

Methodology

This paper uses the methodological approach of Kaupapa Maori Research (KMR)[19]. To date, KMR has been used primarily within a qualitative setting. However, a number of more recent studies have described the use of KMR within quantitative analyses, particularly within health.[20-22] This paper reflects a KMR approach because: it puts Maori at the centre of enquiry (i.e. focuses on Maori data and identifies the best quality information available); performs a Maori vs non-Maori analysis (i.e. ensures that Maori are not treated simply as a subgroup of the total population); maximises the quality of ethnicity data (i.e. uses multiple methods to assign ethnicity), and maximises statistical power (i.e. by aggregating five years of data).

This approach reflects the principle of 'equal explanatory power', which promotes the need to gather data to the same breadth and depth for the Maori population as it is collected for the non-Maori population in order to appropriately analyse Maori vs non-Maori inequalities.[23]

Methods

Numerator data

Numerator data on breast cancer incidence and mortality were obtained from national cancer registration information (ICD9-CM code 174 Female Breast)[15] and mortality information (ICD-9-CMA-II code 174 Malignant neoplasm of the female breast).[24] To assess the extent of the Maori undercount associated with routinely collected datasets, four different methods were used to calculate breast cancer incidence and mortality. These methods were chosen because they reflect current practice

in New Zealand, and they allow recently developed analyses (i.e. New Zealand Census Mortality Study [NZCMS] and ever-Maori adjustments) to be examined and compared with unadjusted datasets.

NZCMS mortality-adjusted estimates—These estimates draw on adjustors from the NZCMS, which is a record linkage study in which death registration data are anonymously and probabilistically linked to census data.[25] Ethnic specific rates are calculated by multiplying the Census Mortality adjustor with either the incidence or mortality rate for each age group. As this corrects the estimate for numerator-denominator bias, the NZCMS adjustment is used as the 'gold standard' against which other methods are compared in this paper.[12] It is uncertain how valid it is to apply this method to morbidity data, such as cancer registrations, because ethnicity information in morbidity data has not yet been matched to census ethnicity information. An assumption has been made that the problems with ethnicity data collection are similar between routinely collected data sets. Thus, applying a mortality adjustor to morbidity data is likely to produce more accurate estimates, and this approach is consistent with recent Ministry of Health cancer analyses.[2]

Ever Maori-adjusted estimates—Ethnicity is adjusted according to whether or not any previous admission for patients (as identified by their unique NHI identifiers) had been recorded as Maori, either sole or total, in any admission record at any time or on the death certificate. All remaining records, including those with no ethnicity specified in the NHI unique identifier, were classified as non-Maori. Other researchers have used this method to reduce the undercount of Maori in routinely collected datasets.[20,21] We hypothesised that the ever-Maori approach would approximate the NZCMS adjustment, but probably corrects Maori rates for older age groups better than for younger age groups. This reflects the fact that older people are more likely than younger people to have had previous hospital admissions, and are therefore more likely to have an NHI unique identifier by which to assign an ever-Maori ethnicity classification.

National Health Index (NHI)-adjusted estimates—Ethnicity is adjusted according to the most recent NHI ethnicity recorded in hospital admission data. We expected that this estimate would under-estimate total Maori and over-estimate sole Maori rates compared with NZCMS-adjusted rates. This effect may be even greater than that seen in the unadjusted source information because NHI data only record ethnicity on the most recent publicly-funded hospital admission.

Unadjusted source information—Ethnicity is identified according to the classification recorded at either the cancer or death registration event. This estimate depends on the quality of data in routinely collected cancer registration and mortality datasets. The New Zealand Census Mortality Study indicates that this approach is likely to under-estimate total Maori and over-estimate sole Maori rates.[12]

Denominator data

Denominator data were mean resident population estimates at the year ended 30 June, sourced from Statistics New Zealand estimates based on results from the 1996 and 2001 Censuses of Population and Dwellings.[15,24,26]

Denominator ethnicity was identified as non-Maori and either:

- Total Maori comprising sole Maori (those who identify Maori as their only ethnicity) and mixed Maori (those who identify Maori as one of their multiple ethnic groups), or;
- Sole Maori.

Data Analysis

All statistical analyses were conducted using the SAS system for Windows version 8.2. As this study utilised data collected from cancer registry and mortality records, it was assumed that all cancers and cancer deaths in New Zealand had been obtained. Therefore, the confidence limits provided reflect the uncertainty due to misassignment of ethnicity to each cancer incidence or death event. A Delete-A-Group Jacknife method was used to estimate the confidence intervals around the risk ratios.[27] This involves randomly allocating each individual in the female population to one of one hundred groups. The risk ratios are then recalculated one hundred times after deleting only those women assigned to each group. The variation in the distribution of Delete-A-Group Jacknife estimates were used as a measure of the error in the risk ratios due to misassignment of ethnicity, and the resulting confidence intervals were then log-transformed.[28]

Results

Incidence

Table 1 presents the total number of breast cancer registrations in New Zealand for the years 1996–2000 by total and sole ethnicity. A total of 10,524 records were analysed for unadjusted, NHI-adjusted, and ever Maori-adjusted estimates; 10,424 for NZCMS-adjusted total; and 10,680 for NZCMS-adjusted sole. The difference in total numbers reflects the fact that NZCMS adjustors have been smoothed to allow 5-year age group adjustors. While the total numbers are not exactly the same, the relative proportions are correct based on the smoothing function used.[26] The percentage of total Maori women ranged from 6.2% (NHI) to 8.6% (ever-Maori). Sole Maori percentages were slightly lower with findings ranging from 5.7%(NHI) to 7.5%(unadjusted).

Table 2 presents age-specific relative risk (Maori vs non-Maori) of breast cancer incidence for unadjusted, NHI, ever-Maori and NZCMS-adjusted estimates. Overall, the relative risk of breast cancer incidence is generally higher for sole Maori ethnicity compared with total Maori ethnicity analyses. With respect to total findings, the NHI-adjusted estimate varies most from the NZCMS-adjusted estimate. Both the unadjusted and ever-Maori estimates appear to be relatively similar to the NZCMS-adjusted estimate. When comparing sole Maori findings, the unadjusted estimate is the least consistent with the NZCMS-adjusted one, over-estimating sole Maori risk of developing breast cancer. The NHI-adjusted sole Maori estimate is comparable with the NZCMS-adjusted estimate overall; however, it also appears to overestimate Maori breast cancer incidence at younger ages (i.e. 15–29 years).

Mortality

Table 3 presents total female breast cancer deaths by total and sole ethnicity in New Zealand during the years 1996-2000. A total of 2577 deaths were analysed for unadjusted, NHI-adjusted and ever Maori-adjusted estimates and 2560 deaths for NZCMS-adjusted. The proportion of total Maori women ranged from 7.3% to 9.9%. Sole Maori proportions were similar with estimates ranging from 7.1%(NHI) to 9.9% (NZCMS).

Table 1. Cancer incidence by total number and percentage Maori and non-Maori for total and sole NZCMS, ever-Maori, NHI, and unadjusted estimates (1996-2000)

	Total				Sole		
	NZCMS	**Ever-Maori**	**Unadjusted**	**NHI**	**NZCMS**	**Unadjusted**	**NHI**
Maori number	843	906	792	649	675	788	600
(%)	(8.1)	(8.6)	(7.5)	(6.2)	(6.3)	(7.5)	(5.7)
non-Maori number	9581	9618	9732	9875	10005	9736	9924
(%)	(91.6)	(91.4)	(92.5)	(93.8)	(93.7)	(92.5)	(94.3)
Total number	**10,424**	**10,524**	**10,524**	**10,524**	**10,680**	**10,524**	**10,524**

NZCMS= New Zealand Census Mortality Study; NHI=National Health Index.

Table 2. Age-specific relative risk of total and sole, Maori vs non-Maori breast cancer incidence for NZCMS, ever-Maori, NHI, and unadjusted estimates (1996–2000)

Age group (years)	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
Total													
NZCMS	1.8 (1.1-3.0) H	1.3 (0.9-1.8)	1.3 (1.0-1.6)	1.2 (1.0-1.4)	1.0 (0.8-1.2)	1.0 (0.8-1.1)	0.9 (0.7-1.1)	1.0 (0.8-1.2)	1.2 (1.0-1.5)	1.1 (0.8-1.5)	1.0 (0.6-1.5)	0.8 0.5-1.4)	0.7 (0.4-1.5)
Ever-Maori	1.7 (1.0-2.8)	1.2 (0.8-1.7)	1.2 (1.0-1.5)	1.2 (1.0-1.5)	1.1 (1.0-1.3)	1.1 (0.9-1.3)	1.0 (0.8-1.2)	1.1 (0.9-1.3)	1.2 (1.0-1.5)	1.2 (0.9-1.6)	1.0 (0.6-1.6)	0.8 (0.5-1.4)	0.8 (0.4-1.6)
Unadjusted	1.6 (0.9-2.8)	1.1 (0.8-1.5)	1.1 (0.9-1.5)	1.1 (0.9-1.3)	0.9 (0.8-1.1)	0.9 (0.7-1.1)	0.8 (0.7-1.0)	0.9 (0.7-1.2)	1.1 (0.9-1.4)	1.0 0.7-1.4)	0.9 (0.6-1.3)	0.7 (0.4-1.5)	0.6 (0.3-1.4)
NHI	1.3 (0.7-2.4)	0.7 (0.4-1.0)	0.9 (0.6-1.2)	0.8 (0.7-1.1)	0.7 (0.6-0.9) L	0.7 (0.6-0.9) L	0.7 (0.5-0.9) L	0.8 (0.7-1.1)	0.9 (0.7-1.1)	0.9 (0.6-1.3)	0.6 (0.3-1.2)	0.7 (0.4-1.2)	0.5 (0.2-1.3)
Sole													
NZCMS	2.2 (1.1-4.4) H	1.4 (0.9-2.1)	1.3 (0.9-1.8)	1.3 (1.0-1.6)	1.2 (1.0-1.4)	1.1 (0.9-1.3)	1.0 (0.8-1.2)	1.1 (0.8-1.4)	1.3 (1.0-1.7)	1.2 (0.9-1.7)	1.1 (0.7-1.8)	1.0 (0.5-2.0)	1.1 (0.5-2.4)
Unadjusted	3.0 (1.6-5.3) H	1.9 (1.3-2.7) H	1.7 (1.3-2.3) H	1.6 (1.4-2.0) H	1.4 (1.2-1.7) H	1.3 (1.0-1.6)	1.1 (0.9-1.4)	1.2 (1.0-1.5)	1.5 (1.2-1.9) H	1.4 (1.0-1.9)	1.2 (0.8-2.0)	1.1 (0.6-2.0)	1.1 (0.5-2.3)
NHI	2.5 (1.2-4.9) H	0.9 (0.6-1.5)	1.2 (0.9-1.6)	1.2 (0.9-1.5)	1.0 (0.8-1.2)	0.9 (0.8-1.2)	0.9 (0.7-1.1)	1.1 (0.9-1.3)	1.1 (0.9-1.5)	1.1 (0.8-1.6)	0.8 (0.4-1.5)	0.9 (0.5-1.8)	0.9 (0.4-2.2)

H=significantly higher risk (alpha=0.05); L=significantly lower risk (alpha=0.05); NZCMS= New Zealand Census Mortality Study; NHI=National Health Index.

Table 3. Cancer mortality by total number and percentage Maori and non-Maori for total and sole NZCMS, ever-Maori, NHI, and unadjusted estimates (1996–2000)

	Total				Sole		
	NZCMS	**Ever-Maori**	**Unadjusted**	**NHI**	**NZCMS**	**Unadjusted**	**NHI**
Maori number	254	252	239	188	254	239	182
(%)	(9.9)	(9.8)	(9.3)	(7.3)	(9.9)	(9.3)	(7.1)
non-Maori number	2306	2325	2338	2389	2306	2338	2395
(%)	(90.1)	(90.2)	(90.7)	(90.7)	(90.1)	(90.7)	(92.9)
Total number	**2560**	**2577**	**2577**	**2577**	**2560**	**2577**	**2577**

NZCMS= New Zealand Census Mortality Study; NHI=National Health Index.

Table 4. Age-specific relative risk of total and sole, Maori vs non-Maori breast cancer mortality for NZCMS, ever-Maori, NHI, and unadjusted estimates (1996-2000)

Age group (years)	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
Total													
NZCMS	4.7 (1.5-14.8)[H]	2.4 (1.2-4.8)[H]	2.2 (1.4-3.5)[H]	2.0 (1.3-3.1)[H]	1.7 (1.2-2.5)[H]	1.7 (1.2-2.3)[H]	1.8 (1.3-2.5)[H]	1.0 (0.6-1.7)	1.0 (0.6-1.7)	1.2 (0.7-2.0)	1.8 (1.1-3.1)[H]	1.3 (0.6-2.9)	0.9 (0.4-2.4)
Ever-Maori	4.0 (1.2-13.0)[H]	2.0 (1.2-3.4)[H]	2.0 (1.2-3.4)[H]	1.8 (1.2-2.8)[H]	1.8 (1.2-2.6)[H]	1.6 (1.1-2.3)[H]	1.7 (1.3-2.3)[H]	1.0 (0.7-1.6)	1.1 (0.7-1.8)	1.3 (0.8-2.1)	1.6 (0.9-2.8)	1.1 (0.5-2.7)	0.9 (0.4-2.5)
Unadjusted	4.0 (1.1-15.1)[H]	2.0 (1.0-4.0)	2.0 (1.2-3.5)	1.7 (1.1-2.7)[H]	1.6 (1.1-2.3)[H]	1.6 (1.1-2.3)[H]	1.7 (1.3-2.3)[H]	0.9 (0.6-1.5)	0.9 (0.5-1.5)	1.1 (0.6-2.0)	1.6 (0.9-2.8)	1.1 (0.5-2.6)	0.7 (0.2-2.3)
NHI	2.9 (0.9-9.9)	1.7 (0.9-3.3)	1.2 (0.7-2.0)	1.6 (1.1-2.4)[H]	1.3 (0.8-1.9)	1.0 (0.7-1.5)	1.2 (0.8-1.7)	0.7 (0.4-1.4)	0.8 (0.4-1.3)	0.9 (0.5-1.6)	1.1 (0.6-2.1)	1.1 (0.5-2.6)	0.6 (0.1-2.1)
Sole													
NZCMS	5.6 (1.8-17.1)[H]	2.6 (1.2-5.5)[H]	2.3 (1.3-4.0)[H]	2.1 (1.4-3.3)[H]	2.0 (1.3-3.0)[H]	1.9 (1.4-2.7)[H]	2.0 (1.4-2.9)[H]	1.1 (0.7-1.9)	1.1 (0.7-1.9)	1.4 (0.8-2.5)	2.0 (1.2-3.6)[H]	1.6 (0.7-3.9)	1.3 (0.4-3.8)
Unadjusted	7.6 (2.6-22.5)[H]	3.4 (1.7-6.7)[H]	3.1 (1.9-5.1)[H]	2.7 (1.8-4.0)[H]	2.4 (1.6-3.4)[H]	2.3 (1.6-3.2)[H]	2.3 (1.7-3.1)[H]	1.2 (0.7-2.0)	1.2 (0.7-2.2)	1.6 (0.9-2.8)	2.2 (1.2-4.1)[H]	1.7 (0.6-4.7)	1.3 (0.4-3.9)
NHI	5.6 (1.6-18.8)[H]	3.0 (1.4-6.1)[H]	1.8 (1.0-3.2)	2.3 (1.4-3.6)[H]	1.7 (1.1-2.7)[H]	1.5 (1.0-2.2)	1.5 (1.0-2.3)	1.0 (0.6-1.7)	1.1 (0.6-1.9)	1.2 (0.7-2.2)	1.5 (0.8-3.0)	1.4 (0.5-3.6)	1.0 (0.2-3.7)

H=significantly higher risk (alpha=0.05); NZCMS= New Zealand Census Mortality Study; NHI=National Health Index.

Figure 1. Age-specific relative risk (Maori vs non-Maori) of breast cancer incidence for total and sole NZCMS, ever-Maori, NHI, and unadjusted estimates (1996-2000) (NZCMS=New Zealand Census Mortality Study; NHI=National Health Index)

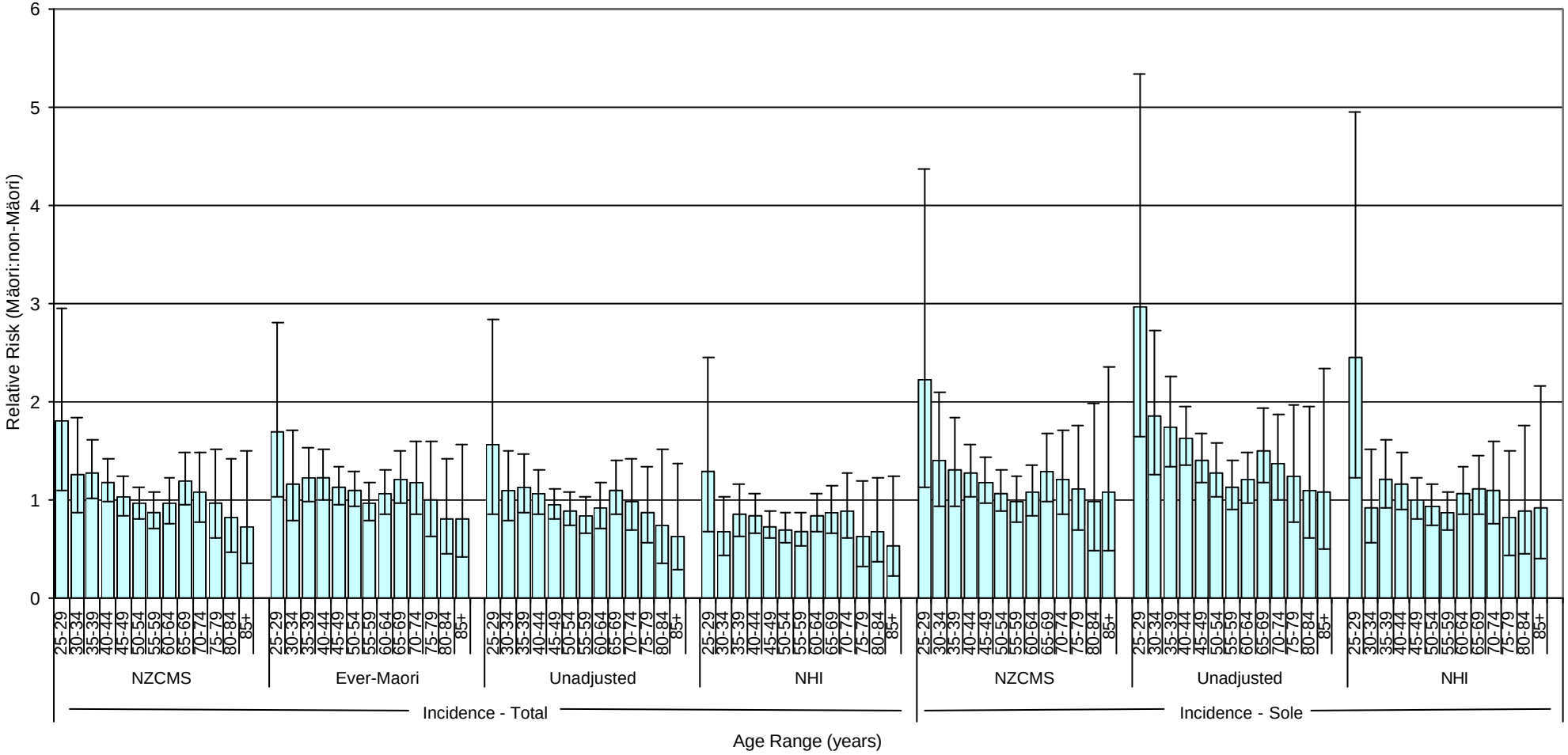

Figure 2. Age-specific relative risk (Maori vs non-Maori) of breast cancer mortality for total and sole NZCMS, ever-Maori, NHI, and unadjusted estimates (1996-2000) (NZCMS=New Zealand Census Mortality Study; NHI=National Health Index)

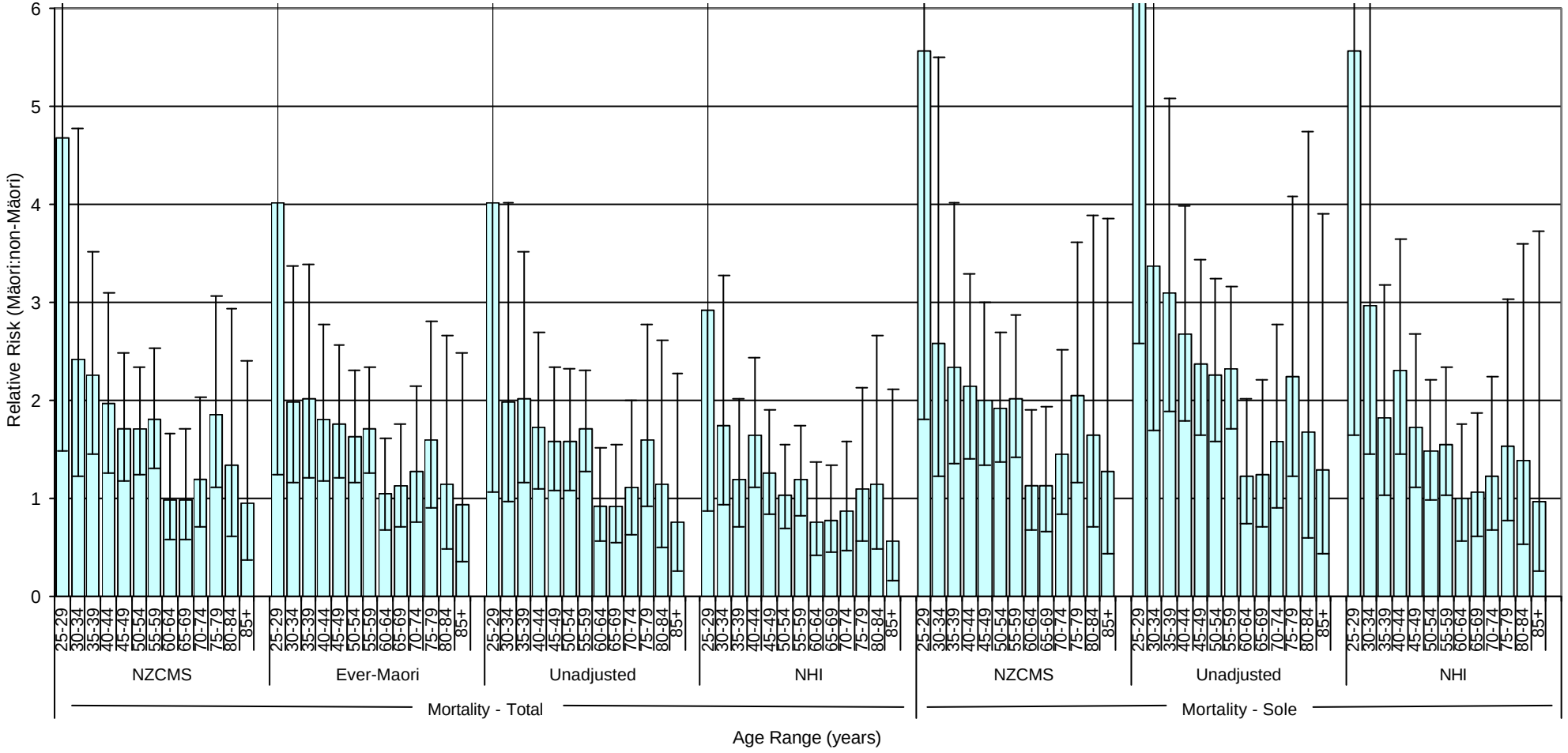

Table 4 presents age-specific relative risk (Maori vs non-Maori) of breast cancer mortality for the unadjusted, NHI, ever-Maori, and NZCMS-adjusted estimates. Similar to breast cancer incidence findings, the relative risk estimates for mortality are greater for sole Maori than for total Maori ethnicity.

With respect to total Maori mortality findings, the NHI-adjusted results are least consistent with the NZCMS-adjusted estimates. This is followed by unadjusted and ever-Maori estimates that both have a similar risk pattern to the NZCMS-adjusted estimates.

With respect to sole Maori mortality findings, the unadjusted results are least consistent with the NZCMS-adjusted estimate, overestimating the sole Maori risk of death when compared with the NZCMS-adjusted estimate. Although the NHI sole estimate still differs from the NZCMS 'gold standard' one, this difference is less than the unadjusted sole Maori estimate. This is to be expected because data obtained from the National Health Index underestimate the number of Maori. Therefore (in the case of sole Maori estimates) NHI adjustment reduces the overestimation of sole Maori numbers found in unadjusted estimates. This results in sole Maori NHI findings being more closely aligned to the NZCMS 'gold standard' than unadjusted sole Maori findings (the opposite to what was found for total Maori results).

Figures 1 and 2 present the age-specific relative risk of total Maori and sole Maori breast cancer incidence and mortality for each estimate. As noted previously, NHI-adjusted and unadjusted estimates are least similar to NZCMS-adjusted estimate, with ever Maori-adjusted risk estimates closely approximating NZCMS-adjusted estimates for both incidence and mortality data.

Overall, the majority of confidence intervals across the seven incidence estimates include one, and therefore the age-specific relative risks are not significantly different at the 95 % level of confidence. The risk ratios for the under-30 age groups should be interpreted cautiously given the low incidence rates in these age groups. In contrast to breast cancer incidence findings, confidence intervals for Maori vs non-Maori mortality relative risks in women aged 25-59 years did not include one and therefore are statistically significant at the 95% level of confidence

Discussion

This study found different breast cancer incidence and mortality rates when different methods were used to estimate Maori and non-Maori ethnicity. These results confirm previous findings of the unreliable quality of ethnicity data in routinely collected datasets.

With respect to total findings for mortality, the NHI-adjusted and unadjusted estimates were least similar to NZCMS-adjusted estimates. These findings were predicted and are consistent with other analyses.[12] However, it is concerning that ethnicity data obtained from mortality datasets after 1995 continue to undercount Maori despite attempts to align ethnicity collection with that of the census during this period. This highlights the ongoing presence of numerator/denominator bias and reinforces the need to assume an undercount of Maori in mortality datasets. Accordingly, the method used in this paper to reassign ethnicity using NZCMS derived adjustors should be considered routinely. Of note, the ever-Maori estimate

closely approximates the NZCMS-adjusted estimate representing an alternative option for adjustment.

Consistent with other ethnic analyses, this study found that the mortality risk was higher for women who identified solely as Maori compared with women who identified themselves as belonging to more than one ethnic group.[29] One proposed explanation for this finding is that people identified as Maori (assumed to be more likely for the sole Maori ethnic group) are at increased risk of institutional racism and differential health care access, and therefore differential health outcomes.[29] This hypothesis supports the ongoing examination of breast cancer incidence and mortality rates by both sole and total Maori ethnicity.

Concerns about the validity of applying the NZCMS adjustor to cancer registration data remain. While this analysis supports the application of mortality adjustors to morbidity data, the findings are suggestive rather than conclusive. In particular, we cannot conclude whether the use of NZCMS or ever Maori-adjusted morbidity data is appropriate in other contexts—e.g. data collected prior to 1996, fewer years of data, or data reviewing rarer diseases or health outcomes with lower incidence.

The relatively short study period and modest number of breast cancer events may affect the pattern observed between the different estimates, and a similar analysis on a larger dataset would be worthwhile. Ideally, cancer registration data should be linked with census information to quantify the ethnicity misclassification as in the New Zealand Census Mortality Study. This analysis is currently underway at the Wellington School of Medicine (personal communication, Dr Martin Tobias, 2004) and will aid future ethnic analyses of breast cancer incidence.

Despite these limitations, this study represents the first time an analysis of cause-specific incidence and mortality has been performed in New Zealand using and comparing multiple methods of ethnicity adjustment. In addition, these estimates are the best available for age-specific Maori rates of breast cancer incidence and mortality, and they represent a significant advance in the quality of ethnicity data on which to base breast cancer screening policy and treatment interventions. The use of a Kaupapa Maori Research approach within a quantitative setting has provided new information that will guide the approach to future analyses of breast cancer data in Maori and non-Maori women.

In conclusion, NZCMS or ever Maori-adjusted breast cancer incidence and mortality estimates are the measures of choice for analysing Maori data. If unadjusted or NHI data have to be used, then the undercount of Maori in the data should be acknowledged. This paper reinforces the need to improve the collection and analysis of both sole and total ethnicity data in New Zealand so that Maori vs non-Maori disparities in breast cancer can be appropriately identified, monitored, and eventually eliminated.

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