



## Heart failure hospitalisations and deaths in New Zealand: patterns by deprivation and ethnicity

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### Abstract

**Aim** To examine the association between socioeconomic deprivation and heart failure outcomes in Maori and non-Maori New Zealanders.

**Methods** Retrospective analysis of heart failure mortality and hospital admissions among Maori and non-Maori aged 45 year and older assigned to small area deprivation (NZDep91/96) during the period 1988–1998.

**Results** Deprivation was associated with an increase in risk of heart failure deaths and hospitalisations for both Maori and non-Maori. Within all socioeconomic strata, this risk was higher for Maori than non-Maori.

**Conclusion** Socioeconomic deprivation was associated with an increased chance of death and hospitalisation from heart failure in New Zealand. Maori disparities in heart failure outcomes do not simply reflect differences in deprivation, however, and further studies are needed to explain the influence of other determinants such as lifecourse and lifestyle exposures, neighbourhood characteristics, access to medical care, and racism.

Heart failure is a debilitating and costly disease.<sup>1</sup> The aging of populations and enhanced survival of coronary heart disease patients in developed countries now means that heart failure is a significant public health concern. Indeed, it is the only major cardiovascular disease known to have an increasing prevalence.<sup>2</sup>

Although heart failure is a common disease, with high mortality and hospitalisation rates, very little was known of its extent in New Zealand (NZ) until relatively recently. Hospital admissions for heart failure increased by more than 50% between 1988 and 1997,<sup>3</sup> and were estimated to consume approximately 1% of the New Zealand health budget.<sup>4</sup> Even less was known of the socioeconomic and ethnic differences for heart failure outcomes. However, two studies have demonstrated that deprivation is positively associated with heart failure hospitalisation rates in New Zealand,<sup>5</sup> and that mortality and hospitalisation rates are up to eight times higher among Maori compared to non-Maori in the age group 45–64 years.<sup>6</sup>

This study examined the association between socioeconomic deprivation and heart failure outcomes in Maori and non-Maori New Zealanders for the period 1988–1998.

### Methods

Data on deaths (1988–1997), and public hospital discharges (1988–1998) with heart failure listed as a primary cause, were obtained from the New Zealand Health Information Service's (NZHIS) National Minimum Data Set (NMDS). Details of the International Classification of Diseases (ICD9) codes used in this study are presented in Table 1.

**Table 1. ICD9 classification of heart failure deaths/hospitalisations**

	ICD9 descriptor	ICD9 code
Primary diagnosis	Heart failure – ‘cause unspecified’	428
	Myocardial degeneration	429.1
	Cardiomegaly	429.3
	Hypertensive heart disease	402
	Primary cardiomyopathy	425.4
	Alcoholic cardiomyopathy	425.5
	Myocarditis	422 429 (except 429.1, 429.3)
	Other cardiomyopathy	425 (except 425.4, 425.5)

Source: International classification of diseases, 9<sup>th</sup> revision, 1989

The NMDS does not include a measure of socioeconomic position. However, domicile of residence is assigned to each record, which allows an area-based measure of deprivation to be derived. Using the meshblock code assigned by NZHIS, a NZ Index of Deprivation (NZDep) decile was assigned to each record. NZDep is a measure of small area deprivation, with decile one being the least deprived and decile ten the most deprived of small areas in New Zealand.<sup>7</sup>

Because Maori are under-represented in the least deprived deciles, deciles one to four were collapsed to improve statistical stability. This created seven NZDep strata (1–4, 5, 6, 7, 8, 9, 10) for comparison within this study. Data were split into the intervals 1988–1992 and 1993–1998 allowing for variation between the NZDep91 and NZDep96 indices.

The 1991 and 1996 census population distributions of over 45 year old people, by age group, sex, ethnicity, and NZDep91/96 strata were used as the denominators for the calculation of rates. Direct standardisation was used to assess the independent associations of ethnicity and small area deprivation with heart failure outcomes, and to control for age.<sup>8</sup> The total New Zealand population according to the 1991 and 1996 census populations were used as the external standards. In a sensitivity analysis, the total Maori population was also used as an external standard.

Age was measured at death or hospital discharge and presented as two groups: 45–64 years, and 65 years and older. The groupings were based on an examination of crude numbers within 10-year age groups and a judgement of lifestyles in relation to heart failure as a chronic disease.

For the classification of ethnicity, any record that included Maori in either the NMDS or NHI fields was identified as Maori. All remaining records, including those with no ethnicity specified, were classified as non-Maori. The rationale for this priority method of classification has been described previously.<sup>5,6</sup>

Poisson regression analysis was also used to determine the association between ethnicity and heart failure outcome after allowance for deprivation and age. All analyses were carried out using SAS version 8.0.

## Results

In total, 8079 heart failure deaths (1988–1997) and 66,416 heart failure hospitalisations (1988–1998) for people aged 45 years and older were recorded by the NMDS. Socioeconomic deprivation was significantly associated with a greater likelihood that the patient was Maori ( $p < 0.0001$ ).

Heart failure deaths and hospitalisations increased across deprivation strata. Overall, for an increase of one NZDep decile, there was an 11% increase in heart failure deaths ( $p < 0.01$ ) and hospitalisations ( $p < 0.0001$ ) (Table 2).

**Table 2. Poisson regression analysis of relative risk for increase of one NZDep decile**

Outcome	Relative risk	Confidence interval (95%)
Heart failure deaths	1.11	1.06–1.16
Heart failure hospitalisations	1.11	1.09–1.14

Source of base data: NZHIS.

Within deprivation strata, Maori mortality and hospitalisation rates were about four to five times higher than those of non-Maori aged 45–64 years, and twice those of non-Maori aged 65 years and older. Tables 3 and 4 show the Maori/non-Maori rate ratios and 95% confidence intervals for males by NZDep96.

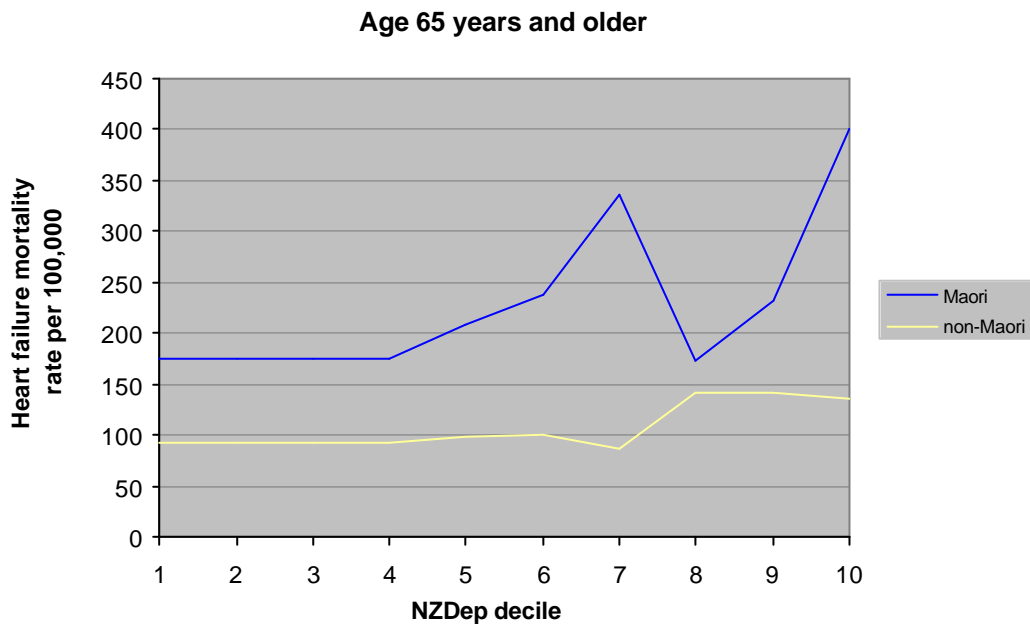
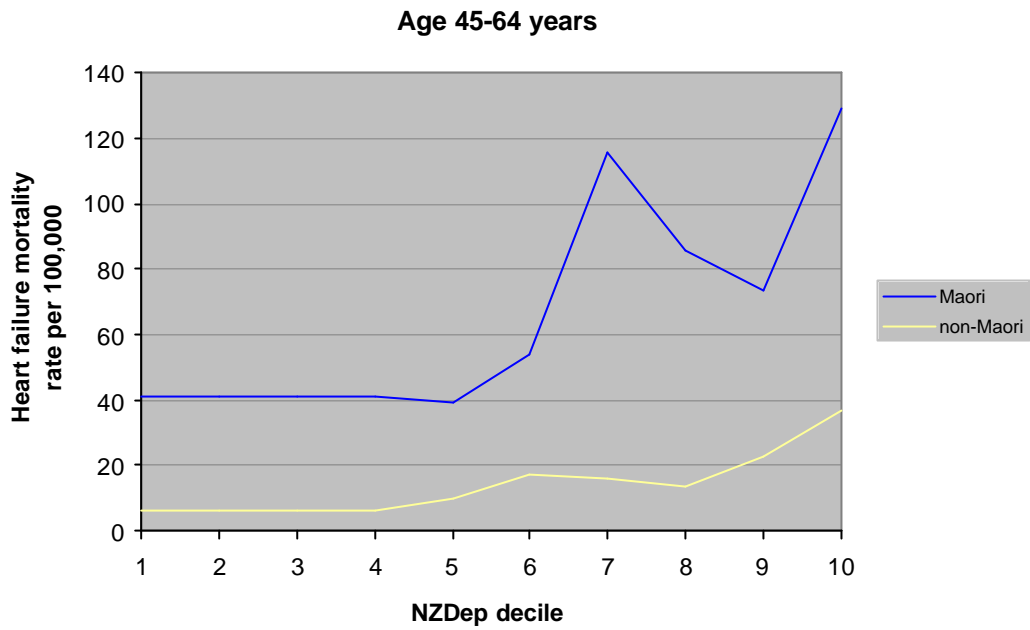
**Table 3. Maori and non-Maori male heart failure mortality rates and rate ratios by NZDep96, 1993–1997**

Age	NZDep96	Maori male rate (per 100,000)	Non-Maori male rate (per 100,000)	Rate ratio (Maori vs non-Maori)	Confidence interval (95%)
45–64 years	1–4	41.0	6.3	6.5	3.3–12.6
	5	39.0	9.7	4.0	1.3–12.1
	6	53.9	17.5	3.1	1.3–7.1
	7	115.8	15.9	7.3	3.9–13.5
	8	85.9	13.4	6.4	3.3–12.6
	9	73.2	23.0	3.2	1.8–5.7
	10	129.0	36.8	3.5	2.2–5.5
65+ years	1–4	174.5	92.0	1.9	1.0–3.6
	5	209.2	97.8	2.1	0.9–5.3
	6	237.6	99.9	2.4	0.9–6.2
	7	336.9	87.4	3.9	2.0–7.6
	8	173.9	142.4	1.2	0.5–2.7
	9	231.1	141.7	1.6	0.9–3.0
	10	401.0	135.3	3.0	1.9–4.6

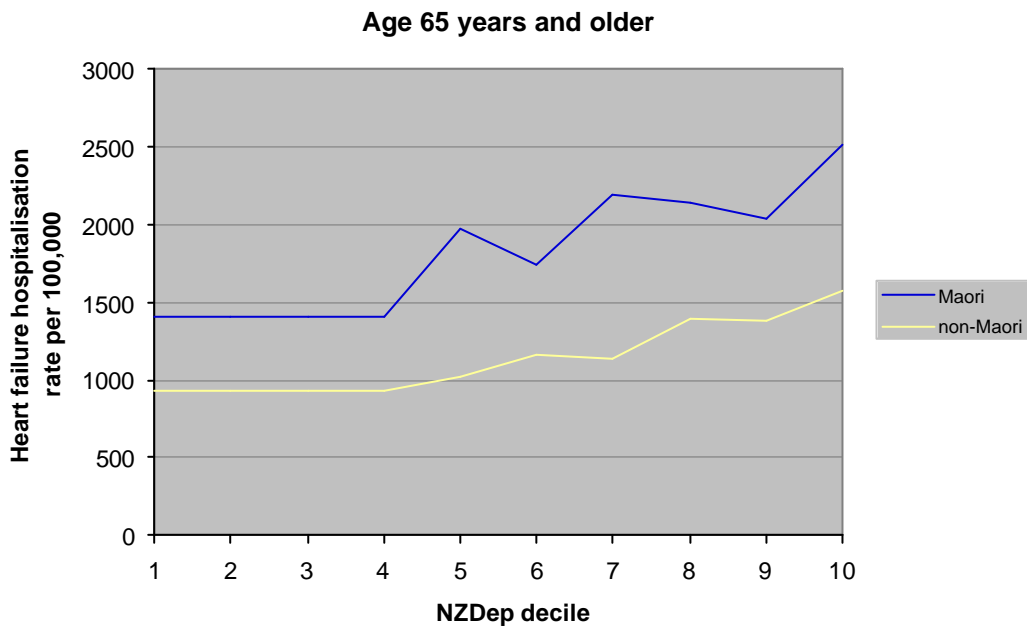
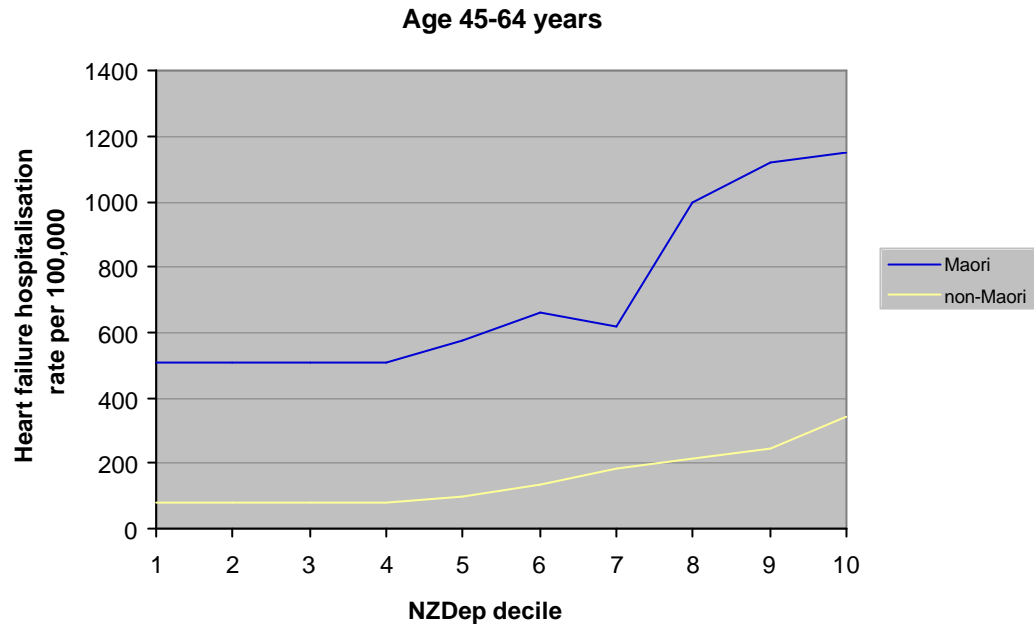
Source of base data: NZHIS. Note: rate per 100,000 per year, age-standardised to total New Zealand population.

Figures 1 and 2 are the graphical representation of these results. It is clear from the graphs that the relationship is not linear (probably due to small numbers). However, the age-standardised heart failure death and hospitalisation rates were higher for Maori compared to non-Maori.

**Figure 1. Heart failure mortality for males by NZDep96, ethnic and age group, 1993–1997**



**Figure 2. Heart failure hospitalisation for males by NZDep96, ethnic and age group, 1993–1998**



**Table 4. Maori and non-Maori male heart failure hospitalisation rates and rate ratios by NZDep96, 1993 - 98**

Age	NZDep96	Maori male rate (per 100,000)	Non-Maori male rate (per 100,000)	Rate ratio (Maori vs non-Maori)	Confidence interval (95%)
45–64 years	1–4	509.5	79.9	6.4	5.2–7.8
	5	575.0	101.3	5.7	4.1–7.9
	6	663.2	137.1	4.8	3.7–6.4
	7	619.8	186.1	3.3	2.6–4.3
	8	995.2	214.5	4.6	3.8–5.7
	9	1119.1	245.3	4.6	3.8–5.5
	10	1149.8	342.5	3.6	2.9–3.9
65+ years	1–4	1404.0	932.0	1.5	1.2–1.9
	5	1973.6	1014.0	1.9	1.4–2.8
	6	1737.2	1161.3	1.5	1.1–2.1
	7	2198.0	1139.1	1.9	1.5–2.5
	8	2137.5	1389.0	1.5	1.2–2.0
	9	2042.8	1378.6	1.5	1.2–1.8
	10	2509.1	1570.1	1.6	1.3–1.9

Source of base data: NZHIS. Note: rate per 100,000 per year, age-standardised to total New Zealand population.

## Discussion

This study has demonstrated that mortality and morbidity from heart failure in New Zealand has a social gradient. More deprived groups experience a greater burden of the disease. This is consistent with the findings of other studies<sup>5,9</sup>.

Importantly, what this study adds is that (within any given socioeconomic strata) Maori heart failure outcomes compare unfavourably with those of non-Maori. These differences were particularly marked in middle age (45–64 years). Specifically, Maori aged 45–64 years had four to five times the heart failure death and hospitalisation rate of non-Maori.

An excess of this magnitude clearly demonstrates that Maori experience worse heart failure outcomes that are independent of, and in addition to, those associated with deprivation. Thus, the associations evident in this study suggest that although deprivation is among the causes of excess heart failure mortality and morbidity for Maori in New Zealand, it does not in itself provide a full answer.

These results add to the already robust evidence of socioeconomic inequalities in cardiovascular disease. Previous studies suggest that systematic inequalities in the distribution of income, education, employment, housing, and health services are major determinants of cardiovascular disease inequalities.<sup>10–13</sup>

Several potential explanations for the differences in heart failure outcomes between Maori and non-Maori should be considered. One possibility is that the severity and/or underlying pathophysiology of heart failure differs between Maori and non-Maori. Maori are known to have a higher prevalence of diseases that predispose to heart failure such as hypertension, coronary artery disease, diabetes, and valvular disease.<sup>14,15</sup>

It is likely these diseases contribute to the early development of heart failure with greater end organ severity. However, while the aetiological profile of heart failure in Maori remains unknown this hypothesis is unproven. Indeed, pathologically it has been found that Maori do not exhibit a higher prevalence of cardiomyopathy post-myocardial infarction compared to European New Zealanders.<sup>16</sup>

A second plausible explanation for this finding may be that access to care and quality of care differs between Maori and non-Maori. Heart failure has been identified as a common condition that leads to 'avoidable hospitalisations'—hospitalisations that are potentially preventable by timely and effective health service interventions.<sup>17</sup> This is not a new concept in health research.<sup>12</sup> However, there is very little New Zealand evidence to substantiate or refute this hypothesis.

The interaction of socioeconomic position with ethnicity, and its association with cardiovascular health, is complex and not adequately understood. Socioeconomic and ethnic inequalities in health are the consequence of a lifetime of exposure to disadvantage.<sup>18</sup> These inequalities differentially shape population groups' exposures to cardiovascular disease risk factors (such as hypertension,<sup>19</sup> smoking,<sup>20</sup> physical activity,<sup>21</sup> and obesity<sup>22</sup>) and their access to and utilisation of health services.<sup>23</sup>

Neighbourhood influences may provide an additional pathway through which social structures shape cardiovascular disease risk exposure.<sup>24</sup> This is of interest within the New Zealand context where the impact of living in disenfranchised and impoverished communities impacts more on Maori than non-Maori New Zealanders.<sup>25</sup>

Racism has been described as the 'missing variable' within ethnic health disparities research.<sup>26</sup> Evidence of ethnic inequalities in health and health care are abundant, but their underlying causes, and especially the contribution of racism are controversial. Indeed, the health professions, governed by ethical codes of duty, find the charge of racism hard to bear.<sup>27</sup>

Finally, it is plausible that all of these explanations may contribute to the observed ethnic difference in heart failure outcomes in New Zealand.

Several problems related to the methods of this type of study have been described previously.<sup>28</sup> It was a retrospective study that used administrative datasets, and had the inherent limitations of this design. Thus, it was prone to confounding and its cross-sectional nature provided no basis for determining causal directionality.

Such studies are often criticised for expecting administrative data to provide more than they should.<sup>29</sup> Two sources of bias must be discussed. First, misclassification of ethnicity data leads to the under-enumeration of Maori within official health datasets. This in turn produces an under-estimation of Maori rates. Therefore, the rates calculated in this study are likely to be an underestimate of the true mortality and morbidity associated with Maori heart failure. At the same time, census data are known to undercount Maori, although modest undercounts of Maori in the census would be unlikely to have meaningfully changed the overall patterns observed in this study. Second, misclassification of ICD9 codes had the potential to contribute to bias within this study. If access to echocardiography is different for Maori compared with non-Maori, this could bias the diagnosis of heart failure and hence measurement of rates. Again the likely effect of this potential bias, if it existed, would have been to

underestimate the true mortality and morbidity associated with heart failure for Maori in this study.

Some other weaknesses are acknowledged. NZDep does not adequately capture lifecourse experience. Area-based measures may be less adequate than individual measures to control for socioeconomic confounding in analyses of ethnic differences in health.<sup>30</sup> Lastly, this study could not investigate clinical factors such as disease severity nor undertake an audit of medical records to confirm the accuracy of diagnosis.

In conclusion, this study demonstrates that socioeconomic deprivation is associated with an increased chance of death and hospitalisation from heart failure in New Zealand. Importantly, within socioeconomic strata, Maori disparities in heart failure outcomes persist. Clarification of the explanations for these results await more detailed studies—a call to action in the interim is required, however.

Specifically, a broad approach that includes structural interventions (such as social policy to address ethnic power relations and racism in New Zealand), social interventions (such as policy to increase Maori access to affordable and high quality housing) and health sector interventions (such as measures to increase Maori access to culturally competent health services and boost the Maori cardiovascular workforce) is required.

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