

Trends in ischaemic heart disease: patterns of hospitalisation and mortality rates differ by ethnicity (ANZACS-QI 21)

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ABSTRACT

AIM: To examine trends in ischaemic heart disease (IHD) events by ethnicity.

METHODS: All IHD deaths and hospitalisations from 2006–2015 were identified using individual-linkage of national hospitalisation and mortality data. Age-standardised IHD rates and average annual age-adjusted percent changes were estimated by ethnic group. Ratios of non-fatal to fatal events were calculated by dividing age-standardised hospitalisation by death rates.

RESULTS: IHD mortality rates declined by 3.1–5.4% per year for most groups, except Pacific women, who experienced a non-significant decline of 1.3% per year. IHD hospitalisation rates declined significantly by 3.6–8.8% per year in all groups. IHD mortality rates were highest in Māori and Pacific people, but hospitalisation rates highest in Indians. Indians also had the highest ratio of hospitalisations to deaths. For every person who died from IHD in 2014/15, 7–8 Indians, but only 3–4 Māori or Pacific people, were hospitalised with IHD.

CONCLUSION: Fatal and non-fatal IHD rates are declining in all groups, but Māori and Pacific people have disproportionately high rates of IHD mortality. The much lower ratio of IHD hospitalisations to deaths among Māori and Pacific people compared to others suggests there are still important barriers to preventive interventions and acute care for Māori and Pacific men and women.

Mortality rates from ischaemic heart disease (IHD) have been declining in New Zealand and throughout the industrialised world since the 1960s,¹ with age-adjusted mortality rates declining to less than one-third of their 1960s baseline by 2000.^{2,3} These declines have been attributed to rapid progress in the prevention and treatment of cardiovascular disease, including reductions in blood cholesterol and smoking prevalence, improvements in blood pressure control and the increasing use of revascularisation in the treatment of acute coronary syndromes.⁴

However, there are concerns that rising rates of obesity and diabetes may halt, or even reverse, these favourable trends in IHD.² Increases in body mass index (BMI) and diabetes prevalence have been implicated in recent slowdowns in the rates of decline of IHD mortality in young adults in the US, UK and Australia.^{5–7} New Zealand, however, has not yet observed this phenomenon in the total population: between 2005 and 2015 IHD event rates continued to decline in men and women of all ages.⁸ However, these trends have not been examined by ethnicity, even though

cardiovascular outcomes and the prevalence of obesity and diabetes is known to vary markedly by ethnic group. Māori, Pacific and Indian adults are known to be at increased risk of cardiovascular disease in New Zealand, with higher prevalence and hospitalisation rates compared to Europeans.^{9,10} Obesity rates are highest in Pacific (67%) and Māori (47%), intermediate in European (30%) and lowest in Asian (15%) adults;¹¹ however, it has been shown that Indians have similar body fat levels to those of Europeans with BMI levels 4–6 units higher, so relative obesity rates in Indians may be higher than official rates suggest.¹² Estimates of diabetes prevalence range from 5.9% for Europeans to 12.3% for Māori, 17.4% for Indians and 19.5% for Pacific people.¹³ It is possible that these ethnic differences in obesity and diabetes prevalence could result in differential rates of decline in IHD.

The aims of this study were therefore to: (1) investigate whether recent declines in IHD deaths and hospitalisations in New Zealand were experienced by all major ethnic groups, and (2) quantify the rate of change in fatal and non-fatal IHD events between 2006 and 2015 by ethnicity.

Methods

The study population included all New Zealand residents aged 35–84 years during the period 2006–2015. Over that time, the population in this age group increased from approximately 2.09 to 2.35 million. There is no standard age range for these types of analyses internationally; however, the upper age limit of 84 years was chosen because of concerns about the accuracy of diagnostic codes in the oldest age groups. Diagnostic uncertainty increases with age, particularly in the presence of multiple comorbidities.

IHD hospitalisation rates were estimated using discharge data for acute admissions from the National Minimum Dataset, a national collection of all ICD-10 coded public hospitalisation data.¹⁴ IHD death rates were estimated from the Mortality Collection, a national dataset classifying the underlying cause of death for all deaths registered in New Zealand.¹⁵ Both datasets used version ICD-10-AM (International Statistical Classification of Diseases and Related Health

Problems, Tenth Revision, Australian Modification). IHD events were identified using the ICD-10 codes I20-I25.

To ensure that differing rates of re-hospitalisation by ethnic group did not skew results, a per-person-per-year, rather than a per-event, analysis was conducted. Thus, even if re-admitted, a person only contributed once to the hospitalisation numerator for each year.

For those with multiple ethnic groups recorded, a prioritisation method, modified from that outlined in the recently revised Ministry of Health *Ethnicity Data Protocols*,¹⁶ was used to assign each individual to one ethnic group. Prioritisation occurred in the following order: Māori, Pacific, Indian, Other Asian, European/Other. There was one exception to this prioritisation process, and that was people recorded in the national datasets as belonging to both 'Fijian' and 'Indian' groups, who were categorised in these analyses as Indian rather than Pacific. The rationale for this decision came from previous analyses by our research group that have noted that people classified as both Fijian and Indian have cardiovascular risk profiles more consistent with those classified as Indians than other Pacific groups.¹⁷ Moreover, the revised *Ethnicity Data Protocols* report that there have been data quality issues with the collection, classification and recording of 'Fijian Indian', with some respondents and some providers choosing to alter collection forms or allow respondents to select 'Fijian' and 'Indian' separately.¹⁶

Denominators for the calculation of rates were obtained from ethnic group population projections (2015 update), produced by Statistics New Zealand according to assumptions specified by the Ministry of Health. These projections are available by five-year age group for the following four ethnic groups: Māori, Pacific (excluding Māori), Asian (excluding Māori and Pacific) and Other (total population excluding Māori, Pacific and Asian). The Other group is mostly comprised of New Zealand Europeans, with small numbers (approximately 1%) of people identified as Middle Eastern, Latin American or African. The population projections are based on the estimated resident population of each ethnic group

at 30 June 2013 and adjusted for census undercount due to various factors, such as non-response and residents temporarily overseas on census night.

Because Indians are not identified separately in the population projections, separate denominators for Indians and Other Asians were estimated using a customised dataset from Statistics New Zealand of the numbers of Indians and Other Asians in the 2006 and 2013 censuses. The proportion of the total Asian group that was Indian was calculated for 2006 and 2013 by five-year age group and sex, interpolated for the intervening years and extrapolated for the years 2014–2015. These proportions were then applied to the population projections for Asians.

Statistical analysis

The ethnic distribution of the male and female population aged 35–84 years and of IHD deaths and IHD/MI hospitalisations were compared for the years 2006/07 and 2014/15. Average annual event rates were calculated over each two-year period because of the small number of IHD deaths in some ethnic groups. Crude rates were age standardised, using five-year age groups, to the Projected New Zealand Population 2015 by the direct method (Supplementary Table 1). Age-standardised IHD hospitalisation rates were divided by age-standardised IHD mortality rates to estimate the ratio of non-fatal to fatal IHD events for each ethnic group. Because individuals were counted only once when calculating hospitalisation rates (regardless of how many times they were hospitalised each year), this ratio represented the number of people hospitalised with IHD for every IHD death.

Temporal trends in IHD death and hospitalisation rates were examined by sex and ethnic group using negative binomial regression, with year of admission (continuous variable) and five-year age group (categorical variable) as independent variables. Interactions between year and age group were tested for, but there was no evidence of an interaction effect. The results of the final models were summarised as age-adjusted annual percent changes in IHD

rates over the study period. Data analysis was performed using Stata SE statistical software version 13.0.¹⁸

Ethical approval

This analysis is part of the VIEW research programme, which receives annual ethical re-approvals from the Northern Region Ethics committee Y (original approval in 2003 [AKY/03/12/314]) and the Multi-Region Ethics Committee (original approvals in 2007 [MEC/01/19/EXP] and 2011 [MEC/11/EXP/078]). Individual patient consent is not required as all data are anonymised.

Results

Between 2006 and 2015, 145,929 New Zealand residents aged 35–84 years experienced at least one IHD hospitalisation and/or an IHD death. Ethnicity was not identified in 3,984 (2.7%) people. The number of men and women in the study population increased by 12.2% and 13.4% respectively between Year 1 and Year 10, but there was a steady decline in the number of people who experienced IHD events. The number of people hospitalised with IHD decreased from 21,311 in 2006 to 14,174 in 2015 (33.5% decline) and the number who died from IHD decreased from 3,624 to 2,820 (22.2% decline) over the same period.

Europeans accounted for almost 80% of the New Zealand population aged 35–84 years in 2006, but declined to approximately 75% in 2015 (Tables 1A and 1B). The four other ethnic groups all increased in size over this period, particularly the Indian and Other Asian groups. The mean age of Europeans was almost 57 years, approximately five years older than other ethnic groups. Māori and Pacific people were over-represented for IHD hospitalisations and deaths except for hospitalisations among Māori men. In contrast, Indians were over-represented for IHD hospitalisations but under-represented for mortality while Other Asians were under-represented for both hospitalisations and deaths. The European ethnic group were under-represented for deaths but their IHD hospitalisations were in proportion to their population size.

Table 1A: Proportions of the population, of IHD deaths, and of those hospitalised with IHD, in each ethnic group for men, 2006/07 and 2014/15.

Year		Māori	Pacific	Indian	Other Asian	European	Total*
2006/07	% of NZ population 35–84y	9.7%	4.2%	2.4%	4.8%	78.9%	2,030,425
	% of IHD deaths	12.5%	4.1%	1.2%	0.8%	72.3%	4,621
	% of hospitalised with IHD	9.8%	3.6%	2.7%	1.5%	80.2%	25,460
2014/15	% of NZ population 35–84y	10.5%	4.6%	3.5%	6.3%	75.1%	2,238,730
	% of IHD deaths	14.1%	5.5%	2.2%	1.2%	72.1%	3,778
	% of hospitalised with IHD	10.1%	5.3%	4.2%	2.5%	76.0%	18,513
Mean age of population 35–84y 2014/15		52.1y	51.6y	50.7y	52.3y	56.7y	

Table 1B: Proportions of the population, of IHD deaths, and of those hospitalised with IHD, in each ethnic group for women, 2006/07 and 2014/15.

Year		Māori	Pacific	Indian	Other Asian	European	Total*
2006/07	% of NZ population 35–84y	10.0%	4.2%	2.1%	5.7%	77.8%	2,179,490
	% of IHD deaths	11.3%	3.6%	1.0%	0.6%	77.1%	2,510
	% of hospitalised with IHD	12.0%	3.9%	1.8%	1.3%	79.4%	16,891
2014/15	% of NZ population 35–84y	11.2%	4.6%	3.1%	7.6%	73.5%	2,428,175
	% of IHD deaths	15.9%	6.4%	1.8%	1.2%	71.7%	1,932
	% of hospitalised with IHD	13.7%	5.2%	3.2%	2.4%	74.4%	10,192
Mean age of population 35–84y 2014/15		52.1y	52.0y	50.6y	52.1y	56.9y	

*Over two-year period.

Figures 1–2 show age-standardised IHD hospitalisation and death rates in men and women. Over the 10-year study period, there was a steady decline in IHD rates in men of all ethnic groups. Indian men had the highest hospitalisation rates (1,414 per 100,000 in 2014/15), followed by Pacific (1,243) and Māori men (996), while European (779) and Asian (416) men had the lowest IHD hospitalisation rates. Mortality rates, on the other hand, were consistently highest among Māori men (337 per 100,000 in 2014/15), followed by Pacific (292), Indian (197), European (149) and Other Asian (48) men.

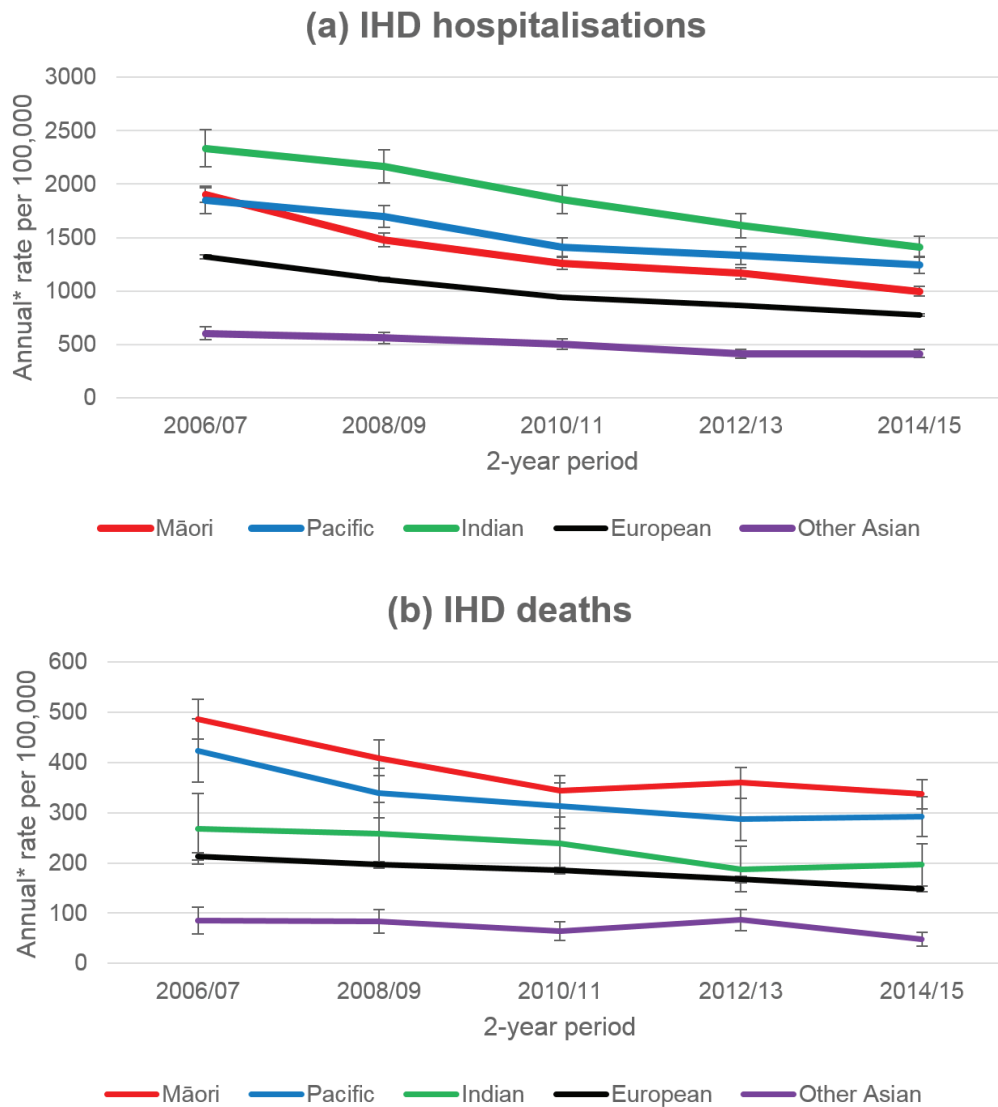
IHD hospitalisation rates among women were highest among Indians (706 per 100,000 in 2014/15), followed by Māori (644), Pacific (624), European (376) and Asian (211) women. Mortality rates showed a consistent decline in almost all women over this period, with the exception of Pacific women. In a pattern similar to men, Māori women had the highest IHD mortality rates (177

per 100,000 in 2014/15), followed by Pacific (171), Indian (87), European (65) and Other Asian (25) women. In 2014/15, age-standardised IHD mortality rates in Māori and Pacific women were more than twice the rate for European women.

Table 2 shows the number of people hospitalised with IHD for each IHD death that occurred in 2006/07 and 2014/15 by ethnicity. Indian and Other Asian men and women had the highest ratio of hospitalisations to deaths (7.2–8.6 IHD hospitalisations for every IHD death in 2014/15), followed by European women (5.8:1), European men (6.2:1), Pacific men (4.4:1), Māori and Pacific women (3.6–3.8:1) and Māori men (3.0:1).

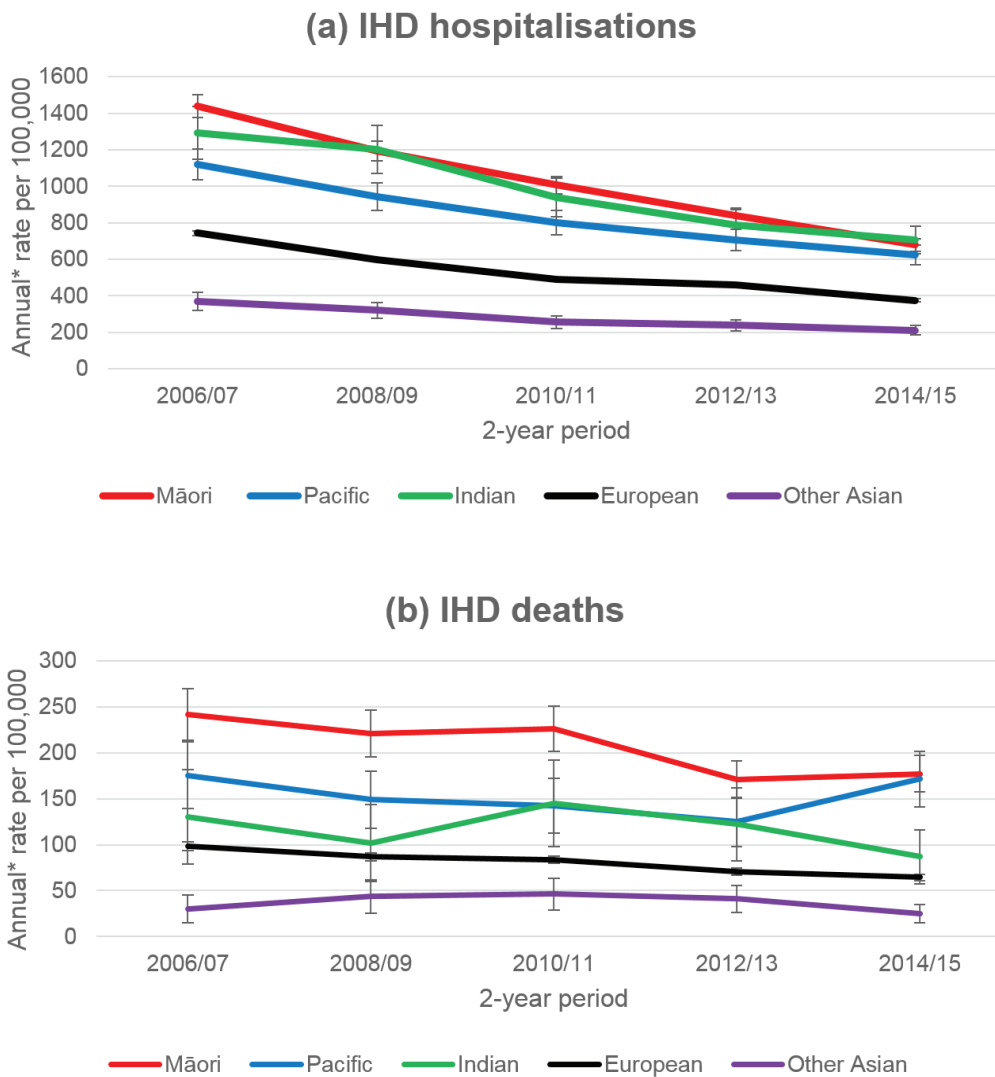
Table 3 shows age-adjusted annual percent changes in IHD deaths and hospitalisations by sex and ethnic group between 2006/07 and 2014/15. Annual declines in IHD deaths were highest among Māori and Indian men (5.0% and 4.9%, respectively) and Indian, European and Māori women (5.4%, 5.0%

Figure 1: Age-standardised* IHD (a) Hospitalisation and (b) Death Rates in Men aged 35–84y, by ethnic group, 2006–2015.



*Rates averaged over a two-year period and age-standardised to the Projected New Zealand Population 2015. Error bars denote 95% confidence intervals.

Figure 2: Age-standardised* IHD (a) Hospitalisation and (b) Death Rates in Women aged 35–84y, by ethnic group, 2006–2015.



*Rates averaged over a two-year period and age-standardised to the Projected New Zealand Population 2015.

Table 2: Number of people hospitalised with IHD for each IHD death that occurred, 2006/07 and 2014/15.*

Sex	Ethnic group	2006/07	2014/15
Men	Māori	3.9	3.0
	Pacific	4.4	4.3
	Indian	8.7	7.2
	Other Asian	7.1	8.6
	European	6.2	5.2
Women	Māori	6.0	3.8
	Pacific	6.4	3.6
	Indian	10.0	8.1
	Other Asian	12.3	8.4
	European	7.5	5.8

*Calculated by dividing age-standardised IHD hospitalisation rates by age-standardised IHD death rates.

Table 3: Age-adjusted* annual percent changes (95% confidence intervals) in IHD deaths and hospitalisations between 2006/07 and 2014/15 for men and women, by ethnic group.

Sex	Ethnic group	IHD deaths	IHD hospitalisations
Men	Māori	-5.0% (-3.8 to -6.3%)	-7.2% (-6.6 to -7.8%)
	Pacific	-3.1% (-0.9 to -5.2%)	-3.6% (-2.6 to -4.5%)
	Indian	-4.9% (-1.4 to -8.3%)	-5.7% (-4.6 to -6.8%)
	Other Asian	-4.7% (-0.4 to -8.7%)	-4.0% (-2.3 to -5.6%)
	European	-4.3% (-3.7 to -4.9%)	-6.1% (-5.7 to -6.5%)
Women	Māori	-4.5% (-2.8 to -6.2%)	-8.8% (-8.1 to -9.5%)
	Pacific	-1.3% (-4.4 to +1.8%)	-6.3% (-5.1 to -7.6%)
	Indian	-5.4% (-0.1 to -10.4%)	-7.9% (-6.3 to -9.5%)
	Other Asian	-3.1% (-9.0% to +3.2%)	-6.3% (-4.4 to -8.2%)
	European	-5.0% (-4.2% to -5.8%)	-8.1% (-7.8 to -8.4%)

*Negative binomial regression performed using five-year age bands.

and 4.5%, respectively). Pacific women had the lowest annual rate of decline in IHD mortality (1.3%). Larger declines were observed for IHD hospitalisations, with women of all ethnic groups and Māori and European men experiencing annual declines in age-adjusted mortality exceeding 6%. Pacific men had the slowest rate of decline in IHD hospitalisations, at 3.6% per year.

Discussion

To our knowledge, this is the first study to examine recent IHD trends at a country-wide level by ethnicity. Between 2006 and 2015, IHD deaths and hospitalisations declined in all main ethnic groups and in both sexes. There were no clear differences in pattern of decline by ethnicity with the possible exception of smaller declines among Pacific people, particularly IHD deaths in Pacific women. Among both men and women, IHD mortality rates were highest in Māori and Pacific people, intermediate in Indians, and lowest in Europeans and Other Asians. However, IHD hospitalisation rates were highest in Indians, who also had high age-standardised IHD hospitalisation to IHD death rate ratios. For every Indian man or woman that died from IHD in 2014/15, approximately seven Indian men and eight Indian women were hospitalised with IHD. In contrast, for every Māori or Pacific man or woman who died from IHD in 2014/15, approximately three or four people were hospitalised.

The sustained decline in IHD deaths and hospitalisations in all ethnic groups is encouraging and likely due to continued improvements in the acute and long-term management of coronary disease as well as favourable risk factor trends, such as for smoking and blood cholesterol.^{19,20} The slower declines in IHD among Pacific people, however, needs to be monitored carefully, especially in light of the high and increasing rates of overweight and obesity in this population group.^{11,21} Our finding of a small and statistically non-significant decline in IHD mortality in Pacific women is consistent with other New Zealand studies that have noted slower declines in stroke and all-cause mortality among Pacific people over a similar time period.^{22,23}

Marked ethnic disparities in IHD mortality continue to be a cause for concern. Age-standardised IHD mortality rates for Māori and Pacific people are more than twice as high as those for Europeans, and the even lower rates among the Other Asian population indicate what could be possible for all groups if socioeconomic determinants of health and preventive and treatment strategies were optimised. As well as obesity, smoking is known to be a key contributor to health loss in New Zealand,²⁴ and smoking prevalence is substantially lower among Asian and European New Zealanders. Smoking rates have been less than 10% for Asian New Zealanders since 2006 and 15% for Europeans since 2011.²⁰ By contrast, an

estimated 38% of Māori and 25% of Pacific people are current smokers.¹¹

Our study also highlights a potential problem with differential access to care in different ethnic groups, as reflected in the markedly lower ratios of hospitalisations to deaths in Māori and Pacific men and women. Previous studies have noted a discrepancy between IHD mortality and hospitalisation rates for Māori, concluding that despite high need, Māori receive relatively poor access to appropriate care for IHD.^{25,26} Our study confirms these previous observations, and assuming that the ratio of non-fatal to fatal IHD events should be relatively constant across different incidence rates, suggests that access to care is an important issue for both Māori and Pacific people. These findings are consistent with studies that have shown lower rates of revascularisation and higher rates of out-of-hospital IHD deaths in Māori and Pacific people.^{27–29}

Māori and Pacific people are significantly more likely to report unmet need for primary care than people from other ethnic groups, with one in five citing the cost of a general practitioner as a major barrier.¹¹ Māori and Pacific patients suffering from an acute coronary syndrome were less likely to call an ambulance in a South Auckland study, a factor which contributed to greater delays to acute care.³⁰ Transport by ambulance is associated with a significant cost (~\$100) to the patient. Māori are also less likely to report having a positive experience of care in hospital.³¹ Other barriers to healthcare for Māori and Pacific people include: transport, availability of appointments, previous poor experiences, costs, perceptions of negative or racist health provider attitudes, and language and cultural fit barriers, such as a preference for Māori or Pacific clinicians or a lack of cultural competency.^{32,33} Strategies to overcome these barriers should therefore focus on increasing the availability of public and/or private transport, extending opening hours, operating flexible and accommodating approaches to appointment times, increasing the Māori and Pacific health workforce and supporting cultural competence across the entire health services workforce.³³

Limitations

While data-linkage is a powerful way to examine event rates on a large scale, there are also associated limitations. First, analyses were reliant on the accuracy and validity of routinely collected data

through which IHD events were identified using ICD-10 codes. Studies from several European countries have reported high sensitivity and positive predictive values for ICD-coded IHD events in national datasets,³⁴ but there are no published validation studies over a contemporary period in New Zealand. Our group have compared ACS diagnoses in hospitalisation data with a clinical registry and found 95% agreement (unpublished data). Second, our analyses are unlikely to have captured all non-fatal IHD events, as some people will have been undiagnosed or treated in the community. Third, because of the way ethnicity is currently coded in the national datasets, Indians are able to be identified as a separate group, but not the small number of other people identifying with other South Asian groups (eg, Pakistani, Bangladeshi), who are also at increased cardiovascular risk. In these analyses, therefore, other South Asian groups are included as ‘Other Asians’, rather than Indian.

Fourth, denominators for the Indian and Other Asian populations were not readily available using Ministry of Health population projections (only ‘total Asian’ numbers are published). We therefore derived Indian and Other Asian denominators by calculating the proportions of the total Asian group that were Indian in the 2006 and 2013 census and linearly interpolating and extrapolating these proportions for each sex and five-year age group. We believe this method is valid because there is no reason to believe that there were any differences in the proportions of Indians and Other Asians represented on the Census nights. Indeed, because Indians represented approximately one-third of all Asians, it was very important to calculate their rates of IHD separately, as the extremely low rates of IHD in the total Asian group would have masked the high risk experienced by Indians.

Conclusions

IHD death and hospitalisation rates continue to decline in all ethnic groups in New Zealand, but the decline in mortality was slowest in Pacific people, particularly Pacific women. Māori and Pacific people also have disproportionately high rates of IHD mortality compared to hospitalisations, suggesting poor access to care. More effective strategies are required to improve both access to CVD prevention and to acute care for these population groups.

Appendix

Supplementary Table 1: Standard Population used for age standardisation.

Projected New Zealand Population 2015 (35-84 years)		
Age group	Number	% of population
35-39	274,950	11.68
40-44	310,120	13.17
45-49	314,425	13.35
50-54	319,175	13.55
55-59	287,985	12.23
60-64	251,080	10.66
65-69	226,430	9.62
70-74	165,555	7.03
75-79	120,835	5.13
80-84	84,150	3.57
Total	2,354,705	99.99

Note: Because of the very low number of IHD deaths in the younger age groups, age standardisation was performed based on the following three age groups: 35-64y, 65-74y, 75-84y.

Competing interests:

CG has been the recipient of a Health Research Council Clinical Research Training Fellowship and a National Heart Foundation Research Fellowship. SW has received a grant from the Stevenson Foundation during the conduct of the study and grants from Roche Diagnostics Ltd and the National Heart Foundation outside of the submitted work. KP holds the National Heart Foundation Hynds Senior Fellowship. This research is part of the VIEW research programme, which is funded by the Health Research Council.

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