

# Half a century of declining acute coronary syndrome incidence is ending and ethnic inequity is rising: ANZACS-QI 88

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## ABSTRACT

**AIMS:** Despite dramatic declines in coronary heart disease (CHD) incidence in Aotearoa New Zealand over more than 50 years, the burden of CHD is still inequitable, particularly for Māori and Pacific peoples. We studied recent trends in first hospitalisations for acute coronary syndromes (ACS) by ethnicity.

**METHODS:** All first ACS hospitalisations (2005–2019) were identified from national administrative datasets. Population denominators were constructed using multiple linked national data sources. Trends in rates of incident ACS and incidence rate ratios (IRRs) were analysed for younger (20–59 years) and older (60–84 years) patients.

**RESULTS:** The ACS cohort (n=69,161) comprised 74.7% European, 14.2% Māori, 6.1% Pacific peoples, 2.8% Indian and 2.2% non-Indian Asian peoples. For younger patients, annual ACS incidence initially decreased in all ethnic groups but plateaued between 2013 and 2015 for Māori, non-Indian Asians and Europeans; the decline was minimal for Pacific peoples across the time period. In older patients ACS incidence initially fell for all groups, but plateaued for Māori from 2015, and slowed after 2014 for Europeans. IRRs, compared with Europeans, increased between 2005 and 2019 for younger Māori (IRR 1.5 to 2.25, p=0.017) and Pacific peoples (IRR 1.25 to 1.5, p<0.001), and for older Māori (IRR 1.35 to 1.6, p=0.006) and Pacific peoples (IRR 1.0 to 1.6, p<0.001).

**CONCLUSION:** Rates of decline in ACS incidence have stalled or slowed for most younger ethnic groups, and for older Māori and Europeans. The differential rate of change between ethnic groups has resulted in increasing inequity for Māori and Pacific peoples across the age range.

The dramatic reduction in the burden of coronary heart disease (CHD) over the past 60 years is a public health success story.<sup>1,2</sup> The decline is attributable to improvements across the spectrum of primary and secondary prevention.<sup>3–5</sup> However, in Aotearoa New Zealand, reports demonstrate a persisting inequitable burden of CHD experienced by Māori and Pacific peoples compared with European people.<sup>6,7</sup> To achieve equity, the rates of CHD for Māori and Pacific peoples will need to continue to fall and converge with the European rates.<sup>8</sup> Hospitalisation for an acute coronary syndrome (ACS) is the most clinically important, common and discrete first presentation of CHD,<sup>9</sup> making it a sensitive early indicator of change in CHD trends. A prior study in Aotearoa New Zealand showed ACS incidence continuing to fall until 2015, but data for separate ethnic groups were unavailable.<sup>10</sup> The aim of this study is therefore to study trends in first hospitalisations for ACS

between 2005 and 2019 for each major ethnic group.

## Methods

In Aotearoa New Zealand, everyone in contact with the public health system (>98% of the population) has a unique identifier (the National Health Index [NHI]). The NHI can be used to link individuals across multiple national health datasets, enabling the tracking of a person's journey through the health system until death. This made it possible to examine trends in first hospitalised ACS events for all New Zealanders, excluding people with any record for previous hospitalised CHD.

## Ethnicity

The NHI records up to three ethnicities for each person. For the purposes of this study, people with more than one recorded ethnicity were allocated to a single ethnic group using a modified

version of the prioritisation process outlined in the Health Information Standards Organisation Ethnicity Data Protocols.<sup>11</sup> Those coded as both Fijian and Indian were categorised as Indian based on prior work showing the CVD risk profiles for Fijian Indian people were more closely related to Indian than to Pacific peoples.<sup>12</sup> The ethnic groups in order of prioritisation were: Māori, Pacific, Indian, Chinese, Other Asian, and European, with the Chinese and Other Asian groupings combined into “non-Indian Asian” peoples for these analyses due to small numbers of ACS events. Of note, the CHD and ACS burden is likely to be similar among Indian and other South Asian communities in Aotearoa New Zealand based on international evidence. However, Indian people (who comprise around 90% of South Asians nationally) are currently the only South Asian subpopulation that can be identified in routinely collected health data based on national ethnicity data protocols in use during the study period, so South Asian peoples other than Indians were included in the non-Indian Asian grouping. There were 1,059 (1.5% of total) people of other ethnicities (including Middle Eastern, Latin American and African peoples) who are not reported in this study because numbers were insufficient to perform meaningful trend analyses.

### Establishment of the study annual denominator populations

Individual-level population denominators (in age bands) for each ethnic group were derived from annual health contact populations between 2005 and 2019 constructed using multiple NHI-linked national health data sources. To be included in the denominator for a calendar year, an individual had to be aged 20 to <85 years, have had contact with the health system in that calendar year as shown by an entry in one of the national health datasets listed below and have had no prior recorded primary- or secondary-coded CHD hospitalisation or coronary intervention since 1990. The national health datasets used to determine the denominators were: primary health organisation enrolment, primary care reimbursement (to capture primary care visits by non-enrolled patients), community laboratory requests, community pharmaceutical dispensing, hospitalisations, outpatient visits and mortality.<sup>13</sup> The vast majority of people in the health contact populations were identified from the primary health organisation enrolment data-

set. New Zealand residents are expected to actively re-enrol with a primary health organisation every 3 years and were defined as being in contact with the health system in a specified calendar year if they had re-enrolled in that year or in the previous 2 years. Linked hospital records were available from 1990, enabling a look-back period of at least 15 years (before the 2005 study start date) to exclude people with prior CHD hospitalisations.

### Identification of incident cases (numerators)

Numerators for calculating annual hospitalisation rates from 2005 to 2019 included people within a specified year's denominator who had a first ever (since 1990) ACS hospitalisation in a public hospital during that year. A person could only be recorded in the numerator once during the entire 15-year study period, as after their first event they were no longer eligible to be in either the numerator or denominator for the remainder of the study period. ACS hospitalisations were defined as those where the primary or secondary discharge diagnosis included the relevant ICD-10AM (International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification) codes. The ACS outcome combined ST-elevation myocardial infarction (MI) (I21.0–I21.3, I22.0–I22.9), non-ST-elevation MI (I21.4), unstable angina (UA) (I20.0) and unspecified MI (I21.9). It was not necessary to include private hospital data in the numerator as virtually all ACS admissions in Aotearoa New Zealand are to public hospitals.

### Statistical analysis

First ACS hospitalisation rates were calculated for each calendar year and were stratified by ethnicity. In prior analyses we found that the recent plateauing of CHD incidence was most pronounced in younger people.<sup>14</sup> Based on these prior analyses, two age categories were chosen for this study: 20–59 years and 60–84 years. Individuals younger than 20 years and aged 85 years or older were excluded. The upper age limit was applied due to uncertainty regarding the accuracy of capture of ACS diagnoses in the very elderly due to the increasing complexity of comorbidity and concern that ACS events may have been missed in hospital or not recognised in the community and referred to hospital.

To obtain annual hospitalisation rates, the numerator for each calendar year was divided by the respective denominator and additionally

split into quarters for time series modelling. Plots showing the temporal trend of ACS hospitalisation rates by ethnicity and age were then examined and analysed using piecewise linear regression (joinpoint regression) to investigate statistically significant changes in the trend over time.<sup>15</sup> The time series demonstrated heteroscedasticity (non-constant variance), including seasonal variation, so log transformation was used to reduce the variation. Transformation also meant changes in incidence rates could be reported as relative changes, rather than absolute changes. Model assumptions, including the absence of significant autocorrelation, were assessed to validate the results.

The Davies' test was used to assess any potential change points in the regression by comparing the slope after a time break to the slope preceding that time break. If the Davies' test was statistically significant ( $p < 0.05$ ), the change in slope was significant and the change point was retained in the model. For  $p$ -values between 0.05 and 0.10, the time break was similarly included if the change of slope made sense visually, i.e., by looking at the plot. What appeared to be time breaks within five quarters of the start or end of the series were not included as insufficient data were present to assess the validity of the change. Time breaks that were not whole numbers were rounded to the nearest quarter. The slopes of trends are represented by the coefficients of the model, and a plateau in the trend was defined when the slope after (or potentially before) a significant change point had a slope that was not statistically significantly different from zero. Where a time break was identified, slope 1 describes the annual percent change (APC) in rates prior to the change, and slope 2 describes the APC after the change. When no time break was identified, the slope over the entire period was obtained using linear regression on the log-transformed data.

When displaying trends graphically the quarters were combined to display annual rates. To compare ethnic-specific trends, relative differences expressed as the ratio of incident ACS hospitalisation rates (incidence rate ratio [IRR]) were calculated for each age-ethnicity sub-group per quarter using Europeans as the reference group. Temporal trends in quarterly IRRs were analysed using Mann-Kendall trend analysis. For graphical display the quarterly IRRs were combined into annual IRRs. RStudio version 1.2.5033 and the "segmented" package were used for analyses.

## Ethics

This is an Aotearoa New Zealand All Cardiology Services Quality Improvement (ANZACS QI) sub-study. ANZACS-QI is part of the wider Vascular Risk Equity in Aotearoa New Zealand (VAREANZ) study. This study was originally approved by the Northern Region Ethics Committee Y in 2003 (AKY/03/12/314), with subsequent approval by the National Multi-region Ethics Committee in 2007 (MEC07/19/EXP) as well as annual re-approval since as part of a vascular research programme (2022 EXP 13442). Individual patient consent is not required as all data were de-identified at source.

## Results

Between 2005 and 2019 there were 69,161 people admitted with a first ACS hospitalisation, 29.3% of whom were under 60 years of age (Table 1). The ACS cohort comprised 51,638 (74.7%) European, 9,853 (14.2%) Māori, 4,205 (6.1%) Pacific, 1,932 (2.8%) Indian and 1,533 (2.2%) non-Indian Asian people. The proportion of ACS events that occurred in those under 60 years was higher for Māori (50.7%), Pacific (45.2%) and Indian people (45.4%) than for European (23.3%) or non-Indian Asian (32.9%) people. Over the time period Māori and Pacific people comprised 14.5% and 6.8% of the population aged 20–59 years but experienced 24.6% and 9.4% of the incident ACS events, respectively. For those aged 60–84 years, Māori and Pacific people comprised 6.6% and 3.5% of the population but had 9.9% and 4.7% of events. In contrast, European people aged 20–59 years comprised 66.2% of the population and had 59.2% of the ACS events: those aged 60–84 years comprised 82.9% and had 81.1% of the events.

Temporal trends in incident ACS hospitalisations by ethnic group are shown in Figure 1, Table 2, and Appendix Table 1a and 1b. Figure 2 shows the IRRs for each ethnic group relative to the rate for European people.

### Younger age group (20–59 years)

The annual rate of first ACS hospitalisations decreased in all ethnic groups over the first part of the period, but the rates plateaued between 2013 and 2015 for Māori, Other Asians and Europeans. For Indian and Pacific people the incidence rate continued to decline across the time period but more steeply for Indian (APC –8.2%) than for Pacific people (APC –2.1%). Prior to plateauing, the APC was –6.2% for Māori, –9.3% for non-Indian Asian and –5.0% for European people.

**Table 1:** Number (row %; col %) of first acute coronary syndrome hospitalisations in Aotearoa New Zealand between 2005 and 2019, stratified by ethnicity and age group.

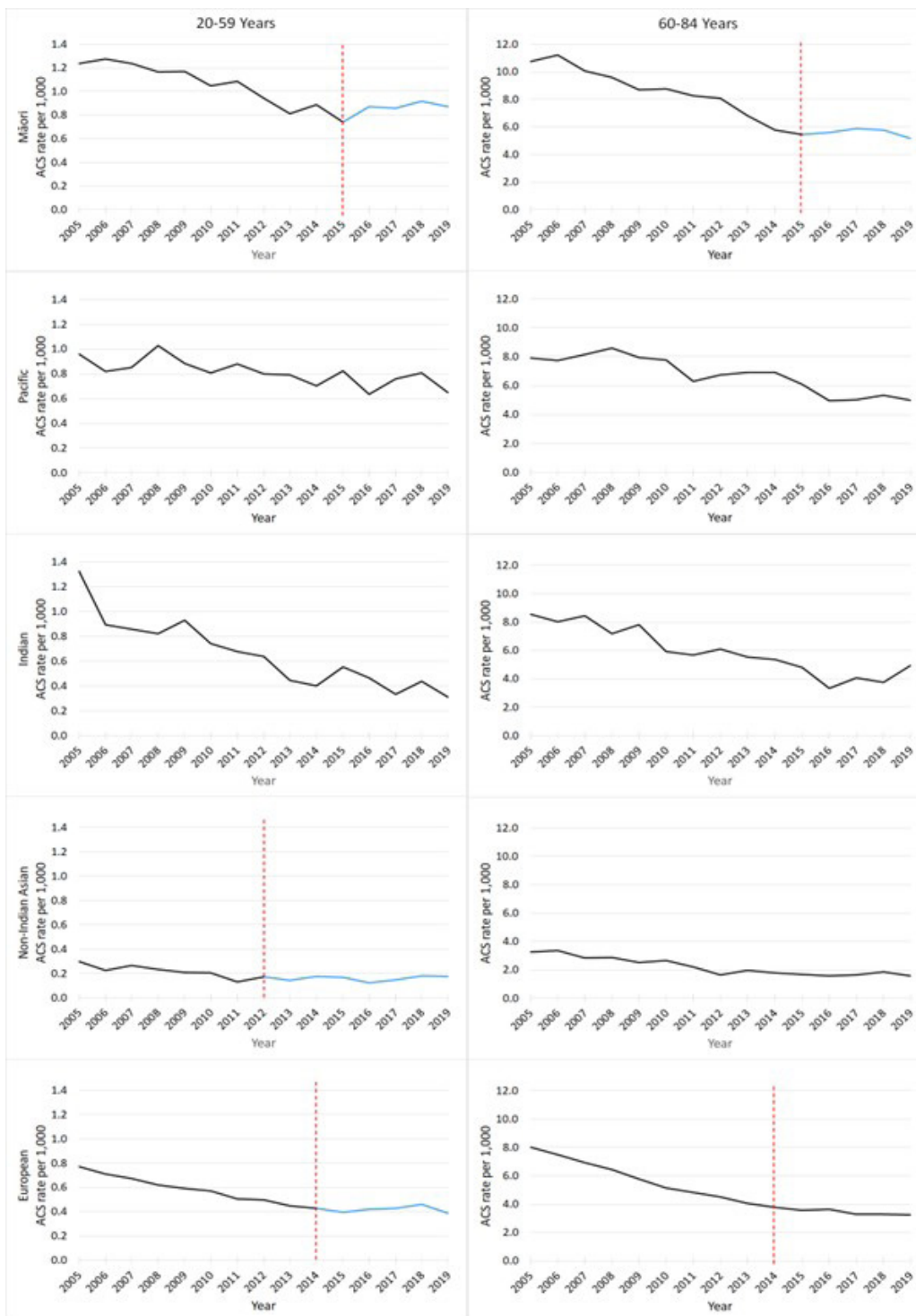
Ethnicity	Age group, years		Total (col %)
	20–59	60–84	
Māori	4,998 (50.7%; 24.6%)	4,855 (49.3%; 9.9%)	9,853 (14.2%)
Pacific peoples	1,899 (45.2%; 9.4%)	2,306 (54.8%; 4.7%)	4,205 (6.1%)
Indian	878 (45.4%; 4.3%)	1,054 (54.6%; 2.2%)	1,932 (2.8%)
Non-Indian Asian peoples	505 (32.9%; 2.5%)	1,028 (67.1%; 2.1%)	1,533 (2.2%)
European	12,009 (23.3%; 59.2%)	39,629 (76.7%; 81.1%)	51,638 (74.7%)
<b>Total (row %)</b>	<b>20,289 (29.3%)</b>	<b>48,872 (70.7%)</b>	<b>69,161</b>

**Table 2:** Acute coronary syndrome trends 2005–2019 by age and ethnicity.

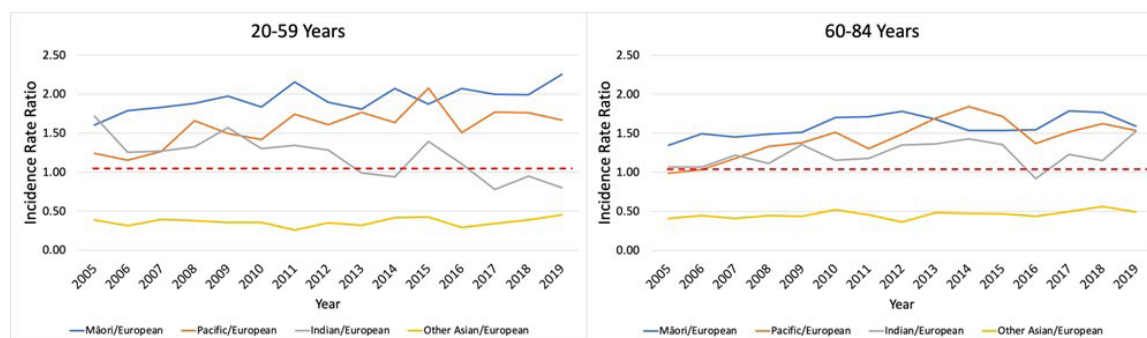
Ethnicity	Time break	Davies' test p-value	Slope(s) Annual % change	95% confidence interval
<b>20–59 years</b>				
Māori	Q2 2015	0.0009	-4.97% +2.74%	(-6.11%--3.82%) (-1.12%+6.74%)
Pacific peoples	N/A	–	-2.08%	(-3.10%--1.06%)
Indian	N/A	–	-8.23%	(-9.84%--6.59%)
Non-Indian Asian peoples	Q1 2012	0.0279	-9.27% +1.71%	(-13.82%--4.47%) (-3.39%+7.08%)
European	Q4 2014	<.001	-6.24% +0.14%	(-7.07%--5.41%) (-2.35%+2.70%)
<b>60–84 years</b>				
Māori	Q3 2015	0.0703	-6.63% -1.77%	(-7.65%--5.60%) (-5.54%+2.15%)
Pacific peoples	N/A	–	-3.86%	(-4.82%--2.89%)
Indian	N/A	–	-5.73%	(-7.00%--4.44%)
Non-Indian Asian peoples	N/A	–	-5.28%	(-6.98%--3.54%)
European	Q4 2014	<.001	-8.20% -2.72%	(-8.68%--7.71%) (-4.17%--1.25%)

The Davies' test p-value tests the statistical significance of a change of slope at the time break; only time breaks with  $p < 0.1$  are shown. When a time break is identified, the first slope is the annual percent change (APC) prior to the time break, and the second slope the APC after the time break.

**Figure 1:** Temporal trends in acute coronary syndrome incidence by ethnicity. Trends before or after each time break (red dotted line) are decreasing (black line) or flat (not statistically significant from zero—blue line).



**Figure 2:** Temporal trends in annual rate ratios of acute coronary syndrome incidence for each ethnic group relative to European incidence rates.



Incidence rates had plateaued by 2015 for Māori at 0.9/1,000, by 2014 for Europeans at 0.4/1,000 and by 2012 for Other Asians at 0.2/1,000. Despite an ongoing minimal decline, the incidence rates for Pacific people remained relatively high in 2018–2019 (0.6–0.8/1,000). For Indian people, rates had declined to 0.3–0.4/1,000 in 2018–2019.

IRRs compared with European people increased between 2005 and 2019 for Māori (IRR 1.5 to 2.25,  $p=0.017$  for trend) and Pacific peoples (IRR 1.25 to 1.5,  $p<0.001$  for trend), and decreased for Indian people (IRR 1.6 to 0.75,  $p<0.001$  for trend). There was no significant change for non-Indian Asian people (IRR 0.4 to 0.5,  $p=0.59$ ).

### Older age group (60–84 years)

ACS incidence rates in the older cohort fell for all ethnic groups in the first part of the time period. The decline plateaued for Māori in 2015 after initially declining at 6.6% per year. For Europeans the initial steep decline slowed after 2014 (APC  $-8.2\%$  pre-2014,  $-2.7\%$  post-2014). Rates continued to decline in Pacific (APC  $-3.9\%$ ), Indian (APC  $-5.7\%$ ) and non-Indian Asian people ( $-5.3\%$ ). By 2019 rates had plateaued among Māori at 5.2/1,000. For the other ethnic groups, in whom ACS incidence continued to decline, the rates in 2019 were as follows: Pacific people 5.0/1,000, Indian people 4.9/1,000, non-Indian Asian people 1.6/1,000 and Europeans 3.2/1,000.

IRRs compared with Europeans increased between 2005 and 2019 for older Māori (IRR 1.4 to 1.6,  $p=0.006$  for trend) and Pacific peoples (IRR 1.0 to 1.6,  $p<0.001$  for trend) but the changes in trends were not statistically significant for Indian (IRR 1.1 to 1.5,  $p=0.09$ ) or non-Indian Asian people (IRR 0.4 to 0.5,  $p=0.11$ ).

## Discussion

In Aotearoa New Zealand the long-term declining incidence of ACS has stalled for younger Māori, European and non-Indian Asian people in the last decade. In younger Pacific people the rate of decline is minimal. The rate of decline has also plateaued for older Māori and markedly slowed for older Europeans. Over the 15-year period of this study, ethnic inequities widened across the age range. Although rates have slowed or stalled for Europeans, the incidence of ACS relative to Europeans has progressively increased for Māori and Pacific peoples. By 2019 Māori and Pacific peoples had incidence rates 1.5 times to more than twice European rates. Rates for younger Indian people appear to have converged towards those of European people after previously being much higher, but rates in older Indian people remain higher than for Europeans.

Multiple prior publications have documented a decline in CHD morbidity and mortality in high-income countries up until the last decade.<sup>2,16</sup> In Aotearoa New Zealand we have previously documented a progressive fall in incident CHD hospitalisation and mortality rates and in CHD hospitalisations by ethnic group until the mid-2010s, with no evidence of plateauing.<sup>7,12</sup> Similarly, ACS rates were continuing to fall in men and women and all age groups up until 2016.<sup>10</sup> Internationally, however, there is evidence that the decline in cardiovascular disease (CVD) and CHD mortality rates in high-income countries has been slowing or plateauing in younger people since the 1990s.<sup>17–19</sup>

The decline in incident CHD has been attributed to improvements in both prevention and treatment.<sup>3–5</sup>

In Aotearoa New Zealand this has included progressive improvements in population health through improved nutrition and smoking cessation, together with increased availability and adoption of effective blood pressure and lipid-lowering therapy for primary prevention of CVD. The plateauing of incident ACS is likely associated with a plateauing of the implementation of some prevention and treatment efforts and offset by the rise of new risk factors. Overall rates of smoking fell markedly from 2000 to relatively low levels by the mid-2010s.<sup>20</sup> Mean systolic blood pressure fell until the 1990s but may have increased in the first decade of the twenty-first century,<sup>21</sup> and most current blood pressure-lowering agents have been available since the early 2000s. There was a rapid uptake of statin medications for primary prevention of CVD in Aotearoa New Zealand and internationally in the early 2000s, but by 2014 the rate of increase had plateaued in Aotearoa New Zealand.<sup>22</sup> In contrast, there has been an increase in cardiometabolic risk factors. In particular, obesity rates continue to climb<sup>23</sup> and overall rates of diabetes mellitus continue to increase by about 7% per year.<sup>24</sup>

### Reasons for persisting inequity among Māori and Pacific peoples

The persisting and widening gap in ACS rates for Māori and Pacific peoples relative to European people is related to systemic deficits across the continuum of prevention and treatment. Structural causes, including colonisation and institutional racism, have established advantages for Europeans and disadvantages for Māori and Pacific peoples within the wider (social, economic, political and environmental) determinants of health. These advantages and disadvantages have resulted in differential access to healthcare and differences in the quality of healthcare.<sup>25</sup> They also impact multiple dimensions of preventative health, including access to healthy diets, spaces to engage in physical activity, health-promoting environments and appropriate assessment and treatment in primary healthcare. Despite the documented improvement in many cardiac risk factors discussed above, Māori and Pacific people continue to have a relative excess of traditional risk factors, including elevated blood pressure, hyperlipidaemia and smoking.<sup>26,27</sup> Similarly, though rates of diabetes are increasing in the total population, they are highest among Māori and particularly Pacific and Indian peoples.<sup>24,26</sup> Identification of risk factors and of people at

elevated CVD risk to facilitate targeted interventions is enabled in Aotearoa New Zealand by nationwide CVD risk assessment in primary care. However, due to inequities in access to healthcare, there are significant gaps for Māori and Pacific people in the receipt of CVD risk assessment and management.<sup>28</sup> Although the data on ethnic inequities in use of primary prevention medications are mixed and limited,<sup>28</sup> several studies report that Māori and Pacific patients are less likely to be maintained on secondary prevention medications.<sup>29-31</sup>

### Findings among Indian and non-Indian Asian peoples

Interpretation of trends in ACS incidence for Indian people is complicated by the large numbers of working-age Indian migrants who have arrived in Aotearoa New Zealand over the last 10 years. This is likely to have influenced the decrease in IRR relative to Europeans due to the healthy migrant effect, whereby immigrants to a high-income country can have better health outcomes than the native-born population, despite often facing socio-economic disadvantages.<sup>32</sup> There will be a far smaller proportion of new migrants among older Indians, for whom the IRRs relative to Europeans remain elevated. The high burden of diabetes in particular, as well as raised total cholesterol to high-density lipoprotein ratios, are likely to be relevant for the elevated ACS burden among older Indians.<sup>26,33</sup> The IRRs were much lower across non-Indian Asian people, consistent with the lower burden of CVD risk factors averaged across the grouping as a whole;<sup>26</sup> nevertheless, there is heterogeneity in the burden of ACS across the diverse Asian subpopulations in this grouping, including non-Indian South Asian peoples who are likely to have a similar burden to Indian people.

For this analysis male and females were combined. Further analyses are needed to determine if trends differ by sex within the ethnic groups, including for Indian people (and non-Indian South Asian peoples) where the burden of CHD is known to be higher among males than females.

### What can be done to reduce inequities in incident ACS?

The factors contributing to inequities are broad and complex and require careful consideration when developing health interventions to improve preventive CVD care, particularly for Māori and Pacific peoples.<sup>28</sup> If we are to reverse the observed worsening inequities and stop ACS

incidence increasing across all ethnic groups, a whole-of-system approach is needed.<sup>34</sup> Political leaders must address the socio-economic determinants of health, including equitable access to safe, healthy housing, adequate income and high-quality education. Improved regulation of the food industry and food retail sector is needed to address the underlying determinants of obesity, the key factor driving the increasing burden of diabetes. These actions should be particularly focussed on younger people. We need ongoing population tobacco control initiatives to address the higher rates of smoking among Māori. An important finding of a recent review of CVD risk assessment and management in Aotearoa New Zealand by Wheeler et al. is that Māori and Pacific peoples are not provided equitable levels of CVD health literacy, which affects primary prevention, secondary prevention and cultural safety in CVD care, including language support where required.<sup>28</sup> Improved provision of health literacy through the education and health systems is needed. In primary care, CVD risk screening can identify those at risk for more intensive input and preventive treatment.<sup>35</sup> Important factors that improve access to CVD care include a multi-disciplinary approach, a focus on communities, culturally safe care centred on manaakitanga and support for Māori and Pacific providers.<sup>28</sup> However, there remain multiple barriers to primary healthcare, CVD risk assessment and subsequent management, which need to be overcome.

### Limitations

Valid interpretation of trends depends on stability of definitions over time. In this study we chose ACS (MI or UA) as the incident condition because the definition has not changed over the time period. This is in contrast to the definition of MI, which has been progressively redefined by the increasing sensitivity of the troponin assays used to identify MI. This redefinition has resulted in some patients previously diagnosed as UA now being classified as having an MI and consequently fewer being diagnosed with UA.<sup>36</sup> In Aotearoa New Zealand, ethnicity is defined as the “*ethnic group or groups that people identify with or feel they belong*

*to.*”<sup>23</sup> The 2004 Ministry of Health Information Standards Organisation Ethnicity Data Protocol and subsequent 2017 update aimed to improve the recording of ethnicity data by progressive standardisation of the methods of data collection, the minimum data field requirements and the frequency of updates.<sup>11</sup> Nevertheless, Māori continue to be undercounted in NHI datasets.<sup>37,38</sup> The extent of undercount of Māori in NHI data was 21% in 2013 and 16% in 2018 using comparable methodology,<sup>38</sup> and this undercount will have impacted on the current study. A more recent Stats New Zealand publication reports considerable improvements in the quality of ethnicity recording in the NHI dataset, but there are persisting deficiencies in the recording of Māori and Pacific ethnicity.<sup>39</sup> Further work is required to address ethnicity data quality. In this study we used a health contact population denominator to allow us to exclude patients with known CHD from the denominator and to minimise numerator/denominator bias related to the undercount of Māori in the NHI dataset. We acknowledge that there are people who have no contact with the health system who will not be captured in the denominator. Our group has recently assessed the difference between the health contact denominator of adult New Zealand residents and the equivalent Stats New Zealand Integrated Data Infrastructure (IDI) denominator. Our health contact denominator includes 92% of the complete IDI population (in personal communication from Professor Rod Jackson, 2025). We chose to report trends until 2019 because of concern that the COVID-19 pandemic would affect hospitalisation rates in 2020 to 2022.

### Conclusion

Rates of decline in ACS incidence have stalled or slowed for both young and old in ethnic groups that comprise the majority of the Aotearoa New Zealand population. The differential rate of change between ethnic groups has resulted in increasing inequity for both younger and older Māori and Pacific peoples. Comprehensive actions across health and non-healthcare sectors are required.

**COMPETING INTERESTS**

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AK has been contracted to provide clinical advice for ANZACS-QI programme by The University of Auckland. AK is co-chair of the ANZACS-QI governance group. MH has received payment or honoraria paid to their organisation from Māori Health Review compilation. MH received travel and accommodation support to speak at the CSANZ Conference August 2025. MH is a board member of the Heart Foundation, board member of MRINZ and a member of the MAS Foundation.

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## Appendix

Appendix Table 1a: Total first acute coronary syndrome hospitalisations, population values and crude rates from 2005 to 2019 (for those aged 20–59 years).

	Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Māori	Numerator	360	380	378	365	374	342	362	317	276	305	258	308	308	335	330
	Denominator	291,143	298,553	305,579	312,872	320,333	327,147	332,905	336,842	340,372	343,500	347,828	353,421	359,542	365,414	378,670
	<b>Crude rate/1,000</b>	<b>1.2</b>	<b>1.3</b>	<b>1.2</b>	<b>1.2</b>	<b>1.2</b>	<b>1.0</b>	<b>1.1</b>	<b>0.9</b>	<b>0.8</b>	<b>0.9</b>	<b>0.7</b>	<b>0.9</b>	<b>0.9</b>	<b>0.9</b>	<b>0.9</b>
Pacific	Numerator	123	109	118	148	132	124	138	128	128	115	137	107	131	143	118
	Denominator	128,279	133,152	138,368	143,990	149,471	153,509	156,984	160,309	161,733	163,930	166,475	168,896	172,297	176,764	182,520
	<b>Crude rate/1,000</b>	<b>1.0</b>	<b>0.8</b>	<b>0.9</b>	<b>1.0</b>	<b>0.9</b>	<b>0.8</b>	<b>0.9</b>	<b>0.8</b>	<b>0.8</b>	<b>0.7</b>	<b>0.8</b>	<b>0.6</b>	<b>0.8</b>	<b>0.8</b>	<b>0.6</b>
Indian	Numerator	75	56	59	61	75	64	62	62	45	43	63	57	44	63	49
	Denominator	56,470	62,709	68,750	74,300	80,730	86,433	91,401	97,351	101,184	107,006	114,075	122,373	132,184	144,469	158,380
	<b>Crude rate/1,000</b>	<b>1.3</b>	<b>0.9</b>	<b>0.9</b>	<b>0.8</b>	<b>0.9</b>	<b>0.7</b>	<b>0.7</b>	<b>0.6</b>	<b>0.4</b>	<b>0.4</b>	<b>0.6</b>	<b>0.5</b>	<b>0.3</b>	<b>0.4</b>	<b>0.3</b>
Non-Indian Asian	Numerator	34	28	36	34	33	34	23	32	27	35	35	27	34	45	48
	Denominator	113,323	124,753	135,589	145,165	157,370	167,704	175,341	184,908	189,525	197,543	207,631	219,969	233,581	252,175	274,666
	<b>Crude rate/1,000</b>	<b>0.3</b>	<b>0.2</b>	<b>0.3</b>	<b>0.2</b>	<b>0.2</b>	<b>0.2</b>	<b>0.1</b>	<b>0.2</b>	<b>0.1</b>	<b>0.2</b>	<b>0.2</b>	<b>0.1</b>	<b>0.1</b>	<b>0.2</b>	<b>0.2</b>
European	Numerator	1,136	1,062	1,017	941	906	878	778	765	687	653	603	640	653	701	589
	Denominator	1,472,117	1,493,789	1,506,929	1,517,590	1,533,193	1,542,291	1,542,764	1,540,560	1,530,859	1,524,563	1,521,599	1,520,652	1,522,393	1,52,4815	1,522,011
	<b>Crude rate/1,000</b>	<b>0.8</b>	<b>0.7</b>	<b>0.7</b>	<b>0.6</b>	<b>0.6</b>	<b>0.6</b>	<b>0.5</b>	<b>0.5</b>	<b>0.4</b>	<b>0.4</b>	<b>0.4</b>	<b>0.4</b>	<b>0.4</b>	<b>0.5</b>	<b>0.4</b>

**Appendix Table 1b:** Total first acute coronary syndrome hospitalisations, population values and crude rates from 2005 to 2019 (for those aged 60–84 years).

	Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
<b>Māori</b>	Numerator	312	342	324	327	315	336	336	347	310	278	279	304	340	355	350
	Denominator	28,983	30,520	32,179	34,096	36,139	38,370	40,569	42,990	45,334	48,112	51,112	54,298	57,708	61,310	67,763
	<b>Crude rate/1,000</b>	<b>10.8</b>	<b>11.2</b>	<b>10.1</b>	<b>9.6</b>	<b>8.7</b>	<b>8.8</b>	<b>8.3</b>	<b>8.1</b>	<b>6.8</b>	<b>5.8</b>	<b>5.5</b>	<b>5.6</b>	<b>5.9</b>	<b>5.8</b>	<b>5.2</b>
<b>Pacific</b>	Numerator	133	138	152	169	162	165	139	155	165	173	159	135	143	160	158
	Denominator	16,830	17,801	18,625	19,678	20,432	21,224	22,035	22,964	23,920	24,978	26,043	27,228	28,548	30,040	31,739
	<b>Crude rate/1,000</b>	<b>7.9</b>	<b>7.8</b>	<b>8.2</b>	<b>8.6</b>	<b>7.9</b>	<b>7.8</b>	<b>6.3</b>	<b>6.7</b>	<b>6.9</b>	<b>6.9</b>	<b>6.1</b>	<b>5.0</b>	<b>5.0</b>	<b>5.3</b>	<b>5.0</b>
<b>Indian</b>	Numerator	52	56	67	64	76	63	65	76	74	77	75	56	74	74	105
	Denominator	6,083	6,979	7,928	8,922	9,725	10,621	11,425	12,437	13,332	14,330	15,566	16,809	18,242	19,644	21,239
	<b>Crude rate/1,000</b>	<b>8.5</b>	<b>8.0</b>	<b>8.5</b>	<b>7.2</b>	<b>7.8</b>	<b>5.9</b>	<b>5.7</b>	<b>6.1</b>	<b>5.6</b>	<b>5.4</b>	<b>4.8</b>	<b>3.3</b>	<b>4.1</b>	<b>3.8</b>	<b>4.9</b>
<b>Non-Indian Asian</b>	Numerator	51	58	55	62	60	70	63	51	67	67	70	73	84	102	95
	Denominator	15,594	17,301	19,401	21,476	23,832	26,220	28,562	31,240	33,892	37,457	41,753	46,293	50,996	55,311	59,722
	<b>Crude rate/1,000</b>	<b>3.3</b>	<b>3.4</b>	<b>2.8</b>	<b>2.9</b>	<b>2.5</b>	<b>2.7</b>	<b>2.2</b>	<b>1.6</b>	<b>2.0</b>	<b>1.8</b>	<b>1.7</b>	<b>1.6</b>	<b>1.6</b>	<b>1.8</b>	<b>1.6</b>
<b>European</b>	Numerator	3,546	3,434	3,299	3,171	2,926	2,693	2,608	2,511	2,322	2,207	2,147	2,256	2,119	2,170	2,220
	Denominator	442,844	457,814	475,648	492,276	508,082	523,970	539,390	554,649	569,942	586,902	604,110	622,600	642,189	662,247	685,067
	<b>Crude rate/1,000</b>	<b>8.0</b>	<b>7.5</b>	<b>6.9</b>	<b>6.4</b>	<b>5.8</b>	<b>5.1</b>	<b>4.8</b>	<b>4.5</b>	<b>4.1</b>	<b>3.8</b>	<b>3.6</b>	<b>3.6</b>	<b>3.3</b>	<b>3.3</b>	<b>3.2</b>