Variation in emergency medical service use for acute coronary syndromes by ethnicity: an Aotearoa New Zealand observational study

Bridget Dicker, Vanessa Selak, Haydn Drake, Graham Howie, Andy Swain, Rochelle Newport, Sandra Hanchard, Shanthi Ameratunga, Corina Grey, Matire Harwood

ABSTRACT

AIM: This study investigated whether emergency medical services (EMS) use varies by ethnicity among patients hospitalised with acute coronary syndrome (ACS) in Aotearoa New Zealand.

METHODS: All adults (aged ≥18 years) hospitalised with ACS (2019–2021) were identified. EMS use was determined by linkage between national hospitalisation and EMS data. Associations between ethnicity and EMS use for ACS (ST-elevation myocardial infarction [STEMI]; non-STEMI [NSTEMI]; unstable angina [UA]) were assessed.

RESULTS: A total of 19,283 patients with ACS were identified (STEMI 25%, NSTEMI 55%, UA 20%). For STEMI, EMS use was lower in Māori (adjusted odds ratio 0.72, 95% confidence interval [CI] 0.58–0.90), Pacific (0.64, 0.48–0.87), Indian (0.63, 0.43–0.86) and non-Indian Asian (0.52, 0.37–0.74) but not Other patients (0.79, 0.43–1.52), compared with Europeans. Similar findings by ethnicity were found for NSTEMI. Although odds of EMS use were also lower for UA in all ethnic groups compared with Europeans, the magnitude of the reduction was attenuated, and the effect was not statistically significant, apart from for non-Indian Asian patients.

CONCLUSIONS: EMS use prior to admission for ACS was less likely for most ethnic groups compared with Europeans. Heart healthcare access enablers identified in previously published research—including good-quality information, reduced cost and health professional cultural safety—may reduce barriers to EMS use by non-Europeans.

Māori (the Indigenous people of Aotearoa New Zealand), Pacific peoples (people predominantly from South Pacific Islands) and South Asian peoples living in Aotearoa New Zealand are disproportionately affected by cardiovascular disease (CVD).[1] Māori, Pacific peoples and Indians (who are the only South Asian group that can currently be identified in routinely collected Aotearoa New Zealand health data) experience the onset of CVD at a younger age,[2,3] and have a significantly higher prevalence of diabetes than Europeans.[4] Compared with their European counterparts, Māori and Pacific peoples also have a much higher prevalence of other risk factors for CVD such as smoking and atrial fibrillation,[5–7] and are more likely to die from CVD.[4,8] Of all ethnic groups in Aotearoa New Zealand, Indians have the highest prevalence of coronary heart disease. Yet, compared with Europeans, Māori and Pacific peoples are the most likely to die from coronary heart disease before reaching hospital.[9] Indeed, coronary heart disease is the most important cause of potentially avoidable deaths for Māori and Pacific peoples, contributing up to 1 year of the approximately 6–7 year reduction in life expectancy for Māori and Pacific peoples compared with other New Zealanders.[10]

Acute coronary syndrome (ACS), comprised of ST-elevation myocardial infarction (STEMI), non-STEMI (NSTEMI) and unstable angina (UA), is a major contributor to the burden of CVD. Highly effective treatments reduce the morbidity and mortality of ACS, but the effectiveness of reperfusion (required for STEMI) is critically time-dependent.[11,12] Prehospital triage and investigations like electrocardiograph by emergency medical services (EMS) to promptly identify and manage such patients has led to significant advances in their management, and is a critical factor in reducing times to definitive reperfusion treatment for patients with STEMI.[13] A study from 2012 found that among patients admitted to the coronary care unit of an Aotearoa New Zealand hospital with ACS, the delay between symptom onset and defibrillator availability was 7 hours longer for patients arriving by self-transport compared with EMS.[14] That study also found

Māori, Pacific and Indian peoples, as well as those from areas of higher deprivation, were less likely to arrive by EMS.[14] Another study found that communities with the highest levels of socio-economic deprviation had the least availablity of public access defibrillatiors, despite also having the highest incidence of out-of-hospital cardiac arrest.[15] In addition to determining early interventions, ACS type is also associated with prognosis.[16]

The Aotearoa New Zealand health system is required under the *Pae Ora (Healthy Futures)* legislation to ensure equitable access to health services.[17] The aim of this study was to use contemporary national data to determine if there are ethnic variations in EMS use by ACS type.

Methods

Study design and inclusion and exclusion criteria

A retrospective cross-sectional study of all adult patients (aged 18+ years) hospitalised for an ACS event in Aotearoa New Zealand was undertaken between 1 July 2019 and 30 June 2021. Patients were identified from the national hospitalisation data collection (National Minimum Dataset [NMDS]). This 2-year period was chosen because it was the earliest date where there were reliable electronic EMS data, and, at the time of the analysis, the latest date that hospitalisation data were available. An ACS event was defined as a primary diagnosis (at discharge) of International Classification of Diseases (ICD) 10 codes for STEMI (I21.0–I123, I220, I221, I228, I229), NSTEMI (I214, I222) or UA (I200). For patients with multiple ACS events during the study, only the first was included in the analysis. Patients were excluded if they had duplicate EMS records for the same date.

Variables

EMS use for each included ACS event was determined by linkage (using an encrypted National Health Index [NHI], a unique patient identifier) to the national EMS registry, the Aotearoa New Zealand Paramedic Care Collection (ANZPaCC). The ANZPaCC contains all routinely collected electronic clinical record data for all patients in Aotearoa New Zealand attended by EMS. We determined for each patient if their ACS event could be matched with an EMS encounter on the day of or the day prior to admission. If a match was made, they were classified as having been transported by EMS. Otherwise, they were classified as having been transported by other means.

Age, sex, ethnicity, socio-economic deprivation and rurality were obtained from the NHI data collection. Ethnicity was prioritised using a slight modification of the Aotearoa New Zealand Health and Disability sector standard[18] in the following order: Māori > Pacific > Indian (including Fijian Indian) > non-Indian Asians (including Chinese) > Middle Eastern, Latin American and African (MELAA) > European > Other. MELAA and Other ethnic groups were combined given small numbers. Indians comprise approximately 90% of the total South Asian group but due to limitations in the ethnicity categorisations currently available in routinely collected Aotearoa New Zealand health data, non-Indian South Asians cannot be disaggregated from the rest of the non-Indian Asian group. Socio-economic deprivation and rurality measures were based on patients' domicile code, which reflected their residential address. Socio-economic deprivation decile or quintile was classified according to the New Zealand Index of Deprivation (NZDep) 2013, based on a range of 2013 Census data from people living in the same small area (of at least 100 people).[19] The Geographic Classification for Health (GCH) was used to classify each patient into one of five levels of (reducing) rurality (two urban categories [U1, U2] and three rural categories [R1, R2, R3]).[20]

Statistical analysis

Patients were described using categorical variables (summarised as counts and percentages) and continuous variables (summarised as means with standard deviations [SD] and medians with interquartile ranges [IQR]) according to ACS type (STEMI, NSTEMI, UA) and within each ACS type by ethnicity. Differences in continuous variables (using the Kruskal–Wallis rank sum test) and categorical variables (using the Chi-squared test, or Fisher's exact test where any cells had a value <5) were assessed between ACS types and, within each ACS type, by ethnicity (using Episheet). The association between variables (ethnicity as well as age, sex, NZDep and rurality, either individually for univariable or in combination [ethnicity, age, sex, NZDep, rurality] for multivariable analyses) and arrival via EMS was assessed using logistic regression separately for each ACS type (using R Studio). Data are presented as (adjusted) odds ratios (OR or aOR) with 95% confidence intervals (CI). A p-value of <0.05 was considered statistically significant. Analyses were undertaken using Episheet or R Studio.

Ethics

This study was conducted under a long-term CVD research programme, which undergoes annual ethics approval, most recently approved by the Northern Region B Health and Disability Ethics Committee on 21 October 2022 (2022 EXP 13442). This approval includes a waiver for individual participant consent. Ethical approval was also obtained from the Auckland University of Technology Ethics Committee (21/369) as the study was undertaken as part of the master's thesis of Haydn Drake.

Results

Between 1 July 2019 and 30 June 2021, 19,283 patients were admitted with an ACS event and included in this analysis (STEMI n=4,827, 25%; NSTEMI n=10,627, 55%; UA n=3,829, 19.9%) (Table 1). Their median age was 69 years (IQR 60–78 years) and nearly two-thirds were male (65.2%, n=12,567). Most were European (75%), followed by Māori (11%), Pacific (5%), Indian (4%), non-Indian Asians (3%) and Other (1%). Most lived in urban areas (U1 51%, U2 23%), and the proportion living in areas with the greatest deprivation quintile was 23%. While there were statistically significant differences in each of these characteristics by ACS type, most differences were relatively minor, apart from those by age (median age STEMI 66 vs NSTEMI 71 and UA 70 years) and sex (women STEMI 31% vs 37% NSTEMI 37% and UA 36%). Each ACS type is also described by ethnicity in Appendix Table 1–3.

There were substantial (as well as statistically significant) differences in EMS use by ACS type, ranging from 75% for STEMI to 61% for NSTEMI and 45% for UA. The association between patient characteristics and EMS use is described for each ACS type in Table 2, both by proportions arriving by EMS (with numerators and denominators provided in Appendix Table 4–6) as well as by logistic regression.

For STEMI, EMS use ranged from 63.7% for non-Indian Asians to 77.9% for Europeans. All ethnic groups assessed were less likely to arrive by EMS for STEMI than Europeans, both for unadjusted as well as for adjusted analyses, although the effect was not statistically significant for Other patients (Figure 1). A similar pattern was evident for NSTEMI, although the reduced odds of EMS use compared with Europeans was not statistically significant in adjusted analyses for Indian or Other patients. For UA, while there were reduced odds of EMS use for all ethnic groups compared with Europeans, the magnitude of the reduction was attenuated, and odds were only statistically significant in adjusted analyses for non-Indian Asian patients.

EMS use also varied according to the other characteristics assessed. Men were consistently less likely than women to arrive via EMS across all ACS types, for unadjusted as well as adjusted analysis. Similarly, EMS was strongly associated with increasing age. The observed association between EMS use and deprivation was inconsistent, with some indication of lower access with increasing deprivation for STEMI and NSTEMI, but the inverse evident for UA. There was some indication of reduced EMS access with increasing rurality, although the pattern was mixed. EMS access was lower for U2 (second most urban) compared with U1 for all ACS types in adjusted analyses. EMS access was similarly lower for R2 and R3 (most rural) compared with U1, although the effect wasn't consistently statistically significant for STEMI and NSTEMI, and no statistically significant effects were observed for UA. In adjusted analyses, EMS access for R1 (mid-level on the five-level rurality scale) was slightly reduced (but not statistically different) to that for U1 for STEMI, and increased (though again not statistically significantly) to that for U1 for NSTEMI and UA.

Discussion

Between 1 July 2019 and 30 June 2021, 19,283 ACS events were identified (STEMI 25%, NSTEMI 55%, UA 20%). Consistent with the findings of an earlier national study,[16] STEMI patients were younger and less likely to be women than NSTEMI or UA patients (median age 66 vs 71 and 70 years, respectively; women 31% vs 37% and 36%, respectively). EMS use ranged from 45% for UA to 61% for NSTEMI and 75% for STEMI. EMS use for STEMI was similar to that found in an earlier study from Aotearoa New Zealand (73%).[21]

EMS use was highest in Europeans (48–78%) compared with other ethnic groups (Māori 36–66%, Pacific 41–66%, Indian 37–68%, non-Indian Asians 26–64%, Other 32–71%). For STEMI, EMS use was lower in Māori (aOR 0.72, 95% CI 0.58–0.90), Pacific (aOR 0.64, 95% CI 0.48–0.87), Indian (aOR 0.63, 95% CI 0.43–0.86) and non-Indian Asian (aOR 0.52, 95% CI 0.37–0.74) but not Other patients (aOR 0.79, 95% CI 0.43–1.52) compared with Europeans. Similar findings by

ethnicity were found for NSTEMI. Although odds of EMS use were also lower for UA in all ethnic groups compared with Europeans, the magnitude of the reduction was attenuated, and the effect was not statistically significant, apart from for non-Indian Asian patients.

Other studies have similarly found lower levels of EMS use for ACS among minority ethnic populations. One study focussed on STEMI found that Māori and Pacific patients were less likely than other ethnic groups to be transported by EMS than to self-transport.[21] A systematic review[22] identified three studies that found Latino,[23] Māori, Pacific and Indian peoples[14] and South Asians[24] were less likely to have been transported to hospital by EMS than non-minoritised populations.

A systematic review of ethnic differences of the care pathway following an out-of-hospital cardiac event found that disparities in access were attributed to a range of factors (comorbidities, insurance status, socio-economic variables, transportation barriers) and that addressing these disparities required targeted context- and population-specific interventions, informed by qualitative research.[22] Responding to this gap, a recent study of Māori patients and families accessing care for an out-of-hospital cardiac event found that EMS initiation was influenced by knowledge of symptoms and a desire to maintain personal dignity, alongside systemic barriers including racism, discrimination and inadequate resourcing.[25] The following factors were found to be critical to optimising healthcare journeys: relationships with health professionals, availability of good-quality information and family support and the use of cultural practices.[25] Similar factors are also relevant for Pacific and Asian (including South Asian) populations, who may also experience other barriers related to language and lack of knowledge of the Aotearoa New Zealand health system (particularly among migrants within Asian communities).[26–28] Key recommendations for achieving equity from that study, which are likely to be relevant to improving EMS access for Māori, as well as other groups with reduced access, are to increase awareness of the concepts and implications of cultural safety among health professionals and to integrate cultural practices into the healthcare journey of patients and their families.[25] Such approaches are likely to be important—alongside addressing other barriers such as lack of good information and cost—to supporting equitable EMS access. Strategies that make non-Europeans as comfortable using the EMS service as Europeans might include diversification of the EMS workforce as well as collaboration with ethnic groups to develop ethnic-appropriate education, communication and outreach. Further research is needed to determine the effectiveness of such strategies in ensuring that the Aotearoa New Zealand health system meets its responsibility for ensuring equitable access to pre-hospital care for ACS patients.

The strengths of this study were that it was based on recent and near complete national hospitalisation and EMS data, and analyses by ethnicity were undertaken separately by ACS type and were adjusted for age, sex, deprivation and rurality. On the other hand, EMS access may have been over-estimated because patients were matched with an EMS encounter on the day of or the day prior to admission. Some of the findings may be spurious because no adjustment was made for multiple statistical testing, and it is possible that COVID-19 and associated national lockdowns may have influenced the results observed given the study period. This study only assessed patients who were admitted to hospital with ACS, and therefore excluded patients who died with ACS prior to hospitalisation. This is an important consideration for future research given that as many as three-quarters of deaths from ACS occur outside the hospital, there is a strong relationship between delay in paramedic care and mortality[14] and Māori and Pacific peoples are significantly more likely than Europeans to have an unwitnessed cardiac arrest[29] and to die from coronary heart disease before reaching hospital.[9]

Conclusions

EMS use for ACS (particularly STEMI, and similarly for NSTEMI) varies by ethnicity, with most ethnic groups (including Māori and Pacific peoples) less likely to have access to EMS than Europeans. This is despite Māori and Pacific peoples experiencing the greatest burden of CVD, and legislative requirements in Aotearoa New Zealand for equitable access to health services, including EMS. Previously published research from Aotearoa New Zealand on heart healthcare has identified enablers of access, including good-quality information, reduced cost and health professional cultural safety. Strengthening these enablers could increase access to EMS use for ACS by Māori, Pacific peoples and other non-Europeans.

Table 1: Patient characteristics by acute coronary syndrome type.

	STEMI, n (%)	NSTEMI, n (%)	UA, n (%)	Total, n (%)	p-value*
Total	4,827 (25.0)	10,627 (55.1)	3,829 (19.9)	19,283	
Sex					
Female	1,470 (30.5)	3,876 (36.5)	1,370 (35.8)	6,716 (34.8)	<0.0001
Male	3,357 (69.5)	6,751 (63.5)	2,459 (64.2)	12,567 (65.2)	
Age, years					
Mean (SD)	66.4 (13.6)	69.8 (13.1)	68.9 (11.6)	68.7 (13.1)	<0.0001
Median (IQR)	66.0 (57.0–76.5)	71.0 (61.0–80.0)	70.0 (61.0–77.0)	69.0 (60.0–78.0)	
Age groups, years					
18–39	115 (2.4)	146 (1.4)	31 (0.8)	292 (1.5)	<0.0001
40–49	420 (8.7)	596 (5.6)	172 (4.5)	1,188 (6.2)	
50–59	998 (20.7)	1,661 (15.6)	636 (16.6)	3,295 (17.1)	
60–69	1,292 (26.8)	2,633 (24.8)	1,050 (27.4)	4,975 (25.8)	
70–79	1,086 (22.5)	2,914 (27.4)	1,240 (32.4)	5,240 (27.2)	
80+	916 (19)	2,677 (25.2)	700 (18.3)	4,293 (22.3)	
Ethnicity					
Māori	566 (11.7)	1,204 (11.3)	418 (10.9)	2,188 (11.3)	0.0055
Pacific	268 (5.6)	560 (5.3)	149 (3.9)	977 (5.1)	
Indian	226 (4.7)	425 (4)	148 (3.9)	799 (4.1)	
Non-Indian Asian	168 (3.5)	352 (3.3)	143 (3.7)	663 (3.4)	
Other	56 (1.2)	134 (1.3)	57 (1.5)	247 (1.3)	
European	3,543 (73.4)	7,952 (74.8)	2,914 (76.1)	14,409 (74.7)	
Deprivation quintile, from 1 (least) to 5 (most) deprivation					
1	824 (17.1)	1,713 (16.1)	636 (16.6)	3,173 (16.5)	0.0309
2	904 (18.7)	1,875 (17.6)	643 (16.8)	3,422 (17.7)	
3	879 (18.2)	2,069 (19.5)	807 (21.1)	3,755 (19.5)	
4	1,092 (22.6)	2,454 (23.1)	865 (22.6)	4,411 (22.9)	
5	1,102 (22.8)	2,488 (23.4)	868 (22.7)	4,458 (23.1)	
Missing	26 (0.5)	28 (0.3)	10 (0.3)	64 (0.3)	

Table 1 (continued): Patient characteristics by acute coronary syndrome type.

	STEMI, n (%)	NSTEMI, n (%)	UA, n (%)	Total, n (%)	p-value*
Rurality, from Urban 1 (least) to Rural 3 (most) rural					
Urban 1	2,588 (53.6)	5,405 (50.9)	1,834 (47.9)	9,827 (51.0)	<0.0001
Urban 2	1,042 (21.6)	2,406 (22.6)	892 (23.3)	4,340 (22.5)	
Rural 1	625 (12.9)	1,552 (14.6)	621 (16.2)	2,798 (14.5)	
Rural 2	321 (6.7)	768 (7.2)	314 (8.2)	1,403 (7.3)	
Rural 3	67 (1.4)	145 (1.4)	59 (1.5)	271 (1.4)	
Missing	184 (3.8)	351 (3.3)	109 (2.8)	644 (3.3)	
Transportation to hospital					
Ambulance	3,612 (74.8)	6,455 (60.7)	1,714 (44.8)	11,781 (61.1)	<0.0001
Self	1,215 (25.2)	4,172 (39.3)	2,115 (55.2)	7,502 (38.9)	

STEMI = ST-elevation myocardial infarction; NSTEMI = non-STEMI; UA = unstable angina; SD = standard deviation; IQR = interquartile range.
*p-value for difference by acute coronary syndrome type .

Table 2: Association between patient characteristics and emergency medical services access by acute coronary syndrome type.

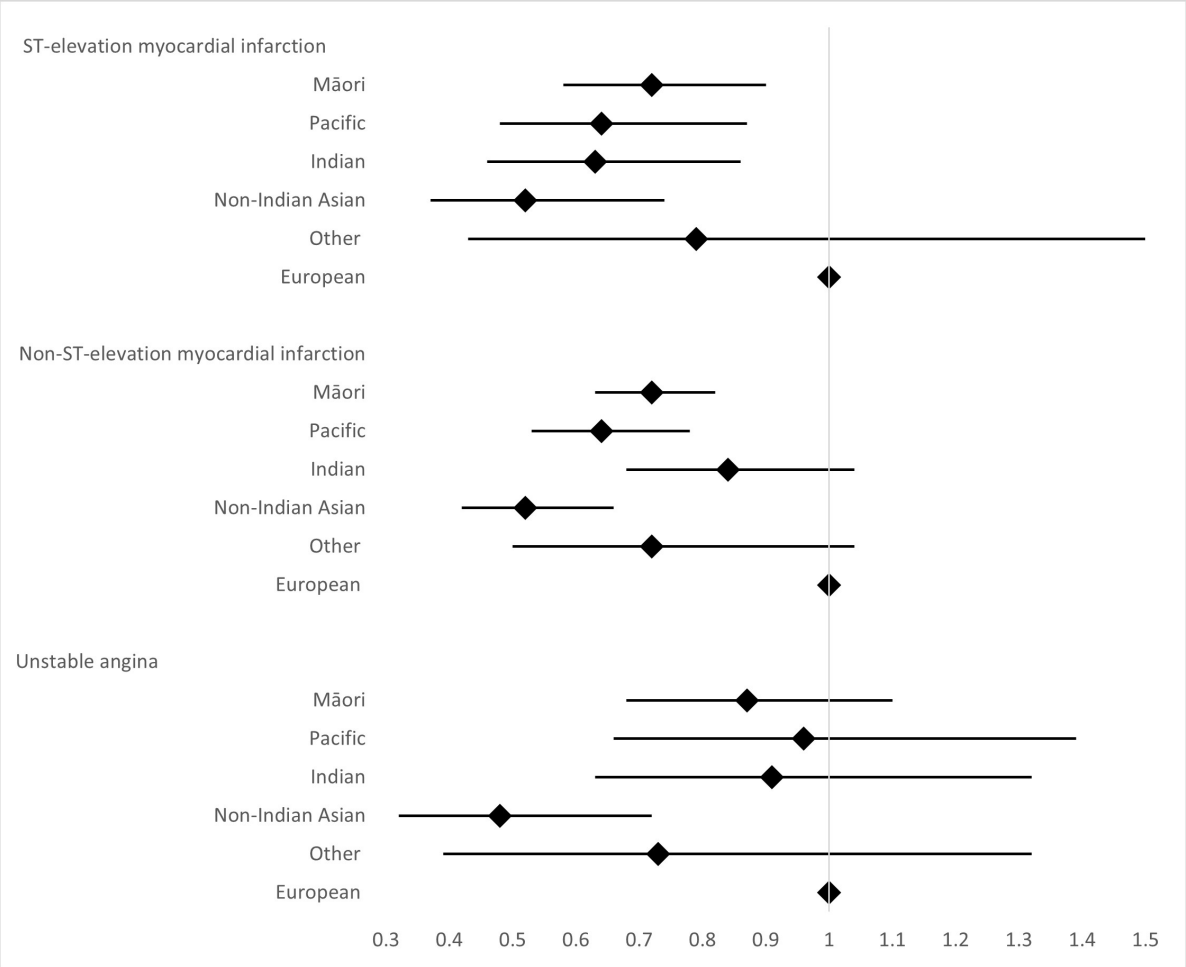
	ST-elevation myocardial infarction			Non-ST-elevation myocardial infarction			Unstable angina		
	n/N (%) arriving by EMS	OR (95% CI)		n/N (%) arriving by EMS	OR (95% CI)		n/N (%) arriving by EMS	OR (95% CI)	
		Unadjusted	Adjusted*		Unadjusted	Adjusted*		Unadjusted	Adjusted*
Ethnicity									
Māori	375/566 (66)	0.56 (0.46–0.68)	0.72 (0.58–0.90)	586/1,204 (49)	OR 0.51 (0.46–0.58)	OR 0.72 (0.63–0.82)	150/418 (36)	OR 0.61 (0.49–0.75)	OR 0.87 (0.68–1.10)
Pacific	177/268 (66)	0.55 (0.42–0.72)	0.64 (0.48–0.87)	264/560 (47)	OR 0.48 (0.41–0.57)	OR 0.64 (0.53–0.78)	61/149 (41)	OR 0.76 (0.54–1.06)	OR 0.96 (0.66–1.39)
Indian	153/226 (68)	0.59 (0.45–0.80)	0.63 (0.46–0.86)	226/425 (53)	OR 0.62 (0.51–0.75)	OR 0.84 (0.68–1.04)	55/148 (37)	OR 0.65 (0.46–0.90)	OR 0.91 (0.63–1.32)
Non-Indian Asian	107/168 (64)	0.50 (0.36–0.69)	0.52 (0.37–0.74)	154/352 (44)	OR 0.42 (0.34–0.52)	OR 0.52 (0.42–0.66)	37/143 (26)	OR 0.38 (0.26–0.55)	OR 0.48 (0.32–0.72)
Other	40/56 (71)	0.71 (0.40–1.31)	0.79 (0.43–1.52)	70/134 (52)	OR 0.59 (0.42–0.84)	OR 0.72 (0.50–1.04)	18/57 (32)	OR 0.50 (0.28–0.87)	OR 0.73 (0.39–1.32)
European	2,760/3,543 (78)	1.00	1.00	5,155/7,952 (65)	1.00	1.00	1,393/2,914 (48)	1.00	1.00
Sex									
M	2,442/3,357 (73)	0.68 (0.59–0.79)	0.79 (0.67–0.93)	3,875/6,751 (57)	OR 0.68 (0.62–0.73)	OR 0.79 (0.72–0.86)	1,016/2,459 (41)	OR 0.68 (0.59–0.77)	OR 0.74 (0.64–0.85)
F	1,170/1,470 (80)	1.00	1.00	2,580/3,876 (67)	1.00	1.00	698/1,370 (51)	1.00	1.00
Age, years									
Per increase in year		1.03 (1.02–1.03)	1.02 (1.02–1.03)		OR 1.05 (1.04–1.05)	OR 1.04 (1.04–1.05)		OR 1.05 (1.05–1.06)	OR 1.05 (1.04–1.06)
18–39	72/115 (63)			51/146 (35)			10/31 (32)		
40–49	280/420 (67)			258/596 (43)			52/172 (30)		
50–59	708/998 (71)			761/1,661 (46)			179/636 (28)		
60–69	921/1,292 (71)			1357/2,633 (52)			383/1,050 (37)		

Table 2 (continued): Association between patient characteristics and emergency medical services access by acute coronary syndrome type.

	ST-elevation myocardial infarction			Non-ST-elevation myocardial infarction			Unstable angina		
	n/N (%) arriving by EMS	OR (95% CI)		n/N (%) arriving by EMS	OR (95% CI)		n/N (%) arriving by EMS	OR (95% CI)	
		Unadjusted	Adjusted*		Unadjusted	Adjusted*		Unadjusted	Adjusted*
70–79	827/1,086 (76)			1845/2,914 (63)			588/1,240 (47)		
80+	804/916 (88)			2183/2,677 (82)			502/700 (72)		
Deprivation decile from 1 (least) to 10 (most) deprivation									
Per increase in decile		0.96 (0.93–0.98)	0.98 (0.96–1.01)		OR 0.99 (0.97–1.00)	OR 1.02 (1.00–1.03)		OR 1.02 (1.00–1.04)	OR 1.05 (1.02–1.08)
1–2	642/824 (78)			1,033/1,713 (60)			256/636 (40)		
3–4	692/904 (77)			1,141/1,875 (61)			287/643 (45)		
5–6	677/879 (77)			1,305/2,069 (63)			371/807 (46)		
7–8	796/1,092 (73)			1,542/2,454 (63)			418/865 (48)		
9–10	793/1,102 (72)			1,420/2,488 (52)			377/868 (43)		
Rurality, from Urban 1 (least) to Rural 3 (most) rural									
Urban 2	692/1,042 (66)	0.55 (0.47–0.65)	0.47 (0.40–0.56)	1,366/2,406 (57)	OR 0.83 (0.75–0.91)	OR 0.70 (0.63–0.78)	365/892 (41)	OR 0.87 (0.74–1.02)	OR 0.76 (0.64–0.91)
Rural 1	489/625 (78)	1.00 (0.81–1.24)	0.87 (0.70–1.09)	1,031/1,552 (66)	OR 1.25 (1.11–1.41)	OR 1.10 (0.97–1.25)	319/621 (51)	OR 1.32 (1.10–1.59)	OR 1.21 (0.99–1.47)
Rural 2	223/321 (70)	0.63 (0.49–0.82)	0.57 (0.44–0.75)	438/768 (57)	OR 0.84 (0.72–0.98)	OR 0.73 (0.62–0.86)	134/314 (43)	OR 0.93 (0.73–1.19)	OR 0.86 (0.67–1.12)
Rural 3	51/67 (76)	0.89 (0.51–1.62)	0.92 (0.52–1.69)	78/145 (54)	OR 0.74 (0.53–1.03)	OR 0.71 (0.50–1.00)	25/59 (42)	OR 0.92 (0.54–1.55)	OR 0.81 (0.46–1.40)
Urban 1	2,024/2,588 (78)	1.00	1.00	3,313/5,405 (61)	1.00	1.00	814/1,834 (44)	1.00	1.00

OR = odds ratio; CI = confidence interval.
*Adjusted for all variables listed in table.

Figure 1: Association between ethnicity and emergency medical services access by acute coronary syndrome type, adjusted odds ratios (95% confidence intervals).



COMPETING INTERESTS

Vanessa Selak, Shanthi Ameratunga, Matire Harwood and Corina Grey report funding from the Healthier Lives | He Oranga Hauora – National Science Challenge, the Heart Foundation of New Zealand and the Health Research Council of New Zealand (programme and project grants).

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Andy Swain is Chair of Paramedicine Research Unit, Auckland University of Technology.

Corina Grey is Chair of the National Verification Committee for the Elimination of Measles and Rubella and Member of the National Mortality Review Committee.

Matire Harwood is Board Member of the Hauora Māori Advisory Committee, Member of the Heart Foundation, Member of the MAS Foundation and Board Member of the MRINZ Board.

Rochelle Newport received a PhD scholarship from Manawataki Fatu Fatu.

Vanessa Selak is Board Member of the EQUIT3 (vaping cessation trial) DSMB, Board Member of the Cess@Tion (smoking cessation trial) DSMB, Board Member of the Auckland Medical Research Foundation and Deputy Chair of the Medical Committee of the Auckland Medical Research Foundation.

Bridget Dicker is an employee of Hato Hone St John and this work was undertaken in "time only" as part of her employment.

Sandra Hanchard received support of Pacific Fellowship from the Heart Foundation and Pūtahi Manawa Healthy Hearts for Aotearoa New Zealand. Sandra Hanchard is a Governance Member of the National Cardiac Clinician Network and a Council Member of the Health New Zealand – Te Whatu Ora Whānau, Consumer and Clinician Digital Council.

ACKNOWLEDGEMENTS

This work was undertaken as part of Manawataki Fatu Fatu (Māori and Pacific hearts in unison for Achieving Cardiovascular Care for Equity StudieS [ACCESS]).

The programme is led by Associate Professor Matire Harwood and Dr Corina Grey and includes Professor Shanthi Ameratunga, Associate Professor Vanessa Selak, Professor Bridget Dicker, Dr Karen Brewer, Dr Janine Paynter, Dr Tua Taueetia-Su'a, Dr Sandra Hanchard, Dr Sione Vaka, Rochelle Newport, Julie Winter-Smith, Taria Tane and Jess Lagaluga Hutchings.

We kindly acknowledge and thank Hato Hone St John and Wellington Free Ambulance for their assistance with data access.

This work was undertaken in conjunction with the Vascular Risk Equity in Aotearoa New Zealand (VAREANZ) programme. The programme is led by Professor Rod Jackson, Associate Professor Sue Wells, Professor Sue Crengle and Associate Professor Matire Harwood. The authors would like to thank the VAREANZ team and in particular Associate Professor Katrina Poppe, Dr Claris Chung and Dr Yeunhyang Choi for their assistance with data access, linkage and curation, and Dr Suneela Mehta for her advice regarding analyses for Asian patients.

The authors would like to thank the National Heart Foundation of New Zealand and Healthier Lives | He Oranga Hauora – National Science Challenge of New Zealand, co-funders of the Manawataki Fatu Fatu programme, and in particular Sir Jerry Mateparae (Chair, Healthier Lives), Professor Jim Mann (Director, Healthier Lives) and Associate Professor Gerry Devlin (Medical Director, Heart Foundation).

AUTHOR INFORMATION

Bridget Dicker: Hato Hone St John, Auckland, Aotearoa New Zealand; Auckland University of Technology, Faculty of Health and Environmental Sciences, Auckland, Aotearoa New Zealand.

Vanessa Selak: The University of Auckland, Faculty of Medical and Health Sciences, Auckland, Aotearoa New Zealand.

Haydn Drake: Hato Hone St John, Auckland, Aotearoa New Zealand.

Graham Howie: Auckland University of Technology, Faculty of Health and Environmental Sciences, Auckland, Aotearoa New Zealand.

Andy Swain: Auckland University of Technology, Faculty of Health and Environmental Sciences, Auckland, Aotearoa New Zealand; Wellington Free Ambulance, Wellington, Aotearoa New Zealand.

Rochelle Newport: The University of Auckland, Faculty of Medical and Health Sciences, Auckland, Aotearoa New Zealand.

Sandra Hanchard: The University of Auckland, Faculty of Medical and Health Sciences, Auckland, Aotearoa New Zealand.

Shanthi Ameratunga: The University of Auckland, Faculty of Medical and Health Sciences, Auckland, Aotearoa New Zealand; Health New Zealand – Te Whatu Ora, Service Improvement & Innovation, Auckland, Aotearoa New Zealand.

Corina Grey: The University of Auckland, Faculty of Medical and Health Sciences, Auckland, Aotearoa New Zealand.

Matire Harwood: The University of Auckland, Faculty of Medical and Health Sciences, Auckland, Aotearoa New Zealand.

CORRESPONDING AUTHOR
Vanessa Selak: School of Population Health, The University of Auckland, Private Bag 92019, Auckland 1142, Aotearoa New Zealand.
E: v.selak@auckland.ac.nz

URL
https://nzmj.org.nz/journal/vol-138-no-1611/variation-in-emergency-medical-service-use-for-acute-coronary-syndromes-by-ethnicity-an-aotearoa-new-zealand-observational-study

REFERENCES
1. Chan WC, Wright C, Riddell T, et al. Ethnic and socioeconomic disparities in the prevalence of cardiovascular disease in New Zealand. N Z Med J. 2008;121(1285):11-20.
2. Pylypchuk R, Wells S, Kerr A, et al. Cardiovascular disease risk prediction equations in 400 000 primary care patients in New Zealand: a derivation and validation study. Lancet. 2018;391(10133):1897-1907. doi: 10.1016/S0140-6736(18)30664-0.
3. Ministry of Health – Manatū Hauora. Cardiovascular Disease Risk Assessment and Management for Primary Care [Internet]. Wellington, New Zealand: Ministry of Health – Manatū Hauora; 2018 [cited 2024 Dec 2]. Available from: https://www.tewhatuora.govt.nz/assets/Publications/Cardiovascular-Publications/cardiovascular-disease-risk-assessment-management-primary-care-feb18-v4_0.pdf
4. Selak V, Poppe K, Grey C, et al. Ethnic differences in cardiovascular risk profiles among 475,241 adults in primary care in Aotearoa, New Zealand. N Z Med J. 2020;133(1521):14-27.
5. Cameron VA, Faatoese AF, Gillies MW, et al. A cohort study comparing cardiovascular risk factors in rural Maori, urban Maori and non-Maori communities in New Zealand. BMJ Open. 2012;2(3):e000799. doi: 10.1136/bmjopen-2011-000799.
6. Grey C, Wells S, Riddell T, et al. A comparative analysis of the cardiovascular disease risk factor profiles of Pacific peoples and Europeans living in New Zealand assessed in routine primary care: PREDICT CVD-11. N Z Med J. 2010;123(1309):62-75.
7. Riddell T, Jackson RT, Wells S, et al. Assessing Māori/non-Māori differences in cardiovascular disease risk and risk management in routine primary care practice using web-based clinical decision support: (PREDICT CVD-2). N Z Med J. 2007;120(1250):U2445.
8. Grey C, Jackson R, Wells S, et al. Trends in ischaemic heart disease: patterns of hospitalisation and mortality rates differ by ethnicity (ANZACS-QI 21). N Z Med J. 2018;131(1478):21-31.
9. Grey C, Jackson R, Wells S, et al. Ethnic differences in case fatality following an acute ischaemic heart disease event in New Zealand: ANZACS-QI 13. Eur J Prev Cardiol. 2016;23(17):1823-1830. doi: 10.1177/2047487316657671.
10. Walsh M, Grey C. The contribution of avoidable mortality to the life expectancy gap in Māori and Pacific populations in New Zealand - a decomposition analysis. N Z Med J. 2019;132(1492):46-60.
11. Chew DP, Scott IA, Cullen L, et al. National Heart Foundation of Australia and Cardiac Society of Australia and New Zealand: Australian clinical guidelines for the management of acute coronary syndromes 2016. Med J Aust. 2016;205(3):128-33. doi: 10.5694/mja16.00368.
12. Moser DK, Kimble LP, Alberts MJ, et al. Reducing delay in seeking treatment by patients with acute coronary syndrome and stroke: a scientific statement from the American Heart Association Council on cardiovascular nursing and stroke council. Circulation. 2006;114(2):168-82. doi: 10.1161/CIRCULATIONAHA.106.176040.
13. ST-Elevation Myocardial Infarction Guidelines Group; New Zealand Branch of the Cardiac Society of Australia and New Zealand. ST-elevation myocardial infarction: New Zealand Management Guidelines, 2013. N Z Med J. 2013;126(1387):127-64.
14. Garofalo D, Grey C, Lee M, et al. Pre-hospital delay in acute coronary syndromes: PREDICT CVD-18. N Z Med J. 2012;125(1348):12-22.
15. Dicker B, Garrett N, Wong S, et al. Relationship between socioeconomic factors, distribution of public access defibrillators and incidence of out-of-hospital cardiac arrest. Resuscitation. 2019;138:53-58. doi: 10.1016/j.resuscitation.2019.02.022.
16. Wang TKM, Grey C, Jiang Y, et al. Nationwide trends in acute coronary syndrome by subtype in New Zealand 2006-2016. Heart. 2020;106(3):221-227. doi: 10.1136/heartjnl-2019-315655.
17. *Pae Ora (Healthy Futures) Act 2022* (NZ).
18. Ministry of Health Ministry of Health – Manatū Hauora. Ethnicity Data Protocols: HISO 10001:2017. Version 1.1 [Internet]. Wellington, New Zealand: Ministry of Health – Manatū Hauora; 2017 [cited 2024 Dec 2]. Available from: https://www.tewhatuora.govt.nz/assets/Our-health-system/Digital-health/Health-information-standards/HISO-10001-2017-Ethnicity-Data-Protocols.pdf
19. Atkinson J, Salmond C, Crampton P. NZDep2013 Index of Deprivation [Internet]. Dunedin, New Zealand: University of Otago; 2014 [cited 2024 Dec 2]. Available from: https://www.otago.ac.nz/__data/

assets/pdf_file/0029/318458/nzdep2013-index-of-deprivation-research-report-069936.pdf
20. Whitehead J, Davie G, de Graaf B, et al. Defining rural in Aotearoa New Zealand: a novel geographic classification for health purposes. N Z Med J. 2022;135(1559):24-40. doi: 10.26635/6965.5495.
21. Liao BY, Lee MAW, Dicker B, et al. Prehospital identification of ST-segment elevation myocardial infarction and mortality (ANZACS-QI 61). Open Heart. 2022;9(1):e001868. doi: 10.1136/openhrt-2021-001868.
22. Newport R, Grey C, Dicker B, et al. Ethnic differences of the care pathway following an out-of-hospital cardiac event: A systematic review. Resuscitation. 2023;193:110017. doi: 10.1016/j.resuscitation.2023.110017.
23. Zègre-Hemsey JK, Pickham D, Pelter MM. Electrocardiographic indicators of acute coronary syndrome are more common in patients with ambulance transport compared to those who self-transport to the emergency department. J Electrocardiol. 2016;49(6):944-950. doi: 10.1016/j.jelectrocard.2016.08.008.
24. Ben-Shlomo Y, Naqvi H, Baker I. Ethnic differences in healthcare-seeking behaviour and management for acute chest pain: secondary analysis of the MINAP dataset 2002-2003. Heart. 2008;94(3):354-9. doi: 10.1136/hrt.2007.119412.
25. Newport R, Grey C, Dicker B, et al. Upholding te mana o te wā: Māori patients and their families' experiences of accessing care following an out-of-hospital cardiac event. Am Heart J Plus. 2023;36:100341. doi: 10.1016/j.ahjo.2023.100341.
26. Brewer KM, Taueetia-Su'a T, Hanchard S, et al. Māori and Pacific families' experiences and perspectives of cardiovascular care; A qualitative study. Aust N Z J Public Health. 2024;48(3):100149. doi: 10.1016/j.anzjph.2024.100149.
27. Xiang V, Parackal S, Gurung G, Subramaniam RM. Asian migrants navigating New Zealand primary care: a qualitative study. J Prim Health Care. 2023;15(1):30-37. doi: 10.1071/HC22132.
28. Harris RB, Stanley J, Cormack DM. Racism and health in New Zealand: Prevalence over time and associations between recent experience of racism and health and wellbeing measures using national survey data. PLoS One. 2018;13(5):e0196476. doi: 10.1371/journal.pone.0196476.
29. Dicker B, Todd VF, Tunnage B, et al. Ethnic disparities in the incidence and outcome from out-of-hospital cardiac arrest: A New Zealand observational study. Resuscitation. 2019;145:56-62. doi: 10.1016/j.resuscitation.2019.09.026.

Appendix

Appendix Table 1: ST-elevation myocardial infarction patient characteristics by ethnicity, n (%).

	Māori	Pacific	Indian	Non-Indian Asian	Other	European	p-value*
Total	566 (11.7%)	268 (5.6%)	226 (4.7%)	168 (3.5%)	56 (1.2%)	3,543 (73.4%)	
Sex							
Female	190 (33.6%)	72 (26.9%)	44 (19.5%)	31 (18.5%)	10 (17.9%)	1,123 (31.7%)	<0.0001
Male	376 (66.4%)	196 (73.1%)	182 (80.5%)	137 (81.5%)	46 (82.1%)	2,420 (68.3%)	
Age, years							
Mean (SD)	59.3 (11.5)	58.8 (13.0)	58.8 (14.4)	61.2 (15.2)	65.4 (12.2)	68.8 (12.9)	<0.0001
Median (IQR)	59.0 (52.0–67.0)	58.0 (50.0–67.0)	59.0 (48.3–69.0)	61.0 (50.0–72.3)	65.0 (59.0–74.3)	69.0 (60.0–79.0)	
Age group, years							
18–39	22 (3.9%)	16 (6.0%)	23 (10.2%)	14 (8.3%)	2 (3.6%)	38 (1.1%)	0.005
40–49	91 (16.1%)	47 (17.5%)	40 (17.7%)	27 (16.1%)	3 (5.4%)	212 (6.0%)	
50–59	184 (32.5%)	84 (31.3%)	52 (23.0%)	35 (20.8%)	11 (19.6%)	632 (17.8%)	
60–69	163 (28.8%)	63 (23.5%)	56 (24.8%)	40 (23.8%)	20 (35.7%)	950 (26.8%)	
70–79	78 (13.8%)	39 (14.6%)	36 (15.9%)	28 (16.7%)	14 (25.0%)	891 (25.1%)	
80+	28 (4.9%)	19 (7.1%)	19 (8.4%)	24 (14.3%)	6 (10.7%)	820 (23.1%)	
Deprivation quintile (NZDep13), from 1 (least) to 5 (most) deprivation							
1	29 (5.1%)	11 (4.1%)	36 (15.9%)	43 (25.6%)	9 (16.1%)	696 (19.6%)	<0.0001
2	41 (7.2%)	22 (8.2%)	46 (20.4%)	41 (24.4%)	12 (21.4%)	742 (20.9%)	

Appendix Table 1 (continued): ST-elevation myocardial infarction patient characteristics by ethnicity, n (%).

	Māori	Pacific	Indian	Non-Indian Asian	Other	European	p-value*
3	68 (12.0%)	27 (10.1%)	42 (18.6%)	20 (11.9%)	11 (19.6%)	711 (20.1%)	
4	142 (25.1%)	53 (19.8%)	46 (20.4%)	40 (23.8%)	14 (25.0%)	797 (22.5%)	
5	286 (50.5%)	153 (57.1%)	55 (24.3%)	22 (13.1%)	9 (16.1%)	577 (16.3%)	
Missing	0 (0.0%)	2 (0.7%)	1 (0.4%)	2 (1.2%)	1 (1.8%)	20 (0.6%)	
Rurality (Geographic Classification for Health), from Urban 1 (least) to Rural 3 (most) rural							
Urban 1	216 (38.2%)	222 (82.8%)	198 (87.6%)	141 (83.9%)	36 (64.3%)	1,775 (50.1%)	
Urban 2	158 (27.9%)	24 (9.0%)	12 (5.3%)	14 (8.3%)	8 (14.3%)	826 (23.3%)	
Rural 1	85 (15.0%)	4 (1.5%)	5 (2.2%)	5 (3.0%)	6 (10.7%)	520 (14.7%)	
Rural 2	64 (11.3%)	2 (0.7%)	0 (0.0%)	1 (0.6%)	3 (5.4%)	251 (7.1%)	0.0005
Rural 3	26 (4.6%)	1 (0.4%)	0 (0.0%)	1 (0.6%)	0 (0.0%)	39 (1.1%)	
Missing	17 (3.0%)	15 (5.6%)	11 (4.9%)	6 (3.6%)	3 (5.4%)	132 (3.7%)	
Transportation to hospital							
Ambulance	375 (66.3%)	177 (66.0%)	153 (67.7%)	107 (63.7%)	40 (71.4%)	2,760 (77.9%)	
Self	191 (33.7%)	91 (34.0%)	73 (32.3%)	61 (36.3%)	16 (28.6%)	783 (22.1%)	<0.0001

SD = standard deviation; IQR = interquartile range.
*p-value for difference by ethnicity.

Appendix Table 2: Non-ST-elevation myocardial infarction patient characteristics by ethnicity, n (%).

	Māori	Pacific	Indian	Non-Indian Asian	Other	European	p-value*
Total	1,204 (11.3%)	560 (5.3%)	425 (4.0%)	352 (3.3%)	134 (1.3%)	7,952 (74.8%)	
Sex							
Female	547 (45.4%)	233 (41.6%)	106 (24.9%)	102 (29.0%)	39 (29.1%)	2,849 (35.8%)	<0.0001
Male	657 (54.6%)	327 (58.4%)	319 (75.1%)	250 (71.0%)	95 (70.9%)	5,103 (64.2%)	
Age, years							
Mean (SD)	62.3 (12.4)	61.8 (12.9)	62.7 (13.8)	64.3 (14.6)	66.1 (13.5)	72.1 (12.3)	<0.0001
Median (IQR)	63.0 (54.0–71.0)	61.5 (53.0–71.0)	63.0 (53.0–73.0)	65.0 (53.0–76.0)	64.0 (56.0–76.0)	73.0 (63.0–81.0)	
Age group, years							
18–39	41 (3.4%)	21 (3.8%)	23 (5.4%)	17 (4.8%)	1 (0.7%)	43 (0.5%)	0.0005
40–49	143 (11.9%)	77 (13.8%)	51 (12.0%)	49 (13.9%)	10 (7.5%)	266 (3.3%)	
50–59	310 (25.7%)	147 (26.3%)	95 (22.4%)	67 (19.0%)	33 (24.6%)	1,009 (12.7%)	
60–69	368 (30.6%)	163 (29.1%)	108 (25.4%)	85 (24.1%)	41 (30.6%)	1,868 (23.5%)	
70–79	237 (19.7%)	100 (17.9%)	92 (21.6%)	69 (19.6%)	28 (20.9%)	2,388 (30.0%)	
80+	105 (8.7%)	52 (9.3%)	56 (13.2%)	65 (18.5%)	21 (15.7%)	2,378 (29.9%)	
Deprivation quintile (NZDep13), from 1 (least) to 5 (most) deprivation							
1	70 (5.8%)	24 (4.3%)	49 (11.5%)	69 (19.6%)	26 (19.4%)	1,475 (18.5%)	<0.0001
2	90 (7.5%)	43 (7.7%)	76 (17.9%)	92 (26.1%)	30 (22.4%)	1,544 (19.4%)	
3	160 (13.3%)	65 (11.6%)	64 (15.1%)	67 (19.0%)	26 (19.4%)	1,687 (21.2%)	

Appendix Table 2 (continued): Non-ST-elevation myocardial infarction patient characteristics by ethnicity, n (%).

	Māori	Pacific	Indian	Non-Indian Asian	Other	European	p-value*
4	271 (22.5%)	118 (21.1%)	86 (20.2%)	69 (19.6%)	25 (18.7%)	1,885 (23.7%)	
5	612 (50.8%)	305 (54.5%)	149 (35.1%)	55 (15.6%)	27 (20.1%)	1,340 (16.9%)	
Missing	1 (0.1%)	5 (0.9%)	1 (0.2%)	0 (0.0%)	0 (0.0%)	21 (0.3%)	
Rurality (Geographical Classification for Health), from Urban 1 (least) to Rural 3 (most) rural							
Urban 1	415 (34.5%)	475 (84.8%)	373 (87.8%)	307 (87.2%)	98 (73.1%)	3,737 (47.0%)	
Urban 2	363 (30.1%)	36 (6.4%)	21 (4.9%)	20 (5.7%)	10 (7.5%)	1,956 (24.6%)	
Rural 1	176 (14.6%)	15 (2.7%)	12 (2.8%)	12 (3.4%)	13 (9.7%)	1,324 (16.6%)	
Rural 2	159 (13.2%)	8 (1.4%)	2 (0.5%)	2 (0.6%)	7 (5.2%)	590 (7.4%)	0.0005
Rural 3	47 (3.9%)	0 (0.0%)	1 (0.2%)	1 (0.3%)	0 (0.0%)	96 (1.2%)	
Missing	44 (3.7%)	26 (4.6%)	16 (3.8%)	10 (2.8%)	6 (4.5%)	249 (3.1%)	
Transportation to hospital							
Ambulance	586 (48.7%)	264 (47.1%)	226 (53.2%)	154 (43.8%)	70 (52.2%)	5,155 (64.8%)	
Self	618 (51.3%)	296 (52.9%)	199 (46.8%)	198 (56.3%)	64 (47.8%)	2,797 (35.2%)	<0.0001

SD = standard deviation; IQR = interquartile range.
*p-value for difference by ethnicity.

Appendix Table 3: Unstable angina patient characteristics by ethnicity, n (%).

	Māori	Pacific	Indian	Non-Indian Asian	Other	European	p-value*
Total	418 (10.9%)	149 (3.9%)	148 (3.9%)	143 (3.7%)	57 (1.5%)	2,914 (76.1%)	
Sex							
Female	196 (46.9%)	62 (41.6%)	32 (21.6%)	52 (36.4%)	16 (28.1%)	1,012 (34.7%)	<0.0001
Male	222 (53.1%)	87 (58.4%)	116 (78.4%)	91 (63.6%)	41 (71.9%)	1,902 (65.3%)	
Age, years							
Mean (SD)	61.4 (10.8)	61.6 (12.2)	62.8 (11.6)	64.7 (11.6)	63.1 (10.1)	71.0 (11.0)	<0.0001
Median (IQR)	61.0 (55.0–68.0)	60.0 (53.0–72.0)	64.0 (54.8–72.0)	65.0 (57.0–72.0)	63.0 (54.0–72.0)	72.0 (64.0–79.0)	
Age group, years							
18–39	9 (2.2%)	4 (2.7%)	7 (4.7%)	4 (2.8%)	0 (0.0%)	7 (0.2%)	0.0005
40–49	49 (11.7%)	18 (12.1%)	13 (8.8%)	9 (6.3%)	4 (7.0%)	79 (2.7%)	
50–59	116 (27.8%)	49 (32.9%)	31 (20.9%)	30 (21.0%)	19 (33.3%)	391 (13.4%)	
60–69	153 (36.6%)	38 (25.5%)	50 (33.8%)	52 (36.4%)	17 (29.8%)	740 (25.4%)	
70–79	69 (16.5%)	27 (18.1%)	41 (27.7%)	35 (24.5%)	14 (24.6%)	1,054 (36.2%)	
80+	22 (5.3%)	13 (8.7%)	6 (4.1%)	13 (9.1%)	3 (5.3%)	643 (22.1%)	
Deprivation quintile (NZDep13), from 1 (least) to 5 (most) deprivation							
1	27 (6.5%)	6 (4.0%)	15 (10.1%)	34 (23.8%)	13 (22.8%)	541 (18.6%)	<0.0001
2	34 (8.1%)	10 (6.7%)	22 (14.9%)	26 (18.2%)	11 (19.3%)	540 (18.5%)	
3	57 (13.6%)	15 (10.1%)	28 (18.9%)	35 (24.5%)	11 (19.3%)	661 (22.7%)	

Appendix Table 3 (continued): Unstable angina patient characteristics by ethnicity, n (%).

	Māori	Pacific	Indian	Non-Indian Asian	Other	European	p-value*
4	90 (21.5%)	33 (22.1%)	27 (18.2%)	21 (14.7%)	15 (26.3%)	679 (23.3%)	
5	210 (50.2%)	83 (55.7%)	55 (37.2%)	27 (18.9%)	6 (10.5%)	487 (16.7%)	
Missing	0 (0.0%)	2 (1.3%)	1 (0.7%)	0 (0.0%)	1 (1.8%)	6 (0.2%)	
Rurality (Geographical Classification for Health), from Urban 1 (least) to Rural 3 (most) rural							
Urban 1	132 (31.6%)	121 (81.2%)	132 (89.2%)	122 (85.3%)	41 (71.9%)	1,286 (44.1%)	0.0005
Urban 2	135 (32.3%)	9 (6.0%)	3 (2.0%)	13 (9.1%)	7 (12.3%)	725 (24.9%)	
Rural 1	74 (17.7%)	14 (9.4%)	5 (3.4%)	6 (4.2%)	3 (5.3%)	519 (17.8%)	
Rural 2	55 (13.2%)	1 (0.7%)	4 (2.7%)	0 (0.0%)	2 (3.5%)	252 (8.6%)	
Rural 3	12 (2.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (1.8%)	46 (1.6%)	
Missing	10 (2.4%)	4 (2.7%)	4 (2.7%)	2 (1.4%)	3 (5.3%)	86 (3.0%)	
Transportation to hospital							
Ambulance	150 (35.9%)	61 (40.9%)	55 (37.2%)	37 (25.9%)	18 (31.6%)	1,393 (47.8%)	<0.0001
Self	268 (64.1%)	88 (59.1%)	93 (62.8%)	106 (74.1%)	39 (68.4%)	1,521 (52.2%)	

SD = standard deviation; IQR = interquartile range.
*p-value for difference by ethnicity.

Appendix Table 4: ST-elevation myocardial infarction patient characteristics by transport to hospital, n (%).

	Emergency medical service	Other	Total	p-value*
Sex				
Female	1,170 (32.4%)	300 (24.7%)	1,470	<0.01
Male	2,442 (67.6%)	915 (75.3%)	3,357	
Age, years				
18–39	72 (2.0%)	43 (3.5%)	115	<0.01
40–49	280 (7.8%)	140 (11.5%)	420	
50–59	708 (19.6%)	290 (23.9%)	998	
60–69	921 (25.5%)	371 (30.5%)	1,292	
70–79	827 (22.9%)	259 (21.3%)	1,086	
80+	804 (22.3%)	112 (9.2%)	916	
NZDep13 quintiles				
1	642 (17.8%)	182 (15.2%)	824	<0.01
2	692 (19.2%)	212 (17.7%)	904	
3	677 (18.8%)	202 (16.8%)	879	
4	796 (22.1%)	296 (24.6%)	1,092	
5	793 (22.0%)	309 (25.7%)	1,102	
Missing	12	14	26	
Rurality				
Urban 1	2,024 (58.2%)	564 (48.5%)	2,588	<0.01
Urban 2	692 (19.9%)	350 (30.1%)	1,042	
Rural 1	489 (14.1%)	136 (11.7%)	625	
Rural 2	223 (6.4%)	98 (8.4%)	321	
Rural 3	51 (1.5%)	16 (1.4%)	67	
Missing	133	51	184	
Ethnicity				
European	2,760 (76.4%)	783 (64.4%)	3,543	<0.01
Non-Indian Asian	107 (3.0%)	61 (5.0%)	168	
Indian	153 (4.2%)	73 (6.0%)	226	

Appendix Table 4 (continued): ST-elevation myocardial infarction patient characteristics by transport to hospital, n (%).

	Emergency medical service	Other	Total	p-value*
Māori	375 (10.4%)	191 (15.7%)	566	
Pacific	177 (4.9%)	91 (7.5%)	268	
Other	40 (1.1%)	16 (1.3%)	56	

*p-value for difference by transport to hospital by patient.

Appendix Table 5: Non-ST-elevation myocardial infarction patient characteristics by transport to hospital, n (%).

	Emergency medical service	Other	Total	p-value*
Sex				
Female	2,580 (40.0%)	1,296 (31.1%)	3,876	<0.01
Male	3,875 (60.0%)	2,876 (68.9%)	6,751	
Age, years				
18–39	51 (0.8%)	95 (2.3%)	146	<0.01
40–49	258 (4.0%)	338 (8.1%)	596	
50–59	761 (11.8%)	900 (21.6%)	1,661	
60–69	1,357 (21.0%)	1,276 (30.6%)	2,633	
70–79	1,845 (28.6%)	1,069 (25.6%)	2,914	
80+	2,183 (33.8%)	494 (11.8%)	2,677	
NZDep13 quintiles				
1	1,033 (16.0%)	680 (16.4)	1,713	<0.01
2	1,141 (17.7%)	734 (17.7%)	1,875	
3	1,305 (20.3%)	764 (18.4%)	2,069	
4	1,542 (23.9%)	912 (21.9%)	2,454	
5	1,420 (22.0%)	1,068 (25.7%)	2,488	
Missing	14	14	28	
Rurality				
Urban 1	3,313 (53.2%)	2,092 (51.7%)	5,405	<0.01
Urban 2	1,366 (21.9%)	1,040 (25.7%)	2,406	
Rural 1	1,031 (16.6%)	521 (12.9%)	1,552	

Appendix Table 5 (continued): Non-ST-elevation myocardial infarction patient characteristics by transport to hospital, n (%).

	Emergency medical service	Other	Total	p-value*
Rural 2	438 (7.0%)	330 (8.1%)	768	
Rural 3	78 (1.3%)	67 (1.7%)	145	
Missing	229	122	351	
Ethnicity				
European	5,155 (79.9%)	2,797 (67.0%)	7,952	<0.01
Non-Indian Asian	154 (2.4%)	198 (4.7%)	352	
Indian	226 (3.5%)	199 (4.8%)	425	
Māori	586 (9.1%)	618 (14.8%)	1,204	
Pacific	264 (4.1%)	296 (7.1%)	560	
Other	70 (1.1%)	64 (1.5%)	134	

*p-value for difference by transport to hospital by patient characteristic.

Appendix Table 6: Unstable angina patient characteristics by transport to hospital, n (%).

	Emergency medical service	Other	Total	p-value*
Sex				
Female	698 (40.7%)	672 (31.8%)	1,370	<0.01
Male	1,016 (59.3%)	1,443 (68.2%)	2,459	
Age, years				
18–39	10 (0.6%)	21 (1.0%)	31	<0.01
40–49	52 (3.0%)	120 (5.7%)	172	
50–59	179 (10.4%)	457 (21.6%)	636	
60–69	383 (22.3%)	667 (31.5%)	1,050	
70–79	588 (34.3%)	652 (30.8%)	1,240	
80+	502 (29.3%)	198 (9.4%)	700	
NZDep13 quintiles				
1	256 (15.0%)	380 (18.0%)	636	<0.01
2	287 (16.8%)	356 (16.9%)	643	
3	371 (21.7%)	436 (20.7%)	807	
4	418 (24.5%)	447 (21.2%)	865	

Appendix Table 6 (continued): Unstable angina patient characteristics by transport to hospital, n (%).

	Emergency medical service	Other	Total	p-value*
5	377 (22.1%)	491 (23.3%)	868	
Missing	5	5	10	
Rurality				
Urban 1	814 (49.1%)	1,020 (49.4%)	1,834	<0.01
Urban 2	365 (22.0%)	527 (25.5%)	892	
Rural 1	319 (19.3%)	302 (14.6%)	621	
Rural 2	134 (8.1%)	180 (8.7%)	314	
Rural 3	25 (1.5%)	34 (1.6%)	59	
Missing	57	52	109	
Ethnicity				
European	1,393 (81.3%)	1,521 (71.9%)	2,914	<0.01
Non-Indian Asian	37 (2.2%)	106 (5.0%)	143	
Indian	55 (3.2%)	93 (4.4%)	148	
Māori	150 (8.8%)	268 (12.7%)	418	
Pacific	61 (3.6%)	88 (4.2%)	149	
Other	18 (1.1%)	39 (1.8%)	57	

*p-value for difference by transport to hospital by patient characteristic.