

Characteristics and outcomes of adults admitted to New Zealand ICUs following a cardiac arrest by ethnicity: a brief report

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There are significant ethnic disparities in the risk of developing and dying from heart disease in New Zealand. While the incidence of cardiac arrest is higher for the Māori compared with the non-Māori population,¹ the intensive care unit (ICU) admission rates after cardiac arrest and outcomes for major New Zealand ethnic groups have not been reported. Many patients who have a cardiac arrest require a period of supportive care in the ICU, and, accordingly, ICU care is a critical link in the chain of survival.

We conducted a retrospective cohort study using data from the New Zealand Ministry of Health National Minimum Dataset matched to the Australian New Zealand Intensive Care Society Centre for Outcome and Resource Evaluation Adult Patient Database (ANZICS CORE APD). This study was submitted to the Health and Disability Ethics Committee of New Zealand (20/CEN/86) and deemed out of scope due to minimal risk. The National Minimum Dataset is a centralised data collection system containing all New Zealand hospital admissions, organised using a patient's National Health Index number and administered by the New Zealand Ministry of Health.² The ANZICS CORE APD is an established binational voluntary intensive care registry database, which has been described previously.³

We used data relating to ICU admissions in New Zealand hospitals following cardiac arrest from 1 July 2009 to 30 June 2018 inclusive. We included all admissions where the ICU admission diagnosis was cardiac arrest and all admissions where a cardiac arrest occurred in the 24 hours before ICU admission, even when this was not the ICU admission diagnosis. We evaluated the association between ethnicity and outcomes (day 180 mortality, ICU mortality, hospital mortality, and discharge home) using European ethnicity as the reference category. We used logistic regression and performed analyses using four models. First, we evaluated the raw association between ethnicity and each of the binomial outcomes. Second, we evaluated these same associations incorporating adjustment for deprivation status. Third, we evaluated these associations adjusting for all variables that were known before ICU admission (ie, deprivation status, age, sex, site of admission, year of admission, and chronic comorbidities as measured using

the Charlson Comorbidity Index⁴). Finally, we adjusted for illness severity using the Australian and New Zealand Risk of Death (ANZROD) assessment, which includes data from the first 24 hours in the ICU. This final analysis also incorporated adjustment for deprivation status, site, sex, year, and comorbidity as included in the ANZROD model. Comparison of outcomes by ethnic group are reported as odds ratios (ORs) along with 95% confidence intervals (CIs), with an OR of more than 1 corresponding to a greater risk of an adverse outcome for non-European patients.

A total of 3308 of 61 873 ICU admissions (5.3%) occurred after a cardiac arrest. There were highly statistically significant differences in post-cardiac arrest ICU admission rates by ethnicity, with 2039 of 42 871 European (4.8%), 667 of 9681 Māori (6.9%), 325 of 4603 Pacific peoples (7.1%), and 194 of 3435 Asian (5.6%) ICU patients, respectively, admitted following a cardiac arrest ($P < 0.001$). European patients were older, had fewer comorbidities, had markedly lower rates of diabetes, and had lower illness severity (Table 1).

Notably, for day 180 mortality, the OR for death adjusting for pre-ICU baseline confounders (deprivation status, age, sex, site of admission, year of admission, and chronic comorbidities) was significantly higher for Māori, Pacific peoples and Asian patients compared with European patients (Table 2 and Figure 1). While Asian patients appeared to have worse outcomes than European patients when accounting for ICU illness severity, the illness severity-adjusted outcomes for other ethnic groups were similar to those of European patients (Table 2).

Our data show that, after accounting for illness severity, Asian patients had worse outcomes, and Māori and Pacific peoples patients had similar outcomes to European post-cardiac arrest patients admitted to the ICU. Thus, they suggest that for Māori and Pacific peoples patients there may not be major inequities in relation to the provision of ICU care in these patients. Nevertheless, because Māori, Pacific peoples and Asian patients have higher mortality rates than European patients, post-cardiac arrest interventions provided in the ICU that produce a given overall relative reduction in mortality will result in greater absolute

Table 1. Patient characteristics by ethnicity*

	Ethnicity				P
	European	Māori	Pacific peoples	Asian	
Total number of patients	2039	667	325	194	
Age, year, mean (SD)	63.1 (15.1)	51.8 (15.8)	53.4 (16.8)	56.9 (16.3)	< 0.0001
Sex, male	1435 (70.4%)	392 (58.8%)	209 (64.3%)	135 (69.6%)	< 0.0001
Weight, kg, mean (SD)	82.4 (19.9)	91.3 (26.7)	99.7 (25.2)	75.4 (16.2)	< 0.0001
Frailty, [†] median (IQR)	3 (1–4)	3.5 (3–5)	0.5 (0–1)	3 (0–3)	0.13
Deprivation status, [‡] mean (SD)	5.6 (2.73)	7.88 (2.34)	8.24 (2.33)	5.9 (2.89)	< 0.0001
Source of ICU admission					
Operating theatre	259 (12.7%)	56 (8.4%)	36 (11.1%)	24 (12.4%)	0.03
Emergency department	1304 (64%)	448 (67.2%)	228 (70.2%)	122 (62.9%)	0.09
Ward	257 (12.6%)	75 (11.2%)	44 (13.5%)	34 (17.5%)	0.14
Transfer from another hospital	210 (10.3%)	88 (13.2%)	17 (5.2%)	14 (7.2%)	0.0007
Unknown	9 (0.441%)	0 (0%)	0 (0%)	0 (0%)	0.35
Chronic comorbidities					
Charlson Comorbidity Index, median (IQR)	1 (0–2)	1 (0–3)	1 (0–3)	2 (0–3)	< 0.0001
Myocardial infarction	651 (31.9%)	142 (21.3%)	70 (21.5%)	59 (30.4%)	< 0.0001
Congestive cardiac failure	481 (23.6%)	157 (23.5%)	79 (24.3%)	48 (24.7%)	0.98
Peripheral vascular disease	88 (4.3%)	43 (6.4%)	6 (1.8%)	11 (5.7%)	0.008
CVA or TIA	132 (6.5%)	46 (6.9%)	19 (5.8%)	15 (7.7%)	0.84
Dementia	12 (0.589%)	3 (0.45%)	1 (0.308%)	1 (0.515%)	0.91
COPD	112 (5.5%)	61 (9.1%)	11 (3.4%)	13 (6.7%)	0.009
Connective tissue disease	10 (0.49%)	0 (0%)	2 (0.615%)	3 (1.5%)	0.04
Peptic ulcer disease	23 (1.1%)	14 (2.1%)	5 (1.5%)	3 (1.5%)	0.32
Mild liver disease	44 (2.2%)	26 (3.9%)	8 (2.5%)	9 (4.6%)	0.03
Diabetes without complications	120 (5.9%)	67 (10%)	37 (11.4%)	30 (15.5%)	< 0.0001
Diabetes with complications	213 (10.4%)	134 (20.1%)	104 (32%)	54 (27.8%)	< 0.0001
Paraplegia or hemiplegia	48 (2.4%)	15 (2.2%)	4 (1.2%)	5 (2.6%)	0.63
Renal disease	166 (8.1%)	93 (13.9%)	62 (19.1%)	26 (13.4%)	< 0.0001
Cancer	68 (3.3%)	27 (4%)	8 (2.5%)	5 (2.6%)	0.54
Moderate to severe liver disease	38 (1.9%)	4 (0.6%)	10 (3.1%)	7 (3.6%)	0.008
Metastatic cancer	17 (0.8%)	8 (1.2%)	1 (0.3%)	1 (0.5%)	0.50
HIV/AIDS	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1
Illness severity [§]					
ANZROD, mean (SD)	41.5 (27.5)	43.9 (28.3)	43.3 (29.1)	44.3 (28.3)	0.14

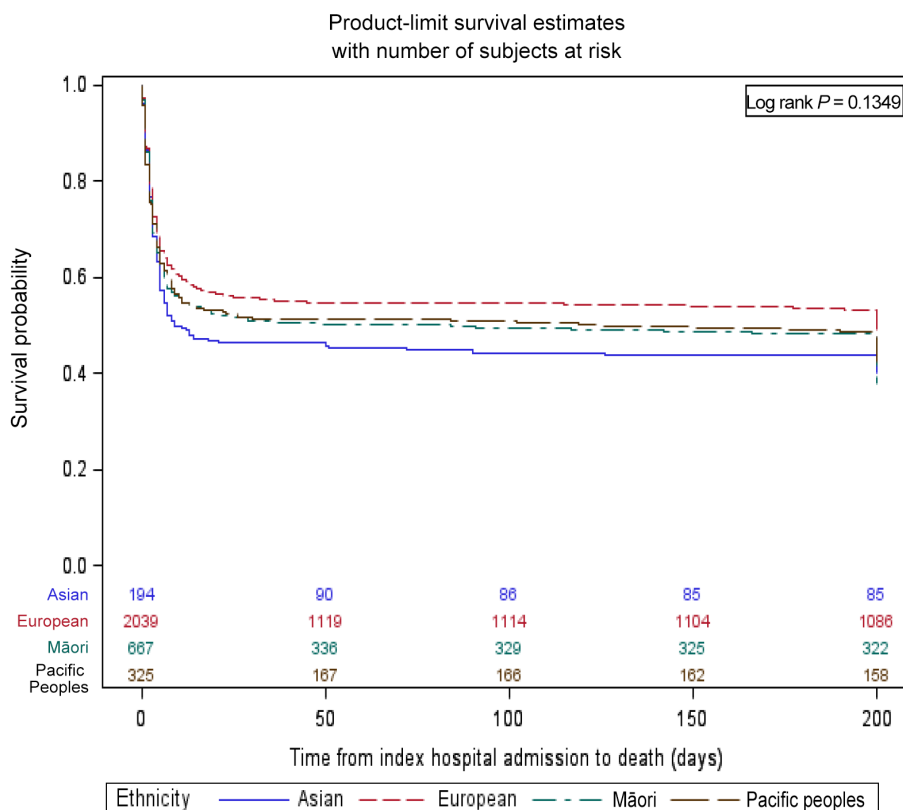
AIDS = acquired immunodeficiency syndrome; ANZROD = Australian and New Zealand Risk of Death; COPD = chronic obstructive pulmonary disease; CVA = cerebrovascular accident; HIV = human immunodeficiency virus; ICU = intensive care unit; IQR = interquartile range; SD = standard deviation; TIA = transient ischaemic attack. * There were 55 patients where ethnicity was unknown and 28 patients who were categorised as belonging to another ethnic group. These patients were not included in the analyses. † Frailty was calculated at ICU admission based on pre-illness function status using the Dalhousie Frailty Score, which classifies patients into the following categories: very fit, 1; fit, 2; managing well, 3; living with very mild frailty, 4; living with mild frailty, 5; living with moderate frailty, 6; living with severe frailty, 7; living with very severe frailty, 8. ‡ Deprivation status was categorised in deciles from 1 (least deprived) to 10 (most deprived) using data associated with postcodes obtained from the 2013 New Zealand census. § The ANZROD model combines physiology, age, diagnosis, and comorbidities collected during the first 24 hours in the ICU to create the predicted risk of death in hospital. The chronic score was not normally distributed; however, the median score was 0 (IQR, 0–0) for both groups.

Table 2. Patient outcomes by ethnicity*

	Ethnicity				P
	European	Māori	Pacific peoples	Asian	
Total number of patients	2039	667	325	194	
ICU mortality	746 (36.6%)	284 (42.6%)	150 (46.2%)	97 (50%)	< 0.001
Unadjusted OR [†] (95% CI)	Reference category	1.23 (1.02–1.47)	1.25 (0.99–1.60)	1.42 (1.05–1.92)	0.02
OR adjusted for deprivation status [‡] (95% CI)		1.15 (0.95–1.40)	1.13 (0.87–1.46)	1.39 (1.03–1.88)	0.12
OR adjusted for pre-ICU admission characteristics [§] (95% CI)		1.17 (0.95–1.44)	1.27 (0.96–1.68)	1.53 (1.12–2.09)	0.03
OR adjusted for variables including ICU illness severity [¶] (95% CI)		1.09 (0.88–1.37)	1.18 (0.87–1.60)	1.36 (0.96–1.92)	0.29
In-hospital mortality	891 (43.7%)	314 (47.1%)	159 (48.9%)	103 (53.1%)	0.06
Unadjusted OR [†] (95% CI)	Reference category	1.17 (0.98–1.39)	1.23 (0.97–1.55)	1.47 (1.10–1.98)	0.02
OR adjusted for deprivation status [‡] (95% CI)		1.08 (0.90–1.31)	1.11 (0.86–1.42)	1.48 (1.10–1.99)	0.07
OR adjusted for pre-ICU admission characteristics [§] (95% CI)		1.22 (0.99–1.49)	1.45 (1.10–1.91)	1.85 (1.35–2.52)	< 0.001
OR adjusted for variables including ICU illness severity [¶] (95% CI)		0.99 (0.79–1.24)	1.26 (0.92–1.71)	1.62 (1.14–2.31)	0.03
Day 180 mortality	946 (46.4%)	344 (51.6%)	165 (50.8%)	109 (56.2%)	0.03
Unadjusted OR [†] (95% CI)	Reference category	1.23 (1.03–1.47)	1.19 (0.94–1.51)	1.48 (1.10–1.99)	0.01
OR adjusted for deprivation status [‡] (95% CI)		1.12 (0.93–1.35)	1.05 (0.82–1.35)	1.49 (1.10–2.00)	0.06
OR adjusted for pre-ICU admission characteristics [§] (95% CI)		1.36 (1.10–1.66)	1.48 (1.13–1.95)	1.97 (1.44–2.70)	< 0.001
OR adjusted for variables including ICU illness severity [¶] (95% CI)		1.06 (0.85–1.32)	1.23 (0.90–1.67)	1.71 (1.20–2.44)	0.03
Discharged home	696 (34.1%)	215 (32.2%)	103 (31.7%)	53 (27.3%)	0.36
Unadjusted OR [†] (95% CI)	Reference category	1.00 (0.83–1.20)	1.03 (0.81–1.32)	0.78 (0.56–1.07)	0.46
OR adjusted for deprivation status [‡] (95% CI)		1.07 (0.88–1.30)	1.11 (0.86–1.45)	0.78 (0.56–1.08)	0.30
OR adjusted for pre-ICU admission characteristics [§] (95% CI)		0.93 (0.75–1.15)	0.91 (0.68–1.20)	0.68 (0.48–0.95)	0.15
OR adjusted for variables including ICU illness severity [¶] (95% CI)		1.14 (0.92–1.43)	1.08 (0.80–1.47)	0.81 (0.56–1.16)	0.33

ICU = intensive care unit; OR = odds ratio. * There were 55 patients for whom ethnicity was unknown and, 28 patients who were categorised as belonging to another ethnic group. These patients were not included in the analyses. All ORs show associations between Māori ethnicity and the outcome of interest, with European as the reference category. ORs over 1 correspond to a higher chance of the outcome for Māori patients compared with European patients. Bold text indicates ORs where 95% CIs do not cross 1. † The unadjusted OR shows the raw association. ‡ The OR adjusted for deprivation status shows the strength of the association accounting for baseline differences in the New Zealand deprivation status based on the 2013 census (NZDep13 Index of Deprivation). § The OR adjusted for pre-ICU admission characteristics shows the strength of the association accounting for baseline differences, deprivation status, age, sex, site of admission, year of admission, and chronic comorbidities. ¶ The OR adjusted for ICU illness severity shows the strength of the association accounting for baseline differences in the Australian and New Zealand Risk of Death (ANZROD) model, deprivation status, site, sex, and the year of admission.

Figure 1. Survival by ethnicity



reductions in mortality and a smaller number needed to treat for such ethnic minorities. Moreover, as cardiac arrest before ICU admission is more common in non-European patients, the population-level effects of such improvements will disproportionately benefit non-European patients. Accordingly, these data provide support for prioritisation of ICU research investigating improvements in cardiac arrest treatments in order to reduce inequities in this aspect of New Zealand public health delivery.

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Competing interests

No relevant disclosures.

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BRIEF REPORTS

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