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Original Article

Outcomes for Pacific and European patients admitted to New Zealand intensive care units from 2009 to 2018

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ABSTRACT

Objective: To describe the characteristics and outcomes of Pacific and European patients admitted to New Zealand (NZ) intensive care units (ICUs) 2009–2018.

Design: Retrospective cohort study.

Setting and participants: The NZ Ministry of Health National Minimum Dataset and the Australia NZ Intensive Care Society Adult Patient Database were matched. Data were for ICU admissions in NZ hospitals from July 2009 until June 2018; long-term mortality outcomes were obtained from the NZ death registry until June 2020.

Main outcome measures: The primary outcome was day 180 mortality. Secondary outcomes were ICU mortality, hospital mortality, discharge to home, ICU and hospital length of stay, and survival. We evaluated the associations between Pacific ethnicity and outcomes with European as the reference using regression analyses. We adjusted sequentially for site, deprivation status, sex, year of admission, Charlson Comorbidity Index, age, admission source and type, ICU admission diagnosis, ventilation status, and illness severity.

Results: Pacific people had a median age of 14 years younger than Europeans. 644/4603 (14.0%) Pacific, and 6407/42,871 (14.9%) European patients died within 180 days of ICU admission; odds ratio (OR) 0.93; 95% CI, 0.85–1.01. When adjusting for age, the OR for day 180 mortality for Pacific vs. European patients increased. The OR decreased after adjustment for admission source and type, and after accounting for Pacific patients having a higher comorbidity index and more severe illness. In the final model, incorporating adjustments for all specified variables, Pacific ethnicity was not significantly associated with day 180 mortality (adjusted OR 0.91; 95% CI, 0.80–1.05). Findings were similar for secondary outcomes except for the proportion of patients discharged home; Pacific ethnicity was associated with significantly increased odds of being discharged home compared to European ethnicity.

Conclusions: Pacific ethnicity was not associated with increased day 180 mortality compared to European ethnicity; Pacific patients admitted to the ICU were more likely to be discharged home than European patients.

Pacific peoples make up 8% of the New Zealand (NZ) population; however, this percentage is increasing with time, and the number of Pacific people living in NZ are expected to reach between 440,000 and 480,000 in 2025.[1] The estimated life expectancy of Pacific peoples in NZ is a median of 5 years less than the NZ European population. Most research evaluates health inequalities that adversely affect Pacific peoples in NZ has focussed on chronic conditions.[2,3] Coronary disease, diabetes and cerebrovascular disease appear to be the largest contributors to the differential life expectancy.[2] However, Pacific peoples in NZ also experience a higher incidence and lower survival rates for cancers including lung, liver, and stomach cancers compared to the NZ European population.[3]

After controlling for age and chronic conditions, Pacific peoples had three times greater odds of hospitalisation for coronavirus

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disease 2019 (COVID-19) in NZ than Europeans.[4] However, overall, there is a paucity of research focussing on health inequities between Pacific and European populations in NZ that arise in patients receiving acute care. We recently reported that compared to European patients, Māori admitted to NZ ICUs between 2009 and 2018 were markedly more likely to be admitted after trauma or with sepsis.[5] Despite Māori patients being 13 years younger at ICU admission on average than their European counterparts, and they had more comorbidities, higher illness severity, and a higher risk of dying within 180 days.[5] Similar data on the characteristics and outcomes of Pacific patients admitted to NZ ICUs have not been reported.

Accordingly, we sought to describe outcomes for Pacific and European patients admitted to NZ ICUs. We undertook a series of analyses, adjusting for potential confounders with a view to describing possible contributors to any observed inequalities in health outcomes.

1. Methods

1.1. Study design and setting

We undertook a retrospective cohort study using data from the NZ Ministry of Health National Minimum Dataset (NMD) matched to the Australian New Zealand Intensive Care Society Centre for Outcome and Resource Evaluation Adult Patient Database (ANZICS CORE APD). The NMD is a centralised data collection system containing all NZ hospital admissions, organised using a patient's National Health Index number and administered by the NZ Ministry of Health.[6] The ANZICS CORE APD is an established bi-national voluntary ICU registry, which has been described previously.[7]

We used data relating to ICU admissions to NZ hospitals from July 1, 2009, until June 30, 2018, inclusive, and focussed on admissions to the 16 ICUs in 15 hospitals that contributed to the ANZICS CORE APD throughout the period of interest. These included major tertiary, regional, and rural public hospital ICUs in NZ. All public hospital ICUs where care is provided by intensivists were included in this study (except for one). We chose the specified time period to facilitate comparison with our recent publication comparing outcomes for Māori vs. European patients admitted to NZ ICUs,[5] and because of the potential for changes in longer-term comparative outcomes in more recent data to be influenced by the COVID-19 pandemic.[4,8]

This study was submitted to the Health and Disability Ethics Committee of NZ (20/CEN/86) and deemed out of scope due to minimal risk.

1.2. Patients

All patients aged 18 years or older who were admitted to one of the 16 participating NZ ICUs were eligible for inclusion. The matching of patients included in the two databases of interest was performed based on six variables that were common to both databases. These variables were the name of the admission hospital, the date of hospital admission, and the date of hospital discharge, age, sex and in-hospital mortality. To account for situations where patients were transferred from one ICU to another, we linked ICU admission episodes where a particular patient was discharged from one ICU and then readmitted to another ICU on the same day. In these circumstances, descriptive baseline data were obtained from the first ICU admission, but outcome data were obtained from the last ICU admission. Where a patient had multiple ICU admissions within the study period, only the first ICU admission was included. Accordingly, all ICU admissions included in our final dataset were from unique patients. Because illness severity is a key determinant of outcome for ICU patients,[9] we excluded patients whose illness severity data were not available in the ANZICS CORE APD.

In this analysis, we compared the outcomes of Pacific and European patients. We defined patients whose ethnicity was coded as "NZ European", "European not further defined" and "Other European" as European for the purposes of this analysis. Patients who were neither European nor Pacific were excluded from the current analysis. We obtained long-term mortality data from the NZ death registry up until June 2020.

1.3. Outcomes

1.3.1. Primary outcome

The primary outcome was day 180 mortality.

1.3.2. Secondary outcomes

Secondary outcomes were ICU mortality, hospital mortality, discharge to home, ICU length of stay, hospital length of stay, and survival time.

1.4. Outcome predictors, potential confounders, and effect modifiers

In order to explore the extent to which, in the NZ health care system, Pacific ethnicity is a *predictor* of adverse outcomes, we compared ethnic groupings of Pacific and European using 'prioritised' ethnicity classification where each patient is allocated to a single ethnic group using prioritisation tables as used in the NZ Ministry of Health NMD.[10]

As in our previous study comparing outcomes for European and Māori patients,[5] we specified a number of variables as *potential confounders* of the relationship between ethnicity and outcome. These variables were deprivation status, age, sex, site of admission, year of admission, chronic comorbidities as measured using the Charlson Comorbidity Index,[11] admission diagnosis, admission type (elective vs. emergency), and source (operating theatre, emergency department, ward, transfer from another hospital, and unknown), ventilation status, and illness severity. Deprivation status was defined using the NZ deprivation index as included in the NZ Ministry of Health NMD.[12] This index uses data associated with postcodes obtained from the 2013 census as a surrogate for the deprivation status of individual patients. The NZ deprivation index categorises patients into deciles from 1 (least deprived) to 10 (most deprived). Age and year of admission were calculated at the date of hospital admission. Age, sex, site of admission, and year of admission we included in both study databases; however, where there were minor date discrepancies encountered during merging, we used data obtained from the ANZICS CORE APD for reporting purposes. The Charlson Comorbidity Index[11] was calculated using preexisting comorbidities based on ICD-10 codes included in the New Zealand Ministry of Health NMD as previously described.[13] To obtain a measure of illness severity that was independent of other potential confounders, we evaluated illness severity using only the physiological parameters included in the Acute Physiology And Chronic Health Evaluation (APACHE) III score[14] (i.e. the age and comorbidity components of the score were removed).

1.5. Statistical methods

All baseline characteristics were summarised by ethnic group using means and standard deviations for normally distributed variables, medians and interquartile ranges for other continuous variables, and counts and percentages for categorical variables. Comparisons of baseline variables by ethnic group were undertaken using the Student's t test for normally distributed

variables and Wilcoxon rank sum tests otherwise. Categorical variables were compared using chi-square tests for equal proportions.

For outcome comparisons, we evaluated the association between Pacific ethnicity and outcome using European ethnicity as the reference category. For day 180 mortality, ICU mortality, hospital mortality, and discharge home, we used logistic regression adjusting for known covariates and baseline imbalances. These variables included site, deprivation status, sex, year of admission, Charlson Comorbidity Index,[11] age, admission source and type, admission diagnosis, ventilation status, and illness severity. To ascertain the individual impact of each covariate, we fitted these sequentially, with the resulting risk for Pacific ethnicity (vs. European) reported as odds ratios (OR) with a 95% confidence interval for each stage, with an OR of more than one corresponding to a greater risk of an adverse outcome for Pacific compared to their European counterparts. ICU and hospital length of stay were evaluated using competing risk analyses adjusted for the competing risk of death using an analogous approach to that described above, with results reported at each stage as hazard ratios (HR) along with a 95% CI and presented as cumulative incidence plots. For these analyses, a HR greater than one corresponds to a shorter time to discharge alive for Pacific peoples compared to their European counterparts. Survival time to 180 days was compared using the Cox proportionl hazards regression in accordance with the approach described above, with results reported as a Hazard ratio (95% CI) for each stage of the model development. Proportionality assumptions for ethnicity were visually assessed using log-cumulative hazard plots. For the survival analysis, a hazard ratio of more than one corresponds to a worse outcome for the Pacific compared to their European counterparts because it equates to a shorter time to death.

Analyses were conducted using SAS statistical software, version 9.4 (SAS Institute).

2. Results

2.1. Patients

A total of 47,474 patients from 16 ICUs were included in this study (Fig. 1). The ICUs that contributed data are listed in the acknowledgements section. Annual hospital data were available for 132 of 150 (88%) of hospital-years with 11 of 16 sites contributing data for all years of the study period. A comparison of Pacific and European patients in the New Zealand Ministry of Health NMD who could be matched to the ANZICS CORE APD, with those who could not be matched to the ANZICS CORE APD is shown in Table S1 in the

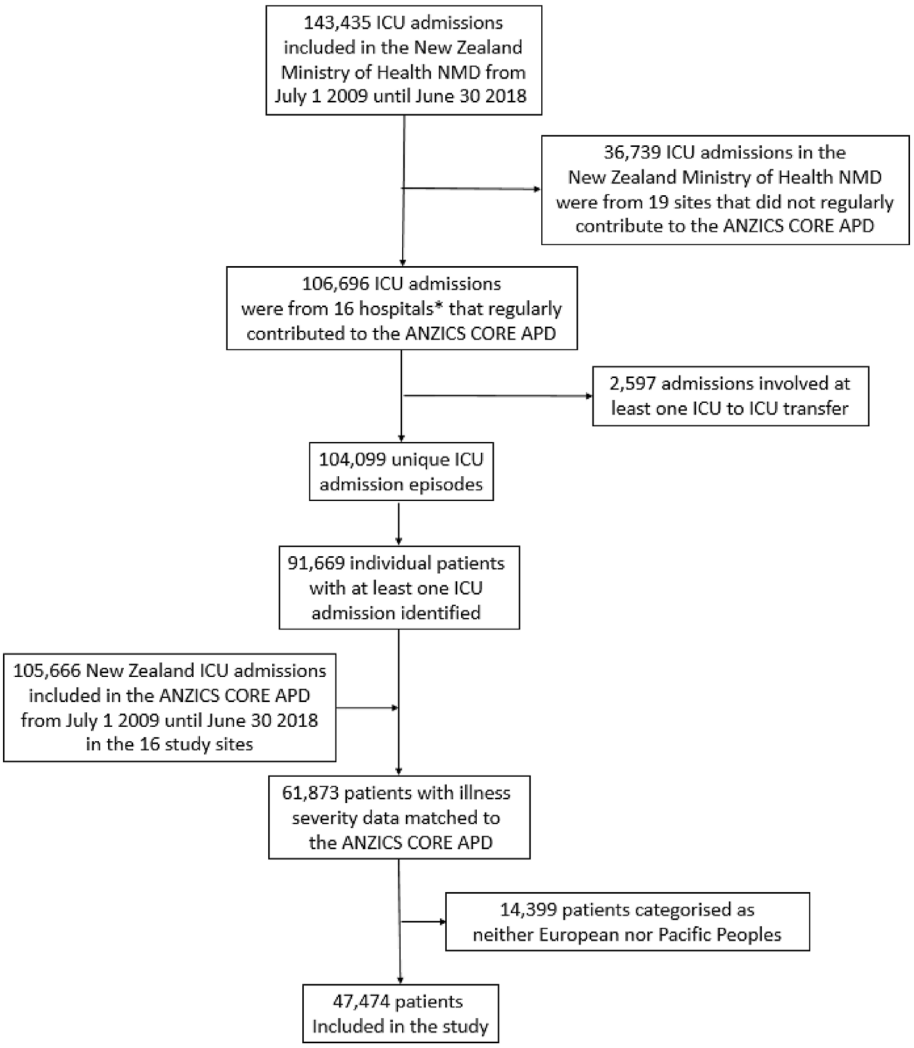

Fig. 1. Flow diagram. * *Two ICUs from a single hospital were included, for a total of 17 contributing ICUs. Abbreviations: ANZICS CORE APD: Australian and New Zealand Intensive Care Society Centre for Outcome and Resource Evaluation Adult Patient Database; ICU: intensive care unit; NMD: National minimum database.

Supplement. Of the patients included in this analysis (i.e. Pacific and European patients), 4603 (10.3%) were Pacific people. When patients from other (non-European) ethnic groups were included, Pacific peoples made up 7.4% of all ICU admissions. The specific ethnicities included in the Pacific ethnic group are shown in Table S2.

Compared to European patients, Pacific patients had a median age of 14 years younger at ICU admission. They were more likely to be female, had higher deprivation status, were more likely to be admitted to the ICU in an emergency, and had a more severe illness (Table 1). Pacific patients also had higher rates of a number of comorbidities and a higher Charlson Comorbidity Index than European patients. Diabetes mellitus, in particular, was much more common in Pacific patients (Table 1). Additional data on comorbidities for Pacific and European patients are shown in Table S3 in the Supplement. A total of 1851 of 4603 Pacific patients (40.2%) and 2959 of 42871 European patients (6.9%) were categorised in the most deprived decile (Table S4 in the Supplement). A total of 4136 of 4603 Pacific patients (89.9%) and 25459 of 42871 European patients (59.4%) were admitted to an ICU in a majority (Table 1).Data on admission site and year by ethnicity are shown in Table S5 in the Supplement.

Table 2
ICU admission diagnostic categories by ethnicity[a].

Diagnostic category, n (%)	Pacific (N=4603)	European (N=42,871)
Cardiovascular	1827 (39.7%)	18401 (42.9%)
Respiratory	665 (14.4%)	5713 (13.3%)
Gastrointestinal	398 (8.6%)	5398 (12.6%)
Neurological	350 (7.6%)	3028 (7.1%)
Trauma	240 (5.2%)	2732 (6.4%)
Metabolic	196 (4.3%)	2359 (5.5%)
Sepsis	417 (9.1%)	2318 (5.4%)
Musculoskeletal	170 (3.7%)	1318 (3.1%)
Renal/Genitourinary	190 (4.1%)	998 (2.3%)
Gynaecological	123 (2.7%)	317 (0.7%)
Haematological	13 (0.3%)	127 (0.3%)
Other medical disorders	5 (0.1%)	102 (0.2%)
Unknown	9 (0.2%)	60 (0.1%)

[a] $P < 0.0001$.

Compared to European patients, Pacific patients were more likely to be admitted to the ICU with sepsis, respiratory and genitourinary and renal disorders, and less likely to be admitted to the ICU with cardiovascular, gastrointestinal, and metabolic disorders, and trauma (Table 2).

Table 1
Baseline characteristics by ethnicity[a].

	Pacific Peoples (N = 4603)	European (N = 42,871)
Age, yr, median [IQR]	52 [39–63]	66 [54–75]
0–39.9 years, n (%)	1212 (26.3%)	4815 (11.2%)
40–59.9 years, n (%)	1817 (39.5%)	10072 (23.5%)
60–79.9 years, n (%)	1496 (32.5%)	22418 (52.3%)
80+ years, n (%)	78 (1.7%)	5566 (13.0%)
Male sex, n (%)	2685 (58.3%)	26885 (62.7%)
Weight, kg	99.5 ± 28.5	81.1 ± 20.4
Deprivation status[b]	8.2 ± 2.3	5.7 ± 2.7
Category of admission, n (%)		
Elective ICU admission	1829 (39.7%)	18765 (43.9%)
Emergency ICU admission	2774 (60.3%)	24106 (56.1%)
Source of ICU admission, n (%)		
Operating theatre	2450 (53.2%)	25054 (58.4%)
Emergency department	1384 (30.1%)	10252 (23.9%)
Ward	595 (12.9%)	5443 (12.7%)
Transfer from another hospital	166 (3.6%)	2069 (4.8%)
Unknown	8 (0.2%)	53 (0.1%)
Charlson Comorbidity Index, median [IQR]	1 [0–3]	1 [0–2]
Charlson Comorbidity Index 0, n (%)	1511 (32.8%)	17548 (40.9%)
Charlson Comorbidity Index 1, n (%)	857 (18.6%)	10404 (24.3%)
Charlson Comorbidity Index 2, n (%)	669 (14.5%)	5935 (13.8%)
Charlson Comorbidity Index ≥3, n (%)	1566 (34.0%)	8984 (21.0%)
Common comorbidities, n (%)		
Myocardial infarction	597 (13.0%)	5007 (11.7%)
Congestive cardiac failure	576 (12.5%)	3924 (9.2%)
Diabetes without complications	675 (14.7%)	2755 (6.4%)
Diabetes with complications	1350 (29.3%)	4864 (11.3%)
Renal disease	838 (18.2%)	3406 (7.9%)
Cancer	407 (8.8%)	5016 (11.7%)
Illness severity[c]		
ANZROD, %	10.0 ± 18.6	9.5 ± 17.5
APACHE-III Physiology score	49.4 ± 26.1	46.0 ± 23.6
Admitted to an ICU in a major city[d], n (%)	4136 (89.9)	25459 (59.4)

Abbreviations: ANZROD: Australian and New Zealand Risk of Death; APACHE: Acute Physiology and Chronic Health Evaluation; IQR: interquartile range; SD: standard deviation.
± values are mean ± SD.
[a] The P values for all between-group comparisons were <0.0001 except for myocardial infarction (comorbidity), P = 0.01.
[b] 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.
[c] The ANZROD combines physiology, age, diagnosis, and comorbidities collected during the first 24 h in the ICU to create predicted risk of death in hospital.
[d] Auckland, Wellington, and Christchurch were defined as major cities.

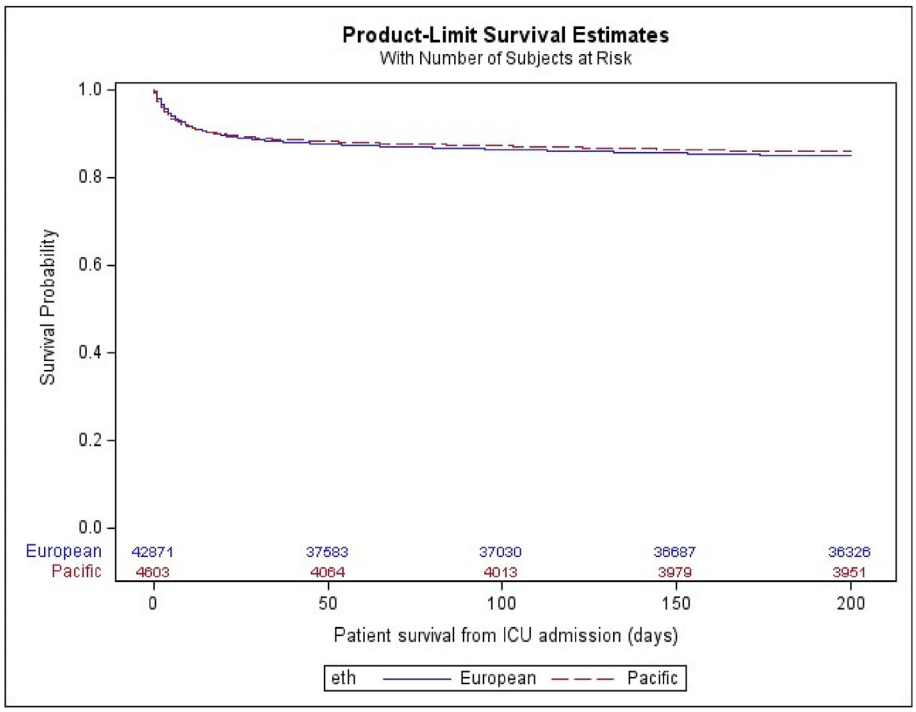

Fig. 2. Kaplan–Meier survival plot. * * The unadjusted hazard ratio for survival to day 180 for Pacific Peoples vs. European patients was 0.94 (0.86–1.01) with a hazard ratio of less than one corresponds to a better outcome for Pacific patients compared to their European counterparts because it equates to a longer time to death. Data showing hazard ratios adjusted for potential confounding variables are shown in the Supplement (Table S6).

2.2. Primary outcome

A total of 644 (14.0%) and 6407 (14.9%) Pacific and European patients, respectively, had died within 180 days of ICU admission (OR: 0.93, 95% CI, 0.85 to 1.01) (Fig. 2, Table 3, and Table S6 in the Supplement). The effect of sequentially adjusting for potential confounding variables is shown in Table 3. Deprivation status, sex, year of admission, diagnosis, and whether the patient was ventilated did not appear to be important confounders of the association between Pacific ethnicity and day 180 mortality. While the site had some effect, the strongest confounder was age. Inclusion of age in the regression model increased the OR for day 180 mortality for Pacific vs. European patients substantially. Adjustments for the Charlson Comorbidity Index and for illness severity both reduced the OR for day 180 mortality for Pacific vs. European patients. In the final model, incorporating adjustments for all specified variables, Pacific ethnicity was not significantly associated with day 180 mortality (OR 0.91, 95% CI 0.80 to 1.05).

2.3. Secondary outcomes

A total of 311 (6.8%) and 2525 (5.9%) Pacific and European patients, respectively, died prior to ICU discharge (OR: 1.16, 95% CI, 1.02–1.31) with 500 (10.9%) and 4662 (10.9%), respectively, dying prior to hospital discharge (OR: 1.01, 95% CI, 0.91–1.11). A total of 3532 (76.7%) and 29,295 (68.3%) Pacific and European patients, respectively, were discharged home from the hospital (OR: 1.53, 95% CI, 1.42–1.64). Compared to European ethnicity, Pacific ethnicity was significantly associated with higher odds of being discharged home in all analyses (Table 3).

For all other secondary outcomes, the effect of confounding variables on the associations between Pacific ethnicity and outcome were similar to those observed when evaluating the relationship between Pacific ethnicity and day 180 mortality. Age was observed consistently to be the strongest confounder (Table 3). The ICU length of stay was a median of 1.4 days [IQR, 0.9–2.8 days] and 1.3 [IQR, 0.9–3.0 days] for Pacific and European patients, respectively (Fig. S1 in the Supplement). The median hospital length of stay was 8 days [IQR, 5–14] and 9 days [IQR, 5–15] for Pacific and European patients, respectively (Fig. S2 in the Supplement). In the final models, adjusting for all specified confounders, Pacific ethnicity was not an independent predictor of ICU mortality, in-hospital mortality, or ICU or hospital length of stay (Table 3 and in Tables S6 and S7 in the Supplement.)

3. Discussion

3.1. Statement of principal findings

In this retrospective cohort study from July 1, 2009, until June 30, 2018, we observed that Pacific people had a similar rate of death within 180 days of ICU admission in NZ to European patients. The adjusted risk of death for Pacific vs. European patients increased when accounting for site (i.e. the ICU the patients were admitted to), and for Pacific patients being a median age of 14 years younger than European patients. The adjusted risk of death for Pacific vs. European patients decreased when accounting for the higher burden of comorbidities and for the higher illness severity observed in Pacific patients. The adjusted risk of death for Pacific vs. European patients was further decreased, but to a lesser extent, when accounting for the ICU admission diagnosis, the higher rate of unplanned ICU admission, the deprivation status, and the use of invasive ventilation. Neither gender nor year of admission appeared to substantially affect the association between Pacific ethnicity and day 180 mortality. In our final model, accounting for all the aforementioned covariates, patients with Pacific ethnicity did not have significantly increased odds of day 180 mortality compared to European patients. The findings were similar for

Table 3
Key outcomes by ethnicity.

	Pacific (N = 4603)	European (N = 42,871)	Analysis model[a]	Odds ratio (95% CI)
Day 180 mortality (primary outcome), n (%)	644 (14.0%)	6407 (14.9%)	Unadjusted	0.93 (0.85–1.01)
			+Site	1.07 (0.96–1.19)
			+Deprivation[b]	1.04 (0.93–1.16)
			+Gender	1.04 (0.93–1.16)
			+Year	1.04 (0.93–1.16)
			+Charlson Comorbidity Index	0.87 (0.77–0.97)
			+Age	1.15 (1.02–1.30)
			+Admission type[c]	1.04 (0.92–1.17)
			+ICU admission diagnosis	1.01 (0.89–1.14)
			+Ventilated (Y/N)	0.99 (0.87–1.12)
			+Illness severity[d]	0.91 (0.80–1.05)
ICU mortality, n (%)	311 (6.8%)	2525 (5.9%)	Unadjusted	1.16 (1.02–1.31)
			+Site	1.34 (1.15–1.55)
			+Deprivation[b]	1.28 (1.10–1.50)
			+Gender	1.28 (1.10–1.50)
			+Year	1.27 (1.09–1.49)
			+Charlson Comorbidity Index	1.22 (1.04–1.43)
			+Age	1.39 (1.19–1.64)
			+Admission type[c]	1.31 (1.11–1.56)
			+ICU admission diagnosis	1.21 (1.02–1.43)
			+Ventilated (Y/N)	1.21 (1.02–1.44)
			+Illness severity[d]	1.13 (0.93–1.37)
Hospital mortality, n (%)	500 (10.9%)	4662 (10.9%)	Unadjusted	1.01 (0.91–1.11)
			+Site	1.19 (1.06–1.34)
			+Deprivation[b]	1.16 (1.02–1.31)
			+Gender	1.15 (1.02–1.30)
			+Year	1.15 (1.02–1.30)
			+Charlson Comorbidity Index	1.02 (0.90–1.16)
			+Age	1.31 (1.15–1.49)
			+Admission type[c]	1.19 (1.04–1.37)
			+ICU admission diagnosis	1.14 (1.00–1.31)
			+Ventilated (Y/N)	1.13 (0.98–1.30)
			+Illness severity[d]	1.03 (0.88–1.21)
Discharged home, n (%)	3532 (76.7%)	29295 (68.3%)	Unadjusted	1.53 (1.42–1.64)
			+Site	1.23 (1.13–1.34)
			+Deprivation[b]	1.36 (1.24–1.48)
			+Gender	1.37 (1.25–1.49)
			+Year	1.37 (1.25–1.50)
			+Charlson Comorbidity Index	1.51 (1.38–1.65)
			+Age	1.20 (1.09–1.32)
			+Admission type[c]	1.25 (1.14–1.38)
			+ICU admission diagnosis	1.24 (1.13–1.37)
			+Ventilated (Y/N)	1.28 (1.16–1.42)
			+Illness severity[d]	1.37 (1.23–1.52)

[a] Variables shown were added sequentially to the model with the reported Odds Ratio for Pacific vs European.
[b] 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.
[c] Admission type combined both source of ICU admission (operating theatre, emergency department, ward, transfer from another hospital, and unknown) and whether the admission was categorised as elective or emergency.
[d] Illness severity was calculated using the physiological components of the Acute Physiology and Chronic Health Evaluation (APACHE) III score.

survival to day 180, ICU mortality, hospital mortality, ICU length of stay, and hospital length of stay. However, in all analyses, Pacific patients had significantly increased odds of being discharged home compared to their European counterparts.

3.2. Relationship to previous studies

We have previously reported outcomes for Māori and European patients admitted to NZ ICUs between 2009 and 2018.[5] Despite their younger age, Māori had more comorbidities and more severe illnesses than their European counterparts.[5] Pacific patients are also younger and have more comorbidities and more severe illnesses than their European counterparts. However, while Māori had a higher risk of dying within 180 days of ICU admission than European patients,[5] Pacific patients appeared to have a similar risk of dying to European patients.

Both Māori and Pacific patients are much more likely to be admitted to the ICU with sepsis than European patients; however, in contrast to Māori patients, where trauma admissions were higher than in European patients,[5] the proportion of people admitted to the ICU after trauma appears similar for Pacific and European patients. Previous studies have also highlighted the high burden of serious infections requiring hospitalisation[15] and diabetes among Pacific patients.[16]

The consistent association between Pacific ethnicity and an increased odd of being discharged home contrasts to the similar odds of being discharged home for Māori vs. European patients.[5]

3.3. Strengths and weaknesses

Our study had a number of strengths. It included data from more than 47,000 patients admitted to all major tertiary, regional, and rural public hospital ICUs over a 10 year period. The only ICUs that were not included in this study were private ICUs and some small ICUs in rural and regional centres. We conducted analyses that adjusted for important variables that might potentially have

contributed to health inequalities in Pacific patients admitted to the ICU, including deprivation status and comorbid conditions. We were also able to conduct analyses that included robust adjustments for illness severity.

Our study had some limitations. Despite its large size, it only included a subset of ICU admission episodes where we could match patient data from the NZ Ministry of Health NMD to the ANZICS CORE APD, so that the patient group we studied is not representative of all patients admitted to NZ ICUs. Although data were available for 88% of hospital-years for the 16 study sites, five sites did not contribute data for the entire study period. We used the NZ Ministry of Health NMD prioritised ethnicity categories to define ethnic groups; different methods for categorising ethnicity may result in different findings. Our method of categorising deprivation was based on data related to the postcode of the patient's residence obtained from the 2013 census. Our study included data from ICU admissions in 2013; however, the reliability of the categorisation of deprivation may be lower for patients admitted in other years. Although we were able to ascertain deaths that occurred beyond hospital discharge, we only captured deaths that were registered in NZ. It is possible that some patients died overseas within 180 days of an ICU admission. We chose day 180 mortality as the primary end point for this study, as deaths occurring as a consequence of an acute illness episode beyond this point are rare;[17] however, our findings may have been different if we had evaluated mortality rates at a different time point. Finally, because our analysis was conducted using data from up until the beginning of the COVID-19 pandemic, they may not reflect current epidemiology.

3.4. Implications

Despite a median age of 14 years younger than European patients, Pacific patients had a similar risk of dying within 180 days of an ICU admission to European patients. In large part, this appeared to be due to the higher burden of comorbidities and more severe acute illnesses at ICU presentation. The observation that Pacific ethnicity was independently associated with a greater chance of being discharged home has important implications. Being discharged home is sometimes used as a surrogate measure for a good functional recovery (i.e. survival without substantial morbidity). However, because a common feature of Pacific cultures is that they emphasise family kinship and communalism,[18] the relatively higher rates of discharge home for Pacific patients might also be attributable to a greater likelihood of Pacific families choosing to provide care to family members who survive with disabilities. Given our observation that Pacific patients have a substantially greater burden of socioeconomic deprivation compared to European patients, the burden of this responsibility has the potential to worsen socioeconomic inequities for Pacific families. Further research focussing on the morbidity faced by Pacific people who are admitted to the ICU is warranted.

4. Conclusions

Compared to Europeans, Pacific patients were markedly more likely to be admitted to the ICU with sepsis. The median age of Pacific patients was 14 years less than for European patients; however, Pacific patients had more comorbidities, higher illness severity, and a similar risk of dying within 180 days of an ICU admission. Pacific ethnicity was consistently associated with an increased chance of being discharged home from hospital compared to European ethnicity.

Credit authorship contribution statement

Young: Conceptualisation, Methodology, Original draft preparation. Bailey: Metholodology, Formal analysis, Writing - reviewing and editing.

Conflict of interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Prof Young serves as an Associate Editor for Critical Care and Resuscitation.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ccrj.2024.04.002.

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