




ORIGINAL RESEARCH

Examining emergency department inequities in Aotearoa New Zealand: Findings from a national retrospective observational study examining Indigenous emergency care outcomes

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Abstract

Objective: There is increasing evidence that EDs may not operate equitably for all patients, with Indigenous and minoritised ethnicity patients experiencing longer wait times for assessment, differential pain management and less evaluation and treatment of acute conditions.

Methods: This retrospective observational study used a Kaupapa Māori framework to investigate ED admissions into 18/20 District Health Boards in Aotearoa New Zealand (2006–2012). Key pre-admission variable was ethnicity (Māori:non-Māori), and outcome variables included: ED self-discharge; ED arrival to assessment time; hospital re-admission within 72 h; ED re-presentation within 72 h; ED length of stay; ward length of stay; access block and mortality (in ED or within 10 days of ED departure). Generalised linear regression models controlled for

year of presentation, sex, age, deprivation, triage category and comorbidity.

Results: Despite some ED process measures favouring Māori, for example arrival to assessment time (mean difference -2.14 min; 95% confidence interval [CI] -2.42 to -1.86) and access block (odds ratio [OR] 0.89, 95% CI 0.87–0.91), others showed no difference, for example self-discharge (OR 0.98, 95% CI 0.97–1.00). Despite this, Māori mortality (OR 1.60, 95% CI 1.50–1.71) and ED re-presentation (OR 1.11, 95% CI 1.09–1.12) were higher than non-Māori.

Conclusion: To our knowledge, this is the most comprehensive investigation of acute outcomes by ethnicity to date in New Zealand. We found ED mortality inequities that are unlikely to be explained by ED process measures or comorbidities. Our findings reinforce the need to investigate health

Key findings

- This study shows that Indigenous inequities in mortality within 10 days of an ED presentation exist, regardless of whether patients are discharged from the ED or admitted to hospital.
- These inequities do not appear to be driven by differences in process measures (assessment and disposition times) in the ED or comorbidities.
- Overall, our findings reinforce the need to investigate whether health professional bias and institutional racism exists within acute care in hospitals and health systems and if so, how these factors act in this environment.

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professional bias and institutional racism within an acute care context.

Key words: *emergency medicine, ethnic, Indigenous, inequities, mortality.*

Introduction

EDs are an integral component of healthcare delivery worldwide. However, there is increasing evidence that EDs may not operate equitably for all patients with Indigenous and minoritised

ethnicity patients experiencing longer wait times for assessment, differential pain management and less evaluation and treatment of acute conditions.¹⁻³ Explanations for these findings include provider bias (i.e. stereotyping and prejudice), resulting in differential timing and intensity of ED therapy, different patterns of referral and a lower level of hospital admission prioritisation.⁴

Despite Aotearoa New Zealand (NZ) being one of the first countries to establish a universal, tax-funded national health service, problems with access to care persist and the system is not equitable for all population groups.⁵ National data document Indigenous inequities in access to, and through, healthcare services particularly within primary healthcare and chronic disease contexts within NZ.⁶ However, there is limited research on Indigenous ED inequities within NZ.^{7,8} Investigating one NZ ED, Prisk *et al.* showed that Māori (the Indigenous peoples of NZ) were less likely to receive bloodwork or radiographs, go to observation areas and more likely to be discharged or to self-discharge from ED compared to NZ European.

The present study aims to investigate whether clinically important inequities between Māori and non-Māori exist within NZ EDs. The study hypothesises that (a) there are inequities in ED practice and outcomes between Māori and non-Māori; (b) any Māori:non-Māori inequities are unlikely to be fully explained by pre-admission/demographic variables and (c) any Māori:non-Māori inequities in ED markers of care are likely to contribute to differences in clinically important outcomes including mortality.

Methods

We conducted a retrospective observational study 'Examining Emergency Department Inequities' (EEDI) using national data linkage representing all ED admissions into 18/20 District Health Boards in NZ between 2006 and 2012. The included District Health Boards see more than 90% of all ED presentations in NZ. Data sources include the Shorter Stays in ED National Research Project⁹ and the National Minimum Dataset,¹⁰ that is

the national collection of hospital discharge information (public and private) that includes primary and secondary diagnoses coded using ICD-10-AM-I. The full study protocol was published online.¹¹

This project incorporates an Indigenous Kaupapa Māori Research (KMR) positioning. This is reflected through Māori research leadership, putting Māori at the centre of the research question/objectives, undertaking Māori:non-Māori comparison consistent with the Indigenous rights of Māori, maximisation of statistical power to quantitatively examine Māori:non-Māori inequities and use of a conceptual framework that incorporates a structural determinants approach to critique issues of power, racism and privilege.¹²

An advisory group consisting of emergency medicine clinicians, Māori health experts, senior statistical and policy advisors provided project governance. The project was funded by the Health Research Council of NZ. Ethical approval was obtained from the NZ Health and Disability Ethics Committee (HDEC17/NTB/185).

The key pre-admission variable is prioritised patient ethnicity, classified as Māori *versus* non-Māori (Pacific, Asian, European and Other combined). Other patient characteristics include: year at presentation; sex (female, male); age group (years); NZ 2006 Deprivation Index quintiles (NZDep-Q, 1 = least deprived, 5 = most deprived¹³); triage category (immediate, 10, 30, 60, 120 min). Comorbidity data were obtained from the National Minimum Dataset and analysed using the Multimorbidity Measure (M3 Index) calculated using primary and secondary diagnoses from the 5 years prior to ED presentation.¹⁴

Outcome variables include patient-centred markers of care: ED self-discharge (did not wait, self-discharge from hospital with/without indemnity signed); ED arrival to assessment time (minutes); hospital re-admission within 72 h of ED/ward discharge; system-centred markers of care: ED re-presentation within 72 h of ED/ward discharge; ED length of stay (LOS; minutes); ward LOS (hours); access block (>8 h ED LOS before ward admission) and

mortality (died in ED or within 10 days of ED departure).

The total number and proportion of ED events between 2006 and 2012 were reported elsewhere.¹⁵ For the present study, the first ED presentation of all patients during the study period were included in the primary cohort. In order to capture as many mortality events as possible, the last ED presentation of all patients were also used on the mortality outcome as a sensitivity analysis.

Continuous variables are presented as mean and standard deviation (SD), and categorical variables as frequencies and percentages. Age-standardised event rates and rate ratios (and 95% confidence intervals [CIs]) between Māori and non-Māori were calculated for mortality, ED re-presentation, hospital re-admission, self-discharge and access block. Because the population age structures differ between Māori and non-Māori (with Māori on average being younger than non-Māori), the 2001 NZ Māori population was used as the standard population consistent with our KMR positioning.^{16,17}

Generalised linear regression models were used to examine outcome differences between Māori and non-Māori, controlling for year of presentation, sex, age, NZDep-Q, triage category and comorbidity. The selection of confounders reflects the EEDI conceptual framework and team knowledge of ethnic inequity causation.¹³ The results were compared with the unadjusted regression analyses (Table S1).

For all regression models, a link function appropriate to the distribution of the outcome variable was considered. Linear regression was conducted on continuous outcomes and the difference between Māori and non-Māori was reported as mean difference (MD) and 95% CI. Logistic regression and odds ratios (ORs) were reported on binary outcomes in the main analysis. Relative risks (RRs) were also calculated using modified Poisson regression with robust error estimates.¹⁸ Statistical analyses were performed using SAS version 9.4 (SAS Institute, Inc., Cary, NC, USA). All statistical tests were two-sided at 5% significance level.

Results

A total of 2 238 308 ED patients were identified including 365 282 (16.3%) Māori and 1 873 026 (83.7%) non-Māori (Table 1).

Descriptive data (Table 1) shows that the sex profile was similar for Māori and non-Māori (i.e. 49.1% and 48.2% women, respectively); however, a higher proportion of Māori patients were younger compared to non-Māori, particularly those aged 0–4 years (i.e. 21.2% vs 12.0%) and 15–24 years (i.e. 19.5% vs 14.8%). In contrast, 1.7% of Māori patients were aged ≥75 years versus 10.2% of non-Māori. The NZDep-Q profile differed with 50.6% of Māori in the most deprived quintile compared to 23% for non-Māori. A higher proportion of Māori were triaged to be seen within a longer time frame compared to non-Māori, that is 120-min (12.1% vs 9.4%) and 60-min (44.8% vs 41.6%). A lower proportion of Māori were triaged to be seen within 10-min compared to non-Māori (7.1% vs 9.5%). The comorbidity (M3 Index) was similar between Māori (0.09, SD 0.3) and non-Māori (0.10, SD 0.34).

Table 2 presents patient outcomes at first ED presentation. Patient-centred markers of care show that 4.7% ($n = 17\,278$) of Māori self-discharged from ED compared to 4.1% ($n = 76\,300$) of non-Māori. Hospital re-admission within 72 h of ED/ward discharge was the same for Māori and non-Māori (2.4%) and ED arrival to assessment time was also similar for Māori (74.26 min) and non-Māori (75.57 min). System-centred markers of care show that ED re-presentation within 72 h of ED/ward discharge was lower for Māori (13.1%) compared to non-Māori (18.2%). A similar pattern is seen for ED LOS between Māori (224.27 min, SD 279.65) and non-Māori (269.83 min, SD 338.98), ward LOS between Māori (78.65 h, SD 137.61) and non-Māori (99.43 h, SD 174.92) and access block (13.1% for Māori compared to 18.2% for non-Māori). Mortality findings show that the proportion of Māori who died in ED or within 10 days of ED

departure was 0.4% compared to 0.6% for non-Māori.

Table 3 presents age-standardised rates (per 100) and rate ratios (SRR, Māori vs non-Māori). The key patient outcomes include: ED re-presentation within 72 h of ED/ward discharge; hospital re-admission within 72 h of ED/ward discharge;

died in ED or within 10 days of ED departure; and ED self-discharge and access block. The age-standardised rate ratios were higher for Māori patients on ED re-presentation (SRR 1.12, 95% CI 1.11–1.14) and died in ED or within 10 days of ED departure (SRR 1.8, 95% CI 1.70–1.90). Access block was lower for Māori

TABLE 1. Characteristics of Māori and non-Māori ED patients at first ED presentation, 2006–2012

Patient characteristics	Māori ($n = 365\,282$), n (%)	Non-Māori ($n = 1\,873\,026$), n (%)
Sex		
Female	179 368 (49.1)	903 404 (48.2)
Male	185 905 (50.9)	969 485 (51.8)
Missing	9 (0.0)	137 (0.0)
Age group (in years)		
0–4	77 483 (21.2)	225 284 (12.0)
5–9	29 211 (8.0)	94 521 (5.0)
10–14	31 112 (8.5)	105 588 (5.6)
15–24	71 064 (19.5)	276 482 (14.8)
25–34	44 657 (12.2)	220 782 (11.8)
35–44	40 197 (11.0)	218 017 (11.6)
45–54	32 592 (8.9)	205 675 (11.0)
55–64	20 395 (5.6)	183 311 (9.8)
65–74	12 449 (3.4)	151 474 (8.1)
≥75	6117 (1.7)	191 864 (10.2)
Missing	5 (0.0)	28 (0.0)
New Zealand deprivation quintile (2006)		
1 (least deprived)	16 294 (4.5)	297 308 (15.9)
2	26 379 (7.2)	307 365 (16.4)
3	47 214 (12.9)	360 057 (19.2)
4	88 572 (24.2)	432 211 (23.1)
5 (most deprived)	184 947 (50.6)	430 866 (23.0)
Missing	1876 (0.5)	45 219 (2.4)
Triage category		
Immediate	2623 (0.7)	12 794 (0.7)
10 min	26 030 (7.1)	177 404 (9.5)
30 min	128 088 (35.1)	723 442 (38.6)
60 min	163 587 (44.8)	779 255 (41.6)
120 min	44 354 (12.1)	176 442 (9.4)
Missing	600 (0.2)	3689 (0.2)
Comorbidity (M3 Index), mean (SD)	0.09 (0.30)	0.10 (0.34)

compared to non-Māori (SRR 0.90, 95% CI 0.89–0.92). No significant differences in hospital re-admission or ED self-discharge were observed with age-standardisation.

Table 4 presents linear regression models for ED care outcomes comparing Māori to non-Māori. After adjustment for year of presentation, sex, age, triage category, NZDep-Q and M3 comorbidity score, patient-centred markers of care showed no significant difference in ED self-discharge (OR 0.98, 95% CI 0.97–1.00) and hospital re-admission (OR 1.00, 95% CI 0.98–1.023). However, ED arrival to assessment time was significantly lower for Māori compared to non-Māori with an MD of -2.14 min (95% CI -2.42 to -1.86). For system-centred markers of care, the odds of ED re-presentation was higher for Māori compared to non-Māori (OR 1.11, 95% CI 1.09–1.12). Māori patients also had shorter ED LOS compared to non-Māori patients (MD -10.74 min, 95% CI -12.02 to -9.45). For the ward patients, hospital LOS was longer for Māori (MD 4.34 h, 95% CI 3.18–5.49) although they had lower odds of experiencing access block (OR 0.89, 95% CI 0.87–0.91) compared to non-Māori patients.

The odds of mortality (died in ED or within 10 days of ED departure) for Māori was significantly higher than non-Māori (OR 1.60, 95% CI 1.50–1.71). The results were similar in the sensitivity analysis using the last ED event (OR 1.87, 95% CI 1.81–1.94). As a post-hoc analysis, we also excluded patients who were admitted or transferred to hospital after ED departure. The odds of mortality for Māori remained high compared to non-Māori (OR 2.03, 95% CI 1.76–2.34).

The unadjusted and adjusted RRs using modified Poisson regression showed similar results (not reported).

Discussion

To our knowledge, the present study represents the most comprehensive investigation of Indigenous acute care outcomes within NZ. We found that some ED process measures were positive for Māori compared to non-Māori, while others showed no difference.

Despite this, Māori mortality within 10 days of ED departure and re-presentation after ED or hospital discharge were significantly higher than non-Māori.

The present study using first ED events, found that a higher proportion of Māori ED patients were seen within younger age groups, were more deprived and were triaged to be seen within a longer time frame compared to non-Māori. This aligns with our previous analysis of all ED events and is likely to represent differences in population age structure and known Māori:non-Māori inequities in deprivation.¹⁵ Further research is required to investigate the triage time difference and whether ethnic bias is a factor within triage categorisation within NZ as has been reported internationally.^{19,20}

Our findings reinforce the need to age-standardise data when comparing between populations with different age structures.¹⁶ For example, our descriptive findings showed a slightly higher proportion of self-discharge and ED re-presentation but similar hospital re-admission rates and ED arrival to assessment times

for Māori compared to non-Māori. In contrast, non-Māori had a higher proportion of access block, longer ED and ward LOS and higher mortality than Māori. Some of these descriptive findings are suggestive of lower quality ED care²¹ for non-Māori compared to Māori – findings that were unexpected¹¹ and do not align with international patterns for ethnic inequities within ED care.^{22–24} However, when adjusted for ethnic age differences from baseline data the pattern of inequity changed to Māori having a similar pattern of self-discharge but higher ED mortality compared to non-Māori.

Further, after adjusting for multiple confounding factors including year, age, sex, deprivation, triage score (a marker of ED presentation severity) and comorbidity (commonly used to 'explain' ethnic inequities), we found no significant difference in ED self-discharge or hospital re-admission between Māori and non-Māori. In contrast, Māori experience a shorter ED arrival to assessment time compared to non-Māori. Fully adjusted findings also show that Māori had a higher rate of re-presentation to ED

TABLE 2. Patient outcomes at first ED presentation, 2006–2012

Outcome variables	Māori (<i>n</i> = 365 282)	Non-Māori (<i>n</i> = 1 873 026)
Access block (>8 h ED LOS before ward admission)†, <i>n</i> (%)	12 052 (13.1)	99 484 (18.2)
ED re-presentation within 72 h of ED/ward discharge, <i>n</i> (%)	25 958 (7.1)	118 199 (6.3)
Hospital re-admission within 72 h of ED/ward discharge, <i>n</i> (%)	8734 (2.4)	45 470 (2.4)
Died in ED or within 10 days of ED departure, <i>n</i> (%)	1405 (0.4)	12 099 (0.6)
ED self-discharge (DNW/DI/DS), <i>n</i> (%)	17 278 (4.7)	76 300 (4.1)
ED arrival to assessment time (min), mean (SD)	59.64 (74.3)	61.42 (75.6)
ED LOS (min), mean (SD)	224.27 (279.7)	269.83 (339.0)
Ward LOS (h)†, mean (SD)	78.65 (137.6)	99.43 (174.9)

†Access block and Ward LOS are only applicable to ED patients admitted to the ward (Māori, *n* = 92 313; non-Māori, *n* = 545 892). DI, self-discharge from hospital, indemnity signed; DNW, did not wait; DS, self-discharge from hospital, no indemnity signed; LOS, length of stay.

TABLE 3. Age-standardised rates and rate ratio (Māorionon-Māori) for ED re-presentation, hospital re-admission, mortality, access block and ED self-discharge, first ED presentation, 2006–2012

Variable	Māori			Non-Māori			Maorionon-Māori			
	Number of events	Number of ED patients	Age-standardised rate†	95% CI	Number of events	Number of ED patients	Age-standardised rate†	95% CI	Age-standardised rate ratio	95% CI
ED re-presentation within 72 h of ED/ward discharge	2 598	365 277	7.13	7.04–7.22	118 199	1 872 998	6.36	6.32–6.41	1.12	1.11–1.14
Hospital re-admission within 72 h of ED/ward discharge	8734	365 277	2.35	2.30–2.40	45 470	1 872 998	2.33	2.31–2.36	1.01	0.98–1.03
Died in ED or within 10 days of ED departure	1405	365 277	0.31	0.29–0.32	12 095	1 872 998	0.17	0.17–0.18	1.80	1.70–1.90
Access block (>8 h ED LOS before ward admission)‡	12 052	92 312	12.78	12.52–13.04	99 484	545 891	14.14	14.01–14.27	0.90	0.89–0.92
ED self-discharge (DNW/DI/DS)	17 276	365 277	4.79	4.71–4.86	76 289	1 872 998	4.73	4.69–4.77	1.01	1.00–1.03

Bold value indicates statistically significant findings at 95% level of confidence. †Rates are calculated per 100 000. Patients with missing age group were excluded. ‡Access block is only applicable to ED patients admitted to the ward. CI, confidence interval; DI, self-discharge from hospital, indemnity signed; DNW, did not wait; DS, self-discharge from hospital, no indemnity signed; LOS, length of stay.

and a longer ward stay, although ED LOS and access block were lower than non-Māori.

Despite the findings of positive markers of ED care for Māori, adjusted findings show that the odds of Māori mortality for first ED events was 1.6 times that of non-Māori (increasing to 1.8 for last ED event and 2.0 when deaths for patients admitted or transferred to hospital were excluded). This important finding is likely to be clinically relevant, reinforces the need to adjust for potential confounding factors and requires further investigation.¹¹

A number of studies have linked hospital and ED overcrowding to mortality in Australia, and in NZ access block has been identified as having the strongest association with 7-day mortality post-ED arrival.²⁵ Given our study found a lower level of access block (a marker of overcrowding) for Māori compared to non-Māori, other hypotheses for our mortality findings need to be considered.

Potential areas of enquiry include unmeasured factors i.e. physician and institutional bias/racism that may contribute to mortality inequities within EDs. Quigley *et al.*

note that implicit racial bias within emergency medicine clinicians in Australia exists (with a moderate implicit preference for Caucasians) which ‘can result in stereotyping of racial minorities and premature diagnostic closure’ (p. 9).²⁶ This review evidence aligns with our theoretical hypotheses; however, we note that we have mixed findings in the present study with some positive markers of ED care alongside significant inequity in mortality. Our finding that ED mortality inequity increases after removing patients admitted to hospital/wards should be seen by NZ ED clinicians as a call for action and a commitment to cultural safety that requires self-reflection and critical consciousness as key tools by which to address these disparities.²⁷ Regular auditing for ethnic inequities within ED care is recommended²⁸ alongside support for the Australasian College for Emergency Medicine’s *Te Rautaki Manaaki Mana* strategy that aims to achieve equity for Māori in EDs within NZ.²⁹

The present study presents the most comprehensive investigation of Indigenous/Māori ED inequities undertaken within NZ. The present study extends beyond international findings that have

tended to focus on single markers of care, with few studies controlling for multiple factors known to contribute to ethnic inequities in acute care. We note that the use of a Māori population standard aligns with recommended practice and the Kaupapa Māori positioning of this research as it can provide rates that more closely approximate the crude Māori rates (and therefore Māori reality) compared to analyses that use other standard populations, for example the World Health Organization World Standard Population.¹⁸ The collaboration between Māori academic, public health and ED clinical expertise under Māori leadership using a KMR framework is a key strength of the present study and responds to international calls for Indigenous-led quantitative analyses.³⁰

The present study was limited to the original Shorter Stays in ED National Research Project time frame (up to 2012) and variables (that did not include clinical details of ED events). Despite this, we believe that the inequities observed during this time period are unlikely to have changed significantly overtime and the data remain the most comprehensive analysis in NZ to date.

TABLE 4. Patient outcomes at first ED presentation in 2006–2012 comparing Māori and non-Māori patients, adjusted for all pre-defined confounders†

	Mean difference	95% CI	P-value
ED arrival to assessment time (min)	−2.14	−2.42 to −1.86	<0.0001
ED LOS (min)	−10.74	−12.02 to −9.45	<0.0001
Ward LOS (h)	4.34	3.18 to 5.49	<0.0001
	Odds ratio	95% CI	P-value
Access block (>8 h ED LOS before ward admission)	0.89	0.87–0.91	<0.0001
ED re-presentation within 72 h of ED/ward discharge	1.11	1.09–1.12	<0.0001
Hospital re-admission within 72 h of ED/ward discharge	1.00	0.98–1.02	0.9081
ED self-discharge (DNW/DI/DS)	0.98	0.97–1.00	0.0874
Died in ED or within 10 days of ED departure	1.60	1.51–1.71	<0.0001

Bold value indicates statistically significant findings at 95% level of confidence. †Adjusted regression models have controlled for year of first presentation, sex, age, triage category, NZDep-Q and M3 comorbidity score. CI, confidence interval; DI, self-discharge from hospital, indemnity signed; DNW, did not wait; DS, self-discharge from hospital, no indemnity signed; LOS, length of stay.

Conclusion

The present study shows that inequities in mortality within 10 days of an ED presentation exist, regardless of whether patients are discharged from the ED or admitted to hospital. These inequities do not appear to be driven by differences in process measures (assessment and disposition times) in the ED or comorbidities. Further research is needed to explore the reasons leading to the observed inequities. Overall, our findings reinforce the need to investigate whether health professional bias and institutional racism exists within acute care in hospitals and health systems and if so, how these factors act in this environment.

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Competing interests

PJ is a section editor for *Emergency Medicine Australasia*.

Data availability statement

Data available upon request and approval by authors.

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Supporting information

Additional supporting information may be found in the online version of this article at the publisher's web site:

Table S1. Patient outcomes at first ED presentation in 2006–2012 comparing Māori and non-Māori patients, adjusted for year of presentation only.