Trends in deprivation in hospitalisations of Indigenous children and young people in Aotearoa New Zealand

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Aim: To examine the 20-year trends in socio-economic inequities in hospitalisations of Māori and non-Māori non-Pacific (NMNP) under-25-year olds in Aotearoa New Zealand.

Methods: Hospital discharge data for Māori and NMNP tātāmāriki aged under-25 years were extracted from the National Minimum Dataset for the period 2000–2019. Acute or arranged admissions to hospital were included where the primary diagnosis was for a medical condition. Age- and gender-standardised rates (per 1000, 0–24-year old) were calculated for both ethnic groups by area deprivation using the 2013 NZ census estimated resident population. For each ethnic group, inequity indices of socio-economic deprivation (Slope Index of Inequality and Relative Index of Inequality) were computed, using regression modelling, to quantify inequity of medical condition-related hospitalisations and its changes over time.

Results: Hospitalisation rates for medical conditions were consistently higher for Māori than for NMNP under-25-year olds from 2000 to 2019. Māori tātāmāriki residing in the most deprived (quintile 5) areas were more likely than NMNP to be hospitalised for a medical condition at each time point. Deprivation inequities existed for both ethnic groups and were greater for Māori. Despite reducing deprivation inequities over time, ethnic differences persist on both absolute and relative scales.

Conclusion: Deprivation inequities in hospitalisation for medical conditions persist for Māori tātāmāriki compared with NMNP and highlights society’s tolerance of enduring inequity in health outcomes.

Key words: inequality; inequity; Māori; morbidity; socio-economic factor; tātāmāriki.

What is already known on this topic
1. Hospitalisation rates for Māori are higher than for non-Māori non-Pacific (NMNP) under-25-year olds.
2. There is a social gradient in hospitalisation rates for Māori and for NMNP.

What this paper adds
1. Monitoring temporal patterns of area deprivation by ethnicity contribute to evaluating progress towards equitable outcomes.
2. Absolute deprivation inequities are greater and have persisted longer for Māori than for NMNP.
3. Despite the overall increase in hospitalisation rates for Māori between 2000 and 2019, inequities on both absolute and relative scales have gradually decreased in the last decade.

Every child has the right to health and well-being from before birth, and should have the same opportunity to achieve their full potential, including optimal and equitable health outcomes. A society with equitable health outcomes involves not only the absence of systemic, unjust and unnecessary differences in the health of individuals or groups within a population but requires society to recognise that different people at different socio-economic levels require different approaches and resources. Inequitable differences in health outcomes occur when some groups in society (usually the dominant cultures) enjoy privileges and superior living conditions, which are unjustly denied to other groups through discrimination and intergenerational psychosocial stress. Inherent bias in societal systems can mean that services are least available to those in greatest need.

Children have little control over the circumstances into which they are born, grow up and live. Multiple intersecting discriminations experienced by some children can have long-lasting impacts into adulthood. Despite Aotearoa New Zealand signifying the importance of healthy happy children by ratifying the United Nations Convention on the Rights of the Child, and...
wanting ‘New Zealand to be the best place in the world for children and young people’ to grow up, for many children, including Māori children or children living in the most deprived areas, attaining optimal health, development and well-being have been elusive. Māori are tangata whenua, the peoples indigenous to Aotearoa New Zealand, and have unique rights, particularly to equitable health status and outcomes, that are reinforced by Te Tiriti o Waitangi and the United Nations Declaration on the Rights of Indigenous Peoples.

Health inequities remain pervasive in Aotearoa New Zealand, and the insufficiency of action to reduce inequities is evidenced by the continued presence of a socio-economic deprivation gradient for health, that is, health outcomes become progressively better with increasing social advantage. Studies repeatedly present differences for Māori or for children living in the most deprived areas in rates of death and of illnesses requiring hospitalisation, as well as higher levels of material deprivation and adverse health outcomes. There is a paucity of population-level information evaluating the patterns of hospitalisations over time for Māori children aged under-25 years by socio-economic deprivation using absolute and relative terms.

The aim of this study was to describe socio-economic inequities in medical condition-related hospitalisations of Māori and non-Māori non-Pacific (NMNP) under-25-year olds in Aotearoa New Zealand.

Methods

A retrospective analysis of hospitalisations for children aged under-25 years (taitamariki) in Aotearoa New Zealand, from 1 January 2000 to 31 December 2019 was conducted.

Hospitalisation data

De-identified publicly funded hospital discharge data were obtained from the National Minimum Dataset (NMDS) for taitamariki discharged from hospital following an acute or arranged admission for a medical (non-injury) condition (ICD-10-AM: A00-R99 as primary diagnosis) during the study period. The NMDS is a national administrative collection containing data on all publicly funded patient discharges submitted by public and private hospitals. It includes demographic data and diagnostic information coded on discharge using the Australian Modification of the International Classification of Diseases and Related Health Problems 10th revision (ICD-10-AM). This study involved analysing the number of hospitalisations (episodes of care) rather than the number of unique taitamariki hospitalised, and therein some individuals with multiple hospital episodes of care during the study period would be represented more than once. The first hospitalisation event of each hospital episode of care was included. Hospitalisations of non-residents, neonates (babies aged 0–27 days), and hospital transfers (between- and within-facilities) were excluded.

Data management and analyses

The analysed demographics were the age at discharge (grouped into 5-year bands), sex/gender, prioritised ethnicity and socio-economic deprivation using the New Zealand Deprivation Index. Hospitalisations of Māori and NMNP (comprising European, Asian/Indian and other non-Pacific ethnicities) taitamariki for medical conditions (n = 2 107 334) were the focus of this study and identified using the documented prioritised ethnicity. Prioritised ethnicity identifies persons belonging to multiple ethnic groups and the Ministry of Health assigns to a single ethnic group using a prescribed prioritised order. Hospitalisations for the ethnic groupings of Pacific and Not stated were excluded from these analyses. A specific subset of the medical hospitalisations, namely potentially avoidable conditions, were also identified based on the Ministry of Health definition, as these conditions are widely acknowledged as being modifiable through appropriate provision of primary health care, public health and/or social policy interventions.

The New Zealand Deprivation Index is a validated classification system, described elsewhere, that measures socio-economic disadvantage in small geographic areas using census data. Quintile 1 represents people living in the least deprived areas and is used as the reference group in this study; quintile 5 represents the most deprived areas.

All statistical analyses were performed using SAS version 9.4. Denominator data for the number of children aged under-25 years were obtained from the Stats NZ census estimated resident populations by ethnicity and deprivation. Direct age- and gender-standardised rates were calculated using the 2013 New Zealand Census Estimated Resident Population as the standard. In addition to 95% confidence intervals, other tests of statistical significance were conducted, including the use of Poisson regression models to test for linear trends and to derive the Slope Index of Inequality (SII) as an indirect measure of inequality. The SII is an absolute measure of the spread in hospitalisation rates across deprivation quintiles (from most to least deprived). The Relative Index of Inequality (RII) is also a regression-based measure that examines the relative differences in hospitalisation rates across all deprivation quintiles. A flat regression line, that is, a zero slope across the deprivation quintiles, means no difference on the absolute scale (SII). Similarly, a quotient of one on the relative scale (RII) also means that the hospitalisation rates for the most and for the least deprived quintiles are equal to the overall average hospitalisation rate. Both indices were calculated for Māori and NMNP separately.

Results

Study population and demographic characteristics

The number of hospitalisations for medical conditions in the time period 2000–2019 was 694 252 hospitalisations of 271 339 Māori taitamariki (aged under-25 years) and 1 413 082 hospitalisations of 658 324 NMNP taitamariki.

The demographic distribution of hospitalisations for both ethnic groups overall and by deprivation quintile is presented in Table 1. For Māori, taitamariki residing in the most deprived areas accounted for over 50% of hospitalisations and under 5% in the least deprived areas. Whereas for NMNP, the hospitalisations were similarly spread at approximately 20% in each quintile.
Hospitalisation rates for medical conditions

Figure 1 and Table 2 show that the standardised hospitalisation rates by ethnicity were higher for Māori than for NMNP. Both ethnic groups had increases in hospitalisations between 2000 and 2009, before subsequent declines (Fig. 1). These changes were statistically significant only for Māori (2000–2009 – slope: 2.3, \( P < 0.0001 \); 2010–2019 – slope: 0.8, \( P = 0.038 \)). The absolute

Table 1  Demographic characteristics for hospitalisations of under-25-year old for medical conditions, by ethnicity and deprivation quintile, Aotearoa New Zealand 2000–2019

|                  | Total† | 1 (least deprived) | 2 | 3 | 4 | 5 (most deprived) |
|------------------|--------|---------------------|---|---|---|-------------------|
| **Total medical hospitalisations** |        |                     |   |   |   |                   |
| Māori            |        |                     |   |   |   |                   |
| Total medical    | 694 252| 100                 | 30 363| 7 | 51 869| 7 | 84 677| 12 | 160 830| 23 | 365 877| 53 |
| Medical: PAH     | 308 960| 45                  | 12 987| 43| 22 589| 44| 36 869| 44| 70 611| 44| 165 645| 45 |
| Gender           |        |                     |   |   |   |                   |
| Male             | 259 108| 37                  | 12 083| 40| 20 397| 39| 32 107| 38| 59 812| 37| 134 448| 37 |
| Female           | 435 143| 63                  | 18 280| 60| 31 472| 61| 52 570| 62| 101 018| 63| 231 428| 63 |
| Age groups (years) |       |                     |   |   |   |                   |
| 0–4              | 236 149| 34                  | 9 733| 32| 17 217| 33| 27 840| 33| 54 322| 34| 126 823| 35 |
| 5–9              | 59 995 | 9                   | 3 050| 10| 48 203| 9 | 74 388| 9 | 13 753| 9 | 30 505| 8 |
| 10–14            | 53 095 | 8                   | 2 645| 9  | 44 179| 9 | 69 255| 8 | 11 921| 7 | 27 157| 7 |
| 15–19            | 139 035| 20                  | 6 208| 20| 10 414| 20| 17 266| 20| 32 241| 20| 72 771| 20 |
| 20–24            | 206 378| 30                  | 8 827| 29| 15 001| 29| 25 208| 30| 48 593| 30| 108 621| 30 |
| Non-Māori non-Pacific (NMNP) | | | | | | |
| Total medical    | 1 413 082| 100 000| 243 307| 17| 256 375| 18| 287 227| 20| 338 344| 24| 286 820| 20 |
| Medical: PAH     | 556 871| 39                  | 99 166| 41| 102 959| 40| 113 777| 40| 129 523| 38| 111 072| 39 |
| Gender           |        |                     |   |   |   |                   |
| Male             | 581 229| 41                  | 110 516| 45| 110 408| 43| 119 482| 42| 131 840| 40| 108 581| 38 |
| Female           | 831 849| 59                  | 132 791| 55| 145 967| 57| 167 743| 58| 206 503| 61| 178 238| 62 |
| Age groups (years) |       |                     |   |   |   |                   |
| 0–4              | 418 793| 30                  | 75 972| 31| 78 465| 31| 86 535| 30| 97 310| 29| 80 280| 28 |
| 5–9              | 143 976| 10                  | 30 443| 13| 28 650| 11| 29 408| 10| 30 777| 9 | 24 642| 9 |
| 10–14            | 136 612| 10                  | 30 136| 12| 27 821| 11| 28 295| 10| 28 043| 8 | 22 248| 8 |
| 15–19            | 284 306| 20                  | 49 364| 20| 51 103| 20| 56 437| 20| 68 435| 20| 58 731| 20 |
| 20–24            | 429 395| 30                  | 57 392| 24| 70 336| 27| 86 552| 30| 113 779| 34| 100 919| 35 |

† Includes hospitalisations where a deprivation score could not be assigned. PAH, potentially avoidable hospitalisation.

Fig. 1  Trends in medical-condition hospitalisations rate of under-25-year olds, by ethnicity, Aotearoa New Zealand 2000–2019. Ethnicity is level 1 prioritised. Rates are age- and sex-standardised. Arrows represent rate difference.

Journal of Paediatrics and Child Health 58 (2022) 1345–1351 © 2022 The Authors. Journal of Paediatrics and Child Health published by John Wiley & Sons Australia, Ltd on behalf of Paediatrics and Child Health Division (The Royal Australasian College of Physicians).
The difference in rates increased from 22 in 2000 to 44 in 2009, then declined to 22 in 2016 but increased again in the subsequent years.

For both ethnicities, the rates of hospitalisation were lowest in quintile 1 (least deprived) and progressively increased as deprivation increased. The increase in hospitalisation rate as deprivation increased was more marked for Māori, as shown in the relative gap (rate ratio) between quintile 5 and quintile 1 for Māori of 2.47, compared with 1.88 for NMNP (Table 2). This finding was apparent and consistent across all years in the time period (Fig. 2). Statistically, significant increases were observed across all years for Māori in quintiles 4 and 5, and over the whole time period in all quintiles for NMNP. Statistically, significant decreases were only observed for Māori in quintile 2. Of particular note, the standardised hospitalisation rate/1000 for Māori in quintile 5 (most deprived) reached peak levels in 2009 (slope: 4.7, P < 0.0001), before declining in 2010–2019 (slope: −1.5, P = 0.0004).

### Hospitalisations on the absolute scale

A visual inspection of the absolute gap in hospitalisation rates between the quintiles 5 (most deprived) and 1 (least deprived) areas in Figure 2 suggested that the difference between the two quintiles was greater for Māori than for NMNP. This was confirmed using SII, which shows the increase in absolute deprivation inequities in hospitalisations in the Māori population began earlier, was more severe, and persisted for a longer time period than that seen in the NMNP population (Fig. 3). For Māori, the decrease in SII seen after 2009 has been slower and by 2019 had

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**Table 2** Number, rate, rate differences and rate ratios for medical condition-related hospitalisations of under-25-year olds by ethnicity and deprivation, Aotearoa New Zealand 2000–2019

| Medical condition-related hospitalisations | Deprivation                          | Number | Rate  | 95% CI    | SRD   | 95% CI   | SRR   | 95% CI   |
|-------------------------------------------|--------------------------------------|--------|-------|-----------|-------|----------|-------|----------|
|                                           | Māori                                |        |       |           |       |          |       |          |
|                                           | Quintile 1 (least deprived)          | 30 363 | 53.45 | 53.37–53.53 | 0.0   | 1.00     |       |          |
|                                           | Quintile 2                           | 51 869 | 69.97 | 69.89–70.05 | 16.5  | 15.7–17.4 | 1.31 | 1.31–1.31 |
|                                           | Quintile 3                           | 84 677 | 74.88 | 74.81–74.95 | 21.4  | 20.7–22.2 | 1.40 | 1.40–1.40 |
|                                           | Quintile 4                           | 160 830 | 95.47 | 95.40–95.53 | 42.0  | 41.3–42.8 | 1.79 | 1.78–1.79 |
|                                           | Quintile 5 (most deprived)           | 365 877 | 131.90 | 131.8–132.0 | 78.5  | 77.7–79.2 | 2.47 | 2.46–2.47 |
|                                           | Total                                | 694 252 | 101   | 100.5–100.6 |       |          |       |          |
|                                           | Non-Māori non-Pacific                 |        |       |           |       |          |       |          |
|                                           | Quintile 1 (least deprived)          | 243 307 | 51.26 | 51.23–51.29 | 0.0   | 1.00     |       |          |
|                                           | Quintile 2                           | 256 375 | 59.47 | 59.44–59.50 | 8.2   | 7.9–8.5  | 1.16 | 1.16–1.16 |
|                                           | Quintile 3                           | 287 227 | 67.39 | 67.36–67.43 | 16.1  | 15.8–16.5 | 1.31 | 1.31–1.32 |
|                                           | Quintile 4                           | 338 344 | 81.74 | 81.71–81.78 | 30.5  | 30.1–30.8 | 1.59 | 1.59–1.60 |
|                                           | Quintile 5 (most deprived)           | 286 820 | 96.39 | 96.34–96.44 | 45.1  | 44.7–45.5 | 1.88 | 1.88–1.88 |
|                                           | Total                                | 1 413 082 | 69    | 69.15–69.18 |       |          |       |          |

Rates: age- and gender-standardised and per 1000, reference group: Quintile 1, SRD: adjusted rate difference and per 1000, SRR: adjusted rate ratio.
only reached levels equivalent to 2007. For NMNP, the rise in SII began later (2002), peaked in 2004 and by 2017, the SII was lower than in 2002 (Fig. 3).

Hospitalisations on the relative scale

Relative to the overall average rate (as measured using RII), the level of deprivation inequities was similar for both ethnic groups between 2004 and 2007. After which, a marked increase was observed for Māori in 2009, followed by similar patterns of annual decline for both ethnic groups (Fig. 4).

Discussion

The findings from this study indicate:

1 Māori taitamariki aged under-25 years had higher rates of hospitalisation for medical conditions than NMNP, particularly those from the most deprived (quintile 5) areas.
2 Deprivation gradients existed for both ethnic groups but to a lesser degree for NMNP.
3 Hospitalisations by area deprivation on both absolute and relative scales were greater for Māori during 2009–2019.

4 Since 2009, declines on both absolute and relative scales were observed for the two ethnic groups; however, the reduction has been slower for Māori.

The high and increased rate of hospitalisation for Māori, compared to NMNP taitamariki, both overall and among those in the most deprived areas are consistent with findings reported elsewhere.11–13,20,21 This study confirms the presence of health inequity between Māori and NMNP and also within the population of Māori taitamariki by social and material deprivation. This study expands upon earlier studies through the inclusion of complex inequity measures on absolute and relative scales.

The differences presented reveal the high and persistent level of health inequity experienced by Māori taitamariki within Aotearoa New Zealand. Inequity is related not only to differences in the day-to-day circumstances which impact on the lives and well-being of taitamariki and their whānau (such as housing conditions and barriers to care), but also to the way that social, political and economic policy decisions impact on the wider social and environmental determinants of health.7,22

The inequity was highlighted by the fact that nearly half of the medical hospitalisations for Māori in this study were potentially avoidable (which was consistent with an earlier study23) and the slower decline in health inequity, on both

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**Fig. 3** Trends in medical-related hospitalisations on the absolute scale (SII), by ethnicity and time, Aotearoa New Zealand 2000–2019.

**Fig. 4** Trends in medical-related hospitalisations on the relative scale (RII), by ethnicity and time, Aotearoa New Zealand 2000–2019.
absolute and relative scales, observed in recent years. Given unequal access to services heightens health inequities,1,2,22 these observations suggest that access to, and quality of, primary care services delivered to children may not have improved despite removal of fees for children accessing these services.22,24 Access restrictions may also reflect non-fee related barriers in conjunction with the lasting effects of the 2008–2010 Global Financial Crisis (GFC). For whānau living in the most deprived (quintile 5) areas, the GFC drove increased unemployment, decreased discretionary income, increased need for benefits, and increased hospitalisation rates for children.11,21,25 This study noted that the impact on hospitalisations during and following the GFC on Māori whānau was substantially greater than that for NMNP families.

Increasing rates of non-fee related barriers have been documented for children as limited accessibility and availability of primary care appointments, lack of transport or of childcare for siblings, associated costs arising from the appointment, and awareness of unpaid fees for other family members. The flow-on consequences were increased inability for under-15-year old to get a GP appointment within 24 h, increased rates of attendance at emergency departments, and unfilled prescriptions, particularly for Māori.13,21,26 This study noted that the impact on hospitalisation rates from health policies targeting specific barriers, which warrant consideration in future analyses.

Acknowledgements

The authors wish to thank the Ministry of Health for supplying the data utilised in this study. This research was supported in part by a University of Otago research-in-aid grant. Ethics approval: University of Otago Human Research Ethics Committee (Reference number: HD19/084). Open access publishing facilitated by University of Otago, as part of the Wiley - University of Otago agreement via the Council of Australian University Librarians.

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Black beauty by Alyssa Rodrigues (aged 13) from “A Pop of Colour” art competition, Youth Arts, Children’s Hospital at Westmead