TE OHONGA AKE

THE HEALTH STATUS OF MĀORI CHILDREN AND YOUNG PEOPLE IN NEW ZEALAND

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This report was prepared for the Ministry of Health by Elizabeth Craig, Judith Adams, Glenda Oben, Anne Reddington, Andrew Wicken and Jean Simpson on behalf of the NZ Child and Youth Epidemiology Service,

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Te Ohonga Ake

The literal translation of Te Ohonga Ake is the Awakening. In the context of this report it refers to an awakening towards the reality of Māori child and youth health status in New Zealand. While many of us have been acutely aware of poor outcomes for Māori children and young people in this country, this report confirms our concerns and provides strong evidence for everyone to wake up, pay attention and take action to improve the lives of our most precious asset, our mokopuna.

Cover Artwork: *Whakapapa* – Family Tree by Coree Te Whata-Colley

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INTRODUCTION AND OVERVIEW

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Introduction

This second report in the *Te Ohonga Ake* series explores the health status of Māori infants, children and young people using a range of routinely collected data sources. It suggests that while progress has been made in a number of areas (e.g. reductions in hospital admissions for meningococcal disease, infant mortality and some types of injury death), hospital admissions for a number of infectious and respiratory diseases (e.g. acute rheumatic fever, serious skin infections, asthma) have continued to increase. Further, large disparities remain, with hospital admissions and mortality for many conditions remaining much higher for Māori than for non-Māori non-Pacific children and young people.

Report Sections and Indicators

Due to its large size, this report is presented as reference manual, which is divided into three main sections:

1. **Issues More Common in Infants**: This section considers issues more common in infants <1 year, and includes indicators such as *Fetal Deaths*, *Preterm Birth*, *Infant Mortality and Sudden Unexpected Death in Infancy (SUDI*), and *Breastfeeding.* It begins with a **Viewpoint by Dr David Tipene-Leach** which considers SUDI, and the development over the last decade, of local SUDI prevention initiatives which aim to create safer sleeping environments for Māori infants.
2. **Issues More Common in Children or Common in Children and Young People**: This section focuses on issues more common in children (0–14 years) or in both children and young people (0–24 years). It is further divided into three sub-sections: Total and Avoidable Morbidity and Mortality, Infectious and Respiratory Diseases (including Upper and Lower Respiratory Tract Conditions and Infectious Diseases) and Other Issues (including Injuries in Children, Oral Health and Permanent Hearing Loss).
3. **Issues More Common in Young People**: This stream reviews a number of conditions more common in young people (15–24 years), including *The Most Frequent Causes of Hospital Admissions and Mortality, Injuries, Teenage Births* and *Terminations of Pregnancy*.

For each indicator a “snapshot” of the most recent 5 years of data (hospital admissions 2006–2010; mortality 2004–2008) is provided, which compares rates for Māori children and young people with those of non-Māori non-Pacific children and young people. Where possible, ethnic specific trends for each indicator are also presented for 2000–2010 (hospital admissions) or 2000–2008 (mortality).

Other Reports in This Series

This report is the second in a three part series on the Health of Māori Children and Young People and fits into the reporting cycle as follows:

Year 1: Māori Children and Young People with Chronic Conditions and Disabilities

Year 2: The Health Status of Māori Children and Young People

Year 3: The Determinants of Health for Māori Children and Young People

The current report is based on *Indicator Framework* common to all NZ Child and Youth Epidemiology Service reports, and sit alongside a total population focused report entitled *The Health Status of Children and Young People in New Zealand* [1]. The key findings of this report have been briefly summarised at the end of each chapter, so that the health status of Māori children and young people can be considered in the context of a range of other factors (e.g. age, NZ Deprivation Index decile).

Data Quality and Interpretation Issues

In the preparation of this report, high quality data were not always available in areas of public health importance. In a number of cases, the authors have opted to utilise data of lesser quality, in order to ensure that such issues do not fall below the public health radar. As a consequence, the reader is strongly urged to read the cautions on interpretation that accompany each indicator in order to gain a better understanding of the strengths and weaknesses of the data used. In addition, a number of more specific data quality issues are outlined in the text box below.

Ethnicity Coding and the Ethnicity Classifications Used in this Report

In New Zealand's national health collections up to 3 ethnic groups are stored electronically for each event [2]. Because of inconsistencies in the way ethnicity information was collected in national data collections prior to 1996 however, all of the ethnic specific analysis presented in this report are from 1996 onwards, and thus reflect self-identified concepts of ethnicity (see **Appendix 5** for a more detailed review). Further, unless otherwise specified, total response ethnicity has been used to identify Māori children and young people (i.e. those identifying as Māori in any of their first three ethnic groups). In contrast, the term non-Māori non-Pacific refers to those children and young people who did not identify as being either Māori or Pacific in any of their first three ethnic groups.

Note: While in the Health Sector, the non-Māori reference group is often used for rate ratio comparisons, the non-Māori non-Pacific reference group was selected by the Te Ohonga Ake Advisory Group, on the basis that as a group, these children and young people had the lowest documented exposures to health disparities.

Undercounting of Māori in National Health Collections

Despite significant improvements in the quality of ethnicity data since 1996, care must still be taken when interpreting the ethnic specific rates presented in this report, as the potential still remains for Māori children and young people to be undercounted in our national data collections. In a review linking hospital admission and cancer registry data to other more reliable data sources, the authors of Hauora Māori Standards of Health IV [3] found that on average, hospital admission data during 2000–2004 undercounted Māori children by 6%, and Māori young people by 5–6%. For cancer registrations, the undercount was in the order of 1–2% (see **Appendix 5**). Thus when reviewing the hospital admission data in sections which follow, the reader must bear in mind that none of the rates have been adjusted for undercounting, and thus the rate ratios presented may underestimate, to a variable extent, the magnitude of any ethnic inequalities present.

Signalling of Statistical Significance and Other Data Quality Issues

As previously **Appendix 1** outlines the rationale for the use of statistical significance testing in this report and **Appendix 2 to Appendix 4** contain information on the data sources used to develop each indicator. Readers are urged to be aware of the contents of these Appendices when interpreting any information in this report. (Note: As outlined in **Appendix 1**, in order to assist the reader to determine whether tests of statistical significance have been used in a particular section, the significance of the associations presented has been signalled in the text with the words *significant*, or not *significant* in italics. Where the words *significant* or not *significant* do not appear in the text, then the associations described do not imply statistical significance or non-significance).

Overview of the Health Status of Children and Young People in New Zealand

The table which follows provides a brief overview of each of the indicators in this year's report. While it is possible to consider each of these issues individually, when considering which should be awarded the highest priority in future national planning, three possible approaches to prioritising health need are possible:

1. **An Inequalities Approach**: One approach to prioritisation would be to consider those issues for which disparities for Māori children and young people were most marked. A brief review of the tables which follow suggests that Māori children and young people experience large disparities across a range of conditions including hospital admissions for infectious and respiratory diseases, dental caries, sudden unexpected death in infancy (SUDI), hospital admissions for assault, and injury mortality.
2. **An Absolute Approach**: An alternative approach to prioritisation is to consider those issues which, irrespective of ethnic inequalities, made the greatest contributions to hospital admissions and mortality in Māori children and young people. A brief perusal of the tables which follow suggests that during the past 5 years, sudden unexpected death in infancy (SUDI) was a prominent cause of infant mortality, while injuries (particularly from land transport injuries), congenital anomalies and neoplasms were important causes of mortality for children and young people. Suicide, however, also claimed the lives of a large number of Māori young people. In terms of hospital admissions, injuries again made a significant contribution to morbidity for both children and young people, although infectious and respiratory conditions were prominent for children, and reproductive health issues (particularly admissions for labour and delivery) were important for young people.
3. **Consideration of Areas of Unmet Need**: Finally, it is important to remember that hospital admission and mortality data does not fully capture all of the issues experienced by Māori children and young people. In particular, there is a paucity of information on Māori children and young people with disabilities and mental health issues, with the 2010 report suggesting that there may be considerable unmet need in these areas. Thus, in addition to the approaches outlined above, it is also necessary to consider the needs of these children and young people when allocating resources for future service development.

Conclusion

This report provides an overview of the health status of Māori children and young people, so that their health needs can be assessed in a systematic and evidence-based manner. In considering how best to address the health issues identified, it is suggested that the Ministry of Health, District Health Boards and the wider health sector combine the epidemiological data presented, with knowledge of existing services and key stakeholders' views. In addition, any approaches developed need to be congruent with existing Government policy, and the evidence contained in the current literature. Finally for policy makers, funding and planning managers, and others developing new services in areas where there is currently no sound evidence base, the plea is that they build into their programmes an evaluation arm, so that any learnings gained can be used by others working in the health sector to ensure the wellbeing of Māori children and young people.

Table 1. Overview of the Health Status of Māori Children and Young People in New Zealand

Indicator	New Zealand Distribution and Trends
	Issues More Common in Infancy
Regional Births (Page 32)	• During 2010, Tairawhiti (69.4%) had the highest proportion of newborn babies registered as Māori and Auckland DHB (14.2%) had the lowest. • In absolute terms, the largest number of Māori babies were born in Counties Manukau (n=2,541), while the lowest number born was in the West Coast (n=91).
Fetal Deaths (Page 35)	• During 2004–2008, unspecified cause was the most frequently listed fetal cause of intermediate fetal deaths (IFD: 20–27 weeks gestation) in Māori babies, followed by extreme immaturity/low birth weight and congenital and chromosomal anomalies. Of IFDs with a maternal cause listed, the most frequent causes were placenta praevia/placental separation/haemorrhage and chorioamnionitis. • Unspecified cause was also the most frequently listed fetal cause of late fetal deaths (LFD: 28+ weeks gestation) in Māori babies, followed by congenital anomalies, malnutrition/slow fetal growth and intrauterine hypoxia. Of LFDs with a maternal cause listed, the most frequent causes were placenta praevia/other placental separation and compression of the umbilical cord. • During 2004–2008, IFDs were *significantly* lower for Māori babies (RR 0.86 95% CI 0.76–0.98) than for non-Māori non-Pacific babies. While *no significant* ethnic differences were seen for LFDs, deaths due to unspecified causes were *significantly* higher for Māori (RR 1.72 95% CI 1.36–2.17) than for non-Māori non-Pacific babies.
Preterm Birth (Page 41)	• During 2006–2010, preterm birth rates were *significantly* higher for Māori (RR 1.15 95% CI 1.12–1.19) than for non-Māori non-Pacific babies. Similar ethnic differences were seen during 1996–2010, with preterm birth rates in Māori babies increasing gradually during 2004–2010.
Infant Mortality and Sudden Unexpected Death in Infancy (SUDI) (Page 43)	• During 2004–2008, extreme prematurity and congenital anomalies were the leading causes of neonatal mortality (0–28 days) in Māori babies, although intrauterine/birth asphyxia and other perinatal conditions made a significant contribution. In contrast, SUDI was the leading cause of post neonatal mortality (29-264 days), followed by congenital anomalies. • Neonatal (RR 1.22 95% CI 1.06–1.42) and post neonatal (RR 2.85 95% CI 2.42–3.37) mortality were both *significantly* higher for Māori than for non-Māori non-Pacific babies, with the largest differences being seen for post-neonatal mortality. • During 2004–2008, SUDI rates were *significantly* higher for Māori (RR 5.66 95% CI 4.33–7.40) than for non-Māori non-Pacific babies. • SUDI rates were highest for teenage mothers, with rates decreasing with increasing maternal age. In each maternal age category, SUDI rates were higher for Māori than for non-Māori non-Pacific babies. • SUDI rates also increased with increasing NZDep01 deprivation. At each level of NZDep01 deprivation however, SUDI rates were higher for Māori than for non-Māori non-Pacific babies. • During 2004–2008, 51.7% of SUDI deaths in Māori babies aged 0–3 weeks were attributed to suffocation/strangulation in bed, as compared to 40.0% in babies aged 4–7 weeks and 31.6% in babies 8–11 weeks. The largest absolute number of SUDI deaths occurred in Māori infants 4–7 weeks of age, followed by those aged 8–11 weeks.
Breastfeeding (Page 51)	• In the years ending June 2004–2011, the proportion of Māori Plunket babies who were exclusively/fully breastfed at <6 weeks, 3 months and 6 months was lower than for European/Other babies. Breastfeeding rates for Māori babies also remained relatively static during this period. • In the year ending June 2011, 60.8% of Māori Plunket babies were exclusively/fully breastfed at <6 weeks, 44.6% at 3 months and 16.7% at 6 months. This proportion varied considerably by DHB however, although it remains unclear whether these differences reflect real differences in breastfeeding rates, regional differences in the availability of Well Child/Tamariki Ora Providers, or regional variations in the recording of breastfeeding information.

Indicator	New Zealand Distribution and Trends
Issues More Common in Children or in Children and Young People	
Total and Avoidable Morbidity and Mortality	
Most Frequent Causes of Hospital Admission and Mortality in Children (Page 61)	• During 2006–2010, injury/poisoning, bronchiolitis and asthma were the most frequent reasons for acute hospital admissions in Māori children aged 0–14 years. Neoplasms/chemotherapy/ radiotherapy, dental conditions and injury/poisoning were the most frequent reasons for arranged admissions, while dental procedures and grommets were the most frequent reasons for a waiting list admission. • During 2004−2008, vehicle occupant transport injuries were the most frequent cause of mortality in Māori children aged 1–14 years, followed by congenital anomalies and neoplasms.
Ambulatory Sensitive Hospitalisations (ASH) (Page 65)	• During 2006–2010, asthma, dental conditions and gastroenteritis were the most frequent causes of ASH in Māori children aged 0–4 years. • ASH rates were *significantly* higher for Māori (ED included RR 1.61 95% CI 1.59–1.64; ED excluded RR 1.72 95% CI 1.69–1.74) than for non-Māori non-Pacific children, irrespective of whether Emergency Department (ED) cases were included or excluded. • During 2000–2010, ASH rates in Māori children increased, while ASH rates in non-Māori non-Pacific children remained static (ED cases included), or declined (ED cases excluded). • During 2006–2010, ASH rates in Māori children were highest in those aged one year, followed by infants less than one year of age. • ASH rates were also higher during the cooler months.
Upper Respiratory Tract Conditions	
Acute Upper Respiratory Tract Infections and Tonsillectomy (Page 77)	• During 2006–2010, acute upper respiratory tract infections (URTI) of multiple/unspecified sites were the most frequent reason for an admission with an URTI in Māori children, followed by croup/acute laryngitis/tracheitis. • Admissions for acute URTIs were *significantly* higher for Māori (RR 1.28 95% CI 1.25–1.32) than for non-Māori non-Pacific children, with rates for Māori children increasing during 2000–2010. Admissions were most frequent in infants and one year olds, with rates tapering off rapidly thereafter. Admissions were also higher during the winter months. • During 2006–2010, chronic tonsillitis was the most frequent primary diagnosis in Māori children admitted to hospital for tonsillectomy +/− adenoidectomy, followed by hypertrophy of the tonsils/adenoids and sleep apnoea. • Admissions for tonsillectomy +/− adenoidectomy were *significantly* lower for Māori (RR 0.66 95% CI 0.63–0.69) than for non-Māori non-Pacific children, with admissions for both Māori and non-Māori non-Pacific children increasing after 2004–05. Admissions in Māori children were relatively infrequent during the first two years of life, but increased rapidly during the preschool years, to reach a peak at five years of age.

Indicator	New Zealand Distribution and Trends
Middle Ear Conditions: Otitis Media and Grommets (Page 85)	• During 2006–2010, otitis media was the most frequent primary diagnosis in Māori children admitted acutely with conditions of the middle ear and mastoid, accounting for 93.2% of admissions. Mastoiditis and related disorders were the second most frequent reason for admission. • Otitis media was also the most frequent primary diagnosis in Māori children admitted for the grommets, accounting for 94.9% of admissions. Perforations/other disorders of the tympanic membrane were the second most frequent reason. • Acute admissions for otitis media (RR 1.71 95% CI 1.58–1.86) and arranged/waiting list admissions for grommets (RR 1.33 95% CI 1.29–1.36) were both *significantly* higher for Māori than for non-Māori non-Pacific children. Similar ethnic differences were seen during 2000–2010, with admissions for both outcomes decreasing in Māori children during this period. • Acute admissions for otitis media in Māori children were highest in infants and one year olds, with rates tapering off rapidly thereafter. In contrast, arranged/waiting list admissions for grommets were infrequent during the first year, but then increased rapidly, reaching a peak at two years. Rates remaining elevated during the preschool years, but tapering off after six years of age. • While acute admissions for otitis media were higher during the cooler months, no seasonal variations in arranged/waiting list admissions for grommets were evident.
Lower Respiratory Tract Conditions	
Bronchiolitis (Page 93)	• During 2006–2010, hospital admissions for bronchiolitis were *significantly* higher for Māori (RR 3.10 95% CI 3.01–3.19) than for non-Māori non-Pacific infants. • Admissions for Māori children were highest in infants aged less than one year, although a smaller number of admissions were evident in one year olds. • Admissions in Māori infants were also higher in winter and early spring.
Pneumonia (Page 97)	• During 2006–2010, hospital admissions for bacterial/non-viral/unspecified pneumonia were *significantly* higher for Māori children (RR 1.97 95% CI 1.90–2.05) and young people (RR 2.61 95% CI 2.38–2.86) than for non-Māori non-Pacific children and young people. • While admissions for viral pneumonia were also *significantly* higher for Māori (RR 1.85 95% CI 1.66–2.06) than for non-Māori non-Pacific children, ethnic differences for young people did not reach statistical significance. • When broken down by age, admissions for both outcomes in Māori children and young people were highest in one year olds, followed by infants aged less than one year. Rates then tapered off rapidly during the preschool years. • Admissions for both outcomes were also higher during the winter months.
Asthma (Page 102)	• During 2006−2010, hospital admissions for asthma were *significantly* higher for Māori children (RR 2.19 95% CI 2.13–2.26) and young people (RR 2.60 95% CI 2.43–2.78) than for non-Māori non-Pacific children and young people. Similar ethnic differences were seen during 2000–2010, with admissions in Māori children increasing for the majority of this period, and for Māori young people from 2006–07 onwards. • When broken down by age, admissions were infrequent in Māori infants, but increased rapidly thereafter. Rates reached a peak in one year olds, with the next highest rates being in those two and then three years of age. • There were no consistent seasonal variations in admissions in Māori children and young people, although the number of admissions was lowest in January.
Bronchiectasis (Page 106)	• During 2006–2010, hospital admissions for bronchiectasis were *significantly* higher for Māori (RR 6.62 95% CI 5.85–7.49) than for non-Māori non-Pacific children and young people. • When broken down by age, admissions were relatively infrequent in Māori infants but increased thereafter, to reach a peak at ten years of age. Admissions were less frequent amongst those in their late teens and early twenties. • While there were no consistent seasonal variations, the number of admissions was highest in June and July.

Indicator	New Zealand Distribution and Trends
	Infectious Diseases
Pertussis (Page 113)	• During 2006–2010, hospital admissions for pertussis were *significantly* higher for Māori (RR 2.43 95% CI 1.90–3.11) than for non-Māori non-Pacific infants. • When broken down by age, pertussis admissions were highest in Māori infants aged less than one year, with admissions being very infrequent in older children and young people. • There were no consistent seasonal variations in pertussis admissions for Māori infants.
Meningococcal Disease (Page 117)	• During 2006−2010, hospital admissions for meningococcal disease were *significantly* higher for Māori (RR 3.16 95% CI 2.64–3.79) than for non-Māori non-Pacific children and young people. While similar ethnic differences were seen during 2000–2010, admission rates for Māori children and young people declined during this period, with the most rapid declines occurring between 200–01 and 2006–07. • When broken down by age, admissions were highest in Māori infants aged less than one year, with rates then declining during the preschool years and becoming relatively infrequent after six years of age.
Tuberculosis (Page 121)	• During 2006–2010, hospital admissions for tuberculosis in Māori children and young people were *not significantly* different from those for non-Māori non-Pacific children and young people. While similar patterns were seen during 2000–2010, tuberculosis admissions for both Māori and non-Māori non-Pacific children and young people declined during this period. • When broken down by age, admissions were most frequent amongst Māori young people in their teens and early twenties, although a small number of admissions also occurred in children under five years of age. • No seasonal variations in TB admissions in Māori children and young people were evident.
Acute Rheumatic Fever and Rheumatic Heart Disease (Page 125)	• During 2006–2010, hospital admissions for those with acute rheumatic fever (RR 25.38 95% CI 19.93–32.31) and rheumatic heart disease (RR 9.96 95% CI 7.97–12.44) were both *significantly* higher for Māori than for non-Māori non-Pacific children and young people. While similar ethnic differences were seen during 2000–2010, admissions for acute rheumatic fever in Māori children and young people increased, while admissions for those with rheumatic heart disease were more static. • When broken down by age, acute rheumatic fever admissions were relatively infrequent during the preschool years, but increased rapidly during childhood to reach a peak at eleven years of age, before tapering off again. While admissions for rheumatic heart disease followed a similar pattern, admissions remained elevated amongst those in their late teens and early twenties. • Acute rheumatic fever admissions were also generally higher during the cooler months, although seasonal variations in rheumatic heart disease admissions were less consistent.
Serious Skin Infections (Page 129)	• During 2006–2010, cutaneous abscesses/furuncles/carbuncles and cellulitis were the most frequent primary diagnoses in Māori children and young people admitted to hospital with serious skin infections, followed by infected/unspecified/other dermatitis. • Admissions for serious skin infections were *significantly* higher for Māori (RR 2.51 95% CI 2.46–2.56) than for non-Māori non-Pacific children and young people. While similar ethnic differences were seen during 2000–2010, admissions for Māori children and young people increased during this period. • When broken down by age, admissions were highest in Māori infants aged less than one year, with rates then tapering off during the preschool years, to reach their lowest point at 13 years of age. Rates then increased again, to reach a second (albeit lower) plateau amongst those in their late teens and early twenties. • There were no consistent seasonal variations in admissions for serious skin infections in Māori children and young people.

Indicator	New Zealand Distribution and Trends
Gastroenteritis (Page 134)	• During 2006−2010, hospital admissions for gastroenteritis were *significantly* lower for Māori children (RR 0.89 95% CI 0.86–0.91) than for non-Māori non-Pacific children. While admissions for Māori young people were also lower than for non-Māori non-Pacific young people, these differences failed to reach statistical significance. • During 2000–2010, gastroenteritis admissions increased in Māori children and young people, although in the case of children, rates remained lower than for non-Māori non-Pacific children. Rates for Māori young people however, were more similar to those of non-Māori non-Pacific young people during 2008–2010. • When broken down by age, admissions were highest in Māori infants aged less than one year, followed by one year olds. Rates then tapered off rapidly during the pre-school years. • Gastroenteritis admissions in Māori children and young people were also higher in spring.
Other Issues	
Injuries in Children (Page 141)	• During 2006–2010 falls, followed by inanimate mechanical forces were the leading causes of injury admissions in Māori children, although transport injuries as a group also made a significant contribution. • In contrast, accidental threats to breathing, followed by vehicle occupant and pedestrian injuries were the leading causes of injury mortality in Māori children during 2004–2008.
Oral Health: School Dental Service Data (Page 151)	• During 2003–2010, the proportion of Māori children who were caries-free at five years was consistently lower than for non-Māori non-Pacific children in both fluoridated and non-fluoridated areas. Amongst Māori children however, the proportion that were caries-free at five years was consistently higher for those with access to fluoridated school water. • Similarly, mean DMFT scores at 12 years were higher for Māori children than for non-Māori non-Pacific children in both fluoridated and non-fluoridated areas. Amongst Māori children, mean DMFT scores at 12 years were lower for those with access to fluoridated school water.
Oral Health: Hospital Admissions for Dental Conditions (Page 154)	• During 2006–2010, dental caries, followed by diseases of the pulp and periapical tissue, were the leading reasons for a dental admission in Māori children aged 0–4 and 5–14 years. In contrast, embedded/impacted teeth, followed by dental caries were the leading reasons for an admission in Māori young people aged 15–24 years. • During 2006–2010, hospital admissions for dental caries were *significantly* higher for Māori children (0–4 years RR 2.24 95% CI 2.15–2.33; 5–14 years RR 1.61 95% CI 1.56–1.67) and young people (RR 1.17 95% CI 1.03–1.33) than for non-Māori non-Pacific children and young people, with the largest ethnic differences being evident in children aged 0–4 years, followed by those aged 5–14 years. Similar ethnic differences were seen during 2000–2010, with rates increasing in all three age groups during this period. • When broken down by age, admissions for dental caries were infrequent in Māori infants and one year olds, but increased rapidly thereafter, to reach a peak at four years. • While there were no consistent seasonal variations, the number of admissions for dental caries was lowest in January.
Newborn Hearing Screening (Page 158)	• In the Universal Newborn Hearing Screening and Early Intervention Programme's (UNHSEIP) report for the period 1 April 2010–30 September 2010, the lack of a suitable denominator precluded the assessment of consent rates by ethnicity. Thus is it difficult to determine from UNHSEIP data, the proportion of Māori babies who completed newborn hearing screening. • However of those Māori babies whose parents consented to screening, 92.8% completed screening within one month, with 2.8% being referred to audiology and 9.2% being targeted for follow up.

Indicator	New Zealand Distribution and Trends
Issues More Common in Young People	
Total and Avoidable Morbidity and Mortality	
Most Frequent Causes of Hospital Admissions and Mortality (Page 163)	• During 2006–2010, issues associated with pregnancy, delivery and the postnatal period were the leading reasons for hospital admission in Māori young people aged 15–24 years. • In terms of other admission types, injury/poisoning, mental health issues and abdominal/pelvic pain were the leading reasons for acute admissions, dialysis, injury/ poisoning and neoplasms/chemotherapy/radiotherapy the leading reasons for arranged admissions, and musculoskeletal and gastrointestinal procedures the leading reasons for waiting list admissions. • In contrast, during 2004–2008 vehicle occupant transport injuries and intentional self-harm were the leading causes of mortality in Māori young people, followed by neoplasms.
Other Issues	
Injuries in Young People (Page 167)	• During 2006–2010, inanimate mechanical forces, falls and assaults were the leading causes of injury admissions in Māori young people, although as a group transport injuries also made a significant contribution. • In contrast, during 2004–2008, intentional self-harm and vehicle occupant injuries were the leading causes of injury related mortality in Māori young people.
Teenage Pregnancy (Page 176)	• During 2006–2010, teenage birth rates were *significantly* higher for Māori (RR 4.74 95% CI 4.61–4.87) than for non-Māori non-Pacific women. Teenage birth rates however need to be considered within the context of overall fertility rates and the fact that during 2006–2010, Māori women had higher birth rates than non-Māori non-Pacific women in each age group, up until thirty years of age.
Terminations of Pregnancy (Page 179)	• During 2010, terminations of pregnancy were highest for Māori women aged 20–24 years, followed by those aged 25–29 years and those aged 15–19 years. While similar patterns were seen for European women, in each age group, termination rates were higher for Māori women than for European women. • During 2006–2010, terminations were consistently higher for Māori teenagers and women aged 20–24 years, than for European teenagers and women aged 20–24 years, although termination rates in Māori women in these age groups gradually declined after 2007.

THE HEALTH STATUS OF MĀORI CHILDREN AND YOUNG PEOPLE

ISSUES MORE COMMON IN INFANCY

Viewpoint: Is the 'safer' sleeping environment the remaining holy grail of SUDI prevention? by David Tipene-Leach

Hopefully this second publication of Te Ohonga Ake by the NZ Child and Youth Epidemiology Service is able to fulfil the promise of its title, that is, 'the awakening' of the New Zealand health community to the need for active management around the dire health status of Māori children and young people. It is an excellent compilation of the poor outcomes that our health system routinely delivers Māori children. But recent developments to address the persistently higher rates of Sudden Death in Infancy (SUDI) in the Māori community signal that parts of the New Zealand health system are innovative and responsive and will be worthy of praise should we be able to pursue these developments to a fruitful outcome.

There is an almost six fold (RR=5.66) disparity in SUDI between Māori and European infants with no evidence of any decrease since 1996. Te Ohonga Ake reveals a significant fall in Māori SUDI mortality over the 1996 to 2002 period, but then it appears to have ceased. Together with the observation that there is preponderance of SUDI in a much younger age cohort than that usual for Sudden Infant Death Syndrome (SIDS) and the associated finding that accidental suffocation is an increasingly likely cause of SUDI, the need for a change in the assumptions we make in our SUDI prevention work has become clear.

Knowing that 21% of Māori mothers both smoke in pregnancy and bed-share with their infant compared to only 1% of a largely European sample [4], [5] and understanding the interacting risk(s) of 'smoking in pregnancy and bed-sharing' [6], [7] is key to the huge disparity in SUDI mortality. The difficulties of population level smoking cessation among Māori women and the tenacity of bed sharing by Māori mums as a preferred infant care practice is common knowledge, and creative attention therefore, to modification of the shared sleeping environment seems the obvious move.

The American Academy of Pediatrics Task Force on Sudden Infant Death Syndrome makes evidence-based infant sleeping environment recommendations, identifying as hazards: bed-sharing, use of pillows, toys and bumpers in the bassinet, soft mattresses, head covering, multiple bed-sharers, co-sleeping adults who are over-tired or under the influence of alcohol, and sofas or couches as infant sleeping places [8]. Their more recent report, SIDS and other sleep related deaths: Expansion of Recommendations for a Safe Infant Sleeping Environment, states, in reference to room-sharing without bedsharing, that a "separate sleep surface (crib or similar surface) decreases the risk of SIDS by as much as 50%". It also, on the basis of "insufficient evidence", is unable to recommend any "device promoted to make bedsharing safe" [9].

Working with the current knowledge that the removal of one of two interacting risk factors will remove the risk associated with the interacting pair, a Māori SIDS/SUDI prevention initiative uses the 'separate sleep surface' advice but ignores the advice around 'a device promoted to make bedsharing safe'. A 'separate sleep surface' that is able to be deployed almost anywhere, including in or on the adult bed has been developed. The term 'safer' separate sleep surface acknowledges the lack of evidence around safety but claims, in a common sense stand, that it is safer than a shared sleeping surface of direct bedsharing.

The wahakura, developed by the Nukutere Weavers Collective in Gisborne, is the form in which this 'safer separate sleep surface' first appeared in 2006. A 36 x 72 cm bassinet-like structure woven from flax, it is culturally attractive and has a particular appeal in its ability to maintain the valued proximity at night. This proximity also makes for easy return to wahakura after night feeding, and its mobility provides a consistent safer sleep environment for use at any time by any caregiver in any place. The wahakura has a traditional forebear in the pōrakaraka, a similar pre-European structure slung from the rafters. The ‘safe sleep rules’ that accompany the wahakura include: back sleeping, keeping the face clear, using a firm mattress without pillows, maintaining a smoke free environment, keeping inebriated or excessively tired people and younger siblings at bay and, ensuring adherence to the ‘return to wahakura after feeding’ and ‘every place-every sleep’ messages [10].

The original wahakura distribution project, The Tairawhiti Wahakura Project, funded by Te Puni Kokiri, involved the Ngā Maia Māori midwifery group distributing 85 devices to smoking Māori mothers in Gisborne in 2007. The evaluation found them to be highly acceptable as sleeping environments and well used by whānau [11]. The second major wahakura project, The Wahakura: Weaving our way to the future, undertaken in the Hawke’s Bay by Tu Meke First Choice PHO, found the wahakura to be an effective vessel around which to pass on a range of antenatal messages but also established that, without specific funding for the highly skilled and time consuming construction, it was difficult to procure wahakura from within communities to match demand [12]. A similar development in North Auckland, the Taitokerau Mokopuna Ora Wānanga, spearheaded by the Māori SIDS team under the framework of the kaumatua group, Ngā Manga Puriri, has managed to build wahakura construction widely into tribal networks, but the evidence of ubiquitous production is not yet clear. The search, therefore, for a cheaper alternative and for evidence of safety that might facilitate access to funding began.

Subsequently, the term ‘pēpi-pod’ was conceived by the Māori SIDS team to be any device that served the function of a wahakura, was not made of flax and was relatively simple and cheap to source. The currently used pēpi-pod is the bottom section of a easily available plastic clothes container with an attractive cover, a simple mattress and a blanket set. It was identified and developed by child health advocacy programme, Change for our Children. The pēpi-pod has so far been widely deployed in two major sites. Change for our Children distributed around 900 in post-earthquake Christchurch which, with its destruction of homes and property, experienced the proliferation of “increased risks to babies, posed by disrupted living and sleeping conditions” [13]. The second site is the Hawke’s Bay where the District Health Board (DHB), in response to a four-fold increase in SUDI deaths in 2010, launched an intervention called the Safe Sleep Action Project. This project provides enhanced antenatal safe sleep education and a safe sleeping environment audit, with the provision of pēpi-pods as deemed appropriate in identified high risk situations. Its evaluation seeks to report on retention of safe sleep knowledge and behaviours with the device at three months. There is also a potential third site. The Waikato Safe Sleep Pēpi-pod Project has recently finished a pilot study and may soon launch a similar, but potentially much larger, intervention.

The search for direct evidence around the safety of the wahakura is also based in Hawke’s Bay. Entitled the Kahungunu Infant Safe Sleep (KISS) study, it is a randomised controlled trial (RCT) of the wahakura versus the standard bassinet, comparing safety and other features of the devices using a range of measures including, physiological environment (O2 saturation, heart rate and temperature, episodes of head covering) and mother/infant behaviour (waking, touching, breastfeeding, return to sleeping device). The null hypothesis is that there is no difference in the safety profile of the two devices. This research is funded by the Health Research Council (HRC) of New Zealand through the University of Otago.

The key, however, to ‘breaking the back’ of SUDI/SIDS in New Zealand, is developing preventive intervention services in South and West Auckland, where the majority of SUDI cases occur. An intervention study by Counties-Manukau DHB and Whakawhetu National SIDS Prevention for Māori will begin to address this need. The Evaluation of a Sleep Intervention for the Prevention of Sudden Unexpected Death in Infancy in a cohort of Māori and Pacific Infants in South Auckland, an RCT of safe sleep education and a supplied wahakura or pēpi-pod versus safe sleep education and a supplied bassinet, seeks to examine knowledge and behaviours at 3 and 6 months as an evidence base for possible widespread distribution of such sleeping devices.

New Zealand has a history of innovative SIDS investigation; reviewing and redefining its own findings as well as current knowledge and accepted practice in its wake. A 1984/85 post-neonatal mortality review in Auckland reported that SIDS was unpredictable and unpreventable [14] but the NZ Cot Death Study team's subsequent research paved the way for a worldwide fall in SIDS mortality by overturning the standard medical advice about infant prone sleeping. Its lead researcher has commended "new approaches to establishing a safe sleeping environment for infants" [15] and has recently commenced an HRC funded RCT study, the Sudden Unexpected Death in Infancy (SUDI): a Nationwide case-control study, which seeks to examine, amongst other things, risk factors relating to bed sharing and what exactly makes bed sharing safer or more dangerous.

To date the assumption that the wahakura and the pēpi-pod are safer than uncontrolled bedsharing has been implicitly accepted by three DHBs and two significant infant health organisations and robust research investigating this is underway. It appears, then, that New Zealand is a hot bed of innovation and development in the SIDS/SUDI area. We have taken the infant safe sleeping environment 'by the horns', actively creating and investigating developments in SUDI/SIDS prevention that, in turn, may forge another trajectory in the story of post neonatal mortality in the Western world. Perceptiveness, persistence and courage are called for to work creatively with the tail of this SIDS/SUDI epidemic.

REGIONAL BIRTHS

Introduction

The following section provides an overview of the distribution of births by ethnicity and District Health Board (DHB), with a view to identifying how many Māori babies were born in each of New Zealand's DHBs during 2010. While an understanding of the regional distribution of older Māori children and young people would also be of utility, due to the postponement of the 2011 Census, Census data has not been included this year, but will be updated as soon as it becomes available.

Distribution of Births by Ethnicity and Region

Distribution by Ethnicity and Region

In New Zealand during 2010, the proportion of Māori babies born varied by region, with Tairawhiti (69.4%) having the highest proportion of babies registered as Māori and Auckland DHB (14.2%) the lowest. In absolute terms however, the largest number of Māori babies were born in Counties Manukau (n=2,541), while the lowest number of births occurred in the West Coast (n=91) (**Table 2**–**Table 3**).

Data Sources and Methods

Indicator

1. Distribution of Live Births by Prioritised Ethnicity

Numerator: Birth Registration Dataset

Notes on Interpretation

Note 1: The number of births presented here may vary slightly from previous years, as the Ministry of Health no longer provides information on stillbirths in the Birth Registration Dataset due to concerns about data quality. Thus the current analysis is restricted to live births (as compared to total births (including stillbirths) which were presented in previous years).

Note 2: Year is year of birth registration rather than year of birth.

Table 2. Distribution of Live Births by Prioritised Ethnicity, North Island District Health Boards 2010

Ethnicity	Number of Births	% of Births	Number of Births	% of Births	Number of Births	% of Births
	Northland		Waitemata		Auckland DHB	
Māori	1,471	59.9	1,726	21.3	950	14.2
Pacific	60	2.4	1,008	12.4	1,353	20.2
Asian/Indian	74	3.0	1,451	17.9	1,695	25.3
Other	11	0.4	164	2.0	189	2.8
European	838	34.1	3,757	46.3	2,509	37.5
Total	2,454	100.0	8,106	100.0	6,696	100.0
	Counties Manukau		Waikato		Bay of Plenty	
Māori	2,541	28.7	2,258	39.7	1,398	46.8
Pacific	2,854	32.3	215	3.8	76	2.5
Asian/Indian	1,529	17.3	400	7.0	175	5.9
Other	115	1.3	107	1.9	20	0.7
European	1,808	20.4	2,712	47.6	1,318	44.1
Total	8,847	100.0	5,692	100.0	2,987	100.0
	Lakes		Tairawhiti		Taranaki	
Māori	923	56.8	559	69.4	535	33.3
Pacific	55	3.4	19	2.4	32	2.0
Asian/Indian	58	3.6	16	2.0	50	3.1
Other	13	0.8	6	0.7	6	0.4
European	575	35.4	205	25.5	984	61.2
Total	1,624	100.0	805	100.0	1,607	100.0
	Hawke's Bay		MidCentral		Whanganui	
Māori	1,088	46.5	903	38.1	428	46.9
Pacific	147	6.3	103	4.3	30	3.3
Asian/Indian	93	4.0	152	6.4	19	2.1
Other	16	0.7	23	1.0	5	0.5
European	995	42.5	1,188	50.1	430	47.1
Total	2,339	100.0	2,369	100.0	912	100.0
	Wairarapa		Hutt Valley		Capital and Coast	
Māori	179	32.6	611	28.4	804	20.1
Pacific	20	3.6	267	12.4	427	10.7
Asian/Indian	8	1.5	214	10.0	508	12.7
Other	<3	s	36	1.7	117	2.9
European	340	61.9	1,021	47.5	2,139	53.5
Total	549	100.0	2,149	100.0	3,995	100.0

Source: Birth Registration Dataset. Ethnicity is Level 1 Prioritised. Note: s: suppressed due to small numbers.

Table 3. Distribution of Live Births by Prioritised Ethnicity, South Island District Health Boards vs. New Zealand 2010

Ethnicity	Number of Births	% of Births	Number of Births	% of Births	Number of Births	% of Births
	Nelson Marlborough		South Canterbury		Canterbury	
Māori	345	20.0	102	16.3	1,179	17.7
Pacific	48	2.8	14	2.2	326	4.9
Asian/Indian	100	5.8	12	1.9	596	8.9
Other	24	1.4	5	0.8	116	1.7
European	1,208	70.0	494	78.8	4,460	66.8
Total	1,725	100.0	627	100.0	6,677	100.0
	West Coast		Otago		Southland	
Māori	91	21.1	348	16.8	383	22.5
Pacific	9	2.1	83	4.0	50	2.9
Asian/Indian	13	3.0	106	5.1	73	4.3
Other	5	1.2	27	1.3	22	1.3
European	314	72.7	1,505	72.7	1,172	68.9
Total	432	100.0	2,069	100.0	1,700	100.0
			New Zealand			
Māori			18,893	29.2		
Pacific			7,261	11.2		
Asian/Indian			7,451	11.5		
Other			1,045	1.6		
European			30,016	46.4		
Total			64,666	100.0		

Source: Birth Registration Dataset. Ethnicity is Level 1 Prioritised

FETAL DEATHS

Introduction

The following section reviews intermediate and late fetal deaths in Māori babies using information from the National Mortality Collection.

Background

In May 1950 the WHO recommended the following dentition of fetal death be adopted for international use [16] *"Death prior to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy; the death is indicated by the fact that after such separation the foetus does not breathe or show any other evidence of life such as beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles"*.

While internationally, controversy still exists regarding the exact gestation at which a death becomes a fetal death rather than a spontaneous abortion (some countries use 22 weeks [17] and others 24 weeks [18]), in New Zealand the Perinatal and Maternal Mortality Review Committee defines a fetal death as "*the death of a fetus born at 20 weeks gestation or beyond, or weighing at least 400g if gestation is unknown. Fetal death includes stillbirth and termination of pregnancy*" [19].

In New Zealand, the risk of stillbirth is higher for babies born to Indian and Pacific women, older women (35+ years), smokers, those from more deprived areas (NZDep01 decile 9–10), or those who are growth restricted [20,21]. For Māori babies, while some studies have shown the risk of stillbirth to be similar to, or slightly higher than for European babies [20,21] one recent case control study (155 late fetal deaths vs. 310 controls), found that after adjusting for confounding factors such as maternal age, marital status, socioeconomic deprivation, parity, BMI and smoking and/or recreational drug use, that Māori women had a significantly reduced risk of late fetal death (28+ weeks gestation) compared to European women [22]. The authors of this study noted that previous studies had not been able to adjust for known confounders such as BMI and smoking (which this study had adjusted for) and that other studies that had suggested an excess risk of stillbirth for Māori babies were at earlier gestations. They concluded that their findings were consistent with the existing literature, which suggested no overall increase in stillbirth risk for Māori babies. They also noted that Māori women who did not have lifestyle risk factors may potentially have a reduced risk of late fetal death and that future well designed studies were needed to confirm or refute these findings [22].

Data Sources and Methods

Indicator

1. *Intermediate Fetal Deaths*

Numerator: National Mortality Collection: Fetal deaths occurring between 20 and 27 weeks gestation.

Denominator: Birth Registration Dataset and National Mortality Collection: All births 20+ weeks gestation.

2. *Late Fetal Deaths*

Numerator: National Mortality Collection: Fetal deaths occurring 28+ weeks gestation.

Denominator: Birth Registration Dataset and National Mortality Collection: All births 28+ weeks gestation.

3. *Unspecified Fetal Deaths*

Numerator: National Mortality Collection: Fetal deaths occurring 20+ weeks gestation where the main fetal cause of death was unspecified (ICD10-AM P95 or R99) and there were no additional fetal or maternal causes of death listed.

<u>Denominator</u>: Birth Registration Dataset and National Mortality Collection: All births 20+ weeks gestation.

In the National Mortality Collection, all fetal deaths are assigned a main underlying (fetal) cause of death. In addition other fetal and maternal causes contributing to the death are also listed. In this section, the main (fetal) underlying cause of death was assigned using the following ICD-10-AM codes: Malnutrition/Slow Fetal Growth (P05), Extreme Immaturity/Low Birth Weight (P07.0, P07.2), Intrauterine Hypoxia: Pre Labour Onset (P20.0), Intrauterine Hypoxia: In Labour/Unspecified (P20.1, P20.9), Congenital Pneumonia (P23), Infections Specific to Perinatal Period (P35–P39), Fetal Blood Loss (P50), Unspecified Cause (P95), Congenital Anomalies: CNS (Q00–Q07), Congenital Anomalies: CVS (Q20–Q28), Chromosomal Anomalies (Q90–Q99), Congenital Anomalies: Other (remainder Q08–Q89), Other Causes (remainder ICD-10-AM).

In addition, the first maternal cause of death (if present) was assigned using the following ICD-10-AM codes: Incompetent Cervix/Premature Rupture Membranes (P01.0, P01.1), Oligohydramnios (P01.2), Multiple Pregnancy (P01.5), Placenta Praevia/Other Placental Separation/Haemorrhage (P02.0, P02.1), Other/Unspecified Placental Anomalies (P02.2), Compression of Umbilical Cord (P02.5), Chorioamnionitis (P02.7), Maternal Hypertensive Disorders (P00.0), Placental Transfusion Syndrome (P02.3), Other Causes (remainder ICD-10-AM).

For gestational age specific rates, the denominator was those remaining in utero at the specified gestational age (e.g. the 22 week denominator excludes all births occurring at 20 and 21 weeks)

Notes on Interpretation

Note 1: Death Registration data do not differentiate between spontaneous fetal deaths and late terminations of pregnancy (all fetal deaths 20+ weeks gestation require death registration). The admixture of spontaneous and induced fetal deaths is likely to be most prominent at earlier gestations (e.g. the high number of deaths attributed to congenital anomalies prior to 25 weeks gestation) and this must be taken into account when interpreting the data in this section.

Distribution in Māori Babies

Distribution by Cause

Intermediate Fetal Deaths: In New Zealand during 2004−2008, unspecified cause was the most frequently listed fetal cause of death for Māori babies dying in utero between 20 and 27 weeks of gestation, followed by extreme immaturity/low birth weight and congenital and chromosomal anomalies. Of those intermediate fetal deaths with a maternal cause listed, the most frequent causes were placenta praevia/placental separation/haemorrhage and chorioamnionitis (**Table 4**).

Late Fetal Deaths: In New Zealand during 2004−2008, unspecified cause was also the most frequently listed fetal cause of death for Māori babies dying in utero at 28+ weeks gestation, followed by congenital anomalies, malnutrition/slow fetal growth and intrauterine hypoxia. Of those late fetal deaths with a maternal cause listed, the most frequent causes were placenta praevia/placental separation/haemorrhage and compression of the umbilical cord (**Table 5**).

Distribution by Ethnicity

In New Zealand during 2004−2008, intermediate fetal deaths were *significantly* lower for Māori babies (RR 0.86 95% CI 0.76–0.98) than for non-Māori non-Pacific babies. While no *significant* ethnic differences were seen for late fetal deaths, deaths due to unspecified causes were *significantly* higher for Māori (RR 1.72 95% CI 1.36–2.17) than for non-Māori non-Pacific babies (**Table 6**). Similar ethnic differences were seen during 2000−2008 (**Figure 1**).

Table 4. Intermediate Fetal Deaths in Māori Babies by Cause, New Zealand 2004−2008

Cause of Death	Number: Total 2004–2008	Number: Annual Average	Rate per 100,000 Births	Percent of Deaths (%)
Intermediate Fetal Deaths in Māori Babies				
Main Fetal Cause of Death				
Unspecified Cause	101	20.2	111.3	29.7
Extreme Immaturity/Low Birth Weight	72	14.4	79.3	21.2
Congenital Anomalies: CNS	32	6.4	35.3	9.4
Congenital Anomalies: CVS	10	2.0	11.0	2.9
Congenital Anomalies: Other	38	7.6	41.9	11.2
Chromosomal Anomalies	34	6.8	37.5	10.0
Malnutrition/Slow Fetal Growth	13	2.6	14.3	3.8
Fetal Blood Loss	7	1.4	7.7	2.1
Infections Specific to Perinatal Period	5	1.0	5.5	1.5
Congenital Pneumonia	3	0.6	3.3	0.9
Intrauterine Hypoxia	4	0.8	4.4	1.2
Other Causes	21	4.2	23.1	6.2
Total	340	68.0	374.7	100.0
First Listed Maternal Cause				
No Listed Maternal Cause	174	34.8	191.7	51.2
Placenta Praevia/Placental Separation/Haemorrhage	31	6.2	34.2	9.1
Chorioamnionitis	22	4.4	24.2	6.5
Incompetent Cervix/Premature Rupture Membranes	17	3.4	18.7	5.0
Other/Unspecified Placental Anomalies	15	3.0	16.5	4.4
Oligohydramnios	13	2.6	14.3	3.8
Multiple Pregnancy	11	2.2	12.1	3.2
Placental Transfusion Syndrome	9	1.8	9.9	2.6
Compression of Umbilical Cord	5	1.0	5.5	1.5
Maternal Hypertensive Disorders	5	1.0	5.5	1.5
Other Causes	38	7.6	41.9	11.2
Total	340	68.0	374.7	100.0

Source: Numerator: National Mortality Collection; Denominators: Birth Registration Dataset and National Mortality Collection. Note: CNS = Central Nervous System, CVS = Cardiovascular System.

Table 5. Late Fetal Deaths in Māori Babies by Cause, New Zealand 2004−2008

Cause of Death	Number: Total 2004–2008	Number: Annual Average	Rate per 100,000 Births	Percent of Deaths (%)
Late Fetal Deaths in Māori Babies				
Main Fetal Cause of Death				
Unspecified Cause	177	35.4	196.9	58.0
Congenital Anomalies: CVS	6	1.2	6.7	2.0
Congenital Anomalies: CNS	5	1.0	5.6	1.6
Congenital Anomalies: Other	18	3.6	20.0	5.9
Malnutrition/Slow Fetal Growth	17	3.4	18.9	5.6
Intrauterine Hypoxia: In Labour/Unspecified	16	3.2	17.8	5.2
Intrauterine Hypoxia: Pre Labour Onset	14	2.8	15.6	4.6
Chromosomal Anomalies	8	1.6	8.9	2.6
Fetal Blood Loss	7	1.4	7.8	2.3
Other Causes	37	7.4	41.1	12.1
Total	305	61.0	339.2	100.0
First Listed Maternal Cause				
No Listed Maternal Cause	119	23.8	132.3	39.0
Placenta Praevia/Placental Separation/Haemorrhage	36	7.2	40.0	11.8
Compression of Umbilical Cord	33	6.6	36.7	10.8
Other/Unspecified Placental Anomalies	24	4.8	26.7	7.9
Multiple Pregnancy	12	2.4	13.3	3.9
Incompetent Cervix/Premature Rupture Membranes	10	2.0	11.1	3.3
Chorioamnionitis	8	1.6	8.9	2.6
Oligohydramnios	8	1.6	8.9	2.6
Maternal Hypertensive Disorders	5	1.0	5.6	1.6
Placental Transfusion Syndrome	5	1.0	5.6	1.6
Other Causes	45	9.0	50.0	14.8
Total	305	61.0	339.2	100.0

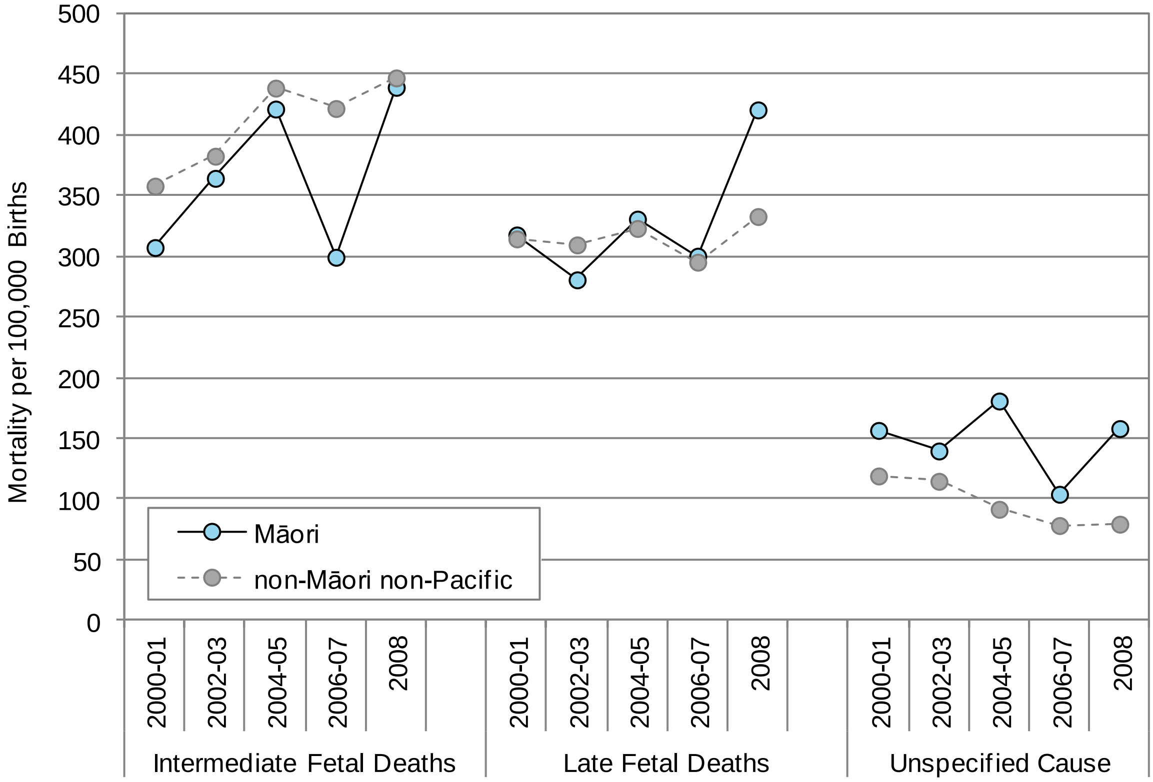
Source: Numerator: National Mortality Collection; Denominators: Birth Registration Dataset and National Mortality Collection. Note: CNS = Central Nervous System, CVS = Cardiovascular System.

Table 6. Intermediate and Late Fetal Deaths and Unspecified Deaths by Ethnicity, New Zealand 2004–2008

Ethnicity	Number: Total 2004−2008	Number: Annual Average	Rate per 100,000 Births	Rate Ratio	95% CI
Intermediate Fetal Deaths					
Māori	340	68.0	374.7	0.86	0.76 – 0.98
non-Māori non-Pacific	806	161.2	433.3	1.00	
Late Fetal Deaths					
Māori	305	61.0	339.2	1.08	0.94 – 1.24
non-Māori non-Pacific	581	116.2	315.0	1.00	
Unspecified Cause (All Gestations)					
Māori	128	25.6	141.1	1.69	1.34 – 2.14
non-Māori non-Pacific	155	31.0	83.3	1.00	

Source: Numerator: National Mortality Collection; Denominators: Birth Registration Dataset and National Mortality Collection

Figure 1. Intermediate and Late Fetal Deaths and Unspecified Deaths by Ethnicity, New Zealand 2000−2008



Source: Numerator: National Mortality Collection; Denominators: Birth Registration Dataset and National Mortality Collection. Note: Unspecified deaths include all unspecified deaths occurring at 20+ weeks' gestation.

New Zealand Distribution and Trends

Distribution by Cause

Intermediate Fetal Deaths: In New Zealand during 2004–2008, unspecified cause was the most frequently listed fetal cause of death for babies dying in utero between 20 and 27 weeks of gestation, followed by extreme immaturity/low birth weight and chromosomal anomalies. Congenital anomalies as a group, however, also made a significant contribution. Of those intermediate fetal deaths with a maternal cause listed, the most frequent causes were placenta praevia/placental separation/haemorrhage and chorioamnionitis.

Late Fetal Deaths: In New Zealand during 2004–2008, unspecified cause was also the most frequently listed fetal cause of death for babies dying in utero at 28+ weeks gestation, followed by malnutrition/slow fetal growth and intrauterine hypoxia. Congenital anomalies as a group, however, still made a significant contribution. Of those late fetal deaths with a maternal cause listed, the most frequent causes were placenta praevia/placental separation/haemorrhage/other placental anomalies, and compression of the umbilical cord.

New Zealand Trends

In New Zealand, late fetal deaths were relatively static during the early-to-mid 2000s. While an upswing in rates was evident during 2008, it is too early to tell if this was a one off fluctuation, or the beginning of a longer term trend. Intermediate fetal deaths increased during the early 2000s, but were more variable after 2004–05, with the contribution unspecified deaths made to each category remaining relatively constant throughout this period.

Distribution by Gestational Age and Cause

In New Zealand during 2004–2008, fetal deaths exhibited a J-shaped distribution with gestational age. A peak was evident at <25 weeks, with rates declining and then increasing rapidly again after 37 weeks. In interpreting these figures, it must be remembered that rates were calculated by dividing the number of fetal deaths at each gestational age by the number of babies remaining in utero. Thus, while the absolute number of babies dying in utero did not rise exponentially towards term, the risk for those remaining in utero increased markedly with increasing age. Further, it was not always possible to distinguish between spontaneous fetal deaths and late terminations of pregnancy and thus the high mortality rates (e.g. from congenital anomalies) in those <25 weeks must be interpreted with this in mind. When broken down by cause, fetal deaths arising from congenital anomalies and extreme immaturity/low birth weight were highest in babies 20–22 weeks gestation, while unspecified fetal deaths increased rapidly after 37 weeks.

Distribution by NZDep01 Index Decile, Maternal Age and Gender

Intermediate Fetal Deaths: In New Zealand during 2004–2008, intermediate fetal deaths were *significantly* higher for babies born to women aged 35+ years (vs. women 30–34 years). No significant differences were evident by gender or NZ Deprivation Index quintile.

Late Fetal Deaths: In New Zealand during 2004–2008, late fetal deaths were *significantly* higher for those from average-to-more deprived (NZDep01 decile 5–10) areas and for babies born to teenage women (vs. women aged 30–34 years). No significant differences were evident by gender.

Unspecified Fetal Deaths: In New Zealand during 2004–2008, unspecified fetal deaths were *significantly* higher for babies from more deprived (NZDep01 7–10) areas. No significant differences were evident by gender or maternal age.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

PRETERM BIRTH

Introduction

The following section explores preterm birth rates in Māori babies using information from the Birth Registration Dataset.

Background
Preterm birth is defined as the birth of a baby before 37 weeks completed gestation [23], with gestational age being defined as the number of completed weeks since the first day of the last menstrual period. If this date is unknown, ultrasound measurements may provide an estimate (+/- 1 week) if undertaken in the first 20 weeks of pregnancy.

Preterm deliveries comprise a heterogeneous group, and are often divided into three distinct categories [24]: (1) Idiopathic Preterm Births, where labour starts without apparent reason and without prior rupture of the membranes; (2) Preterm Premature Rupture of the Membranes, where the fetal membranes rupture prior the onset of labour, resulting in preterm delivery; and (3) Iatrogenic Preterm Births, where delivery is induced for a variety of reasons including pre-eclampsia, diabetes, and antepartum haemorrhage.

In New Zealand, preterm birth rates remain higher for Māori women than for European or Pacific women. However, during 1980–1994 preterm birth rates increased by 30% for European women, as opposed to a non-significant reduction of 7% for Māori women, leading to a significant reduction in ethnic inequalities in preterm birth. However, it remains unclear whether these findings arose from increasing obstetric intervention in European women, as opposed to any real reductions in ethnic inequalities in spontaneous preterm birth (as no information on the reasons for preterm delivery was available [20,25]).

Data Sources and Methods

Indicator

1. *Preterm Birth Rates in Singleton Live Born Babies*

Numerator: Birth Registration Dataset: All singleton live born babies 20–36 weeks gestation

Denominator: Birth Registration Dataset: All singleton live born babies 20+ weeks gestation

Notes on Interpretation

Note 1: Year is year of registration, rather than year of birth.

Note 2: See **Appendix 3** for an overview of the Birth Registration Dataset

Distribution in Māori Babies

Distribution by Ethnicity

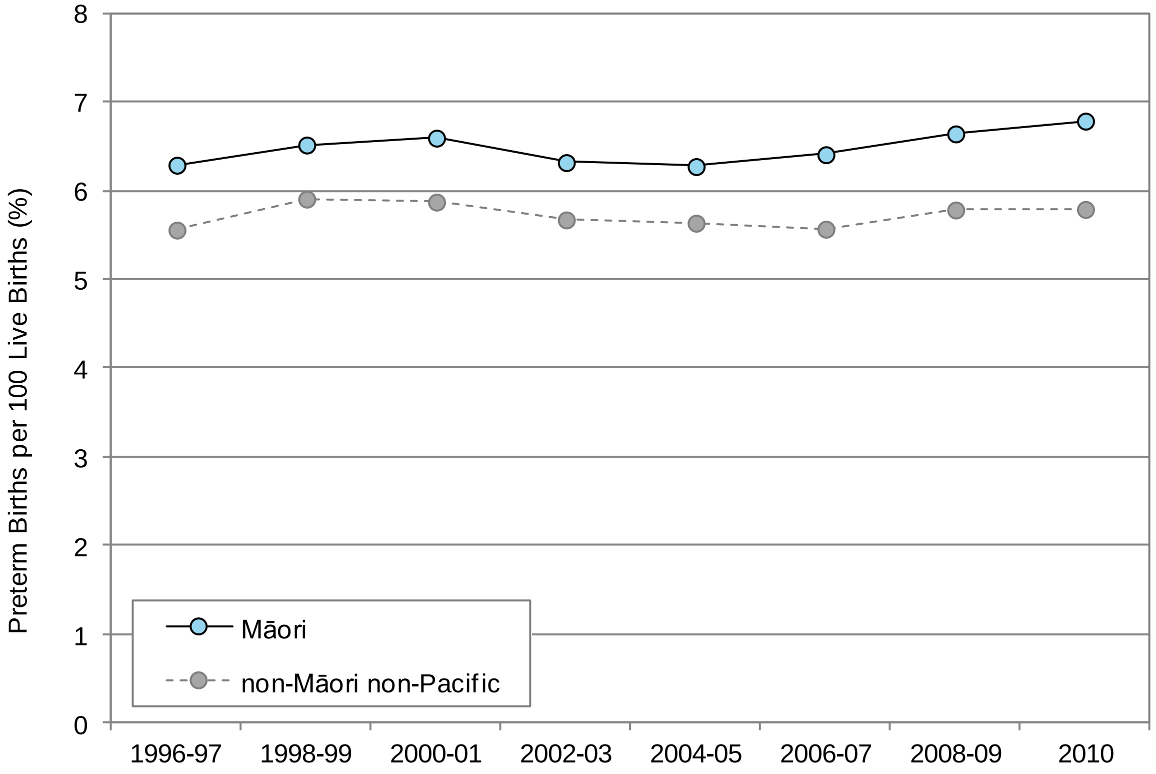
In New Zealand during 2006–2010, preterm birth rates were *significantly* higher for Māori (RR 1.15 95% CI 1.12–1.19) than for non-Māori non-Pacific babies (**Table 7**). Similar ethnic differences were seen during 1996–2010, with preterm birth rates in Māori babies increasing gradually during 2004–2010 (**Figure 2**).

Table 7. Preterm Birth Rates in Singleton Live Born Babies by Ethnicity, New Zealand 2006–2010

Ethnicity	Number: Total 2006−2010	Number: Annual Average	% of Live Births	Rate Ratio	95% CI
Preterm Birth					
Māori	6,007	1,201.4	6.58	1.15	1.12 – 1.19
non-Māori non-Pacific	10,475	2,095.0	5.70	1.00	

Source: Birth Registration Dataset

Figure 2. Preterm Birth Rates in Singleton Live Born Babies by Ethnicity, New Zealand 1996−2010



Source: Birth Registration Dataset

New Zealand Distribution and Trends

New Zealand Distribution by NZDep01 Index Decile, Maternal Age and Gender

In New Zealand during 2006–2010, preterm birth rates were *significantly* higher for males, babies born into more deprived (NZDep01 decile 6–10) areas, and babies born to younger (<25 years) or older (35+ years) mothers.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

INFANT MORTALITY AND SUDDEN UNEXPECTED DEATH IN INFANCY

Introduction

The following section uses information from the National Mortality Collection to review neonatal (first 28 days), post neonatal (29-364 days) and total infant (0–364 days) mortality in Māori babies, as well as Sudden Unexpected Death in Infancy (SUDI) since 1996.

Total Infant Mortality: In New Zealand, both neonatal and post neonatal mortality are higher for Māori than for European infants, with neonatal mortality during 2002–2006 being 1.22 (95% CI 1.06–1.42) times higher for Māori than for European infants, and post-neonatal mortality being 3.03 (95% CI 2.52–3.63) times higher. When broken down by cause, the greatest disparities are seen for SUDI, with rates for Māori babies being 5.74 (95% CI 4.32–7.63) times higher than for European babies during 2002–2006 [26].

Sudden Infant Death Syndrome (SIDS) and SUDI: SIDS is defined as "*the sudden unexpected death of an infant <1 year of age with onset of the fatal episode apparently occurring during sleep, that remains unexplained after a thorough investigation, including performance of a complete autopsy and review of the circumstances of death and the clinical history* [27]".

In New Zealand, SIDS has had a relatively high profile since the 1980s, when it became apparent that rates were high by international standards and that mortality was not falling, as it was in other developed countries [28]. A large case control study was commissioned which found that SIDS was associated with three risk factors: placing babies on their fronts to sleep, cigarette smoking and a lack of breastfeeding [29]. Later a fourth risk factor, bed sharing, was added [30]. As a result, a National SIDS Prevention Campaign was launched in 1991 and between 1988 and 1994 New Zealand saw a 70% decline in SIDS deaths amongst European/Other babies. For Māori babies, however, the decline was much less marked resulting in a progressive rise in ethnic differences in SIDS as the decade progressed [31].

While more recently SIDS has continued to decline, large ethnic differences remain with SIDS being 6 fold higher for Māori than for European infants [32]. In addition, new issues with the definition of SIDS have emerged, possibly as the result of pathologists and coroners becoming increasingly reluctant to label a death as SIDS in the context of equivocal death scene findings (e.g. infant co-sleeping with parental alcohol consumption [33]). This has resulted in a fall in the number of SIDS deaths, and a rise in the number of deaths attributed to "*suffocation/strangulation in bed*" or "*unspecified causes*". In turn, this has led to the adoption of the term *Sudden Unexpected Death in Infancy* (SUDI), to try to provide some consistency for measuring trends in the face of probable diagnostic transfer [33].

In attempting to understand the reasons why SUDI rates have remained higher for Māori babies, a study of SIDS-related knowledge and infant care practices was undertaken in South Auckland. This study found that knowledge about SIDS prevention was much lower amongst Māori than European mothers, with more Māori infants sleeping prone (face down) and having stopped breastfeeding earlier. Although co-sleeping rates were similar, bed sharing occurred in up to 65% for some part of the night, with more than half of Māori mothers smoking in pregnancy and 21% sharing a bed with their infant. Potentially unsafe soft objects (e.g. rolled blankets or pillows) were used by a third to help maintain sleep position. Tipene-Leach et al concluded that appropriate health promotion measures needed to be developed which were of relevance to Māori whānau [4].

Data Source and Methods

Definition

1. Total Infant Mortality: Death of a live born infant prior to 365 days of life

2. Neonatal Mortality: Death of a live born infant in the first 28 days of life

3. Post Neonatal Mortality: Death of a live born infant after 28 days but prior to 365 days of life

4. Sudden Unexpected Death in Infancy (SUDI): Death of a live born infant <365 days of life, where the cause of death is SIDS, Suffocation/Strangulation in Bed or Unspecified

Data Sources

Numerator: National Mortality Collection: All deaths in the first year of life, using the definitions for total infant, neonatal and post neonatal mortality outlined above. Cause of death is derived from the ICD-10-AM main underlying cause of death as follows: Extreme Prematurity (P07.2), Congenital Anomalies (Q00–Q99), Perinatal Conditions (P00–P96); SUDI (R95, R96, R98, R99, W75); SUDI: SIDS (R95); SUDI: Suffocation/Strangulation in Bed (W75); SUDI: Unspecified (R96, R98, R99).

Denominator: Birth Registration Dataset (Live Births Only)

Notes on Interpretation

Note 1: See **Appendix 4** for an overview of the National Mortality Collection

Total Infant, Neonatal and Post Neonatal Mortality

Distribution in Māori Babies

Distribution by Cause

In New Zealand during 2004–2008, extreme prematurity and congenital anomalies were the leading causes of neonatal mortality in Māori babies, although intrauterine/birth asphyxia and other perinatal conditions also made a significant contribution. In contrast, SUDI was the leading cause of post neonatal mortality, followed by congenital anomalies (**Table 8**).

Distribution by Ethnicity

In New Zealand during 2004–2008, neonatal (RR 1.22 95% CI 1.06–1.42) and post neonatal mortality (RR 2.85 95% CI 2.42–3.37) were both *significantly* higher for Māori than for non-Māori non-Pacific babies, with the largest ethnic differences being seen for post-neonatal mortality (**Table 9**). Similar ethnic differences were seen during 1996–2008 (**Figure 3**).

Distribution by Maternal Age

When broken down by maternal age, neonatal and post-neonatal mortality rates were both higher for teenage mothers, with rates decreasing as maternal age increased. While neonatal mortality rates were similar for Māori and non-Māori non-Pacific infants once they were broken down by maternal age, for post-neonatal mortality, rates were higher for Māori than for non-Māori non-Pacific infants in each maternal age category (**Figure 4**).

Table 8. Neonatal and Post Neonatal Mortality in Māori Infants by Main Underlying Cause of Death, New Zealand 2004−2008

Cause of Death	Number: Total 2004–2008	Number: Annual Average	Rate per 100,000 Live Births	Percent of Deaths (%)
Māori Infants				
Neonatal Mortality				
Extreme Prematurity	94	18.8	104.2	32.2
Congenital Anomalies: CVS	13	2.6	14.4	4.5
Congenital Anomalies: CNS	10	2.0	11.1	3.4
Congenital Anomalies: Other	38	7.6	42.1	13.0
Intrauterine/Birth Asphyxia	15	3.0	16.6	5.1
Other Perinatal Conditions	80	16.0	88.6	27.4
SUDI: Suffocation/Strangulation in Bed	16	3.2	17.7	5.5
SUDI: SIDS	13	2.6	14.4	4.5
SUDI: Unspecified	3	0.6	3.3	1.0
Injury/Poisoning	3	0.6	3.3	1.0
Other Causes	7	1.4	7.8	2.4
Total	292	58.4	323.6	100.0
Post Neonatal Mortality				
SUDI: SIDS	104	20.8	115.2	31.0
SUDI: Suffocation/Strangulation in Bed	59	11.8	65.4	17.6
SUDI: Unspecified	7	1.4	7.8	2.1
Congenital Anomalies: CVS	19	3.8	21.1	5.7
Congenital Anomalies: All Other	16	3.2	17.7	4.8
Injury/Poisoning	19	3.8	21.1	5.7
All Other Perinatal Conditions	26	5.2	28.8	7.7
Other Causes	86	17.2	95.3	25.6
Total	336	67.2	372.3	100.0

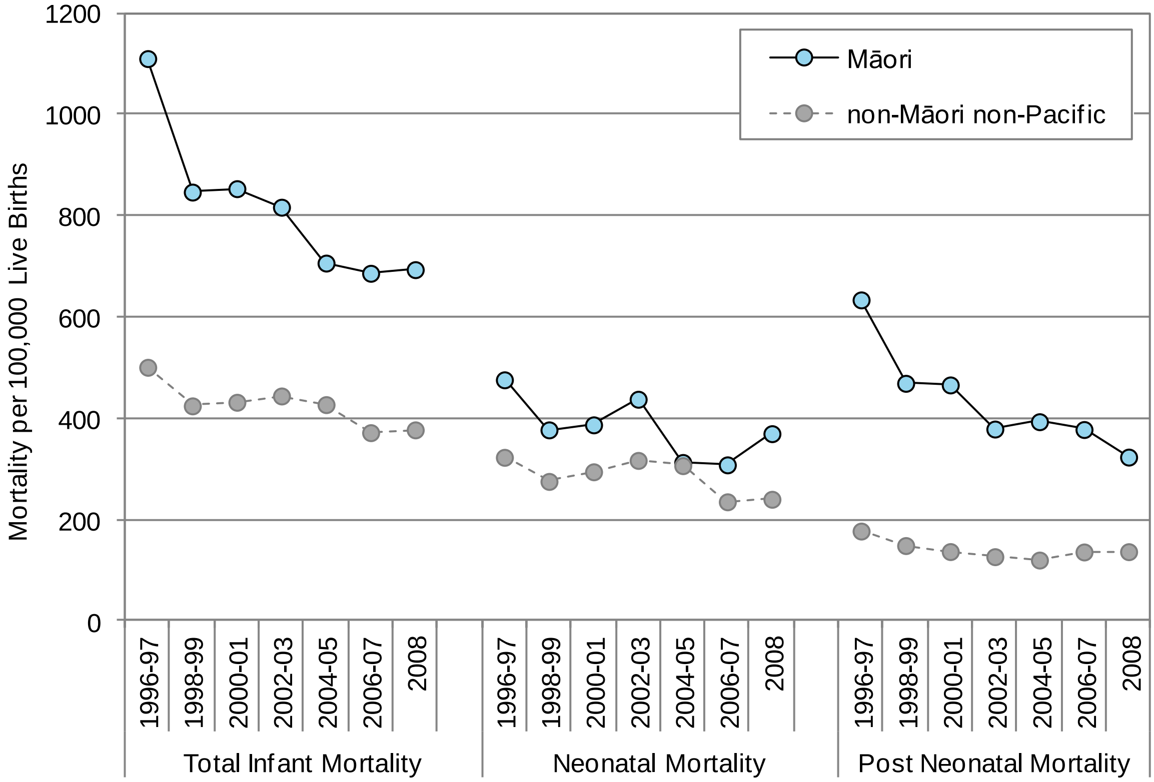
Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; Note: CVS = Cardiovascular System; CNS = Central Nervous System

Table 9. Neonatal and Post Neonatal Mortality by Ethnicity, New Zealand 2004−2008

Ethnicity	Number: Total 2004−2008	Number: Annual Average	Rate per 100,000 Live Births	Rate Ratio	95% CI
Neonatal Mortality					
Māori	292	58.4	323.55	1.22	1.06 – 1.42
non-Māori non-Pacific	488	97.6	264.20	1.00	
Post Neonatal Mortality					
Māori	336	67.2	372.30	2.85	2.42 – 3.37
non-Māori non-Pacific	241	48.2	130.47	1.00	

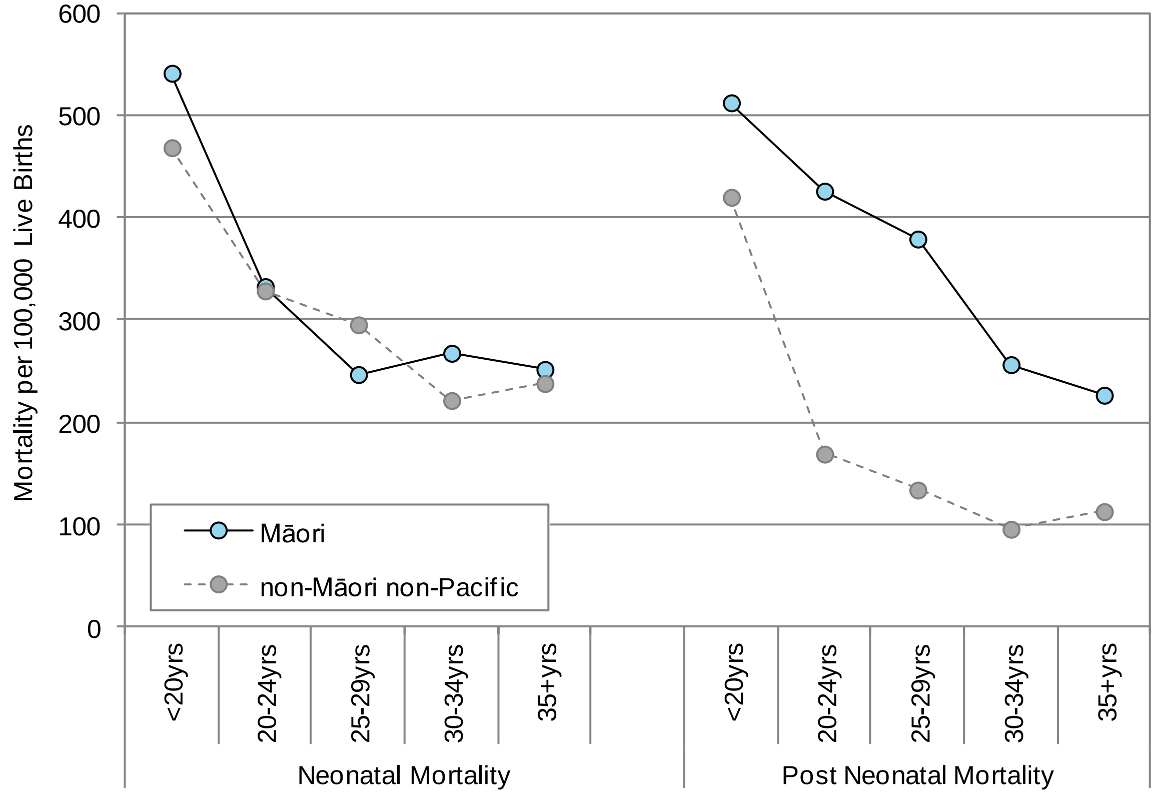
Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

Figure 3. Total Infant, Neonatal and Post Neonatal Mortality by Ethnicity, New Zealand 1996−2008



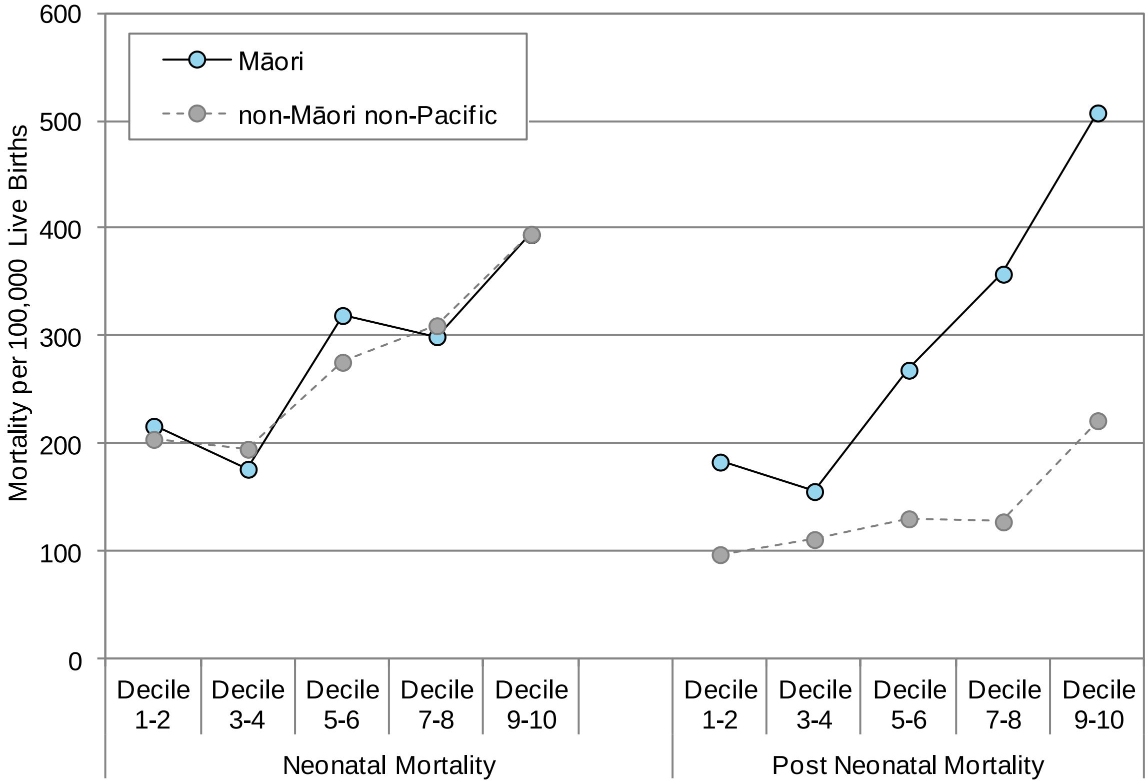
Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

Figure 4. Neonatal and Post Neonatal Mortality by Ethnicity and Maternal Age, New Zealand 2004−2008



Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

Figure 5. Neonatal and Post Neonatal Mortality by Ethnicity and NZ Deprivation Index Decile, New Zealand 2004−2008



Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; Decile is NZDep2001

Distribution by NZ Deprivation Index Decile

When broken down by NZ Deprivation Index decile, neonatal and post-neonatal mortality rates both exhibited a marked social gradient, with rates increasing with increasing NZDep01 deprivation. While neonatal mortality rates were similar for Māori and non-Māori non-Pacific infants once broken down by NZDep01 decile, for post-neonatal mortality, rates were higher for Māori than for non-Māori non-Pacific infants at each level of NZDep01 deprivation (**Figure 5**).

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand during 1990–2008, neonatal and post neonatal mortality both declined, with neonatal mortality exceeding post neonatal mortality from 1996 onwards.

Distribution by Cause

In New Zealand during 2004–2008, extreme prematurity and congenital anomalies were the leading causes of neonatal mortality, although intrauterine/birth asphyxia and other perinatal conditions also made a significant contribution. In contrast, SUDI was the leading cause of post neonatal mortality, followed by congenital anomalies.

Distribution by NZDep01 Index Decile, Maternal Age, Gender and Gestation

In New Zealand during 2004–2008, neonatal mortality was *significantly* higher for males, for babies from average-to-more deprived (NZDep01 decile 5–10) areas, for preterm babies, and those whose mothers were <25 years of age. During the same period, post neonatal mortality was also *significantly* higher for males, for babies from average-to-more deprived (NZDep01 decile 5–10) areas, preterm babies, and those whose mothers were <30 years of age.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

Sudden Unexpected Death in Infancy (SUDI)

Distribution in Māori Babies

Distribution by Ethnicity

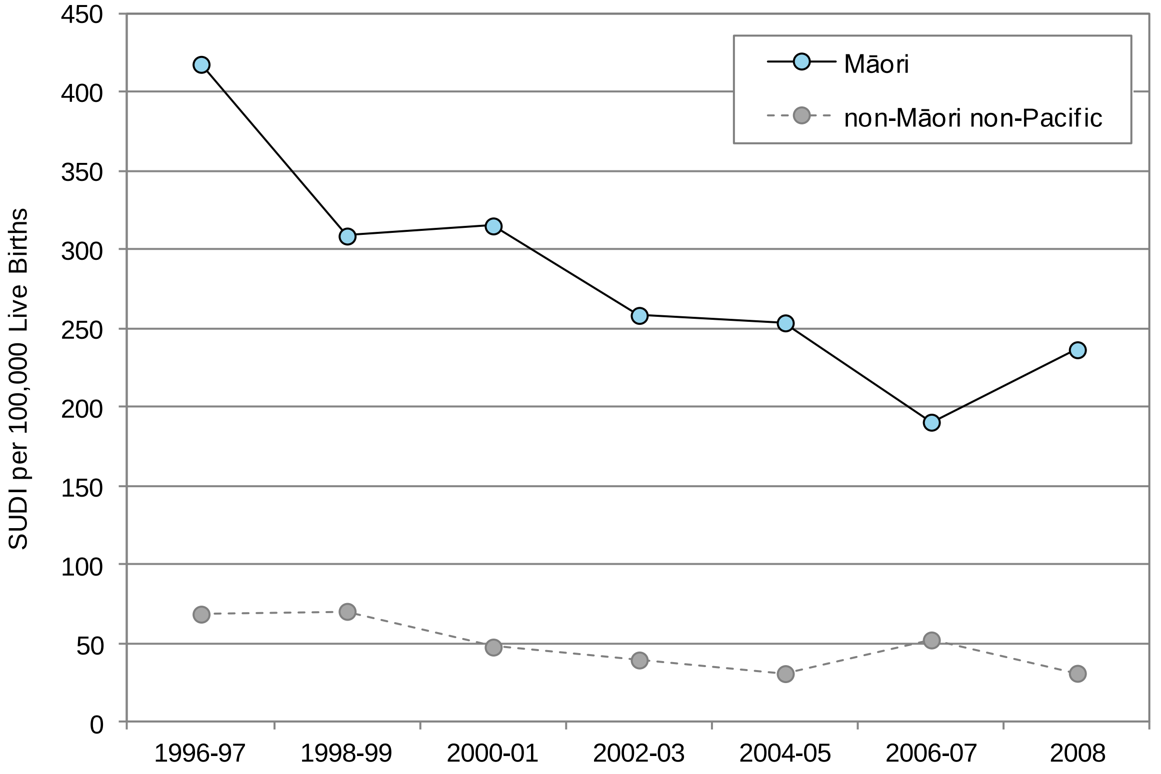
In New Zealand during 2004–2008, SUDI rates were *significantly* higher for Māori (RR 5.66 95% CI 4.33–7.40) than for non-Māori non-Pacific babies (**Table 10**). Similar ethnic differences were seen during 1996–2008, although SUDI rates in both ethnic groups declined during this period (**Figure 6**).

Table 10. Sudden Unexpected Death in Infancy by Ethnicity, New Zealand 2004−2008

Ethnicity	Number: Total 2004−2008	Number: Annual Average	Rate per 100,000 Live Births	Rate Ratio	95% CI
SUDI					
Māori	202	40.4	223.83	5.66	4.33 – 7.40
non-Māori non-Pacific	73	14.6	39.52	1.00	

Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

Figure 6. Sudden Unexpected Death in Infancy by Ethnicity, New Zealand 1996−2008

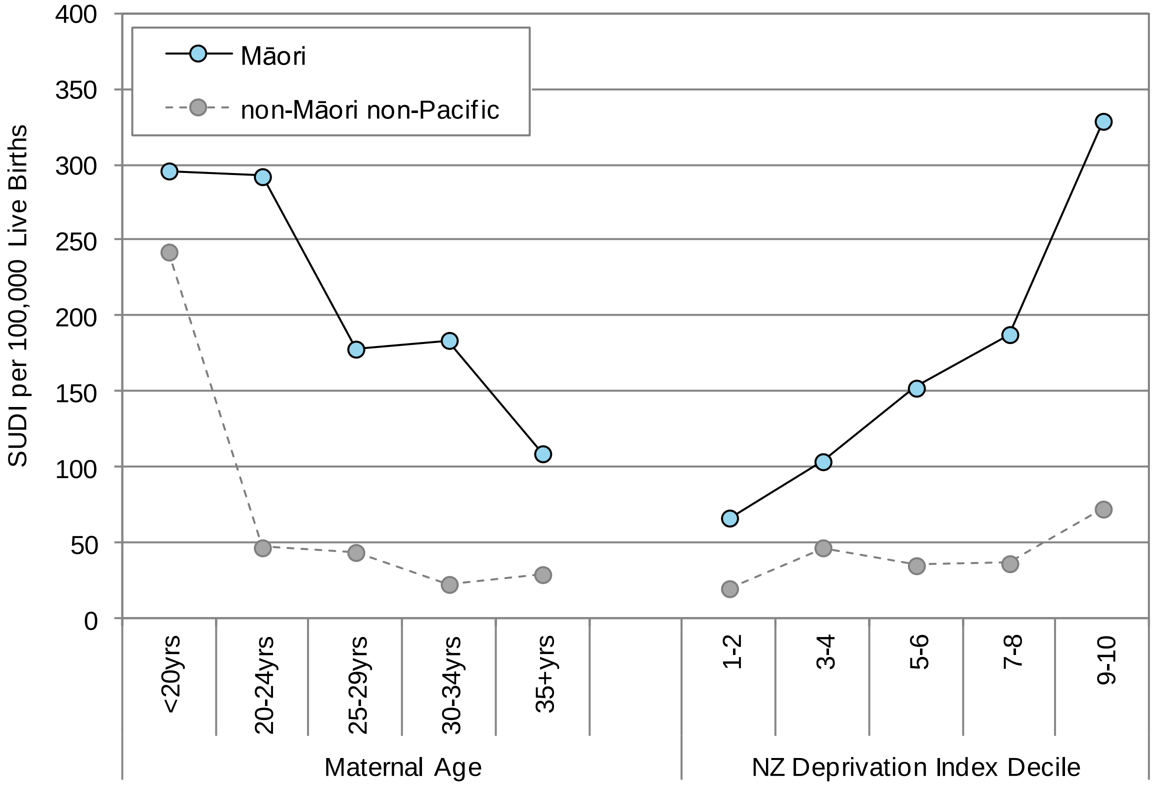


Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

Distribution by Maternal Age and NZ Deprivation Index Decile

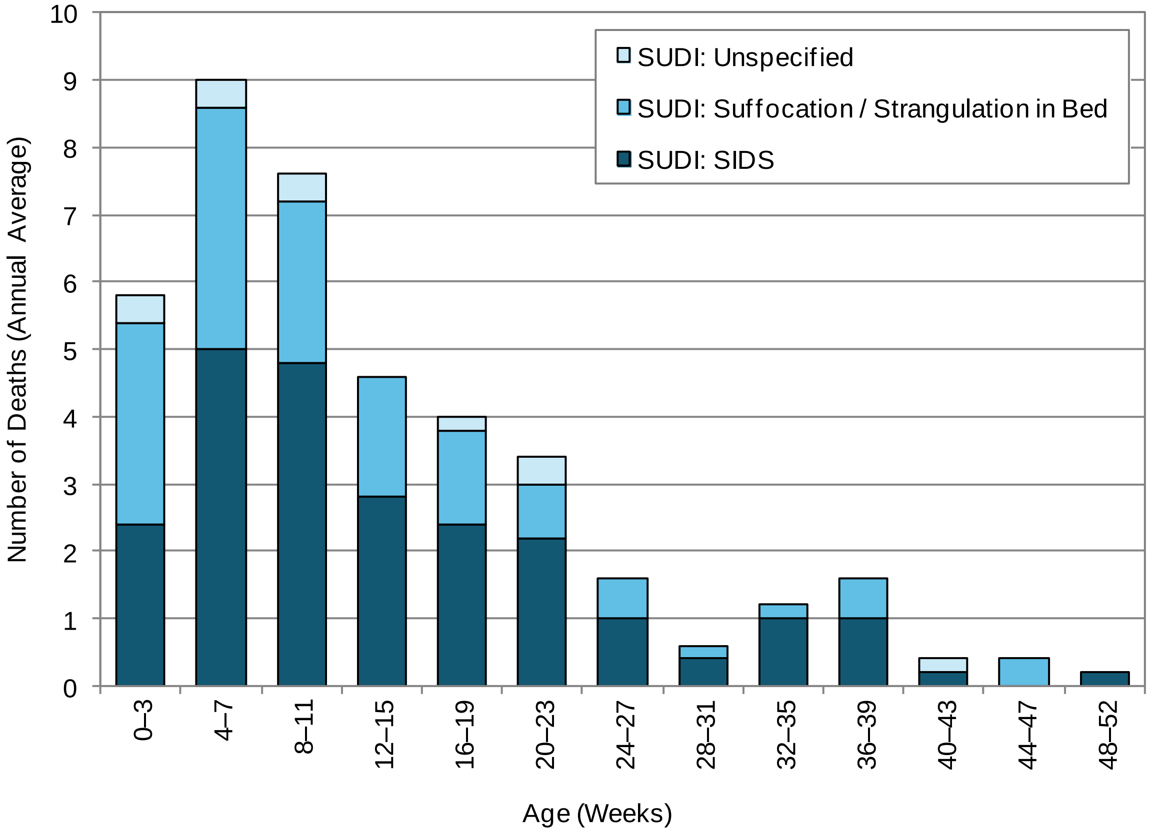
When broken down by maternal age, SUDI rates were highest for teenage mothers, with rates decreasing with increasing maternal age. In each maternal age category however, SUDI rates were higher for Māori than for non-Māori non-Pacific babies. Similarly, when broken down by NZ Deprivation Index decile, SUDI rates exhibited a marked social gradient, with rates increasing with increasing NZDep01 deprivation. At each level of NZDep01 deprivation however, SUDI rates were higher for Māori than for non-Māori non-Pacific babies (**Figure 7**).

Figure 7. Sudden Unexpected Death in Infancy by Ethnicity, Maternal Age and NZ Deprivation Index Decile, New Zealand 2004−2008



Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset. Decile is NZDep2001

Figure 8. Sudden Unexpected Death in Infancy in Māori Infants by Type and Age in Weeks, New Zealand 2004−2008



Source: National Mortality Collection; See Methods for classifications used

Distribution by Age and SUDI Type

In New Zealand during 2004–2008, 51.7% of SUDI deaths in Māori babies aged 0–3 weeks were attributed to suffocation/strangulation in bed, as compared to 40.0% in babies aged 4–7 weeks and 31.6% in babies 8–11 weeks. The largest absolute number of SUDI deaths occurred in Māori infants 4–7 weeks of age, followed by those aged 8–11 weeks (**Figure 8**).

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand, SUDI rates declined during the late 1990s and early 2000s, but became more static after 2002–03. When broken down by SUDI sub-type, deaths attributed to SIDS continued to decline throughout 1996–2008, while deaths due to suffocation or strangulation in bed became more prominent as the period progressed. It is unclear, however, whether this represented a diagnostic shift in the coding of SUDI, or whether the sleeping environment made an increasingly greater contribution to SUDI as the period progressed. During 2004–2008, SUDI rates in New Zealand were 100.9 per 100,000 live births.

Distribution by Age

In New Zealand during 2004–2008, SUDI mortality was highest in infants 4–7 weeks of age, followed by those aged 8–11 weeks and those 0–3 weeks. Of note, SUDI: Suffocation/Strangulation in Bed accounted for 57.1% of all SUDI deaths in those aged 0–3 weeks and 36.8% of SUDI deaths in those aged 4–7 weeks.

Distribution by NZDep01 Index Decile, Maternal Age, Gender, and Gestation

In New Zealand during 2004–2008, mortality from SUDI was *significantly* higher for babies from average-to-more deprived (NZDep01 decile 3–10) areas, preterm babies, and those whose mothers were <30 years of age.

Distribution by Season

In New Zealand during 2004–2008, while small numbers make precise interpretation difficult, SUDI: SIDS was generally more common in the cooler months while SUDI: Suffocation/Strangulation in Bed was more evenly distributed through the year.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

BREASTFEEDING

Introduction

The following section reviews breastfeeding rates for Māori babies at <6 weeks, 3 months and 6 months using data from the Plunket Client Information System.

Background

The World Health Organisation recommends that infants be exclusively breastfed for the first six months of life and that breastfeeding, together with the provision of nutritionally adequate and safe complementary foods, should continue until a child reaches two years of age or beyond [34]. Breastfeeding has considerable health benefits for both the baby and the mother. Breastfed babies have lower rates of common childhood infections such as diarrhoea, respiratory infections and otitis media and lower rates of SIDS [35]. Mothers who breastfeed have lower rates of post-partum haemorrhage, lose their extra pregnancy weight faster, are less likely to become pregnant again soon after their baby's birth and have lower rates of breast cancer and ovarian cancer [35,36,37].

In New Zealand, research suggests that most Māori women are aware of the benefits of breastfeeding and wish to breastfeed. However a number of barriers may exist including difficulty establishing breastfeeding, lack of professional support, perceptions of inadequate milk supply, the need to return to work, and whānau members who have either not breastfed, or who have had trouble breastfeeding. Other barriers include not attending antenatal classes, the false belief that you shouldn't breastfeed if you smoke and the knowledge that bed-sharing is frowned upon (although it makes breastfeeding at night easier) [38]. Glover et al [38] note that such research suggests that "*there are opportunities for maternity services to improve, monitor and maintain the effectiveness and delivery of antenatal education, breastfeeding resources and postnatal care to Māori. There is also a need for recognition and valuing of Māori infant care practices and health beliefs and adaptations to increase partner involvement and other whānau support*".

Distribution in Māori Babies

Distribution by Ethnicity

In New Zealand during the years ending June 2004–2011, the proportion of Māori Plunket babies who were exclusively/fully breastfed was lower than for European/Other babies at <6 weeks, 3 months and 6 months. Breastfeeding rates for Māori babies remained relatively static during this period (**Figure 9**).

Distribution by Ethnicity and District Health Board

In New Zealand during the year ending June 2011, the proportion of Māori Plunket babies who were exclusively/fully breastfed varied considerably by DHB, although care should be taken when interpreting these differences, as it remains unclear the extent to which they reflect real differences in breastfeeding rates, regional differences in the availability of different Well Child/Tamariki Ora Providers, or regional variations in the recording of breastfeeding information. Overall, 60.8% of Māori Plunket babies were exclusively/fully breastfed at <6 weeks, 44.6% at 3 months and 16.7% at 6 months (**Table 11**-**Table 13**).

Data Sources and Methods

Indicator

1. Exclusive/Full Breastfeeding Rates in Plunket Babies at <6 Weeks, 3 Months and 6 Months of Age

Numerator: Plunket Client Information System: The number of Plunket babies exclusively/fully breastfed at <6 weeks (2 weeks to 5 weeks, 6 days), 3 months (10 weeks to 15 weeks, 6 days) and 6 months (16 weeks to 7 months, 4 weeks).

Denominator: Plunket Client Information System: The number of babies in contact with Plunket at these ages

Notes on Interpretation

Note 1: Plunket currently enrol more than 88% of the new baby population, although Māori and Pacific mothers may be under-reported in these samples. Plunket have breastfeeding data dating back to 1922, with more detailed information being available in recent years.

Note 2: Plunket's breastfeeding definitions, which are similar to those of the World Health Organisation (WHO) are as follows [39]:

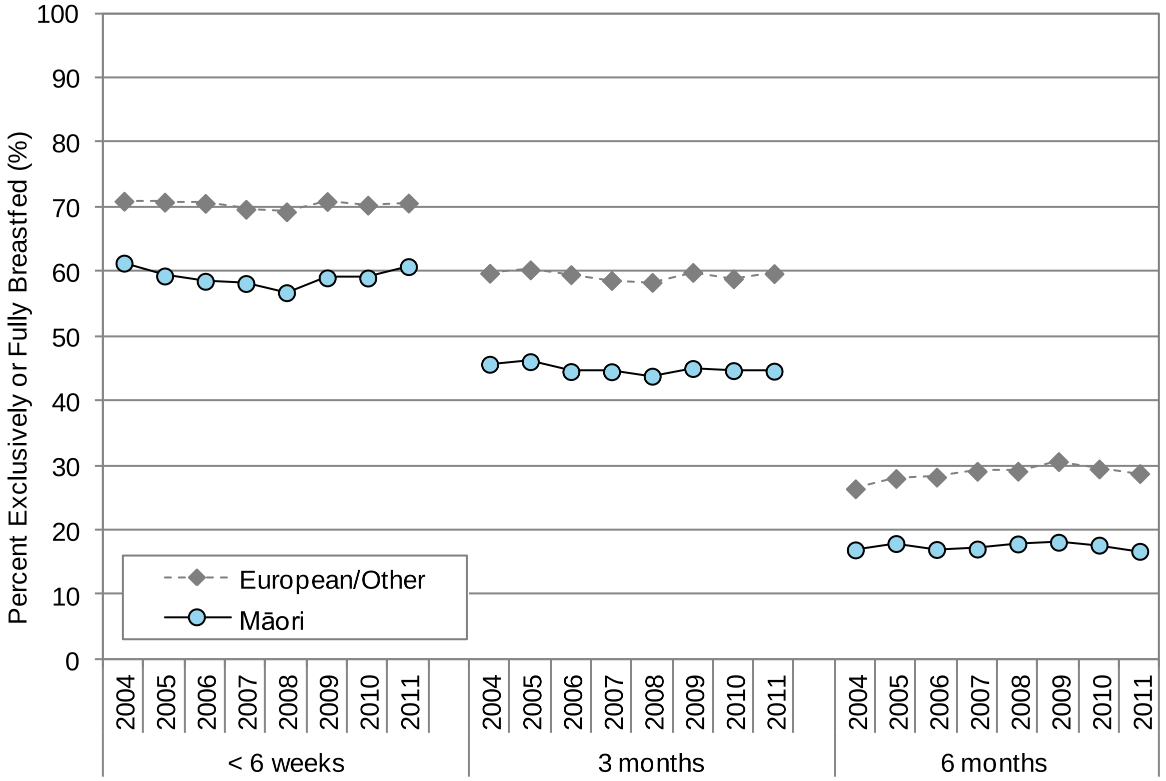
**Exclusive Breastfeeding*: The infant has never, to the mother's knowledge, had any water, formula or other liquid or solid food. Only breast milk, from the breast or expressed, and prescribed medicines have been given from birth.

**Fully Breastfed*: The infant has taken breast milk only and no other liquids or solids except a minimal amount of water or prescribed medicines, in the past 48 hours.

**Partially Breastfed*: The infant has had some breast milk and some infant formula or other solid food in the past 48 hours.

**Artificially Fed*: The infant has had no breast milk, but has had an alternative liquid such as infant formula, with or without solid food in the past 48 hours.

Figure 9. Proportion of Plunket Babies who were Exclusively or Fully Breastfed by Age and Ethnicity, New Zealand, Years Ending June 2004−2011



Source: Plunket Client Information System

Table 11. Breastfeeding Rates for Māori Plunket Babies at <6 Weeks by DHB, Year Ending June 2011

District Health Board	Māori Babies (Number)					Exclusive/Full (%)	
	Exclusive	Full	Partial	Artificial	Total	Māori	European/ Other
<6 Weeks							
Northland	281	35	85	68	469	67.4	76.6
Waitemata	387	57	131	136	711	62.4	74.0
Auckland	245	48	87	92	472	62.1	76.3
Counties Manukau	560	135	271	353	1,319	52.7	60.5
Waikato	554	99	163	228	1,044	62.5	73.2
Bay of Plenty	344	42	84	100	570	67.7	73.8
Lakes	153	24	70	73	320	55.3	74.2
Tairawhiti	101	34	25	30	190	71.1	85.5
Taranaki	87	19	31	41	178	59.6	72.3
Hawke's Bay	231	23	66	120	440	57.7	72.3
MidCentral	174	40	68	104	386	55.4	63.7
Whanganui	94	12	24	41	171	62.0	65.7
Wairarapa	31	18	8	7	64	76.6	73.3
Hutt Valley	128	29	46	77	280	56.1	62.3
Capital and Coast	126	35	45	45	251	64.1	72.9
Nelson Marlborough	52	13	18	14	97	67.0	72.9
Canterbury	202	40	55	107	404	59.9	67.7
South Canterbury	37	0	5	8	50	74.0	62.8
West Coast	27	8	3	7	45	77.8	73.2
Otago	117	5	18	34	174	70.1	74.8
Southland	118	21	38	60	237	58.6	64.4
New Zealand	4,049	737	1,341	1,745	7,872	60.8	70.6

Source: Plunket Client Information System

Table 12. Breastfeeding Rates for Māori Plunket Babies at 3 Months by DHB, Year Ending June 2011

District Health Board	Māori Babies (Number)					Exclusive/Full (%)	
	Exclusive	Full	Partial	Artificial	Total	Māori	European/ Other
3 Months							
Northland	269	72	152	218	711	48.0	64.9
Waitemata	308	91	178	239	816	48.9	63.1
Auckland	206	70	115	162	553	49.9	66.5
Counties Manukau	385	170	368	691	1,614	34.4	49.1
Waikato	466	143	246	506	1,361	44.7	60.5
Bay of Plenty	284	79	122	205	690	52.6	62.0
Lakes	131	37	96	148	412	40.8	60.9
Tairawhiti	82	42	40	70	234	53.0	69.6
Taranaki	79	47	43	113	282	44.7	57.6
Hawke's Bay	192	43	83	213	531	44.3	58.1
MidCentral	142	58	100	187	487	41.1	52.6
Whanganui	66	19	41	94	220	38.6	51.9
Wairarapa	23	20	12	20	75	57.3	61.3
Hutt Valley	108	32	69	145	354	39.5	52.8
Capital and Coast	127	49	66	106	348	50.6	67.8
Nelson Marlborough	50	11	23	38	122	50.0	61.4
Canterbury	167	54	81	173	475	46.5	57.8
South Canterbury	30	1	4	27	62	50.0	50.1
West Coast	17	13	6	16	52	57.7	65.2
Otago	119	16	39	72	246	54.9	62.6
Southland	80	17	44	111	252	38.5	54.5
New Zealand	3,331	1,084	1,928	3,554	9,897	44.6	59.7

Source: Plunket Client Information System

Table 13. Breastfeeding Rates for Māori Plunket Babies at 6 Months by DHB, Year Ending June 2011

District Health Board	Māori Babies (Number)					Exclusive/Full (%)	
	Exclusive	Full	Partial	Artificial	Total	Māori	European/ Other
6 Months							
Northland	95	38	310	330	773	17.2	27.7
Waitemata	77	47	370	380	874	14.2	28.0
Auckland	66	58	225	224	573	21.6	32.8
Counties Manukau	102	96	535	917	1,650	12.0	21.2
Waikato	150	122	463	767	1,502	18.1	30.7
Bay of Plenty	78	84	232	312	706	22.9	32.4
Lakes	25	29	178	216	448	12.1	20.7
Tairawhiti	18	40	78	98	234	24.8	38.0
Taranaki	24	19	106	137	286	15.0	23.3
Hawke's Bay	53	40	153	265	511	18.2	33.0
MidCentral	37	21	179	250	487	11.9	18.8
Whanganui	16	16	81	138	251	12.7	17.9
Wairarapa	4	14	23	29	70	25.7	27.1
Hutt Valley	26	14	130	204	374	10.7	23.2
Capital and Coast	42	44	111	173	370	23.2	38.5
Nelson Marlborough	13	5	63	64	145	12.4	23.7
Canterbury	52	28	182	246	508	15.7	27.5
South Canterbury	6	7	22	35	70	18.6	24.0
West Coast	5	9	10	29	53	26.4	36.6
Otago	54	14	63	108	239	28.5	41.7
Southland	28	21	66	152	267	18.4	25.5
New Zealand	971	766	3,580	5,074	10,391	16.7	28.8

Source: Plunket Client Information System

New Zealand Distribution and Trends

Trends by Age

In New Zealand during the years ending June 2004–2011, the proportion of babies who were exclusively or fully breastfed remained fairly static, with exclusive/full breastfeeding rates in the year ending June 2011 being 66.3% at <6 weeks, 54.9% at 3 months and 25.2% at 6 months of age.

Distribution by NZDep01 Decile

In New Zealand during the year ending June 2011, exclusive/full breastfeeding rates at <6 weeks, 3 months and 6 months were generally lower for babies from the most deprived (NZDep01 decile 10) areas, than for babies from average or less deprived areas.

For further detail see *The Health Status of Children and Young People in New Zealand* [1]

ISSUES MORE COMMON IN CHILDREN, OR CHILDREN AND YOUNG PEOPLE

TOTAL AVOIDABLE MORBIDITY AND MORTALITY

MOST FREQUENT CAUSES OF HOSPITAL ADMISSION AND MORTALITY IN CHILDREN

Introduction

Before considering the more detailed analyses in the sections which follow, it is worthwhile briefly reviewing the most frequent causes of hospital admission and mortality in Māori children during the past five years, with a view to gaining an overall context within which to consider the relative importance of the various health issues experienced by Māori children in recent years.

Data Sources and Methods

Indicator

1. *Most Frequent Reasons for Hospital Admission in Children Aged 0–14 Years (excluding neonates)*

Numerator: National Minimum Dataset: Hospital admissions for children aged 0–14 years (excluding neonates) by primary diagnosis (acute and arranged admissions) or primary procedure (waiting list admissions).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

2. *Most Frequent Causes of Mortality in Children Aged 1–14 Years*

Numerator: National Mortality Collection: Mortality for children aged 1–14 years by main underlying cause of death (**Appendix 4**).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Primary Diagnoses/ Cause of Death: Acute URTI (J00–J04, J05.0, J05.1, J06); Bronchiolitis (J21); Asthma (J45, J46); Bacterial/Viral/Other Pneumonia (J12–J18, J10.0, J11.0); Gastroenteritis (A00–A09, R11, K52.9); Skin Infections (L00–L04, L05.0, L08, H00.0, H01.0, J34.0, L98.0); Meningococcal Disease (A39); Bacterial Meningitis (G00–G01); Dental Conditions (K00–K08); Neoplasm/Chemotherapy/Radiotherapy (C00–D48, Z51.0, Z51.1); Mental Health (F00–F99); Abdominal/Pelvic Pain (R10); Viral Infection NOS (B34.9); Renal Failure (N17–N19); Immune Disorders (D80–D89); Metabolic Disorders (E70–E89); Haemolytic Anaemias (D55–D59); Fever of Unknown Origin (R50.8, R50.9); Removal of Internal Fixateur (Z47.0); Dialysis (Z49); Appendicitis (K35–K37); Injury/Poisoning (S00–T79 Excluding ED Cases); Urinary Tract Infection (N10, N11, N12, N30.0, N30.1, N30.2, N30.3, N30.8, N30.9, N39.0); Constipation (K59.0).

Injuries (Mortality): Pedestrian (V01–V09), Cyclist (V10–V19), Motorbike (V20–29), Vehicle Occupant (V40–79), Other Land Transport (V30–39, V80–89); Other Transport (V90–V99); Falls (W00–W19), Mechanical Forces: Inanimate (W20–W49), Mechanical Forces: Animate (W50–64), Drowning/Submersion (W65–74), Accidental Threat to Breathing (W75–W84), Electricity/Fire/Burns (W85–X19), Accidental Poisoning (X40–X49), Intentional Self-Harm (X60–84), Assault (X85–Y09), Undetermined Intent (Y10–Y34).

Procedures (Procedure or Block Code): Grommets (4163200, 4163201); Tonsillectomy +/− Adenoidectomy (4178900, 4178901); Adenoidectomy without Tonsillectomy (4180100); Procedures on Extraocular Muscles (block 215–220); Myringoplasty (block 313); Procedures on Nose (block 370–381); Dental Procedures (block 450–490); Inguinal Hernia Repair (block 990); Gastrointestinal Procedures (block 850–1011); Haemodialysis (block 1059); Orchidopexy (block 1186); Circumcision (3065300); Hypospadias Repair (block 1198); Procedures on the Cervix (block 1274–1278); Musculoskeletal Procedures (block 1360–1579); Procedures on Skin/Subcutaneous Tissue (block 1600–1660); Magnetic Resonance Imaging (MRI)(block 2015);

Notes on Interpretation

Note 1: Because hospital admissions during the neonatal period are likely to be heavily influenced by perinatal factors and/or result from preterm infants transitioning through different levels of neonatal care (e.g. from neonatal intensive care, to Level 1–3 special care baby units), neonatal admissions have been excluded from this analysis. Similarly, infant mortality is also likely to be heavily influenced by perinatal factors, and thus this section is restricted to an analysis of mortality in children aged 1–14 years (see the Infant Mortality section for a review of the most frequent causes of mortality in those aged <1year).

Note 2: In order to maintain consistency with the injury section, all injury admissions with an Emergency Medicine Specialty Code (M05–M08) on discharge have been excluded (see **Appendix 2** for rationale).

Note 3: An acute admission is an unplanned admission occurring on the day of presentation, while a semi-acute admission (referred to in the NMDS as an arranged admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary. A waiting list admission is a planned admission, with an admission date 7+ days after the date the decision was made that the admission was necessary.

Distribution in Māori Children

Hospital Admissions in Māori Children

In New Zealand during 2006–2010, injury/poisoning, bronchiolitis and asthma were the most frequent reasons for an acute hospital admission in Māori children aged 0–14 years. Neoplasms/chemotherapy/radiotherapy, dental conditions and injury/poisoning were the most frequent reasons for arranged admissions, while dental procedures and grommets were the most frequent reasons for a waiting list admission (**Table 14**).

Mortality in Māori Children

In New Zealand during 2004–2008, vehicle occupant transport injuries were the most frequent cause of mortality in Māori children aged 1–14 years, followed by congenital anomalies and neoplasms (**Table 15**).

Table 14. Most Frequent Reasons for Hospital Admission in Māori Children Aged 0−14 Years (Neonates Excluded) by Admission Type, New Zealand 2006−2010

Primary Diagnosis/Procedure	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Percent (%)
Māori Children 0–14 Years				
Acute Admissions by Primary Diagnosis				
Injury/Poisoning	14,231	2,846.2	13.24	15.08
Bronchiolitis	11,760	2,352.0	10.94	12.46
Asthma	8,512	1,702.4	7.92	9.02
Acute URTI	6,630	1,326.0	6.17	7.03
Skin Infections	5,648	1,129.6	5.25	5.99
Gastroenteritis	5,508	1,101.6	5.12	5.84
Bacterial/Viral/Other Pneumonia	4,985	997.0	4.64	5.28
Viral Infection NOS	4,112	822.4	3.83	4.36
Abdominal/Pelvic Pain	1,544	308.8	1.44	1.64
Urinary Tract Infection	1,422	284.4	1.32	1.51
Appendicitis	973	194.6	0.91	1.03
Fever of Unknown Origin	869	173.8	0.81	0.92
Constipation	660	132.0	0.61	0.70
Other Diagnoses	27,500	5,500.0	25.58	29.15
Total Acute Admissions	94,354	18,870.8	87.77	100.00
Arranged Admissions by Primary Diagnosis				
Neoplasm/Chemotherapy/Radiotherapy	2,543	508.6	2.37	16.97
Dental Conditions	1,236	247.2	1.15	8.25
Injury/Poisoning	1,119	223.8	1.04	7.47
Dialysis	579	115.8	0.54	3.86
Other Diagnoses	9,510	1,902.0	8.85	63.46
Total Arranged Admissions	14,987	2,997.4	13.94	100.00
Waiting List Admissions by Primary Procedure				
Dental Procedures	9,067	1,813.4	8.43	26.39
Grommets	7,412	1,482.4	6.90	21.57
Musculoskeletal Procedures	2,745	549.0	2.55	7.99
Tonsillectomy +/− Adenoidectomy	2,422	484.4	2.25	7.05
No Procedure Listed	1,892	378.4	1.76	5.51
Inguinal Hernia Repair	965	193.0	0.90	2.81
Gastrointestinal Procedures	946	189.2	0.88	2.75
Procedures on Skin/Subcutaneous Tissue	840	168.0	0.78	2.44
Myringoplasty	703	140.6	0.65	2.05
Adenoidectomy without Tonsillectomy	560	112.0	0.52	1.63
Orchidopexy	526	105.2	0.49	1.53
Procedures on Extraocular Muscles	325	65.0	0.30	0.95
Other Procedures	5,959	1,191.8	5.54	17.34
Total Waiting List Admissions	34,362	6,872.4	31.97	100.00
Total Admissions	143,703	28,740.6	133.68	100.00

Source: Numerator: National Minimum Dataset (Neonates excluded); Denominator: Statistics NZ Estimated Resident Population. Note: Injury admissions with an emergency department code on discharge excluded.

Table 15. Most Frequent Causes of Mortality in Māori Children Aged 1−14 Years by Main Underlying Cause of Death, New Zealand 2004−2008

Cause of Death	Number: Total 2004−2008	Number: Annual Average	Rate per 100,000	Percent (%)
Māori Children 1–14 Years				
Transport: Vehicle Occupant	39	7.8	3.95	13.64
Congenital Anomalies	30	6.0	3.04	10.49
Neoplasms	30	6.0	3.04	10.49
Transport: Pedestrian	25	5.0	2.53	8.74
Drowning/Submersion	17	3.4	1.72	5.94
Assault	13	2.6	1.32	4.55
Intentional Self-Harm	12	2.4	1.22	4.20
Transport: All Other Causes	8	1.6	0.81	2.80
Electricity/Fire/Burns	7	1.4	0.71	2.45
Epilepsy/Status Epilepticus	7	1.4	0.71	2.45
SUDI	6	1.2	0.61	2.10
Falls	5	1.0	0.51	1.75
Mechanical Forces: Inanimate	5	1.0	0.51	1.75
Meningococcal Disease	5	1.0	0.51	1.75
Undetermined Intent	5	1.0	0.51	1.75
Transport: Cyclist	4	0.8	0.41	1.40
Accidental Poisoning	4	0.8	0.41	1.40
Asthma	4	0.8	0.41	1.40
Bacterial/Non-Viral Pneumonia	3	0.6	0.30	1.05
Other Causes	57	11.4	5.78	19.93
Total	286	57.2	29.00	100.00

Source: Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

New Zealand Distribution

New Zealand Hospital Admissions

In New Zealand during 2006–2010, injury/poisoning, gastroenteritis and bronchiolitis were the most frequent reasons for an acute hospital admission in children aged 0–14 years. Neoplasms/chemotherapy/radiotherapy, injury/poisoning and dental conditions were the most frequent reasons for arranged admissions, while dental procedures, grommets and tonsillectomy +/− adenoidectomy were the most frequent reasons for a waiting list admission.

New Zealand Mortality

In New Zealand during 2004–2008, neoplasms were the most frequent cause of mortality in children aged 1–14 years, followed by congenital anomalies and vehicle occupant transport injuries.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

AMBULATORY SENSITIVE HOSPITALISATIONS

Introduction

The following sections review ambulatory sensitive hospitalisations (ASH) in Māori children aged 0−4 years using information from the National Minimum Dataset.

Background

Ambulatory sensitive hospitalisations are often used as a measure for assessing the performance of primary health care [40]. In 2007 the Ministry of Health identified reducing ASH in children aged 0−4 years as a priority [41]. The measure is not used to assess failure in individual cases however, but to identify conditions where a specific intervention could reduce groups of admissions [42]. Common conditions implicated in ASH among New Zealand children aged 0−4 years are gastroenteritis, respiratory infections, dental conditions and asthma [40]. Commonalities in these conditions are the abrupt nature of their onset and/or their infectious origin. The primary health care response to these conditions often needs to be swift, if it is to prevent the need for admission to hospital. Acute conditions, therefore, place specific demands on primary health services which are different to the demands of the predominantly chronic conditions that constitute ASH among older people [43].

In New Zealand, ASH rates are higher for Māori than for European children [40]. It is thus concerning that the 2006/2007 New Zealand Health Survey found that, after adjusting for age, Māori children were significantly more likely than non-Māori children to have experienced unmet need for GP services six or more times in the previous 12 months (Māori 5.2%, 95% CI 1.7–11.9 vs. non-Māori 0.4%, 95% CI 0.0–2.0). For both Māori and non-Māori, the top three reasons given by parents for not being able to get their child seen by a GP when they wanted to were that they *'couldn't get an appointment at a suitable time'*, that it '*it costs too much'* and that '*it was after hours'*. Almost 10% of Māori parents reported lack of transport as a reason for their child being unable to see a GP when they needed to. The survey also found that Māori were more likely than non-Māori not to have been charged for their child's last visit, suggesting that access to primary health care is not solely an issue of cost and that further work is needed to improve access to primary health care for Māori children [44].

Data Sources and Methods

Indicator

1. Ambulatory *Sensitive Hospitalisations (ASH) in Children Aged 0–4 Years*

Numerator: National Minimum Dataset: Acute and semi-acute hospital admissions for ambulatory sensitive conditions in children aged 0–4 years. Includes admissions with an ICD-10-AM primary diagnosis of Asthma (J45–46), Bronchiectasis (J47), Skin Infections (H00.0, H01.0, J34.0, L01–L04, L08, L98.0), Constipation (K59.0), Dental Caries/Other Dental Conditions (K02, K04, K05), Dermatitis and Eczema (L20–30), Gastroenteritis (A02–A09, R11, K52.9), Gastro-Oesophageal Reflux (K21), Nutritional Deficiency (D50–D53, E40–E46, E50–E56, E58–E61, E63–E64), Bacterial/Non-Viral Pneumonia (J13–J16, J18), Rheumatic Fever/Heart Disease (I00–I09), Otitis Media (H65–H67), Acute Upper Respiratory Tract Infections (excluding croup) (J00–J03, J06), Vaccine Preventable Diseases: Neonatal/Other Tetanus, Congenital Rubella; ≥6 months: Pertussis, Diphtheria, Hepatitis B; ≥16 months: Measles, Mumps, Rubella (A35, A36, A37, A80, B16, B18.0, B18.1 A33, A34, P35.0, B05, B06, B26, M01.4); over 4 years: Urinary Tract Infections (N10, N12, N30.0, N39.0, N30.9, N13.6).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: *Age Filters*: The 0–4 year age group has been selected for this analysis as it aligns with the Ministry of Health's previous paediatric ASH Target (0–4 years). Neonatal admissions (0–28 days) have been excluded on the basis that issues arising in the neonatal period are likely to be heavily influenced by antenatal/perinatal factors, and as a consequence are likely to require different care pathways from conditions arising in the community (e.g. pneumonia in a very preterm infant). The only exceptions are neonatal tetanus and congenital rubella, which are potentially preventable by timely (maternal) access to immunisation. Further, age filters have also been applied to some vaccine preventable diseases (e.g. measles ≥16 months) on the basis that these conditions may not be (primary care) preventable, prior to the age at which immunisation for the relevant condition is due. Similarly, an over 4 year age criteria has been applied to urinary tract infections, on the basis that younger children may require hospitalisation for further investigation.

Note 2: *Admission Type Filters*: An acute admission is an unplanned admission occurring on the day of presentation, while an arranged admission is a non-acute admission with an admission date <7 days after the decision was made that the admission was required. A waiting list admission is a planned admission, where the admission date is 7+ days after the decision was made that the admission was necessary. In this section, all analyses include acute and arranged (semi-acute) admissions only, with the exception of dental conditions, which also include waiting list admissions (as some DHBs routinely admit dental conditions from the waiting list, while others admit the majority as arranged admissions, potentially creating artefactual DHB differences if the entire burden of dental morbidity is not captured). This restriction was applied in order to eliminate the large number of cases where the primary diagnosis was e.g. otitis media, but where the main reason for admission was for the insertion of grommets, as it was felt that the role primary care played in preventing acute admissions (e.g. for acute otitis media), was likely to differ from the one it played in ensuring children had access to waiting list procedures (e.g. for the insertion of grommets).

Note 3: *Emergency Department Filters*: In order to deal with the issue of inconsistent uploading of Emergency Department (ED) cases to the National Minimum Dataset (see **Appendix 2**), the Ministry of Health has traditionally applied a number of filters to its ASH analyses [45,46]. These filters exclude Accident and Emergency cases which meet the following criteria:

- The admission and discharge dates are the same AND,
- The patient was not discharged dead (i.e. discharge type not in 'DD') AND,
- The health specialty code is in ('M05', 'M06', 'M07', or 'M08').

While the NZ Child and Youth Epidemiology service does not recommend the use of such filters in the paediatric population (see **Appendix 2** for a discussion of these issues), in order to allow DHBs to assess the impact ED cases have on their ASH rates, all the analyses in this section are presented with both ED cases included and excluded. In contrast to the Ministry of Health filters described above however, all ED cases have either been totally included or excluded, not just those admitted and discharged on the same day (as in the paediatric population many presentations occur late in the evening, with children then being discharged in the early hours of the following day, potentially making their total length of stay similar to that of ED day cases).

For those DHBs without a dedicated paediatric emergency department, who assess the majority of their cases in a Paediatric Assessment Unit or on the Paediatric Ward, the ED included and excluded analyses may be identical. Local variations in the way health specialty codes are assigned to such cases may profoundly influence the differences seen between the ED included and excluded rates.

Distribution in Māori Children

Distribution by Cause

In New Zealand during 2006−2010, asthma, dental conditions and gastroenteritis were the most frequent causes of ASH in Māori children 0−4 years when emergency department (ED) cases were included, while dental conditions, asthma and gastroenteritis were the most frequent causes when ED cases were excluded (**Table 16**).

Table 16. Ambulatory Sensitive Hospitalisations in Māori Children Aged 0−4 Years by Primary Diagnosis, New Zealand 2006−2010

Primary Diagnosis	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Percent (%)
Māori Children 0–4 Years				
Ambulatory Sensitive Hospitalisations (ED Cases Included)				
Asthma	5,873	1,174.6	16.22	20.10
ASH Dental	4,986	997.2	13.77	17.06
ASH Gastroenteritis	4,762	952.4	13.15	16.30
Acute Upper Respiratory Infections*	4,397	879.4	12.14	15.05
Bacterial/Non-Viral Pneumonia	3,389	677.8	9.36	11.60
ASH Skin Infections	3,284	656.8	9.07	11.24
Dermatitis and Eczema	1,049	209.8	2.90	3.59
Otitis Media	874	174.8	2.41	2.99
Constipation	252	50.4	0.70	0.86
Gastro-Oesophageal Reflux	185	37.0	0.51	0.63
Bronchiectasis	94	18.8	0.26	0.32
Nutritional Disorders	42	8.4	0.12	0.14
VPD ≥6 Months: DTP, Polio, HepB	21	4.2	0.06	0.07
Rheumatic Fever/Heart Disease	6	1.2	0.02	0.02
VPD ≥16 Months: MMR	6	1.2	0.02	0.02
Total	29,220	5,844.0	80.68	100.00
Ambulatory Sensitive Hospitalisations (ED Cases Excluded)				
ASH Dental	4,978	995.6	13.75	19.52
Asthma	4,859	971.8	13.42	19.06
ASH Gastroenteritis	3,694	738.8	10.20	14.49
Acute Upper Respiratory Infections*	3,494	698.8	9.65	13.70
ASH Skin Infections	3,151	630.2	8.70	12.36
Bacterial/Non-Viral Pneumonia	3,037	607.4	8.39	11.91
Dermatitis and Eczema	1,000	200.0	2.76	3.92
Otitis Media	742	148.4	2.05	2.91
Constipation	210	42.0	0.58	0.82
Gastro-Oesophageal Reflux	168	33.6	0.46	0.66
Bronchiectasis	94	18.8	0.26	0.37
Nutritional Disorders	40	8.0	0.11	0.16
VPD ≥6 Months: DTP, Polio, HepB	19	3.8	0.05	0.07
Rheumatic Fever/Heart Disease	6	1.2	0.02	0.02
VPD ≥16 Months: MMR	5	1.0	0.01	0.02
Total	25,497	5,099.4	70.40	100.00

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only, Neonates excluded); Denominator: Statistics NZ Estimated Resident Population. *Acute URTIs exclude croup.

Distribution by Ethnicity

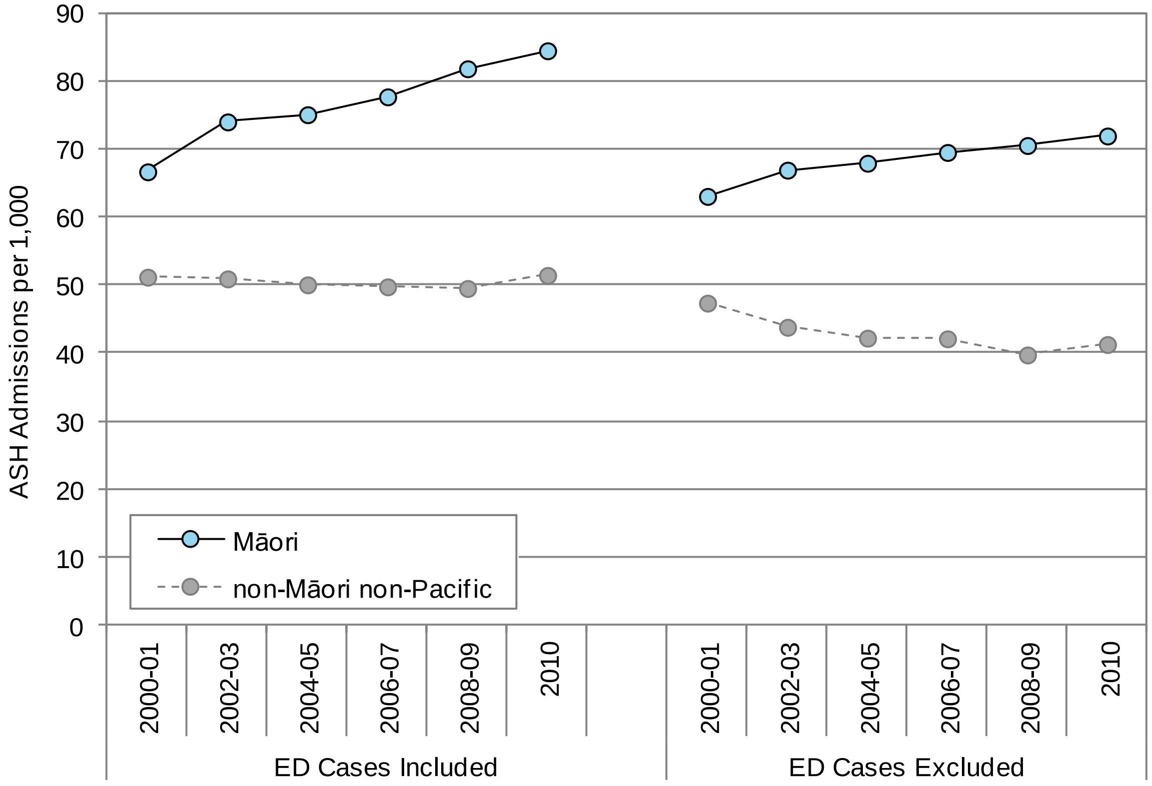
In New Zealand during 2006−2010, ASH rates were *significantly* higher for Māori (ED included RR 1.61 95% CI 1.59–1.64; ED excluded RR 1.72 95% CI 1.69–1.74) than for non-Māori non-Pacific children, irrespective of whether ED cases were included or excluded (**Table 17**). Similar ethnic differences were seen during 2000−2010, with ASH rates in Māori children increasing during this period, while ASH rates in non-Māori non-Pacific children remained static (ED cases included), or declined (ED cases excluded) (**Figure 10**).

Table 17. Ambulatory Sensitive Hospitalisations in Children Aged 0−4 Years by Ethnicity, New Zealand 2006−2010

Ethnicity	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Ambulatory Sensitive Hospitalisations (ED Cases Included)					
Māori	29,220	5,844.0	80.7	1.61	1.59 – 1.64
non-Māori non-Pacific	46,708	9,341.6	50.0	1.00	
Ambulatory Sensitive Hospitalisations (ED Cases Excluded)					
Māori	25,497	5,099.4	70.4	1.72	1.69 – 1.74
non-Māori non-Pacific	38,296	7,659.2	41.0	1.00	

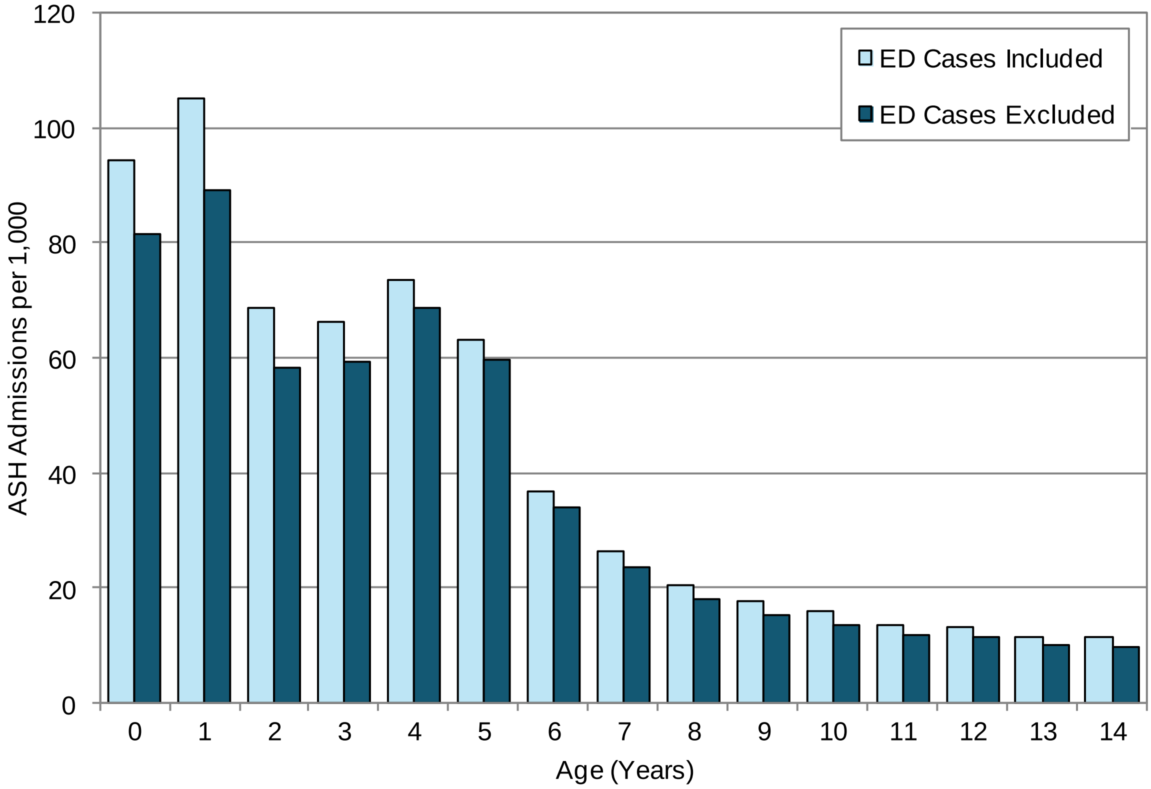
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only, Neonates excluded); Denominator: Statistics NZ Estimated Resident Population

Figure 10. Ambulatory Sensitive Hospitalisations in Children Aged 0−4 Years by Ethnicity, New Zealand 2000−2010



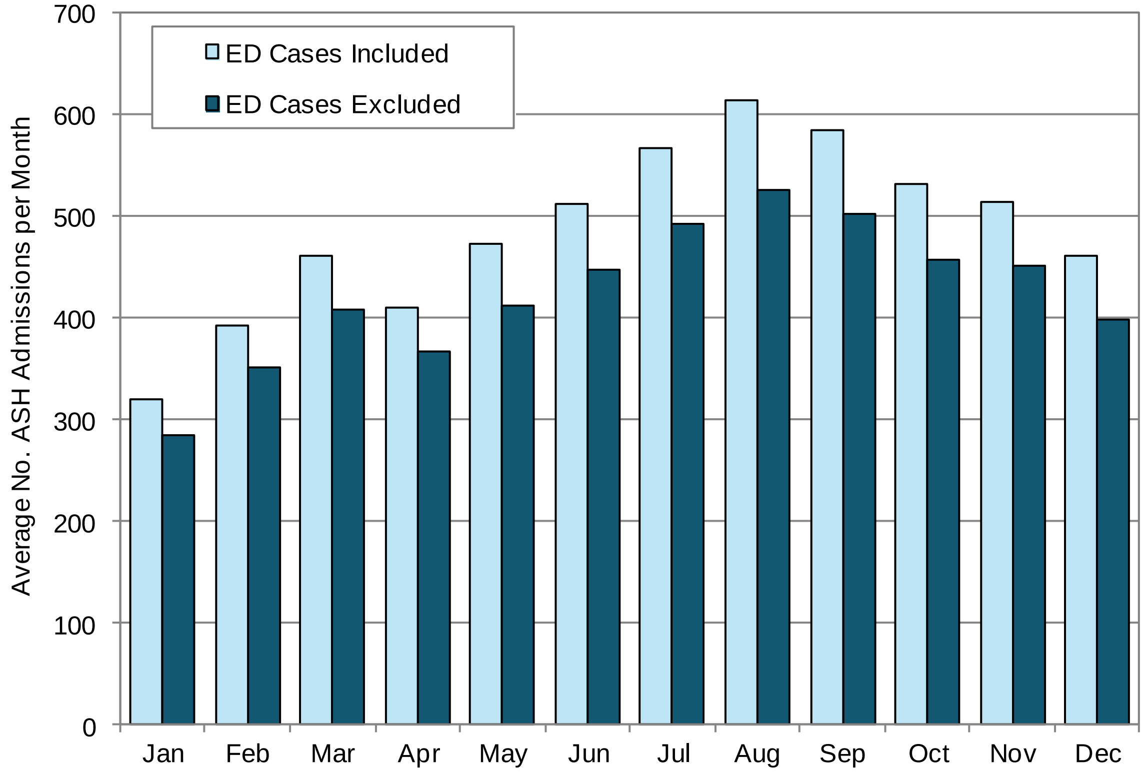
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only, Neonates excluded); Denominator: Statistics NZ Estimated Resident Population

Figure 11. Ambulatory Sensitive Hospitalisations in Māori Children 0−14 Years by Age, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only, Neonates excluded); Denominator: Statistics NZ Estimated Resident Population

Figure 12. Ambulatory Sensitive Hospital Admissions in Māori Children Aged 0−4 Years by Month, New Zealand 2006−2010



Source: National Minimum Dataset (Acute and semi-acute admissions only, Neonates excluded)

Distribution by Age

When broken down by age, ASH rates in Māori children during 2006−2010 were highest in those aged one year, followed by those less than one year of age, irrespective of whether ED cases were included or excluded (**Figure 11**).

Distribution by Season

In New Zealand during 2006−2010, ASH rates in Māori children were highest during the cooler months (**Figure 12**).

New Zealand Distribution and Trends

Distribution by Primary Diagnosis

In New Zealand during 2006–2010, gastroenteritis, acute upper respiratory infections and asthma were the most frequent causes of ASH in children 0–4 years when emergency department (ED) cases were included, while gastroenteritis, dental conditions and asthma were the most frequent causes when ED cases were excluded.

New Zealand Trends

In New Zealand during 2000–2010 when ED cases were included, ASH rates in children 0–4 years gradually increased, whereas when ED cases were excluded, ASH rates were more static.

Distribution by Age

In New Zealand during 2006–2010, ASH rates were highest in infants and one year olds, with rates then tapering off rapidly between one and two years, and then again between four and seven years of age. The exclusion of ED cases did not alter this overall pattern appreciably.

Distribution by NZDep01 Index Decile and Gender

In New Zealand during 2006–2010, ASH rates in children 0–4 years were *significantly* higher for males and children living in average-to-more deprived (NZDep01 decile 3–10) areas. Similar patterns were seen when ED cases were excluded.

Distribution by Season

In New Zealand during 2006–2010, ASH in children 0–4 years were most frequent in winter and spring, irrespective of whether ED cases were included or excluded.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

INFECTIOUS AND RESPIRATORY DISEASES

INTRODUCTION TO INFECTIOUS AND RESPIRATORY DISEASES SECTION

Introduction

Māori children and young people experience a large burden of avoidable morbidity and mortality as a result of infectious and respiratory diseases. Examples include whooping cough, pneumonia, bronchiolitis and tuberculosis [47]. In 2001, a review of New Zealand's approaches to infectious disease control [48] found that in the past, well-organised government-run programmes had eliminated some infectious diseases transmitted from animals (e.g. *Brucella abortis* and hydatids). In more recent times, however, the reviewers noted that success in controlling infectious diseases had been mixed, with rates of rheumatic fever, tuberculosis and enteric infections being high, and with many of these conditions disproportionately affecting Māori [48]. A more recent review also noted the significant contribution poverty, poor housing, poor nutrition, smoking, air pollution and difficulties with accessing primary, secondary and tertiary healthcare made to the burden of respiratory and infectious diseases in New Zealand children [47].

Given their significant impact on the wellbeing of New Zealand children, infectious and respiratory diseases have been given a relatively high priority in this report, with a range of conditions being reviewed in three main sections as follows:

1. **Upper Respiratory Tract Conditions**: This section contains two chapters:
    - *Acute Upper Respiratory Infections and Tonsillectomy* reviews acute and arranged hospital admissions for a range of acute upper respiratory tract infections in Māori children, as well as waiting list admission for tonsillectomy +/− adenoidectomy.
    - *Middle Ear Conditions: Otitis Media and Grommets* reviews acute hospital admissions for otitis media in Māori children, as well as arranged and waiting list admission for the insertion of grommets.
2. **Lower Respiratory Tract Conditions**: This section contains four chapters, with the first reviewing hospital admissions and mortality from *Bronchiolitis* in Māori infants <1 year. The remaining chapters review hospital admissions and mortality from *Pneumonia, Asthma* and *Bronchiectasis* in Māori children and young people aged 0–24 years.
3. **Infectious Diseases**: This section contains six chapters, with the first reviewing hospital admissions and mortality from *Pertussis* in Māori infants <1 year. The remaining chapters review hospital admissions and mortality from *Meningococcal Disease, Tuberculosis, Acute Rheumatic Fever and Rheumatic Heart Disease, Serious Skin Infections* and *Gastroenteritis* in Māori children and young people aged 0–24 years.

UPPER RESPIRATORY TRACT CONDITIONS

ACUTE UPPER RESPIRATORY INFECTIONS AND TONSILLECTOMY IN CHILDREN

Introduction

The following section uses data from the National Minimum Dataset to review acute and arranged hospital admissions for acute upper respiratory infections in Māori children aged 0–14 years, as well as waiting list admissions for tonsillectomy +/- adenoidectomy.

Background

Upper respiratory tract infections (URTIs) are a common cause of illness in childhood and account for a large number of visits to primary care each year [49]. Although they are generally of short duration and limited severity, upper respiratory infections may place a significant burden on secondary care services. The conditions which are most relevant for Māori children [40] are outlined briefly below:

Non Specific URTIs: Non-specific URTIs, including the common cold, produce a variety of symptoms including cough, sore throat, runny nose, fever and malaise. They are usually of viral origin [49]. The available evidence indicates that antibiotic treatment does not alter the course of these illnesses, which are self-limiting in the vast majority of cases, nor is it an effective strategy for preventing complications such as lower respiratory conditions like pneumonia [50].

Acute Pharyngitis and Tonsillitis: While the majority of cases of pharyngitis and tonsillitis are also due to viral infections and thus need only symptomatic treatment, a small proportion are due to group A streptococcus and may, if untreated, lead to acute rheumatic fever [51]. Acute rheumatic fever is of particular concern for Māori children and young people, with one review of rheumatic fever admissions during 1996–2005 finding that rates for Māori were 10.0 (95% CI 1.7–58.3) times higher than for European/Other peoples and that Māori accounted for almost 50% of the total number of cases seen [52]. (For further information see the Rheumatic Fever section commencing on **Page 125**).

Waiting List Admissions for Tonsillectomy: In New Zealand, a large number of waiting list admissions for tonsillectomy occur each year, although research suggests that Māori children may have much lower hospital admission rates for tonsillectomy than European children [40].

While a number of tonsillectomies are performed for the management of upper airway obstruction/obstructive sleep apnoea, the majority are for the management of recurrent tonsillitis [40]. There has been considerable controversy, however, concerning the benefits of tonsillectomy for recurrent throat infections, and internationally tonsillectomy is now a much less frequently performed procedure than it was in the past [53,54]. Several national guidelines and an Australasian position paper recommend the use of the “Paradise Criteria” when determining the indications for tonsillectomy [53,55,56]. These are: seven or more well-documented, adequately treated disabling sore throats due to tonsillitis in the preceding year; OR five or more such episodes in each of the previous two years; OR three or more such episodes in each of the previous three years [57].

Data Sources and Methods

Indicator

1. *Acute and Arranged Hospital Admissions for Acute Upper Respiratory Tract Infections in Children Aged 0–14 Years*

Numerator: National Minimum Dataset: Acute and arranged hospital admissions for children aged 0–14 years with an ICD-10-AM primary diagnosis of Acute Upper Respiratory Tract Infection: Acute Nasopharyngitis (Common Cold) (J00); Acute Sinusitis (J01); Acute Pharyngitis (J02); Acute Tonsillitis (J03); Croup/Acute Laryngitis/Tracheitis (J04, J05.0); Acute URTI Multiple/Unspecified Sites (J06); Epiglottitis (J05.1).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

2. *Arranged and Waiting List Admissions for Tonsillectomy +/-Adenoidectomy in Children Aged 0–14 Years*

Numerator: National Minimum Dataset: Arranged and waiting list admissions for tonsillectomy (Primary Procedure Code 4178900) or tonsillectomy and adenoidectomy (Primary Procedure Code 4178901) in children (0–14 years). Indications for tonsillectomy (ICD-10-AM primary diagnosis codes) included: Chronic Tonsillitis (J35.0); Hypertrophy of the Tonsils/Adenoids (J35.1–J35.3); Sleep Apnoea (G47.3); Other/Unspecified Chronic Diseases of the Tonsils/Adenoids (J35.8–J35.9).

Notes on Interpretation

Note 1: All of the acute upper respiratory tract infections listed above are considered ambulatory sensitive, with the exception of croup/acute laryngitis/tracheitis, where early access to primary care may not prevent a hospitalisation (e.g. children with croup may require hospitalisation for the management of respiratory distress).

Note 2: An acute admission is an unplanned admission occurring on the day of presentation, while an arranged admission (referred to elsewhere in this report as a semi-acute admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary. A waiting list admission is a planned admission, where the admission date is 7+ days after the date the decision was made that the admission was necessary. Because arranged admissions comprise a mix of patients being admitted semi-acutely for the management of medical conditions, and semi-urgently for operative procedures, in this section arranged admissions have been included in both the acute upper respiratory tract infection and tonsillectomy categories. While in a small number of cases, a single child may have appeared in both analyses, in reality the majority of admissions for tonsillectomy were for chronic upper respiratory conditions (e.g. chronic tonsillitis, obstructive sleep apnoea) which were not included in the acute URTI section.

Note 3: The term Tonsillectomy +/-Adenoidectomy has been used as adenoidectomy is often performed simultaneously with tonsillectomy and it is difficult to exclude those receiving both procedures without excluding a large number of cases of tonsillectomy. Thus the analysis includes cases coded as receiving a tonsillectomy (4178900) or tonsillectomy and adenoidectomy (4178901).

Note 4: **Appendix 3** outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

Acute Upper Respiratory Tract Infections

Distribution in Māori Children

Distribution by Cause

In New Zealand during 2006–2010, acute upper respiratory tract infections (URTI) of multiple/unspecified sites were the most frequent reason for an admission with an URTI in Māori children, followed by croup/acute laryngitis/tracheitis (**Table 18**).

Table 18. Acute and Arranged Hospital Admissions for Acute URTIs in Māori Children Aged 0−14 Years by Primary Diagnosis, New Zealand 2006−2010

Primary Diagnosis	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Percent (%)
Acute Upper Respiratory Tract Infections				
Māori Children 0–14 Years				
Acute URTI Multiple/Unspecified Sites	4,510	902.0	4.20	64.3
Croup/Acute Laryngitis/Tracheitis	1,460	292.0	1.36	20.8
Acute Tonsillitis	613	122.6	0.57	8.7
Acute Pharyngitis	339	67.8	0.32	4.8
Acute Nasopharyngitis (Common Cold)	62	12.4	0.06	0.9
Acute Sinusitis	29	5.8	0.03	0.4
Epiglottitis	<3	s	s	s
Total	7,015	1,403.0	6.53	100.0

Source: Numerator: National Minimum Dataset (Acute and arranged admissions only); Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.

Distribution by Ethnicity

In New Zealand during 2006–2010, hospital admissions for acute URTIs were *significantly* higher for Māori (RR 1.28 95% CI 1.25–1.32) than for non-Māori non-Pacific children (**Table 19**). Similar ethnic differences were seen during 2000–2010, with admission rates in Māori children increasing during this period (**Figure 13**).

Table 19. Acute and Arranged Hospital Admissions for Acute URTIs in Children Aged 0−14 Years by Ethnicity, New Zealand 2006−2010

Ethnicity	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Acute Upper Respiratory Tract Infections					
Māori	7,015	1,403.0	6.53	1.28	1.25 – 1.32
non-Māori non-Pacific	15,047	3,009.4	5.08	1.00	

Source: Numerator: National Minimum Dataset (Acute and arranged admissions only); Denominator: Statistics NZ Estimated Resident Population

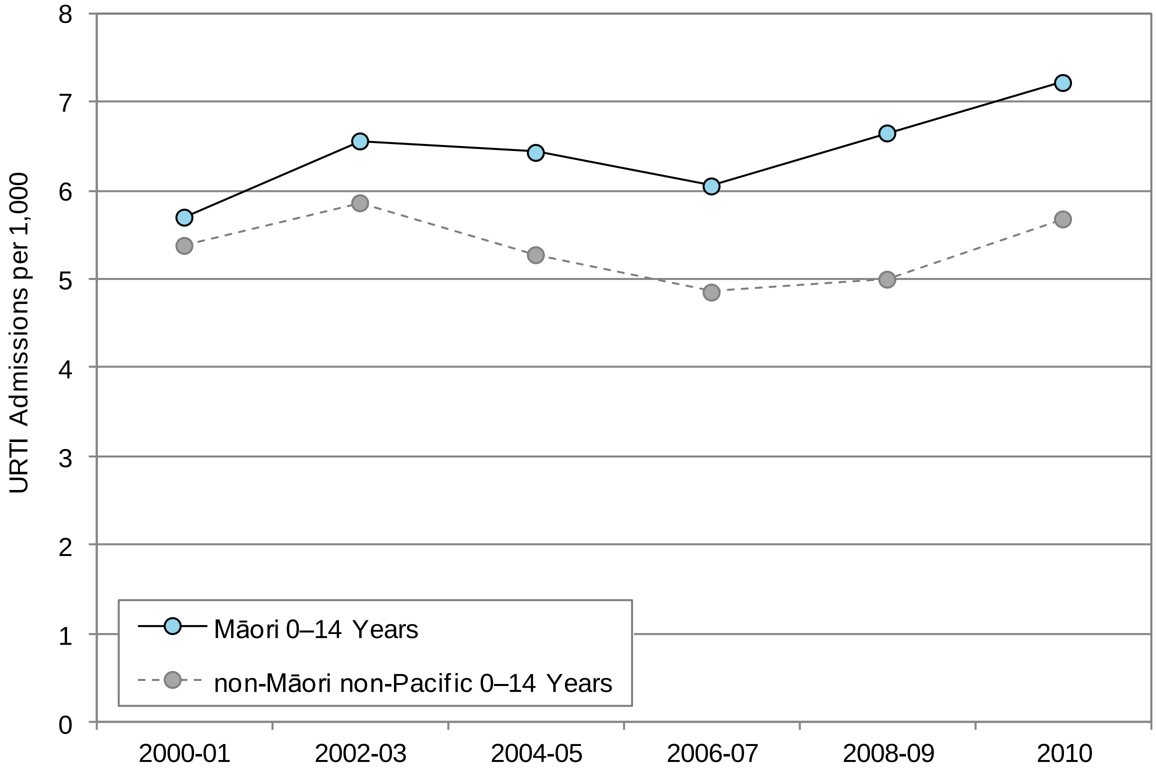
Distribution by Age

When broken down by age, hospital admissions for acute URTI in Māori children during 2006−2010 were most frequent in infants and one year olds, with rates tapering off rapidly thereafter (**Figure 14**).

Distribution by Season

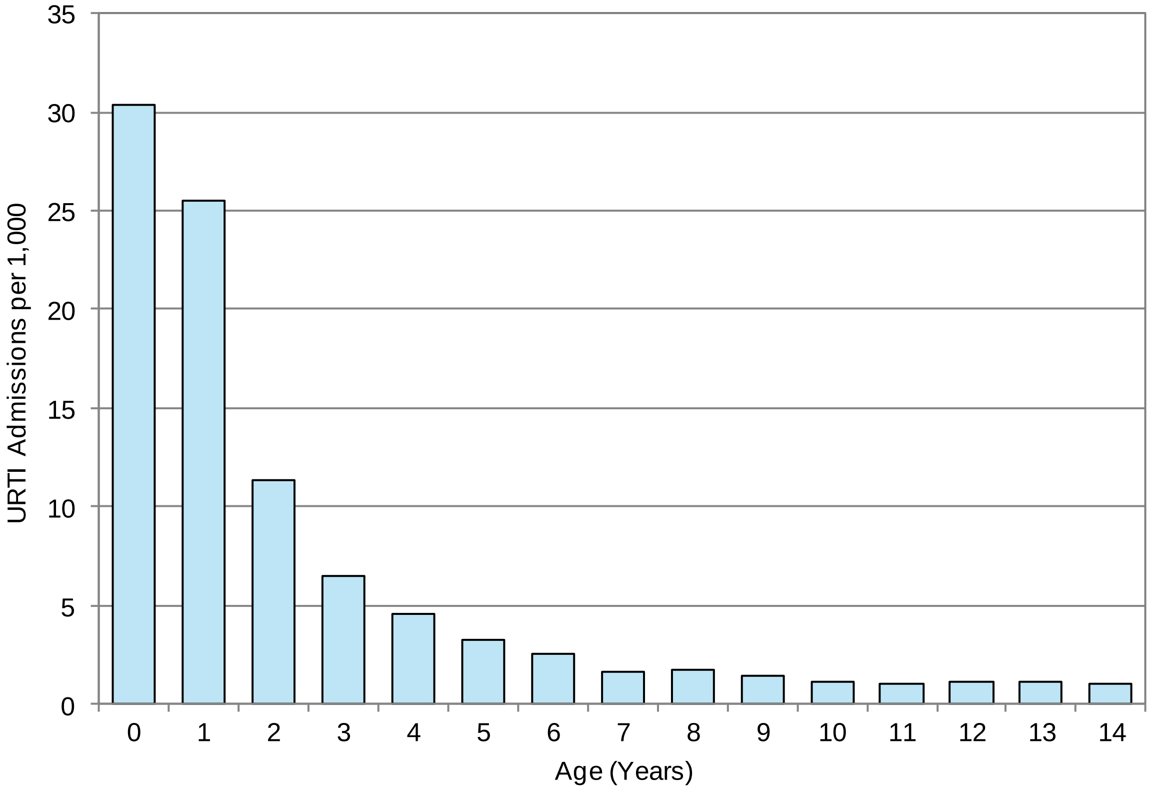
In New Zealand during 2006−2010, hospital admissions for acute URTIs in Māori children were highest during the winter months (**Figure 15**).

Figure 13. Acute and Arranged Hospital Admissions for Acute URTIs in Children Aged 0−14 Years by Ethnicity, New Zealand 2000−2010



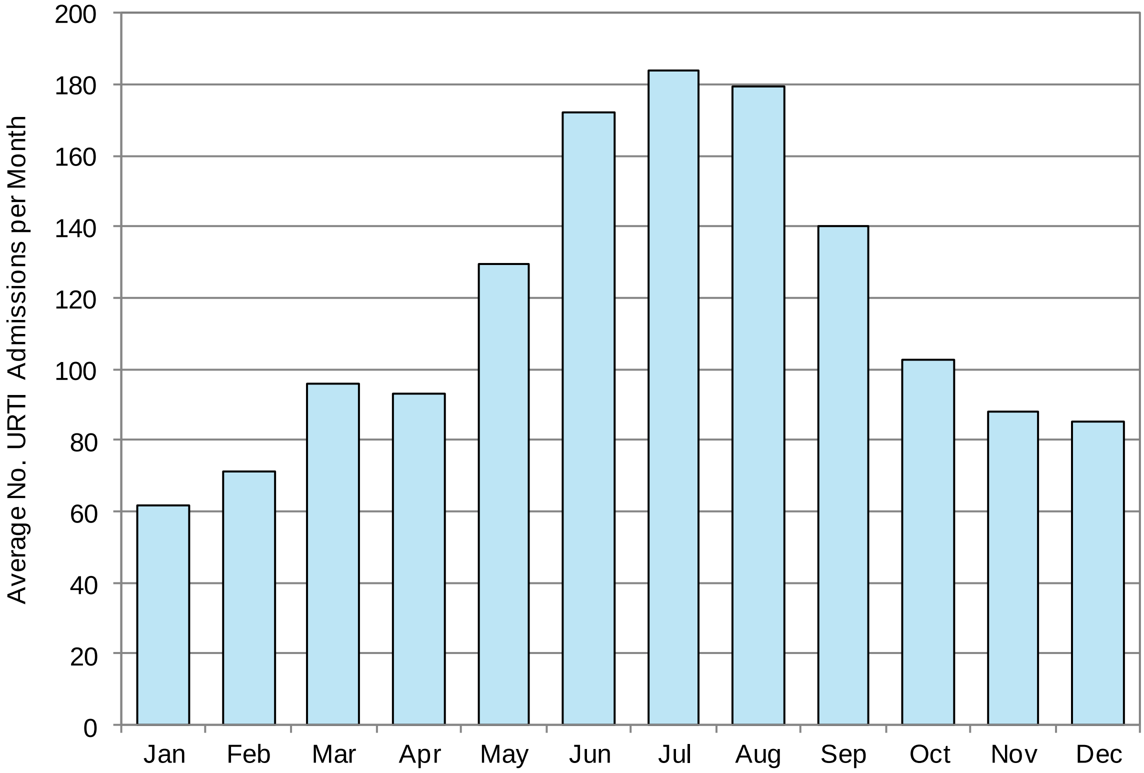
Source: Numerator: National Minimum Dataset (Acute and arranged admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 14. Acute and Arranged Hospital Admissions for Acute URTIs in Māori Children 0−14 Years by Age, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset (Acute and arranged admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 15. Average Number of Acute and Arranged Hospital Admissions for Acute URTI per Month in Māori Children 0−14 Years, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset (Acute and arranged admissions only)

New Zealand Distribution and Trends

Distribution by Primary Diagnosis

In New Zealand during 2006–2010, acute upper respiratory tract infections (URTI) of multiple/unspecified sites were the most frequent reason for an admission with an URTI in children, followed by croup/acute laryngitis/tracheitis.

Distribution by Age

In New Zealand during 2006–2010, admissions for acute URTIs were most common in infants and one year olds, with rates tapering off rapidly thereafter.

Distribution by NZDep01 Index Decile and Gender

In New Zealand during 2006–2010, hospital admissions for acute URTIs were *significantly* higher for males and children living in average-to-more deprived (NZDep01 decile 4–10) areas.

Distribution by Season

In New Zealand during 2006–2010, hospital admissions for acute URTIs in children were highest during the winter months.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

Tonsillectomy

Distribution in Māori Children

Distribution by Cause

In New Zealand during 2006−2010, chronic tonsillitis was the most frequent primary diagnosis in Māori children admitted to hospital for tonsillectomy +/− adenoidectomy, accounting for 54.5% of all admissions in this category. Hypertrophy of the tonsils/adenoids was the second leading diagnosis, followed by sleep apnoea (**Table 20**).

Table 20. Arranged/Waiting List Admissions for Tonsillectomy +/− Adenoidectomy in Māori Children Aged 0−14 Years by Primary Diagnosis, New Zealand 2006−2010

Primary Diagnosis	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Percent (%)
Tonsillectomy +/− Adenoidectomy				
Māori Children 0–14 Years				
Chronic Tonsillitis	1,345	269.0	1.25	54.5
Hypertrophy Tonsils/Adenoids	672	134.4	0.63	27.2
Sleep Apnoea	325	65.0	0.30	13.2
Acute Tonsillitis	31	6.2	0.03	1.3
Otitis Media	27	5.4	0.03	1.1
Other Chronic Diseases Tonsils/Adenoids	8	1.6	0.01	0.3
Peritonsillar Abscess	3	0.6	< 0.01	0.1
Other Diagnoses	57	11.4	0.05	2.3
Total	2,468	493.6	2.30	100.0

Source: Numerator: National Minimum Dataset (Arranged and waiting list admissions only); Denominator: Statistics NZ Estimated Resident Population

Distribution by Ethnicity

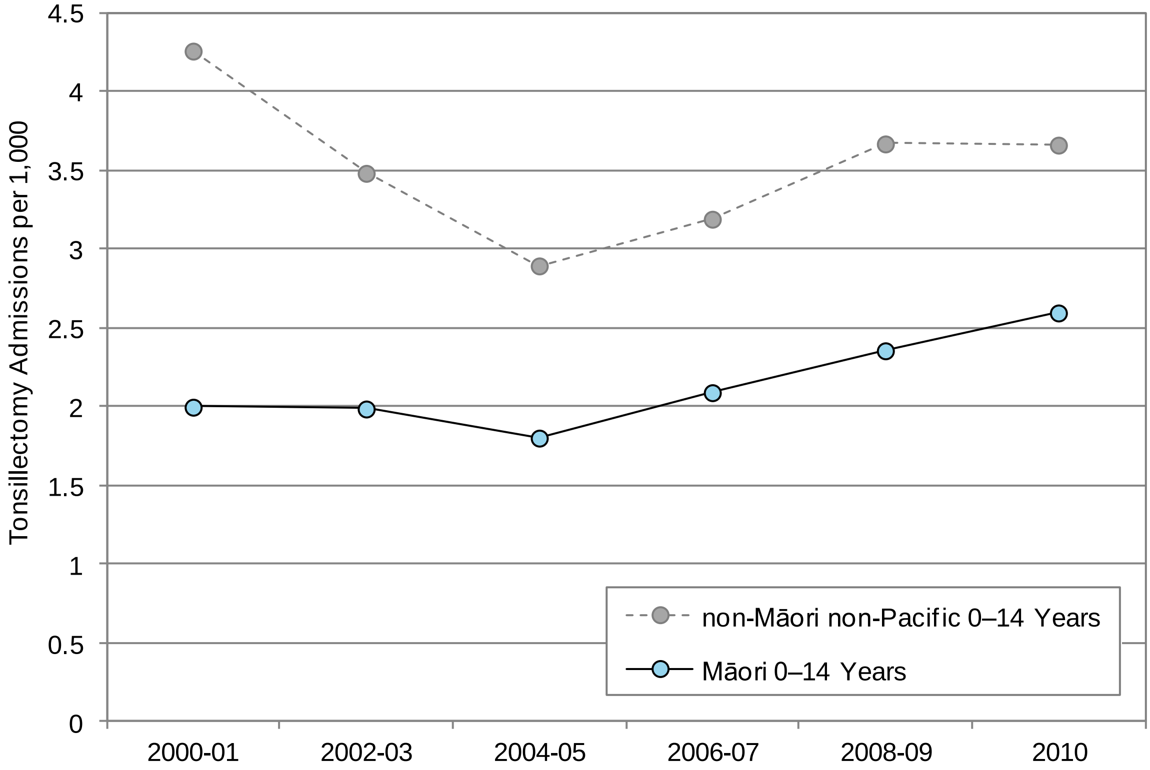
In New Zealand during 2006−2010, arranged/waiting list admissions for tonsillectomy +/− adenoidectomy were *significantly* lower for Māori children (RR 0.66 95% CI 0.63–0.69) than for non-Māori non-Pacific children (**Table 21**). Similar ethnic differences were seen during 2000−2010, with admission rates for both Māori and non-Māori non-Pacific children increasing after 2004−05 (**Figure 16**).

Table 21. Arranged/Waiting List Admissions for Tonsillectomy +/− Adenoidectomy in Children Aged 0−14 Years by Ethnicity, New Zealand 2006−2010

Ethnicity	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Tonsillectomy +/− Adenoidectomy					
Māori	2,468	493.6	2.30	0.66	0.63 – 0.69
non-Māori non-Pacific	10,295	2,059.0	3.48	1.00	

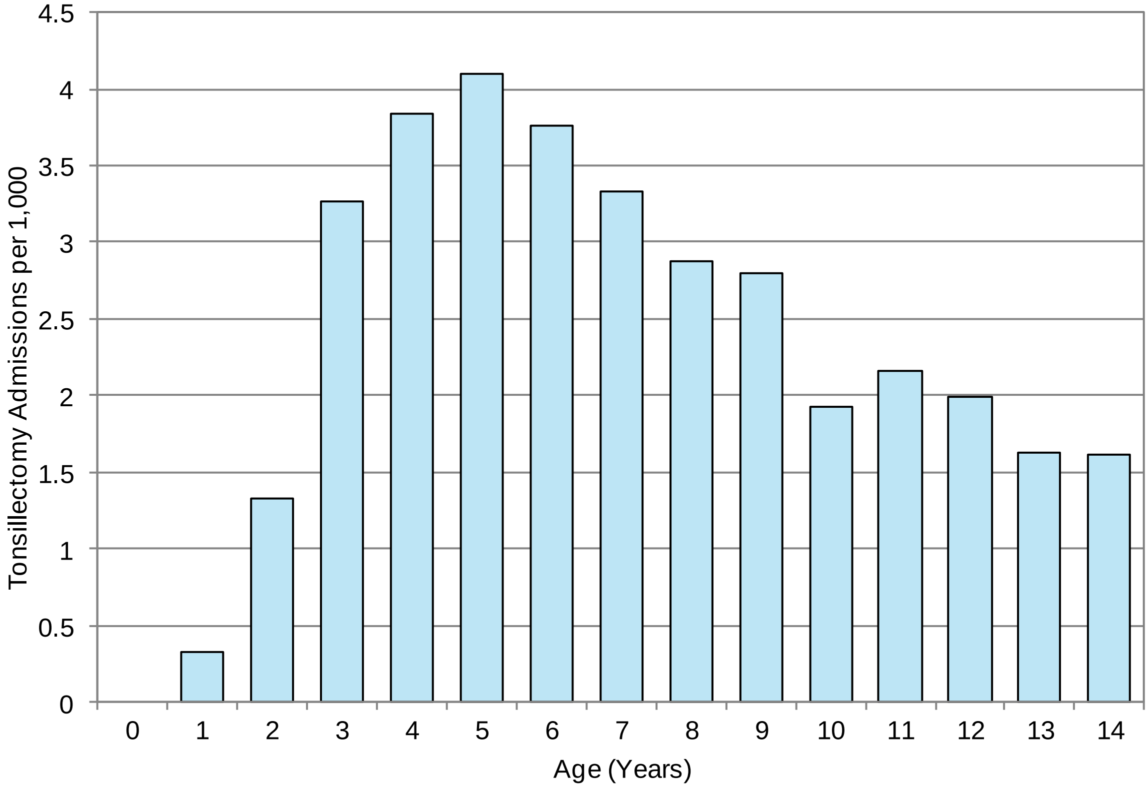
Source: Numerator: National Minimum Dataset (Arranged and waiting list admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 16. Arranged/Waiting List Admissions for Tonsillectomy +/− Adenoidectomy in Children Aged 0−14 Years by Ethnicity, New Zealand 2000−2010



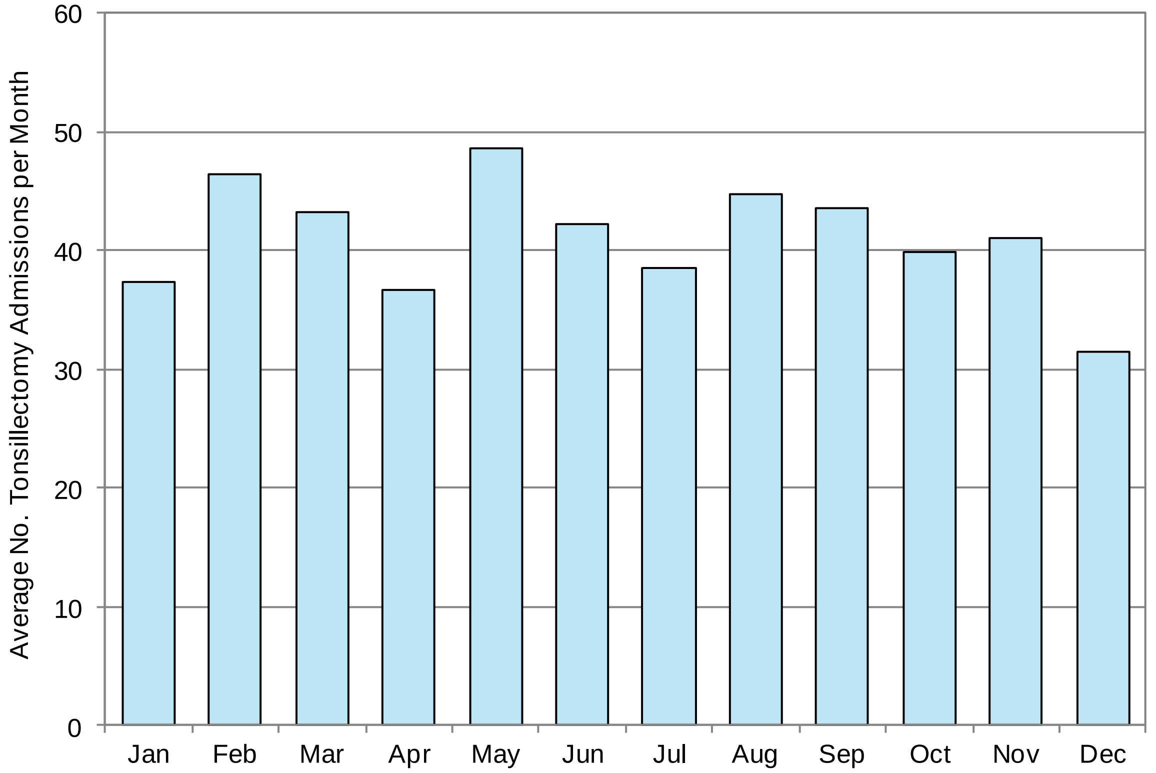
Source: Numerator: National Minimum Dataset (Arranged and waiting list admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 17. Arranged/Waiting List Admissions for Tonsillectomy +/− Adenoidectomy in Māori Children 0−14 Years by Age, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset (Arranged and waiting list admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 18. Average Number of Arranged/Waiting List Admissions for Tonsillectomy +/− Adenoidectomy per Month in Māori Children Aged 0−14 Years, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset (Arranged and waiting list admissions only)

Distribution by Age

In New Zealand during 2006−2010, arranged/waiting list admissions for tonsillectomy +/− adenoidectomy in Māori children were relatively infrequent during the first two years of life, but increased rapidly during the preschool years, to reach a peak at five years of age, before declining again (**Figure 17**).

Distribution by Season

In New Zealand during 2006–2010, there were no consistent seasonal variations in admissions for tonsillectomy +/− adenoidectomy in Māori children (**Figure 18**).

New Zealand Distribution and Trends

Distribution by Primary Diagnosis

In New Zealand during 2006–2010, chronic tonsillitis was the most frequent primary diagnosis in children admitted to hospital for tonsillectomy +/− adenoidectomy, accounting for 60.1% of all admissions in this category. Hypertrophy of the tonsils/adenoids was the second leading diagnosis, followed by sleep apnoea.

New Zealand Trends

In New Zealand, arranged/waiting list admissions for tonsillectomy +/− adenoidectomy in children decreased during the early 2000s. Admission rates reached their lowest point in 2004–05, before increasing again.

Distribution by NZDep01 Index Decile and Gender

In New Zealand during 2006–2010, arranged/waiting list admissions for tonsillectomy were *significantly* lower for those living in the least deprived (NZDep01 decile 1) areas. No *significant* gender differences were evident however.

Distribution by Season

In New Zealand during 2006–2010, there were no consistent seasonal variations in arranged/waiting list admissions for tonsillectomy +/− adenoidectomy in children, although the number of admissions was lower in December and January.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

MIDDLE EAR CONDITIONS: OTITIS MEDIA AND GROMMETS

Introduction

The following section uses data from the National Minimum Dataset to explore acute hospital admission for otitis media in Māori children, as well as arranged and waiting list admissions for the insertion of grommets.

Background

Otitis media is one of the most common childhood infections presenting in primary care, and is also a frequent reason for antibiotic treatment and hospitalisation for surgical intervention [58]. It can be subdivided into two related categories:

Acute Otitis Media (AOM): AOM is caused by inflammation of the middle ear and is usually viral or bacterial in origin. Symptoms often follow an upper respiratory infection and include fever, irritability, ear pain and hearing loss, and on examination a red, opaque, bulging eardrum may be present +/- a purulent ear discharge [59]. Risk factors include age (peak incidence 6–11 months), a lack of breastfeeding, parental smoking and attendance at day care. In the acute phase, management includes pain relief, observation (selected mild cases) and antibiotics [58].

Otitis Media with Effusion (OME): OME is defined as the presence of a middle ear effusion (fluid) without signs or symptoms of acute infection. It may arise de-novo or following an episode of acute otitis media [58]. While OME is common, most episodes resolve spontaneously (in one series 28% resolved by 3 months, 42% by 6 months and 59% by 9 months [58]), and thus if children are not at particular risk for speech, language or learning problems (e.g. children with Down Syndrome or cranio-facial abnormalities), they may be managed with watchful waiting for at least 3 months [60].

For children with long-standing (greater than 3−6 months) bilateral OME, or recurrent AOM, grommets (ventilation or tympanostomy tubes) are often considered, with a view to restoring normal hearing. The procedure (which improves ventilation and pressure regulation in the middle ear) involves making a small incision in the eardrum (with or without the aspiration of middle ear fluid) and the insertion of a small ventilation tube. On average, grommets remain in the eardrum for 6–12 months before falling out [61].

In New Zealand, Māori children have higher rates of hospital admission for acute otitis media than European children and they are also more likely to fail their school entry hearing test [40] (Note: No hearing screening data has been published since the introduction of the B4 School Check in 2008). Further, while admission rates for the insertion of grommets are similar for Māori and European children during the preschool years, admission rates for Māori children are higher than for European children from six years of age onwards [40].

Data Sources and Methods

Indicators

1. *Acute Hospital Admissions for Otitis Media in Children Aged 0–14 Years*

2. *Acute Hospital Admissions for Other Conditions of the Middle Ear and Mastoid in Children Aged 0–14 Years*

<u>Numerator</u>: National Minimum Dataset: Acute hospital admissions for children aged 0–14 years with an ICD-10-AM primary diagnosis of Otitis Media (H65–H67) or Other Conditions of the Middle Ear and Mastoid: Eustachian Tube Disorders (H68, H69); Mastoiditis and Related Disorders (H70); Cholesteatoma of the Middle Ear (H71); Perforation/Other Disorders of the Tympanic Membrane (H72–73); and Other Disorders of the Middle Ear/Mastoid (H74–75).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

3. *Arranged and Waiting List Admissions for the Insertion of Grommets in Children Aged 0–14 Years*

Numerator: National Minimum Dataset: Arranged and Waiting List Admissions for the Insertion of Grommets (ICD-10-AM primary procedure codes 4163200 and 4163201).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: An acute admission is an unplanned admission occurring on the day of presentation, while an arranged admission (referred to elsewhere in this report as a semi-acute admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary. A waiting list admission is a planned admission, where the admission date is 7+ days after the date the decision was made that the admission was necessary.

While the majority of children admitted acutely with a primary diagnosis of otitis media do not receive a surgical intervention, the majority of children admitted from the waiting list with the same primary diagnosis do, with the most common operative procedure being the insertion of grommets. For arranged admissions the picture is more mixed, with some patients being admitted semi-acutely for the non-surgical management of otitis media, and others for an operative intervention such as grommets. On balance however, more arranged admissions with a primary diagnosis of otitis media are for surgical interventions, and thus in this section arranged admissions have been grouped with the waiting list category (in contrast to other sections where acute and arranged admission are considered together).

Note 2: **Appendix 2** outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

Distribution in Māori Children

Distribution by Cause

Conditions of the Middle Ear and Mastoid: In New Zealand during 2006−2010, otitis media was the most frequent primary diagnosis in Māori children admitted acutely with conditions of the middle ear and mastoid, accounting for 93.2% of admissions in this category. Mastoiditis and related disorders were the second most frequent reason for admission.

Grommets: In New Zealand during 2006−2010, otitis media was also the most frequent primary diagnosis in Māori children admitted for the insertion of grommets, and accounted for 94.9% of admissions in this category. Perforations/other disorders of the tympanic membrane were the second most frequent primary diagnoses (**Table 22**).

Distribution by Ethnicity

In New Zealand during 2006−2010, acute admissions for otitis media (RR 1.71 95% CI 1.58–1.86) and arranged/waiting list admissions for grommets (RR 1.33 95% CI 1.29–1.36) were both *significantly* higher for Māori than for non-Māori non-Pacific children (**Table 23**). Similar ethnic differences were seen during 2000−2010, with admissions for otitis media and grommets decreasing in Māori children during this period (**Figure 19**).

Distribution by Age

In New Zealand during 2006–2010, acute admissions for otitis media in Māori children were highest in infants and one year olds, with rates tapering off rapidly thereafter. In contrast, arranged/waiting list admissions for grommets were infrequent during the first year, but increased rapidly thereafter, reaching a peak at two years of age, and then remaining elevated during the preschool years, but tapering off after six years of age (**Figure 20**).

Table 22. Acute Hospital Admissions for Conditions of the Middle Ear and Mastoid and Arranged/Waiting List Admissions for Grommets in Māori Children Aged 0−14 Years by Primary Diagnosis, New Zealand 2006−2010

Primary Diagnosis	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Percent (%)
Māori Children 0−14 Years				
Acute Admissions for Conditions of the Middle Ear and Mastoid				
Otitis Media	888	177.6	0.83	93.18
Mastoiditis and Related Disorders	57	11.4	0.05	5.98
Perforation/Other Disorders Tympanic Membrane	6	1.2	0.01	0.63
Cholesteatoma Middle Ear	<3	s	s	s
Total	953	190.6	0.89	100.00
Arranged/Waiting List Admissions for Grommets				
Otitis Media	7,189	1,437.8	6.69	94.87
Perforation/Other Disorders Tympanic Membrane	175	35.0	0.16	2.31
Eustachian Tube Disorders	45	9.0	0.04	0.59
Other Disorders Middle Ear/Mastoid	36	7.2	0.03	0.48
Hypertrophy Tonsils/Adenoids	15	3.0	0.01	0.20
Sleep Apnoea	14	2.8	0.01	0.18
Chronic Tonsillitis	10	2.0	0.01	0.13
Cholesteatoma Middle Ear	4	0.8	0.00	0.05
Other Diagnoses	90	18.0	0.08	1.19
Total	7,578	1,515.6	7.05	100.00

Source: Numerator: National Minimum Dataset); Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers.

Table 23. Acute Hospital Admissions for Otitis Media and Arranged/Waiting List Admissions for Grommets in Children 0−14 Years by Ethnicity, New Zealand 2006−2010

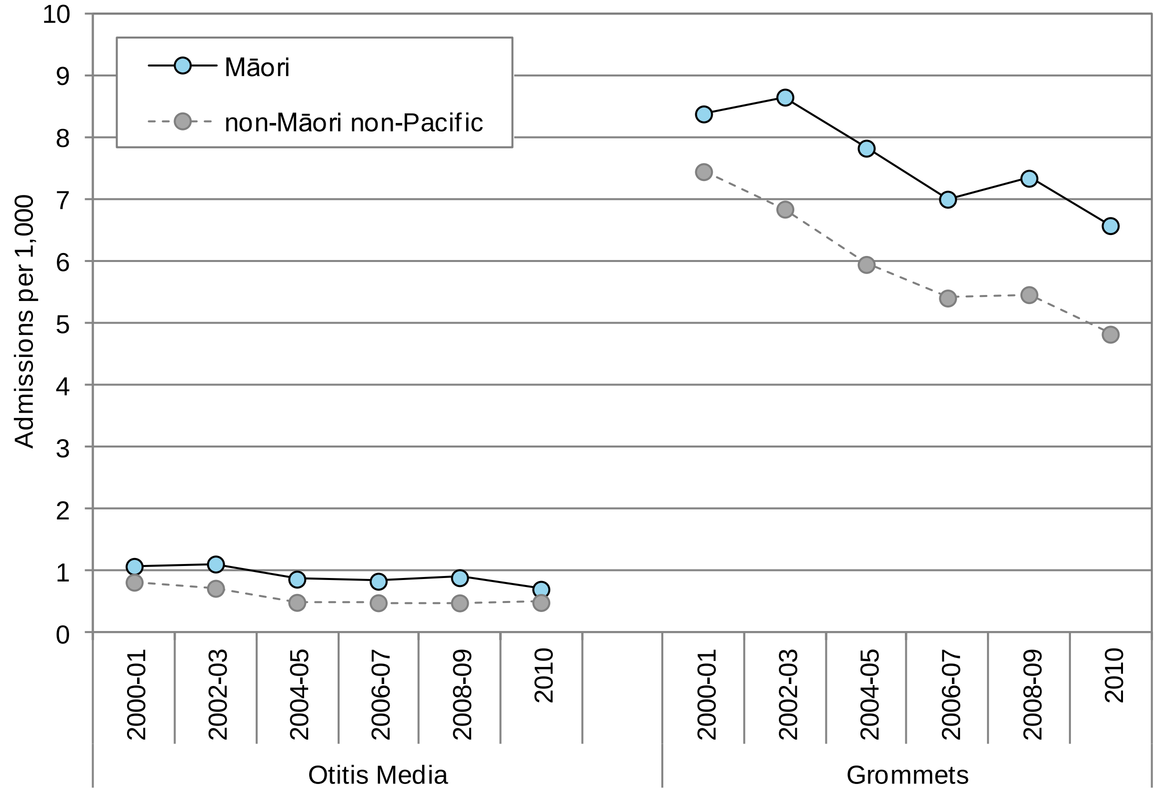
Ethnicity	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Acute Admissions for Otitis Media					
Māori	888	177.6	0.83	1.71	1.58 – 1.86
non-Māori non-Pacific	1,427	285.4	0.48	1.00	
Arranged/Waiting List Admissions for Grommets					
Māori	7,578	1,515.6	7.05	1.33	1.29 – 1.36
non-Māori non-Pacific	15,721	3,144.2	5.31	1.00	

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Distribution by Season

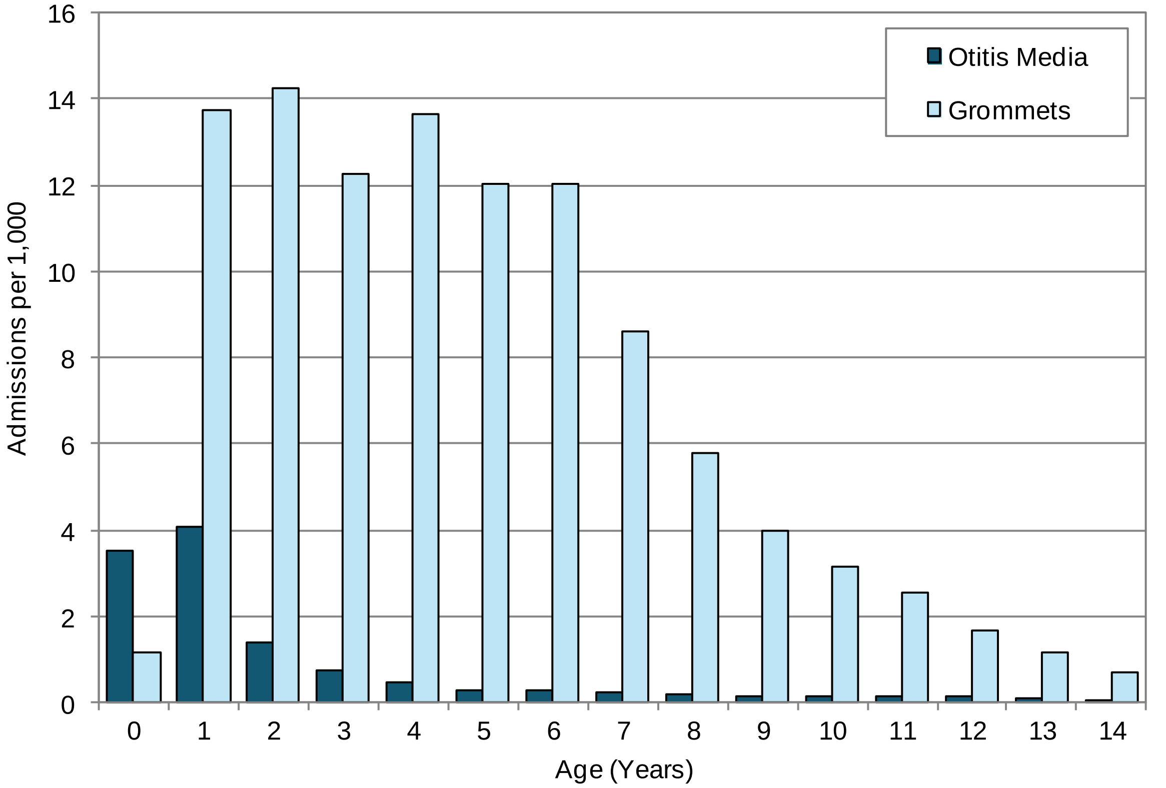
In New Zealand during 2006−2010, acute admissions for otitis media in Māori children were higher during the cooler months, but no seasonal variations in arranged/waiting list admissions for grommets were evident (**Figure 21**).

Figure 19. Acute Hospital Admissions for Otitis Media and Arranged/Waiting List Admissions for Grommets in Children 0−14 Years by Ethnicity, New Zealand 2000−2010



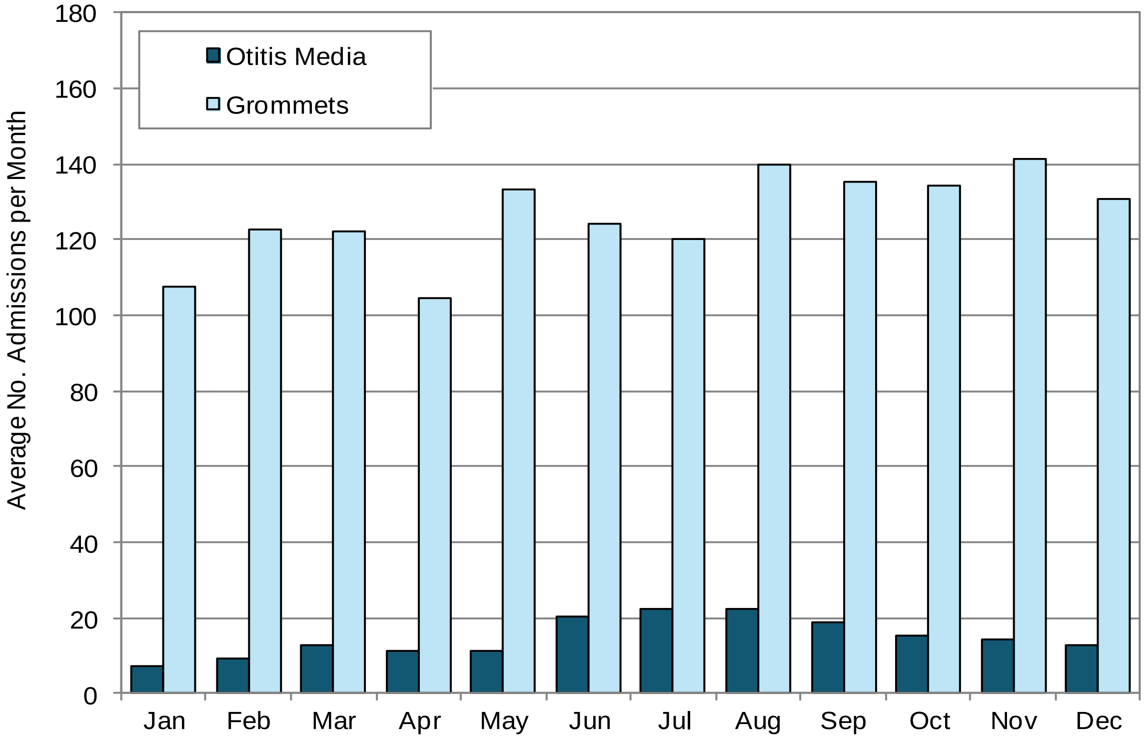
Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Figure 20. Acute Hospital Admissions for Otitis Media and Arranged/Waiting List Admissions for Grommets in Māori Children 0−14 Years by Age, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population.

Figure 21. Average Number of Acute Hospital Admissions for Otitis Media and Arranged/ Waiting List Admissions for Grommets per Month in Māori Children Aged 0−14 Years, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset

New Zealand Distribution and Trends

Distribution by Primary Diagnosis

Conditions of the Middle Ear and Mastoid: In New Zealand during 2006–2010, otitis media was the most frequent primary diagnosis in those admitted acutely with conditions of the middle ear and mastoid, accounting for 93.1% of admissions in this category. Mastoiditis and related disorders was the second most frequent reason for admission.

Grommets: In New Zealand during 2006–2010, otitis media was the most frequent primary diagnosis in arranged/waiting list admissions for the insertion of grommets, and accounted for 95.2% of admissions in this category. Perforations/other disorders tympanic membrane was the second most frequent primary diagnosis.

New Zealand Trends

In New Zealand during 2000–2010, arranged/waiting list admissions for the insertion of grommets declined, while acute admissions for otitis media declined during the early 2000s, but were more static after 2004–05.

Distribution by NZDep01 Index Decile and Gender

Otitis Media: In New Zealand during 2006–2010, acute admissions for otitis media were *significantly* higher for males and children living in average-to-more deprived (NZDep01 decile 4–10) areas.

Grommets: Similarly, during 2006–2010 arranged/waiting list admissions for the insertion of grommets were *significantly* higher for males. Admission rates were *significantly* lower for those living in the least deprived (NZDep01 decile 1) areas.

Distribution by Season

In New Zealand during 2006–2010, there were no consistent seasonal variations in arranged/waiting list admissions for grommets, although acute admissions for otitis media tended to be higher in winter and early spring.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

LOWER RESPIRATORY TRACT CONDITIONS

BRONCHIOLITIS

Introduction

The following section reviews hospital admissions for bronchiolitis in Māori infants aged <1 year using information from the National Minimum Dataset.

Background

Bronchiolitis is the most common lower respiratory infection in infants and is usually due to Respiratory Syncytial Virus (RSV), although other viruses have also been implicated [62,63]. Most children (around 90%) will be infected with RSV before the age of two years. Infection does not confer immunity and re-infections are common [62]. In New Zealand, RSV usually occurs in seasonal epidemics which peak in late winter [64].

Affected infants appear initially to have a simple upper respiratory infection with a mild fever, a runny nose and a cough but after a few days this progresses to wheezing, due to obstruction of the small airways (bronchioles), and respiratory distress with rapid breathing, nasal flaring and the use of accessory muscles. Feeding and sleeping may be impaired [65], and very young infants may also have episodes of apnoea. Severely affected infants require hospital treatment, which usually consists of supportive therapy with fluid supplementation and oxygen [66].

In New Zealand bronchiolitis admission rates are higher for Māori infants than for European infants, with one study of 141 RSV-positive infants admitted to Wellington Hospital during 2003−2005 finding that after adjusting for gender, month of birth, multiple birth, maternal smoking in pregnancy, gestational age and NZDep01 score, Māori infants had admission rates for bronchiolitis three and a half times higher than European infants. The authors noted that disease severity was not associated with ethnicity and therefore concluded that problems with access to primary care, or hospital physicians being more likely to admit Māori infants, were unlikely to have been reasons for the higher admission rates seen (as if they had been, there would have been a higher proportion of less severe cases among admitted Māori infants). Rather, they concluded that a combination of host (e.g. ex-preterm infant) and environmental (e.g. housing conditions and crowding) factors likely contributed to the higher admission rates for Māori infants, and that these were worth investigating further [67].

Data Sources and Methods

Indicator

1. *Acute and Semi-Acute Hospital Admissions for Bronchiolitis in Infants Aged <1 Year*

Numerator: National Minimum Dataset: Acute and semi-acute hospital admissions for infants aged <1 year with a primary diagnosis of Bronchiolitis (ICD-10-AM J21).

Denominator: Birth Registration Dataset

2. Mortality from Bronchiolitis in Infants Aged <1 Year

Numerator: National Mortality Collection: Deaths in Infants Aged <1 Year where the main underlying cause of death was Bronchiolitis (ICD-10-AM J21).

Denominator: Birth Registration Dataset

Notes on Interpretation

Note 1: An acute admission is an unplanned admission occurring on the day of presentation, while a semi-acute admission (referred to in the NMDS as an arranged admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary.

Note 2: **Appendix 2** outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

Distribution in Māori Babies

Distribution by Ethnicity

In New Zealand during 2006−2010, hospital admissions for bronchiolitis were *significantly* higher for Māori (RR 3.10 95% CI 3.01–3.19) than for non-Māori non-Pacific infants (**Table 24**). Similar ethnic differences were seen during 2000−2010 (**Figure 22**).

Distribution by Age

In New Zealand during 2006–2010, hospital admissions for bronchiolitis in Māori children were highest in infants aged less than one year, although a smaller number of admissions were evident in one year olds (**Figure 23**).

Distribution by Season

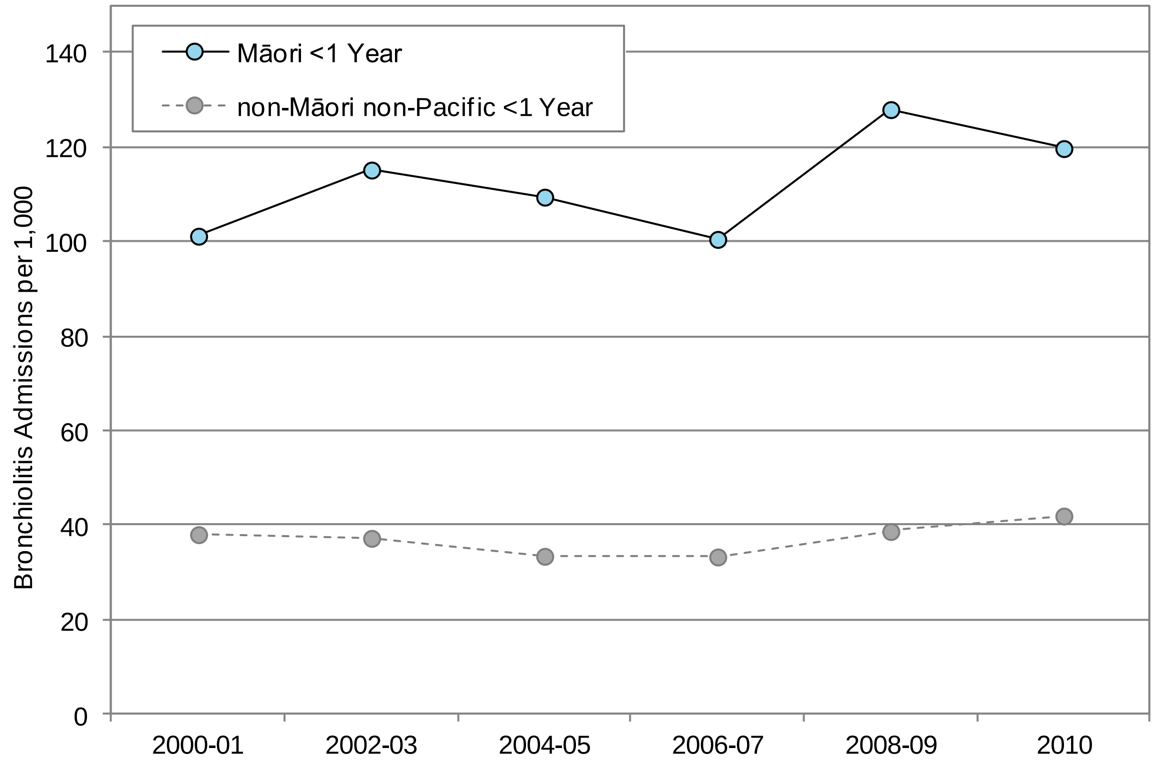
In New Zealand during 2006–2010, hospital admissions for bronchiolitis in Māori infants were highest in winter and early spring (**Figure 24**).

Table 24. Acute and Semi-Acute Hospital Admissions for Bronchiolitis in Infants <1 Year by Ethnicity, New Zealand 2006–2010

Ethnicity	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Bronchiolitis					
Infants <1 Year					
Māori	10,861	2,172.2	115.43	3.10	3.01 – 3.19
non-Māori non-Pacific	7,057	1,411.4	37.22	1.00	

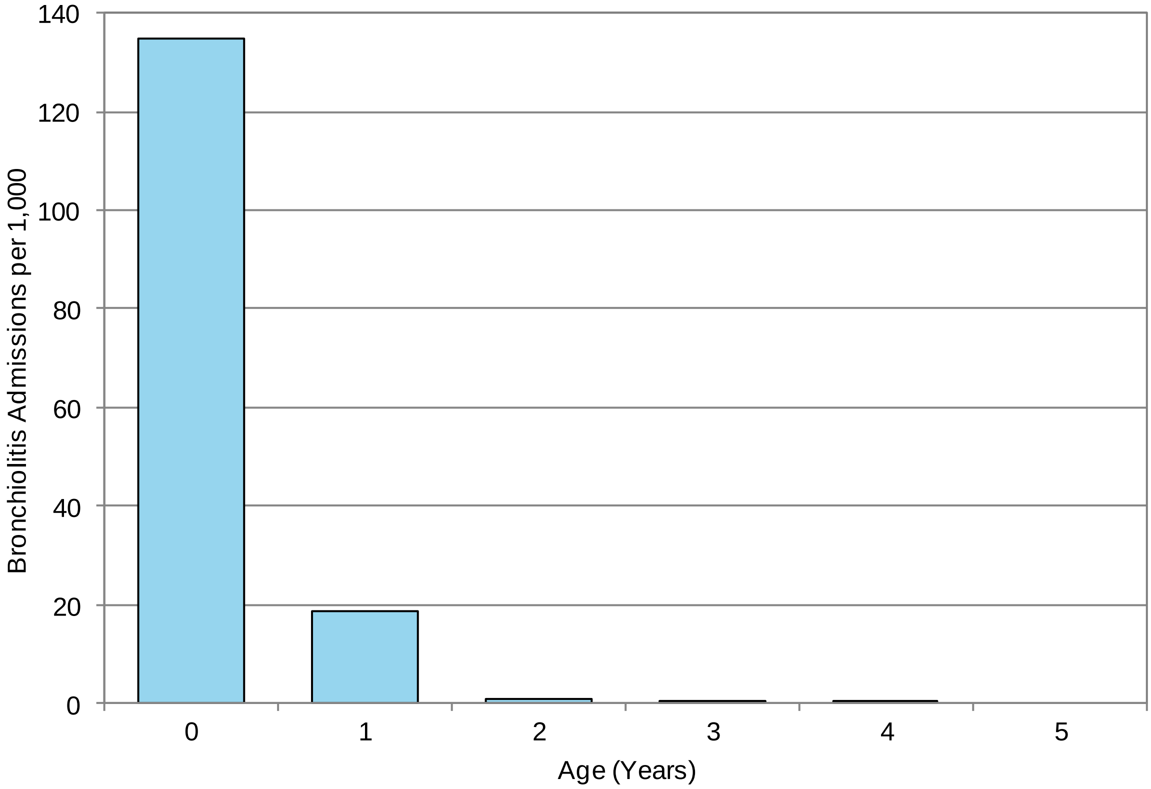
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Birth Registration Dataset

Figure 22. Acute and Semi-Acute Hospital Admissions for Bronchiolitis in Infants <1 Year by Ethnicity, New Zealand 2000–2010



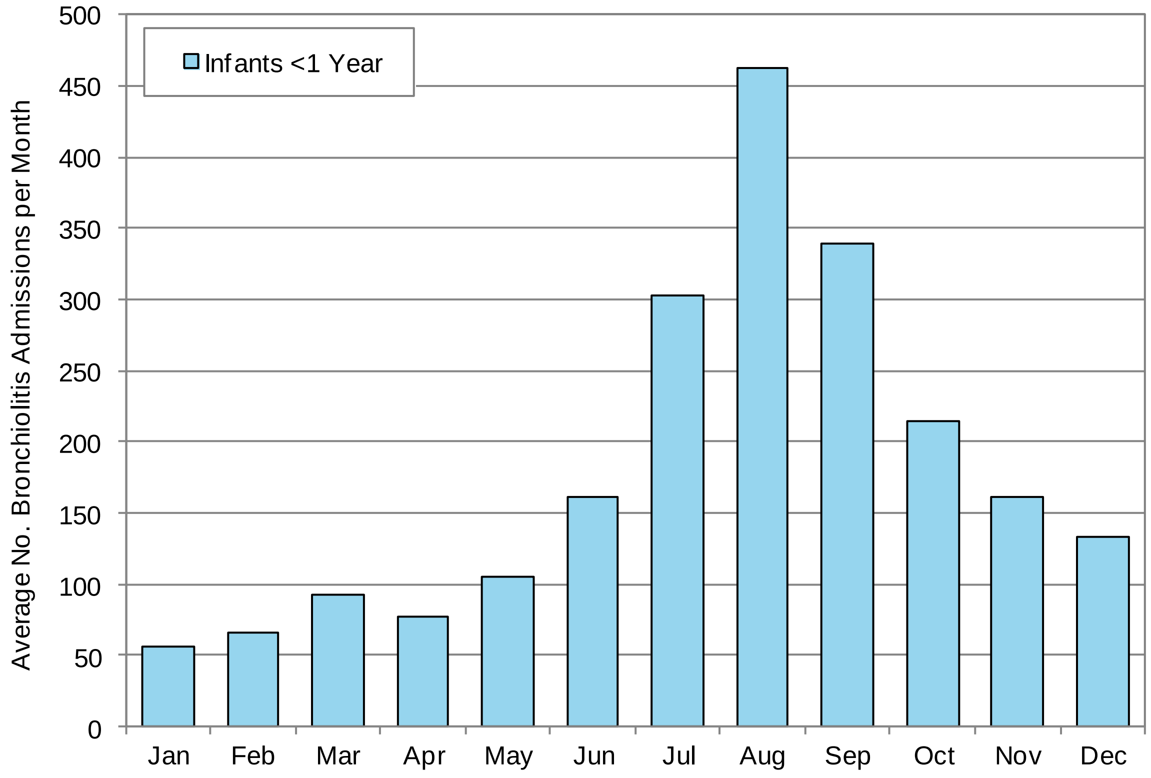
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Birth Registration Dataset

Figure 23. Acute and Semi-Acute Hospital Admissions for Bronchiolitis in Māori Children by Age, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 24. Average Number of Acute and Semi-Acute Hospital Admissions for Bronchiolitis in Māori Infants <1 Year by Month, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only)

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand, bronchiolitis admissions in infants remained fairly static during the early-mid 2000s, but then increased between 2006–07 and 2008–09. On average during 2000–2008, one infant each year died as the result of bronchiolitis.

Distribution by Age

In New Zealand during 2006–2010, bronchiolitis admissions were highest in infants aged less than one year, with rates declining rapidly with increasing age thereafter. In addition, during 2004–2008, all bronchiolitis deaths occurred in infants aged less than one year.

Distribution by NZDep01 Index Decile and Gender

In New Zealand during 2006–2010, bronchiolitis admissions were *significantly* higher for males and for infants living in average-to-more deprived (NZDep01 decile 3–10) areas.

Distribution by Season

In New Zealand during 2006–2010, bronchiolitis admissions in infants were highest in winter and early spring.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

PNEUMONIA

Introduction

The following section explores hospital admissions for bacterial and viral pneumonia in Māori children and young people using information from the National Minimum Dataset.

Background

While most respiratory infections in children are acute upper respiratory infections, children presenting to hospital emergency departments commonly have lower tract respiratory infections, including pneumonia. Pneumonia is an inflammation of the lung tissue. It is usually the result of a viral or bacterial infection following an acute upper respiratory infection. Most cases of pneumonia are due to viruses, but bacterial pneumonias cause most pneumonia deaths [68]. Clinical features include a high respiratory rate, respiratory distress, fever, chills, cough, chest pain, and abdominal pain and distension. Some infants with bacterial pneumonia may have vomiting, anorexia and diarrhoea [69].

In New Zealand, there are significant ethnic disparities in hospitalisations for pneumonia, with Māori children having higher admission rates than European children [70] and more severe disease once admitted [71]. Local research also suggests that factors such as poor housing (cold, damp, mould, overcrowding), a lack of access to primary healthcare and poor nutrition (e.g. iron deficiency) make a significant contribution to such inequalities and that further efforts in these areas will be required if inequalities in respiratory infections for Māori children are to be reduced [47,70].

The introduction of a vaccine which protects against invasive pneumococcal disease (a 7-valent vaccine was introduced in June 2008 for children aged 6 weeks and 3, 5 and 15 months, with this being upgraded to a 10-valent vaccine after July 2011) provides the potential for significant reductions in childhood pneumonia however. One overseas meta-analysis of 7-valent vaccine trials in infants demonstrated an 8% reduction in clinical pneumonia and a 36% reduction in chest x-ray positive pneumonia, while a 52% reduction in pneumonia hospitalisations in those less than two years was seen after the introduction of a 7-valent vaccine into the routine immunisation schedule in one USA evaluation, while a 39% reduction was seen in another USA study [72].

Data Sources and Methods

Indicator

1. *Acute and Semi Acute Hospital Admissions for Bacterial/Non-Viral/Unspecified Pneumonia in Children and Young People Aged 0–24 Years*

2. *Acute and Semi Acute Hospital Admissions for Viral Pneumonia in Children and Young People Aged 0–24 Years*

Numerator: National Minimum Dataset: Acute and semi-acute hospital admissions for children and young people aged 0–24 years with a primary diagnosis of Bacterial/Non-Viral/Unspecified Pneumonia (ICD-10-AM J13–J16, J18) or Viral Pneumonia (ICD-10-AM J12, J10.0, J11.0).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

3. Mortality from Bacterial/Non-Viral/Unspecified Pneumonia in Children and Young People Aged 0–24 Years

4. Mortality from Viral Pneumonia in Children and Young People Aged 0–24 Years

Numerator: National Mortality Collection; Deaths in children and young people aged 0–24 years where the main underlying cause of death was Bacterial/Non-Viral/Unspecified Pneumonia (ICD-10-AM J13–J16, J18) or Viral Pneumonia (ICD-10-AM J12, J10.0, J11.0).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: In this section, a separation has been maintained between bacterial/non-viral/unspecified pneumonia and viral pneumonia, because the former is considered to be ambulatory sensitive (e.g. early antibiotics in primary care may potentially prevent a hospital admission), while viral pneumonia is thought to be less amenable to such primary care interventions. In reality however, a large proportion of the former category comprises admissions with a primary diagnosis of J18: Pneumonia organism unspecified, meaning that there is likely to be considerable overlap between the two categories. It is thus recommended that trends in these two conditions be reviewed concurrently, with the artificial separation being maintained for those wishing to explore the contribution that pneumonia makes to trends in ambulatory sensitive hospital admissions.

Note 2: An acute admission is an unplanned admission occurring on the day of presentation, while a semi-acute admission (referred to in the NMDS as an arranged admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary.

Distribution in Māori Children and Young People

Distribution by Ethnicity

In New Zealand during 2006–2010, hospital admissions for bacterial/non-viral/unspecified pneumonia were *significantly* higher for Māori children (RR 1.97 95% CI 1.90–2.05) and young people (RR 2.61 95% CI 2.38–2.86) than for non-Māori non-Pacific children and young people While admissions for viral pneumonia were also *significantly* higher for Māori (RR 1.85 95% CI 1.66–2.06) than for non-Māori non-Pacific children, ethnic differences for young people did not reach statistical significance (**Table 25**). Similar ethnic differences were seen throughout 2000–2010, with differences between Māori and non-Māori non-Pacific children for viral pneumonia increasing between 2004–05 and 2010 (**Figure 25**, **Figure 26**).

Distribution by Age

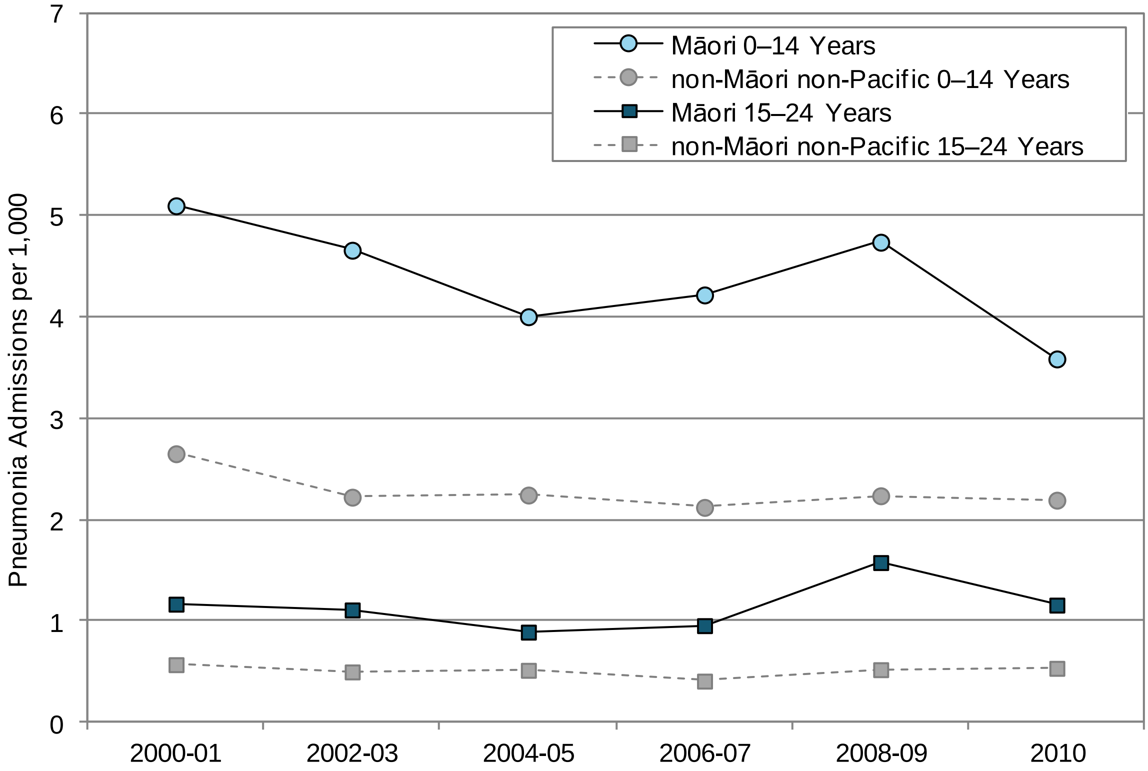
When broken down by age, hospital admission rates for both bacterial/non-viral/unspecified pneumonia and viral pneumonia in Māori children and young people were highest in one year olds, followed by rates in infants aged less than one year. Rates then tapered off rapidly during the preschool years (**Figure 27**).

Table 25. Acute and Semi-Acute Hospital Admissions for Pneumonia in Children and Young People Aged 0−24 Years by Ethnicity, New Zealand 2006−2010

Ethnicity	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Bacterial/Non-Viral/Unspecified Pneumonia					
Children 0–14 Years					
Māori	4,623	924.6	4.30	1.97	1.90 – 2.05
non-Māori non-Pacific	6,462	1,292.4	2.18	1.00	
Young People 15–24 Years					
Māori	756	151.2	1.25	2.61	2.38 – 2.86
non-Māori non-Pacific	1,105	221.0	0.48	1.00	
Viral Pneumonia					
Children 0–14 Years					
Māori	576	115.2	0.54	1.85	1.66 – 2.06
non-Māori non-Pacific	858	171.6	0.29	1.00	
Young People 15–24 Years					
Māori	17	3.4	0.03	1.30	0.75 – 2.25
non-Māori non-Pacific	50	10.0	0.02	1.00	

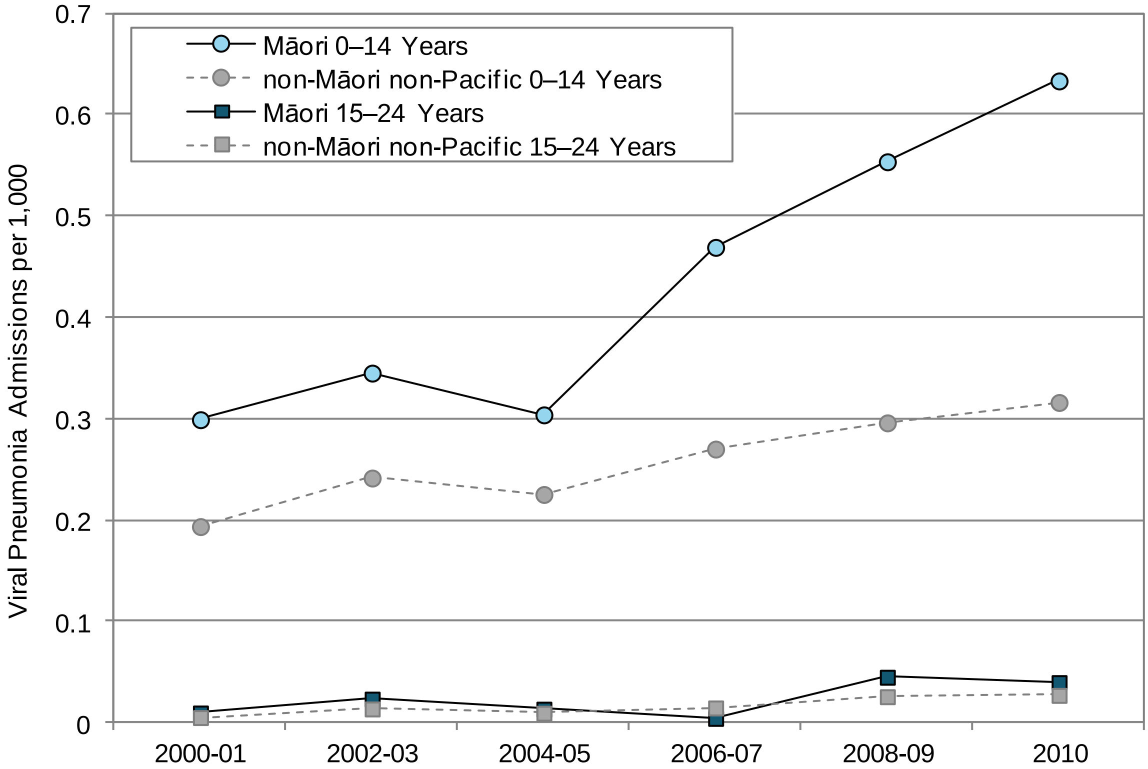
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population.

Figure 25. Acute and Semi-Acute Hospital Admissions for Bacterial/Non-Viral/Unspecified Pneumonia in Children and Young People Aged 0−24 Years by Ethnicity, New Zealand 2000−2010



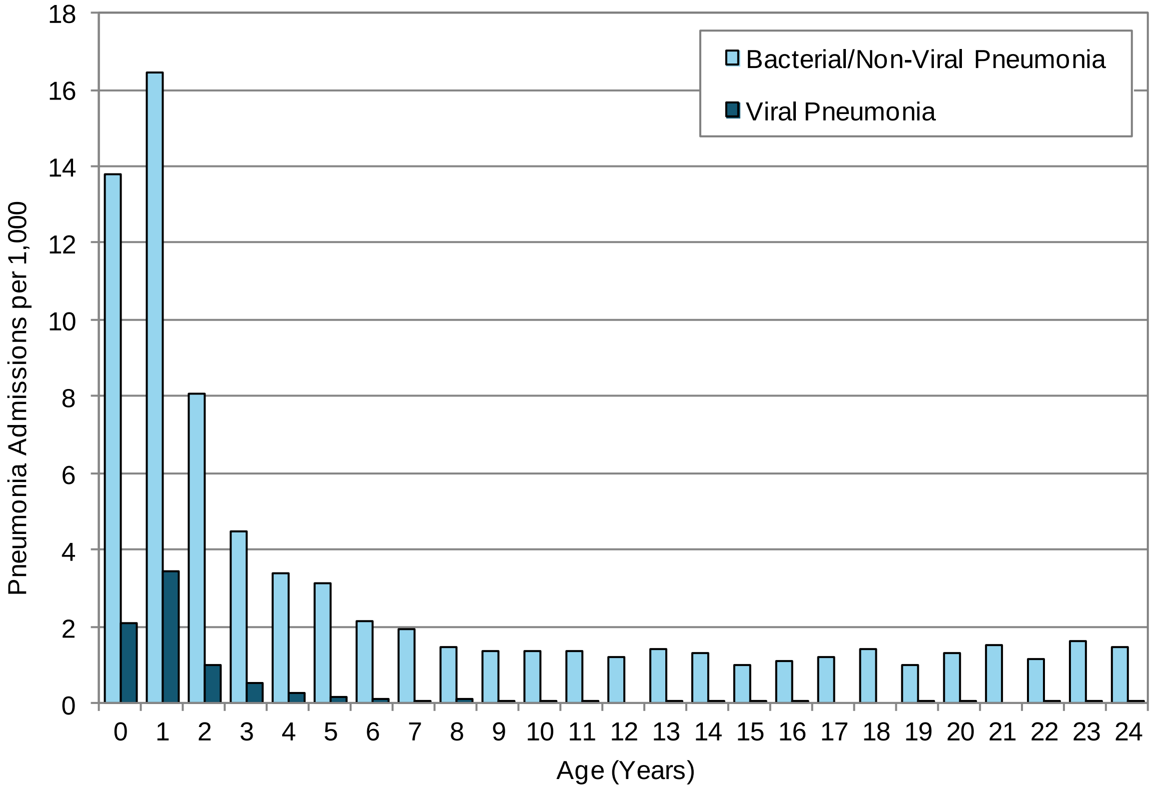
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 26. Acute and Semi-Acute Hospital Admissions for Viral Pneumonia in Children and Young People Aged 0–24 Years by Ethnicity, New Zealand 2000–2010



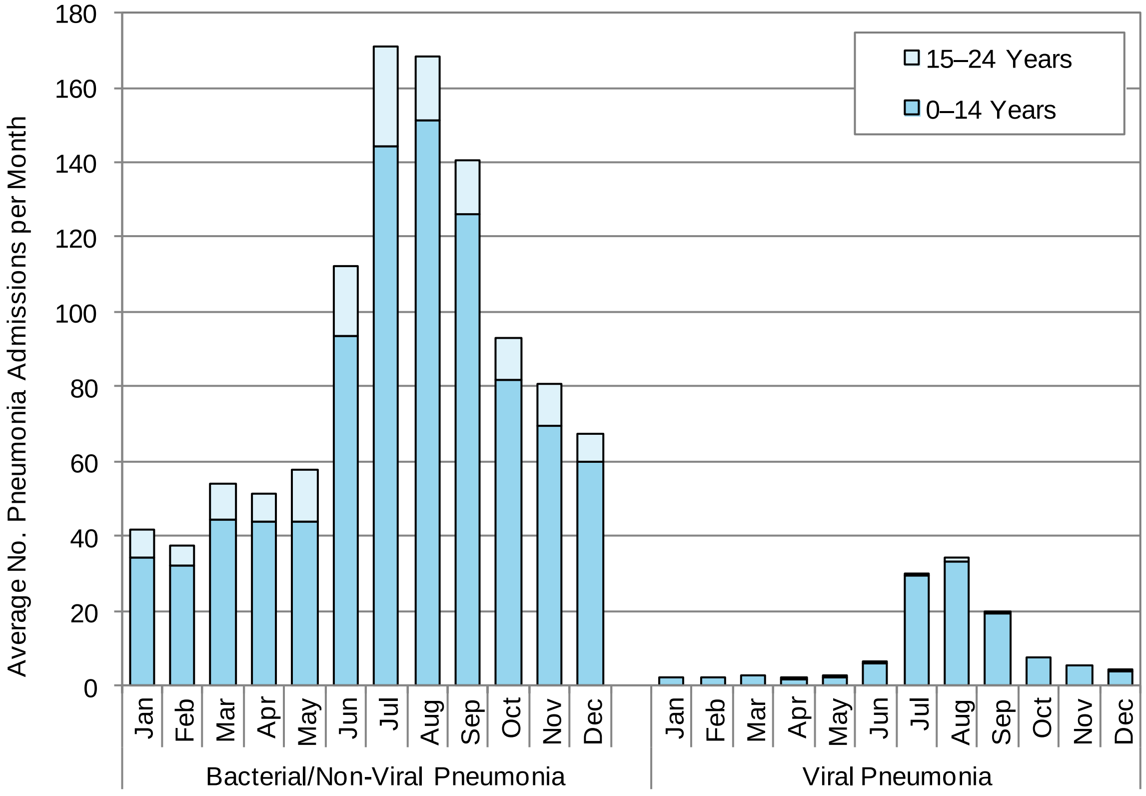
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 27. Acute and Semi-Acute Hospital Admissions for Pneumonia in Māori Children and Young People by Age, New Zealand 2006–2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 28. Average Number of Acute and Semi-Acute Hospital Admissions for Pneumonia in Māori Children and Young People by Month, New Zealand 2006–2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only)

Distribution by Season

In New Zealand during 2006–2010, hospital admissions for bacterial/non-viral/unspecified pneumonia and viral pneumonia in Māori children and young people were highest during the winter months (**Figure 28**).

New Zealand Distribution and Trends

New Zealand Trends

Bacterial/Non-Viral/Unspecified Pneumonia: In New Zealand, bacterial/non-viral/ unspecified pneumonia admissions in children declined during 2000–2007. A small upswing in rates was evident in 2008–09, before admissions declined again in 2010. Similar patterns were seen for young people. During 2000–2008 on average eight children or young people died each year, as the result of bacterial/non-viral/unspecified pneumonia.

Viral Pneumonia: In New Zealand during 2000–2010, viral pneumonia admissions increased in both children and young people, with the most rapid increases in children occurring between 2004–05 and 2008–09. During 2000–2008, on average two or three children or young people each year died as the result of viral pneumonia. While the number of deaths from viral pneumonia may appear high compared to those arising from bacterial/non-viral/unspecified pneumonia, given the much lower admission rates for the former category, it must be remembered that a large proportion of bacterial/non-viral/unspecified pneumonia admissions were coded J18: Pneumonia organism unspecified, meaning there may be considerable overlap between these two categories.

Distribution by Age

In New Zealand during 2006–2010, viral and bacterial/non-viral/unspecified pneumonia admissions were both highest in one year olds, with the next highest rates being seen in infants <1 year. Admissions tapered off rapidly during the preschool years, with the lowest rates being seen in those in their teens and early twenties. During 2004–2008, mortality for both outcomes was highest in infants <1 year.

Distribution by NZDep01 Index Decile and Gender

In New Zealand during 2006–2010, hospital admissions for bacterial/non-viral/unspecified pneumonia in children were *significantly* higher for males and those living in average-to-more deprived (NZDep01 decile 3–10) areas. For young people, admissions were *significantly* higher for those living in average-to-more deprived (NZDep01 decile 5–10) areas. Hospital admissions for viral pneumonia were also higher for children living in average-to-more deprived (NZDep01 decile 6–10) areas, although small numbers precluded a valid analysis for young people.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

Asthma

Introduction

The following section explores hospital admissions for asthma in Māori children and young people using information from the National Minimum Dataset.

Background

Asthma is a chronic inflammatory disorder of the airways of the lower respiratory tract. The inflammation is associated with airflow obstruction and bronchial hyper-responsiveness, which leads to episodes of bronchospasm (where smooth muscle in the airway walls contracts and the airways become narrowed), and symptoms such as wheezing, chest tightness, shortness of breath and coughing [73].

Asthma typically begins in early childhood and a family history of asthma and/or atopy is an important risk factor. The most common triggers of asthma attacks in children are viral infections and aero-allergens such as pollen, mould, house dust mites, animal dander and cigarette smoke but asthma may also be triggered by exposure to cold air, exercise or psychological stress [73].

The prevalence of asthma in New Zealand is one of the highest in the world [74]. Results from Phase Three of the International Study of Asthma and Allergies in Childhood (ISAAC) conducted in Auckland, the Bay of Plenty, Christchurch, Nelson, and Wellington during 2001−2003 found that 30% of children aged 6−7 years and 32% of adolescents reported having ‘ever had’ asthma [75]. The same study also found a higher prevalence of asthma symptoms in Māori children and adolescents compared to European children and adolescents. The study authors noted that these ethnic differences had increased since the ISACC Phase I study, primarily because of a fall in symptom prevalence in European children but also because of a slight increase in Māori children. There was a significantly higher prevalence of severe asthma symptoms (e.g. wheeze severe enough to cause waking from sleep or difficulty speaking), in Māori children [76]. Earlier reports had suggested that Māori children had higher rates of hospital admission for asthma than non-Māori children and that this disparity was greatest for children from rural areas [77].

From a public health perspective, addressing issues such as parental smoking, access to primary healthcare and the appropriate use of preventer medication may assist in reducing ethnic disparities in asthma symptoms and hospital admission rates [78]. However, the extent to which population level interventions may be of value in reducing the overall prevalence of asthma among Māori children and young people is unclear.

Data Sources and Methods

Indicator

1. *Acute and Semi Acute Hospital Admissions for Asthma in Children and Young People Aged 0–24 Years*

Numerator: National Minimum Dataset: Hospital admissions for children and young people aged 0–24 years with a primary diagnosis of Asthma (ICD-10-AM J45–46).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

2. Mortality from Asthma in Children and Young People Aged 0–24 Years

Numerator: National Mortality Collection: Deaths in children and young people aged 0–24 years where the main underlying cause of death was Asthma (ICD-10-AM J45–46).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: An acute admission is an unplanned admission occurring on the day of presentation, while a semi-acute admission (referred to in the NMDS as an arranged admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary.

Note 2: **Appendix 2** outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

Distribution in Māori Children and Young People

Distribution by Ethnicity

In New Zealand during 2006−2010, hospital admissions for asthma were *significantly* higher for Māori children (RR 2.19 95% CI 2.13–2.26) and young people (RR 2.60 95% CI 2.43–2.78) than for non-Māori non-Pacific children and young people (**Table 26**). Similar ethnic differences were seen during 2000−2010, with admissions in Māori children increasing for the majority of this period, and admissions in Māori young people after 2006−07 (**Figure 29**).

Distribution by Age

In New Zealand during 2006−2010, hospital admissions for asthma were infrequent in Māori infants, but increased rapidly thereafter. Rates reached a peak in one year olds, with the next highest rates being in those two and then three years of age (**Figure 30**).

Distribution by Season

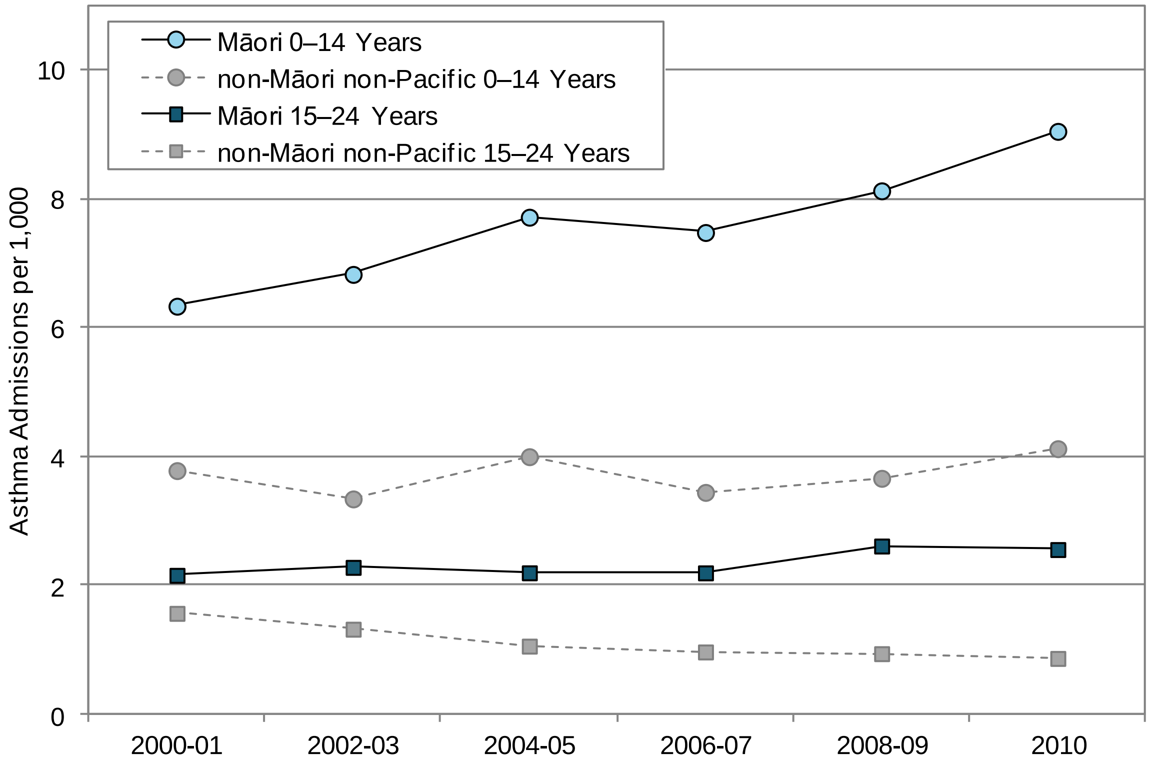
In New Zealand during 2006–2010, there were no consistent seasonal variations in hospital admissions for asthma in Māori children and young people, although the number of admissions was lowest in January (**Figure 31**).

Table 26. Acute and Semi-Acute Hospital Admissions for Asthma in Children and Young People Aged 0−24 Years by Ethnicity, New Zealand 2006−2010

Ethnicity	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Asthma					
Children 0–14 Years					
Māori	8,653	1,730.6	8.05	2.19	2.13 – 2.26
non-Māori non-Pacific	10,870	2,174.0	3.67	1.00	
Young People 15–24 Years					
Māori	1,479	295.8	2.44	2.60	2.43 – 2.78
non-Māori non-Pacific	2,169	433.8	0.94	1.00	

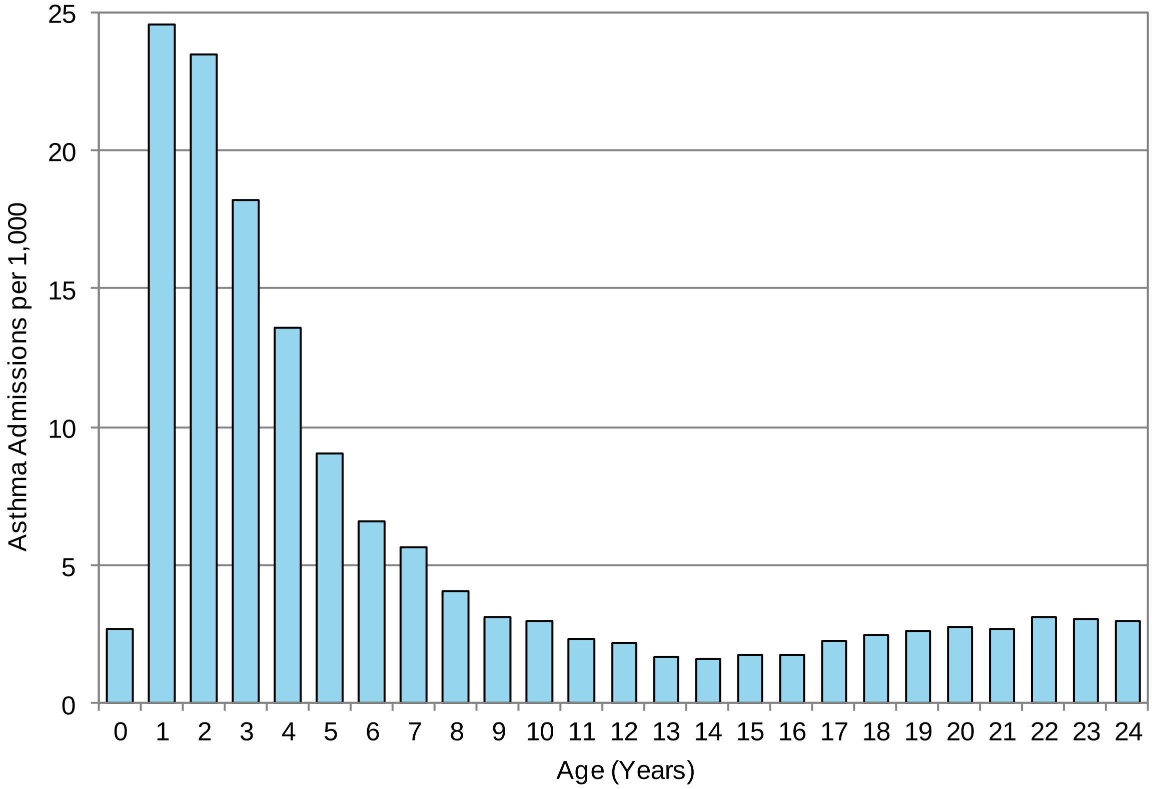
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 29. Acute and Semi-Acute Hospital Admissions for Asthma in Children and Young People Aged 0−24 Years by Ethnicity, New Zealand 2000−2010



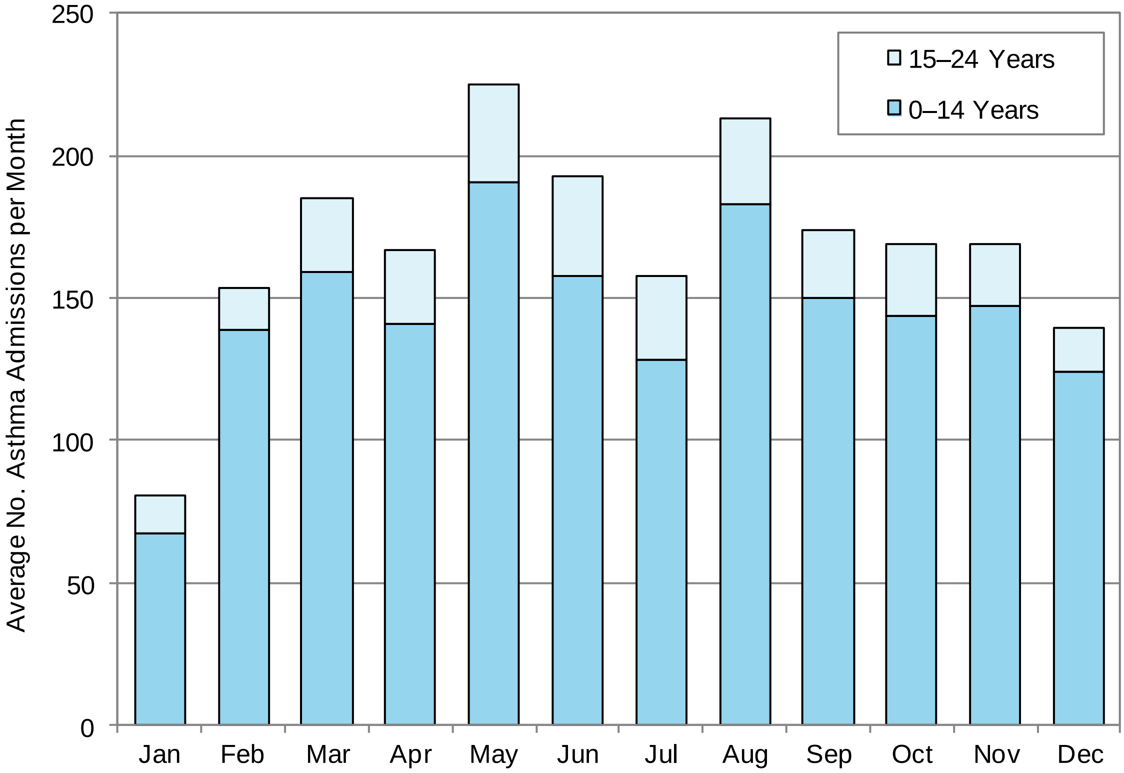
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 30. Acute and Semi-Acute Hospital Admissions for Asthma in Māori Children and Young People by Age, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 31. Average Number of Acute and Semi-Acute Hospital Admissions for Asthma in Māori Children and Young People by Month, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only)

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand during 2000–2010, asthma admissions in children gradually increased, while admissions in young people were more static after 2004–2005. On average during 2000–2008, five New Zealand children or young people each year, died as the result of asthma.

Distribution by Age

In New Zealand during 2006–2010, hospital admissions for asthma were relatively infrequent during infancy but increased rapidly thereafter to reach a peak at 2 years of age. Admissions then declined during early-middle childhood with the lowest rates being seen amongst those in their teens and early twenties. In contrast, asthma deaths were most frequent amongst those in their teens and early twenties.

Distribution by NZDep01 Index Decile and Gender

In New Zealand during 2006–2010, hospital admissions for asthma in children were *significantly* higher for males and those living in average-to-more deprived (NZDep01 decile 3–10) areas. In contrast, asthma admissions in young people were *significantly* higher for females and those living in average-to-more deprived (NZDep01 decile 4–10) areas.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

BRONCHIECTASIS

Introduction

The following section uses the National Minimum Dataset to review hospital admissions for Māori children and young people with bronchiectasis listed in any of the first 15 diagnoses (Note: children and young people with cystic fibrosis as a cause of their bronchiectasis have been excluded from this analysis; for rationale see Methods below).

Background

The term bronchiectasis originates from Greek, literally meaning 'stretching of the windpipe'. Bronchiectasis is usually a progressive disease characterised by bronchial dilatation, with or without associated damage to the bronchial wall and lung tissue, and is usually accompanied by pus within the bronchi. Clinically, bronchiectasis results in a persistent wet cough, with coloured sputum in the older child and recurrent respiratory flare ups [79]. The symptoms result in significant illness, with lost schooldays and multiple absences from work for parents of affected children. Children with extensive bronchiectasis also have a reduced exercise capacity and may have slower growth [79]. Continued problems with untreated or extensive disease may progress to respiratory failure and premature death [80].

In New Zealand bronchiectasis is a disproportionate cause of illness for Māori children and young people, with one study reviewing new cases of bronchiectasis in children (0–14 years) during 2001–2002 finding incidence rates of 4.8 per 100,000 for Māori children, as compared to 1.5 per 100,000 for European children. In this study, Māori children accounted for 30% of the new cases identified [81]. Bronchiectasis also has a marked socioeconomic gradient, with 67% of children in another New Zealand study published in 2003, living in NZDep2001 decile 8–10 areas (the most deprived 30% of areas) and 58% living in households where one or more family members smoked [82]. Yet despite recent advances in diagnosis, the underlying causes of bronchiectasis often remains unclear, with 50% of paediatric cases in the former New Zealand study having an unknown aetiology (although 37% had a history of recurrent lower respiratory infection and a further 25% were presumed secondary to severe pneumonia [82]).

Data Sources and Methods

Indicator

1. *Acute and Semi Acute Hospital Admissions for Children and Young People Aged 0–24 Years with (non-Cystic Fibrosis) Bronchiectasis listed in any of their first 15 diagnoses.*

Numerator: National Minimum Dataset: Acute and semi-acute hospital admissions for children and young people aged 0–24 years with Bronchiectasis (ICD-10-AM J47) in any of the first 15 diagnoses. Admissions with Cystic Fibrosis (ICD-10 E84) in any of the first 15 diagnoses were excluded.

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

2. Mortality from (non-Cystic Fibrosis) Bronchiectasis in Children and Young People Aged 0–24 Years

Numerator: National Mortality Collection; Deaths in children and young people aged 0–24 years where the main underlying cause of death was Bronchiectasis (ICD-10-AM J47) and where Cystic Fibrosis (ICD-10-AM E84) was not listed as a contributory cause.

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: Unless otherwise specified, this analysis focuses on hospital admissions for children and young people with bronchiectasis listed in any of the first 15 diagnoses (rather than on the subset of admissions where bronchiectasis was listed only as the primary diagnosis). The rationale for this wider focus was the fact that many children and young people with bronchiectasis will not be hospitalised for their bronchiectasis per se, but rather for one of its predisposing conditions or resulting complications. For example, during 2005–2009, only 55.4% of hospitalisations for children and young people with bronchiectasis had bronchiectasis listed as the primary diagnosis, with 11.5% having agranulocytosis or immune deficiencies listed as the primary diagnosis, and a further 19.8% having pneumonia and/or other diseases of the respiratory system listed as the primary reason for admission [83].

Note 2: Because children and young people with cystic fibrosis usually develop bronchiectasis over time, and because the epidemiology of cystic fibrosis and non-cystic fibrosis bronchiectasis differ, admissions where cystic fibrosis was mentioned in any of the first 15 diagnoses have been excluded from this analysis.

Note 3: An acute admission is an unplanned admission occurring on the day of presentation, while a semi-acute admission (referred to in the NMDS as an arranged admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary.

Note 4: **Appendix 2** outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

Distribution in Māori Children and Young People

Distribution by Ethnicity

In New Zealand during 2006–2010, hospital admissions for bronchiectasis were *significantly* higher for Māori (RR 6.62 95% CI 5.85–7.49) than for non-Māori non-Pacific children and young people (**Table 27**). Similar ethnic differences were seen during 2000–2010 (**Figure 32**).

Distribution by Age

When broken down by age, hospital admissions for bronchiectasis were relatively infrequent in Māori infants but increased thereafter, to reach a peak at ten years of age. Admissions were less frequent amongst those in their late teens and early twenties (**Figure 33**).

Distribution by Season

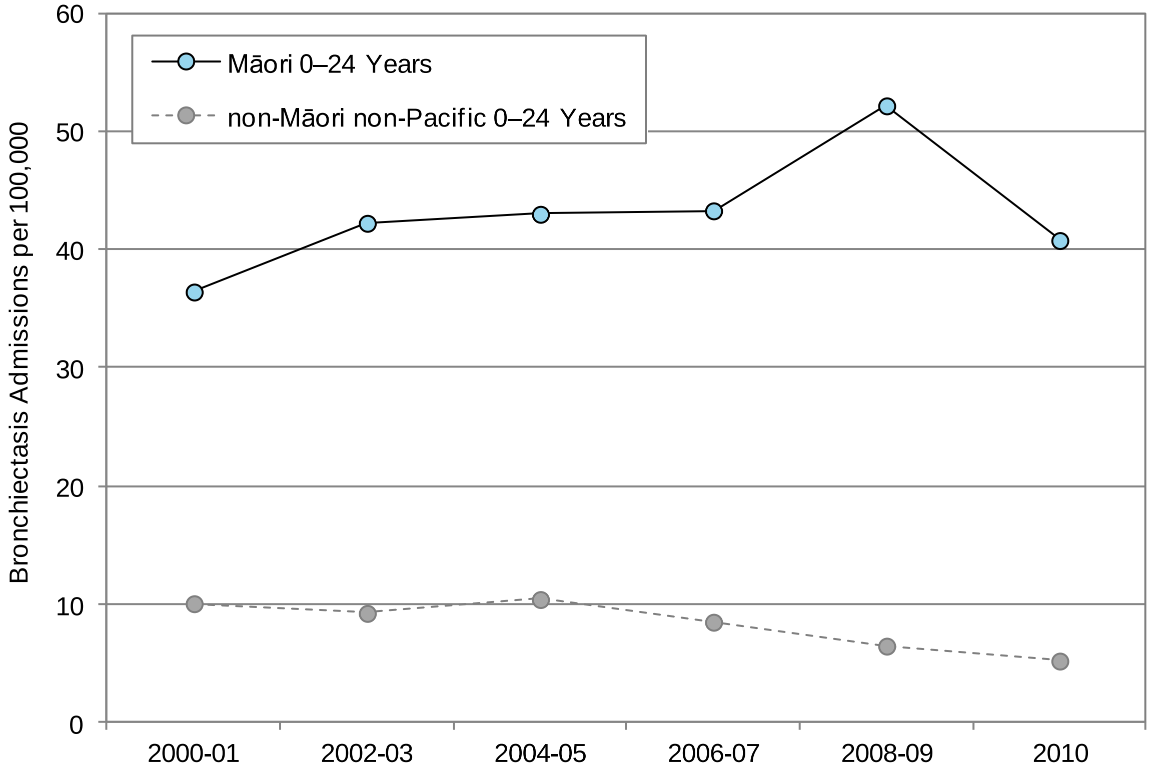
In New Zealand during 2006–2010, there were no consistent seasonal variations in hospital admissions for Māori children and young people with bronchiectasis, although the number of admissions was highest in June and July (**Figure 34**).

Table 27. Acute and Semi-Acute Hospital Admissions for Children and Young People Aged 0−24 Years with Bronchiectasis by Ethnicity, New Zealand 2006−2010

Ethnicity	Number: Total 2006−2010	Number: Annual Average	Rate per 100,000	Rate Ratio	95% CI
Bronchiectasis					
Māori	779	155.8	46.35	6.62	5.85 – 7.49
non-Māori non-Pacific	369	73.8	7.00	1.00	

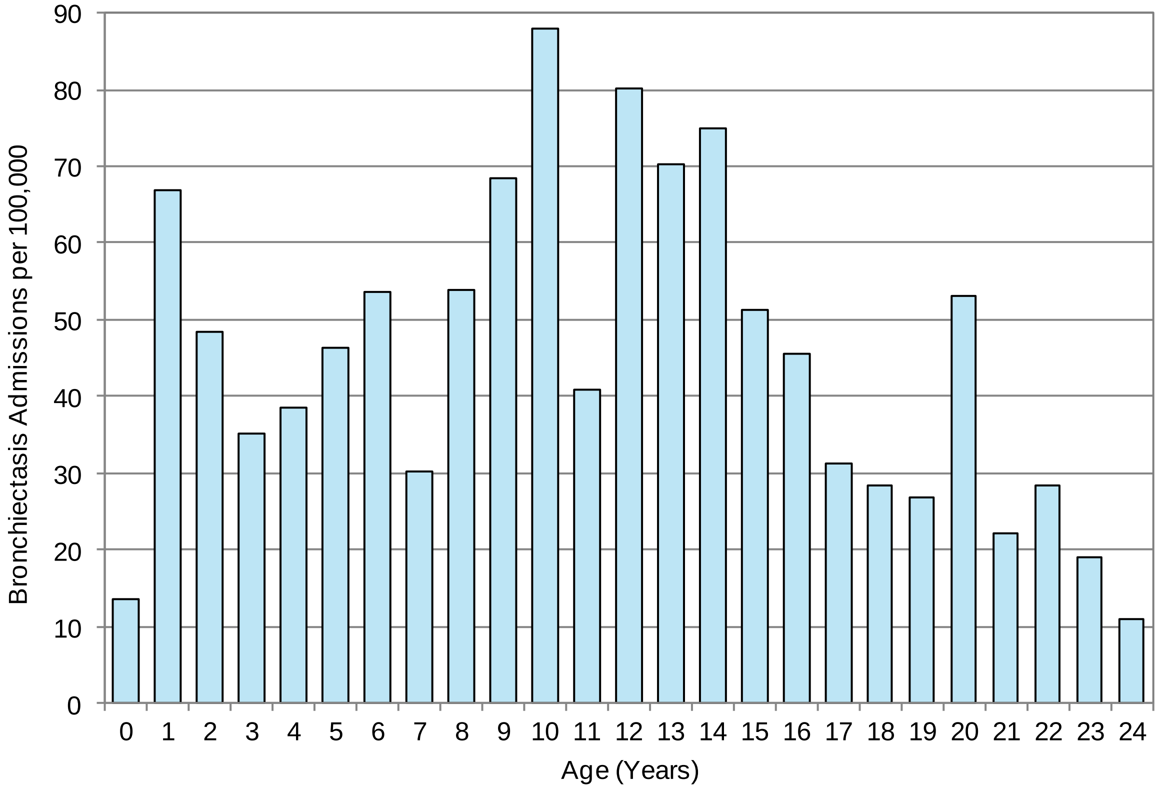
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions with bronchiectasis listed in any of the first 15 diagnoses (cystic fibrosis cases excluded)); Denominator: Statistics NZ Estimated Resident Population

Figure 32. Acute and Semi-Acute Hospital Admissions for Children and Young People Aged 0−24 Years with Bronchiectasis by Ethnicity, New Zealand 2000−2010



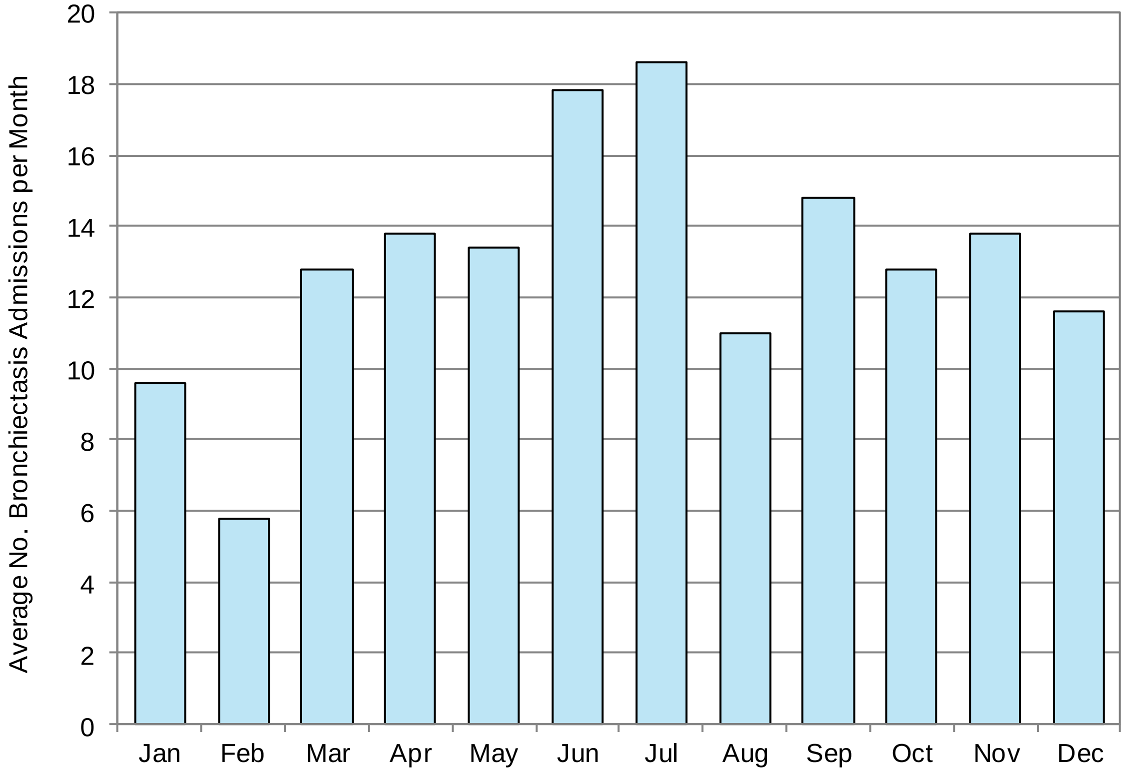
Source: Numerator: National Minimum Dataset (acute and semi-acute admissions with bronchiectasis listed in any of first 15 diagnoses (cystic fibrosis cases excluded)); Denominator: Statistics NZ Estimated Resident Population

Figure 33. Acute and Semi-Acute Hospital Admissions for Māori Children and Young People with Bronchiectasis by Age, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions with bronchiectasis in any of first 15 diagnoses (cystic fibrosis cases excluded); Denominator: Statistics NZ Estimated Resident Population

Figure 34. Average Number of Acute and Semi-Acute Hospital Admissions for Māori Children and Young People Aged 0−24 Years with Bronchiectasis by Month, New Zealand 2006−2010



Source: National Minimum Dataset (Acute and semi-acute admissions with bronchiectasis listed in any of the first 15 diagnoses (cystic fibrosis cases excluded))

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand, hospital admissions for children and young people with bronchiectasis increased during the early 2000s, reached a peak in 2004–05 and then declined. During 2000–2008, a total of six New Zealand children or young people had bronchiectasis listed as their main underlying cause of death.

Distribution by Age

In New Zealand during 2006–2010, hospital admissions for children and young people with bronchiectasis increased rapidly after the first year of life, with rates remaining elevated during childhood, but dropping away amongst those in their teens and early twenties. No consistent age related patterns were evident however, for bronchiectasis deaths during 2004–2008.

Distribution by NZDep01 Index Decile and Gender

In New Zealand during 2006–2010, hospital admissions for children and young people with bronchiectasis were *significantly* higher for those in average-to-more deprived (NZDep01 decile 3–10) areas, although no significant gender differences were evident.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

INFECTIOUS DISEASES

PERTUSSIS

Introduction

The following section reviews hospital admissions for pertussis in Māori infants aged <1 year using information from the National Minimum Dataset.

Background

Pertussis (whooping cough) is a highly contagious respiratory tract infection caused by the bacterium *Bordetella pertussis*. It is spread by aerosol droplets. Neither vaccination nor natural disease provides complete or lifelong immunity. "Classic" pertussis follows an incubation period of a few days to a few weeks and is recognised as having three stages: a catarrhal stage with a runny nose and sneezing (1–2 weeks), a paroxysmal stage (2–6 weeks) in which prolonged bursts of uninterrupted coughing are followed by a characteristic inspiratory whoop, and a convalescent stage (2+ weeks). Young infants, who make up over 90% of the fatalities from pertussis, do not display the classic stages and apnoea and cyanosis may be the only signs of the disease initially. Young infants suspected of having pertussis need hospitalisation and the most severely affected can require intubation, drug-induced paralysis and ventilation [84].

In New Zealand, hospital admissions for pertussis are higher for Māori infants than for European infants. In one study, which used active surveillance to identify all infants admitted to hospital in New Zealand with pertussis between 1st August 2004 and 31st July 2005, 47 of the 110 infants (43%) hospitalised with pertussis were Māori and admission rates for Māori infants were more than twice those of European infants (RR 2.52, 95% CI 1.66 - 3.86). There was little difference, however, between the proportions of Māori and European infants aged 6+ weeks who had not been immunised (50% and 54% respectively), or the proportions who had received all of their immunisations (40% and 43%). The study authors concluded that socioeconomic factors, including larger households which increased the chances of an infant coming into contact with pertussis, may have accounted for some of the ethnic differences seen [85].

In terms of reducing the burden of disease, improving the coverage and timeliness of infant vaccination is crucial. The Global Pertussis Initiative also recommends universal preschool booster doses, adolescent immunisation, and adult immunisation; selective immunisation of new mothers, family, and close contacts of newborns (the "cocoon strategy"); and the selective immunisation of healthcare workers and childcare workers [86,87].

Data Sources and Methods

Indicator

1. *Acute and Semi-Acute Hospital Admissions for Pertussis in Infants Aged <1 Year*

Numerator: National Minimum Dataset: Acute and semi-acute hospital admissions for infants aged <1 Year with an ICD-10-AM primary diagnosis of Pertussis/Whooping Cough: Whooping cough due to *Bordetella pertussis* (A37.0); Whooping cough due to *Bordetella parapertussis* (A37.1); Whooping cough due to other *Bordetella* species (A37.8); Whooping cough, unspecified (A37.9).

Denominator: Birth Registration Dataset

2. Mortality from Pertussis in Infants Aged <1 Year

Numerator: National Mortality Collection: Deaths in Infants Aged <1 Year where the main underlying cause of death was Pertussis/Whooping Cough: Whooping cough due to *Bordetella pertussis* (A37.0); Whooping cough due to *Bordetella parapertussis* (A37.1); Whooping cough due to other *Bordetella* species (A37.8); Whooping cough, unspecified (A37.9).

Denominator: Birth Registration Dataset

Notes on Interpretation

Note 1: An acute admission is an unplanned admission occurring on the day of presentation, while a semi-acute admission (referred to in the NMDS as an arranged admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary.

Note 2: **Appendix 2** outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

Distribution in Māori Babies

Distribution by Ethnicity

In New Zealand during 2006–2010, hospital admissions for pertussis were *significantly* higher for Māori (RR 2.43 95% CI 1.90–3.11) than for non-Māori non-Pacific infants (**Table 28**). Similar ethnic differences were seen during 2000–2010 (Note: 2000 was the peak of a large pertussis epidemic, with rates in the previous year being much lower. Thus the trends presented reflect episodic epidemics, rather than a consistent downward trend (**Figure 35**)).

Distribution by Age

When broken down by age, pertussis admissions were highest in Māori infants aged less than one year, with admissions being very infrequent in older children and young people (**Figure 36**).

Distribution by Season

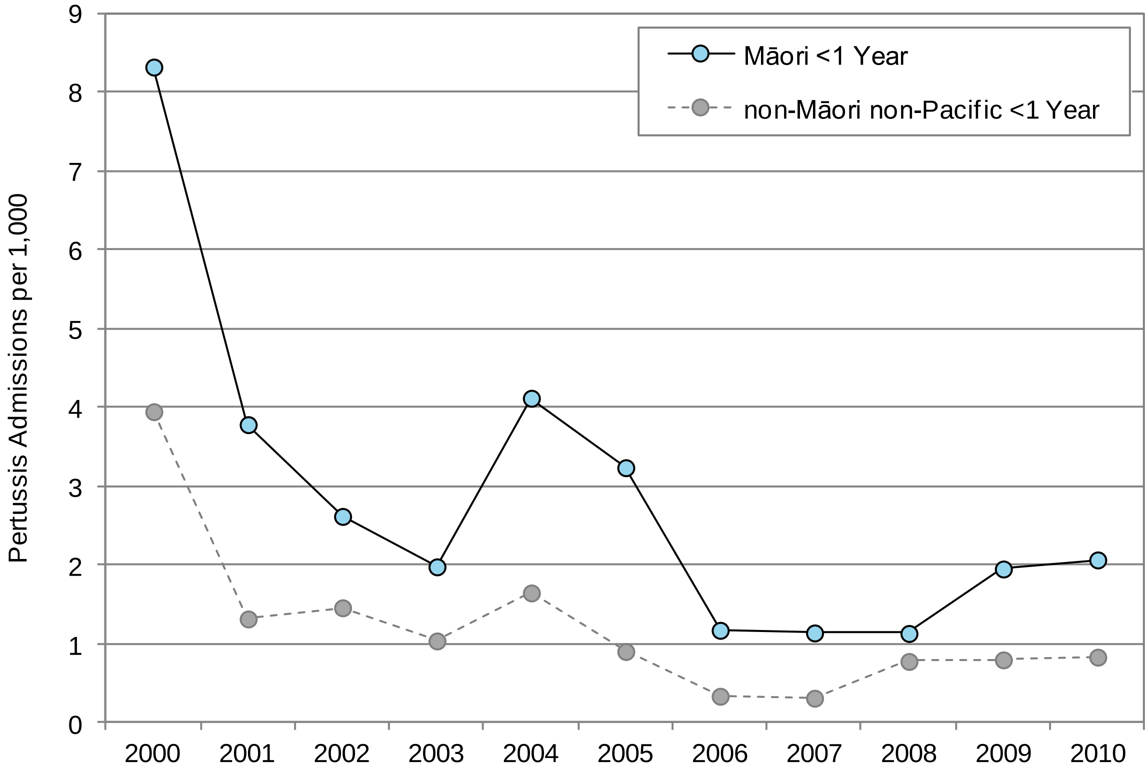
In New Zealand during 2006–2010, there were no consistent seasonal variations in hospital admissions for pertussis in Māori infants (**Figure 37**).

Table 28. Acute and Semi-Acute Hospital Admissions for Pertussis in Infants <1 Year by Ethnicity, New Zealand 2006−2010

Ethnicity	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Pertussis					
Infants <1 Year					
Māori	140	28.0	1.49	2.43	1.90 – 3.11
non-Māori non-Pacific	116	23.2	0.61	1.00	

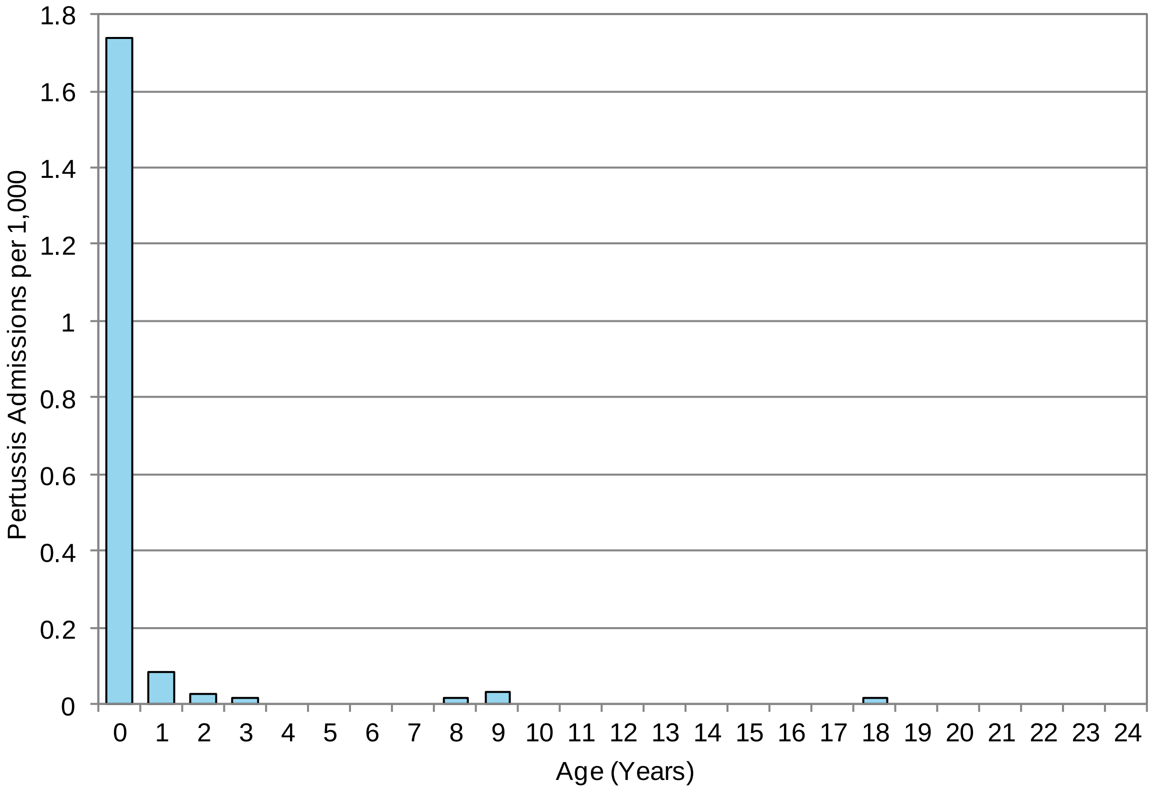
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Birth Registration Dataset

Figure 35. Acute and Semi-Acute Hospital Admissions for Pertussis in Infants <1 Year by Ethnicity, New Zealand 2000−2010



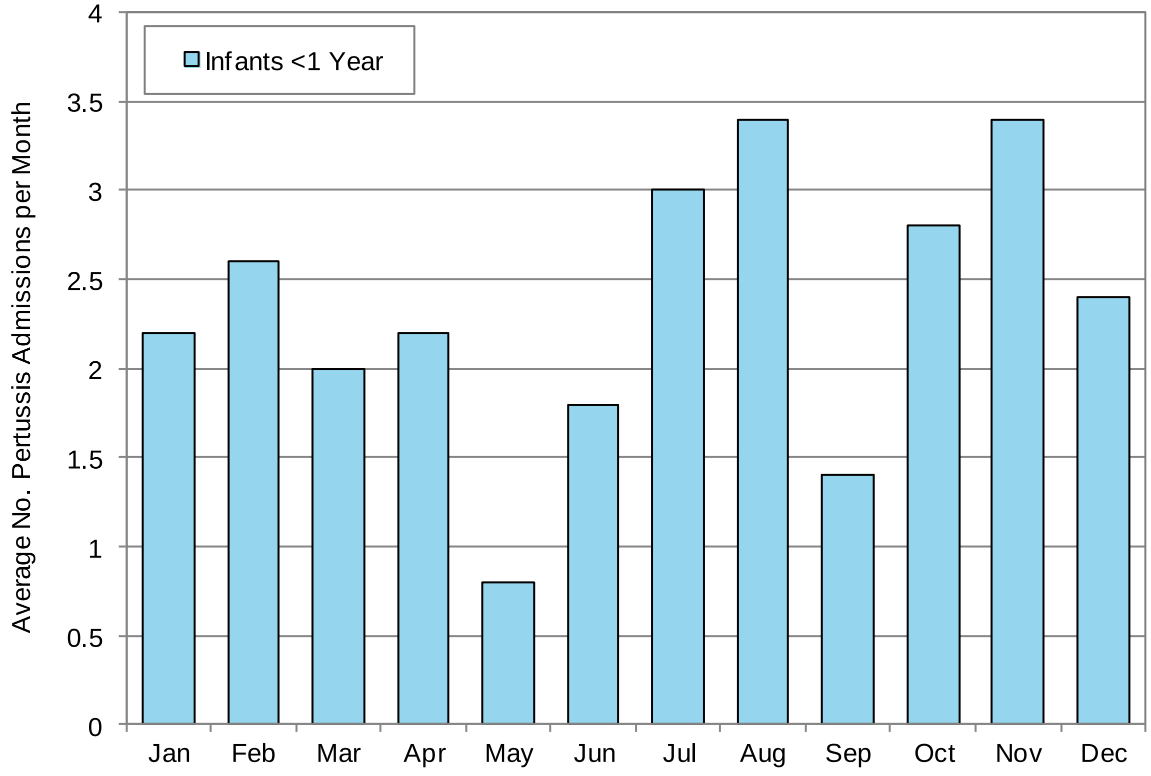
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Birth Registration Dataset

Figure 36. Acute and Semi-Acute Hospital Admissions for Pertussis in Māori Children by Age, New Zealand 2006–2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 37. Average Number of Acute and Semi-Acute Hospital Admissions for Pertussis in Māori Infants <1 Year by Month, New Zealand 2006−2010



Source: National Minimum Dataset (Acute and semi-acute admissions only)

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand during 2000–2010, hospital admissions for pertussis in infants fluctuated, with peaks occurring in 2000 and 2004. Admission rates reached their lowest point in 2007, with rates increasing gradually thereafter. In addition, during the early-mid 2000s one infant each year died from pertussis, although no pertussis deaths occurred during 2006–2008. (Note: The rates seen in 2000 represent the tip of a peak, with the rates immediately prior to this being much lower. Thus rates during this period reflect a series of episodic peaks, rather than an overall downward trend).

Distribution by Age

In New Zealand during 2006–2010, hospital admissions for pertussis were highest in infants aged less than one year, with rates declining rapidly with increasing age thereafter. Similarly, during 2004–2008, all pertussis deaths in children and young people occurred in infants less than one year of age.

Distribution by NZDep01 Index Decile and Gender

In New Zealand during 2006–2010, hospital admissions for pertussis were *significantly* higher for those from more deprived (NZDep01 decile 5–10) areas, although no significant gender differences were evident.

Distribution by Season

In New Zealand during 2006–2010 there were no consistent seasonal differences in hospital admissions for pertussis in infants less than one year of age.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

MENINGOCOCCAL DISEASE

Introduction

The following section explores hospital admissions for meningococcal disease in Māori children and young people using information from the National Minimum Dataset.

Background

Neisseria meningitidis is a bacteria and its only known natural reservoir is the upper airways of humans [88]. Carriage without symptoms is common, with most cases of the disease being acquired through contact with the respiratory droplets of asymptomatic carriers [89]. The onset of symptoms of meningococcal meningitis is often sudden and death can follow within hours, therefore prompt treatment with appropriate antibiotics is vital. Survivors may be left with severe disabilities including deafness, loss of limbs, cognitive impairments and paralysis [90].

There are a number of different strains of *Neisseria meningitidis*. An epidemic of meningococcal disease due to a specific Group B strain began in New Zealand in 1991. A strain-specific vaccine was developed and introduced into the immunisation schedule in 2004. While the epidemic was already waning by this time, the number of cases due to the epidemic strain fell significantly after the vaccine was introduced [91]. The vaccine was thus withdrawn in 2008 [92].

Since then, the Institute of Environmental Science and Research (ESR) has reported regularly on the epidemiology of meningococcal disease [91], with its most recent report noting 96 meningococcal disease notifications in 2010. Age-standardised rates for Māori (5.0 per 100,000, 42 cases) were, as in previous years, higher than for Europeans (1.5 per 100,000, 35 cases). Rates for Māori infants however were 99.8 per 100,000, as compared to 20.2 per 100,000 for European infants. There were also marked differences between Māori and Europeans in the median age for meningococcal disease notification (1.5 years in Māori vs. 18.0 years for Europeans). However, meningococcal disease notifications in 2010 for Māori were only 19.5% of those notified in 2001 (when they were 25.7 per 100,000) [91].

Data Sources and Methods

Indicator

1. *Acute and Semi Acute Hospital Admissions for Meningococcal Disease in Children and Young People Aged 0–24 Years*

Numerator: National Minimum Dataset: Acute and semi-acute hospital admissions for children and young people aged 0–24 years with an ICD-10-AM primary diagnosis of Meningococcal Disease, including meningococcal meningitis (A39).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

2. Mortality from Meningococcal Disease in Children and Young People Aged 0–24 Years

Numerator: National Mortality Collection; Deaths in children and young people aged 0–24 years where the main underlying cause of death was Meningococcal Disease, including meningococcal meningitis (A39).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: In the National Minimum Dataset and the National Mortality Collection it is not possible to identify the specific group of meningococcal disease (e.g. Group A, B or C) responsible for the admission/death. However it is likely that a mix of group B and C strains predominated, with the ESR's review of meningococcal disease notifications during 2011 finding that of the 100 notified cases (92.6% of all notifications) where the strain type was identified, 37.0% were group B:P1.7-2,4 and 27.0% were group C:P1.5-1,10-8 [91].

Note 2: An acute admission is an unplanned admission occurring on the day of presentation, while a semi-acute admission (referred to in the NMDS as an arranged admission) is a non-acute admission <7 days after the date the decision was made that the admission was necessary.

Distribution in Māori Children and Young People

Distribution by Ethnicity

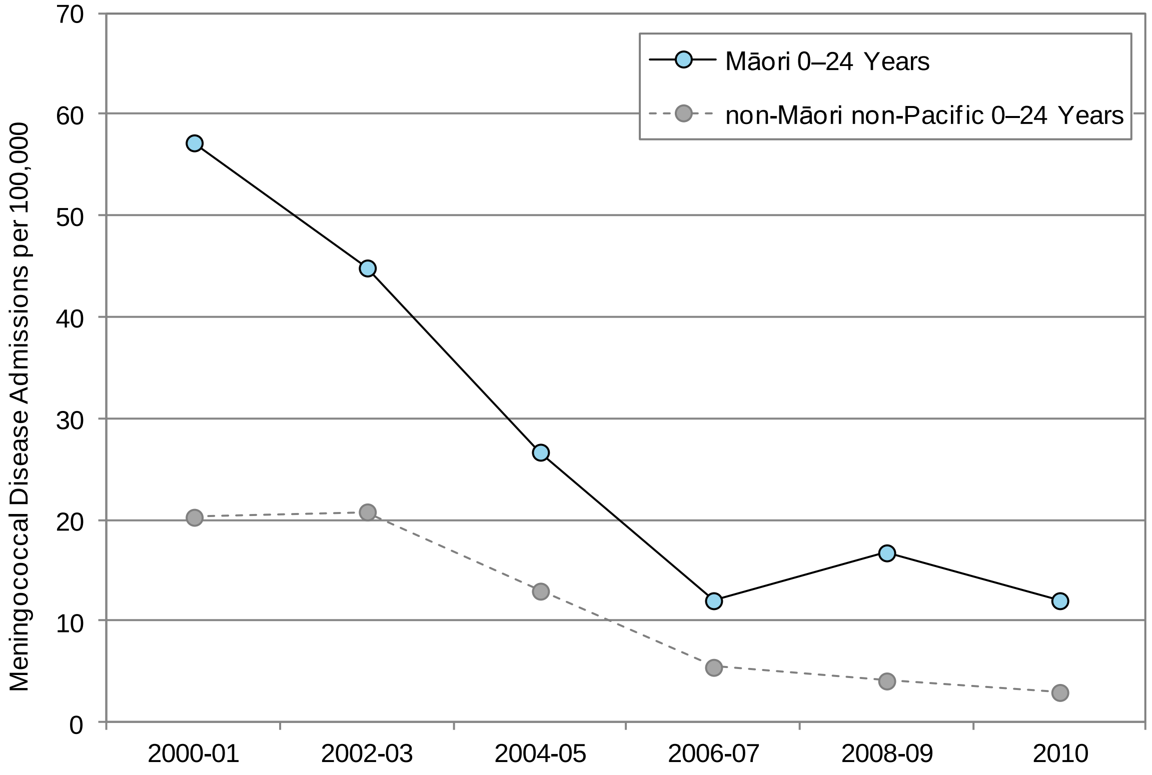
In New Zealand during 2006−2010, hospital admissions for meningococcal disease were *significantly* higher for Māori (RR 3.16 95% CI 2.64–3.79) than for non-Māori non-Pacific children and young people (**Table 29**). While similar ethnic differences were seen during 2000−2010, admission rates for Māori children and young people declined during this period, with the most rapid declines occurring between 2000−01 and 2006−07 (**Figure 38**).

Table 29. Acute and Semi-Acute Hospital Admissions for Meningococcal Disease in Children and Young People Aged 0−24 Years by Ethnicity, New Zealand 2006−2010

Ethnicity	Number: Total 2006−2010	Number: Annual Average	Rate per 100,000	Rate Ratio	95% CI
Meningococcal Disease					
Children and Young People 0–24 Years					
Māori	234	46.8	13.92	3.16	2.64 – 3.79
non-Māori non-Pacific	232	46.4	4.40	1.00	

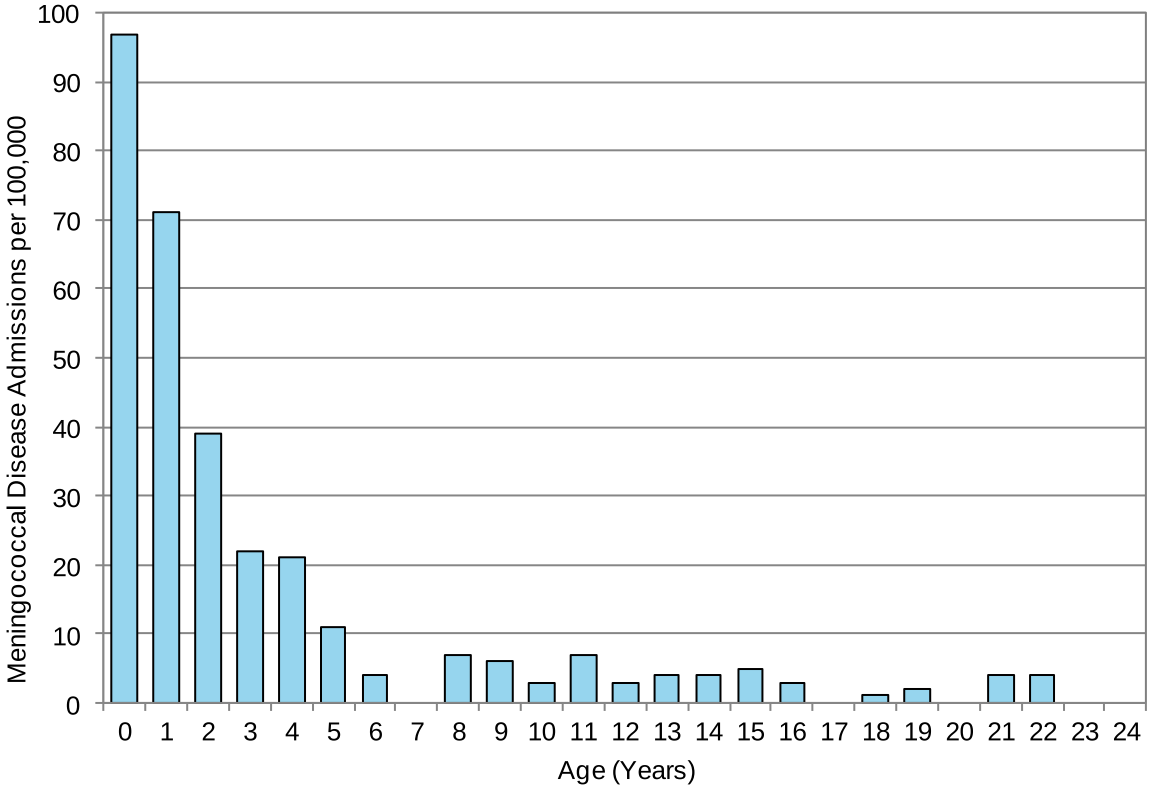
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 38. Acute and Semi-Acute Hospital Admissions for Meningococcal Disease in Children and Young People Aged 0−24 Years by Ethnicity, New Zealand 2000−2010



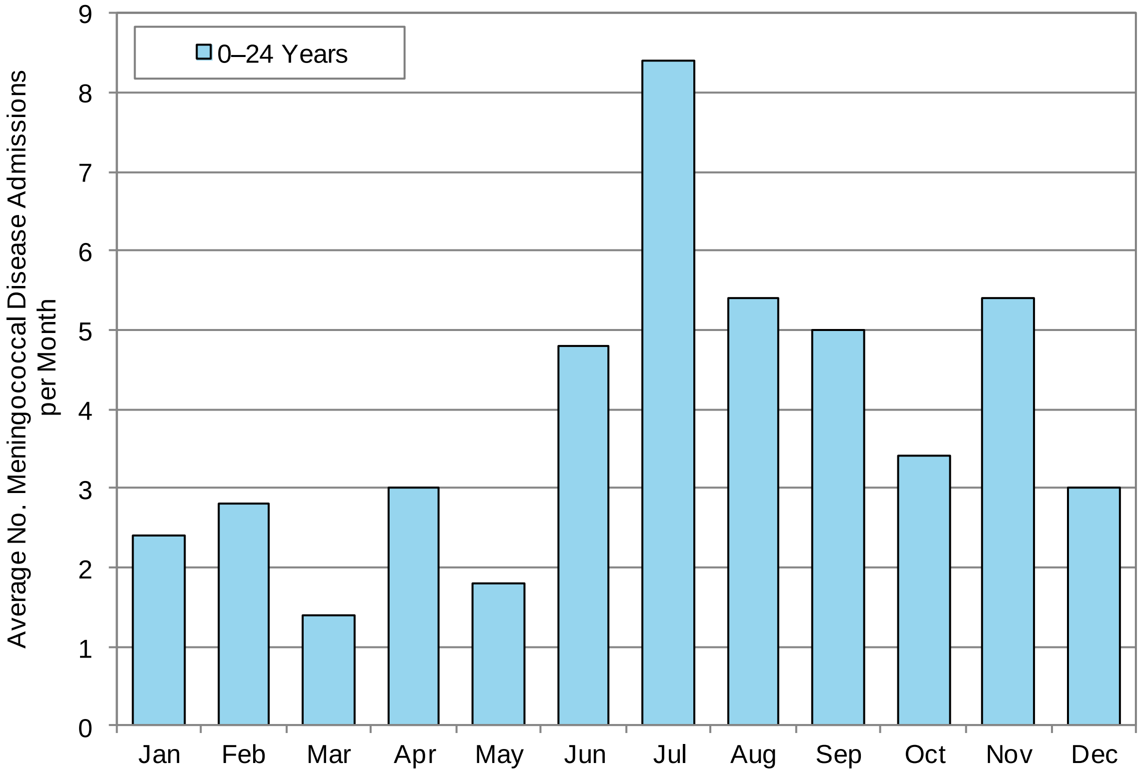
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 39. Acute and Semi-Acute Hospital Admissions for Meningococcal Disease in Māori Children and Young People by Age, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 40. Average Number of Acute and Semi-Acute Hospital Admissions for Meningococcal Disease in Māori Children and Young People Aged 0−24 Years by Month, New Zealand 2006−2010



Source: National Minimum Dataset (Acute and semi-acute admissions only)

Distribution by Age

When broken down by age, meningococcal disease admissions were highest in Māori infants aged less than one year, with rates then declining during the preschool years and becoming relatively infrequent after six years of age (**Figure 39**).

Distribution by Season

In New Zealand during 2006–2010, there were no consistent seasonal variations in hospital admissions for meningococcal disease in Māori children and young people, although the largest number of admission occurred in July (care should be taken when interpreting these figures due to the small number of cases involved) (**Figure 40**).

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand, hospital admissions for meningococcal disease in children and young people declined rapidly during the early-mid 2000s, but became more static after 2006–07. Similar patterns were seen for mortality during 2000–2008, although the number of deaths in 2008 (n=7) was higher than in the previous four years (average n=3.5).

Distribution by Age

In New Zealand during 2006–2010, hospital admissions for meningococcal disease were highest in infants <1 Year, followed by those <5 years of age. Mortality during 2004–2008 was also highest in infants, followed by those <3 years of age, although a small number of deaths also occurred amongst those in their late teens and early twenties.

Distribution by NZDep01 Index Decile and Gender

In New Zealand during 2006–2010, hospital admissions for meningococcal disease were *significantly* higher for males and for children and young people living in more deprived (NZDep01 decile 5–10) areas.

Distribution by Season

In New Zealand during 2006–2010, hospital admissions for meningococcal disease were highest during the winter months.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

TUBERCULOSIS

Introduction

The following section explores hospital admissions for tuberculosis in Māori children and young people using information from the National Minimum Dataset.

Background

Tuberculosis (TB) is caused by *Mycobacterium tuberculosis.* Infection usually occurs as the result of inhaling infected droplets produced by someone who has pulmonary TB. Primary infections in children are often asymptomatic, self-healing and can remain completely unnoticed unless discovered by Mantoux testing. In a minority of cases latent infection progresses to active TB. The risk of progression is greater in the very young, or those who are immunocompromised (e.g. persons with HIV). Symptoms of active pulmonary TB include a chronic cough, fever and weight loss, or failure to thrive. Tuberculosis can also spread from the lungs to other sites including the lymph nodes, the meninges, the pleura, the peritoneum, the joints, and the pericardium [93].

In New Zealand, as in other developed countries, annual notifications for TB declined steadily after World War Two [94]. Between 1980 and 2010 annual notifications fell further, from 15.1 per 100,000 to 7.0 per 100,000, although there was little change from 2005 to 2010 [95]. A 2006 review of TB in New Zealand children, however, reported a resurgence in TB cases between 1992 and 2001, with childhood TB rates being highest in those under five years of age. The report also noted significant ethnic disparities, with disease rates being 6.4 per 100,000 for Māori children as compared to 0.6 per 100,000 for European children. Most cases were identified through contact tracing or immigrant screening and almost half were part of outbreaks [96].

From a public health perspective, the mainstays of controlling TB infection remain the BCG vaccination of high risk neonates, case finding with treatment of active and latent infections, contact tracing and the selective screening of high risk groups [72,97].

Data Sources and Methods

Indicator

1. *Acute and Semi Acute Hospital Admissions for Tuberculosis in Children and Young People 0–24 Years*

Numerator: National Minimum Dataset: Acute and semi-acute hospital admissions for children and young people aged 0–24 years with an ICD-10-AM primary diagnosis of Tuberculosis (A15–A19).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

2. Mortality from Tuberculosis in Children and Young People 0–24 Years

Numerator: National Mortality Collection; Deaths in children and young people aged 0–24 years where the main underlying cause of death was Tuberculosis (A15–A19).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: An acute admission is an unplanned admission occurring on the day of presentation, while a semi-acute admission (referred to in the NMDS as an arranged admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary.

Note 2: **Appendix 2** outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

Distribution in Māori Children and Young People

Distribution by Ethnicity

In New Zealand during 2006–2010, hospital admissions for tuberculosis in Māori children and young people were not *significantly* different from those for non-Māori non-Pacific children and young people (**Table 30**). While similar patterns were seen during 2000−2010, tuberculosis admissions for both Māori and non-Māori non-Pacific children and young people declined during this period (**Figure 41**).

Distribution by Age

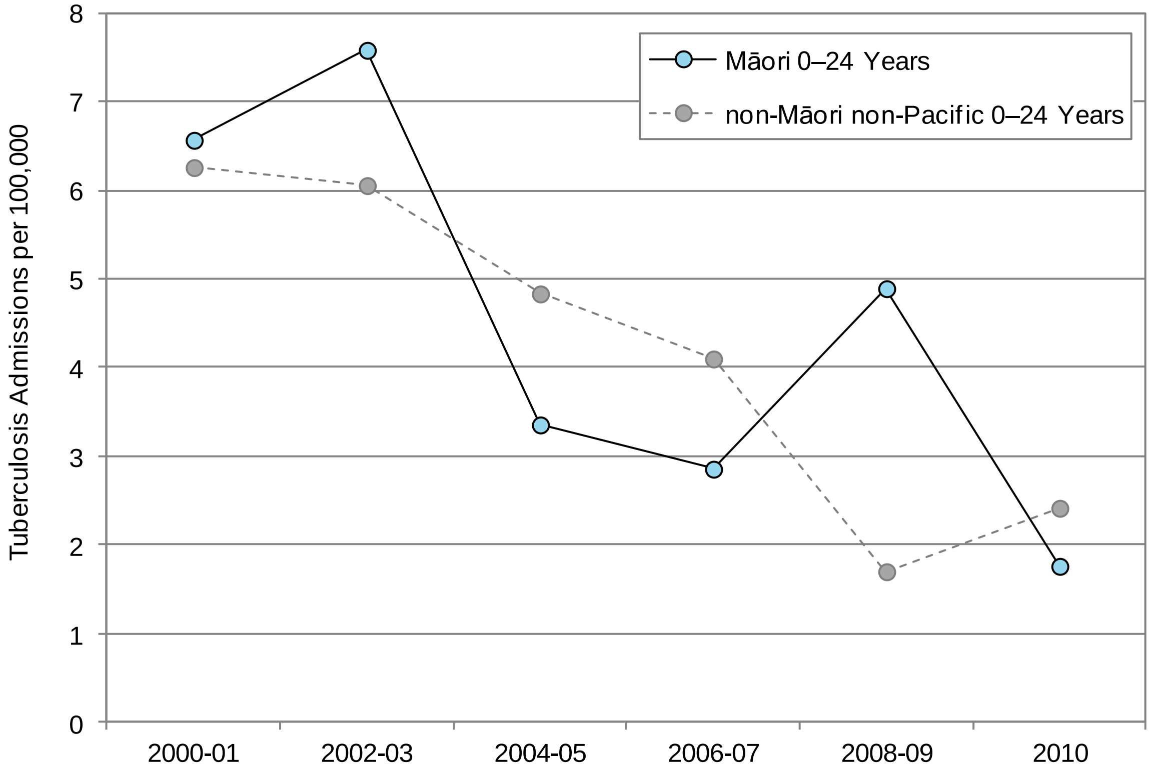
When broken down by age, hospital admissions for tuberculosis were most frequent amongst Māori young people in their teens and early twenties, although a small number of admissions also occurred in children under five years of age (**Figure 42**).

Table 30. Acute and Semi-Acute Hospital Admissions for Tuberculosis in Children and Young People Aged 0−24 Years by Ethnicity, New Zealand 2006−2010

Ethnicity	Number: Total 2006−2010	Number: Annual Average	Rate per 100,000	Rate Ratio	95% CI
Tuberculosis					
Children and Young People 0–24 Years					
Māori	58	11.6	3.45	1.24	0.91 – 1.68
non-Māori non-Pacific	147	29.4	2.79	1.00	

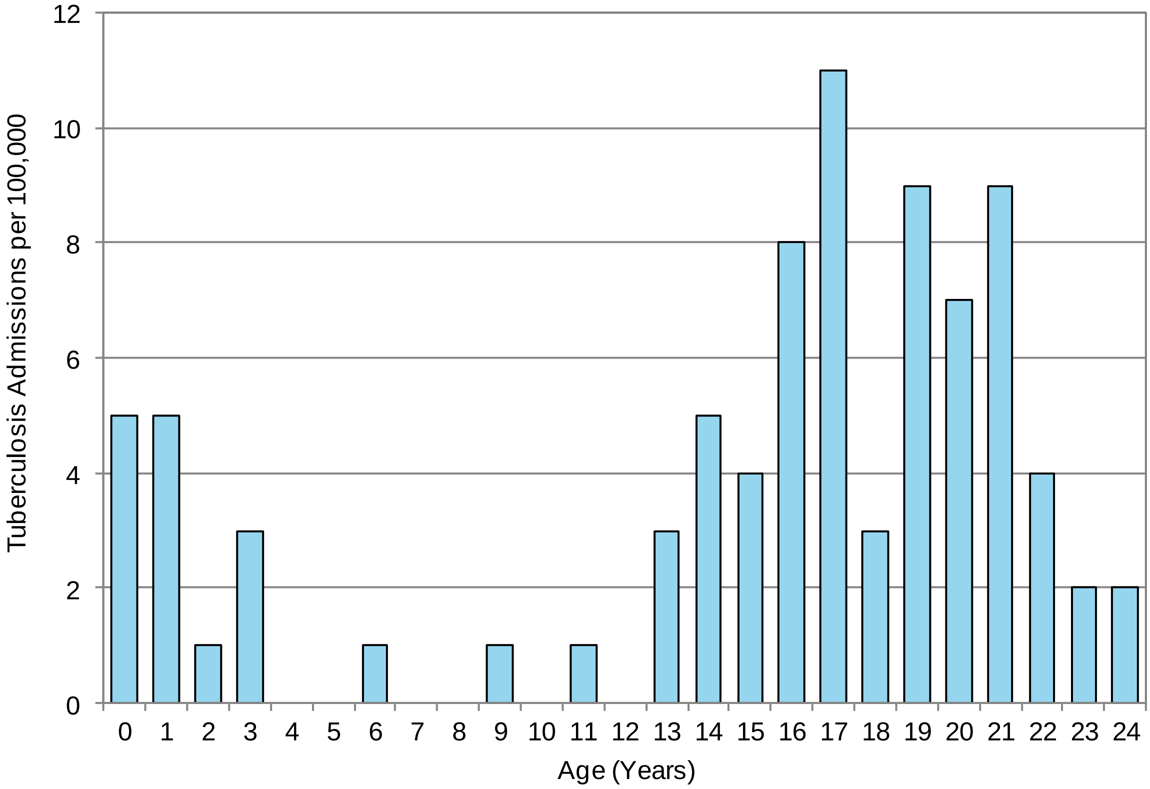
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 41. Acute and Semi-Acute Hospital Admissions for Tuberculosis in Children and Young People Aged 0−24 Years by Ethnicity, New Zealand 2000−2010



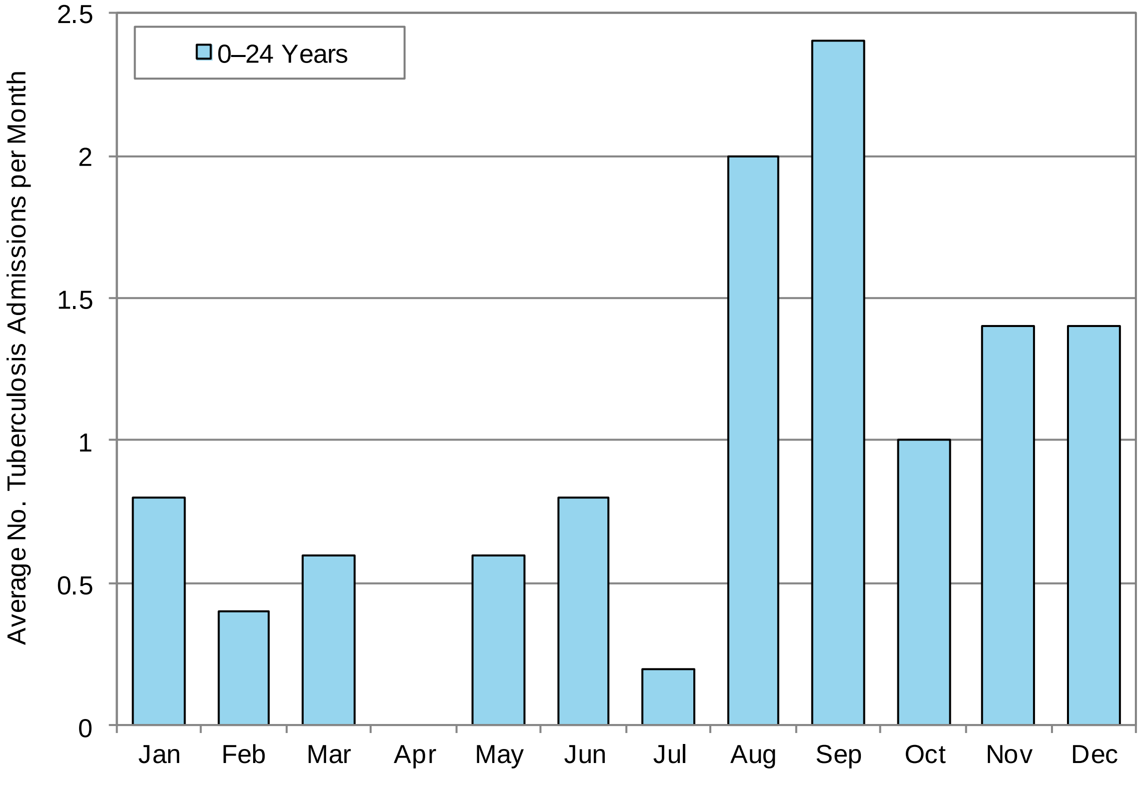
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only): Statistics NZ Estimated Resident Population

Figure 42. Acute and Semi-Acute Hospital Admissions for Tuberculosis in Māori Children and Young People by Age, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 43. Average Number of Acute and Semi-Acute Hospital Admissions for Tuberculosis in Māori Children and Young People Aged 0−24 Years by Month, New Zealand 2006−2010



Source: National Minimum Dataset (Acute and semi-acute admissions only)

Distribution by Season

In New Zealand during 2006–2010, there were no consistent seasonal variations in hospital admissions for tuberculosis in Māori children and young people (**Figure 43**).

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand, hospital admissions for tuberculosis in children and young people declined after 2002–03, although a small upswing in rates was evident in 2010. During 2000–2008, one child or young person died as the result of tuberculosis.

Distribution by Age

In New Zealand during 2006–2010, hospital admissions for tuberculosis were highest amongst those in their late teens and early twenties. During 2004–2008, no children or young people died as a result of tuberculosis.

Distribution by NZDep01 Index Decile and Gender

In New Zealand during 2006–2010, hospital admissions for tuberculosis were *significantly* higher for those from more deprived (NZDep01 decile 5–10) areas although no significant gender differences were evident.

Distribution by Season

In New Zealand during 2006–2010, there were no consistent seasonal variations in hospital admissions for tuberculosis in children and young people, although admissions were lowest in April–June.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

RHEUMATIC FEVER AND HEART DISEASE

Introduction

The following section uses the National Minimum Dataset to review hospital admissions for Māori children and young people with acute rheumatic fever or chronic rheumatic heart disease listed in any of the first 15 diagnoses.

Background

Acute rheumatic fever is a delayed inflammatory reaction which develops in response to a group A streptococcal throat infection. It usually occurs in school-age children and may affect the brain, heart, joints, skin or subcutaneous tissue [98]. Recurrent episodes of rheumatic fever may result in the development of rheumatic heart disease, a progressive condition leading to damage, scarring and deformities of the heart valves and chordae tendineae [98].

In New Zealand, acute rheumatic fever and rheumatic heart disease are a significant cause of morbidity amongst Māori children and young people, with one review of acute rheumatic fever hospitalisations during 1996–2005 finding that admission rates for Māori were 10.0 (95% CI 1.7–58.3) times higher than for European/Other peoples. In this cohort, Māori accounted for almost 50% of the total number of cases seen [52]. Risk factors for rheumatic fever include age (school age children), socioeconomic disadvantage and overcrowding [99]. Primary prevention focuses on the adequate treatment of streptococcal throat infections, while secondary prevention aims to ensure that those previously diagnosed with rheumatic fever receive monthly antibiotic prophylaxis, either for 10 years from their first diagnosis or until 21 years of age, to prevent sequelae [99].

Data Sources and Methods

Indicator

1. *Acute and Semi Acute Hospital Admissions for Children and Young People Aged 0–24 Years with Acute Rheumatic Fever or Rheumatic Heart Disease listed in any of their first 15 diagnoses.*

Numerator: National Minimum Dataset: Acute and semi-acute hospital admissions for children and young people aged 0–24 years with Acute Rheumatic Fever (ICD-10-AM I00–I02) or Chronic Rheumatic Heart Disease (I05–I09) listed in any of the first 15 diagnoses.

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

2. Mortality from Acute Rheumatic Fever or Rheumatic Heart Disease in Children & Young People 0–24 Years

Numerator: National Mortality Collection; Deaths in children and young people aged 0–24 years where the main underlying cause of death was Acute Rheumatic Fever or Rheumatic Heart Disease (I00–I09).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: Unless otherwise specified, this analysis focuses on hospital admissions for children and young people with either acute rheumatic fever or chronic rheumatic heart disease listed in any of the first 15 diagnoses (rather than on the subset of admissions where these diagnoses were listed only as the primary diagnosis). The rationale for this wider focus was the fact that many children and young people with chronic rheumatic heart disease will not be hospitalised for their heart disease per se, but rather for one of its resulting complications. For example, during 2005–2009 only 39.0% of hospitalisations for children and young people with rheumatic heart disease had this listed as the primary diagnosis, with 11.8% being admitted for pregnancy and childbirth, and 11.0% for other cardiovascular diagnoses [83].

Note 2: An acute admission is an unplanned admission occurring on the day of presentation, while a semi-acute admission (referred to in the NMDS as an arranged admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary.

Distribution in Māori Children and Young People

Distribution by Ethnicity

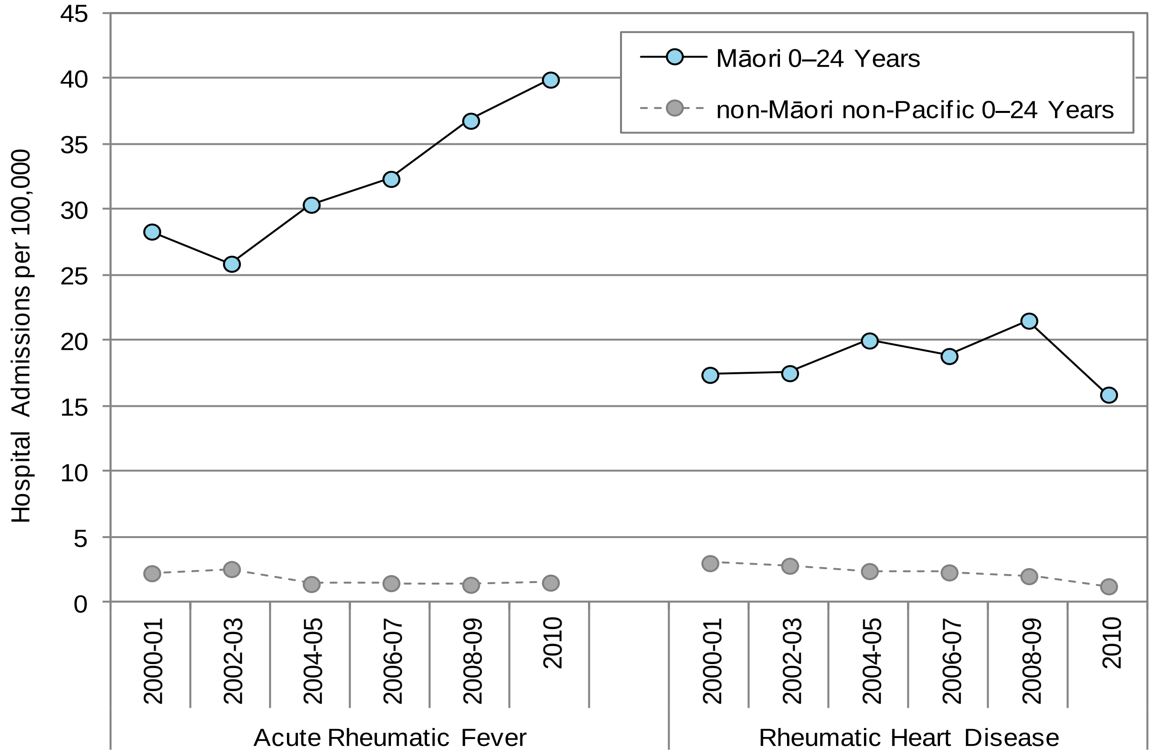
In New Zealand during 2006–2010, hospital admissions for those with acute rheumatic fever (RR 25.38 95% CI 19.93–32.31) and rheumatic heart disease (RR 9.96 95% CI 7.97–12.44) were both *significantly* higher for Māori than for non-Māori non-Pacific children and young people (**Table 31**). During 2000–2010, admissions for acute rheumatic fever in Māori children and young people increased, leading to an increase in ethnic differences during this period. Admissions for those with rheumatic heart disease however were more static (**Figure 44**).

Table 31. Acute and Semi-Acute Hospital Admissions for Acute Rheumatic Fever and Rheumatic Heart Disease in Children and Young People Aged 0−24 Years by Ethnicity, New Zealand 2006–2010

Ethnicity	Number: Total 2006−2010	Number: Annual Average	Rate per 100,000	Rate Ratio	95% CI
Acute Rheumatic Fever					
Māori	599	119.8	35.64	25.38	19.93 – 32.31
non-Māori non-Pacific	74	14.8	1.40	1.00	
Rheumatic Heart Disease					
Māori	324	64.8	19.28	9.96	7.97 – 12.44
non-Māori non-Pacific	102	20.4	1.94	1.00	

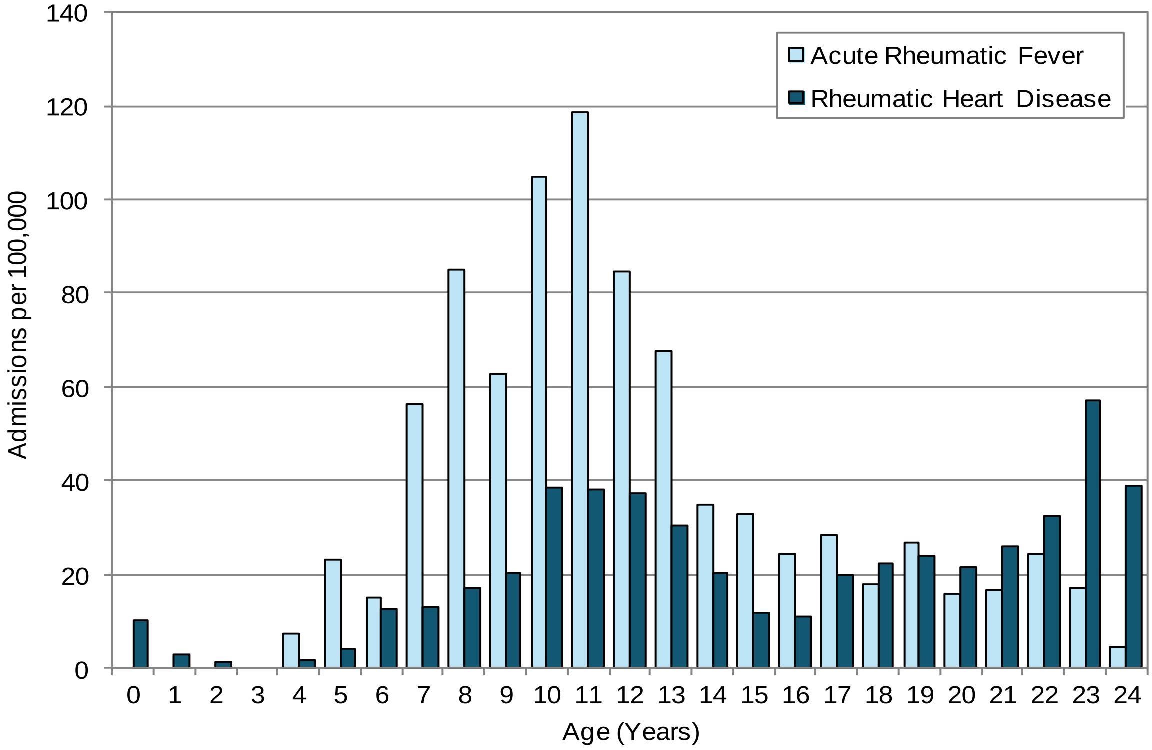
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions with Acute Rheumatic Fever or Rheumatic Heart Disease listed in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population

Figure 44. Acute and Semi-Acute Hospital Admissions for Acute Rheumatic Fever and Rheumatic Heart Disease in Children and Young People Aged 0−24 Years by Ethnicity, New Zealand 2000−2010



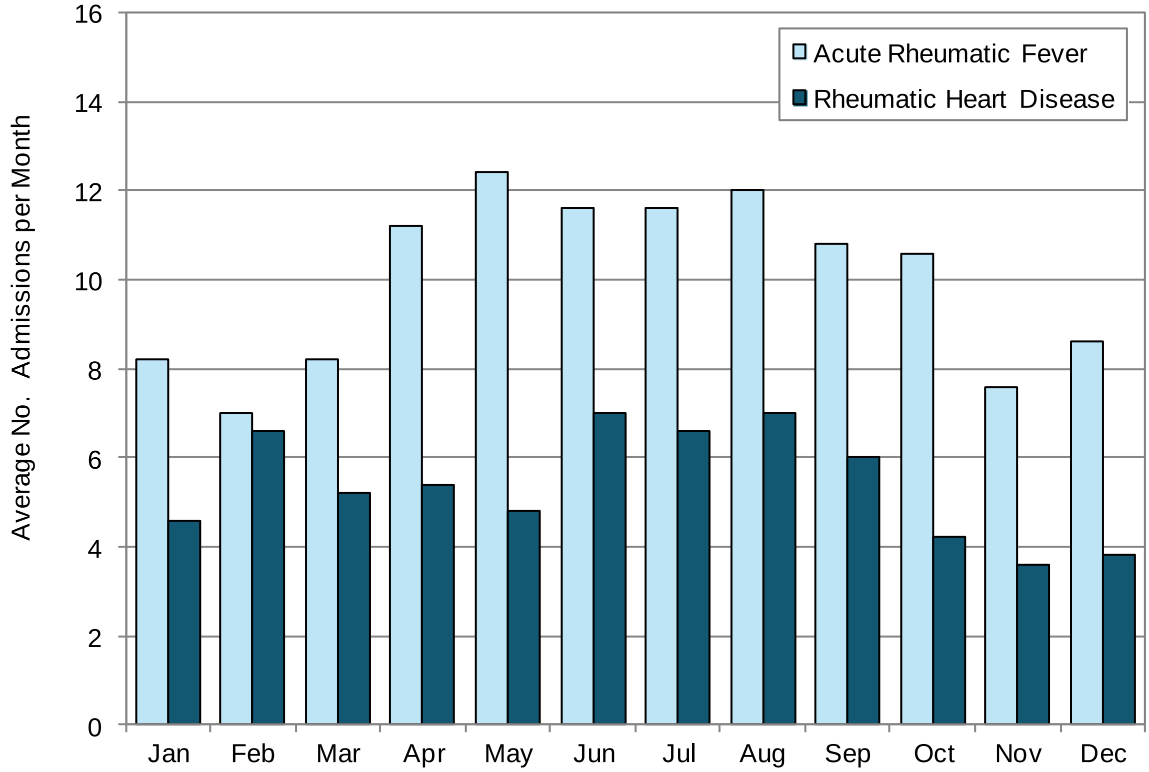
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions with Acute Rheumatic Fever or Rheumatic Heart Disease listed in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population

Figure 45. Acute and Semi-Acute Hospital Admissions for Acute Rheumatic Fever and Rheumatic Heart Disease in Māori Children and Young People by Age, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions with Acute Rheumatic Fever or Rheumatic Heart Disease listed in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population

Figure 46. Average Number of Acute and Semi-Acute Hospital Admissions for Acute Rheumatic Fever and Rheumatic Heart Disease in Māori Children and Young People Aged 0−24 Years by Month, New Zealand 2006−2010



Source: National Minimum Dataset (Acute and semi-acute admissions with Acute Rheumatic Fever or Rheumatic Heart Disease listed in any of the first 15 diagnoses)

Distribution by Age

When broken down by age, hospital admissions for Māori children and young people with acute rheumatic fever were relatively infrequent during the preschool years, but increased rapidly during childhood to reach a peak at eleven years of age, before tapering off again. While admissions for rheumatic heart disease followed a similar pattern, admissions remained elevated amongst those in their late teens and early twenties (**Figure 45**).

Distribution by Season

In New Zealand during 2006−2010, hospital admissions for Māori children and young people with acute rheumatic fever were generally higher during the cooler months, while seasonal variations in admissions for those with rheumatic heart disease were less consistent (**Figure 46**).

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand, hospital admissions for children and young people with acute rheumatic fever declined gradually during the early-mid 2000s, but then increased again after 2006–07. In contrast, admissions for those with rheumatic heart disease were relatively static during the mid 2000s, although a downswing in rates was evident in 2010. During 2000–2008, on average one child or young person each year died as the result of acute rheumatic fever or rheumatic heart disease.

Distribution by Age

In New Zealand during 2006–2010, hospital admissions for acute rheumatic fever were relatively infrequent during infancy, but increased rapidly during childhood, to reach a peak at 11 years of age. Hospital admissions for rheumatic heart disease also increased during childhood, to reach a peak at 12 years of age. In contrast, during 2004–2008 mortality from acute rheumatic fever or rheumatic heart disease was more common amongst those in their late teens and early twenties.

Distribution by NZDep01 Index Decile and Gender

In New Zealand during 2006–2010, hospital admissions for acute rheumatic fever were *significantly* higher for males and for children and young people from average-to-more deprived (NZDep01 decile 3–10) areas. Hospital admissions for rheumatic heart disease were *significantly* higher for females, and for those from average-to-more deprived (NZDep01 decile 3–10) areas.

Distribution by Season

In New Zealand during 2006–2010, hospital admissions for acute rheumatic fever and rheumatic heart disease were generally higher during the cooler months.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

SERIOUS SKIN INFECTIONS

Introduction

The following section explores hospital admissions for skin infections in Māori children and young people using information from the National Minimum Dataset.

Background

Bacterial skin infections are a common cause of hospitalisation in children. The most frequently implicated organisms are *Staphylococcus aureus* and *Streptococcus pyogenes* [100]. Skin infections are more likely to develop in damaged skin which, in children, is often due to eczema, abrasions or insect bites. Common clinical presentations include:

Cellulitis: A diffuse infection of the skin and subcutaneous tissue characterised by local heat, redness, pain, swelling and occasionally fever, swollen lymph glands, malaise, chills and headache. Tissue destruction or abscess formation may occur if antibiotics are not taken [101].

Abscesses, Furuncles and Carbuncles: Skin abscesses are collections of pus within the dermis and deeper skin tissues. They are tender, red, firm or fluctuant masses of walled off purulent material. A furuncle (commonly known as a boil) is an abscess which arises from infection of a hair follicle (usually involving *S. aureus*), which then enlarges and eventually opens to the skin surface, allowing the purulent contents to drain. A carbuncle is an aggregate of infected hair follicles forming a broad, swollen, red and painful mass which usually opens and drains through multiple tracts. Associated symptoms may include fever and malaise [102].

In New Zealand, hospital admissions for childhood skin infections have increased in recent years, with the most rapid increases occurring in Māori and Pacific children [103]. In one study, hospital admissions for skin infections in Māori children increased from 546.3 per 100,000 in 1990–1999, to 866.2 per 100,000 in 2000–2007, with rate ratios for Māori children (vs. European/Other children) increasing from 2.28 (95% CI 2.22–2.34) in 1990–1999 to 2.90 (95% CI 2.84–2.96) in 2000–2007 [103]. Research also suggests that admissions are highest during summer and autumn and amongst those living in the most deprived areas [103,104]. In developing interventions to reduce childhood skin infections, issues such as overcrowding, access to washing machines and first aid kits, treatment of eczema, the cleaning and covering of wounds, reducing exposure to insect bites, and access to primary health care may all need to be addressed simultaneously [104].

Data Sources and Methods

Indicator

1. *Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0–24 Years*

Numerator: National Minimum Dataset: Hospital admissions for children and young people aged 0–24 years with a diagnosis of a Serious Skin Infection in any of their first 15 diagnoses.

The ICD-10-AM coding used is that developed by O'Sullivan and Baker in 2010 for use in the New Zealand context [103] as follows: Impetigo (L01.0, L01.1); Cutaneous Abscess/Furuncle/Carbuncle (L02); Cellulitis (L03); Acute Lymphadenitis (L04); Pilonidal Cyst with Abscess (L05.0); Other Infections Skin/Subcutaneous Tissue (L08); Infections of Other Anatomical Sites (H00.0, H60.0, H60.1, H60.2, H60.3, H62.0, H62.4, J34.0, K61.0, H05.0, N48.2, N49.2, N49.9, N76.4 A46); Infected/Unspecified/Other Dermatitis (L30.3, L30.8, L30.9); Insect/Spider Bites (S10.13, S10.83, S10.93, S20.13, S20.33, S20.43, S20.83, S30.83, S30.93, S40.83, S50.83, S60.83, S70.83, S80.83, S90.83, T09.03, T11.08, T13.03, T14.03, T63.3, T63.4, T00.9); Post Traumatic/Open Wound Infection (T79.3, T89.01, T89.02); Scabies (B86); Varicella with Other Complications (B01.8);

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: The rates presented here differ from those in the Ambulatory Sensitive Hospital Admissions and Hospital Admissions with a Social Gradient sections in two key ways. Firstly, these former sections use primary diagnosis only, so that each hospital admission can be ascribed a single reason for admission. In this section however, hospital admissions with the ICD-10–AM codes listed above in ANY of their first 15 diagnoses have been included. Secondly, the codes included here are broader than those used in the ASH or Hospital Admissions with a social gradient section, as they include codes outside of the traditional ICD-10-AM skin infection sub-chapter (e.g. they include admissions following insect and spider bites, infected and unspecified eczema, infected open wounds, and infections at specific anatomical sites (e.g. the genitalia)). The rationale for the inclusion of these wider categories is to align the coding in this section with that proposed by O'Sullivan and Baker in their recent review of skin infections in children [103], so that a standard reporting convention can be adopted within the sector. The coding conventions however, have not been retrospectively applied to the ASH and Admissions with a Social Gradient sections as these composite indicators require the use of the primary diagnoses only (so that later diagnoses in the coding algorithm do not overwrite earlier primary diagnoses) and because the social gradients and primary care preventability of these additional diagnoses (e.g. open wounds, superficial infections of the genitalia) have not as yet been fully assessed/consulted on within the sector.

Note 2: **Appendix 2** outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

Distribution in Māori Children and Young People

Distribution by Cause

In New Zealand during 2006–2010, cutaneous abscesses/furuncles/carbuncles and cellulitis were the most frequent primary diagnoses in Māori children and young people admitted to hospital with serious skin infections, followed by infected/unspecified/other dermatitis (**Table 32**).

Table 32. Hospital Admissions for Serious Skin Infections in Māori Children and Young People Aged 0−24 Years by Primary Diagnosis, New Zealand 2006−2010

Primary Diagnosis	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Percent (%)
Serious Skin Infections				
Māori Children and Young People 0–24 Years				
Cutaneous Abscess/Furuncle/Carbuncle	3,783	756.6	2.25	20.30
Cellulitis	3,427	685.4	2.04	18.39
Infected/Unspecified/Other Dermatitis	1,348	269.6	0.80	7.23
Infections of Other Anatomical Sites	904	180.8	0.54	4.85
Pilonidal Cyst with Abscess	526	105.2	0.31	2.82
Acute Lymphadenitis	430	86.0	0.26	2.31
Impetigo	401	80.2	0.24	2.15
Scabies	267	53.4	0.16	1.43
Insect/Spider Bites	216	43.2	0.13	1.16
Varicella with Other Complications	182	36.4	0.11	0.98
Post Traumatic/Open Wound Infection	121	24.2	0.07	0.65
Other Infections Skin/Subcutaneous Tissue	231	46.2	0.14	1.24
Other Diagnoses	6,798	1,359.6	4.04	36.48
Total	18,634	3,726.8	11.09	100.00

Source: Numerator: National Minimum Dataset (hospital admissions with serious skin infections in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population.

Distribution by Ethnicity

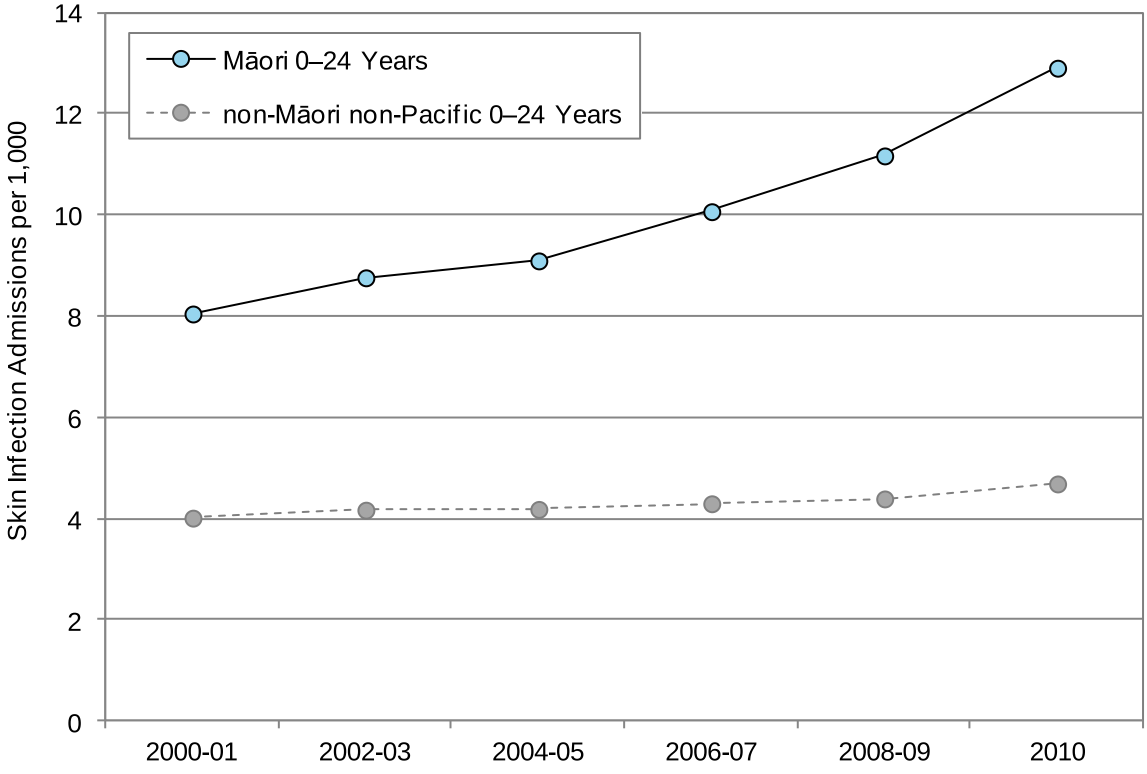
In New Zealand during 2006–2010, hospital admissions for serious skin infections were *significantly* higher for Māori (RR 2.51 95% CI 2.46–2.56) than for non-Māori non-Pacific children and young people (**Table 33**). While similar ethnic differences were seen during 2000–2010, admissions for Māori children and young people increased during this period (**Figure 47**).

Table 33. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0−24 Years by Ethnicity, New Zealand 2006−2010

Ethnicity	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Serious Skin Infections					
Māori	18,634	3,726.8	11.09	2.51	2.46 – 2.56
non-Māori non-Pacific	23,259	4,651.8	4.41	1.00	

Source: Numerator: National Minimum Dataset (hospital admissions with serious skin infections in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population

Figure 47. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0–24 Years by Ethnicity, New Zealand 2010–2010

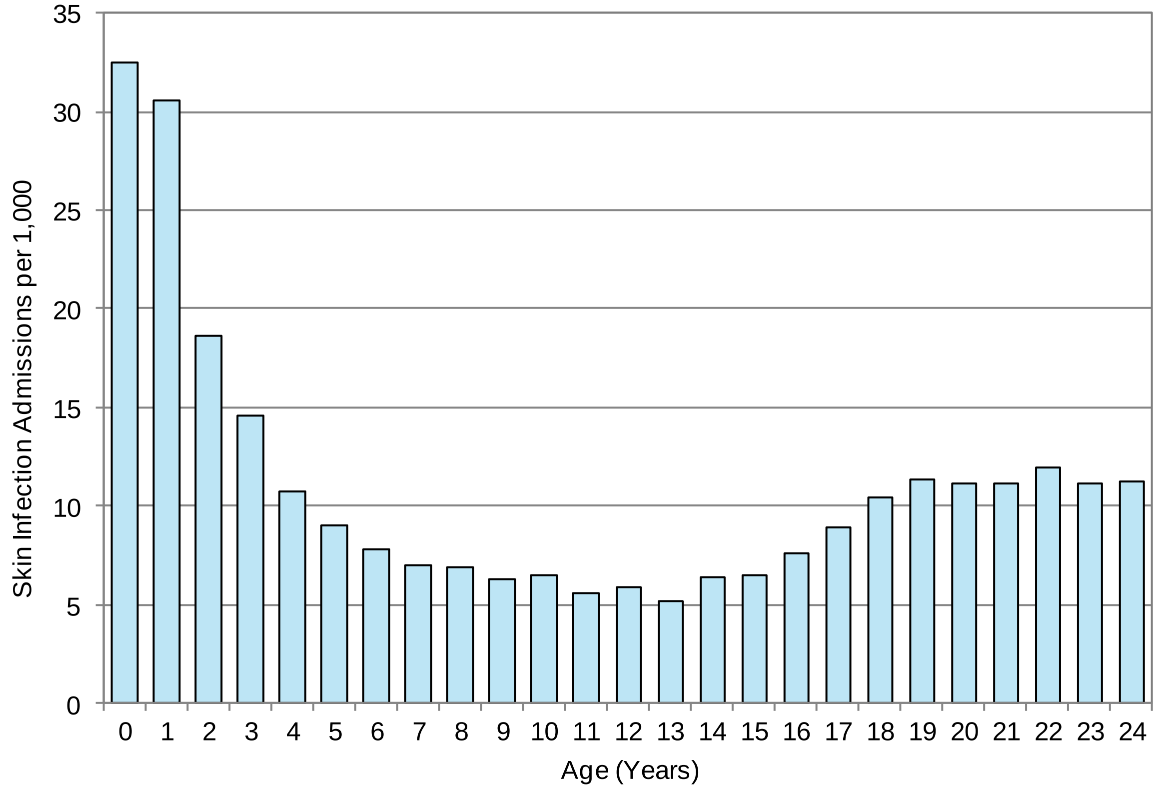


Source: Numerator: National Minimum Dataset (hospital admissions with serious skin infections in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population

Distribution by Age

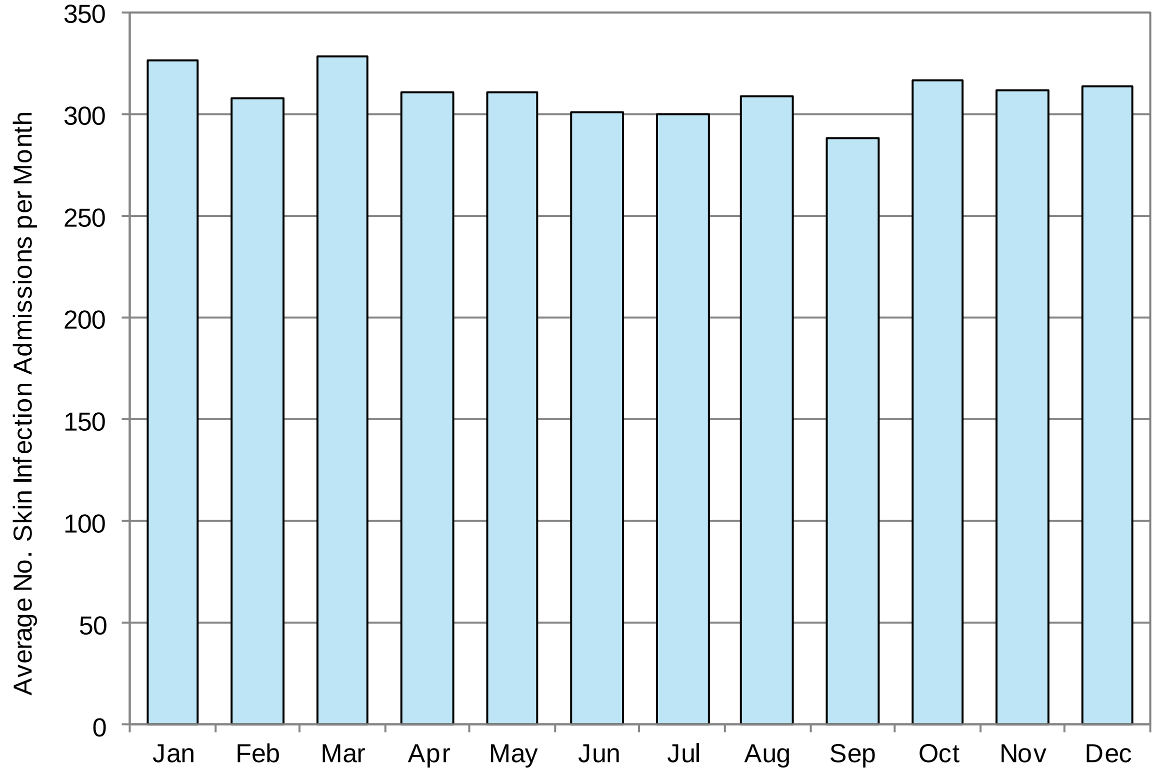
When broken down by age, hospital admissions for serious skin infections were highest in Māori infants aged less than one year, with rates then tapering off during the preschool years, to reach their lowest point at 13 years of age. Rates then increased again, to reach a second (albeit lower) plateau amongst those in their late teens and early twenties (**Figure 48**).

Figure 48. Hospital Admissions for Serious Skin Infections in Māori Children and Young People Aged 0−24 Years by Age, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset (hospital admissions with serious skin infections in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population

Figure 49. Average Number of Hospital Admissions for Serious Skin Infections per Month in Māori Children and Young People Aged 0−24 Years, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset (hospital admissions with serious skin infections in any of the first 15 diagnoses)

Distribution by Season

In New Zealand during 2006−2010, there were no consistent seasonal variations in hospital admissions for serious skin infections in Māori children and young people (**Figure 49**).

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand during 2000–2010, hospital admissions for serious skin infections increased in both children and young people, with admission rates for children being higher than for young people throughout this period.

New Zealand Distribution

In New Zealand during 2006–2010, cellulitis and cutaneous abscesses/furuncles/ carbuncles were the most frequent primary diagnoses in children admitted to hospital with serious skin infections, followed by infected/unspecified/other dermatitis. In contrast, in young people, cutaneous abscesses/furuncles/carbuncles, cellulitis and pilonidal cysts with abscesses were the main reasons for hospital admission.

Distribution by Age

In New Zealand during 2006–2010, hospital admissions for serious skin infections were highest in infants <1 Year, with rates tapering off rapidly during the first five years of life. A second, smaller peak in admissions was evident amongst those in their late teens and early twenties. At each age, admission rates were higher for males than for female.

Distribution by NZDep01 Index Decile and Gender

In New Zealand during 2006–2010, hospital admissions for serious skin infections in both children and young people were *significantly* higher for males and those from average-to-more deprived (NZDep01 decile 3–10) areas.

Distribution by Season

In New Zealand during 2006–2010, there were no consistent seasonal variations in hospital admissions for serious skin infections in young people, although admissions in children were slightly lower during the cooler months.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

GASTROENTERITIS

Introduction

The following section explores hospital admissions for gastroenteritis in Māori children and young people using information from the National Minimum Dataset.

Background

Gastroenteritis is a non-specific term indicating various pathological states of the gastrointestinal tract. Its primary manifestation is diarrhoea and it may also be associated with nausea, anorexia, fever, abdominal pain and vomiting [105,106]. Acute gastroenteritis is normally of infectious origin and the causative agent may be viral, bacterial or parasitic. Infection is transmitted via the faecal-oral route and, in young children, acute infectious gastroenteritis is much the most common cause of diarrhoea, with or without vomiting [107]. Severe gastroenteritis in infants and young children can rapidly lead to dehydration, which is a potentially life-threatening condition and a common cause of infant mortality in the third world [107].

In New Zealand, gastroenteritis is one of the top 10 causes of potentially avoidable hospital admissions in children [108]. It is more common in younger children, with most children requiring hospitalisation being under 2 years of age [109]. While hospital admissions for gastroenteritis are higher for Pacific children and those from more deprived areas, admissions for Māori children appear to be lower than for European children, although the reasons for this remain unclear [40,109]. Admissions are higher in the winter months [110]. The most significant risk factor for gastroenteritis is contact with another person with gastroenteritis, hence the increased risks associated with attending childcare and overcrowding [111]. Breastfeeding is a protective factor, particularly for infants less than 6 months of age [112].

Data Sources and Methods

Indicator

1. *Acute and Semi Acute Hospital Admissions for Gastroenteritis in Children and Young People 0–24 Years*

Numerator: National Minimum Dataset: Acute and semi-acute hospital admissions in children and young people aged 0–24 years with an ICD-10-AM primary diagnosis of Gastroenteritis (A00–A09, R11, K52.9).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

2. Mortality from Gastroenteritis in Children and Young People 0–24 Years

Numerator: National Mortality Collection: Deaths in children and young people aged 0–24 years where the main underlying cause of death was Gastroenteritis (A00–A09, R11, K52.9).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: The gastroenteritis codes used here differ from those used previously, as the result of a change from ICD-10-AM Version 3 to Version 6, which occurred in the National Minimum Dataset in 2008. Prior to this change, a large proportion of gastroenteritis cases were coded to A09 (diarrhoea and gastroenteritis of presumed infectious origin). From 2008 however, the Ministry of Health began to back-map the majority of these cases to K52.9 (non-infective gastroenteritis and colitis unspecified). Because K52.9 only accounted for a minority of cases prior to 2008 (n ≈50–60 cases per year), and because the majority of gastroenteritis cases in the paediatric population are presumed to be of infectious origin, the K52.9 code was not included in previous reports. The coding change however resulted in a large reduction in the number A09 mapped cases and a large increase in the number of K52.9 mapped cases after 2008. Thus, in order to preserve time series continuity (even though the clinical appropriateness of such a coding change remains debatable) the current year's analysis includes both the A09 and K52.9 gastroenteritis codes (with this coding change being extended back to 2000). As a result, the results presented here may differ from those reported previously.

Note 2: An acute admission is an unplanned admission occurring on the day of presentation, while a semi-acute admission (referred to in the NMDS as an arranged admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary.

Note 3: **Appendix 2** outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

Distribution in Māori Children and Young People

Distribution by Ethnicity

In New Zealand during 2006−2010, hospital admissions for gastroenteritis were *significantly* lower for Māori children (RR 0.89 95% CI 0.86–0.91) than for non-Māori non-Pacific children. While admissions for Māori young people were also lower than for non-Māori non-Pacific young people, these differences failed to reach statistical significance (**Table 34**). During 2000−2010, gastroenteritis admissions increased in Māori children and young people, although, in the case of children, rates remained lower than for non-Māori non-Pacific children throughout the period. Rates for Māori young people, however, were more similar to those of non-Māori non-Pacific young people during 2008−2010 (**Figure 50**).

Table 34. Acute and Semi-Acute Hospital Admissions for Gastroenteritis in Children and Young People Aged 0−24 Years by Ethnicity, New Zealand 2006−2010

Ethnicity	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Gastroenteritis					
Children 0–14 Years					
Māori	5,685	1,137.0	5.29	0.89	0.86 – 0.91
non-Māori non-Pacific	17,680	3,536.0	5.97	1.00	
Young People 15–24 Years					
Māori	1,323	264.6	2.18	0.95	0.89 – 1.01
non-Māori non-Pacific	5,322	1,064.4	2.31	1.00	

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

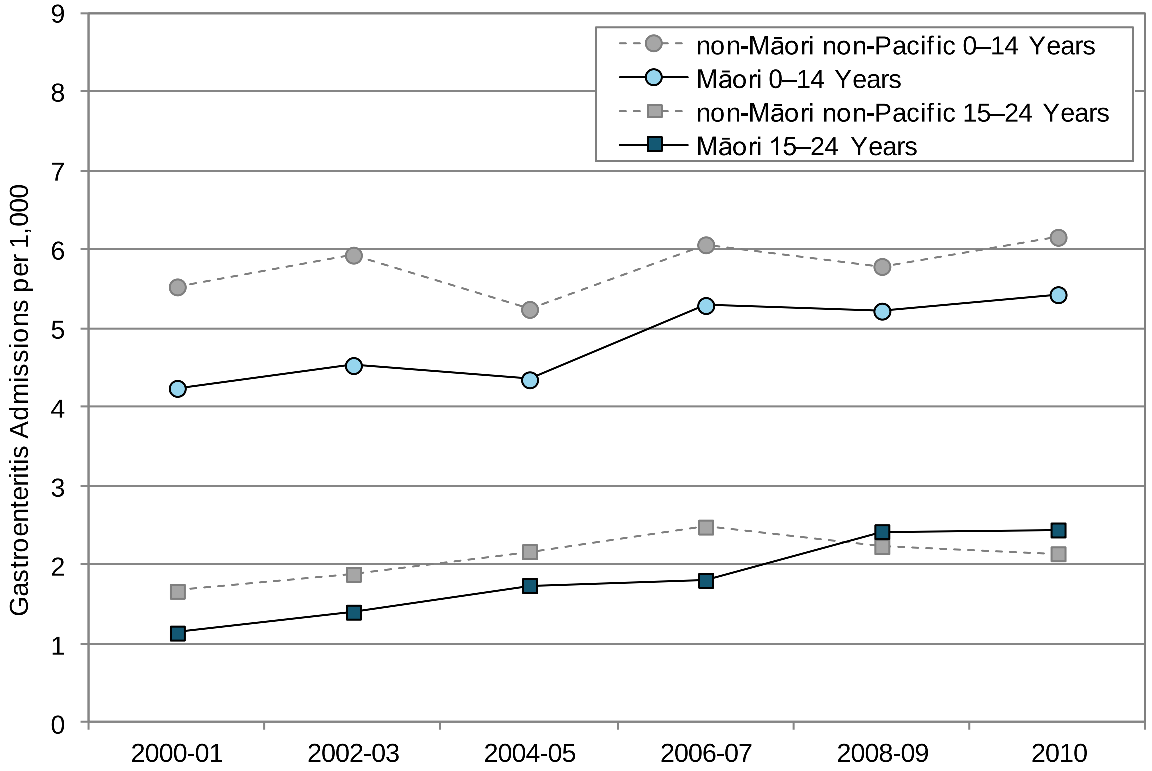
Distribution by Age

When broken down by age, gastroenteritis admission rates were highest in Māori infants <1 Year, and next highest in Māori children aged between 1–2 years. Rates then tapered off rapidly during the pre-school years (**Figure 51**).

Distribution by Season

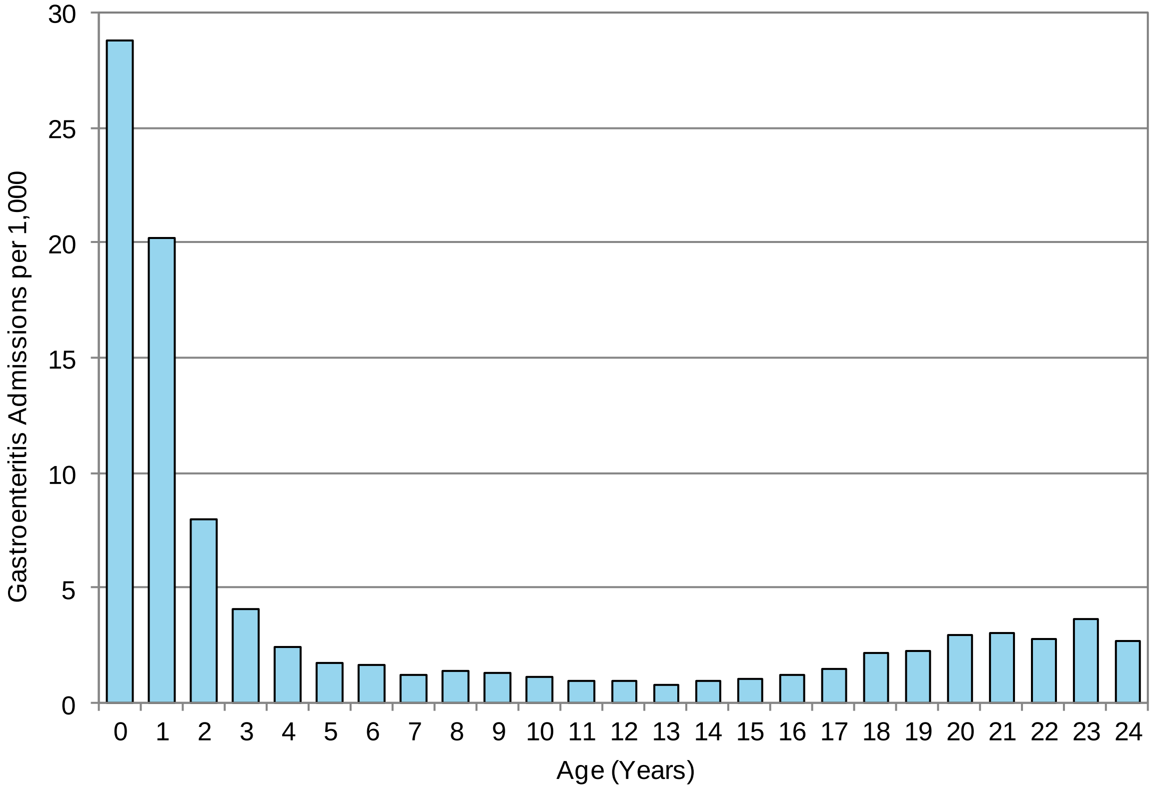
In New Zealand during 2006–2010, hospital admissions for gastroenteritis in Māori children and young people were highest in spring (**Figure 52**).

Figure 50. Acute and Semi-Acute Hospital Admissions for Gastroenteritis in Children and Young People Aged 0−24 Years by Ethnicity, New Zealand 2000−2010



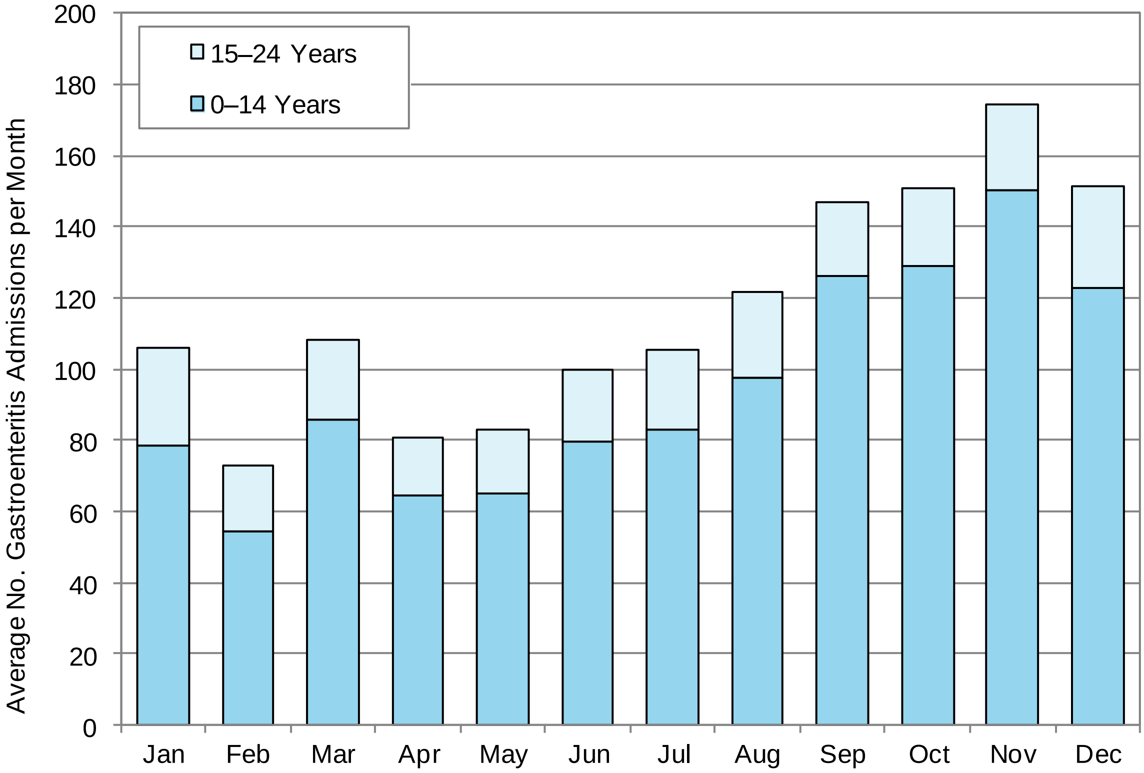
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 51. Acute and Semi-Acute Hospital Admissions for Gastroenteritis in Māori Children and Young People by Age, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Statistics NZ Estimated Resident Population

Figure 52. Average Number of Acute and Semi-Acute Hospital Admissions for Gastroenteritis in Māori Children and Young People by Month, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only)

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand, gastroenteritis admissions increased gradually during the early-mid 2000s but became relatively static after 2006–07 in both children and young people. During 2000–2008, on average two children or young people per year died as a result of gastroenteritis, although this fell to around one death per year, if only the years 2002–08 were included.

Distribution by Age

In New Zealand during 2006–2010, hospital admissions for gastroenteritis were highest in infants <1 Year, with rates then tapering off rapidly during the preschool years, to reach their lowest point in those in their early teens. Mortality was also highest in infants <1 Year, although a small number of deaths also occurred during early childhood.

Distribution by NZDep01 Index Decile and Gender

In New Zealand during 2006–2010, hospital admissions for gastroenteritis in children were *significantly* higher for males and those living in average-to-more deprived (NZDep01 decile 4–10) areas. Gastroenteritis admissions in young people were *significantly* higher for females and those living in average-to-more deprived (NZDep01 decile 4–10) areas.

Distribution by Season

In New Zealand during 2006–2010, hospital admissions for gastroenteritis in children were highest during spring, although seasonal variations for young people were less evident.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

OTHER ISSUES

INJURIES IN CHILDREN

Introduction

The following section reviews injuries in Māori children using data from the National Minimum Dataset and the National Mortality Collection.

Background

In New Zealand, injuries are the leading cause of mortality for Māori children, with mortality from drowning, and pedestrian and motor vehicle injuries being higher for Māori children than for non- Māori children. A child's age and developmental stage affect the types of injury incurred however, with infants being the most likely to die from accidental suffocation in bed. In contrast, drowning, pedestrian injuries and fire related injuries are more common in children aged 1–4 years. Similarly, injuries are the second leading cause of hospitalisation in Māori children aged 1–4 years, and the leading cause in those aged 5–14 years, with falls being the leading cause of injury admission, followed by inanimate mechanical forces and transport injuries [3].

In terms of prevention, New Zealand has a national Injury Prevention Strategy (NZIPS) that details a philosophical approach to reducing injury and identifies strategies for achieving injury prevention goals [113]. In 2011, childhood injury was identified as a priority area, and various government sectors are likely to collaborate with lead agencies to implement the strategies identified [114]. These may include interventions proven to be effective in reducing injury from some causes. For example, cycle helmets reduce head injury except to the jaw area [115], child restraints should be used by all children to prevent injuries arising from land transport crashes but need to be correctly used [116], isolation fencing reduces the risk of young children drowning in domestic swimming pools [117], and smoke detectors alert households so they can leave a potentially burning building [118]. The effectiveness of many interventions is, however, affected by the complexity of the environments in which families live, play and travel. The value of multifaceted interventions, is increasingly noted in systematic reviews of interventions to prevent childhood injury [119].

Data Sources and Methods

Indicators

1. *Hospital Admissions for Injuries in Children Aged 0–14 Years*

Numerator: National Minimum Dataset: Hospital admissions in children aged 0–14 years with a primary diagnosis of Injury (ICD-10-AM S00–T79). Causes of injury were assigned using the ICD-10-AM primary external cause code (E code). The following were excluded: 1) Admissions with an E code in the Y40–Y89 range (complications of drugs/medical/surgical care and late sequelae of injury). 2) Admissions with an Emergency Medicine Specialty code (M05–M08) on discharge.

Causes of injury were assigned using the primary E code (hospital admissions) or the main underlying cause of death as follows: Pedestrian (V01–V09), Cyclist (V10–V19), Motorbike (V20–29), Vehicle Occupant (V40–79), Other Land Transport (V30–39, V80–89); Other Transport (V90–V99); Falls (W00–W19), Mechanical Forces:

Inanimate (W20–W49), Mechanical Forces: Animate (W50–64), Drowning/Submersion (W65–74), Accidental Threat to Breathing (W75–W84), Electricity/Fire/Burns (W85–X19), Accidental Poisoning (X40–X49), Intentional Self-Harm (X60–84), Assault (X85–Y09), Undetermined Intent (Y10–Y34). Broader Categories included Land Transport Injuries (V01–V89) and Unintentional Non-Transport Injuries (W00–W74, W85–X19).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

2. Mortality from Injuries in Children Aged 0–14 Years

Numerator: National Mortality Collection; Deaths in children aged 0–14 years where the main underlying cause of death was an injury (V01–Y36). Causes of injury were assigned using the codes listed above.

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: Because of regional inconsistencies in the uploading of Emergency Department cases to the National Minimum dataset (see **Appendix 2**) all hospital admissions with an Emergency Department specialty code on discharge have been excluded. In addition, because of the potential for these inconsistencies to impact significantly on time series analysis, any reviews of long term trends have been restricted to mortality data, with hospital admission data being used to explore cross sectional associations between demographic factors and different injury types. Despite these restrictions, the reader must bear in mind the fact that differences in the ways different DHBs upload their injury cases to the NMDS may also impact on the regional vs. New Zealand analyses presented (see **Appendix 2** for a fuller explanation of these issues).

Distribution in Māori Children: All Injuries

Distribution by Cause

In New Zealand during 2006−2010, falls followed by inanimate mechanical forces, were the leading causes of injury related hospital admissions in Māori children, although transport injuries as a group also made a significant contribution. In contrast, accidental threats to breathing, followed by vehicle occupant and pedestrian injuries were the leading causes of injury mortality in Māori children during 2004−2008 (**Table 35**).

New Zealand Distribution and Trends: All Injuries

Distribution by Cause

In New Zealand during 2006–2010 falls, followed by inanimate mechanical forces were the leading causes of injury admissions in children, although transport injuries as a group also made a significant contribution. In contrast, accidental threats to breathing, followed by vehicle occupant injuries were the leading causes of injury mortality in children during 2004–2008.

New Zealand Mortality Trends

In New Zealand during 2000–2008, mortality from land transport injuries and unintentional non-transport injuries in children both declined, while mortality from accidental threats to breathing increased. The majority of accidental threats to breathing deaths however, occurred in infants <1 Year, who were coded as dying as a result of suffocation or strangulation in bed, and thus the potential exists for some of the increases seen to have arisen from a diagnostic shift in the coding of Sudden Unexpected Death in Infancy (SUDI) [120] (see SUDI section).

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

Table 35. Hospital Admissions (2006−2010) and Mortality (2004−2008) from Injuries in Māori Children Aged 0−14 Years by Cause

Main External Cause of Injury	Number: Total per 5 Year Period	Number: Annual Average	Rate per 100,000	Percent (%)
Māori Children 0–14 Years				
Injury Admissions				
Falls	6,379	1,275.8	593.41	41.13
Mechanical Forces: Inanimate	3,373	674.6	313.77	21.75
Mechanical Forces: Animate	831	166.2	77.30	5.36
Transport: Cyclist	732	146.4	68.09	4.72
Transport: Vehicle Occupant	486	97.2	45.21	3.13
Transport: Pedestrian	381	76.2	35.44	2.46
Transport: Other Land Transport	235	47.0	21.86	1.52
Transport: Motorbike	208	41.6	19.35	1.34
Transport: Other Transport	18	3.6	1.67	0.12
Electricity/Fire/Burns	710	142.0	66.05	4.58
Accidental Poisoning	695	139.0	64.65	4.48
Assault	403	80.6	37.49	2.60
Intentional Self-Harm	130	26.0	12.09	0.84
Accidental Threat to Breathing	95	19.0	8.84	0.61
Undetermined Intent	74	14.8	6.88	0.48
Drowning/Submersion	59	11.8	5.49	0.38
No External Cause Listed	2	0.4	0.19	0.01
Other Causes	700	140.0	65.12	4.51
Total	15,511	3,102.2	1442.91	100.00
Injury Mortality				
Accidental Threat to Breathing	85	17.0	7.90	33.60
Transport: Vehicle Occupant	48	9.6	4.46	18.97
Transport: Pedestrian	25	5.0	2.32	9.88
Transport: Cyclist	4	0.8	0.37	1.58
Transport: All Other Transport	8	1.6	0.74	3.16
Assault	22	4.4	2.04	8.70
Drowning/Submersion	20	4.0	1.86	7.91
Intentional Self-Harm	12	2.4	1.11	4.74
Electricity/Fire/Burns	7	1.4	0.65	2.77
Mechanical Forces: Inanimate	6	1.2	0.56	2.37
Undetermined Intent	5	1.0	0.46	1.98
Falls	5	1.0	0.46	1.98
Accidental Poisoning	4	0.8	0.37	1.58
Other Causes	2	0.4	0.19	0.79
Total	253	50.6	23.50	100.00

Source: Numerators: National Minimum Dataset and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population.

Distribution in Māori Children: Land Transport Injuries

Distribution by Ethnicity

In New Zealand during 2006–2010, hospital admissions for pedestrian (RR 2.39 95% CI 2.08–2.74) and vehicle occupant (RR 2.28 95% CI 2.02–2.57) injuries were *significantly* higher for Māori children than for non-Māori non-Pacific children, while admissions for motorbike injuries (RR 0.54 95% CI 0.47–0.63) were *significantly* lower. Admissions for cyclist injuries were similar for both ethnic groups (**Table 36**). During 2000–2008, mortality from land transport injuries was consistently higher for Māori children than for non-Māori children (**Figure 53**).

Distribution by Age

In New Zealand during 2006−2010, hospital admissions for cyclist injuries in Māori children increased during childhood, to reach a peak at eleven years of age, before decreasing again. In contrast, admissions for motorbike injuries gradually increased during childhood, while pedestrian injuries were highest in those less than seven years of age (although the degree to which admissions tapered off in older children was not marked). Admissions for vehicle occupant injuries were more evenly distributed until 14 years of age (**Figure 54**).

Distribution by Season

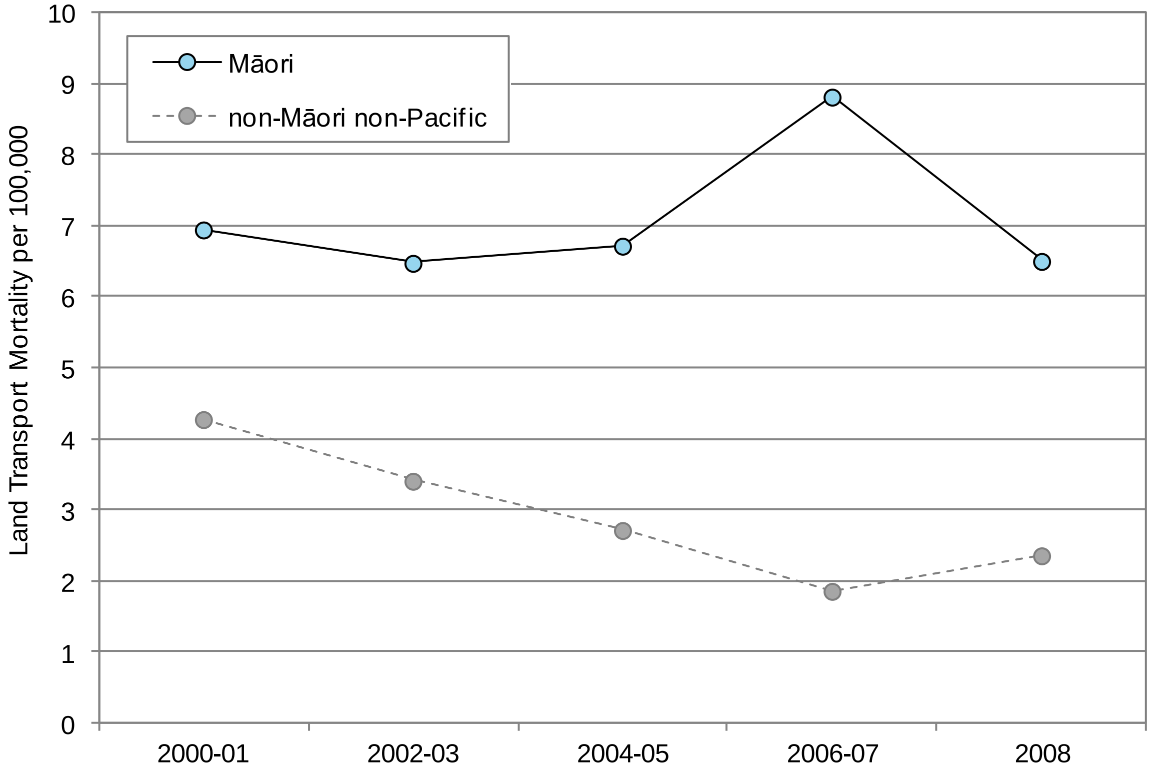
In New Zealand during 2006–2010, hospital admissions for land transport injuries amongst Māori children were lowest during the winter months (**Figure 55**).

Table 36. Hospital Admissions for Selected Transport Injuries in Children Aged 0−14 Years by Ethnicity, New Zealand 2006−2010

Ethnicity	Number: Total 2006−2010	Number: Annual Average	Rate per 100,000	Rate Ratio	95% CI
Māori Children 0–14 Years					
Pedestrian					
Māori	381	76.2	35.44	2.39	2.08 – 2.74
non-Māori non-Pacific	439	87.8	14.82	1.00	
Cyclist					
Māori	732	146.4	68.09	1.00	0.92 – 1.09
non-Māori non-Pacific	2,020	404.0	68.20	1.00	
Motorbike					
Māori	208	41.6	19.35	0.54	0.47 – 0.63
non-Māori non-Pacific	1,059	211.8	35.75	1.00	
Vehicle Occupant					
Māori	486	97.2	45.21	2.28	2.02 – 2.57
non-Māori non-Pacific	587	117.4	19.82	1.00	

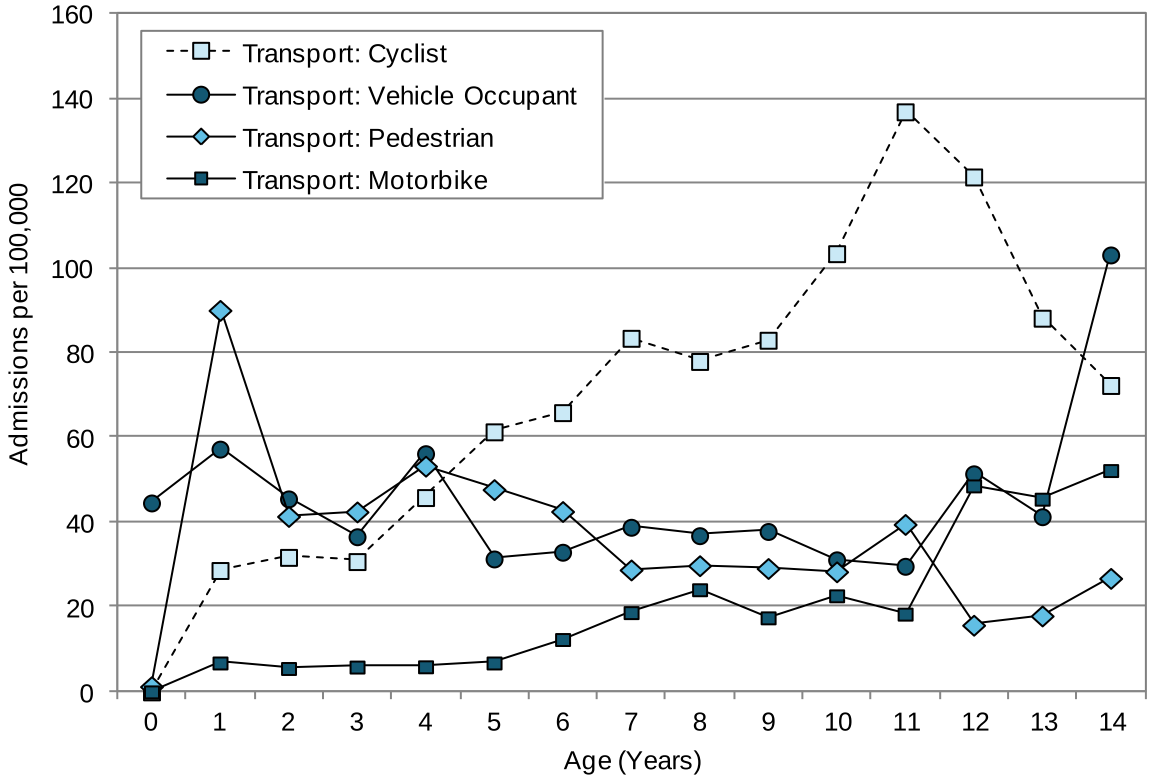
Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Figure 53. Mortality from Land Transport Injuries in Māori Children Aged 0−14 Years by Ethnicity, New Zealand 2000−2008



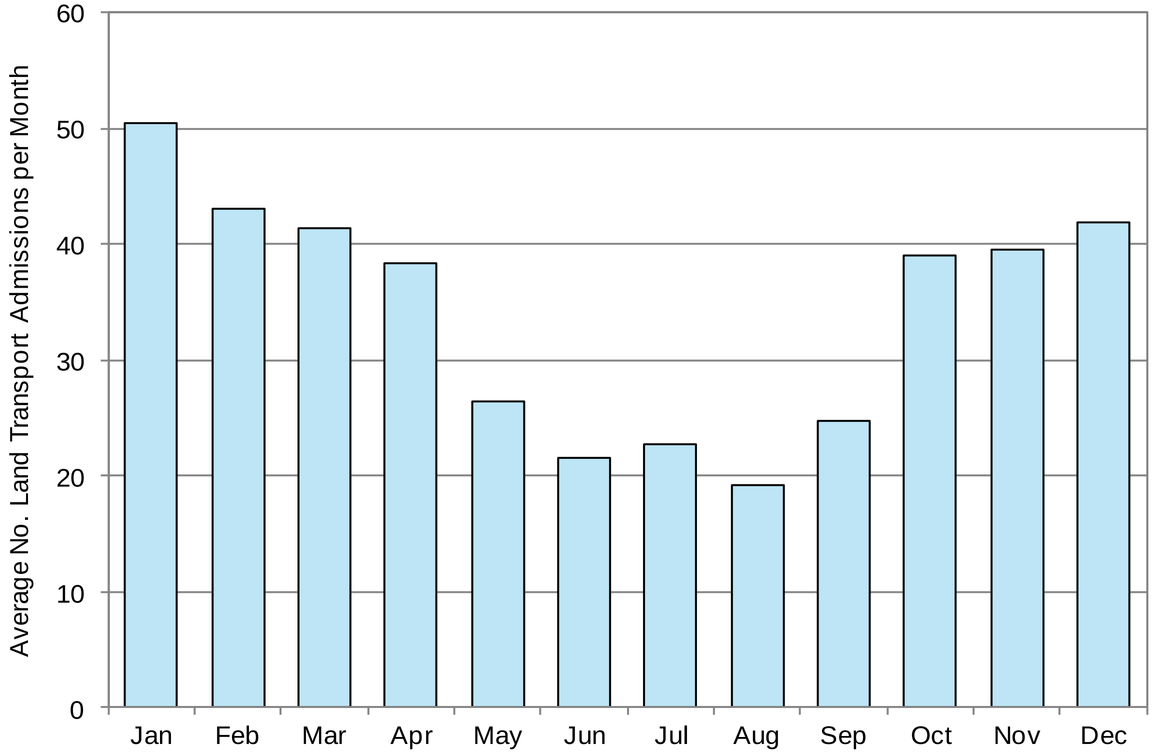
Source: Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population. Note: Ethnicity is Level 1 Prioritised.

Figure 54. Hospital Admissions for Selected Transport Injuries in Māori Children 0−14 Years by Age and Injury Type, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Figure 55. Average Number of Hospital Admissions for Land Transport Injuries per Month in Māori Children Aged 0−14 Years, New Zealand 2006−2010



Source: National Minimum Dataset

New Zealand Distribution: Land Transport Injuries

Distribution by Age

Age and Gender: In New Zealand during 2006–2010, hospital admissions for land transport injuries were lowest in infants <1 Year, with rates increasing progressively thereafter. After infancy, admission rates were consistently higher for males than females, with the rate of increase with age being particularly rapid for males after nine years of age. Gender differences were less marked for land transport mortality during 2004–2008 although a male predominance was evident in many age categories.

Age and Cause: In New Zealand during 2006–2010, hospital admissions for cycle and motorbike injuries increased with increasing age, although cycle injuries began to taper off after 12 years of age, while motorbike injuries continued to increase. In contrast (with the exception of the first year), admissions for pedestrian injuries were more evenly distributed by age, as were admissions for vehicle occupant injuries.

Distribution by Season

In New Zealand during 2006–2010, hospital admissions for land transport injuries were lowest during the winter months.

Distribution by NZDep01 Index Decile and Gender

Pedestrian Injuries: In New Zealand during 2006–2010, hospital admissions for pedestrian injuries were *significantly* higher for males and children from average-to-more deprived (NZDep01 decile 3–10 vs.1) areas.

Cyclist Injuries: In New Zealand during 2006–2010, hospital admissions for cycle injuries were *significantly* higher for males. Socioeconomic differences were not large, although once grouped by NZDep01 quintile, admission rates were *significantly* higher for those from NZDep01 deciles 5–10 vs. deciles 1–2.

Motorbike Injuries: In New Zealand during 2006–2010, hospital admissions for motorbike injuries were *significantly* higher for males. Admission rates also tended to be higher for children living in average (NZDep01 decile 2–7 vs.1) areas.

Vehicle Occupant Injuries: In New Zealand during 2006–2010, hospital admissions for vehicle occupant injuries were *significantly* higher for males and children from average-to-more deprived (NZDep01 decile 5–10 vs.1) areas.

Distribution in Māori Children: Unintentional Non-Transport Injuries

Distribution by Ethnicity

In New Zealand during 2006–2010, hospital admissions for electricity/fire/burns (RR 2.17 95% CI 1.96–2.39) and drowning/submersion (RR 1.75 95% CI 1.26–2.42) were *significantly* higher for Māori children than for non-Māori non-Pacific children, although admissions for accidental poisoning were not *significantly* different (**Table 37**). During 2000–2010, mortality from unintentional non-transport injuries was consistently higher for Māori than for non-Māori non-Pacific children, although mortality for Māori children declined during this period (**Figure 56**).

Distribution by Age

When broken down by age, admissions arising from electricity/fire/burns and inanimate mechanical forces were highest in Māori one year olds, while admissions for accidental poisoning peaked in two year olds, and admissions for falls peaked in those five to six years of age. Admissions for injuries arising from animate mechanical forces however, were more evenly distributed throughout childhood (**Figure 57**, **Figure 58**).

Distribution by Season

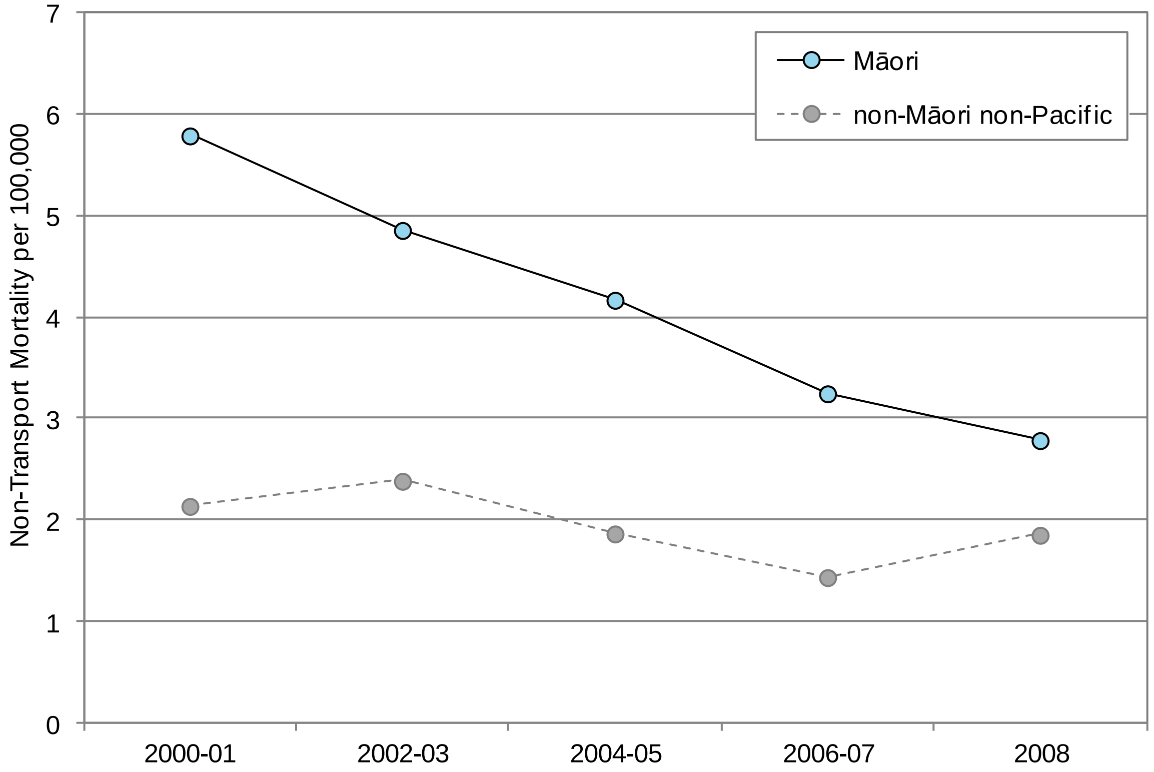
In New Zealand during 2006–2010, hospital admissions for unintentional non-transport injuries were generally lower during the winter months (**Figure 59**).

Table 37. Hospital Admissions for Selected Unintentional Non-Transport Injuires in Children 0−14 Years by Ethnicity, New Zealand 2006−2010

Ethnicity	Number: Total 2006−2010	Number: Annual Average	Rate per 100,000	Rate Ratio	95% CI
Māori Children 0–14 Years					
Electricity/Fire/Burns					
Māori	710	142.0	66.05	2.17	1.96 – 2.39
non-Māori non-Pacific	903	180.6	30.49	1.00	
Accidental Poisoning					
Māori	695	139.0	64.65	1.07	0.98 – 1.17
non-Māori non-Pacific	1,785	357.0	60.27	1.00	
Drowning/Submersion					
Māori	59	11.8	5.49	1.75	1.26 – 2.42
non-Māori non-Pacific	93	18.6	3.14	1.00	

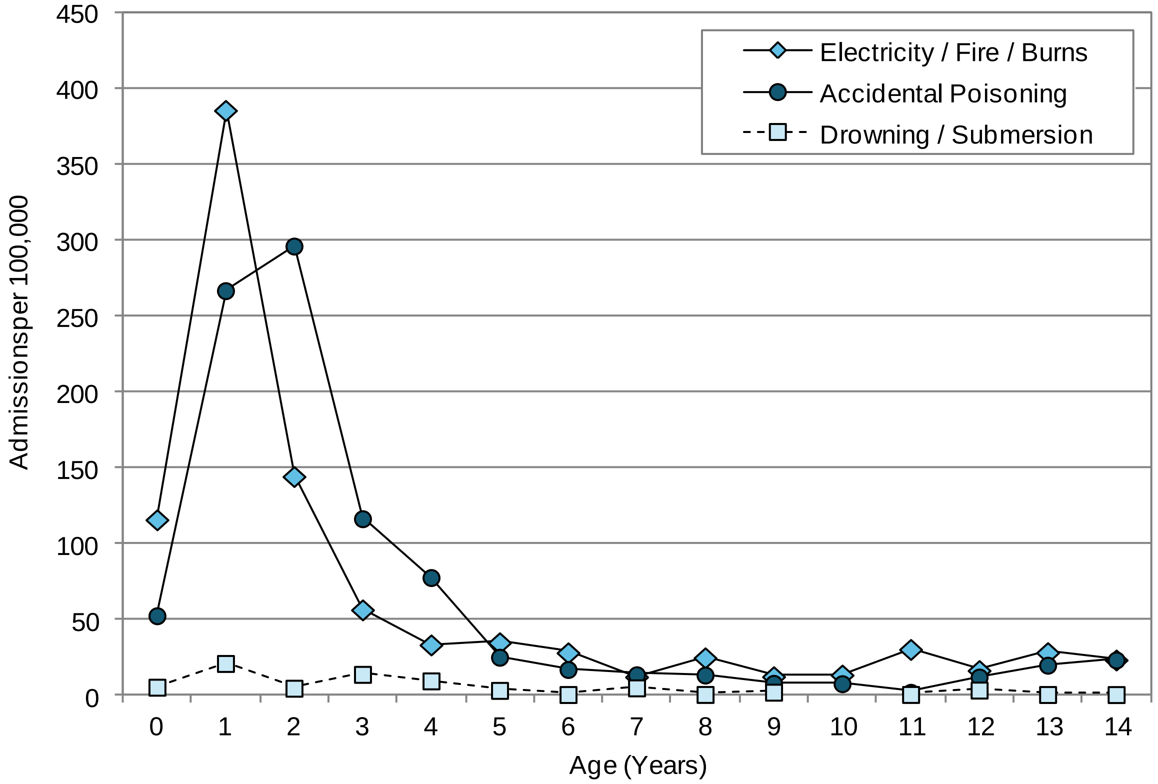
Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Figure 56. Mortality from Unintentional Non-Transport Injuries in Children Aged 0−14 Years by Ethnicity, New Zealand 2000−2008



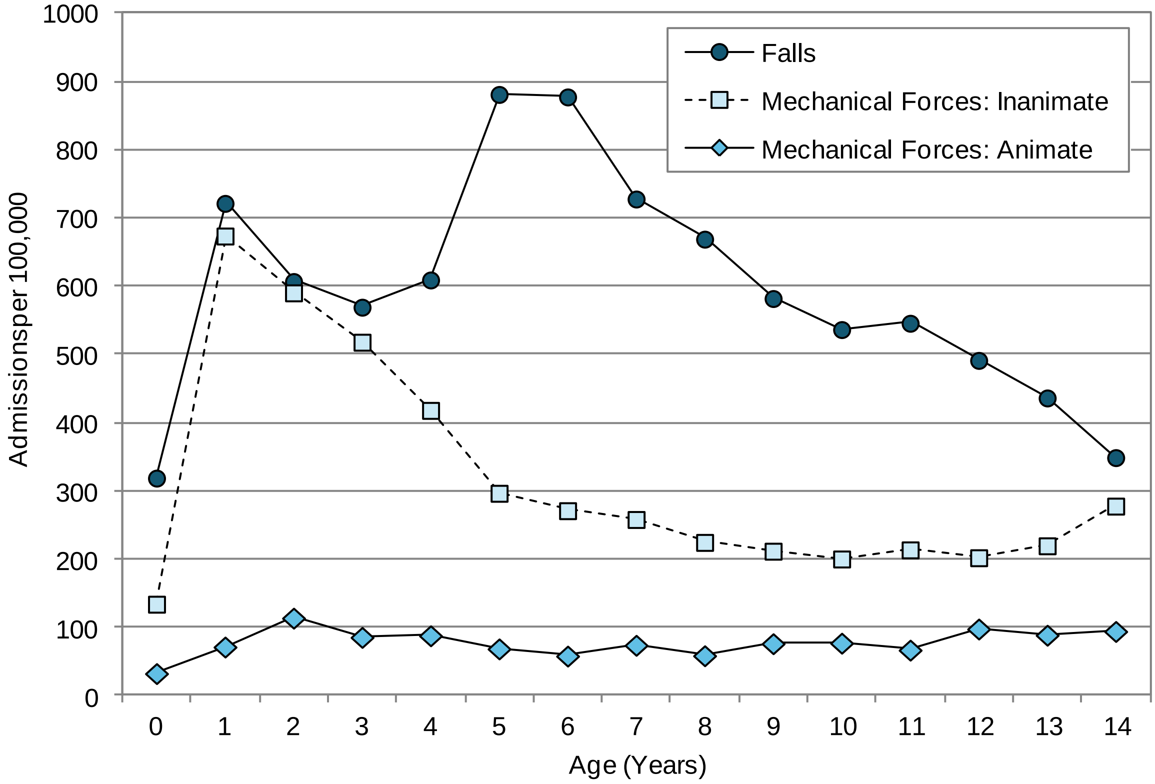
Source: Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Figure 57. Hospital Admissions for Selected Unintentional Non-Transport Injuries in Māori Children 0−14 Years by Age and Injury Type, New Zealand 2006−2010



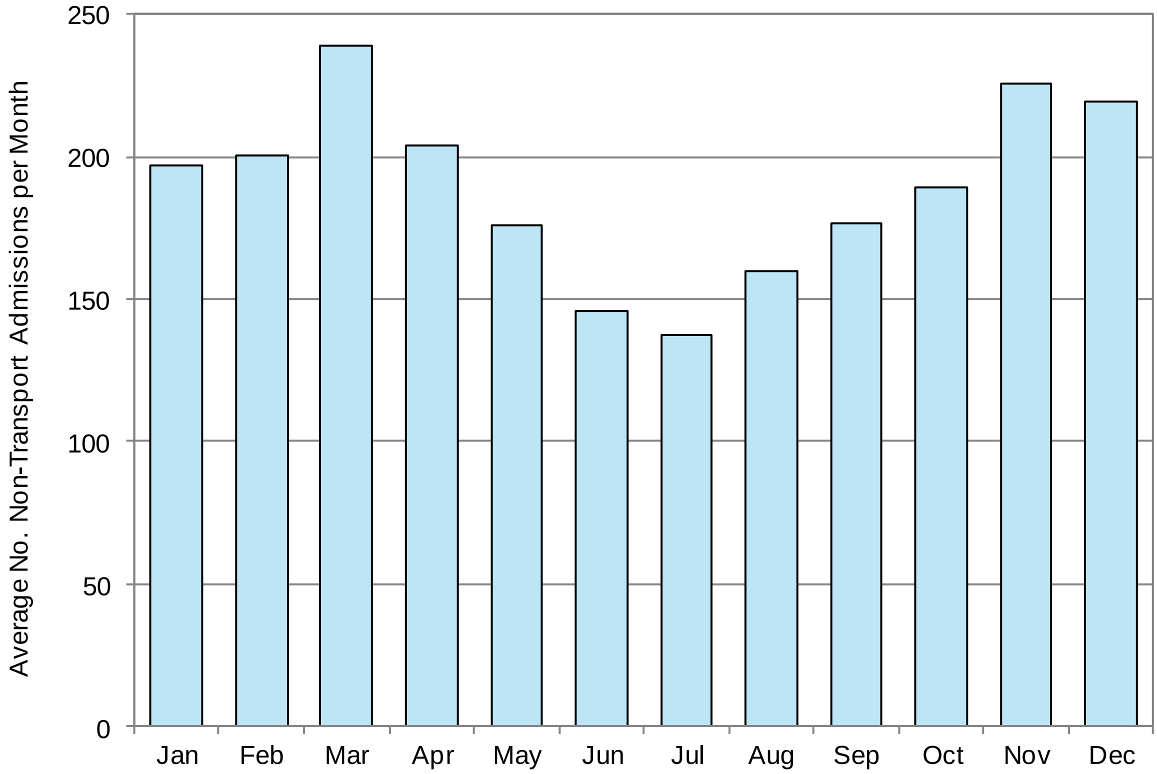
Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Figure 58. Hospital Admissions for Falls and Mechanical Force Type Injuries in Māori Children 0−14 Years by Age and Injury Type, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Figure 59. Average Number of Hospital Admissions for Unintentional Non-Transport Injuries per Month in Māori Children Aged 0−14 Years, New Zealand 2006−2010



Source: National Minimum Dataset

New Zealand Distribution: Unintentional Non-Transport Injuries

Distribution by Age

Age and Gender: In New Zealand during 2006–2010, hospital admissions for unintentional non-transport injuries were lowest in infants <1 Year, with rates rising rapidly thereafter, to reach a peak at one year of age. Admission rates then tapered off during the pre-school years, with another small peak being evident at 5 years of age. At every age, admission rates were higher for males than for females. Mortality during 2004–2008 was also highest at one year of age, with rates declining thereafter. A male predominance was also evident at most ages (with the exception of those aged 8–11 years).

Age and Cause: In New Zealand during 2006–2010, hospital admissions for electricity/fire/burns and accidental poisoning increased rapidly after the first year, with admissions for electricity/fire burns peaking at one year, and admissions for accidental poisoning at 2 years of age. Admissions for falls and injuries arising from inanimate mechanical forces were also lowest in infants <1 Year, with admissions for inanimate mechanical forces peaking at one year, and falls at five years of age.

Distribution by Season

In New Zealand during 2006–2010, hospital admissions for unintentional non-transport injuries in children were lowest during the winter months.

Distribution by NZDep01 Index Decile and Gender

Falls: In New Zealand during 2006–2010, hospital admissions for falls were *significantly* higher for males and children from average-to-more deprived (NZDep01 deciles 5 and 7–10 vs.1) areas.

Electricity/Fire/Burns: In New Zealand during 2006–2010, hospital admissions for injuries arising from electricity/fire/burns were *significantly* higher for males and children from average-to-more deprived (NZDep01 decile 3–10 vs.1) areas.

Inanimate Mechanical Forces: In New Zealand during 2006–2010, hospital admissions for injuries arising from inanimate mechanical forces were *significantly* higher for males and children from average-to-more deprived (NZDep01 decile 4–10 vs.1) areas.

Animate Mechanical Forces: In New Zealand during 2006–2010, hospital admissions for injuries arising from animate mechanical forces were *significantly* higher for males and for children from more deprived (NZDep01 decile 6–10 vs.1) areas.

Accidental Poisoning: In New Zealand during 2006–2010, hospital admissions for accidental poisoning were *significantly* higher for males and for children from average-to-more deprived (NZDep01 decile 5–10 vs.1) areas.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

ORAL HEALTH: SCHOOL DENTAL SERVICE DATA AND DENTAL CARIES ADMISSIONS

Introduction

The following section reviews the oral health status of Māori children and young people using information from two separate sources. The first is School Dental Service data, which provides information on the proportion of children who were caries-free at 5 years, and the number who had decayed, missing or filled teeth (DMFT) at 12 years. The second data source is the National Minimum Dataset, which provides information on hospital admissions for dental caries in Māori children and young people.

Background

In New Zealand, children and adolescents are eligible to receive free basic oral health care from birth until 17 years of age. For children from birth until Year 8 (12–13 years) services are provided through school and community based clinics. From Year 9 (13–14 years) until their 18th birthday, adolescents are eligible for services provided by private dentists, which are funded via Combined Dental Agreements with DHBs [121].

The 2009 New Zealand Oral Health Survey demonstrated large improvements in the oral health status of children since the 1980s, with the proportion of 12–13 year olds who were caries free almost doubling (from 28.5% in 1988 to 51.6% in 2009). However, significant disparities remained, with only 48.1% (95% CI 40.7–55.4) of Māori children aged 2–11 years in this survey having caries free primary teeth (RR 0.8 for Māori vs. non-Māori children). The survey also found that Māori children and adolescents were less likely to have accessed oral health in the previous year than non-Māori children and adolescents, and were less likely to have met tooth brushing recommendations [121].

Data Sources and Methods

Indicators

1. *Proportion of Children Who Were Caries-free at 5 Years*

Numerator: Number of children aged 5 years whose deciduous teeth were caries-free on completion of treatment with the School Dental Service

Denominator: Total number of 5 year olds who were examined in the year

2. Mean DMFT at 12 Years

Numerator: Number of permanent teeth of children aged around 12 years that are decayed, missing (due to caries) or filled on completion of treatment in Year 8, prior to leaving the School Dental Service.

Denominator: Total number of Year 8 children who were examined in the year

Notes on Interpretation

Note 1: The data in this section was obtained from:
http://www.moh.govt.nz/moh.nsf/indexmh/oralhealth-statistics

The Ministry of Health collated this information from the School Dental Service. Once children are enrolled with the Dental Service they are seen, assessed and have appropriate treatment prescribed. Upon completion of treatment, dental health status data are collected on 5 year olds and children in Year 8 (aged approximately 12 years). In this section the term DMFT at 12 years has been used for simplicity, although the actual cohort is Year 8 children (the majority of whom will be 12 years of age).

Note 2: In this section, fluoridation status refers to the water supply of the school which the student attended, rather than the fluoridation status of the area in which they resided.

Note 3: Tests of statistical significance have not been applied to the data in this section, and thus any associations described do not imply statistical significance or non-significance.

Indicator

1. *Hospital Admissions for Dental Caries in Children and Young People Aged 0–24 Years*

Numerator: National Minimum Dataset: Hospital admissions (acute, semi acute and waiting list) for children and young people aged 0–24 years with a primary ICD-10-AM diagnosis of Dental Caries (K02). Other dental conditions assessed in some tables include: Disorders of Tooth Development/Eruption (K00), Embedded/ Impacted Teeth (K01), Other Diseases of the Teeth Hard Tissue (K03), Diseases of the Pulp/Periapical Tissue (K04), Gingivitis/Periodontal Diseases (K05), Other Disorders of the Gingiva/Edentulous Alveolar Ridge (K06), Dentofacial Anomalies/Malocclusion (K07), Other Disorders of the Teeth/Supporting Structures (K08).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: An acute admission is an unplanned admission occurring on the day of presentation, while a semi-acute admission (referred to in the NMDS as an arranged admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary. A waiting list admission is a planned admission, where the admission date is 7+ days after the date the decision was made that the admission was necessary. In New Zealand, most DHBs admit children and young people with dental caries/other oral health problems, either from the waiting list, or on a semi-acute basis (as an arranged admission).

Note 2: **Appendix 2** outlines the limitations of the hospital admission data used. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

School Dental Service Data

Distribution in Māori Children

New Zealand Distribution by Ethnicity

In New Zealand during 2003−2010, the proportion of Māori children who were caries-free at five years was consistently lower than for non-Māori non-Pacific children in both fluoridated and non-fluoridated areas. Amongst Māori children however, the proportion that were caries-free at five years was consistently higher for those with access to fluoridated water at school, than those in non-fluoridated areas (**Figure 60**).

In New Zealand during 2003−2010, mean DMFT scores at 12 years were higher for Māori children than for non-Māori non-Pacific children in both fluoridated and non-fluoridated areas. Amongst Māori children, mean DMFT scores at 12 years were lower for those who had access to fluoridated water at school, as compared to those in non-fluoridated areas (**Figure 61**).

New Zealand Distribution and Trends

New Zealand Trends

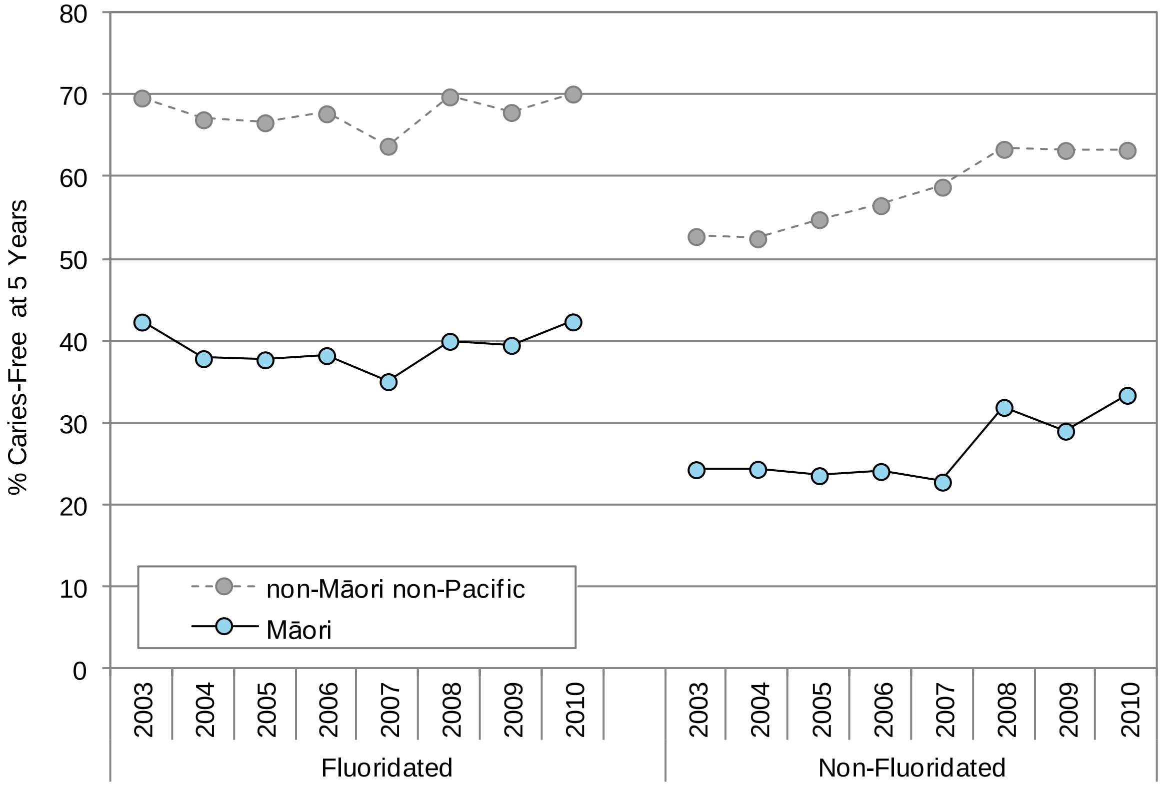
In New Zealand during 2000–2010, the percentage of children who were caries-free at 5 years was consistently higher in areas with fluoridated school water supplies, while mean DMFT scores at 12 years were lower.

Proportion of Adolescents Using Publicly Funded Dental Services

In New Zealand during 2009, when broken down by DHB, the proportion of eligible adolescents (aged ≈13–18 years) who were reported as accessing publicly funded dental services ranged from 42.3% to 88.1%. No information was available however on the frequency or type of service access for these young people.

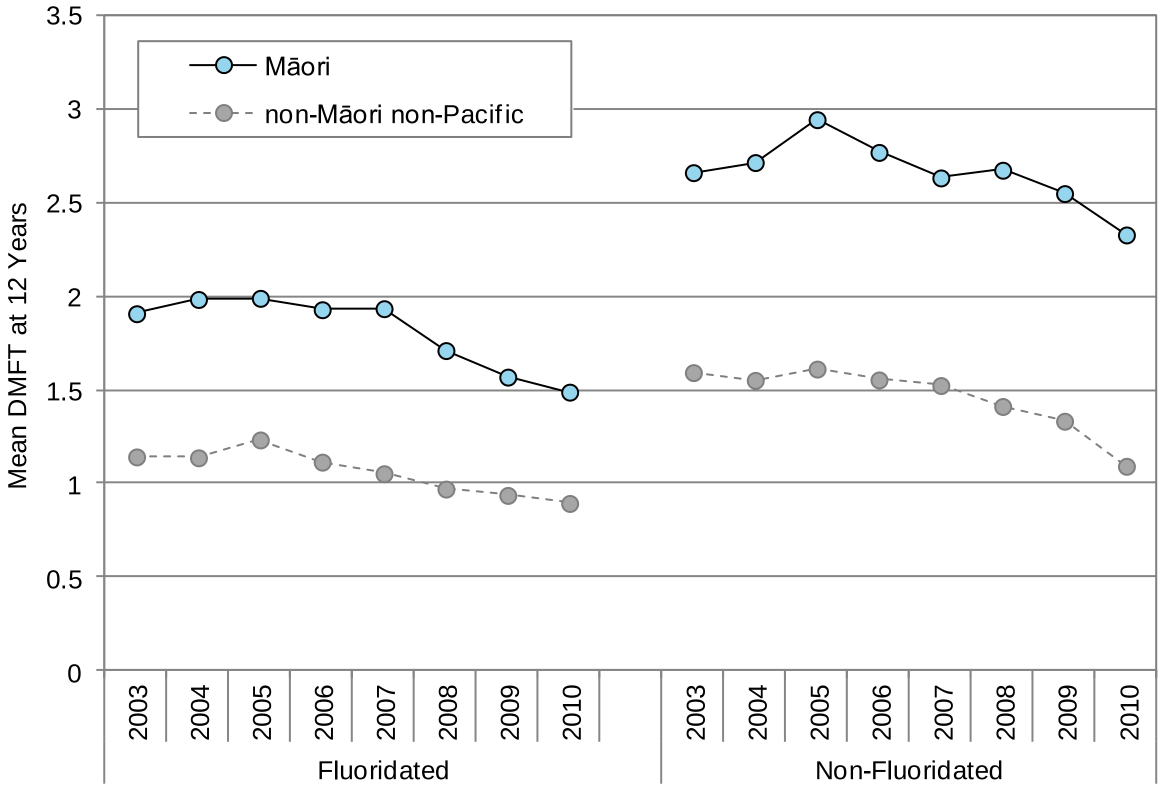
For further detail see *The Health Status of Children and Young People in New Zealand* [1].

Figure 60. Percentage of Children Who Were Caries-Free at 5 Years by Ethnicity, New Zealand 2003−2010



Source: School Dental Service via Ministry of Health

Figure 61. Mean DMFT at 12 Years by Ethnicity, New Zealand 2003−2010



Source: School Dental Service via Ministry of Health

Hospital Admissions for Dental Caries

Distribution in Māori Children and Young People

Table 38. Hospital Admissions for Dental Conditions in Māori Children and Young People Aged 0−24 Years by Primary Diagnosis, New Zealand 2006−2010

Primary Diagnosis	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Percent (%)
Dental Conditions				
Māori Children 0–4 Years				
Dental Caries	4,611	922.2	12.73	91.63
Diseases Pulp/Periapical Tissue	355	71.0	0.98	7.05
Gingivitis/Periodontal Diseases	20	4.0	0.06	0.40
Disorders Tooth Development/Eruption	16	3.2	0.04	0.32
Other Disorders Teeth/Supporting Structures	16	3.2	0.04	0.32
Embedded/Impacted Teeth	5	1.0	0.01	0.10
Dentofacial Anomalies/Malocclusion	3	0.6	0.01	0.06
Other Diseases Teeth Hard Tissue	3	0.6	0.01	0.06
Other Disorders Gingiva/Edentulous Alveolar Ridge	3	0.6	0.01	0.06
Total	5,032	1,006.4	13.89	100.0
Māori Children 5–14 Years				
Dental Caries	5,184	1,036.8	7.27	85.03
Diseases Pulp/Periapical Tissue	521	104.2	0.73	8.55
Disorders Tooth Development/Eruption	150	30.0	0.21	2.46
Embedded/Impacted Teeth	113	22.6	0.16	1.85
Dentofacial Anomalies/Malocclusion	41	8.2	0.06	0.67
Other Disorders Teeth/Supporting Structures	38	7.6	0.05	0.62
Other Diseases Teeth Hard Tissue	23	4.6	0.03	0.38
Gingivitis/Periodontal Diseases	20	4.0	0.03	0.33
Other Disorders Gingiva/Edentulous Alveolar Ridge	7	1.4	0.01	0.11
Total	6,097	1,219.4	8.55	100.0
Māori Young People 15–24 Years				
Embedded/Impacted Teeth	415	83.0	0.69	35.68
Dental Caries	316	63.2	0.52	27.17
Diseases Pulp/Periapical Tissue	251	50.2	0.41	21.58
Gingivitis/Periodontal Diseases	52	10.4	0.09	4.47
Dentofacial Anomalies/Malocclusion	50	10.0	0.08	4.30
Other Disorders Teeth/Supporting Structures	42	8.4	0.07	3.61
Other Diseases Teeth Hard Tissue	19	3.8	0.03	1.63
Disorders Tooth Development/Eruption	15	3.0	0.02	1.29
Other Disorders Gingiva/Edentulous Alveolar Ridge	3	0.6	0.01	0.26
Total	1,163	232.6	1.92	100.0

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Distribution by Cause

In New Zealand during 2006–2010, dental caries, followed by diseases of the pulp and periapical tissue, were the leading reasons for a dental admission in Māori children aged 0–4 and 5–14 years. In contrast, embedded/impacted teeth, followed by dental caries were the leading reasons for an admission in Māori young people aged 15–24 years (**Table 38**).

Distribution by Ethnicity

In New Zealand during 2006–2010, hospital admissions for dental caries were *significantly* higher for Māori children (0–4 years RR 2.24 95% CI 2.15–2.33; 5–14 years RR 1.61 95% CI 1.56–1.67) and young people (RR 1.17 95% CI 1.03–1.33) than for non-Māori non-Pacific children and young people, with the largest ethnic differences being evident in children aged 0–4 years, followed by those aged 5–14 years (**Table 39**). Similar ethnic differences were seen during 2000–2010, with rates increasing in all three age groups during this period (**Figure 62**).

Distribution by Age

When broken down by age, hospital admissions for dental caries were infrequent in Māori infants and one year olds, but increased rapidly in pre-schoolers, to reach a peak at four years of age, before tapering off again (**Figure 63**).

Distribution by Season

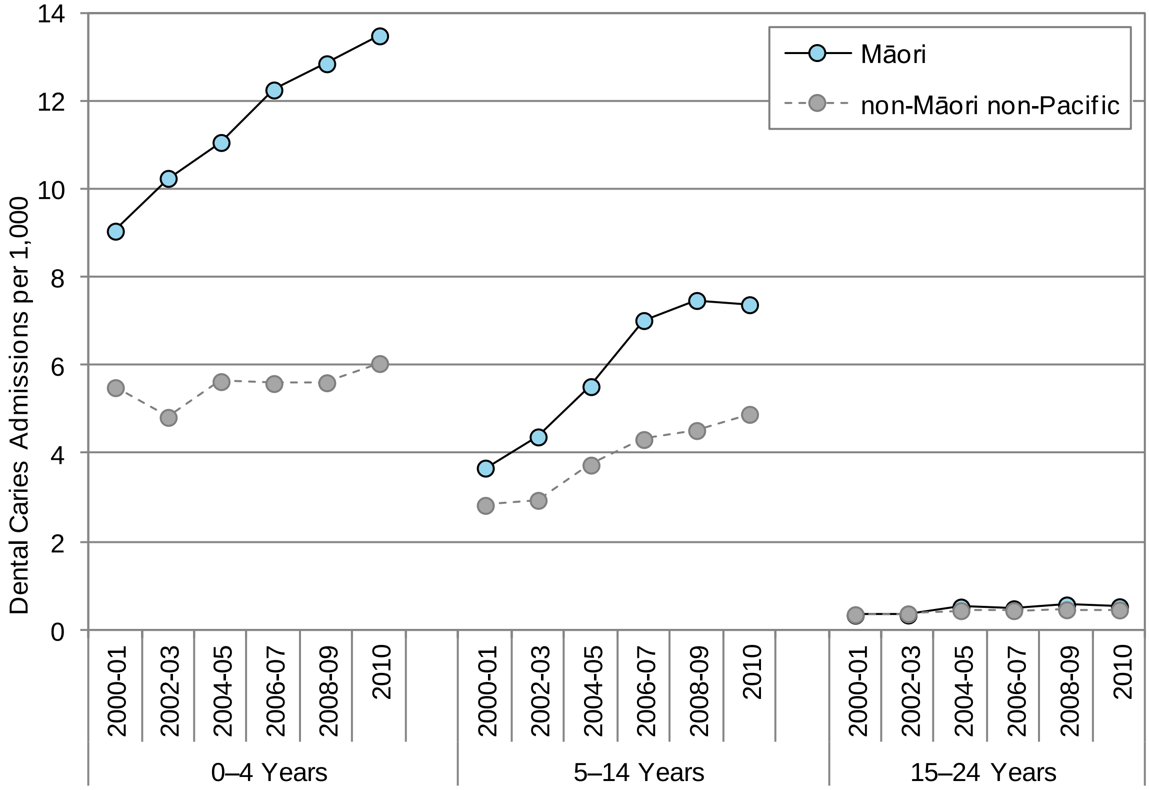
In New Zealand during 2006–2010, there were no consistent seasonal variations in hospital admissions for dental caries in Māori children and young people, although the number of admissions was lowest in January (**Figure 64**).

Table 39. Hospital Admissions for Dental Caries in Children and Young People Aged 0−24 Years by Ethnicity, New Zealand 2006−2010

Ethnicity	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Dental Caries					
Children 0–4 Years					
Māori	4,611	922.2	12.73	2.24	2.15 – 2.33
non-Māori non-Pacific	5,313	1,062.6	5.69	1.00	
Children 5–14 Years					
Māori	5,184	1,036.8	7.27	1.61	1.56 – 1.67
non-Māori non-Pacific	9,153	1,830.6	4.51	1.00	
Young People 15–24 Years					
Māori	316	63.2	0.52	1.17	1.03 – 1.33
non-Māori non-Pacific	1,029	205.8	0.45	1.00	

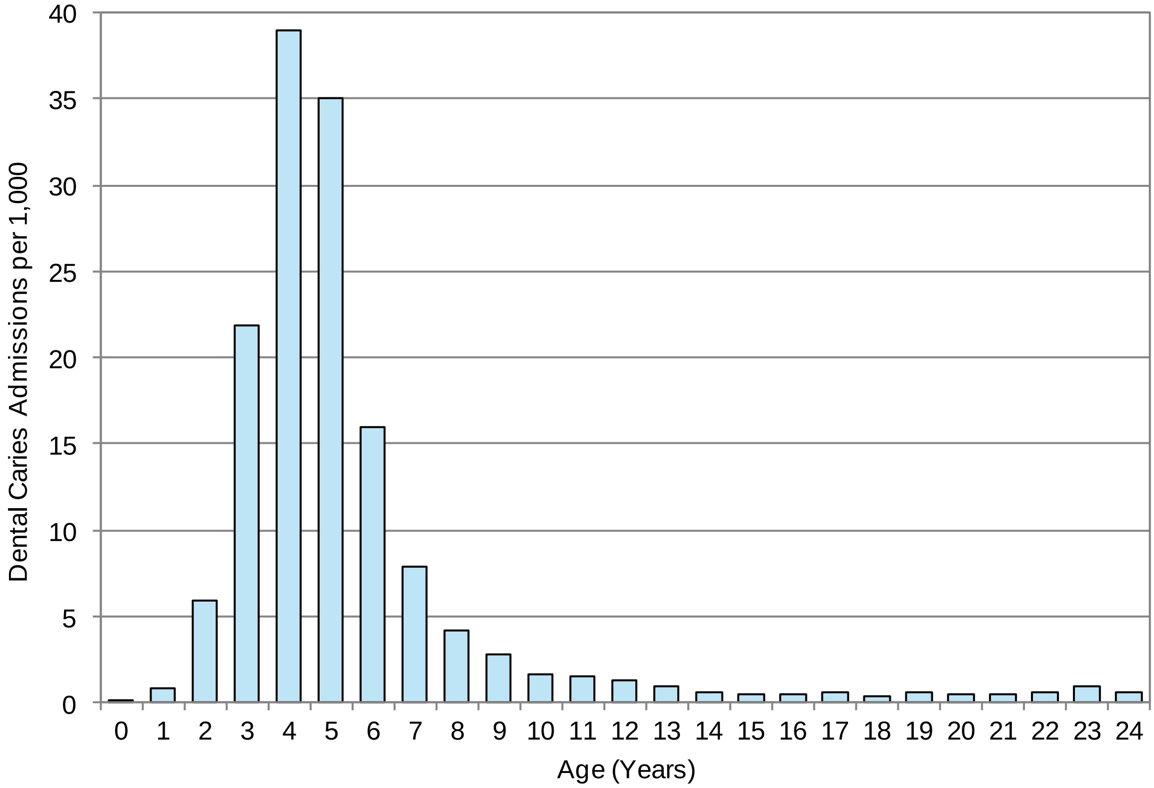
Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Figure 62. Hospital Admissions for Dental Caries in Children and Young People Aged 0−24 Years by Ethnicity, New Zealand 2000−2010



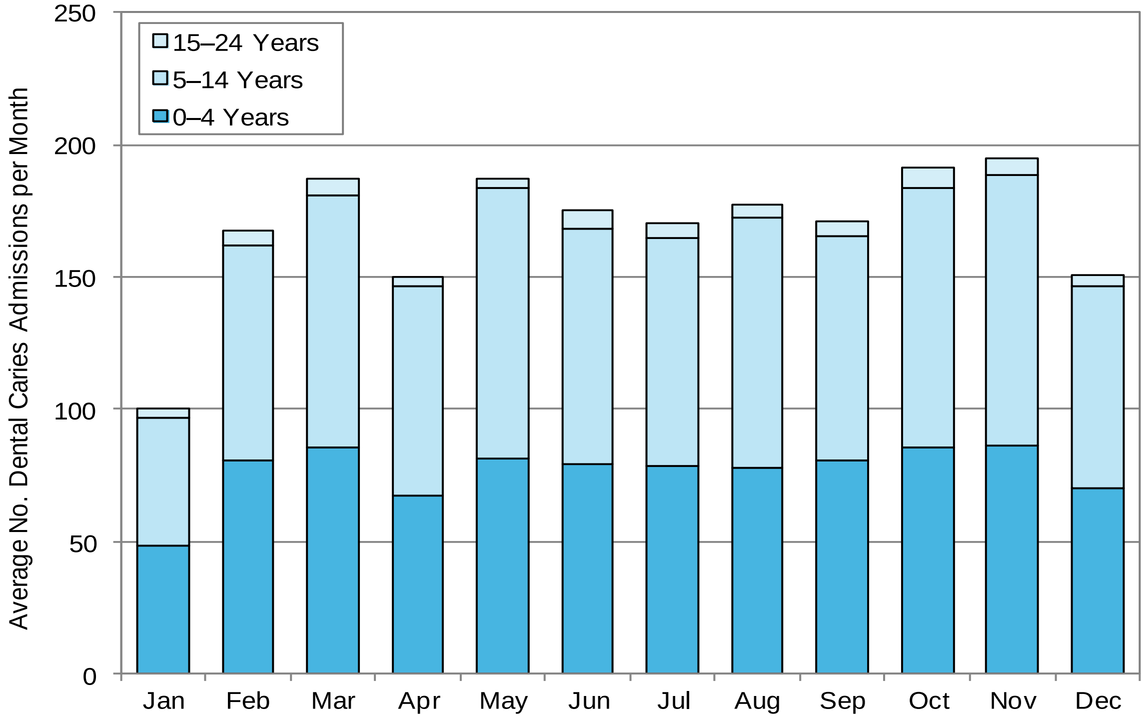
Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Figure 63. Hospital Admissions for Dental Caries in Māori Children and Young People by Age, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Figure 64. Average Number of Hospital Admissions for Dental Caries in Māori Children and Young People Aged 0−24 Years by Month, New Zealand 2006−2010



Source: National Minimum Dataset

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand during 2000–2010, hospital admissions for dental caries were higher for children aged 0–4 years and children aged 5–14 years than for young people aged 15–24 years. While admissions increased for all three age groups during 2000–2010, in absolute terms, increases were greatest for those aged 5–14 and 0–4 years.

Distribution by Age

In New Zealand during 2006–2010, hospital admissions for dental caries were infrequent in infants <1 Year, but rose rapidly thereafter, to reach a peak at 4 years of age. Rates then decreased, with admissions being relatively infrequent after 14 years of age.

Distribution by Primary Diagnosis

In New Zealand during 2006–2010, dental caries, followed by diseases of the pulp and periapical tissue, were the leading reasons for a dental admission in children aged 0–4 and 5–14 years. In contrast, embedded/impacted teeth, followed by dental caries were the leading reasons for an admission in young people aged 15–24 years.

Distribution by NZDep01 Index Decile and Gender

In New Zealand during 2006–2010, hospital admissions for dental caries in children aged 0–4 years were *significantly* higher for males and those from average-to-more deprived (NZDep01 decile 2–10) areas. Similarly, admissions for children aged 5–14 years were *significantly* higher for males and those from average-to-more deprived (NZDep01 decile 3–10) areas. Admissions in young people aged 15–24 years were *significantly* higher for those from more deprived (NZDep01 decile 5–10) areas, although gender differences were not evident.

Distribution by Season

In New Zealand during 2006–2010, there were no consistent seasonal variations in hospital admissions for dental caries in children and young people, although the number of admissions was lowest in January.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

NEWBORN HEARING SCREENING

In New Zealand each year, it is estimated that 135–170 babies are born with mild to profound permanent congenital hearing loss, representing an incidence of 3 per 1,000 births [122]. In response to concerns regarding the late age of diagnosis of congenital hearing losses (average age 35.1 months when screening was based on the presence of risk factors [123]), in 2006 the Government announced a funding package ($16 million over four years) to establish a Universal Newborn Hearing Screening and Early Intervention Programme (UNHSEIP).

The goals of the UNHSEIP were to ensure that [124]:

- Babies were screened for hearing loss by 1 month of age
- Audiology assessments were completed by 3 months of age
- Initiation of appropriate medical, audiological and early intervention services occurred by 6 months of age.

As a result, for babies born in hospital, screening is now offered in most cases before the baby goes home. Those born elsewhere, or not managing to be screened prior to discharge are able to access screening on an outpatient basis.

During 2007−2010, the UNHSEIP was rolled out progressively across all DHBs, with the Ministry of Health being responsible for screening, the audiological diagnosis of hearing loss and medical interventions, and the Ministry of Education being responsible for Early Intervention Services [125]. The following section presents data from the UNHSEIP's most recent monitoring report, which reviews newborn hearing screening in participating DHBs for the period 1st April–30th September 2010.

Data Sources and Methods

Indicators

1. Proportion of eligible newborns whose parents/guardians consent to newborn hearing screening

Numerator: Number of eligible newborns whose parents/guardians consented to newborn hearing screening

Denominator: Number of eligible live births

2. *Proportion of eligible newborns that complete the UNHS screening protocol by one month of age*

Numerator: Number of eligible newborns who complete newborn hearing screening by one month of age

Denominator: Number of eligible newborns who complete newborn hearing screening

3. Proportion of newborns who do not pass hearing screening and are referred to audiology

Numerator: Number of eligible newborns who complete screening with a referral for audiology assessment

Denominator: Number of eligible newborns who complete screening

4. Proportion of newborns that pass screening but have risk factors for developing late onset or progressive hearing loss

Numerator: Number of newborns that pass screening but have risk factors for developing late onset or progressive hearing loss (e.g. family history, craniofacial anomalies, jaundice, NICU >5 days, intrauterine infections, meningitis)

Denominator: Number of eligible newborns who passed screening.

Notes on Interpretation

Note 1: All of the data in this section are derived from the UNHSEIP's second monitoring report [126], which covers the six month period from 1 April 2010 to 30 September 2010. All but one DHB (Southern) had implemented newborn hearing screening by the beginning of this period, and, by the end of the period all DHBs were offering screening. Thus while reporting includes data from all 20 DHBs, data for Southern DHB is only from August 2010 onwards.

Note 2: All denominators in UNHSEIP reports are derived from the Birth Registration Dataset and include live births for the relevant period.

Newborn Hearing Screening in Māori Babies

Distribution by Ethnicity

In the UNHSEIP's most recent report, which covers for the period from 1 April 2010 to 30 September 2010, the lack of a suitable denominator precluded the assessment of consent rates by ethnicity. Thus it was difficult to determine from UNHSEIP data, the proportion of Māori babies who completed newborn hearing screening. However of those Māori babies whose parents consented to screening, 92.8% completed screening within one month, with 2.8% being referred to audiology and 9.2% being targeted for follow up. While there were some variations in audiology referrals and those targeted for follow up by ethnicity, the significance of these differences is unclear, as no assessments of statistical significance were presented for these data (**Table 40**).

Table 40. Newborn Hearing Screening Indicators by Ethnicity, New Zealand 1 April 2010 to 30 September 2010

Variable	Completed Screening ≤1 Month* (%)	Referrals to Audiology* (%)	Targeted for Follow Up* (%)
Newborn Hearing Screening			
Māori	92.8	2.8	9.2
Pacific	95.5	4.4	6.6
Asian/Indian	96.2	2.7	4.4
European	93.8	1.7	7.3
Other	95.7	2.9	6.3

Source: National Screening Unit 2011 [126]. *Note: See methods for indicator definitions. Ethnicity is Level 1 Prioritised

New Zealand Distribution

Distribution by DHB

In New Zealand during 1 April 2010–30 September 2010, the caregivers of 77.8% of eligible babies consented to newborn hearing screening, although this proportion varied considerably by DHB. Of those completing screening 94.0% did so within one month, with on average 2.4% of babies completing screening receiving an audiology referral. Of those babies who passed screening, a further 7.4% were deemed to have risk factors for delayed onset/progressive hearing loss (e.g. family history, craniofacial anomalies, intrauterine infections) which warranted follow up over time.

Distribution by NZDep01 Index Decile and Birth Location

In New Zealand during 1 April 2010–30 September 2010, there were no marked NZDep01 decile differences in the proportion of babies who completed screening within one month, although those who were born at home had lower completion rates than those born elsewhere. While there were some variations in audiology referrals and those targeted for follow up by NZDep01 decile and birth location, the significance of these differences remains unclear, as no assessments of statistical significance were available for these data.

Outcome of Audiology Referrals

Of babies referred to audiology during April–September 2010, 40.5% started audiology assessment, although this varied by DHB (range 0% to 75%). This proportion should be interpreted with caution however, as some DHBs did not submit audiology forms to the National Screening Unit (NSU) and there were delays in entering some data into the national database due to missing information. Of 563 babies who did not pass screening and were referred to audiology, audiology information was recorded in the national database for just 228 [126].

Of those babies with information in the national database, all that started audiology assessment completed the assessment, with 64% of those completing doing so by three months of age. Eleven babies (4.8% of those completing assessment) had a permanent/congenital hearing loss identified, with only one being a Neonatal Intensive care/Special Care Baby Unit (NICU/SCBU) baby. A higher proportion were identified with a conductive or mixed hearing loss (24.1% of those who completed assessment). In terms of the age at which hearing loss was identified, in 9 cases this was by 4 weeks, in 13 cases by 8 weeks, in 16 cases by 12 weeks and the remaining 27 cases by over 12 weeks.

ISSUES MORE COMMON IN YOUNG PEOPLE

MOST FREQUENT CAUSES OF HOSPITAL ADMISSION AND MORTALITY IN YOUNG PEOPLE

Introduction

Before considering any of the more detailed analyses in the other sections of this report, it is worthwhile briefly reviewing the most frequent causes of hospital admission and mortality amongst Māori young people during the past five years. The brief summary tables presented below provide an overall context for considering the relative importance of the various health issues experienced by Māori young people in recent years.

Data Sources and Methods

Indicator

1. *Most Frequent Reasons for Hospital Admission in Young People Aged 15–24 Years*

Numerator: National Minimum Dataset: Hospital admissions for young people aged 15–24 years by primary diagnosis (acute and arranged admissions) or primary procedure (waiting list admissions).

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

2. *Most Frequent Causes of Mortality in Young People Aged 15–24 Years*

Numerator: National Mortality Collection: Mortality for young people aged 15–24 years by main underlying cause of death.

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Primary Diagnoses/Cause of Death: Acute URTI (J00–J04, J05.0, J05.1, J06); Bronchiolitis (J21); Asthma (J45, J46); Bacterial/Viral/Other Pneumonia (J12–J18, J10.0, J11.0); Gastroenteritis (A00–A09, R11, K52.9); Skin Infections (L00–L04, L05.0, L08, H00.0, H01.0, J34.0, L98.0); Meningococcal Disease (A39); Bacterial Meningitis (G00–G01); Dental Conditions (K00–K08); Neoplasm/Chemotherapy/Radiotherapy (C00–D48, Z51.0, Z51.1); Mental Health (F00–F99); Abdominal/Pelvic Pain (R10); Viral Infection NOS (B34.9); Renal Failure (N17–N19); Immune Disorders (D80–D89); Metabolic Disorders (E70–E89); Haemolytic Anaemias (D55–D59); Fever of Unknown Origin (R50.8, R50.9); Removal of Internal Fixation Device (Z47.0); Dialysis (Z49); Appendicitis (K35–K37); Injury/Poisoning (S00–T79 Excluding ED Cases); Urinary Tract Infection (N10, N11, N12, N30.0, N30.1, N30.2, N30.3, N30.8, N30.9, N39.0); Constipation (K59.0); Therapeutic/Other/Unspecified Abortion (O04–O08); Spontaneous Abortion/Other Early Pregnancy Loss (O00–O03); Pregnancy/Delivery/Postnatal (O09–O99); STI/Pelvic Inflammatory Disease (N70–N77, A50–A64, I98.0, M03.1, M73.0, M73.1, N29.0, N34.1).

Injuries (Mortality): Pedestrian (V01–V09), Cyclist (V10–V19), Motorbike (V20–29), Vehicle Occupant (V40–79), Other Land Transport (V30–39, V80–89); Other Transport (V90–V99); Falls (W00–W19), Mechanical Forces: Inanimate (W20–W49), Mechanical Forces: Animate (W50–64), Drowning/Submersion (W65–74), Accidental Threat to Breathing (W75–W84), Electricity/Fire/Burns (W85–X19), Accidental Poisoning (X40–X49), Intentional Self-Harm (X60–84), Assault (X85–Y09), Undetermined Intent (Y10–Y34).

Procedures (Procedure or Block Code): Grommets (4163200, 4163201); Tonsillectomy +/− Adenoidectomy (4178900, 4178901); Adenoidectomy without Tonsillectomy (4180100); Procedures on Extraocular Muscles (block 215–220); Myringoplasty (block 313); Procedures on Nose (block 370–381); Dental Procedures (block 450–490); Inguinal Hernia Repair (block 990); Gastrointestinal Procedures (block 850–1011); Haemodialysis (block 1059); Orchidopexy (block 1186); Circumcision (3065300); Hypospadius Repair (block 1198); Procedures on the Cervix (block 1274–1278); Musculoskeletal Procedures (block 1360–1579); Procedures on Skin/Subcutaneous Tissue (block 1600–1660); Chemotherapy/Radiation Oncology (block 1780–1799); CT Scan 1952–1966); Magnetic Resonance Imaging (MRI)(block 2015).

Notes on Interpretation

Note 1: Because of regional differences in the booking of hospital admissions for pregnancy and childbirth (DHBs vary in their use of acute/arranged/waiting list codes), in this analysis a separate reproductive category has been used, which includes all admissions with a primary diagnosis in the ICD-10-AM O00–O99 range. For the purposes of rate calculations, only females aged 15–24 years have been included in the denominator (as compared to the other admission categories, where both genders have been included).

Note 2: Coverage of therapeutic abortions in the NMDS is partial (as many terminations are undertaken in private facilities which do not report to the NMDS). As a result, the figures presented here may significantly underestimate the number of terminations undertaken during the period.

Note 3: In order to maintain consistency with the injury section, all injury admissions with an Emergency Medicine Specialty Code (M05–M08) on discharge were excluded (see **Appendix 2** for rationale).

Note 4: An acute admission is an unplanned admission occurring on the day of presentation, while a semi-acute admission (referred to in the NMDS as an arranged admission) is a non-acute admission with an admission date <7 days after the date the decision was made that the admission was necessary. A waiting list admission is a planned admission, where the admission date is 7+ days after the date the decision was made that the admission was necessary.

Distribution in Māori Young People

Mortality in Māori Young People

In New Zealand during 2004−2008, vehicle occupant transport injuries and intentional self-harm were the leading causes of mortality in Māori young people aged 15−24 years, followed by neoplasms (**Table 41**).

Table 41. Most Frequent Causes of Mortality in Māori Young People Aged 15−24 Years by Main Underlying Cause of Death, New Zealand 2004−2008

Cause of Death	Number: Total 2004−2008	Number: Annual Average	Rate per 100,000	Percent (%)
Māori Young People 15–24 Years				
Transport: Vehicle Occupant	185	37.0	31.87	30.78
Intentional Self-Harm	183	36.6	31.53	30.45
Neoplasms	43	8.6	7.41	7.15
Accidental Poisoning	25	5.0	4.31	4.16
Transport: Pedestrian	18	3.6	3.10	3.00
Assault	17	3.4	2.93	2.83
Congenital Anomalies	15	3.0	2.58	2.50
Falls	11	2.2	1.90	1.83
Transport: Motorbike	8	1.6	1.38	1.33
Transport: Other	7	1.4	1.21	1.16
Undetermined Intent	7	1.4	1.21	1.16
Drowning/Submersion	6	1.2	1.03	1.00
Asthma	5	1.0	0.86	0.83
Epilepsy/Status Epilepticus	5	1.0	0.86	0.83
Mechanical Forces: Inanimate	4	0.8	0.69	0.67
Transport: Cyclist	3	0.6	0.52	0.50
Electricity/Fire/Burns	3	0.6	0.52	0.50
Other Causes	56	11.2	9.65	9.32
Total	601	120.2	103.54	100.00

Source: Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Table 42. Most Frequent Reasons for Hospital Admission in Māori Young People Aged 15−24 Years by Admission Type, New Zealand 2006−2010

Primary Diagnosis/Procedure	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Percent (%)
Māori Young People 15–24 Years				
Reproductive Admissions by Primary Diagnosis				
Pregnancy/Delivery/Postnatal	43,731	8,746.2	141.73	79.93
*Therapeutic/Other/Unspecified Abortion	7,964	1,592.8	25.81	14.56
Spontaneous Abortion/Other Early Pregnancy Loss	3,014	602.8	9.77	5.51
Total Reproductive Admissions	54,709	10,941.8	177.3	100.00
Acute Admissions by Primary Diagnosis				
Injury/Poisoning	10,984	2,196.8	18.14	22.70
Mental Health	4,677	935.4	7.72	9.67
Abdominal/Pelvic Pain	3,554	710.8	5.87	7.35
Skin Infections	2,939	587.8	4.85	6.07
Urinary Tract Infection	1,601	320.2	2.64	3.31
Asthma	1,451	290.2	2.40	3.00
Appendicitis	1,377	275.4	2.27	2.85
Gastroenteritis	1,290	258.0	2.13	2.67
STI/Pelvic Inflammatory Disease	1,274	254.8	2.10	2.63
Acute URTI	927	185.4	1.53	1.92
Other Diagnoses	18,310	3,662.0	30.23	37.84
Total Acute Admissions	48,384	9,676.8	79.88	100.00
Arranged Admissions by Primary Diagnosis				
Dialysis	1,668	333.6	2.75	12.30
Injury/Poisoning	1,311	262.2	2.16	9.67
Neoplasm/Chemotherapy/Radiotherapy	700	140.0	1.16	5.16
Other Diagnoses	9,883	1,976.6	16.32	72.87
Total Arranged Admissions	13,562	2,712.4	22.39	100.00
Waiting List Admissions by Primary Procedure				
Musculoskeletal Procedures	1,455	291.0	2.40	17.53
Gastrointestinal Procedures	1,031	206.2	1.70	12.42
Dental Procedures	706	141.2	1.17	8.51
Procedures on Skin/Subcutaneous Tissue	616	123.2	1.02	7.42
Tonsillectomy +/− Adenoidectomy	597	119.4	0.99	7.19
Procedures on the Cervix	285	57.0	0.47	3.43
Myringoplasty	204	40.8	0.34	2.46
Inguinal Hernia Repair	160	32.0	0.26	1.93
Procedures on Nose	156	31.2	0.26	1.88
Other Procedures	2,526	505.2	4.17	30.44
No Procedure Listed	563	112.6	0.93	6.78
Total Waiting List Admissions	8,299	1,659.8	13.70	100.00
Total Admissions	124,954	24,990.8		100.00

Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population. Note: Reproductive Rates are per 1,000 females thus overall rate not provided due to use of gender-specific denominator for Reproductive Admissions; *NMDS coverage of therapeutic abortions is incomplete, and thus may underestimate regional totals; Injury ED cases excluded.

Hospital Admissions in Māori Young People

In New Zealand during 2006–2010, issues associated with pregnancy, delivery and the postnatal period were the leading reasons for hospital admission in Māori young people. In terms of other admission types, injury/poisoning, mental health issues and abdominal/pelvic pain were the leading reasons for acute admissions. Dialysis, injury/poisoning and neoplasms/chemotherapy/radiotherapy were the leading reasons for arranged admissions, and musculoskeletal and gastrointestinal procedures were the leading reasons for waiting list admissions in those aged 15–24 years (**Table 42**).

New Zealand Distribution

New Zealand Mortality

In New Zealand during 2004–2008, intentional self-harm, vehicle occupant transport injuries and neoplasms were the leading causes of mortality in young people aged 15–24 years.

New Zealand Hospital Admissions

In New Zealand during 2006–2010, issues associated with pregnancy, delivery and the postnatal period were the leading reasons for hospital admission in young people. In terms of other admission types, injury/poisoning and abdominal/pelvic pain were the leading reasons for acute admissions, injury/poisoning and neoplasms/chemotherapy/radiotherapy the leading reasons for arranged admissions, and musculoskeletal and gastrointestinal procedures the leading reasons for waiting list admissions in those aged 15–24 years.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

Injuries in Young People

Introduction

The following section reviews injuries in Māori young people using data from the National Minimum Dataset and the National Mortality Collection.

Background

Injuries are the leading cause of mortality in Māori young people aged 15−24 years, with motor vehicle injuries being the leading cause of injury mortality, followed by pedestrian injuries and poisoning. Similarly, injuries are the second leading cause of hospital admissions in Māori young people, with injuries arising from mechanical forces and transport injuries being the leading reasons for injury related admissions, followed by assault [3].

In terms of prevention, New Zealand's National Injury Prevention Strategy (NZIPS) provides a strategic framework for reducing injury and identifies strategies for achieving injury prevention goals [113]. These strategies may include interventions proven to be effective in reducing injury from some causes. For example, graduated driver's licences may reduce crash rates amongst young drivers [127], while cycle helmets reduce head injuries [115] and smoke detectors alert households so they can leave a potentially burning building [118]. The effectiveness of many interventions is however, affected by the complexity of the environments in which families live and travel. The value of multifaceted interventions is increasingly noted in reviews of interventions to prevent injury [119].

Data Sources and Methods

Indicators

1. *Hospital Admissions for Injuries in Young People Aged 15–24 Years*

Numerator: National Minimum Dataset: Hospital admissions in young people aged 15–24 years with a primary diagnosis of Injury (ICD-10-AM S00–T79). Causes of injury were assigned using the ICD-10-AM primary external cause code (E code). The following were excluded: 1) Admissions with an E code in the Y40–Y89 range (complications of drugs/medical/surgical care and late sequelae of injury). 2) Admissions with an Emergency Medicine Specialty code (M05–M08) on discharge.

Causes of injury were assigned using the primary E code (hospital admissions) or the main underlying cause of death as follows: Pedestrian (V01–V09), Cyclist (V10–V19), Motorbike (V20–29), Vehicle Occupant (V40–79), Other Land Transport (V30–39, V80–89); Other Transport (V90–V99); Falls (W00–W19), Mechanical Forces: Inanimate (W20–W49), Mechanical Forces: Animate (W50–64), Drowning/Submersion (W65–74), Accidental Threat to Breathing (W75–W84), Electricity/Fire/Burns (W85–X19), Accidental Poisoning (X40–X49), Intentional Self-Harm (X60–84), Assault (X85–Y09), Undetermined Intent (Y10–Y34). Broader Categories included Land Transport Injuries (V01–V89) and Unintentional Non-Transport Injuries (W00–W74, W85–X19)

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

2. Mortality from Injuries in Young People Aged 15–24 Years

Numerator: National Mortality Collection; Deaths in young people aged 15–24 years where the main underlying cause of death was an injury (V01–Y36). Causes of injury were assigned using the codes listed above.

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: Because of regional inconsistencies in the uploading of Emergency Department cases to the National Minimum dataset (see **Appendix 2**) all hospital admissions with an Emergency Department specialty code on discharge have been excluded. In addition, because of the potential for these inconsistencies to impact significantly on time series analysis, any reviews of long term trends have been restricted to mortality data, with hospital admission data being used to explore cross sectional associations between demographic factors and different injury types. Despite these restrictions, the reader must bear in mind the fact that differences in the way different DHBs upload their injury cases to the NMDS may also impact on the regional vs. New Zealand analyses presented (see Appendix 2 for a fuller explanation of these issues).

Distribution in Māori Young People: All Injuries

Distribution by Cause

In New Zealand during 2006−2010, inanimate mechanical forces, falls and assaults were the leading causes of injury admissions in Māori young people, although as a group transport injuries also made a significant contribution. In contrast, during 2004−2008, vehicle occupant injuries and intentional self-harm were the leading causes of injury related mortality in Māori young people (**Table 43**).

New Zealand Distribution and Trends: All Injuries

New Zealand Trends

In New Zealand during 2000−2008, mortality from land transport injuries fluctuated, while mortality from unintentional non-transport injuries and accidental poisoning remained relatively static.

Distribution by Cause

In New Zealand during 2006−2010, inanimate mechanical forces and falls were the leading causes of injury admissions in young people, although as a group transport injuries also made a significant contribution. In contrast, during 2004−2008, intentional self-harm and vehicle occupant injuries were the leading causes of injury related mortality in young people.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

Table 43. Hospital Admissions (2006−2010) and Mortality (2004−2008) from Injuries in Māori Young People Aged 15−24 Years by Cause

Main External Cause of Injury	Number: Total per 5 Year Period	Number: Annual Average	Rate per 100,000	Percent (%)
Māori Young People 15–24 Years				
Injury Admissions				
Mechanical Forces: Inanimate	3,148	629.6	519.75	25.15
Falls	1,955	391.0	322.78	15.62
Assault	1,878	375.6	310.07	15.00
Transport: Vehicle Occupant	1,553	310.6	256.41	12.41
Transport: Motorbike	406	81.2	67.03	3.24
Transport: Other Land Transport	204	40.8	33.68	1.63
Transport: Pedestrian	179	35.8	29.55	1.43
Transport: Cyclist	176	35.2	29.06	1.41
Transport: Other Transport	39	7.8	6.44	0.31
Mechanical Forces: Animate	890	178.0	146.94	7.11
Intentional Self-Harm	722	144.4	119.21	5.77
Electricity/Fire/Burns	205	41.0	33.85	1.64
Undetermined Intent	183	36.6	30.21	1.46
Accidental Poisoning	147	29.4	24.27	1.17
Drowning/Submersion	10	2.0	1.65	0.08
Accidental Threat to Breathing	8	1.6	1.32	0.06
No External Cause Listed	2	0.4	0.33	0.02
Other Causes	812	162.4	134.07	6.49
Total	12,517	2,503.4	2,066.62	100.00
Injury Mortality				
Transport: Vehicle Occupant	185	37.0	31.87	38.30
Transport: Pedestrian	18	3.6	3.10	3.73
Transport: Motorbike	8	1.6	1.38	1.66
Transport: Cyclist	3	0.6	0.52	0.62
Transport: Other Land Transport	7	1.4	1.21	1.45
Intentional Self-Harm	183	36.6	31.53	37.89
Accidental Poisoning	25	5.0	4.31	5.18
Assault	17	3.4	2.93	3.52
Falls	11	2.2	1.90	2.28
Undetermined Intent	7	1.4	1.21	1.45
Drowning/Submersion	6	1.2	1.03	1.24
Mechanical Forces: Inanimate	4	0.8	0.69	0.83
Electricity/Fire/Burns	3	0.6	0.52	0.62
Accidental Threat to Breathing	3	0.6	0.52	0.62
Other Causes	3	0.6	0.52	0.62
Total	483	96.6	83.21	100.00

Source: Numerators: National Minimum Dataset and National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population. Note: s: suppressed due to small numbers

Distribution in Māori Young People: Land Transport Injuries

Distribution by Ethnicity

In New Zealand during 2006–2010, hospital admissions for pedestrian (RR 1.44 95% CI 1.21–1.71) and vehicle occupant (RR 1.74 95% CI 1.64–1.85) injuries were *significantly* higher for Māori than for non-Māori non-Pacific young people, while admissions for cyclist (RR 0.56 95% CI 0.48–0.66) and motorbike (RR 0.63 95% CI 0.57–0.70) injuries were *significantly* lower (**Table 44**). During 2006–2010, mortality from land transport injuries was consistently higher for Māori young people than for non-Māori non-Pacific young people (**Figure 65**).

Distribution by Age

When broken down by age, hospital admissions for vehicle occupant injuries increased rapidly after 13 years of age, reached a peak at 18 years, and then declined. In contrast, admissions for cyclist injuries increased during childhood, reached a peak at 11 years of age and then declined, while pedestrian injuries were relatively evenly distributed amongst those in their teens and early twenties. Admissions for motorbike injuries increased during late childhood and early adolescence and then remained relatively static (**Figure 66**).

Distribution by Season

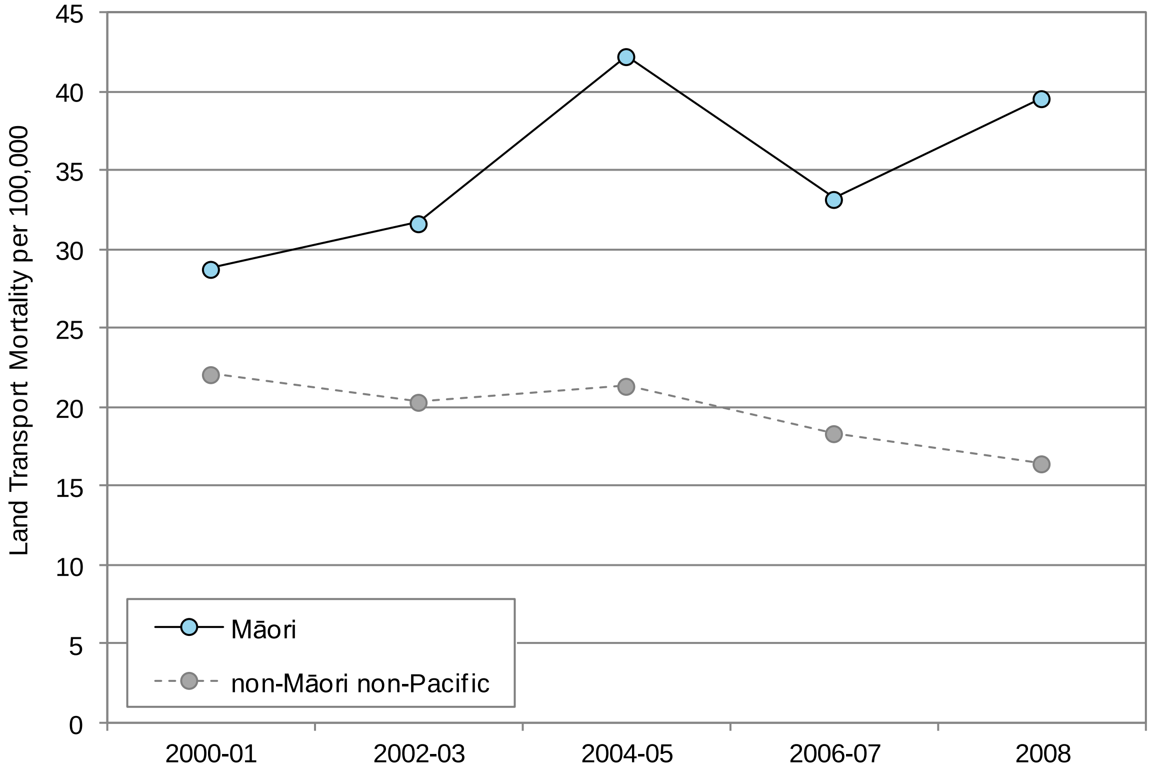
In New Zealand during 2006–2010, hospital admissions for land transport injuries in Māori young people were generally lower during the cooler months (**Figure 67**).

Table 44. Hospital Admissions for Selected Land Transport Injuries in Young People 15−24 Years by Ethnicity, New Zealand 2006−2010

Ethnicity	Number: Total 2006−2010	Number: Annual Average	Rate per 100,000	Rate Ratio	95% CI
Māori Young People 15–24 Years					
Pedestrian					
Māori	179	35.8	29.55	1.44	1.21 – 1.71
non-Māori non-Pacific	473	94.6	20.50	1.00	
Cyclist					
Māori	176	35.2	29.06	0.56	0.48 – 0.66
non-Māori non-Pacific	1,196	239.2	51.83	1.00	
Motorbike					
Māori	406	81.2	67.03	0.63	0.57 – 0.70
non-Māori non-Pacific	2,447	489.4	106.04	1.00	
Vehicle Occupant					
Māori	1,553	310.6	256.41	1.74	1.64 – 1.85
non-Māori non-Pacific	3,403	680.6	147.46	1.00	

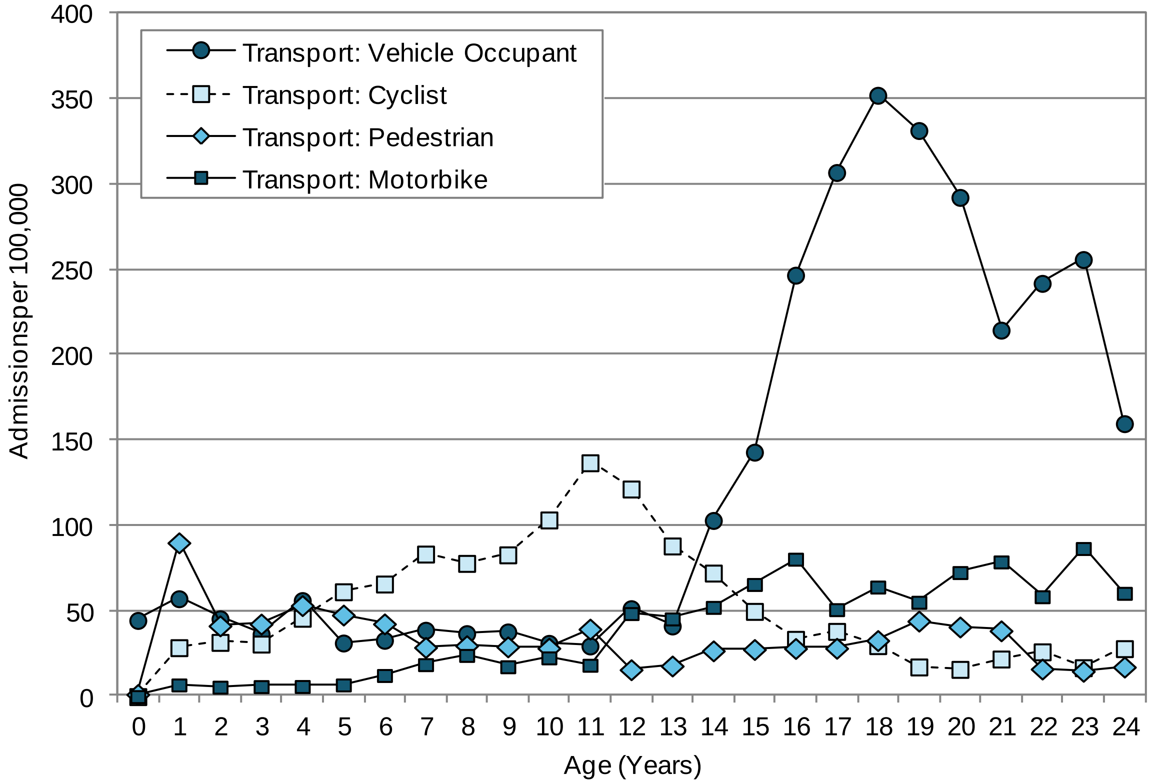
Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Figure 65. Mortality from Land Transport Injuries in Young People Aged 15−24 Years by Ethnicity, New Zealand 2000−2008



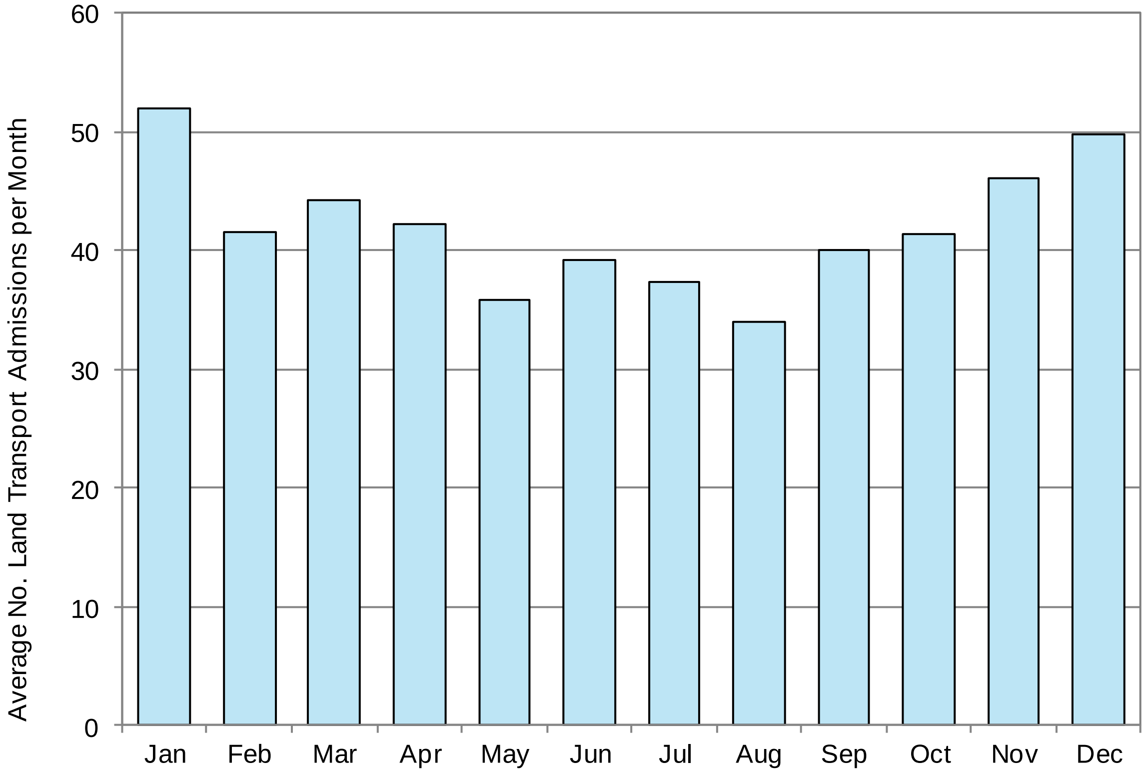
Source: Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population.

Figure 66. Hospital Admissions for Land Transport Injuries in Māori Children and Young People Aged 0−24 Years by Age and Injury Type, New Zealand 2006−2010



Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Figure 67. Average Number of Hospital Admissions for Land Transport Injuries per Month in Māori Young People Aged 15−24 Years, New Zealand 2006−2010



Source: National Minimum Dataset

New Zealand Distribution and Trends: Land Transport Injuries

Distribution by Age

Age and Gender: In New Zealand during 2006–2010, hospital admissions for land transport injuries in males increased rapidly during late childhood and adolescence, to reach a peak at 19 years of age. While similar patterns were evident for females, the rate of increase was much slower prior to 15 years of age. At all ages (with the exception of infants <1 Year) admission rates were higher for males than for females. Mortality during 2004–2008 demonstrated a similar pattern, with rates peaking at 18 years in both genders.

Age and Cause: In New Zealand during 2006–2010, hospital admissions for vehicle occupant injuries increased rapidly after 13 years of age, with rates reaching a peak at 19 years, before declining again. Motorbike injury admissions also increased during adolescence, with rates being highest amongst those in their late teens and early twenties. In contrast, cycle injury admissions increased during childhood to reach a peak amongst those aged 11–14 years, while pedestrian injuries were more evenly distributed across childhood/adolescence/early adulthood.

Distribution by NZDep01 Index Decile and Gender

Pedestrian Injuries: In New Zealand during 2006–2010, hospital admissions for pedestrian injuries were *significantly* higher for males and young people from more deprived (NZDep01 deciles 7–8 and 10) areas.

Cyclist Injuries: In New Zealand during 2006–2010, hospital admissions for cycle injuries were *significantly* higher for males. Admissions were also *significantly* higher in those from the least deprived (NZDep01 decile 1) areas, when compared to those from more deprived (NZDep01 decile 8–10) areas.

Motorbike Injuries: In New Zealand during 2006–2010, hospital admissions for motorbike injuries were *significantly* higher for males. No consistent social gradients were evident however by NZDep01 index decile.

Vehicle Occupant Injuries: In New Zealand during 2006–2010, hospital admissions for vehicle occupant injuries were *significantly* higher for males and those from average-to-more deprived (NZDep01 decile 4–10) areas.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

Distribution in Māori Young People: Unintentional Non-Transport Injuries

Distribution by Ethnicity

In New Zealand during 2006−2010, hospital admissions for electricity/fire/burns (RR 1.48 95% CI 1.26–1.74) and accidental poisoning (RR 1.37 95% CI 1.13–1.65) were *significantly* higher for Māori young people than for non-Māori non-Pacific young people, while admissions for drowning/submersion were similar in both ethnic groups (**Table 45**). During 2000–2010, mortality from unintentional non-transport injuries was similar for Māori and non-Māori non-Pacific young people (**Figure 68**).

Distribution by Age

When broken down by age, hospital admissions for inanimate mechanical forces increased during the early teens, to reach a plateau amongst those in their late teens and early twenties, while admissions for falls declined during the early teens and then became relatively static (**Figure 69**).

Distribution by Season

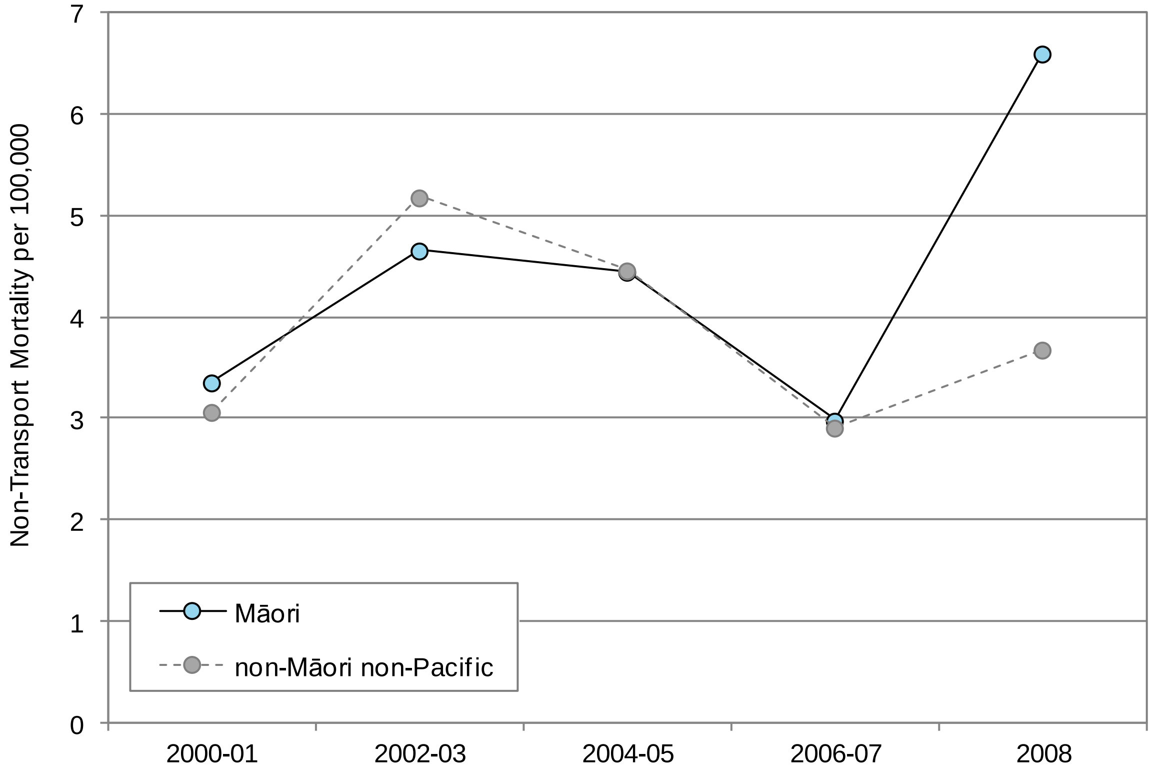
In New Zealand during 2006−2010, there were no consistent seasonal variations in hospital admissions for unintentional non-transport injuries in Māori young people (**Figure 70**).

Table 45. Hospital Admissions for Selected Unintentional Non-Transport Injuries in Young People Aged 15−24 Years by Ethnicity, New Zealand 2006−2010

Ethnicity	Number: Total 2006−2010	Number: Annual Average	Rate per 100,000	Rate Ratio	95% CI
Māori Young People 15–24 Years					
Electricity/Fire/Burns					
Māori	205	41.0	33.85	1.48	1.26 – 1.74
non-Māori non-Pacific	528	105.6	22.88	1.00	
Accidental Poisoning					
Māori	147	29.4	24.27	1.37	1.13 – 1.65
non-Māori non-Pacific	410	82.0	17.77	1.00	
Drowning/Submersion					
Māori	10	2.0	1.65	1.06	0.53 – 2.13
non-Māori non-Pacific	36	7.2	1.56	1.00	

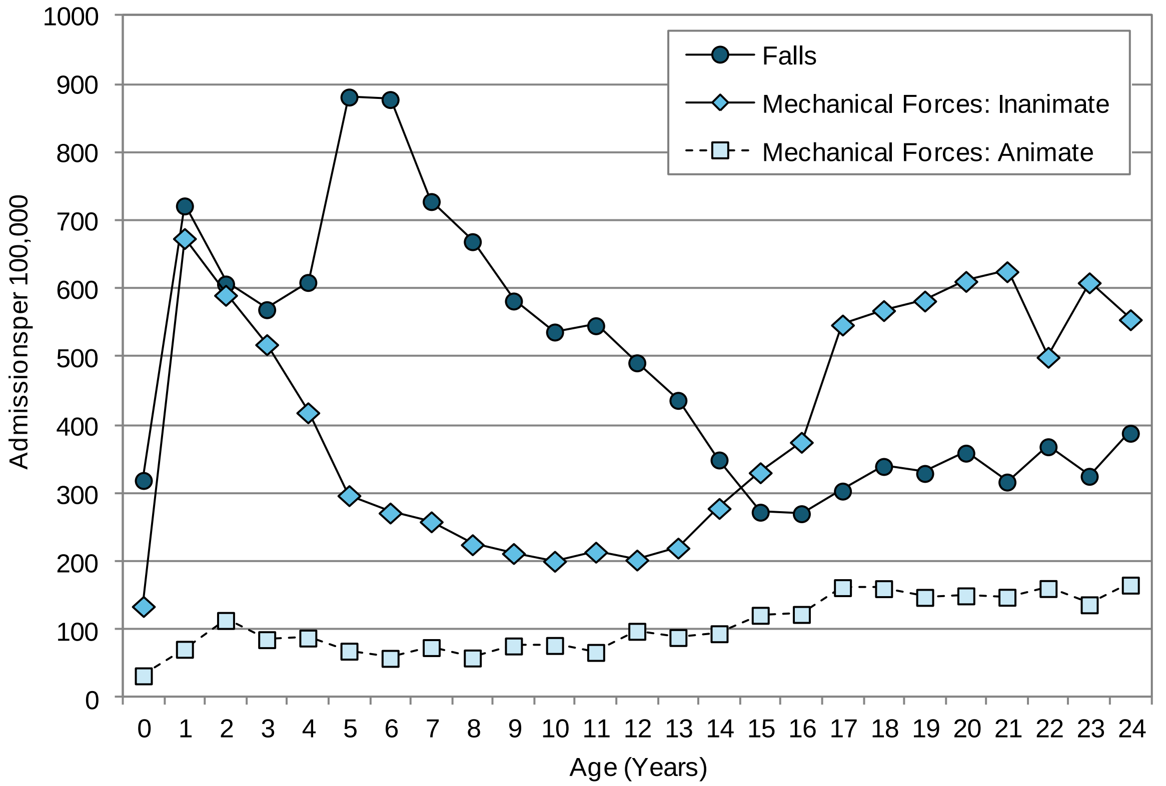
Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Figure 68. Mortality from Unintentional Non-Transport Injuries in Young People Aged 15−24 Years by Ethnicity, New Zealand 2000−2008



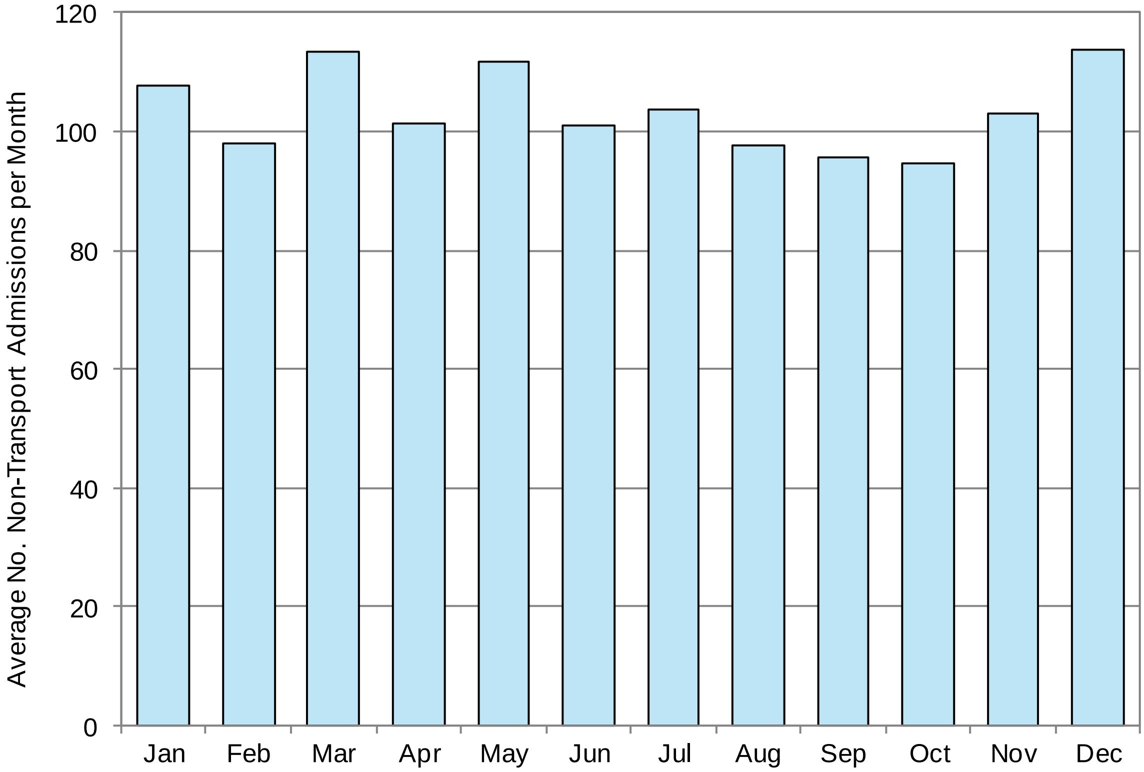
Source: Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Figure 69. Hospital Admissions for Falls and Mechanical Force Type Injuries in Māori Children and Young People 0–24 Years by Age and Injury Type, New Zealand 2006–2010



Source: Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Figure 70. Average Number of Hospital Admissions for Unintentional Non-Transport Injuries per Month in Māori Young People 15−24 Years, New Zealand 2006−2010



Source: National Minimum Dataset

New Zealand Distribution and Trends: Unintentional Non-Transport Injuries

Distribution by Age

In New Zealand during 2006–2010, after peaking at one year of age and again at five years, hospital admissions for unintentional non-transport injuries declined in both males and females. For males, admissions reached a nadir at ten years of age, before increasing again, to reach a further peak at 19 years. For females, rates continued to decline until around 15 years, after which time they became static. Mortality during 2004–2008 demonstrated a similar pattern, with rates for males being consistently higher than for females from 12 years onwards (as they were during the preschool years). While admissions for injuries arising from inanimate mechanical forces and falls tended to be higher in children, they were also prominent causes of injury admission in young people aged 15–24 years.

Distribution by NZDep01 Index Decile and Gender

Falls: In New Zealand during 2006–2010, hospital admissions for falls were *significantly* higher for males and for young people from more deprived (NZDep01 deciles 7 and 9–10) areas.

Electricity/Fire/Burns: In New Zealand during 2006–2010, hospital admissions for injuries arising from electricity/fire/burns were *significantly* higher for males and those from more deprived (NZDep01 decile 5–10) areas.

Inanimate Mechanical Forces: In New Zealand during 2006–2010, hospital admissions for injuries arising from inanimate mechanical forces were *significantly* higher for males and those from average-to-more deprived (NZDep01 decile 3–10) areas.

Animate Mechanical Forces: In New Zealand during 2006–2010, hospital admissions for injuries arising from animate mechanical forces were *significantly* higher for males and those from more deprived (NZDep01 decile 8–10) areas.

Distribution by Season

In New Zealand during 2006–2010, there were no consistent seasonal variations in hospital admissions for unintentional non-transport injuries in young people.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

Teenage Births

Introduction

The following section explores teenage birth rates amongst Māori women using information from the Birth Registration Dataset.

Background

In New Zealand, teenage birth rates are higher for Māori women than for other ethnic groups. Teenage birth rates however must be considered in the context of the higher overall fertility rates of Māori women and the fact that, during 2003–2007, birth rates were higher for Māori women than for European women at every age, up until thirty years [40]. Further, while teenage birth rates and terminations of pregnancy are both higher for Māori women, research suggests that young Māori women who become pregnant are less likely to have a termination of pregnancy than European women [128], [40].

In New Zealand teenage pregnancy has been shown to increase the risk of babies being born preterm or small for gestational age, although the effect of young maternal age on these outcomes may not be as marked for Māori women as for other ethnic groups [20]. However, young maternal age has been associated with an increased risk of neonatal and post-neonatal mortality and sudden unexpected death in infancy (SUDI) in Māori infants (see *Infant Mortality* section). There is currently debate, however, as to whether it is the social or biological factors that play the greatest role, with risk of preterm birth amongst teens disappearing in a number of overseas studies, once the effects of socioeconomic disadvantage are taken into account [129].

Data Sources and Methods

Indicators

1. *Teenage Births: Live Births to Women Aged <20 Years*

<u>Numerator</u>: Birth Registration Dataset: All live births to women aged <20 years

<u>Denominator</u>: Statistics NZ Estimated Resident Population: All women aged 15–19 years (with linear extrapolation being used to calculate denominators between Census years).

2. Terminations of Pregnancy in Women <20 Years of Age

<u>Numerator</u>: Abortion Supervisory Committee via Statistics NZ: Induced abortions registered with the Abortion Supervisory Committee for women aged <20 years.

<u>Denominator</u>: Statistics NZ Estimated Resident Population: All women aged 15–19 years (with linear extrapolation being used to calculate denominators between Census years).

Notes on Interpretation

Note 1: In the analysis of total teenage pregnancy rates, miscarriage rates were estimated at 10% of induced abortions and 20% of live births [128].

Note 2: The teenage birth rates presented here may vary slightly from previous years, as the Ministry of Health no longer provides stillbirth data in the Birth Registration Dataset due to concerns about data quality. Thus the

current analysis is restricted to teenage live births (as compared to total teenage birth rates (including stillbirths) which were presented in previous years).

Note 3: **Appendix 3** provides an overview of the strengths and limitations of the Birth Registration Dataset.

Distribution in Young Māori Women

Distribution by Ethnicity

In New Zealand during 2006–2010, teenage birth rates were *significantly* higher for Māori (RR 4.74 95% CI 4.61–4.87) than for non-Māori non-Pacific women (**Table 46**). Similar ethnic differences were seen during 2000–2010 (**Figure 71**).

Birth Rates by Maternal Age and Ethnicity

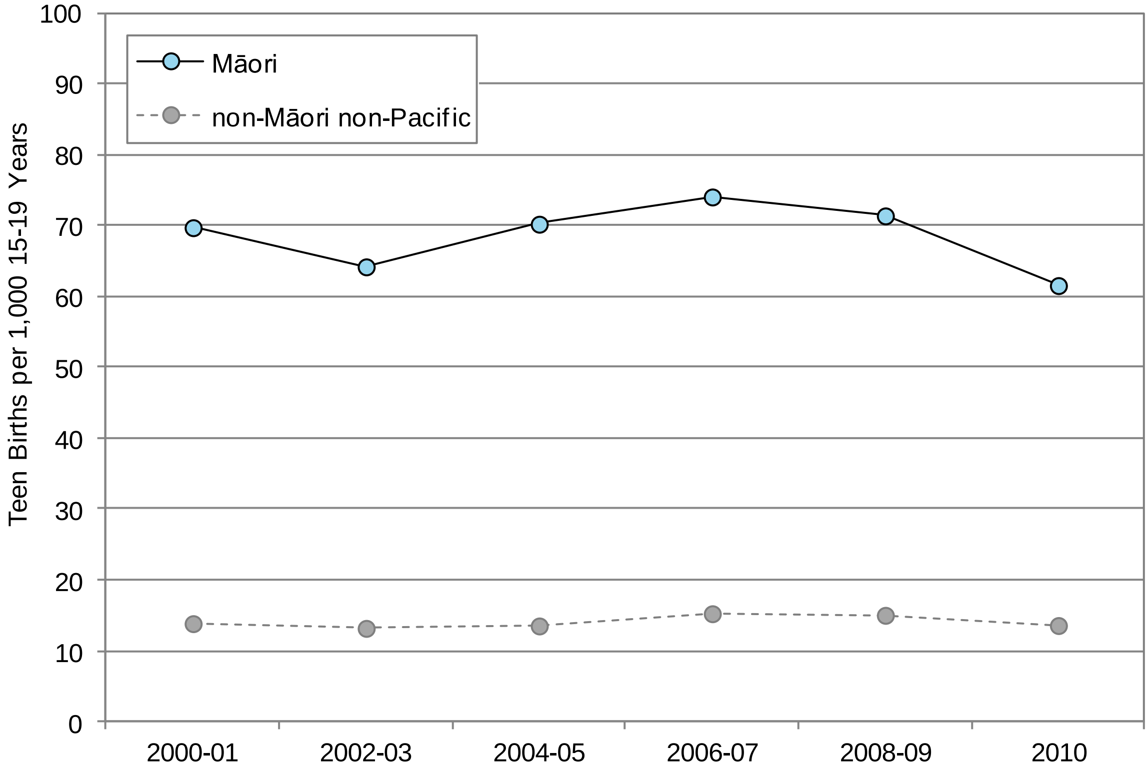
Teenage birth rates however need to be considered within the context of overall fertility rates and the fact that during 2006–2010, Māori women had higher birth rates than non-Māori non-Pacific women in each age group, up until thirty years of age (**Figure 72**).

Table 46. Teenage Birth Rates by Ethnicity, New Zealand 2006–2010

Ethnicity	Number: Total 2006−2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Teenage Live Births					
Māori	12,411	2,482.2	70.34	4.74	4.61 – 4.87
non-Māori non-Pacific	8,307	1,661.4	14.83	1.00	

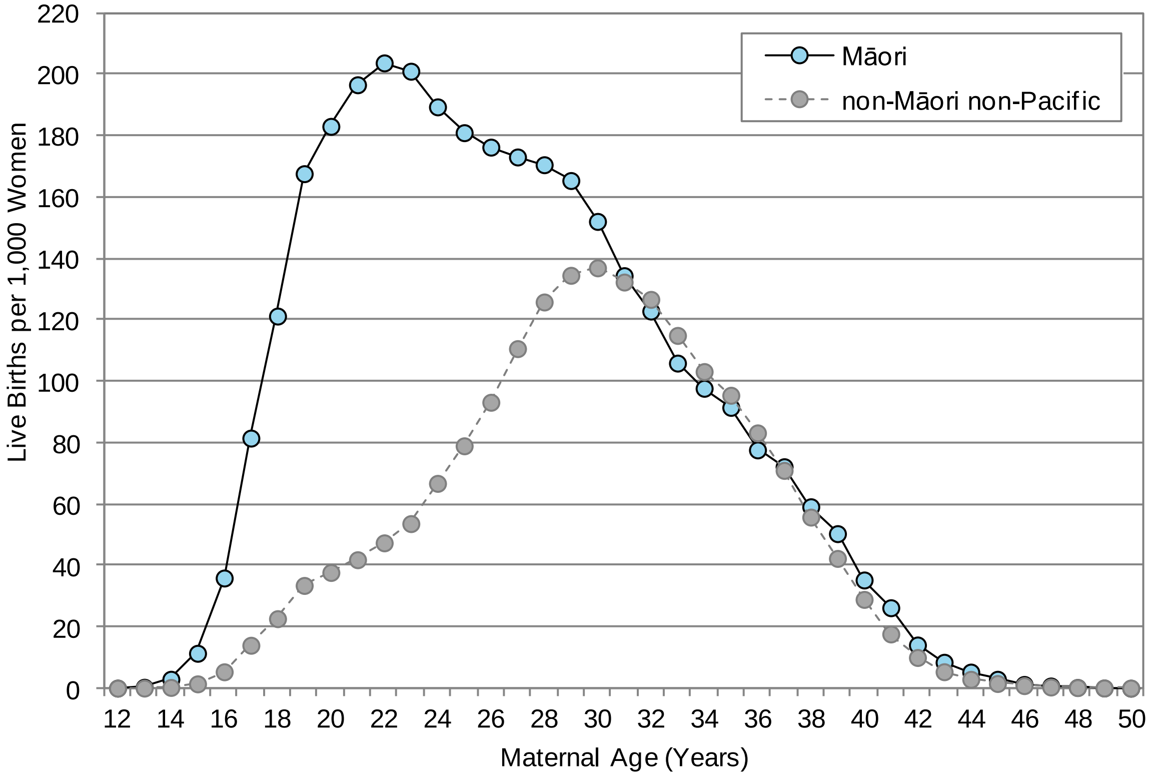
Source: Numerator: Birth Registration Dataset (Live births only); Denominator: Statistics NZ Estimated Resident Population

Figure 71. Teenage Birth Rates by Ethnicity, New Zealand 2000–2010



Source: Numerator: Birth Registration Dataset (Live births only); Denominator: Statistics NZ Estimated Resident Population

Figure 72. Live Birth Rates by Maternal Age and Ethnicity, New Zealand 2006–2010



Source: Numerator: Birth Registration Dataset (Live births only); Denominator: Statistics NZ Census Population Counts

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand, teenage live births declined during the late 1990s and early 2000s, to reach their lowest point, at 25.5 per 1,000, in 2002. Birth rates then gradually increased again, reaching a peak of 32.4 per 1,000 in 2008. In contrast, teenage terminations of pregnancy increased during the late 1990s and early 2000s, reached a plateau between 2002 and 2007, and then declined. Teenage birth and termination rates were thus roughly equivalent during 2002–2004 (i.e. for every woman giving birth in her teenage years, there was one corresponding termination of pregnancy).

Distribution by NZDep01 Decile

In New Zealand during 2006–20010, teenage live birth rates were *significantly* higher for women from average-to-more deprived (NZDep01 decile 2–10) areas.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

TERMINATIONS OF PREGNANCY

Introduction

The following section reviews terminations of pregnancy in young Māori women using information from the Abortion Supervisory Committee (via Statistics New Zealand).

Background

In New Zealand, approximately one quarter of all pregnancies end in a termination, with one in four women undergoing a termination in their lifetimes [130]. Terminations are part of core, publicly funded health services, with pregnancies that present a serious danger to the life of a woman, or to her physical or mental health, that result from incest, or have a fetal abnormality being amongst those which can be legally terminated. Women usually go first to a referring doctor (e.g. a GP or Family Planning doctor) to have the pregnancy confirmed, to undergo diagnostic tests and to be referred to an abortion clinic. Two certifying consultants must then individually review the woman and agree that the case fulfils the legal grounds for a termination [130].

In New Zealand, terminations of pregnancy are higher for Māori women than for European women. However such figures must be viewed in the context of the higher overall fertility rates of Māori women at younger ages (<30 years) and the fact that of young Māori women aged <25 years who did become pregnant during 2007, a lower proportion had a termination than did European women [40].

When considering the factors contributing to terminations, the Dunedin Multidisciplinary Health and Development Study [131] found that amongst their birth cohort of 477 women aged 26 years in 1998/99, 36% had been pregnant before 25 years, and that in 60% of cases the pregnancy had been unwanted. In this cohort, 48% of unwanted pregnancies ended in termination, as compared to 2% of wanted pregnancies. Factors associated with unwanted pregnancy included shorter relationship duration and first or only pregnancies. Unwanted pregnancies were more likely to result from contraception not being used (55%) than it failing (40%), with reasons for non-use of contraception including "not thinking about it" (40%), the use of alcohol (25%), partners not wanting to use a condom (11%), and not being able to afford contraception (6%) [131].

Similarly, a 2002 study of women attending a New Zealand clinic for assessment prior to a termination found that 69.5% had either used no contraception or natural family planning prior to conception, as compared to 48.0% of clinic attendees in 1999 and 44.5% in 1995. The authors concluded that accurate information on contraceptive methods, accompanied by access to reliable contraception could reduce the need for termination of unwanted pregnancies [132].

Data Sources and Methods

Indicator

1. Legally Induced Terminations of Pregnancy

Numerator: Legally Induced Terminations of Pregnancy Registered in New Zealand by the Abortion Supervisory Committee

Denominator: Statistics New Zealand Estimated Resident Population

Notes on Interpretation

Note 1: In New Zealand, information on the domicile of women presenting for a termination of pregnancy has only been recorded by the Abortion Supervisory Committee since 2004, with an agreement existing between the Committee and Statistics NZ that the only geographical breakdown of termination data will be at regional council level. Thus information on terminations of pregnancy by DHB or NZDep01 Index decile is unavailable.

Note 2: In its reporting of terminations, Statistics NZ uses total response ethnicity, and thus women will appear in each ethnic group with which they identified (in both the numerator and denominator).

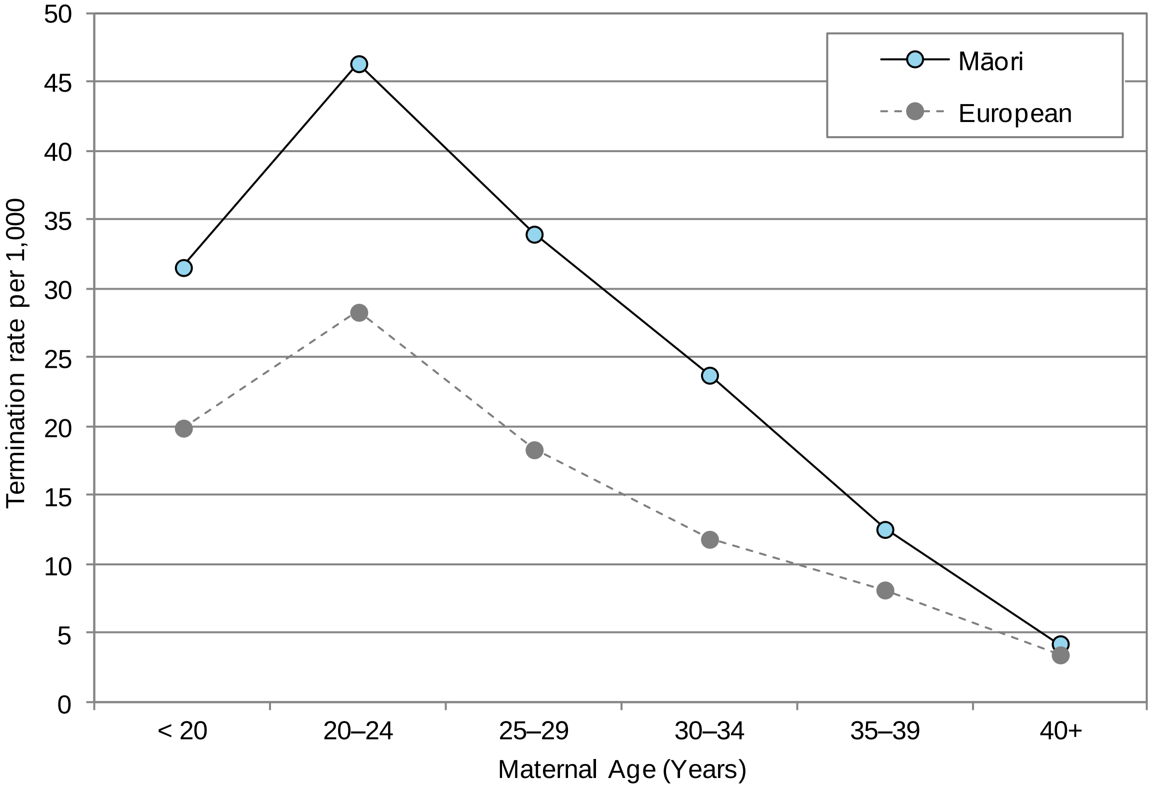
Distribution in Young Māori Women

Distribution by Age and Ethnicity

In New Zealand during 2010, terminations of pregnancy were highest for Māori women aged 20–24 years, followed by those aged 25–29 years and those aged 15–19 years. While similar patterns were seen for European women, in each age group, termination rates were higher for Māori women than for European women (**Figure 73**).

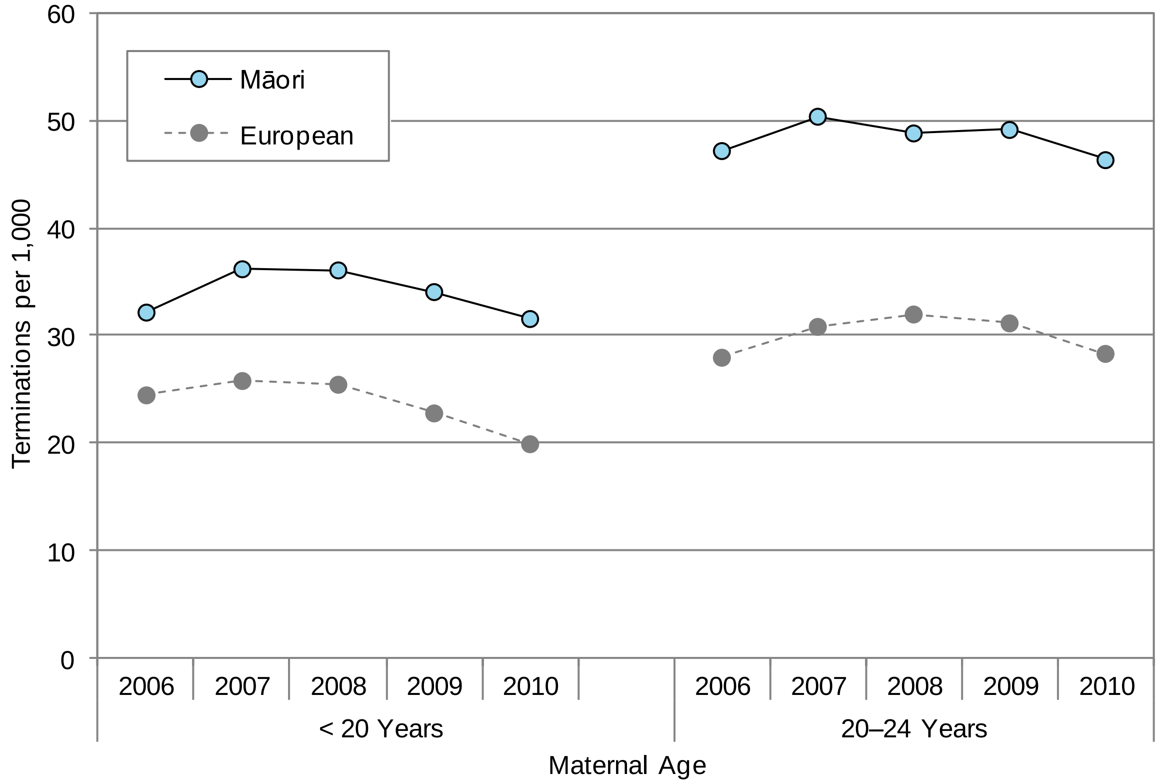
In New Zealand during 2006–2010, terminations of pregnancy were consistently higher for Māori teenagers and women aged 20–24 years, than for European teenagers and women aged 20–24 years, although termination rates in Māori women in these age groups gradually declined after 2007 (**Figure 74**).

Figure 73. Terminations of Pregnancy by Age and Ethnicity, New Zealand 2010



Source: Abortion Supervisory Committee via Statistics New Zealand. Note: Ethnicity is Total Response

Figure 74. Terminations of Pregnancy by Ethnicity in Young Women <25 Years, New Zealand 2006–2010



Source: Abortion Supervisory Committee via Statistics New Zealand. Note: Ethnicity is Total Response

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand during 1980–2010, terminations of pregnancy were highest in women aged 20–24 years, followed by those 25–29 years and 15–19 years of age. Termination rates increased during the 1980s and 1990s, with rates reaching a peak for most age groups in the early 2000s and then beginning to gradually decline.

Distribution by Age and Gestation

In New Zealand during 2009, the majority of terminations of pregnancy occurred between 8 and 12 weeks gestation, in all age groups. The next most frequent gestations were <8 weeks, followed by 13–16 weeks, with women aged 45+ years having a higher proportion of terminations >12 weeks than those from other age groups.

Distribution by Age and Previous Terminations

In New Zealand during 2009, the proportion of women who had not had a previous termination decreased with increasing age, with the highest number of previous terminations being amongst women in their late twenties to early forties.

For further detail see *The Health Status of Children and Young People in New Zealand* [1].

APPENDICES AND REFERENCES

APPENDIX 1: STATISTICAL SIGNIFICANCE TESTING AND ITS USE IN THIS REPORT

Understanding Statistical Significance Testing

Inferential statistics are used when a researcher wishes to use a sample to draw conclusions about the population as a whole (e.g. weighing a class of 10 year old boys, in order to estimate the average weight of all 10 year old boys in New Zealand). Any measurements based on a sample however, even if drawn at random, will always differ from that of the population as a whole, simply because of chance. Similarly, when a researcher wishes to determine whether the risk of a particular condition (e.g. lung cancer) is truly different between two groups (smokers and non-smokers), they must also consider the possibility that the differences observed arose from chance variations in the populations sampled.

Over time, statisticians have developed a range of measures to quantify the uncertainty associated with random sampling error (i.e. to quantify the level of confidence we can have that the average weight of boys in our sample reflects the true weight of all 10 year old boys, or that the rates of lung cancer in smokers are really different to those in non-smokers). Of these measures, two of the most frequently used are:

P values: The p value from a statistical test tells us the probability that we would have seen a difference at least as large as the one observed, if there were no real differences between the groups studied (e.g. if statistical testing of the difference in lung cancer rates between smokers and non-smokers resulted in a p value of 0.01, this tells us that the probability of such a difference occurring if the two groups were identical is 0.01 or 1%. Traditionally, results are considered to be statistically significant (i.e. unlikely to be due to chance) if the probability is < 0.05 (i.e. less than 5%) [133].

Confidence Intervals: A 95% Confidence Interval suggests that if you were to repeat the sampling process 100 times, 95 times out of 100 the confidence interval would include the true value. In general terms, if the 95% confidence intervals of two samples overlap, there is no significant difference between them (i.e. the p value would be ≥ 0.05), whereas if they do not overlap, they can be assumed to be statistically different at the 95% confidence level (i.e. the p value would be < 0.05) [133].

The Use of Statistical Significance Testing in this Report

In the preparation of this report a large range of data sources were used. For the purposes of statistical significance testing however, these data sources can be considered as belonging to one of two groups: Population Surveys and Routine Administrative Datasets. The relevance of statistical testing to each of these data sources is described separately below:

Population Surveys: A number of indicators in this report utilise data derived from national surveys (e.g.2006/07 New Zealand Health Survey), where information from a sample has been used to make inferences about the population as a whole. In this context statistical significance testing is appropriate, and where such information is available in published reports, it has been incorporated into the text accompanying each graph or table (i.e. the words significant, or not significant in italics are used to imply that a test of statistical significance has been applied to the data and that the significance of the associations are as indicated). In a small number of cases however information on statistical significance was not available in published reports, and in such cases any associations described do not imply statistical significance.

Numbers and Rates Derived from Routine Administrative Data: A large number of the indicators in this report are based on data derived from New Zealand's administrative datasets (e.g. National Minimum Dataset, National Mortality Collection), which capture information on all of the events occurring in a particular category. Such datasets can thus be viewed as providing information on the entire population, rather than a sample and as a consequence, 95% confidence intervals are not required to quantify the precision of the estimate (e.g. the number of leukaemia deaths in 2003–2007, although small is not an estimate, but rather reflects the total number of deaths during this period). As a consequence, 95% confidence intervals have not been provided for any of the descriptive data (numbers, proportions, rates) presented in this report, on the basis that the numbers presented are derived from the total population under study.

Rate Ratios Derived from Routine Administrative Data: In considering whether statistical significance testing is ever required when using total population data Rothman [134] notes that if one wishes only to consider descriptive information (e.g. rates) relating to the population in question (e.g. New Zealand), then statistical significance testing is probably not required (as per the argument above). If however, one wishes to use total population data to explore biological phenomena more generally, then the same population can also be considered to be a sample of a larger super-population, for which statistical significance testing may be required (e.g. the fact that SIDS in New Zealand is 10 times higher in the most deprived NZDep01 areas might be used to make inferences about the impact of the socioeconomic environment on SIDS mortality more generally (i.e. outside of New Zealand, or the 5 year period concerned)). Similarly, in the local context the strength of observed associations is likely to vary with the time period under study (e.g. in updating 5-year asthma admission data from 2004–2008 to 2005–2009, rate ratios for Pacific children are likely to change due to random fluctuations in annual rates, even though the data utilised includes all admissions recorded for that particular 5-year period). Thus in this report, whenever measures of association (i.e. rate ratios) are presented, 95% confidence intervals have been provided on the assumption that the reader may wish to use such measures to infer wider relationships between the variables under study [134].

The Signalling of Statistical Significance in this Report

In order to assist the reader to identify whether tests of statistical significance have been applied in a particular section, the significance of the associations presented has been signalled in the text with the words *significant*, or *not significant* in italics. Where the words *significant* or *non-significant* do not appear in the text, then the associations described do not imply statistical significance or non-significance.

APPENDIX 2: THE NATIONAL MINIMUM DATASET

Mode of Data Collection

The National Minimum Dataset (NMDS) is New Zealand's national hospital discharge data collection and is maintained by the Ministry of Health. The information contained in the dataset has been submitted by public hospitals in a pre-agreed electronic format since 1993. Private hospital discharges for publicly funded events (e.g. births, geriatric care) have been submitted since 1997. The original NMDS was implemented in 1993, with public hospital information back loaded to 1988 [2]. Information contained in the NMDS includes principal and additional diagnoses, procedures, external causes of injury, length of stay and sub-specialty code and demographic information such as age, ethnicity and usual area of residence.

Dataset Quality and Changes in Coding Over Time

There are a number of key issues which must be taken into account when interpreting information from the NMDS. Many of these issues arise as a result of regional differences in the way in which data are coded and uploaded to the NMDS. These include

1. Inconsistencies in the way in which different providers upload day cases to the NMDS, and how this has changed over time.
2. The changeover from the ICD-9 to ICD-10 coding system, and irregularities in the way in which diagnoses and procedures are allocated ICD codes.
3. Changes in the way in which ethnicity information has been collected over time and across regions (**Appendix 5**).

The following sections discuss the first two of these issues, while the third is discussed in Appendix 5, which reviews the way in which ethnicity information is collected and coded within the health sector.

1. Inconsistencies in the Uploading of Day-Cases to the NMDS

One of the key issues with time series analysis using hospital discharge data is the variability with which different providers upload day cases to the NMDS. Day cases are defined as cases that are admitted and discharged on the same day, with the "three hour rule" (treatment time over 3 hours) traditionally being utilised to define an admission event. In contrast patients who spend at least one (mid)night in hospital are classified as inpatients irrespective of their length of stay [135].

In the past, there have been significant regional variations in the way in which different providers have uploaded their day cases to the NMDS, leading to problems with both time series analysis and regional comparisons. These inconsistencies have included

1. During the mid-990's, a number of providers began to include A&E events as day cases if the total time in the Emergency Department (including waiting time) exceeded 3 hours, rather than uploading only those whose actual treatment time exceeded 3 hours [135]. NZHIS provided feedback which rectified this anomaly and since January 1995 the correct procedure has been used (these additional cases were coded using medical and surgical sub-specialty codes and are thus difficult to filter out using traditional Emergency sub-specialty filters).
2. Over time, a number of providers have become more efficient at recording the time of first treatment within the Emergency Department (rather than time of attendance) and thus during the late 1990s and early 2000s have become more efficient in identifying emergency department cases which meet the 3-hour treatment rule and are thus eligible to be uploaded to the NMDS. This has resulted in a large number of additional cases being uploaded to the NMDS, particularly in the upper North Island.
3. In addition, some providers admit cases to their short stay observation units while other providers do not, leading to regional variations in the appearance of day cases in the NMDS [45].

Previous Attempts to Address Inconsistent Uploading at the Analytical Stage

When producing their annual Hospital Throughput reports, the Ministry of Health has adopted the following filter to ensure regional and time series comparability with respect to day patient admissions [45]. In its analyses it excludes all cases where:

1. the admission and discharge date are the same (length of stay = 0)
2. and the patient was discharged alive
3. and the health specialty code on discharge is that of Emergency Medicine (M05, M06, M07, and M08).

While this coding filter succeeds in ensuring a degree of comparability between regions and across time (although it fails to correct the anomalies occurring during the mid-1990s when A&E cases were uploaded using medical sub-specialty codes), the exclusion of emergency day cases from time series analysis has a number of limitations including:

1. Exclusion of only those with a length of stay of 0 days means that those emergency cases who begin their treatment late at night and are discharged in the early hours of the following morning (up ¼ of emergency cases have a length of stay of 1 day in some DHBs) are included as genuine hospital admissions, whereas those who begin their treatment early in the morning and are discharged late in the afternoon or the evening of the same day are excluded.

2. With a move towards the development of specialist paediatric emergency departments in larger urban centres (e.g. Auckland), there remains the possibility that some larger DHBs are now seeing and treating a number of acute medical patients within the emergency setting, while in regional centres similar patients continue to be assessed on the paediatric medical ward/assessment unit and thus receive a paediatric medical specialty code. The exclusion of all emergency presentations from time series and sub-regional analysis may thus differentially exclude a large portion of the workload occurring in large urban centres where access to specialist advice and treatment is available within the Emergency Department setting.

The potential impact of inconsistent uploading of day cases to the NMDS is likely to be greatest for those conditions most commonly treated in the emergency department setting. Analysis of 2001–2003 hospital admission data suggests that over 1/3 of NMDS emergency department discharges for those 0–24 years were due to injury, with another 1/3 were due to ambulatory sensitive conditions (e.g. asthma, gastroenteritis, respiratory infections). In contrast, only 2% of those presenting with bacterial meningitis and 4% of those with septic arthritis were discharged with an emergency sub-specialty code.

Further sub-analysis of these two admission categories however demonstrated that inclusion/exclusion of emergency department admissions had quite different effects depending on the category of admission under study (injury vs. ambulatory sensitive admissions) and whether the region had access to a specialist Paediatric Emergency Department. In this analysis the Wider Auckland Region, (comprising 1/3 of the NZ population and whose residents have access to specialist Paediatric Emergency Departments) was compared to the rest of NZ. For ambulatory sensitive admissions, exclusion of emergency department cases resulted in Auckland's admission rates being consistently lower than in the rest of New Zealand. It was only when emergency cases were included in this analysis that Auckland's admission rates began to approximate those of the rest of NZ. In contrast for injuries, inclusion of emergency department cases resulted in hospital admissions in the Auckland Region consistently exceeding the rest of New Zealand. It was only when emergency cases were excluded from the analysis that Auckland's injury admission rates began to approximate those of the rest of NZ. (These findings occurred despite Auckland having a similar proportion of children living in the most deprived NZDep01 small areas as the rest of NZ).

Loosely interpreted, the findings of this analysis suggest that the workload of large specialist paediatric emergency departments must not be discounted when examining trends in ambulatory sensitive or other medical admissions, as it is only when emergency cases are included in the analysis that the admission rates of the Wider Auckland Region (with its access to Specialist Paediatric Emergency care) begin to approximate the rest of NZ. In contrast, it is possible that specialist paediatric emergency departments have much less of an influence on admission thresholds for injury, with these being handled in a similar manner by different emergency departments across the country. Thus for injury data, the greater tendency for some emergency departments to upload their cases to the NMDS must be taken into account in any analysis.

Implications for Interpreting Time Series Analyses in these Reports

Throughout this report, analysis of time series and other information has been undertaken using unfiltered hospital admission data, with the exception of the injury and poisoning sections. Here emergency department discharges have been filtered out of the dataset, in an attempt to address some of the inconsistencies discussed above. Despite such an approach, there remains the potential for the inconsistent uploading of day cases to significantly influence the time series analyses presented in this report. In particular, such practices may lead to an over estimate of the number of medical admissions commonly treated in the emergency department setting (e.g. asthma, skin infections, respiratory tract infections), while at the same time the filtering out of injury/poisoning emergency cases may lead to undercounting for a number of more minor types of injury. Nevertheless, the filtering process utilised in this report is thought to provide the best balance when considering hospital admissions amongst those 0–24 years. Despite this, the reader must bear in mind that the potential for significant residual bias remains, when interpreting the time series analyses presented in this report.

2. Data Quality and Coding Changes over Time (ICD-9 and ICD-10)

Change Over from ICD-9 to ICD-10 Coding

From 1988 until June 1999, clinical information in the NMDS was coded using versions of the ICD-9 classification system (ICD-9 CM until June 1995, then ICD-9–CM-A until June 1999). From July 1999 onwards, the ICD-10-AM classification system has been used, although for time series analysis, back and forward mapping between the two classification systems is possible fusing pre-defined algorithms [2].

The introduction of ICD-10-AM represents the most significant change in the International Classification of Diseases (ICD) in over 50 years and uses an alphanumeric coding system for diseases in which the first character of the code is always a letter followed by several numbers. This has allowed for the expansion of the number of codes to provide for recently recognised conditions and to provide greater specificity about common diseases (there are about 8,000 categories in ICD-10-AM as compared to 5,000 in ICD-9). While for most conditions there is a reasonable 1:1 correspondence between ICD-9 and ICD-10 codes, for some this may lead to some irregularities in time series analysis [136]. Where possible, such irregularities will be highlighted in the text. However care should still be taken when interpreting time series analysis across the 1999–2000 period, as some conditions may not be directly comparable between the two coding systems.

Accuracy of ICD Coding

In recent years the Ministry of Health has undertaken a number of reviews of the quality of ICD coding in the NMDS. In the latest audit 2,708 events were audited over 10 sites during a 3 month period during 2001/2002. Overall the audit found that 22% of events required a change in coding, although this also included changes at the fourth and fifth character level. The average ICD code change was 16%, with changes to the principal diagnosis being 11%, to additional diagnoses being 23% and to procedure coding being 11%. There were 1625 external causes of injury codes, of which 15% were re-coded [137]. These findings were similar to an audit undertaken a year previously.

While the potential for such coding errors must be taken into consideration when interpreting the findings of this report, it may be that the 16% error rate is an overestimate, as in the majority of the analyses undertaken in this report, only the principal diagnosis (with an error rate of 11%) is used to describe the reason for admission. In addition, for most admissions the diagnostic category (e.g. lower respiratory tract infections) is assigned using information at the 3 digit level (with the 16% error rate also including issues with coding at the 4th or 5th digit level).

3. Ethnicity Information in the NMDS

The reader is referred to **Appendix 5** for a discussion of this issue.

Conclusion

In general the inconsistencies outlined above tend to make time series and (regional) comparative analyses based on the NMDS less reliable than those based on Mortality or Birth Registration data (where legislation dictates inclusion criteria and the type of information collected). While hospital discharge data still remains a valuable and reasonably reliable proxy for measuring the health outcomes of children and young people in this country, the reader is cautioned to take into consideration the biases discussed above, when interpreting the findings outlined in this report.

APPENDIX 3: THE BIRTH REGISTRATION DATASET

Mode of Data Collection

Since 1995 all NZ hospitals/delivering midwives have been required to notify Internal Affairs (within 5 working day of delivery), of the birth of a live/stillborn baby 20+ weeks gestation or weighting over 400g. Prior to 1995, only stillborn babies reaching 28+ weeks of gestation required birth notification. Information on the hospital's notification form includes maternal age, ethnicity, multiple birth status, and baby's sex, birth weight and gestational age. In addition parents must complete a Birth Registration Form within 2 years of delivery, duplicating the above information, with the exception of birth weight and gestational age, which are supplied only on hospital notification forms. Once both forms are received by Internal Affairs, the information is merged into a single entry. This 2-stage process is thought to capture 99.9% of births occurring in New Zealand and cross checking at the receipting stage allows for the verification of birth detail [138].

Issues to Take into Account When Interpreting Information Derived from the Birth Registration Dataset

Because of the 2-stage birth registration process, the majority of variables contained within the birth registration dataset are more than 98% complete, and cross checking at the receipting stage (with the exception of birth weight and gestational age) allows for the verification of birth details. In addition, the way in which ethnicity is collected in this dataset confers a number of advantages, with maternal ethnicity being derived from the information supplied by parents on their baby's birth registration form. This has the advantage of avoiding some of the ambiguities associated with hospital and mortality data, which at times have been reported by third parties. Changes in the way ethnicity was defined in 1995 however make information collected prior to this date incomparable with that collected afterwards. For births prior to 1995, maternal ethnicity was defined by ancestry, with those having half or more Māori or Pacific blood meeting ethnic group criteria, resulting in three groups, Māori, Pacific and non-Māori non-Pacific. For births after 1995 maternal ethnicity was self-identified, with an expanded number of ethnic categories being available and parents being asked to tick as many options as required to show which ethnic group(s) they belonged to. For those reporting multiple ethnic affiliations a priority rating system was introduced, as discussed in Appendix 6 of this report.

Because this dataset captures 99.9% of births occurring in NZ, is more than 98% complete for most variables, collects self-reported ethnicity in a standard manner and is collated and coded by a single agency, information derived from this dataset is likely to be of higher quality than that derived from many of NZ's other data sources. Limitations however include the relatively restricted number of variables contained within the dataset (e.g. it lacks information on maternal smoking, BMI or obstetric interventions) and the lack of cross checking for birth weight and gestational age (which is supplied only on the hospital notification form). The change over in ethnicity definition during 1995 also prohibits time series analysis by ethnicity over the medium to long term. Finally, since the last report, the Ministry of Health has stopped providing stillbirth data in the Birth Registration Dataset, and thus all analyses based on this set are restricted to live births only. Each of these factors must thus be taken into account when interpreting information in this report that has been derived from the Birth Registration Dataset.

APPENDIX 4: NATIONAL MORTALITY COLLECTION

Mode of Data Collection

The National Mortality Collection is a dataset managed by the Ministry of Health (MoH), which contains information on the underlying cause(s) of death, as well as basic demographic data, for all deaths registered in New Zealand since 1988. Fetal and infant data are a subset of the Mortality Collection, with cases in this subset having additional information on factors such as birth weight and gestational age [139].

Each month Births, Deaths and Marriages send the Ministry of Health electronic death registration information, Medical Certificates of Cause of Death, and Coroner's reports. Additional information on the cause of death is obtained from the National Minimum Dataset (NMDS), private hospital discharge returns, the NZ Cancer Registry (NZCR), the Department of Courts, the Police, the Land Transport Authority, Water Safety NZ, Media Search and from writing letters to certifying doctors, coroners and medical records officers in public hospitals. Using information from these data sources, an underlying cause of death (ICD-10-AM) is assigned by Ministry of Health staff using the World Health Organisation's rules and guidelines for mortality coding [139].

Data Quality Issues Relating to the National Mortality Collection

Unlike the NMDS, where information on the principal diagnosis is coded at the hospital level and then forwarded electronically to the MoH, in the National Mortality Collection each of the approximately 28,000 deaths occurring in New Zealand each year is coded manually by Ministry of Health staff. For most deaths the Medical Certificate of Cause of Death provides the information required, although coders also have access to the information contained in the NMDS, NZ Cancer Registry, LSTA, Police, Water Safety NZ and ESR [140]. As a consequence, while coding is still reliant on the accuracy of the death certificate and other supporting information, there remains the capacity for a uniform approach to the coding which is not possible for hospital admission data.

While there are few published accounts of the quality of coding information contained in the National Mortality Collection, the dataset lacks some of the inconsistencies associated with the NMDS, as the process of death registration is mandated by law and there are few ambiguities as to the inclusion of cases over time. As a consequence, time series analyses derived from this dataset are likely to be more reliable than that provided by the NMDS. One issue that may affect the quality of information derived from this dataset however is the collection of ethnicity data, which is discussed in more detail in **Appendix 5** of this report.

APPENDIX 5: MEASUREMENT OF ETHNICITY

The majority of rates calculated in this report rely on the division of numerators (e.g. hospital admissions, mortality data) by Statistics NZ Estimated Resident Population denominators. Calculation of accurate ethnic specific rates relies on the assumption that information on ethnicity is collected in a similar manner in both the numerator and the denominator, and that a single child will be identified similarly in each dataset. In New Zealand this has not always been the case, and in addition the manner of collecting information on ethnicity has varied significantly over time. Since 1996 however, there has been a move to ensure that ethnicity information is collected in a similar manner across all administrative datasets in New Zealand (Census, Hospital Admission, Mortality, Births). The following section briefly reviews how information on ethnicity has been collected in national data collections since the early 1980s and the implications of this for the information contained in this report.

1981 Census and Health Sector Definitions

Earlier definitions of ethnicity in official statistics relied on the concept of fractions of descent, with the 1981 census asking people to decide whether they were fully of one ethnic origin (e.g. Full Pacific, Full Māori) or if of more than one origin, what fraction of that ethnic group they identified with (e.g. 7/8 Pacific + 1/8 Māori). When prioritisation was required, those with more than 50% of Pacific or Māori blood were deemed to meet the ethnic group criteria of the time [141]. A similar approach was used to record ethnicity in health sector statistics, with birth and death registration forms asking the degree of Pacific or Māori blood of the parents of a newborn baby/the deceased individual. For hospital admissions, ancestry based definitions were also used during the early 1980s, with admission officers often assuming ethnicity, or leaving the question blank [142].

1986 Census and Health Sector Definitions

Following a review expressing concern at the relevance of basing ethnicity on fractions of descent, a recommendation was made to move towards self-identified cultural affiliation. Thus the 1986 Census asked the question “What is your ethnic origin?” and people were asked to tick the box(s) that applied to them. Birth and death registration forms however, continued to use the “fractions of blood” question until 1995, making comparable numerator and denominator data difficult to obtain [141]. For hospital admissions, the move from an ancestry based to a self-identified definition of ethnicity began in the mid-80s, although non-standard forms were used and typically allowed a single ethnicity only [142].

1991 Census and Health Sector Definitions

A review suggested that the 1986 ethnicity question was unclear as to whether it was measuring ancestry or cultural affiliation, so the 1991 Census asked two questions:

1. Which ethnic group do you belong to? (tick the box or boxes which apply to you)
2. Have you any NZ Māori ancestry? (if yes, what iwi do you belong to?)

As indicated above however, birth and death registrations continued with ancestry based definitions of ethnicity during this period, while a number of hospitals were beginning to use self-identified definitions in a non-standard manner [142].

1996 Census and Health Sector Definitions

While the concepts and definitions remained the same as for the 1991 census, the ethnicity question in the 1996 Census differed in that:

- The NZ Māori category was moved to the top of the ethnic categories
- The 1996 question made it more explicit that people could tick more than 1 box.
- There was a new “Other European” category with 6 sub-groups

As a result of these changes, there was a large increase in the number of multiple responses, as well as an increase in the Māori ethnic group in the 1996 Census [141].

Within the health sector however, there were much larger changes in the way in which ethnicity information was collected. From late 1995, birth and death registration forms incorporated a new ethnicity question identical to that in the 1996 Census, allowing for an expansion of the number of ethnic groups counted (previously only Māori and Pacific) and resulting in a large increase in the proportion of Pacific and Māori births and deaths. From July 1996 onwards, all hospitals were also required to inquire about ethnicity in a standardised way, with a question that was compatible with the 1996 Census and that allowed multiple ethnic affiliations [142]. A random audit of hospital admission forms conducted by Statistics NZ in 1999 however, indicated that the standard ethnicity question had not yet been implemented by many hospitals. In addition, an assessment of hospital admissions by ethnicity over time showed no large increases in the proportions of Māori and Pacific admissions after the 1996 "change over", as had occurred for birth and death statistics, potentially suggesting that the change to a standard form allowing for multiple ethnic affiliations in fact did not occur. Similarities in the number of people reporting a "sole" ethnic group pre and post 1996 also suggest that the way in which information on multiple ethnic affiliations was collected did not change either. Thus while the quality of information available since 1996 has been much better than that previously, there remains some concern that hospitals continue to undercount multiple ethnic identifications and as a result, may continue to undercount Pacific and Māori peoples [142].

2001 Census and Health Sector Definitions

The 2001 Census reverted back to the wording used in the 1991 Census after a review showed that this question provided a better measure of ethnicity based on the current statistical standard [141]. The health sector also continued to use self-identified definitions of ethnicity during this period, with the *Ethnicity Data Protocols for the Health and Disability Sector* providing guidelines which ensured that the information collected across the sector was consistent with the wording of the 2001 Census (i.e. *Which ethnic groups do you belong to (Mark the space or spaces that apply to you)?*)

2006 Census and Health Sector Definitions

In 2004, the Ministry of Health released the *Ethnicity Data Protocols for the Health and Disability Sector[143]*, with these protocols being seen as a significant step forward in terms of standardising the collection and reporting of ethnicity data in the health sector [144]. The protocols stipulated that the standard ethnicity question for the health sector was the 2001 Census ethnicity question, with respondents being required to identify their own ethnicity, and with data collectors being unable to assign this on respondent's behalf, or to transfer this information from another form. The protocols also stipulated that ethnicity data needed to be recorded to a minimum specificity of Level 2 (see below) with systems needing to be able to store, at minimum, three ethnicities, and to utilise standardised prioritisation algorithms, if more than three ethnic groups were reported. In terms of outputs, either: sole/combination, total response, or prioritised ethnicity needed to be reported, with the methods used being clearly described in any report [143].

The following year, Statistics New Zealand's Review of the Measurement of Ethnicity (RME), culminated in the release of the *Statistical Standard for Ethnicity 2005*[145], which recommended that:

1. The 2006 Census ethnicity question use identical wording to the 2001 Census.
2. Within the "Other" ethnic group, that a new category be created, or those identifying as "New Zealander" or "Kiwi". In previous years these responses had been assigned to the European ethnic group.
3. All collections of official statistics measuring ethnicity have the capacity to record and report six ethnicity responses per individual, or at a minimum, three responses when six could not be implemented immediately.
4. The practice of prioritising ethnicity to one ethnic group should be discontinued.

At the 2006 Census however, a total of 429,429 individuals (11.1% of the NZ population) identified themselves as a New Zealander, with further analysis suggesting that 90% of the increase in those identifying as New Zealanders in 2006, had arisen from those identifying as New Zealand European at the 2001 Census [146]. In 2009 Statistics NZ amended the Standard to reflect these issues [147] with the current recommendation being that future Censuses retain the current ethnicity question (i.e. that New Zealander tick boxes not be introduced) but that alongside the current standard outputs, where New Zealander responses are assigned to the Other ethnicity category, that an alternate classification be introduced, which combines the European and New Zealander ethnic groups into a single European and Other Ethnicity category for use in time series analysis (with those identifying as both European and New Zealanders being counted only once in this combined ethnic group [147].

The Current Recording of Ethnicity in New Zealand's National Datasets

In New Zealand's national health collections (e.g. National Minimum Dataset and Mortality Collection, NZ Cancer Registry),up to 3 ethnic groups per person are stored electronically for each event, with data being coded to Level 2 of Statistics New Zealand's 4 Level Hierarchical Ethnicity Classification System [2]. In this Classification System increasing detail is provided at each level. For example [143]:

- Level 1 (least detailed level) e.g. code 1 is European
- Level 2 e.g. code 12 is Other European
- Level 3 e.g. code 121 is British and Irish
- Level 4 (most detailed level) e.g. code 12111 is Celtic

Māori however, are identified similarly at each level (e.g. Level 1: code 2 is Māori...vs Level 4: code 21111 is Māori).

For those reporting multiple ethnic affiliations, information may also be prioritised according to Statistics New Zealand's protocols, with Māori ethnicity taking precedence over Pacific > Asian/Indian > Other > European ethnic groups [143]. This ensures that each individual is counted only once and that the sum of the ethnic group sub-populations equals the total NZ population [142]. The implications of prioritisation for Pacific groups however are that the outcomes of those identifying as both Māori and Pacific are only recorded under the Māori ethnic group.

For those reporting more than 3 ethnic affiliations, the ethnic groups recorded are again prioritised (at Level 2), with Māori ethnicity taking precedence over Pacific > Asian/Indian > Other > European ethnic groups (for further details on the prioritisation algorithms used see [143].In reality however, less than 0.5% of responses in the National Health Index database have three ethnicities recorded, and thus it is likely that this prioritisation process has limited impact on ethnic specific analyses [143].

Undercounting of Māori and Pacific Peoples in National Collections

Despite significant improvements in the quality of ethnicity data in New Zealand's national health collections since 1996, care must still be taken when interpreting the ethnic specific rates presented in this report, as the potential still remains for Māori and Pacific children and young people to be undercounted in our national data collections. In a review that linked hospital admission data to other datasets with more reliable ethnicity information (e.g. death registrations and Housing NZ Corporation Tenant data), the authors of Hauora Māori Standards of Health IV [3] found that on average, hospital admission data during 2000–2004 undercounted Māori children (0–14 years) by around 6%, and Māori young people by around 5–6%. For cancer registrations, the undercount was in the order of 1–2% for the same age groups. While the authors of Hauora Māori Standards of Health IV developed a set of adjusters which could be used to minimise the bias such undercounting introduced when calculating population rates and rate ratios, these (or similar) adjusters were not utilised in this report for the following reasons:

1. Previous research has shown that ethnicity misclassification can change over time, and thus adjusters developed for one period may not be applicable to other periods [148].
2. Research also suggests that ethnic misclassification may vary significantly by DHB [148], and thus that adjusters developed using national level data (as in Hauora Māori Standards of Health IV) may not be applicable to DHB level analyses, with separate adjusters needing to be developed for each DHB.

Further, as the development of adjusters requires the linkage of the dataset under review with another dataset, for which more reliable ethnicity information is available, and as this process is resource intensive, and not without error (particularly if the methodology requires probabilistic linkage of de-identified data) the development of a customised set of period and age specific adjusters was seen as being beyond the scope of the current project. The reader is thus urged to bear in mind, that the data presented in this report may undercount Māori and Pacific children to a variable extent (depending on the dataset used) and that in the case of the hospital admission dataset for Māori, this undercount may be as high as 5–6%.

Ethnicity Classifications Utilised in this Report and Implications for Interpretation of Results.

In New Zealand's national health collections up to 3 ethnic groups are stored electronically for each event [1]. Because of inconsistencies in the way ethnicity information was collected in national data collections prior to 1996 however, all of the ethnic specific analysis presented in this report are from 1996 onwards, and thus reflect self-identified concepts of ethnicity. Further, unless otherwise specified, total response ethnicity has been used to identify Māori children and young people (i.e. those identifying as Māori in any of their first three ethnic groups). In contrast, the term non-Māori non-Pacific refers to those children and young people who did not identify as being either Māori or Pacific in any of their first three ethnic groups.

Note: While in the Health Sector, the non-Māori reference group is often used for rate ratio comparisons, the non-Māori non-Pacific reference group was selected by the Advisory Group, on the basis that as a group, these children and young people had the lowest documented exposures to health disparities.

APPENDIX 6: NZ DEPRIVATION INDEX

The NZ Deprivation Index (NZDep) is a small area index of deprivation, which has been used as a proxy for socioeconomic status in this report. The main concept underpinning small area indices of deprivation is that the socioeconomic environment in which a person lives can confer risks/benefits which may be independent of their own social position within a community [149]. They are thus aggregate measures, providing information about the wider socioeconomic environment in which a person lives, rather than about their individual socioeconomic status.

The NZDep01 was first created using information from the 1991 census, but has since been updated following each census. The NZDep2006 combines 9 variables from the 2006 census which reflect 8 dimensions of deprivation (**Table 47**). Each variable represents a standardised proportion of people living in an area who lack a defined material or social resource (e.g. access to a car, income below a particular threshold), with all 9 variables being combined to give a score representing the average degree of deprivation experienced by people in that area. While the NZDep01 provides deprivation scores at meshblock level (Statistics NZ areas containing approx 90 people), for the purposes of mapping to national datasets, these are aggregated to Census Area Unit level (≈1,000–2,000 people). Individual area scores are then ranked and placed on an ordinal scale from 1 to 10, with decile 1 reflecting the least deprived 10% of small areas and decile 10 reflecting the most deprived 10% of small areas [150].

Table 47. Variables used in the NZDep2006 Index of Deprivation [151]

No	Factor	Variable in Order of Decreasing Weight in the Index
1	Income	People aged 18–64 receiving means tested benefit
2	Employment	People aged 18–64 unemployed
3	Income	People living in households with income below an income threshold
4	Communication	People with no access to a telephone
5	Transport	People with no access to a car
6	Support	People aged <65 living in a single parent family
7	Qualifications	People aged 18–64 without any qualifications
8	Owned Home	People not living in own home
9	Living Space	People living in households below a bedroom occupancy threshold

The advantage of NZDep01 is its ability to assign measures of socioeconomic status to the elderly, the unemployed and to children (where income and occupational measures often don't apply), as well as to provide proxy measures of socioeconomic status for large datasets when other demographic information is lacking. Small area indices have limitations however, as not all individuals in a particular area are accurately represented by their area's aggregate score. While this may be less of a problem for very affluent or very deprived neighbourhoods, in average areas, aggregate measures may be much less predictive of individual socioeconomic status [149]. Despite these limitations, the NZDep01 has been shown to be predictive of mortality and morbidity from a number of diseases in New Zealand.

Note: As New Zealand's national datasets have traditionally continued to use the previous Census' domicile codes for 1–2 years after any new Census, all of the numerators (e.g. numbers of hospital admissions, deaths) and denominators in this report have been mapped to NZDep2001.

APPENDIX 7: AMBULATORY SENSITIVE HOSPITAL ADMISSIONS

The ASH analysis in this report was performed using two coding algorithms, the new Paediatric ASH Algorithm specifically developed by Anderson et al in conjunction with the New Zealand Child and Youth Epidemiology Service (NZCYES) (**Table 48**), and the old coding algorithm developed by Tobias and Jackson, which was used within the New Zealand health sector until 2008 (**Table 49**).

The development of the new Paediatric ASH Coding Algorithm involved four steps:

1. Identification of the most frequent causes of hospital admissions for children and young people in New Zealand using data from the National Minimal Dataset (NMDS).
2. Formation of a convening group to define avoidable morbidity for the purposes of the indicator and to identify key policy areas to be considered in the indicator.
3. Consultation with experts in the paediatric, public health and primary care fields to determine the influence of various policy areas on hospital admissions for the 42 conditions identified in step one. This was an iterative process with the initial feedback being re-circulated to the panel of experts for further consideration before hospitalisations were confirmed as either potentially avoidable or non potentially avoidable. Access to primary care was one of the policy areas considered, with the subset of conditions where the expert panel judged that hospitalisations could potentially be avoided by timely access to appropriate primary care being classified as ASH in the new coding algorithm.
4. Development of a final coding algorithm (**Table 48**) and consideration of appropriate filters.

The ASH classification finally developed is intended to be representative of hospitalisations that could potentially be prevented by access to primary care in the 0–14 year age group, but is not exhaustive. It is important to note that only conditions consulted on during the process described above were included in the ASH coding algorithm. For example while the majority of cases of epiglottitis can be prevented through vaccination against Hib, and therefore hospitalisations due to epiglottitis might be considered ambulatory sensitive, epiglottitis is rare and was not identified in step one of the process described above. Epiglottitis was therefore not consulted on and was not included in the ASH coding algorithm.

Injury and poisoning are also important causes of childhood morbidity and make up a large proportion of paediatric hospital admissions. However injury and poisoning were not consulted on during this process because of the greater tendency for some emergency departments to upload their cases to the NMDS than others, thus making it difficult to obtain consistent data across DHBs. Ideally injury will be incorporated into the ASH coding algorithm in the future if these data issues can be resolved.

The convening group also determined that a number of filters should be applied to this coding algorithm including:

1. Neonatal Admissions (0–28 days) are specifically excluded (as issues arising in the context of a birth are likely to require different care pathways than those arising in the community-, with the exception of neonatal tetanus and congenital rubella, which can be prevented by timely access of women to immunisation in primary care).
2. Waiting List Admissions are specifically excluded, with the exception of Waiting List admissions for dental caries, as DHBs differ in the way these children are admitted around the country.

Table 48. New Paediatric ASH Codes Developed for the New Zealand Health Sector

Ambulatory Sensitive Conditions	ICD 10 coding
Asthma	J45, J46
Bronchiectasis	J47
Skin Infections	H000, H010, J340, L01–L04, L08, L980
Constipation	K590
Dental Caries	K02, K04, K05
Dermatitis and Eczema	L20–L30
Gastroenteritis	A02– A09, R11
Gastro–Oesophageal Reflux	K21
Nutritional Deficiency	D50–D53, E40–E46, E50–E56, E58–E61, E63, E64
Bacterial/Non-Viral Pneumonia	J13–J16, J18
Rheumatic Fever/Heart Disease	I00–I09
Otitis Media	H65–H67
Acute Upper Respiratory Tract Infection	J00–J03, J06
Vaccine Preventable Diseases: Neonatal/Other Tetanus, Congenital Rubella ≥6 months: Pertussis, Diphtheria, Hepatitis B ≥16 months Measles, Mumps, Rubella	A35, A36, A37, A80, B16, B180, B181 A33, A34, P350, B05, B06, B26, M014,
ASH Urinary Tract Infection >4 years	N10, N12, N300, N390, N309, N136
Filters: Codes Apply to Children 0–14 Years (excluding the neonatal period) Acute and Arranged Admissions Only (except Dental Conditions where Waiting List included)	

Note: Coding Algorithm developed by Pip Anderson, Elizabeth Craig, Gary Jackson and Martin Tobias in conjunction with the New Zealand Child and Youth Epidemiology Service

Table 49. Weightings Applied to Potentially Avoidable Hospital Admissions by Jackson and Tobias [46] and Subsequently Used by the New Zealand Ministry of Health [152]

Condition	Population Preventable	Ambulatory Sensitive	Injury Prevention
Tuberculosis	0.5	0.5	0
HIV/AIDS	1	0	0
Skin Cancers	0.5	0.5	0
Oral Cancers	1	0	0
Colorectal Cancer	0.7	0.3	0
Lung Cancer	1	0	0
Breast Cancer	0.3	0.7	0
Nutrition	1	0	0
Alcohol-Related Conditions	1	0	0
Ischemic Heart Disease	1	0	0
Gastroenteritis	0.2	0.8	0
Other Infections	0.2	0.8	0
Immunisation-Preventable	0	1	0
Hepatitis/Liver Cancer	0	1	0
Sexually Transmitted Disease	0	1	0
Cervical Cancer	0	1	0
Thyroid Disease	0	1	0
Diabetes	0.2	0.8	0
Dehydration	0	1	0
Epilepsy	0	1	0
ENT Infections	0	1	0
Rheumatic Fever/Heart Disease	0	1	0
Hypertensive Disease	0.3	0.7	0
Angina	0	1	0
Congestive Heart Failure	0	1	0
Stroke	0.5	0.5	0
Respiratory Infections	0	1	0
CORD	0.6	0.4	0
Asthma	0	1	0
Dental Conditions	0.4	0.6	0
Peptic Ulcer	0	1	0
Ruptured Appendix	0	1	0
Obstructed Hernia	0	1	0
Kidney/Urinary Infection	0	1	0
Cellulitis	0	1	0
Failure to Thrive	0	1	0
Gangrene	0	1	0
Road Traffic Injury	0	0	1
Poisoning	0	0	1
Swimming Pool	0	0	1
Recreation Injury	0	0	1
Sport Injury	0	0	1
Fire	0	0	1
Drowning	0	0	1
Suicide	0	0	1

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