

# BRONCHIOLITIS

## Introduction

Bronchiolitis is the most common lower respiratory infection in infants and a leading cause of hospital admission in this age group. It is a viral infection and is most commonly due to Respiratory Syncytial Virus (RSV), although other viruses including adenovirus, rhinovirus, enterovirus, influenza, parainfluenza and human metapneumovirus have also been implicated [120,121]. Most children (around 90%) will be infected with RSV before the age of two years, however infection does not confer immunity and re-infections are common [120]. In temperate climates such as New Zealand, RSV usually occurs in seasonal epidemics which peak in late winter [122].

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 (the bronchioles) and respiratory distress, with rapid breathing (tachypnoea), nasal flaring and the use of accessory muscles. Feeding and sleeping may be impaired [123], and very young infants may also have episodes of apnoea. A recent study from the U.S. reported a median duration of symptoms of fifteen days in infants presenting to the emergency department (but not necessarily admitted to hospital) with a first-time episode of bronchiolitis [124].

Severely affected infants require hospital treatment, which usually consists of supportive therapy with fluid supplementation and oxygen [125]. However, only around 2-3% of infants with bronchiolitis require hospitalisation [122], and deaths from bronchiolitis are rare, with reported rates in the U.S. and the U.K. being around two per 100,000 live births [122].

Risk factors for severe illness, such as that requiring intensive care, include young age (<6 weeks), premature birth, chronic lung disease of prematurity, congenital heart disease and immunodeficiency [121,122,125]. More common risk factors associated with hospitalisation for less severe bronchiolitis include male sex, age less than six months, birth during the first half of the RSV season, overcrowding, socio-economic disadvantage, older siblings and attendance at day care [126]. Maternal smoking and lack of breast feeding are also considered to be risk factors [120].

The following section reviews bronchiolitis in infants aged <1 year using information from the National Minimum Dataset and Mortality Collection. The section concludes with a brief overview of evidence-based review documents and guidelines which consider interventions to prevent or manage bronchiolitis in infants.

### 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 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.



Note 3: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or not *significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms *significant* or non-*significant* are specifically used) the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

## 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 (**Figure 48**).

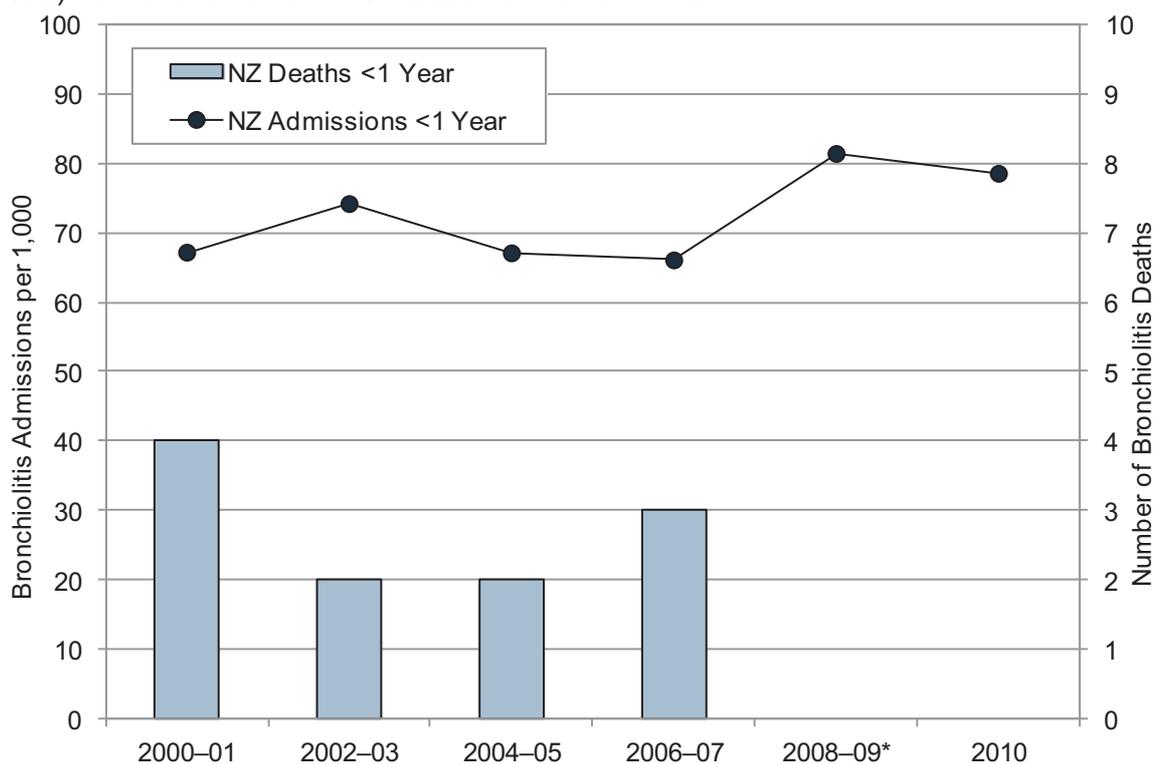
### New Zealand Distribution by Age

In New Zealand during 2006–2010, bronchiolitis admissions were highest in infant <1 year, with rates declining rapidly with increasing age thereafter. In addition, during 2004-2008, all bronchiolitis deaths occurred in infants aged <1 year (**Figure 49**).

### New Zealand Distribution by Ethnicity, NZDep Index Decile and Gender

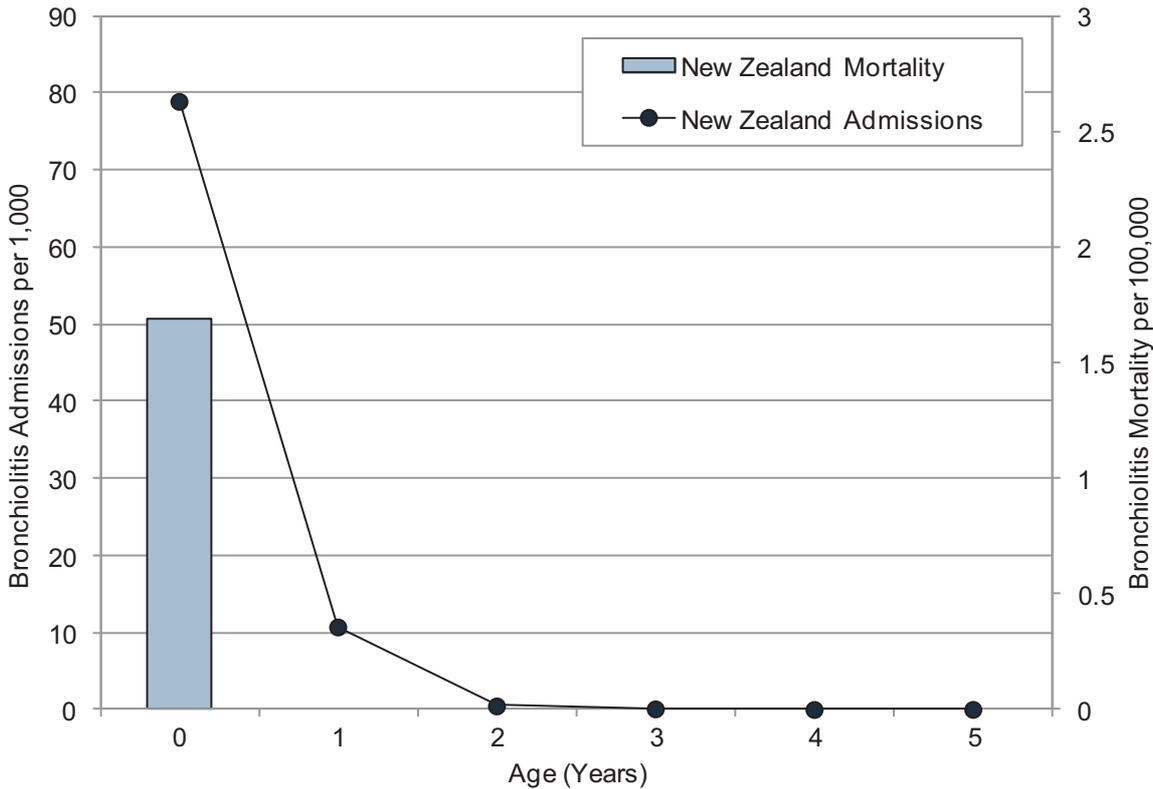
In New Zealand during 2006–2010, bronchiolitis admissions were *significantly* higher for males, Pacific > Māori > European > Asian/Indian infants and those living in average-to-more deprived (NZDep decile 3-10) areas (**Table 67**). Similar ethnic differences were seen during 2000–2010 (**Figure 50**).

Figure 48. Acute and Semi-Acute Hospital Admissions (2000–2010) and Deaths (2000–2008) from Bronchiolitis in New Zealand Infants <1 Year



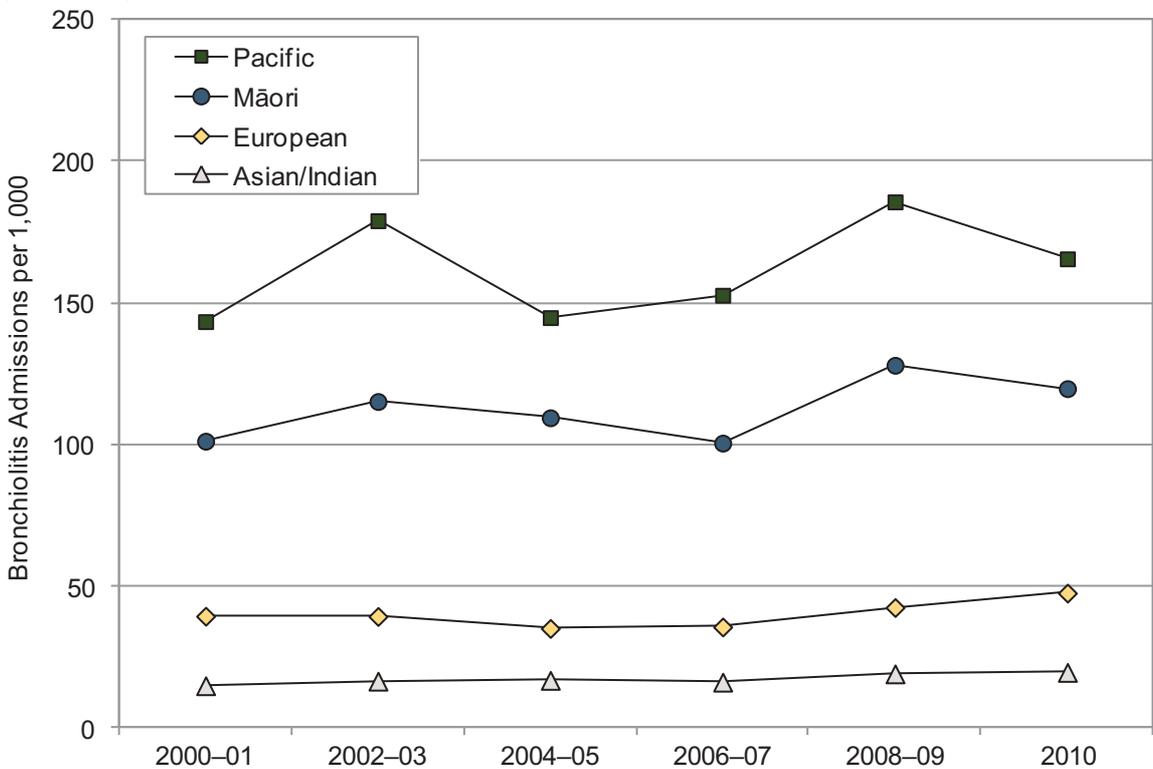
Source: Numerators: National Minimum Dataset (Acute and semi-acute admissions only) and National Mortality Collection; Denominator: Birth Registration Dataset; \*Note: Number of Deaths is per 2 year period, with the exception of 2008-09, which is for a single year (2008) only.

Figure 49. Acute and Semi-Acute Hospital Admissions (2006–2010) and Deaths (2004–2008) from Bronchiolitis in New Zealand Children by Age



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

Figure 50. 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. Note: Ethnicity is Level 1 Prioritised.

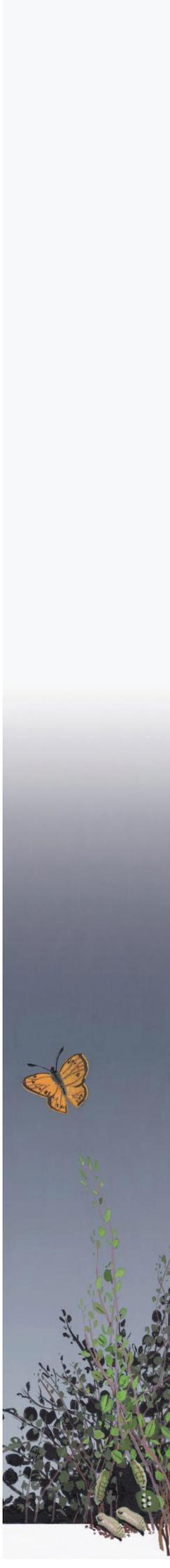


Table 67. Acute and Semi-Acute Hospital Admissions for Bronchiolitis in Infants <1 Year by Ethnicity, NZ Deprivation Index Decile and Gender, New Zealand 2006–2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
Bronchiolitis in Infants <1 Year							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	28.9	1.00		Decile 1–2	29.6	1.00	
Decile 2	30.2	1.05	0.94–1.16	Decile 3–4	38.6	1.31	1.22–1.40
Decile 3	36.8	1.27	1.16–1.40	Decile 5–6	54.9	1.86	1.75–1.97
Decile 4	40.2	1.39	1.27–1.53	Decile 7–8	76.5	2.59	2.45–2.74
Decile 5	47.9	1.66	1.52–1.82	Decile 9–10	136.9	4.63	4.39–4.89
Decile 6	60.6	2.10	1.93–2.28	Prioritised Ethnicity			
Decile 7	68.5	2.37	2.18–2.58	European	40.7	1.00	
Decile 8	83.0	2.87	2.65–3.11	Māori	115.4	2.83	2.75–2.92
Decile 9	107.4	3.72	3.44–4.02	Pacific	168.9	4.15	4.01–4.29
Decile 10	163.2	5.65	5.23–6.10	Asian/Indian	18.1	0.45	0.41–0.48
Gender							
Female	59.4	1.00					
Male	89.3	1.50	1.47–1.54				

Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Birth Registration Dataset. Note: Rate is per 1,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001.

## South Island Distribution and Trends

### South Island DHBs vs. New Zealand

In each of the South Island DHBs during 2006–2010, bronchiolitis admissions in infants were *significantly* lower than the New Zealand rate (**Table 68**).

Table 68. Acute and Semi-Acute Hospital Admissions for Bronchiolitis in Infants <1 Year, South Island DHBs vs. New Zealand 2006–2010

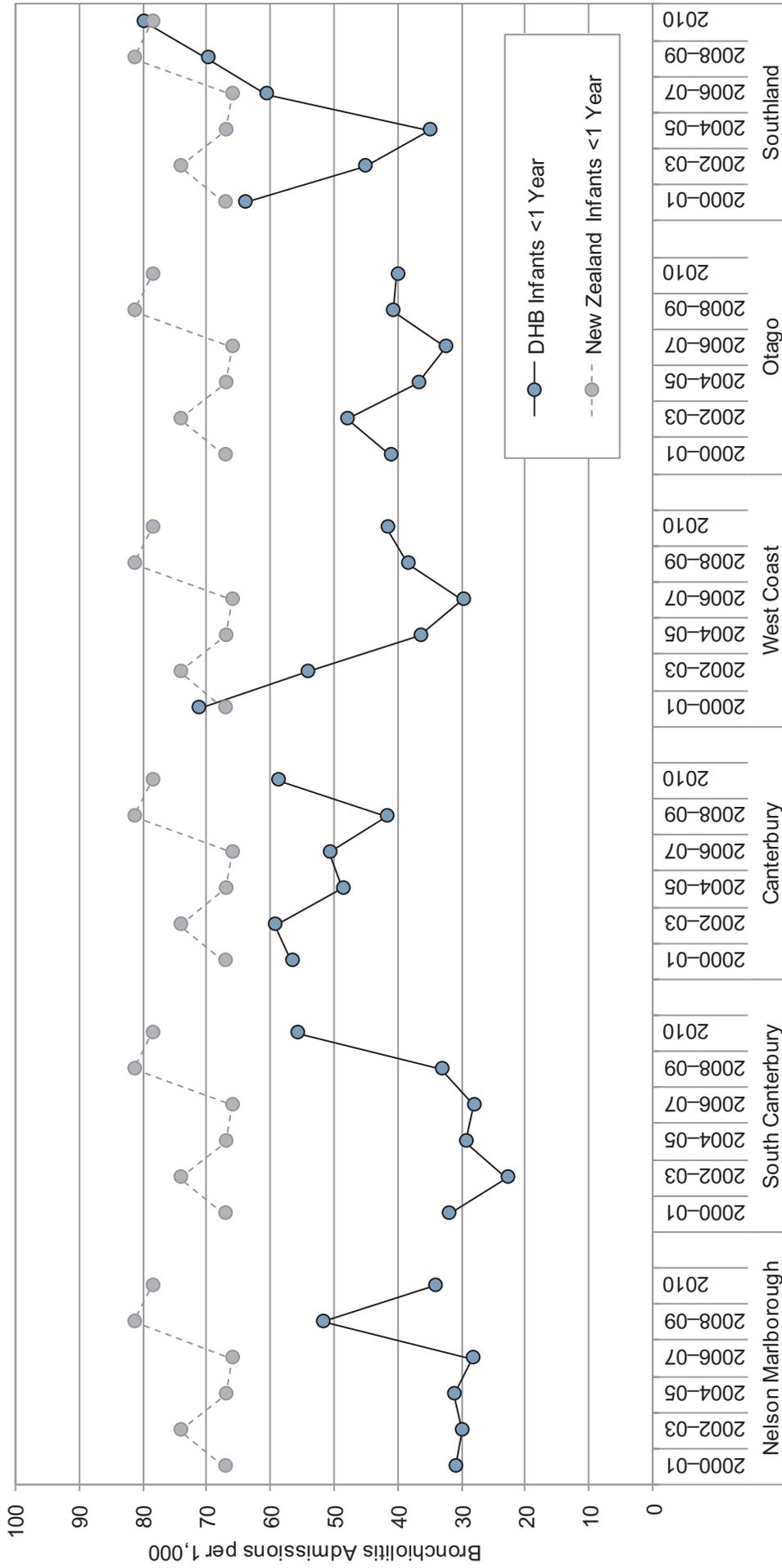
DHB	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Bronchiolitis in Infants <1 Year					
Nelson Marlborough	329	65.8	39.0	0.52	0.47–0.58
West Coast	76	15.2	35.8	0.48	0.38–0.60
Canterbury	1,608	321.6	48.8	0.65	0.62–0.69
South Canterbury	114	22.8	35.6	0.48	0.40–0.57
Otago	387	77.4	37.4	0.50	0.45–0.55
Southland	554	110.8	68.5	0.92	0.84–0.99
New Zealand	23,831	4,766.2	74.8	1.00	

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

### South Island Trends

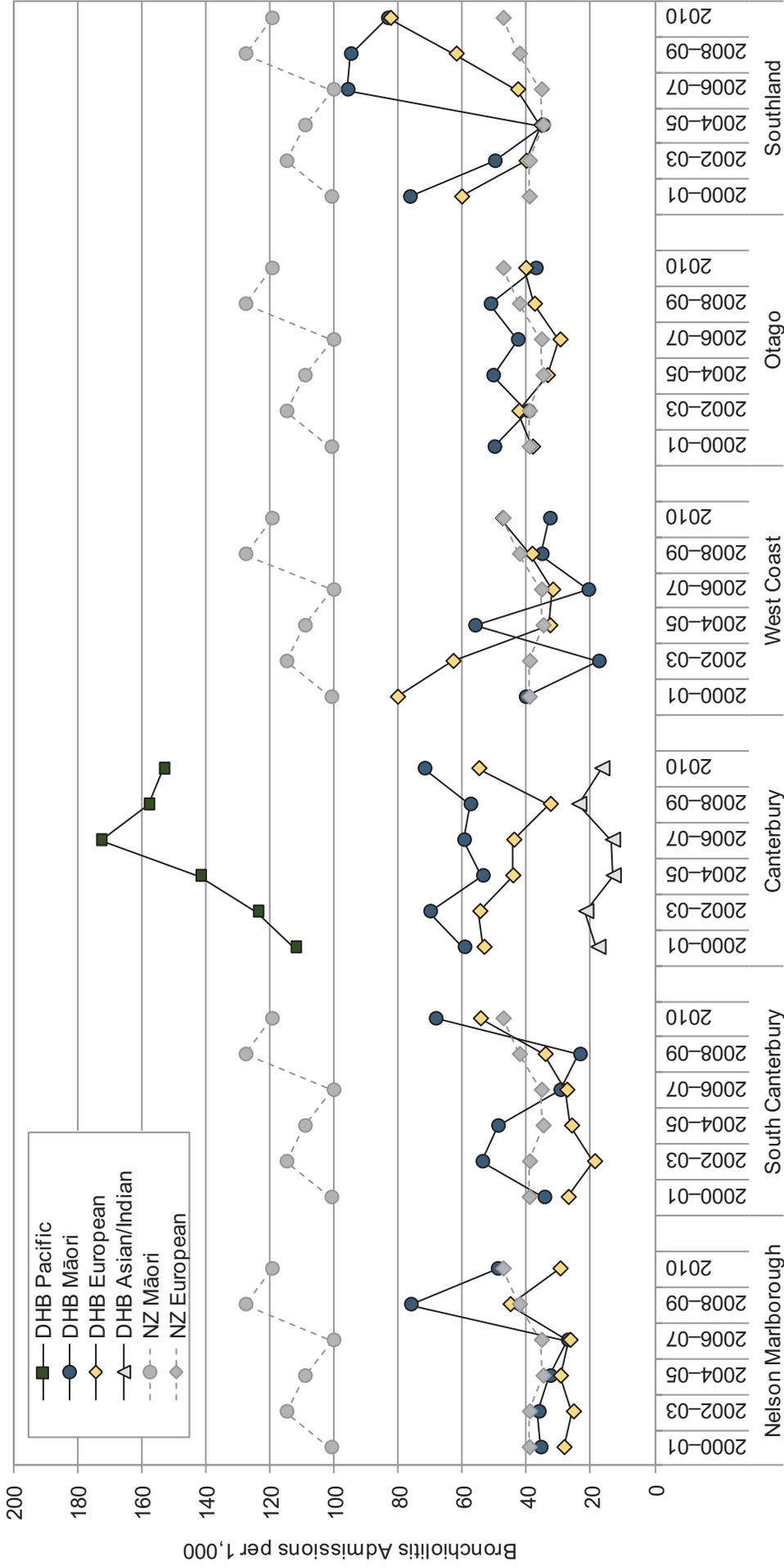
In Nelson Marlborough and South Canterbury, bronchiolitis admissions in infants were relatively static during the early-mid 2000s but increased during 2008–2010. In Canterbury and the West Coast, admissions decreased during the early-mid 2000s, with rates reaching their lowest point in Canterbury in 2008–09, and in the West Coast in 2006–07, before increasing again. In Otago, admissions decreased during the mid-2000s, but increased again after 2006–07, while in Southland admissions decreased during the early-mid 2000s, but increased rapidly after 2004–05 (**Figure 51**).

Figure 51. Acute and Semi-Acute Hospital Admissions for Bronchiolitis in Infants <1 Year, South Island DHBs vs. New Zealand 2000–2010



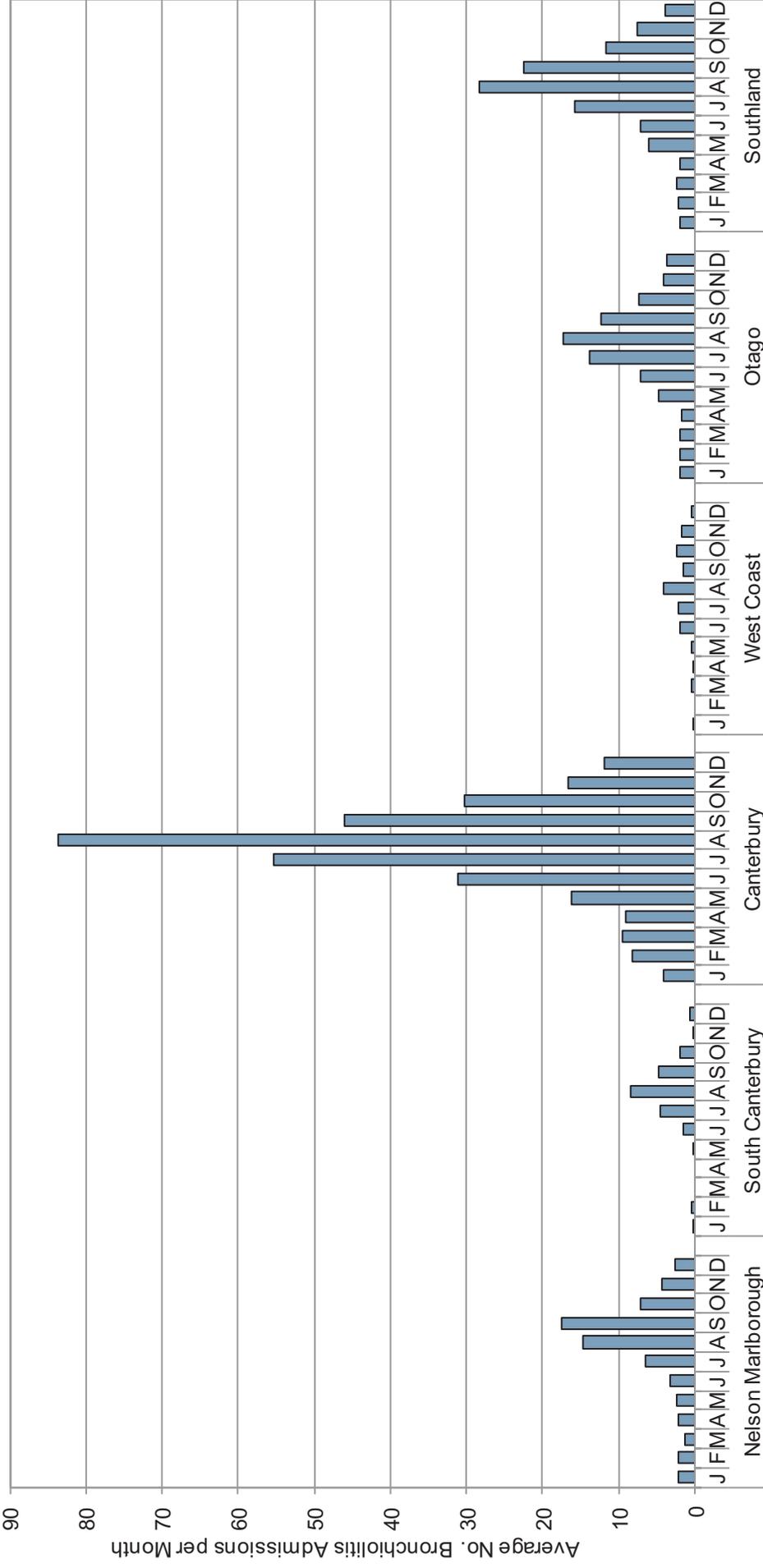
Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Birth Registration Dataset

Figure 52. Acute and Semi-Acute Hospital Admissions for Bronchiolitis in Infants <1 Year by Ethnicity, South Island DHBs vs. New Zealand 2000-2010



Source: Numerator: National Minimum Dataset (Acute and semi-acute admissions only); Denominator: Birth Registration Dataset. Note: Ethnicity is Level 1 Prioritised.

Figure 53. Average Number of Acute and Semi-Acute Hospital Admissions for Bronchiolitis in Infants <1 Year by Month, the South Island DHBs 2006–2010



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

## South Island Distribution by Ethnicity

In Canterbury during 2000–2010, bronchiolitis admissions were higher for Pacific > Māori > European > Asian/Indian infants, although in the West Coast no consistent differences were seen between Māori and European infants. In Nelson Marlborough, South Canterbury, Otago and Southland, while ethnic differences were not consistent, admissions were higher for Māori infants than for European infants in a number of years (Figure 52).

## South Island Distribution by Season

In each of the South Island DHBs during 2006–2010, bronchiolitis admissions in infants were highest during winter and early spring (Figure 53).

## Summary

In New Zealand during 2000–2010, bronchiolitis admissions 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 from bronchiolitis. During 2006–2010, bronchiolitis admissions were *significantly* higher for males, Pacific > Māori > European > Asian/Indian infants and those from average-to-more deprived (NZDep decile 3–10) areas.

In each of the South Island DHBs during 2006–2010, bronchiolitis admissions in infants were *significantly* lower than the New Zealand rate. In Canterbury during 2000–2010, admissions were higher for Pacific > Māori > European > Asian/Indian infants, although in the West Coast no consistent differences were seen between Māori and European infants. In Nelson Marlborough, South Canterbury, Otago and Southland, while ethnic differences were not consistent, admissions were higher for Māori infants than for European infants in a number of years. Admissions however, were higher during winter and early spring in all South Island DHBs.

## Policy Documents and Evidence-Based Reviews Relevant to Bronchiolitis

In New Zealand there are no policy documents which focus solely on the prevention of bronchiolitis. A range of documents however consider approaches to respiratory and infectious diseases more generally, and these are reviewed in other sections of this report:

1. **Generic Approaches to Infectious & Respiratory Disease:** Table 46 on Page 166
2. **The Prevention of Second Hand Smoke Exposure:** Table 47 on Page 168
3. **Interventions Aimed at Housing and Household Crowding:** Table 48 on Page 170
4. **Interventions to Improve Breastfeeding:** Table 27 on Page 107

A range of international reviews and guidelines however, consider the most appropriate management of bronchiolitis, and these are considered in **Table 69**.



Table 69. Policy Documents and Evidence-Based Reviews Relevant to the Prevention and Management of Bronchiolitis

<b>International Guidelines</b>
<p>Bronchiolitis Guideline Team Cincinnati Children's Hospital Medical Center. 2010. <b>Evidence-based care guideline for management of bronchiolitis in infants 1 year of age or less with a first time episode.</b> <a href="http://www.cincinnatichildrens.org/assets/0/78/1067/2709/2777/2793/9199/edf8f194-1a56-48f7-8419-7c5e0a168b5d.pdf">http://www.cincinnatichildrens.org/assets/0/78/1067/2709/2777/2793/9199/edf8f194-1a56-48f7-8419-7c5e0a168b5d.pdf</a></p> <p>These American guidelines aim to: avoid the use of unnecessary diagnostic studies (particularly chest x-rays), decrease the use of medications and respiratory therapy with no observed improvement, improve rates of appropriate admissions, decrease nosocomial infection rates, improve the use of appropriate monitoring and maintain or shorten lengths of hospital stays. Community preventive measures are stated to be: emphasising the importance of hand washing in all settings, eliminating exposure to environmental tobacco smoke, limiting exposure to contagious settings (day care, sick siblings), breastfeeding for six months or more and, for selected high-risk infants, preventive medical therapies such as palivizumab. In the hospital, it is recommended that respiratory isolation policies apply to patients with documented bronchiolitis. All of the recommendations in the guidelines are followed by references to the literature and there is discussion of the quality of the evidence but there is no formal grading of the research evidence.</p>
<p>Committee on Infectious Diseases. 2009. <b>From the American Academy of Pediatrics: Modified Recommendations for Use of Palivizumab for Prevention of Respiratory Syncytial Virus Infections.</b> Pediatrics, 124(6), 1694-701.</p> <p>Palivizumab is a humanized murine monoclonal anti-F glycoprotein immunoglobulin G1 antibody which has both neutralizing and fusion inhibitory activity against Respiratory Syncytial Virus, the most common cause of bronchiolitis. It can be given as an intramuscular injection and requires five monthly doses from the start of the RSV season. It is effective in reducing hospitalisation rates in infants and children at high risk for severe disease but it is very expensive. This policy statement from the American Academy of Pediatrics recommends prophylaxis for infants and children aged &lt;2 years with complicated or cyanotic congenital heart disease, or who have been treated for chronic lung disease within six months of the start of the RSV season, and certain groups of infants born prematurely. A concise summary of these indications can be found on the CDC website at: <a href="http://www.cdc.gov/rsv/clinical/prophylaxis.html">http://www.cdc.gov/rsv/clinical/prophylaxis.html</a></p>
<p>Turner T, Wilkinson F, Harris C, et al. 2008. <b>Evidence based guideline for the management of bronchiolitis.</b> Australian Family Physician, 37(6), S6-13.</p> <p>This is a concise Australian clinical guideline endorsed by The Royal Australian College of General Practitioners. It does not discuss the research evidence in any detail but it does indicate whether or not the authors identified any. Statements in the guideline are accompanied by a letter grade but the grading system is not explained.</p>
<p>National Guideline Clearinghouse. 2007. <b>Guideline synthesis: Prevention, diagnosis and treatment of pediatric bronchiolitis.</b> <a href="http://www.guideline.gov/syntheses/synthesis.aspx?id=16418&amp;search=asthma+children">http://www.guideline.gov/syntheses/synthesis.aspx?id=16418&amp;search=asthma+children</a></p> <p>This web page provides a direct comparison of the recommendations in the guidelines from the American Academy of Pediatrics, the Cincinnati Children's Hospital Medical Center and the Scottish Intercollegiate Guidelines Network and it states that there are no significant areas of difference between the guidelines.</p>
<p>Scottish Intercollegiate Guidelines Network. 2006. <b>Bronchiolitis in children: A national clinical guideline.</b> Edinburgh: Scottish Intercollegiate Guidelines Network. <a href="http://www.sign.ac.uk/pdf/sign91.pdf">http://www.sign.ac.uk/pdf/sign91.pdf</a></p> <p>These guidelines aim to reduce unnecessary investigations and therapies especially in the acute illness and to define indications for referral from primary to secondary and sometimes tertiary care. They provide evidence-based recommendations on the prevention, diagnosis, investigation, treatment and management of bronchiolitis in infants &lt;12 months of age and, in infants with the significant co-morbidities of congenital heart disease, or underlying respiratory disease, or who were born prematurely at <math>\leq</math> 37 weeks gestation, up to 24 months of age. Statements summarising information from the research literature and also the recommendations for practice are accompanied by a grade indicating the quality of the relevant evidence.</p>
<p>American Academy of Pediatrics Subcommittee on D, Management of B. 2006. <b>Diagnosis and management of bronchiolitis.</b> Pediatrics, 118(4), 1774-93.</p> <p>These American guidelines aim to provide an evidence-based approach to the prevention, diagnosis and management of bronchiolitis in children from one month to two years of age. Recommendations are accompanied by a letter grade indicating the quality of evidence on which they are based and are followed by a discussion of the research evidence. Regarding prevention, the guidelines state that prophylactic palivizumab may be given to selected high-risk infants including children with chronic lung disease, a history of prematurity, or congenital heart disease. In hospital frequent hand decontamination by hospital personnel and family members is important for preventing nosocomial infection and alcohol-based rubs are the preferred method. Reducing exposure to second hand smoke and the promotion of breastfeeding are important preventive measures in the community. The guidelines do not recommend any complementary or alternative medications due to lack of evidence. There is a comprehensive list of references.</p>

Paediatric Society of New Zealand. 2005. **Best Practice Evidence Based Guideline Wheeze and Chest Infection in Infants Under 1 Year**. Wellington: Paediatric Society of New Zealand.

<http://www.paediatrics.org.nz/files/guidelines/Wheezeendorsed.pdf>

This publication summarises the international literature and draws on local expertise to provide information to facilitate informed decision making by parents, caregivers and health care providers about the management of lower respiratory tract infection, bronchiolitis, pneumonia and persistent and recurrent wheeze in infants aged over one month and less than one year of age. Key statements and recommendations in the guidelines are graded according to the system used by the New Zealand Guidelines Group. Promotions of breast feeding and smoke-free environments are recommended preventive strategies. Regarding bronchiolitis, oximetry is the only possibly useful investigation and no medications are stated to be effective. Management, in those ill enough to require hospital admission, consists primarily of supportive measures such as oxygen, nasogastric feeding and intravenous fluids. Support and education of parents is important. These guidelines are well referenced however they have not been updated since they were first published.

#### Systematic and Other Reviews from the International Literature

Bialy I, Foisy M, Smith M, et al. 2011. **The Cochrane Library and the Treatment of Bronchiolitis in Children: An Overview of Reviews**. Evidence-Based Child Health, 6(1), 258-75.

This recently updated overview of Cochrane reviews relevant to the treatment of bronchiolitis symptoms brings together evidence from eleven reviews. There was slight variation between the reviews in the clinical definitions of bronchiolitis and the age ranges of children. Seven reviews compared an active treatment to placebo (antibiotics, bronchodilators, epinephrine (adrenaline), glucocorticoids, helium oxygen mixtures (heliox), immunoglobulin, inhaled corticosteroids), two compared active treatment to standard care (extra-thoracic pressure, physiotherapy) and five compared an active treatment with another active treatment (epinephrine, glucocorticoids, hypertonic saline, oxygen, physiotherapy). Some reviews included more than one type of comparison. The authors concluded that for outpatients presenting with wheezing as the major manifestation of bronchiolitis, nebulised epinephrine can be effective in reducing the need for hospitalisation (4 trials, 920 participants, RR 0.67, 95% CI 0.50–0.89). They state that, given the current level of evidence and the potential for adverse events, systemic glucocorticoids such as dexamethasone cannot be recommended as a routine therapy. Regular nebulised hypertonic saline driven using oxygen may reduce the length of hospital stays. Due to the weak level of evidence, chest physiotherapy, nebulised epinephrine and systemic and inhaled corticosteroids cannot be recommended for inpatients. For very sick infants in intensive care, intravenous immunoglobulin, heliox and extra-thoracic pressure cannot be recommended because of lack of available evidence and/or methodological flaws of reviews.

A previous Cochrane review relating to the use of Palivizumab (a monoclonal antibody) for the prevention of infection with respiratory syncytial virus (the major cause of bronchiolitis) has been withdrawn, however a protocol for a new review has been published indicating a forthcoming review.

Wang D, Bayliss S, Meads C. 2011. **Palivizumab for immunoprophylaxis of respiratory syncytial virus (RSV) bronchiolitis in high-risk infants and young children: a systematic review and additional economic modelling of subgroup analyses**. Health Technology Assessment (Winchester, England), 15(5). <http://www.hta.ac.uk/fullmono/mon1505.pdf>

This report is based on an analysis of thirteen studies, most of which were small and inadequately powered for the outcomes of interest. The aim was to use evidence from a systematic review of prognostic and hospitalisation studies to estimate the cost-effectiveness of palivizumab for RSV prophylaxis in different groups of children at high risk from RSV infection including children with and without chronic lung disease (CLD) or congenital heart disease (CHD). The authors concluded that, at a willingness-to-pay threshold of £30,000 per quality-adjusted life year, prophylaxis with palivizumab may be cost-effective for some sub groups. According to this criterion children without either CLD or CHD would need at least two additional risk factors apart from gestational age and birth age to justify prophylaxis but children with CHD or CLD would not necessarily need any apart from gestational age and birth age.

#### Other Relevant Publications

Vogel AM, McKinlay MJ, Ashton T, et al. 2002. **Cost-effectiveness of Palivizumab in New Zealand**. Journal of Paediatrics & Child Health, 38(4), 352-7.

This cost effectiveness evaluation aimed to determine the preterm infant hospitalisation risks for respiratory syncytial virus (RSV) infection and to calculate the net cost per hospitalisation averted due to the use of palivizumab. Pre term infants are often readmitted to hospital after their initial discharge, usually as a result of respiratory infections which are most commonly due to respiratory syncytial virus (RSV). Estimates of readmission risks before one year of prematurity-corrected age in New Zealand ranged from 8% for infants discharged between 29 and 31 weeks gestation without chronic lung disease to 42% for infants less than 32 weeks gestation discharged home on oxygen. The number needed to treat with palivizumab to prevent one hospitalisation ranged from 6 to 26 across the groups of infants and the costs to prevent one hospitalisation ranged from NZ\$28,600 to \$166,700. The authors estimated that prophylaxis for all New Zealand infants born at ≤ 28 weeks would cost \$ 1,090,000 net and prevent 29 hospitalisations for an average cost per admission averted of \$37,000, with eight infants being treated to prevent one hospitalisation. For all groups of infants prophylaxis was associated with a net cost. The authors concluded that, if value was ascribed to preventing morbidity, the priority groups for prophylaxis are infants discharged home on oxygen, followed by infants born at ≤28 weeks gestation. They state that palivizumab has not been proven to reduce mortality, which is low for infections due to RSV, even in high-risk infants.