SERIOUS SKIN INFECTIONS

Introduction

Bacterial skin infections are a common cause of hospitalisation in children. The most frequently implicated organisms are *Staphylococcus aureus* and *Streptococcus pyogenes* [166]. 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 [167].

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 [168].

In New Zealand, hospital admissions for childhood skin infections have increased in recent years [169] and have been reported to be double those of the USA and Australia [170]. Admissions are highest during summer and autumn and are higher for Māori and Pacific children and those living in the most deprived areas [169,170]. 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, exposure to insect bites, and access to primary health care may all need to be addressed simultaneously [170].

The following section explores skin infection rates in children and young people using information from the National Minimum Dataset and Mortality Collection, and a coding algorithm recently developed by O'Sullivan and Baker [169] for use in the New Zealand context. The section concludes with an overview of policy documents and evidence-based reviews which consider interventions to address skin infections at the population level.

Data Sources and Methods

Indicator

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

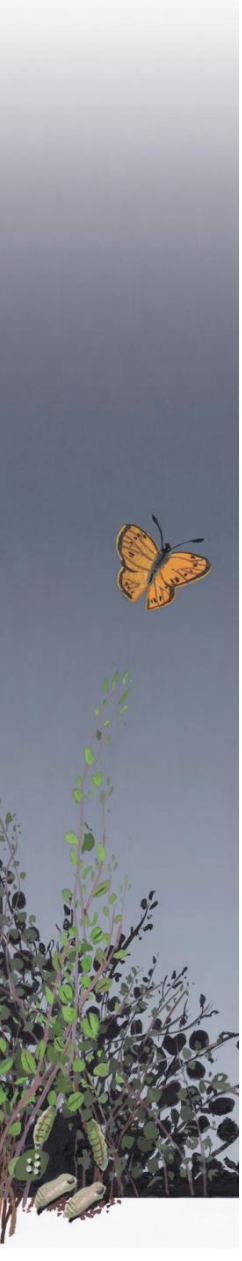
Numerator: National Minimum Dataset: Hospital admissions for children and young people aged 0–24 years with a diagnosis of a Serious Skin Infection in any of their first 15 diagnoses.

The ICD-10-AM coding used is that developed by O'Sullivan and Baker in 2010 for use in the New Zealand context [169] as follows: Impetigo (L010, L011); Cutaneous Abscess/Furuncle/Carbuncle (L02); Cellulitis (L03); Acute Lymphadenitis (L04); Pilonidal Cyst with Abscess (L050); Other Infections Skin/Subcutaneous Tissue (L08); Infections of Other Anatomical Sites (H000, H600, H601, H602, H603, H620, H624, J340, K610, H050, N482, N492, N499, N764 A46); Infected/Unspecified/Other Dermatitis (L303, L308, L309);Insect/Spider Bites (S1013, S1083, S1093, S2013, S2033, S2043, S2083, S3083, S3093, S4083, S5083, S6083, S7083, S8083, S9083, T0903, T1108, T1303, T1403, T633, T634,T009); Post Traumatic/Open Wound Infection (T793, T8901, T8902); Scabies (B86); Varicella with Other Complications (B018);

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 [169], 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 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.

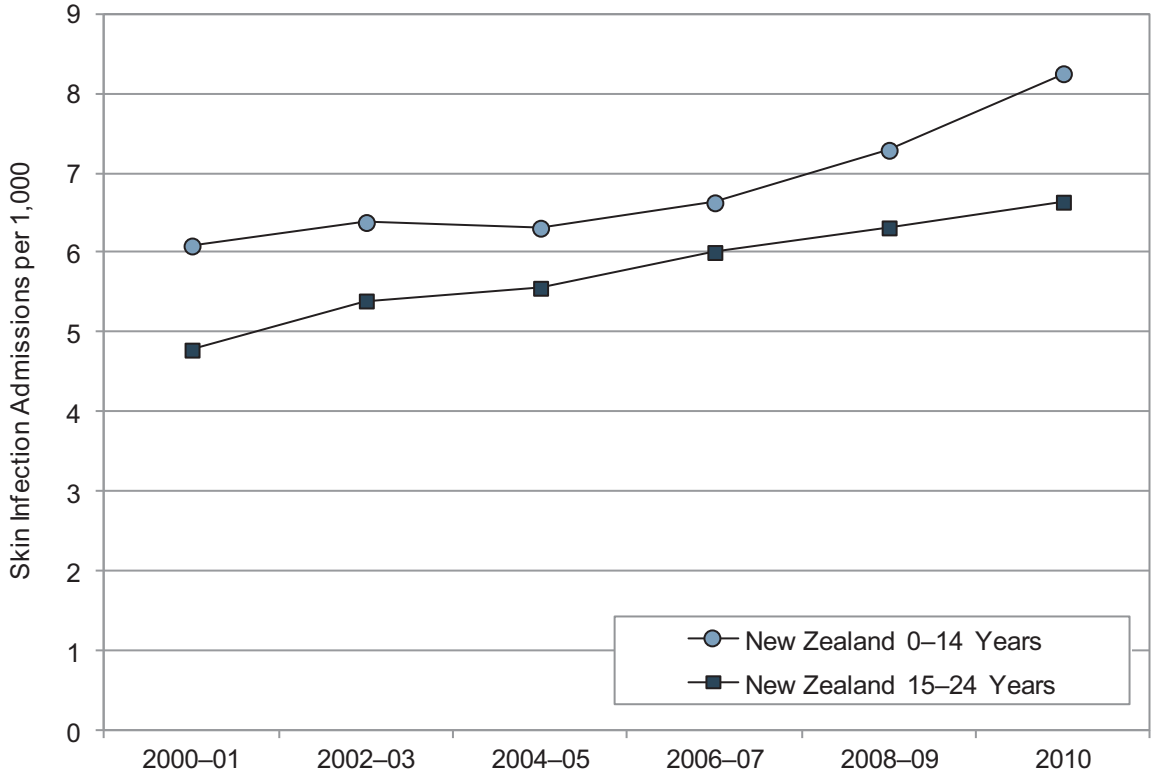
Note 3: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or not *significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data 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 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 (**Figure 93**).

Figure 93. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0−24 Years, New Zealand 2000−2010



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

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 (**Table 92**).

Table 92. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0−24 Years by Primary Diagnosis, New Zealand 2006−2010

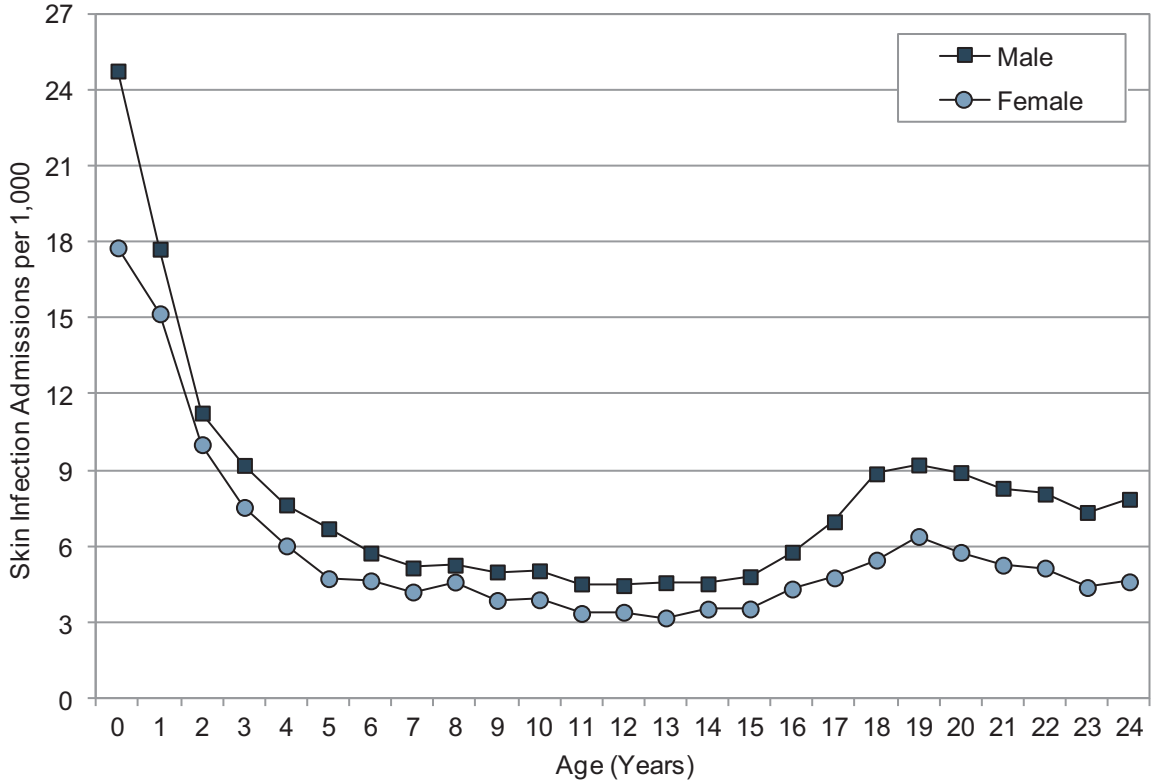
Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
New Zealand				
Children 0–14 Years				
Cellulitis	6,581	1,316.2	1.47	20.4
Cutaneous Abscess/Furuncle/Carbuncle	6,065	1,213.0	1.36	18.8
Infected/Unspecified/Other Dermatitis	2,373	474.6	0.53	7.4
Infections of Other Anatomical Sites	1,757	351.4	0.39	5.5
Acute Lymphadenitis	990	198.0	0.22	3.1
Impetigo	732	146.4	0.16	2.3
Other Infections Skin/Subcutaneous Tissue	570	114.0	0.13	1.8
Varicella with Other Complications	453	90.6	0.10	1.4
Insect/Spider Bites	420	84.0	0.09	1.3
Scabies	385	77.0	0.09	1.2
Post Traumatic/Open Wound Infection	182	36.4	0.04	0.6
Pilonidal Cyst with Abscess	90	18.0	0.02	0.3
Other Diagnoses	11,624	2,324.8	2.60	36.1
Total 0–14 Years	32,222	6,444.4	7.22	100.0
Young People 15–24 Years				
Cutaneous Abscess/Furuncle/Carbuncle	3,997	799.4	1.26	20.2
Cellulitis	3,441	688.2	1.09	17.4
Pilonidal Cyst with Abscess	2,774	554.8	0.88	14.0
Infections of Other Anatomical Sites	1,467	293.4	0.46	7.4
Infected/Unspecified/Other Dermatitis	306	61.2	0.10	1.5
Insect/Spider Bites	246	49.2	0.08	1.2
Other Infections Skin/Subcutaneous Tissue	172	34.4	0.05	0.9
Post Traumatic/Open Wound Infection	158	31.6	0.05	0.8
Acute Lymphadenitis	118	23.6	0.04	0.6
Impetigo	111	22.2	0.04	0.6
Scabies	30	6.0	0.01	0.2
Varicella with Other Complications	12	2.4	<0.01	0.1
Other Diagnoses	6,998	1,399.6	2.21	35.3
Total 15–24 Years	19,830	3,966.0	6.26	100.0

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

New Zealand Distribution by Age

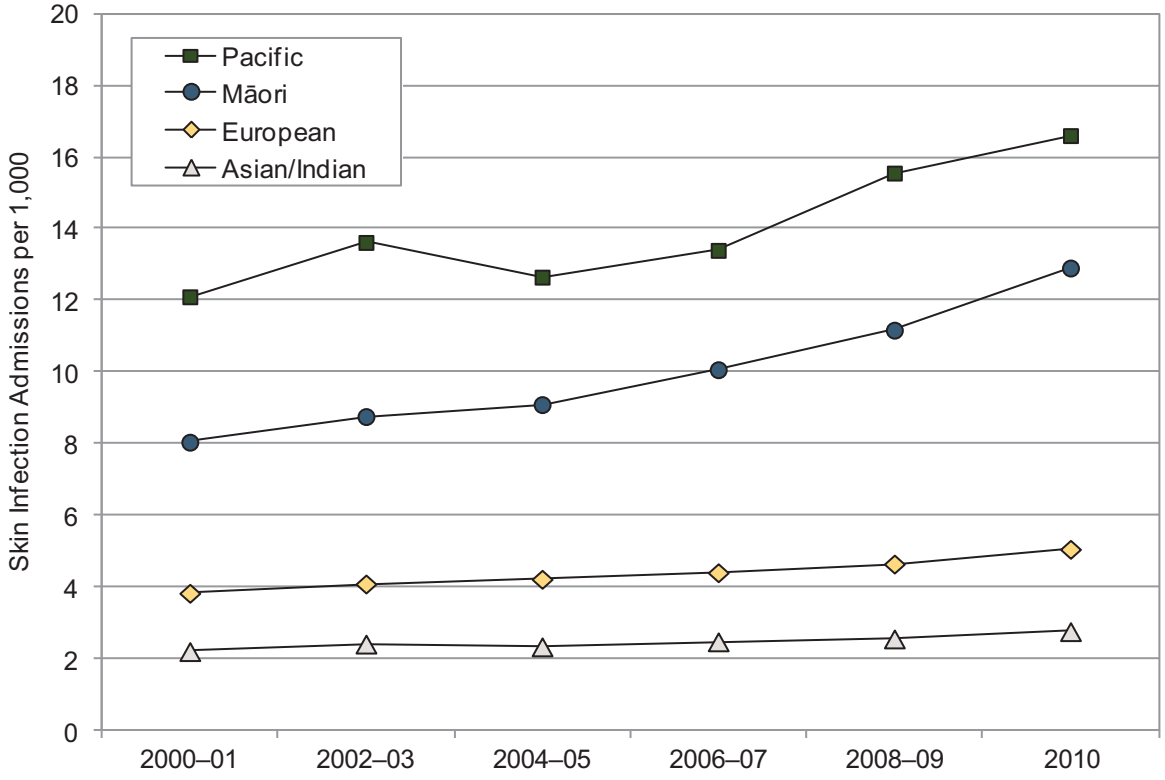
In New Zealand during 2006–2010, hospital admissions for serious skin infections were highest in infants <1 year, with rates tapering off rapidly during the first five years of life. A second, smaller peak in admissions was evident amongst those in their late teens and early twenties. At each age, admission rates were higher for males than for females (**Figure 94**).

Figure 94. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0−24 Years by Age and Gender, 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 95. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0−24 Years by Ethnicity, New Zealand 2000−2010



Source: Numerator: National Minimum Dataset (hospital admissions with serious skin infections in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population. Note: Ethnicity is Level 1 Prioritised.

New Zealand Distribution by Ethnicity, NZDep Index Decile and Gender

In New Zealand during 2006–2010, hospital admissions for serious skin infections in children were *significantly* higher for males, Pacific > Māori > European and Asian/Indian children and those from average-to-more deprived (NZDep decile 3–10) areas. Similarly, for young people, admission rates were *significantly* higher for males, Pacific and Māori > European > Asian/Indian young people and those from average-to-more deprived (NZDep decile 3–10) areas (**Table 93**). Similar ethnic differences were seen, when both age groups were combined during 2000–2010 (**Figure 95**).

Table 93. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0−24 Years by Ethnicity, NZ Deprivation Index Decile and Gender, New Zealand 2006−2010

Variable	Rate	Rate Ratio	95% CI	Variable	Rate	Rate Ratio	95% CI
Serious Skin Infections							
Children 0–14 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	3.09	1.00		Decile 1–2	3.12	1.00	
Decile 2	3.14	1.02	0.94–1.10	Decile 3–4	3.95	1.27	1.20–1.33
Decile 3	3.64	1.18	1.09–1.27	Decile 5–6	5.52	1.77	1.69–1.85
Decile 4	4.24	1.37	1.28–1.47	Decile 7–8	8.23	2.64	2.52–2.76
Decile 5	5.01	1.62	1.51–1.74	Decile 9–10	13.6	4.36	4.18–4.54
Decile 6	5.95	1.92	1.80–2.05	Prioritised Ethnicity			
Decile 7	7.39	2.39	2.24–2.54	European	3.97	1.00	
Decile 8	8.94	2.89	2.72–3.07	Māori	11.8	2.97	2.89–3.05
Decile 9	11.5	3.70	3.49–3.93	Pacific	17.5	4.42	4.29–4.55
Decile 10	15.4	4.98	4.70–5.27	Asian/Indian	3.97	1.00	0.95–1.05
Gender							
Female	6.35	1.00					
Male	8.04	1.27	1.24–1.29				
Young People 15–24 Years							
NZ Deprivation Index Decile				NZ Deprivation Index Quintile			
Decile 1	3.64	1.00		Decile 1–2	3.78	1.00	
Decile 2	3.90	1.07	0.98–1.17	Decile 3–4	4.48	1.18	1.12–1.26
Decile 3	4.14	1.14	1.04–1.24	Decile 5–6	5.48	1.45	1.37–1.53
Decile 4	4.78	1.31	1.21–1.42	Decile 7–8	6.81	1.80	1.71–1.90
Decile 5	5.40	1.48	1.37–1.61	Decile 9–10	9.01	2.39	2.27–2.51
Decile 6	5.55	1.52	1.41–1.65	Prioritised Ethnicity			
Decile 7	6.65	1.82	1.69–1.97	European	5.56	1.00	
Decile 8	6.95	1.91	1.77–2.05	Māori	9.86	1.77	1.72–1.83
Decile 9	7.84	2.15	2.00–2.31	Pacific	10.5	1.89	1.81–1.98
Decile 10	10.4	2.86	2.67–3.07	Asian/Indian	1.37	0.25	0.23–0.27
Gender							
Female	4.95	1.00					
Male	7.55	1.53	1.48–1.57				

Source: Numerator: National Minimum Dataset (hospital admissions with serious skin infections in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population. Note: Rate is per 1,000; Ethnicity is Level 1 Prioritised; Decile is NZDep2001.

South Island Distribution and Trends

South Island Distribution

In the South Island DHBs during 2006–2010, cellulitis, cutaneous abscesses/furuncles/carbuncles and infected/unspecified/other dermatitis were among the most frequent primary diagnoses in children admitted to hospital with serious skin infections. In young people, pilonidal cysts with abscesses, cellulitis and cutaneous abscesses/furuncles/carbuncles were among the leading reasons for hospital admission (**Table 94** to **Table 99**).

Table 94. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0−24 Years by Primary Diagnosis, Nelson Marlborough 2006−2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Nelson Marlborough				
Children 0–14 Years				
Cellulitis	85	17.0	0.66	19.1
Cutaneous Abscess/Furuncle/Carbuncle	52	10.4	0.40	11.7
Infections of Other Anatomical Sites	34	6.8	0.26	7.6
Infected/Unspecified/Other Dermatitis	33	6.6	0.26	7.4
Insect/Spider Bites	16	3.2	0.12	3.6
Other Infections Skin/Subcutaneous Tissue	12	2.4	0.09	2.7
Acute Lymphadenitis	11	2.2	0.09	2.5
Impetigo	9	1.8	0.07	2.0
Varicella with Other Complications	7	1.4	0.05	1.6
Post Traumatic/Open Wound Infection	4	0.8	0.03	0.9
Scabies	4	0.8	0.03	0.9
Other Diagnoses	179	35.8	1.39	40.1
Total 0–14 Years	446	89.2	3.45	100.0
Young People 15–24 Years				
Pilonidal Cyst with Abscess	107	21.4	1.36	23.6
Cellulitis	72	14.4	0.91	15.9
Cutaneous Abscess/Furuncle/Carbuncle	55	11.0	0.70	12.1
Infections of Other Anatomical Sites	42	8.4	0.53	9.3
Infected/Unspecified/Other Dermatitis	7	1.4	0.09	1.5
Other Infections Skin/Subcutaneous Tissue	7	1.4	0.09	1.5
Acute Lymphadenitis	3	0.6	0.04	0.7
Insect/Spider Bites	3	0.6	0.04	0.7
Post Traumatic/Open Wound Infection	<3	s	s	s
Scabies	<3	s	s	s
Impetigo	<3	s	s	s
Other Diagnoses	154	30.8	1.96	33.9
Total 15–24 Years	454	90.8	5.76	100.0

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

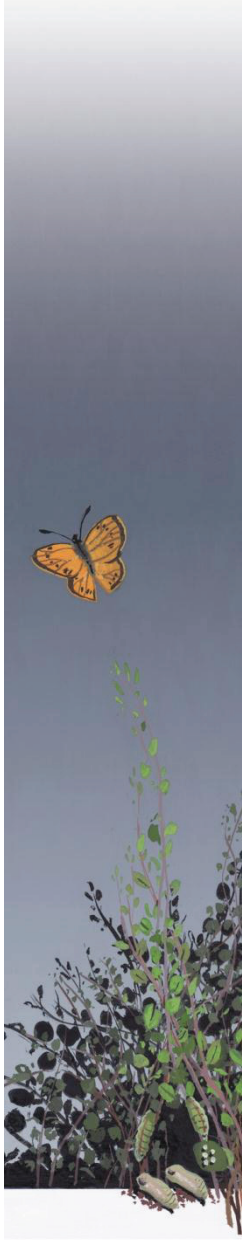


Table 95. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0−24 Years by Primary Diagnosis, South Canterbury 2006−2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
South Canterbury				
Children 0–14 Years				
Cellulitis	17	3.4	0.33	13.8
Cutaneous Abscess/Furuncle/Carbuncle	13	2.6	0.25	10.6
Infected/Unspecified/Other Dermatitis	7	1.4	0.14	5.7
Insect/Spider Bites	6	1.2	0.12	4.9
Infections of Other Anatomical Sites	5	1.0	0.10	4.1
Impetigo	4	0.8	0.08	3.3
Varicella with Other Complications	4	0.8	0.08	3.3
Other Infections Skin/Subcutaneous Tissue	3	0.6	0.06	2.4
Post Traumatic/Open Wound Infection	<3	s	s	s
Other Diagnoses	63	12.6	1.22	51.2
Total 0–14 Years	123	24.6	2.38	100.0
Young People 15–24 Years				
Cellulitis	23	4.6	0.73	19.7
Cutaneous Abscess/Furuncle/Carbuncle	19	3.8	0.60	16.2
Infections of Other Anatomical Sites	13	2.6	0.41	11.1
Pilonidal Cyst with Abscess	9	1.8	0.29	7.7
Other Infections Skin/Subcutaneous Tissue	4	0.8	0.13	3.4
Insect/Spider Bites	3	0.6	0.10	2.6
Acute Lymphadenitis	<3	s	s	s
Infected/Unspecified/Other Dermatitis	<3	s	s	s
Other Diagnoses	44	8.8	1.40	37.6
Total 15–24 Years	117	23.4	3.72	100.0

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

Table 96. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0−24 Years by Primary Diagnosis, Canterbury 2006−2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Canterbury				
Children 0–14 Years				
Cellulitis	312	62.4	0.65	16.5
Cutaneous Abscess/Furuncle/Carbuncle	227	45.4	0.47	12.0
Infected/Unspecified/Other Dermatitis	190	38.0	0.40	10.0
Infections of Other Anatomical Sites	114	22.8	0.24	6.0
Acute Lymphadenitis	68	13.6	0.14	3.6
Impetigo	61	12.2	0.13	3.2
Other Infections Skin/Subcutaneous Tissue	56	11.2	0.12	3.0
Insect/Spider Bites	35	7.0	0.07	1.8
Varicella with Other Complications	31	6.2	0.06	1.6
Scabies	28	5.6	0.06	1.5
Pilonidal Cyst with Abscess	13	2.6	0.03	0.7
Post Traumatic/Open Wound Infection	13	2.6	0.03	0.7
Other Diagnoses	747	149.4	1.56	39.4
Total 0–14 Years	1,895	379.0	3.95	100.0
Young People 15–24 Years				
Pilonidal Cyst with Abscess	417	83.4	1.14	24.6
Cutaneous Abscess/Furuncle/Carbuncle	207	41.4	0.57	12.2
Cellulitis	181	36.2	0.50	10.7
Infections of Other Anatomical Sites	153	30.6	0.42	9.0
Infected/Unspecified/Other Dermatitis	21	4.2	0.06	1.2
Insect/Spider Bites	17	3.4	0.05	1.0
Acute Lymphadenitis	16	3.2	0.04	0.9
Other Infections Skin/Subcutaneous Tissue	14	2.8	0.04	0.8
Post Traumatic/Open Wound Infection	13	2.6	0.04	0.8
Impetigo	11	2.2	0.03	0.6
Scabies	3	0.6	0.01	0.2
Varicella with Other Complications	<3	s	s	s
Other Diagnoses	639	127.8	1.75	37.7
Total 15–24 Years	1,694	338.8	4.64	100.0

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

Table 97. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0−24 Years by Primary Diagnosis, the West Coast 2006−2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
West Coast				
Children 0–14 Years				
Cellulitis	17	3.4	0.54	19.8
Infected/Unspecified/Other Dermatitis	7	1.4	0.22	8.1
Cutaneous Abscess/Furuncle/Carbuncle	6	1.2	0.19	7.0
Scabies	5	1.0	0.16	5.8
Infections of Other Anatomical Sites	5	1.0	0.16	5.8
Acute Lymphadenitis	4	0.8	0.13	4.7
Other Infections Skin/Subcutaneous Tissue	3	0.6	0.10	3.5
Impetigo	<3	s	s	s
Insect/Spider Bites	<3	s	s	s
Other Diagnoses	35	7.0	1.11	40.7
Total 0–14 Years	86	17.2	2.73	100.0
Young People 15–24 Years				
Cellulitis	19	3.8	1.04	18.8
Pilonidal Cyst with Abscess	16	3.2	0.88	15.8
Cutaneous Abscess/Furuncle/Carbuncle	5	1.0	0.27	5.0
Insect/Spider Bites	3	0.6	0.16	3.0
Infected/Unspecified/Other Dermatitis	3	0.6	0.16	3.0
Infections of Other Anatomical Sites	<3	s	s	s
Post Traumatic/Open Wound Infection	<3	s	s	s
Other Diagnoses	52	10.4	2.84	51.5
Total 15–24 Years	101	20.2	5.52	100.0

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

Table 98. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0−24 Years by Primary Diagnosis, Otago 2006−2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Otago				
Children 0–14 Years				
Cellulitis	131	26.2	0.82	27.7
Cutaneous Abscess/Furuncle/Carbuncle	49	9.8	0.31	10.4
Infections of Other Anatomical Sites	27	5.4	0.17	5.7
Infected/Unspecified/Other Dermatitis	25	5.0	0.16	5.3
Acute Lymphadenitis	22	4.4	0.14	4.7
Post Traumatic/Open Wound Infection	12	2.4	0.07	2.5
Other Infections Skin/Subcutaneous Tissue	9	1.8	0.06	1.9
Impetigo	6	1.2	0.04	1.3
Insect/Spider Bites	6	1.2	0.04	1.3
Pilonidal Cyst with Abscess	4	0.8	0.02	0.8
Varicella with Other Complications	4	0.8	0.02	0.8
Scabies	<3	s	s	s
Other Diagnoses	177	35.4	1.10	37.4
Total 0–14 Years	473	94.6	2.95	100.0
Young People 15–24 Years				
Pilonidal Cyst with Abscess	146	29.2	0.86	20.8
Cellulitis	121	24.2	0.71	17.2
Cutaneous Abscess/Furuncle/Carbuncle	86	17.2	0.51	12.3
Infections of Other Anatomical Sites	67	13.4	0.39	9.5
Post Traumatic/Open Wound Infection	19	3.8	0.11	2.7
Infected/Unspecified/Other Dermatitis	9	1.8	0.05	1.3
Insect/Spider Bites	7	1.4	0.04	1.0
Other Infections Skin/Subcutaneous Tissue	4	0.8	0.02	0.6
Acute Lymphadenitis	3	0.6	0.02	0.4
Varicella with Other Complications	<3	s	s	s
Impetigo	<3	s	s	s
Other Diagnoses	238	47.6	1.40	33.9
Total 15–24 Years	702	140.4	4.13	100.0

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

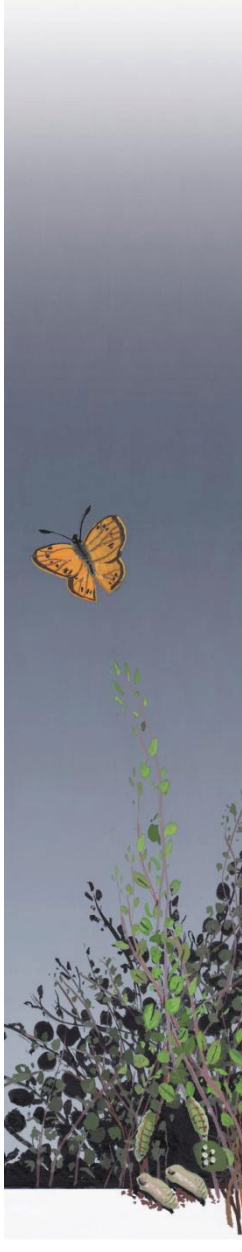


Table 99. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0−24 Years by Primary Diagnosis, Southland 2006−2010

Primary Diagnosis	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Percent (%)
Southland				
Children 0–14 Years				
Cellulitis	96	19.2	0.88	19.4
Infected/Unspecified/Other Dermatitis	41	8.2	0.38	8.3
Cutaneous Abscess/Furuncle/Carbuncle	36	7.2	0.33	7.3
Impetigo	27	5.4	0.25	5.5
Acute Lymphadenitis	21	4.2	0.19	4.3
Infections of Other Anatomical Sites	20	4.0	0.18	4.0
Insect/Spider Bites	12	2.4	0.11	2.4
Scabies	10	2.0	0.09	2.0
Other Infections Skin/Subcutaneous Tissue	10	2.0	0.09	2.0
Varicella with Other Complications	9	1.8	0.08	1.8
Post Traumatic/Open Wound Infection	<3	s	s	s
Other Diagnoses	210	42.0	1.93	42.5
Total 0–14 Years	494	98.8	4.54	100.0
Young People 15–24 Years				
Cellulitis	79	15.8	1.09	20.4
Pilonidal Cyst with Abscess	52	10.4	0.71	13.4
Cutaneous Abscess/Furuncle/Carbuncle	31	6.2	0.43	8.0
Infections of Other Anatomical Sites	24	4.8	0.33	6.2
Insect/Spider Bites	3	0.6	0.04	0.8
Post Traumatic/Open Wound Infection	3	0.6	0.04	0.8
Impetigo	<3	s	s	s
Other Diagnoses	194	38.8	2.67	50.0
Total 15–24 Years	388	77.6	5.33	100.0

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

South Island DHBs vs. New Zealand

In each of the South Island DHBs during 2006–2010, hospital admissions for serious skin infections in children were *significantly* lower than the New Zealand rate. While admissions for young people were also lower than the New Zealand rate in all DHBs, only in Canterbury, South Canterbury, Otago and Southland did these differences reach statistical significance (**Table 100**).

Table 100. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0−24 Years, South Island DHBs vs. New Zealand 2006−2010

DHB	Number: Total 2006–2010	Number: Annual Average	Rate per 1,000	Rate Ratio	95% CI
Serious Skin Infections					
Children 0–14 Years					
Nelson Marlborough	446	89.2	3.46	0.48	0.44–0.53
West Coast	86	17.2	2.73	0.38	0.31–0.47
Canterbury	1,895	379.0	3.95	0.55	0.52–0.57
South Canterbury	123	24.6	2.38	0.33	0.28–0.39
Otago	473	94.6	2.95	0.41	0.37–0.45
Southland	494	98.8	4.54	0.63	0.58–0.69
New Zealand	32,222	6,444.4	7.22	1.00	
Young People 15–24 Years					
Nelson Marlborough	454	90.8	5.76	0.92	0.84–1.01
West Coast	101	20.2	5.52	0.88	0.73–1.07
Canterbury	1,694	338.8	4.64	0.74	0.71–0.78
South Canterbury	117	23.4	3.72	0.59	0.50–0.71
Otago	702	140.4	4.13	0.66	0.61–0.71
Southland	388	77.6	5.33	0.85	0.77–0.94
New Zealand	19,830	3,966.0	6.26	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

South Island Trends

In the South Island during 2000–2010, hospital admissions for serious skin infections in children and young people increased in all DHBs, with the exception of the West Coast, where admissions in young people declined, while admissions in children fluctuated from year to year (**Figure 96**).

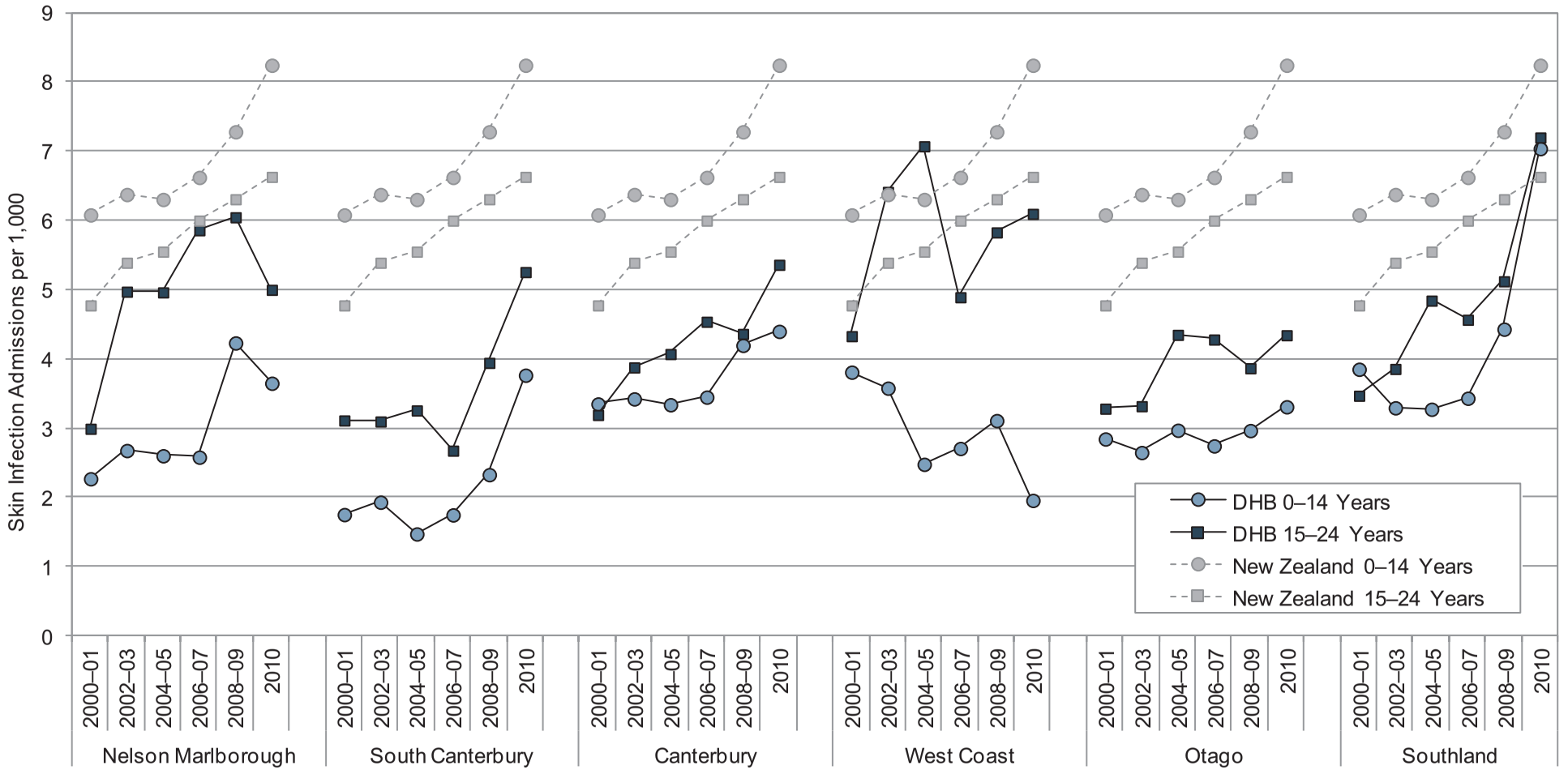
South Island Distribution by Ethnicity

In Canterbury during 2000–2010, hospital admissions for serious skin infections were higher for Pacific > Māori and European > Asian/Indian children and young people, although in the West Coast and South Canterbury no consistent ethnic differences were seen. In Nelson Marlborough admissions were higher for Māori than for European children and young people throughout 2000–2010, while in Otago, admissions were higher from 2004–05 onwards, and in Southland rates were higher during 2008–10 (**Figure 97**).

South Island Distribution by Season

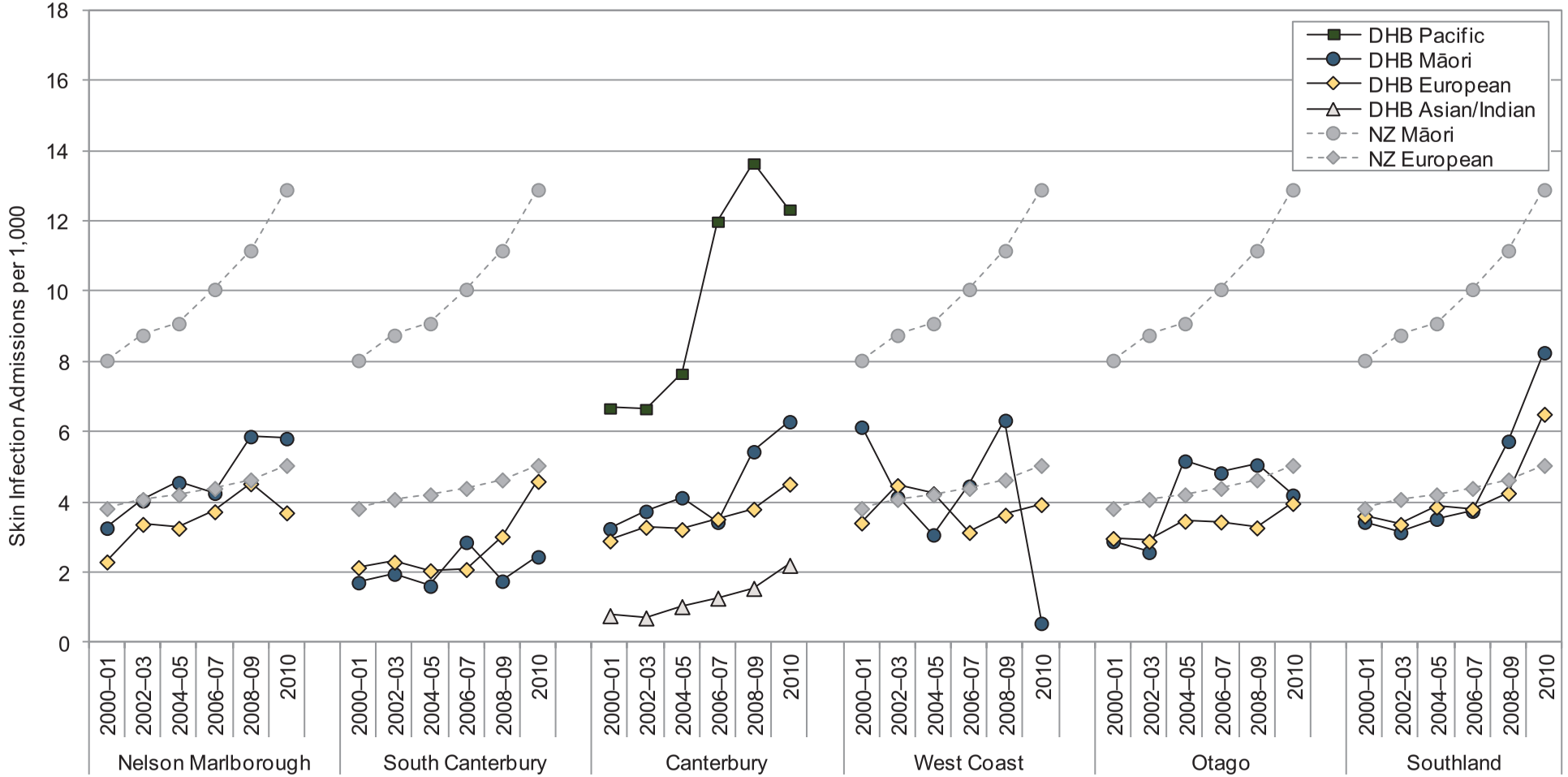
In the South Island during 2006–2010, there were no consistent seasonal variations in hospital admissions for serious skin infections in children or young people (**Figure 98**).

Figure 96. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0−24 Years, South Island DHBs vs. New Zealand 2000−2010



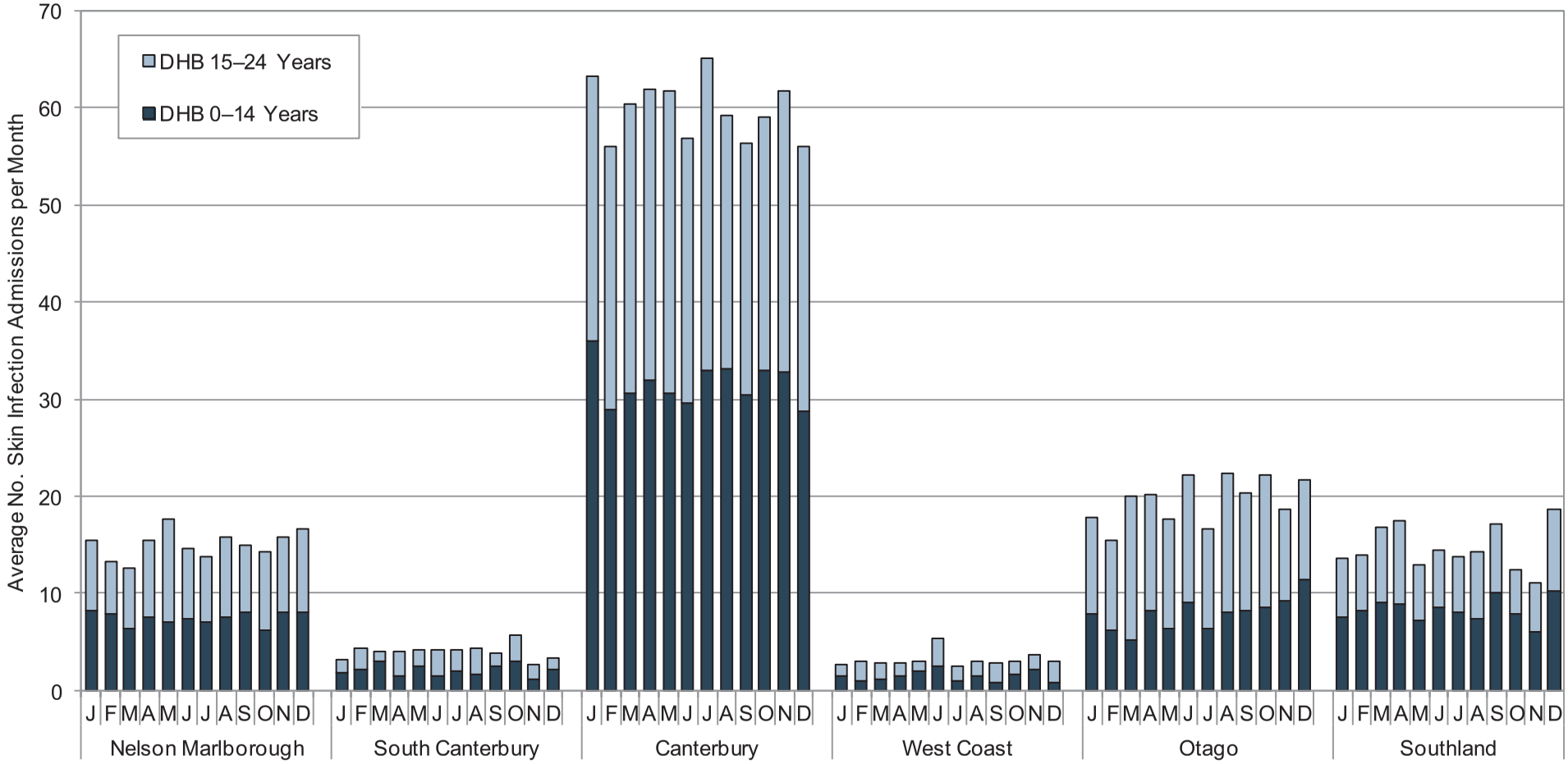
Source: Numerator: National Minimum Dataset (hospital admissions with serious skin infections in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population

Figure 97. Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0−24 Years by Ethnicity, South Island DHBs vs. New Zealand 2000−2010



Source: Numerator: National Minimum Dataset (hospital admissions with serious skin infections in any of the first 15 diagnoses); Denominator: Statistics NZ Estimated Resident Population. Note: Ethnicity is Level 1 Prioritised.

Figure 98. Average Number of Hospital Admissions for Serious Skin Infections in Children and Young People Aged 0−24 Years by Month, the South Island DHBs 2006−2010



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

Summary

In New Zealand during 2000–2010, hospital admissions for serious skin infections increased in both children and young people. During 2006–2010, cellulitis and cutaneous abscesses/furuncles/carbuncles were the most frequent primary diagnoses in children admitted with serious skin infections, while in young people, cutaneous abscesses/furuncles/carbuncles and cellulitis were the main reasons for admission. Admissions were highest in infants <1 year, with a second, smaller peak evident amongst those in their late teens and early twenties. Admissions in children were *significantly* higher for males, Pacific > Māori > European and Asian/Indian children and those from average-to-more deprived (NZDep decile 3–10) areas. For young people, admissions were *significantly* higher for Pacific and Māori > European > Asian/Indian young people and those from average-to-more deprived (NZDep decile 3–10) areas.

In the South Island during 2000–2010, hospital admissions for serious skin infections in children and young people increased in all DHBs, with the exception of the West Coast, where admissions in young people declined, while admissions in children fluctuated from year to year. During 2006–2010, admissions in children were *significantly* lower than the New Zealand rate in all South Island DHBs. While admissions for young people were also lower than the New Zealand rate in all DHBs, only in Canterbury, South Canterbury, Otago and Southland did these differences reach statistical significance. In Canterbury, admissions were higher for Pacific > Māori and European > Asian/Indian children and young people, although in the West Coast and South Canterbury no consistent ethnic differences were seen. In Nelson Marlborough admissions were higher for Māori than for European children and young people throughout 2000–2010, while in Otago, admissions were higher from 2004–05 onwards, and in Southland rates were higher during 2008–10.

Local Policy Documents and Evidence-Based Reviews Relevant to Serious Skin Infections

In New Zealand there are no policy documents which focus solely on the prevention of serious skin infections. A 2004 review of serious skin infections in the Wellington region however, may provide a useful starting point for DHBs wishing to undertake initiatives in this area. This document is briefly summarised in **Table 101**, along with a number of evidence-based reviews which consider these issues in the overseas context. (Note: There is also a paucity of evidence-based reviews in the international literature on effective interventions to reduce serious skin infections at the population level. However, a number of reviews consider the prevention and treatment of common skin conditions which are risk factors for serious skin infection, and these have been included in the overview table where relevant).

In addition, a range of documents consider approaches infectious diseases and their risk factors more generally and these are reviewed in other sections of this report:

1. **Generic Approaches to Infectious Disease:** Table 46 on Page 166
2. **Interventions Aimed at Housing and Household Crowding:** Table 48 on Page 170

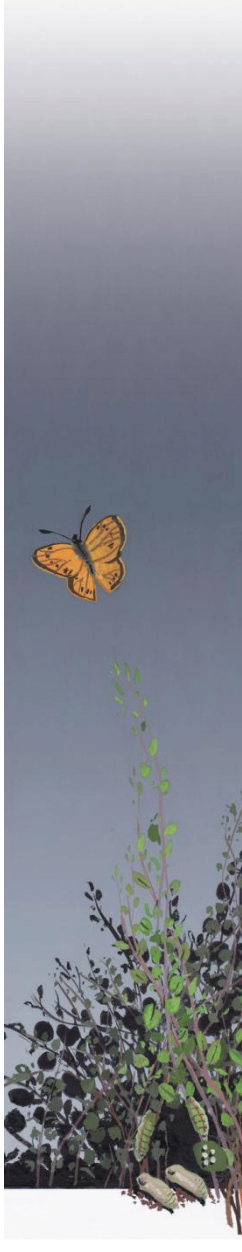


Table 101. Local Policy Documents and Evidence-Based Reviews Relevant to the Prevention or Management of Serious Skin Infections

Ministry of Health Policy Documents
In New Zealand there are no policy documents which focus solely on the prevention of skin infections. There are however, aspects of the Local Government Act 2002, the Local Government Amendment Act 2004 and the Health (drinking water) Amendment Act 2007 that potentially have implications for skin sepsis and other infectious diseases. These Acts require that water companies ensure that households have adequate water to meet minimum drinking, food preparation and sanitary needs even if they do not or are unable to pay their water bill. In the Building Regulations 1992, clause G12.1 has as one of its objectives ensuring that people have hot water for personal hygiene.
Systematic and Other Reviews from the International Literature
Kilburn SA, Featherstone P, Higgins B, et al. 2010. **Interventions for cellulitis and erysipelas**. Cochrane Database of Systematic Reviews*,* 2010(6), CD004299.
This review reports on 25 randomised trials (with a total of 2488 participants) each of which compared two or more different interventions for cellulitis. Most trials compared different drug treatments. The authors concluded that they could not define the best treatment for cellulitis. They noted that most recommendations are made on the basis of single trials. They stated that there is an urgent need for trials comparing oral antibiotics against intravenous antibiotics in community settings as there are implications for health services as well as patient comfort and convenience.
Krakowski AC, Eichenfield LF, Dohil MA. 2008. **Management of atopic dermatitis in the pediatric population**. Pediatrics*,* 122(4), 812-24.
This is a comprehensive review article discussing the various treatment strategies for atopic dermatitis in children.
Fernandez R, Griffiths R. 2008. **Water for wound cleansing**. Cochrane Database of Systematic Reviews*,* 20008(1), CD003861. Content assessed as up to date after new search for studies and content updated, no change to conclusions 2010.
This review considered 11 randomised or quasi randomised trials, 7 of which compared rates of infection and healing in wounds cleansed with water and those cleansed with normal saline, 3 of which compared cleansing with no cleansing and one of which compared procaine spirit with water. Pooled results from three trials in adults (1338 people in total) comparing infection rates between wounds cleansed with tap water and those cleaned with normal saline (in acute soft tissue wounds and lacerations that were sutured) showed a reduction in infection with tap water cleansing compared to normal saline (RR 0.63, 95% CI 0.40-0.99, p= 0.05). Pooled results from two trials in children (535 children in total) comparing tap water with normal saline for cleansing of acute wounds showed no significant difference in infection rates (RR 1.07, 95% CI 0.43-2.64, p = 0.88). The authors concluded that there is no evidence that using tap water to clean acute wounds in adults increases infection and some evidence that it reduces it. They state that there is not strong evidence that cleaning wounds per se increases healing or reduces infection (compared to not cleaning).
Jull AB, Rodgers A, Walker N. 2008. **Honey as a topical treatment for wounds**. Cochrane Database of Systematic Reviews*,* 2008(4), CD005083. (Edited, no change to conclusions published in issue 4 2009)
This review identified 19 randomised or quasi-randomised controlled trials (with a total of 2554 patients) investigating honey as a treatment for any sort of acute or chronic wound. Evidence from a single centre suggested that that honey may reduce healing time in partial thickness burns compared to other dressings but overall the authors concluded that there is insufficient evidence to determine the effect of honey compared to other treatments for burns or other acute or chronic wounds.
Birnie AJ, Bath-Hextall FJ, Ravenscroft JC, et al. 2008. **Interventions to reduce Staphylococcus aureus in the management of atopic eczema**. Cochrane Database of Systematic Reviews*,* 2008(3), CD003871.
Staphylococcus aureus is usually present on the lesions of atopic eczema and there tends to be higher levels of S. aureus colonisation on more severe lesions. It is unknown whether S. aureus has a role causing atopic eczema, makes existing eczema worse or is merely an opportunistic coloniser of damaged skin. Children with atopic eczema have been reported to be at increased risk of skin infections, both mild and severe. The authors of this review considered 21 studies (1018 participants in total) covering 7 treatment categories including oral and topical antibiotics, the addition of antibiotics to steroid creams or ointments, and antibacterial soaps or bath additives. The studies were overall mostly small and poorly reported. The authors concluded that there was no clear evidence that antimicrobial interventions are beneficial in the treatment of atopic eczema, despite their widespread use, and they stated that this does not mean that such treatments do not work but that further large, long term studies are required to determine the efficacy or otherwise of such treatments. The authors have published an update of this review as:
Bath-Hextall FJ, Birnie AJ, Ravenscroft JC, et al. 2010. **Interventions to reduce Staphylococcus aureus in the management of atopic eczema: an updated Cochrane review**. British Journal of Dermatology*,* 163(1), 12-26.

Katz TM, Miller JH, Hebert AA. 2008. **Insect repellents: historical perspectives and new developments**. Journal of the American Academy of Dermatology, 58(5), 865-71.

This is a useful review article with 68 references covering the history of insect repellents, currently used compounds, and the use of insect repellents in children. The American Academy of Pediatrics has published the following guidance:

AAP Committee on Environmental Health A. 2003. **Follow safety precautions when using DEET on children**. AAP News, 22(5), 200399-.

This article states that DEET (N,N-diethyl-m-toluamide, now called N,N-diethyl-3-methylbenzamide) is the most effective mosquito repellent available. The maximum concentration recommended for infants and children is 30%. Lower concentrations provide shorter periods of protection. DEET is not recommended for children under 2 months of age, nor should it be applied to the hands, around the eyes or to cuts, wounds or irritated skin.

Strong M, Johnstone P. 2007. **Interventions for treating scabies**. Cochrane Database of Systematic Reviews, 2007(3), CD000320. Content assessed as up to date after new search for studies and updated content, no change to conclusions, 2010.

Scabies is an extremely itchy parasitic infection caused by the scabies mite. It is spread via direct skin contact and via clothing or furnishings. Secondary bacterial infection can occur via broken skin resulting from scratching. This review included twenty-two small RCTs with a total of 2676 participants. There was one placebo-controlled trial, 18 comparing two or more drug treatments, 3 compared treatment regimens and one compared 2 different vehicles for the same drug. On the basis of the evidence from these trials topical permethrin appears to be the most effective treatment for scabies. Oral Ivermectin appears to be an effective oral treatment.

Laupland KB, Conly JM. 2003. **Treatment of Staphylococcus aureus colonization and prophylaxis for infection with topical intranasal mupirocin: an evidence-based review**. Clinical Infectious Diseases, 37(7), 933-8.

Asymptomatic nasal carriage of Staphylococcus aureus is common and eliminating it is one possible strategy for reducing Staphylococcal infections including skin infections and post-surgical infections. This review considered 16 RCTs two of which involved skin infections although not in children. The authors concluded that, despite several studies showing that mupirocin applied intra-nasally was effective in eliminating nasal colonisation with S. aureus in the short term, the available evidence did not support the use of topical mupirocin intra-nasally as a strategy to reduce infections with S. aureus at other sites.

Koning S, Verhagen AP, van Suijlekom-Smit LWA, et al. 2003. **Interventions for impetigo**. Cochrane Database of Systematic Reviews, 2003(2), CD003261. (Edited, no change to conclusions, republished in Issue 1, 2009)

This review included 57 randomised trials involving a total of 3533 participants studying a variety of oral and topical treatments for impetigo. Most trials compared different treatments rather than treatment vs. placebo. The authors state that there is a lack of data on the untreated course of impetigo and little evidence for the effectiveness of topical disinfectant solution or creams. For people with limited disease, topical antibiotics (mupirocin or fusidic acid) are as effective, or better than oral antibiotics. Penicillin is less effective than most other antibiotics. For extensive disease it is unclear whether oral antibiotics are superior to topical antibiotics. Trials that study topical treatments usually exclude participants with extensive disease and it is commonly believed that more serious forms of impetigo need oral rather than topical antibiotics. The authors note that bacterial antibiotic resistance patterns change over time and from place to place and this should be taken into account when choosing therapy.

Medeiros IM, Saconato H. 2001. **Antibiotic prophylaxis for mammalian bites**. Cochrane Database of Systematic Reviews, 2001(2), CD001738.

School age children make up almost half of those bitten by animals. Most commonly people are bitten by their own pet cat or dog, or by an animal known to them. This review aimed to determine whether prophylactic antibiotics are effective in preventing infection in mammalian bites. Eight RCTs were included in the review. The authors concluded that due methodological deficiencies and small sample sizes in the reviewed studies there is insufficient evidence that prophylactic antibiotics prevent infection after dog bites. There is evidence that the use of antibiotics reduces infection after bites to the hand (pooled data from 4 trials, infection rate 2% in antibiotic group c.f. 28% in the control group, OR 0.10, 95% CI 0.01-0.86).There is weak evidence that antibiotic prophylaxis after human bites reduces infection. (1 trial, 33 participants, infection rate 0% in antibiotic group vs. 47% in the control group, OR 0.02, 95% CI 0.00-0.33).

Other Relevant Publications and Useful Websites

Centers for Disease Control and Prevention. 2011. **Methicillin-resistant Staphylococcus aureus (MRSA) infections.** http://www.cdc.gov/mrsa/index.htmlaccessed 19/05/11

This is the home page for the MRSA-related material on the website of the U.S. Centers for Disease Control and Prevention. While some of the material is MRSA specific much of it applies to all staphylococcal skin infections. There are sections on Definition, Symptoms, Prevention, People at Risk, Treatment, Causes, Diagnosis and Testing, Environmental Cleaning, Statistics and Educational Resources.

Richardson A, Desai U, Mowat E, et al. 2010. **Annual survey of methicillin-resistant Staphylococcus aureus (MRSA) 2010**. Wellington: Nosocomial Infections Laboratory, Institute of Environmental Science and Research Limited (ESR). http://www.surv.esr.cri.nz/PDF_surveillance/Antimicrobial/MRSA/aMRSA_2010.pdf

The ESR conducts annual surveys to provide information on the epidemiology of Methicillin-resistant Staphylococcus aureus (MRSA) in New Zealand. The survey in 2010 involved all MRSA isolated in hospital and community laboratories during either August or October. The report gives the frequencies of different MRSA strains in the different DHBs. The prevalence of MRSA has risen significantly during the last 10 years and it increased by 7.5% from 2009 to 2010.The report states that about half of all MRSA infections were acquired in the community but it does not give the ages of the patients involved. Counties Manukau DHB had the highest rate of MRSA isolations, followed by Northland and Waikato. The authors note that differences between DHBs could be due, in part, to variations in screening practices.

Regional Public Health (Wellington), Auckland Regional Public Health Service. 2006. **Skin Infections**. http://www.skininfections.co.nz/

This website was created to provide information for New Zealand health professionals, community workers, schools and families about the prevention and treatment of serious skin infections. It has a large number of useful resources some of which are available in Pacific languages as well as English.

Hunt D. 2004. **Assessing and Reducing the Burden of Serious Skin Infections in Children and Young People in the Greater Wellington Region. Six-month report January - July 2004 and update on progress October 2004**. Wellington: Capital and Coast DHB, Hutt Valley DHB and Regional Public Health. http://www.skininfections.co.nz/documents/Serious_Skin_Infections_Nov2004.pdf

This is the report of a project involving Capital and Coast DHB, Hutt Valley DHB and Regional Public Health (RPH).It contains data on serious skin infections in children in the region and it outlines interventions relevant to prevention of serious skin infections under four broad categories: Socio-economic and environmental issues, Skin health promotion, Healthcare services and research and National best-practice guidelines. These recommendations are primarily for the DHBs and RPH and they include collaboration with relevant community and non-health sector organisations.

Eady E, Cove J. **Staphylococcal Resistance Revisited: Community Acquired Methicillin Resistant Staphylococcus Aureus - An Emerging Problem For The Management of Skin and Soft Tissue Infections**. Current Opinion in Infectious Diseases, 2003. 16(2): 103-24.

This review of Staphylococcal resistance suggests that improved hygiene offers a very reasonable approach to prevent the spread of Community Acquired Methicillin-Resistant Staphylococcus Aureus(CA-MRSA) in children and that parents, carers, teachers and childcare providers all have an important role to play in helping children to learn and use vigorous hand-washing.