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Serious skin infections in children: a review of admissions to Gisborne Hospital (2006–2007)

Cathryn O'Sullivan, Michael G Baker

Abstract

Aim Serious skin infections are an important and increasing problem in New Zealand children. The highest national rates are in the Tairawhiti (Gisborne) region on the East Coast of New Zealand's North Island, where evidence of significant ethnic disparities exists. This study aimed to describe the characteristics of serious skin infections in children hospitalised in the Tairawhiti region.

Methods The hospital charts of all children aged 0–14 years admitted to Gisborne Hospital between 1 January 2006 and 31 December 2007 for a serious skin infection were retrospectively reviewed and data on a range of variables analysed.

Results There were 163 cases of serious skin infections during the study period with 83% occurring in Māori children. The most common types of infection were cellulitis (38%) and subcutaneous abscesses (36%), and the most frequent sites of infection were the head, face and neck (32%) and lower limbs (32%). A previous episode of skin infection was recorded in 34% of children, with previous hospitalisation in 12%. A skin injury preceded infection in 37% of cases, more than reported in the Auckland and Wellington regions. Of the 77% of children who saw a GP 60% required immediate hospital admission. Compared with figures from the Auckland region, there were longer delays to medical care with a mean duration of symptoms of 2.5 days prior to visiting a GP. The most frequently isolated organisms were *Staphylococcus aureus* (48%) and *Streptococcus pyogenes* (20%) with similar proportions and resistance patterns to other New Zealand settings.

Conclusions The characteristics of serious skin infections in the Tairawhiti region are largely similar to those reported in other New Zealand regions. However, some differences in preceding skin injuries and delays in seeking medical care exist which may contribute to the high incidence of hospitalised infections in the region. These differences require further investigation.

Skin and subcutaneous tissue infections are a heterogeneous group of infections predominantly caused by *Staphylococcus aureus (S. aureus)* and *Streptococcus pyogenes (S. pyogenes).*[1] They are common childhood complaints in primary care, where they are usually adequately treated (see companion skin infection articles in this issue of the *New Zealand Medical Journal).* However in an increasing number of cases worldwide, failed or delayed outpatient therapy is leading to more severe disease, requiring costly hospitalisations for often invasive treatment.[2–5]

In New Zealand (NZ), the incidence of serious skin infections in children has almost doubled between 1990 and 2007.[5] This increasing disease burden results in important health, social and economic consequences (in 2007 the estimated direct hospitalisation costs alone of these infections was NZ$15 million).[5] These infections

also contribute to ethnic and deprivation-related health inequalities with evidence of worsening disparities over time.[5]

In NZ, serious skin infection rates are known to be highest in Māori and Pacific Island children, children younger than 5 years old, boys, children living in deprived neighbourhoods and urban areas, and Northern districts of the country.[5]

Risk factors for infection have been reported in a number of international studies as household crowding, close skin to skin contact, undernourishment, low socioeconomic status, poor hygiene, shared bathing, sharing of soap, minor skin trauma, eczema, chickenpox, insect bites, scabies, recent seawater contact, and warm humid climates.[6–20] While there are a number of recent national and regional reports,[21–25] there are no published studies examining these risk factors in the NZ setting.

Gisborne (Tairawhiti) is a region of NZ where skin infections present a major challenge to the health system; the incidence of serious skin infections in children is the highest out of all NZ regions, with evidence of significantly greater ethnic disparities.

During the period 1990–2007 the observed incidence of infections in the Tairawhiti region was significantly greater than that expected, even after standardising for the high-risk age, ethnicity and deprivation population composition (see this issue of *The New Zealand Medical Journal).*

This study follows on from that work and aimed to further describe the characteristics of serious skin infections in children of the Tairawhiti region to identify any features that might explain the high burden of disease.

Methods

A retrospective review was undertaken of clinical notes from all children aged 0-14 years admitted overnight to Gisborne Hospital between 1 January 2006 and 31 December 2007 with a principal or additional diagnosis of serious skin infection.

The Tairawhiti region is a relatively isolated area of 45 000 people on the East Coast of NZ's North Island. The region experiences a warm year-round climate and is unique for its large Māori population (47.3% of the total population), youthfulness (26.2% of people are aged less than 15 years old),[26] and high level of deprivation (the region has the largest proportion of highly-deprived residents in the country).[27] Gisborne Hospital is a 120-bed secondary referral centre which provides inpatient and outpatient health services for the region.

Cases of serious skin infections were identified using a defined list of skin infection International Classification of Disease Tenth Revision (ICD-10) codes; this definition was developed in earlier work by the authors and the ICD-10 codes are listed in Appendix 1.[28] Day cases, overseas visitors, transfers and readmissions within 30 days with the same diagnosis were excluded.

The clinical notes of all selected patients were reviewed by one investigator (CO). Information on patient demographics, prioritised ethnicity, social and environmental characteristics, past medical history, clinical findings, precipitating events, progress and outpatient management of the current infection, investigations, inpatient management and outcome were recorded on a standardised data collection form.

Levels of socioeconomic deprivation were assigned based on the patient's home address using the New Zealand Deprivation Index (NZDep); a neighbourhood index based on nine variables extracted from census data where NZDep 1 indicates least deprivation and 10 indicates highest deprivation.[29] Information was primarily collected from the records of the current admission, but previous admission notes, general practitioner referral letters and computerised investigation results were reviewed if relevant.

Raw data were entered into Microsoft Excel® and analysed in EpiInfo™ (version 3.4.3, Centers for Disease Control and Prevention). Confidence intervals for proportions were calculated using the Wald method.

Regional Ethics Committee approval was sought and granted for this study.

Results

There were 161 children with 163 discrete cases of serious skin infection admitted to Gisborne Hospital between 1 January 2006 and 31 December 2007. These 163 cases accounted for 2.8% of the 5876 serious skin infection paediatric admissions to all NZ hospitals over the study period. Appendix 2 provides a detailed breakdown of patient characteristics and Appendix 3 summarises inpatient investigations, management and outcome of cases.

Demographics and environmental characteristics—The mean age of patients was 4.64 years with over half of children in the preschool age group. Males accounted for 54% of cases. Eighty-three percent (n=135) of children were Māori, 14% (n=23) were NZ European/Pakeha, 2% (n=4) Pacific, and the remaining 1% (n=1) other ethnicities. Almost half of cases came from households with residents who smoke, solely outside in 36% of cases and both inside and outside in 13% of cases. The mean number of usual household residents was 5.44 people (range 2-11). Forty-one percent of children measured greater or equal to the 90th weight percentile, with mean weight in the 67th percentile.

Past medical history—Fifty-six children (34%) had a recorded history of at least one previous skin infection, with a further 47 (29%) having no documentation of this in their notes. In 20 of the 56 children (12% of total) the previous skin infection was serious, requiring hospitalisation. Ten patients (6%) had a potentially significant pre-existing or concurrent medical condition recorded; these included prematurity (4), impaired glucose tolerance (1), behavioural disorders (1), iron deficiency anaemia (2), Downs' Syndrome (1), and juvenile arthritis requiring systemic immunosuppressants (1).

Clinical presentation—The two most common subtypes of infection were cellulitis and subcutaneous abscesses accounting for 38% and 36% of cases respectively. A superficial bacterial infection of a pre-existing skin condition such as eczema, scabies or chickenpox was present in 14% of cases, impetigo in 5%, acute lymphadenitis in 4%, and other specified types of skin infection in the remaining 3% of cases. The head, face and neck and the lower limbs were the most frequently involved sites (32% of cases each), followed by the trunk, groin and buttocks (18%), and upper limbs (11%). Multiple site involvement occurred in 7% of children.

Predisposing conditions and pre-hospital management—Just over one-third (37%) of children had a recorded history of trauma to the skin in the 2 weeks prior to the development of the infection. These injuries ranged in type and severity; Table 1 details the individual causes of injury and compares the frequency of these to that documented in previous reports on the Wellington and Auckland regions.[22,23] The Tairawhiti region had the highest percentage of cases with a preceding injury identified overall. There was some variation in the distribution of individual causes of injury between the regions; Tairawhiti had the greatest proportion of insect bite/sting related trauma, sports injuries and cuts by a sharp object.

Table 1. Identified causes of injury in children with trauma-related serious skin infections in the Tairawhiti, Wellington and Auckland regions

Cause	Tairawhiti (%) 2006–2007 (n=163)	Wellington (%) 1996–2003[22] (n=1199)	Auckland (%) 1994–1998[23] (n=2055)
Insect bite/sting	37.7	20.8	30.0
Accidental fall	9.8	15.1	15.0
Cut by sharp object	24.6	11.3	22.0
Animal related injury	3.3	8.8	1.0
Struck by person or object	4.9	8.2	12.0
Motor vehicle/cycle or pedestrian accident	0.0	6.9	6.0
Sports injury	4.9	3.8	2.0
Complication of surgical procedure	1.6	2.5	2.0
Vaccination related or iatrogenic	0.0	2.5	2.0
Other or unspecified	13.1	20.1	8.0
Total % of cases with preceding injury/trauma identified	**37.0**	**13.3**	**29.0**

Forty-two percent of children had a recorded history of a chronic or sub-acute skin pathology preceding the development of infection. These conditions included eczema (16%), school sores (10%), scabies (6%), varicella (4%) and other conditions (6%).

Over three-quarters (77%) of children consulted their general practitioner prior to eventual hospital admission with the median duration of skin infection symptoms prior to this consultation found to be 2 days (mean 2.5 days, range <24 hours to >7 days). Forty percent of children who visited their GP had a course of outpatient antibiotics trialled prior to hospitalisation, the remaining 60% were referred for admission immediately. The median duration of skin infection symptoms prior to hospital admission was 2 days (mean 4.0 days) and ranged from less than 24 hours to longer than a week.

Table 2 details the health conditions and management preceding infections in both Māori and non-Māori children. While the number of non-Māori children was too small to enable statistically valid comparisons, the absolute percentages of each variable are not widely divergent. The largest absolute differences are seen in the number of children with a previous serious skin infection; 13% of Māori children and 7% of non-Māori children, and the proportion of cases where antibiotics were started by the GP; 42% of Māori cases and 60% of non-Māori cases. Little absolute ethnic difference is found in the history of a previous skin infection or skin pathology, the frequency of consulting a GP and the duration of symptoms prior to seeking medical attention.

Table 2. Predisposing conditions and pre-hospital management of serious skin infections in 0–14-year-old Māori and non-Māori children in the Tairawhiti region, 2006–2007

Variable	Total(%)	Māori (n=135)		Non-Māori (n=28)	
		f	% (95% CI)	*f*	% (95%CI)
Previous skin infection					
Yes	56 (34)	47	35(27.3–43.2)	9	32(17.8–50.8)
No	60 (37)	49	36(28.7–44.7)	11	39(23.5–57.6)
Not recorded	47 (29)	39	29	8	29
Previous serious skin infection					
Yes	20 (12)	18	13(8.5–20.2)	2	7(0.9–23.7)
No	139 (85)	113	84(76.5–89.1)	26	93(76.3–99.1)
Not recorded	4 (3)	4	3		0
Skin injury/trauma					
Yes	61 (37)	53	39(31.4–47.7)	8	29(15.1–47.2)
No	94 (58)	75	56(47.1–63.7)	19	68(49.2–82.2)
Not recorded	8 (5)	7	5	1	4
Skin pathology†					
Yes	68 (42)	58	43(34.9–51.4)	10	36(20.6–54.3)
No	91 (56)	73	54(45.7–62.2)	18	64(45.8–79.3)
Not recorded	4 (2)	4	3	0	0
Duration prior to admission					
<24 hours	24 (15)	20	15(9.7–21.9)	4	14(5.1–32.1)
1 day	23 (14)	19	14(9.1–21.0)	4	14(5.1–32.1)
2 days	28 (17)	26	19(13.4–26.8)	2	7(0.9–23.7)
3 days	25 (15)	20	15(9.7–21.9)	5	18(7.4–36.1))
4 days	12 (7)	11	8(4.5–14.1)	1	4(<0.01–19.2)
5 days	5 (3)	5	4(1.4–8.6)	0	0
6 days	4 (3)	4	3(0.9–7.6)	0	0
≥7 days	25 (15)	17	12(7.9–19.3)	8	29(15.1–47.2)
Not recorded	17 (11)	13	10	4	14(5.1–32.1)
Mean/median (days)	*3.96/2*	*3.81/2*		*4.71/3*	
Consulted general practitioner					
Yes	126 (77)	106	79(70.8–84.7)	20	71(52.8–84.9)
No	37 (23)	29	21(15.4–29.2)	8	29(15.1–47.2)
Duration prior to consulting GP					
<24 hours	23 (14)	20	15(9.7–21.9)	3	11(2.9–28.0)
1 day	25 (15)	22	16(11.0–23.5)	3	11(2.9–28.0)
2 days	23 (14)	19	14(9.1–21.0)	4	14(5.1–32.1)
3 days	17 (10)	14	10(6.2–16.8)	3	11(2.9–28.0)
4 days	9 (6)	8	6(2.9–11.4)	1	3(<0.01–19.2)
5 days	3 (2)	2	2(<0.1–5.6)	1	3(<0.01–19.2)
6 days	2 (1)	2	2(<0.1–5.6)	0	0
≥7 days	8 (5)	8	6(2.9–11.4)	0	0
Not recorded	16 (10)	11	8(4.5–14.1)	5	18(7.4–36.1)
Not applicable	37 (23)	29	21	8	29(15.1–47.2)
Mean/median (days)	*2.45/2*	*2.51/2*		*2.03/2*	
Antibiotics started by GP					
Yes	50 (40)	45	42(33.5–52.0)	12	60(38.6–78.2)
No	76 (60)	61	58(48.0–66.5)	8	40(21.8–61.4)
Not applicable	37	29		8	
TOTAL	**163 (100)**	**135**	**100**	**28**	**100**

f Frequency of variable; †Skin pathologies include eczema, dermatitis, chicken pox, scabies, school sores, or any other chronic or sub-acute skin condition that could predispose to infection.

Investigations—Ninety-nine children (61%) had blood drawn for laboratory analysis; of these two-thirds (66/99) had a white cell count above the reference range (4.0-13.4 x 10^9/L), 36% (36/99) had a c-reactive protein greater than 5mg/L, and 29% (29/99) had an elevated platelet count (above the reference range 150-400 x 10^9/L). Eighty-one children (50%) had blood cultures taken with significant growth in 2 patients; both were methicillin-sensitive *S. aureus* (MSSA).

Just over half of patients (52%) had a microbiological swab taken with growth in 88% of cases; the most common organisms isolated were *S aureus* (40/84), *S pyogenes* (17/84) and a combination of both (9/84). There were no cases of methicillin-resistant *S. aureus* (MRSA) isolated during the study period. Ultrasonography of subcutaneous tissues was used in 3% of all cases (5/163) and computer tomography assisted diagnosis in one case.

Treatment—Ninety-six percent of patients received antibiotics during their admission, with just over two thirds (70%) of these being administered intravenously (IV), 29% orally and 1% intramuscularly. Flucloxacillin was the most common IV antibiotic prescribed, being given to 56% of patients overall and 84% of those receiving IV antibiotics.

Augmentin was prescribed in 11% of cases and was most frequently used for infections involving the face, head and neck and those related to an animal or human bite. Macrolide antibiotics and cephalosporins were prescribed in the remaining 2% and 3% of IV cases respectively. The median length of IV antibiotic administration was 2 days (mean 2.5 days, range 0.5-10 days). Surgical management, such as incision and drainage or debridement, was required in 31% of all cases. A large proportion of these surgical procedures were performed under general anaesthetic.

Length of stay, complications and outcome—The median length of stay was 3 days (mean 3.9). While this ranged from 1-14 days, just under two thirds (65%) of cases were admitted for three days or less. Most admissions were medically uneventful, but 6 children (4%) experienced a potentially serious complication; these included new abscess formation (3), osteomyelitis (1), febrile convulsion (1), and sepsis/septic shock (2). Four children required transfer to a specialist paediatric referral centre; in all cases this was due to young age and the requirement for a surgical procedure. There were no deaths during the study period.

Discussion

To our knowledge this is the first published study to report the characteristics of serious (hospitalised) skin infections in NZ children. Serious skin infections are a diverse group of conditions, with cellulitis and subcutaneous abscess the most common subtypes in our series. These infections occurred in mainly healthy children from a range of backgrounds, but in keeping with the findings of previous reports, Māori children, boys and children in the preschool age group were overrepresented.[5,21-25] (see article entitled *The epidemiology of serious skin infections in New Zealand children: comparing the Tairawhiti region with national trends* in this issue of the *New Zealand Medical Journal*).

Ethnic disparities in disease rates in NZ children are not unique to skin infections; similar patterns are noted for many infectious diseases[30,31] and are thought due to household crowding, barriers to accessing healthcare and a range of socioeconomic factors.[30-35]

Compared with data from unpublished studies in Wellington and Auckland,[22,23] a greater proportion of serious skin infections were preceded by an identified skin injury in our series. We hypothesise this difference could be related to the warmer climate of the Tairawhiti region. Increased environmental air temperature has been linked to higher frequencies of insect bites and subsequent rises in impetigo incidence.[20] In addition, increased skin exposure due to individual, socioeconomic and climatic factors may raise the rate of both insect bites and other minor skin injuries.

While differences in the size and methodology of our study compared with that used in the Wellington and Auckland studies must be taken into account, the high burden of disease in Tairawhiti could in part be explained by the hypothesis that more frequent minor skin injuries in local children in general lead to a higher incidence of skin infections overall.

We were unable to find any reliable comparative data for the proportion of serious skin infections preceded by sub-acute or chronic skin pathology in other settings, but with the identification of such a condition in 42% of cases in our series, this seems to be an important risk factor.

Eczema was particularly recognised as a frequent precipitant to infections and NZ has one of the highest reported rates of childhood eczema in the world;[36,37] multiple macroscopic and microscopic breaches in the skin surface, itching leading to further skin damage and the introduction of sub-ungal microorganisms, and increased bacterial colonisation of chronically damaged skin can all predispose to infection.[38,39]

The lower limbs and the head, face and neck were equally the most commonly affected sites in our study. Other authors have reported a predominance of lower limb infections and have reasoned this is likely to be a result of frequent minor trauma to the legs;[9,19,23] we agree with this hypothesis and note its particular relevance to the climate of the Tairawhiti region as described above. The equally high incidence of infections of the head, face and neck has not been observed in other settings, and may be due to regional differences in the mechanisms of skin barrier disruption, with higher rates of infections secondary to insect bites in Tairawhiti.

The number of children suffering a recurrence of skin infection, especially those 12% who had previously been hospitalised at least once for a serious skin infection, is concerning. It suggests that opportunities to modify relevant risks, such as delays to medical care, are being missed at the time of initial infection and that secondary prevention efforts by health providers need further improvement and resourcing. Comparative data from other settings were not available.

The 77% of children who saw their GP prior to hospital admission is somewhat less than the 93% reported in a currently unpublished Starship Hospital cellulitis case series,[40] and may reflect difficulties in accessing primary care for functional, geographic, socioeconomic and cultural reasons.

The mean duration of symptoms prior to consulting a GP was also significantly longer in this series compared to the Starship study[40] (2.5 days compared with 1.5 days respectively). This delay is likely due to similar barriers, but may also be contributed to by the normalisation of skin infections in the Tairawhiti region; a locally recognised phenomenon, likely due to the persistently high incidence of disease.

In addition, the proportion of children referred immediately for hospital admission was 60% in this series compared with 40% in the Starship study. This difference could directly relate to delayed first presentation resulting in more serious infection, or may be due to lower referral thresholds caused by geographical and socioeconomic factors in the region.

The ethnic distribution of predisposing conditions and pre-hospital management is notable, with small absolute differences observed in a number of areas. However our study does not have enough power to detect statistically significant differences between the two groups due to the small number of non-Māori children in the series and resulting wide confidence intervals. A similar study with a larger non-Māori sample size is needed to provide sufficient statistical power to investigate these ethnic differences.

The diagnosis of skin infection was primarily based on clinical signs and symptoms, with infrequent need for any investigations beyond basic haematology, biochemistry and microbiological testing. It is unclear whether even these tests were necessary for diagnostic purposes in the majority of cases; the Starship Hospital Cellulitis Clinical Guideline states investigations are not indicated in most children with cellulitis/subcutaneous abscess as they are of little diagnostic value.[41]

The types and proportions of causative organisms isolated were in keeping with those reported in previous NZ reviews,[25] suggesting no difference in local microbiological patterns that might explain higher rates of disease. In addition, during 2006 the incidence of antibiotic resistance was lower in Gisborne Hospital *S aureus* isolates than comparative isolates nationally.[42]

Treatment was primarily antibiotic-based with the majority administered intravenously; the 30% of children who did not receive IV treatment yet still required hospitalisation were either those where a surgical procedure was the primary treatment or where intensive topical skin cares were required in addition to oral antibiotic therapy, such as in cases of superficially infected eczema. The 4% who did not receive antibiotics were short admissions for drainage of a small abscess with antibiotics commenced on discharge.

Besides the small non-Māori sample size discussed above, this study had several other limitations. The study relied on retrospectively reviewing information recorded in standard hospital notes; in some cases these data were unavailable or unclear, resulting in high rates of ‘not recorded’ for some variables and the inability to investigate others.

Comparisons between the Tairawhiti region and other NZ settings largely relied on data in unpublished regional reports; differences in infection characteristics could be due to variations in study methodologies in addition to true differences.

This study has described factors contributing to the development of serious skin infections in the children of the Tairawhiti region. It has highlighted areas where variation in infection characteristics may account for some of the inter-regional differences in observed incidence rates. A case-control study should be considered to further explore these risk factors and quantify their importance with a specific examination on differences between Māori and non-Māori children. It would also be useful to describe characteristics and risk factors for skin infections in the primary care setting (see article entitled *Skin infections in children in a New Zealand primary care setting: exploring beneath the tip of the iceberg* in this issue of the *New Zealand Medical Journal*).

Robust information on these risk factors is critical to the design of evidence based interventions to reduce the high rate of serious skin infections and the large and widening ethnic disparities for children of the Tairawhiti region.

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Author information: Cathryn O'Sullivan, Masters of Medical Sciences Student, Department of Public Health. University of Otago, Wellington; Michael G Baker, Associate Professor, Department of Public Health, University of Otago, Wellington

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Correspondence: Associate Professor Michael Baker, Department of Public Health, University of Otago Wellington, PO Box 7343, Wellington South, New Zealand. Fax: +64 (0)4 3895319; email: michael.baker@otago.ac.nz

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Appendices

Appendix 1. International Classification of Disease Tenth Revision (ICD-10) diagnosis descriptions and codes included in study case definition

Diagnosis description	ICD-10 code(s)
Impetigo	L01.0-L01.1
Cutaneous abscess, furuncle and carbuncle	L02.0-L02.9
Cellulitis	L03.01-L03.9
Acute lymphadenitis	L0.40-L04.9
Pilonidal cyst with abscess	L05.0
Pyoderma	L08.0
Other infections of skin and subcutaneous tissue	L08.1, L08.8, L08.9
Erysipelas	A46
Hordeolum/cellulitis/abscess eyelid	H00.0
Abscess/cellulitis external ear and infective otitis externa	H60.0-H60.3, H62.0, H62.4
Abscess/cellulitis nose	J34.0
Anal abscess/cellulitis (excludes rectal, ischiorectal or intersphincteric regions)	K61.0
Acute inflammation/cellulitis/abscess of orbit	H05.0
Other inflammatory disorders of penis, scrotum and unspecified male genital organ (excludes deeper tissues)	N48.2, N49.2, N49.9
Abscess/cellulitis of vulva	N76.4
Varicella with other complications	B01.8
Scabies	B86
Dermatitis unspecified and other specified (eczema) and infective eczema†	L30.8,L30.9,L30.3 0
Insect/spider bites	S10.13, S10.83, S10.93, S20.13, S20.33, S20.43, S20.83, S30.83, 30.93, S40.83, S50.83, S60.83, S70.83, S80.83, S90.83, T00.9, T09.03, T11.08, T13.03, T14.03, T14.03, T63.3, T63.4
Post-traumatic wound infection not elsewhere classified	T79.3
Open wound infection with foreign body (+-infection) and open wound with infection	T89.01, T89.02

†The medical definition of infective eczema (a primarily inflammatory condition) is not in keeping with the clinical description of a serious skin infection, however due to similarities in terminology, this code is incorrectly used for eczema with a superficial bacterial infection.

Appendix 2. Demographic, social and environmental characteristics of 0-14 year old children with serious skin infections in the Tairawhiti Region, 2006–2007

Characteristic	Description	Number (%)	Mean
Age (years)	0-4	95 (58)	4.64
	5-9	39 (24)	years
	10-14	29 (18)	
Gender	Male	88 (54)	
	Female	75 (46)	
Ethnicity	NZ Māori	135 (83)	
	Pacific Island	4 (2)	
	NZ European/Pakeha	23 (14)	
	Other European	1 (1)	
Weight percentile	≤10th	13 (8)	67th
	25th	17 (11)	
	50th	33 (20)	
	75th	28 (17)	
	≥90th	66 (41)	
	Not applicable†	5 (3)	
Household smoking status	No smokers	27 (17)	
	Outside smokers only	59 (36)	
	Inside and outside smokers	22 (13)	
	Not recorded	55 (34)	
Number of people in household	2-3	12 (7)	5.44
	4-5	84 (52)	
	6-7	37 (23)	
	8-9	8 (5)	
	10-11	10 (6)	
	Not recorded	12 (7)	
Significant past medical history	Yes	10 (6)	
(excluding previous skin infections)	No	153 (94)	
TOTAL		**163 (100)**	

† Due to inconsistencies in gestation accuracy and the largely maternal determinant of birth weight, weight percentiles were not calculated in children younger than 1 month old.

Appendix 3. Inpatient investigations, management and outcome of 0–14-year-old children with serious skin infections in the Tairawhiti Region, 2006–2007

Variable	Description	Number (%)	Mean
Length of stay (days)	1-3 days	105 (65)	3.87
	4-6 days	30 (18)	days
	7-9 days	12 (7)	
	10-12 days	9 (6)	
	≥13 days	7 (4)	
Blood drawn for analysis	No	64 (39)	
	Yes	99 (61)	
	- *Leucocytosis (>13.4 x 10^9/L)*	*66 (66)*	
	- *Elevated CRP (>5mg/L)*	*36 (36)*	
	- *Thrombocytosis (>400 x 10^9/L)*	*29 (29)*	
Blood cultures taken	No	82 (50)	
	Yes	81 (50)	
	- *No growth*	*76 (94)*	
	- *Contaminant growth only†*	*3 (4)*	
	- *Staphylococcus aureus*	*2 (2)*	
Microbiological swabs taken	No	79 (48)	
	Yes	84 (52)	
	- *No growth*	*10 (12)*	
	- *Staphylococcus aureus*	*40 (48)*	
	- *Streptococcus pyogenes*	*17 (20)*	
	- *Staphylococcus aureus and Streptococcus pyogenes*	*9 (11)*	
	- *Staphylococcus aureus and other*	*5 (6)*	
	- *Other*	*3 (3)*	
Ultrasonography	No	158 (97)	
	Yes	5 (3)	
Computer tomography scan	No	162 (99)	
	Yes	1 (1)	
Antibiotic prescribed	No	6 (4)	
	Yes	157 (96)	
Route and type of antibiotic	Oral	46 (29)	
	Intramuscular	1 (1)	
	Intravenous	110 (70)	
	- *Flucloxacillin*	*92 (84)*	
	- *Augmentin*	*12 (11)*	
	- *Macrolide*	*2 (2)*	
	- *Cephalosporin*	*4 (3)*	

Duration of IV antibiotics	≤24 hours	10 (6)	2.45
	1-2 days	59 (36)	days
	3-4 days	27 (17)	
	5-6 days	11 (7)	
	≥7 days	3 (2)	
	Not given	53 (32)	
Surgical management required‡	No	113 (69)	
	Yes	50 (31)	
Complications§	None	157 (6)	
	New abscess formation	3 (2)	
	Osteomyelitis	1 (1)	
	Febrile convulsion	1 (1)	
	Sepsis or septic shock	2 (1)	
	Transfer	4 (2)	
	Death	0 (0)	
TOTAL		**163 (100)**	

†Based on conclusion of microbiological report

‡Surgical management of a serious skin infection refers to surgical procedures under general anaesthetic and includes incision and drainage, and surgical debridement

§The absolute numbers and percentages of complications do not sum to the total due to more than one type of complication in one some patients.