Toi Te Ora
Public Health Service
BAY OF PLENTY DISTRICT HEALTH BOARD
Serving Bay of Plenty and Lakes Districts

Health Needs Assessment:

Cellulitis and Skin Infections in Children in the Bay of Plenty

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Toi Te Ora – Public Health Service

Executive Summary

Overview

Serious skin infections are a preventable cause of ambulatory sensitive hospitalisations in the Bay of Plenty District Health Board (DHB). The aim of this report is to scope issues relevant to the prevention and management of serious skin infections and identify strategies to reduce their incidence. Information was collated from a range of sources, including hospitalisation data, national and international literature. Consultation with key stakeholders was also undertaken.

Summary of key findings

- Admissions for serious skin infections are increasing in the Bay of Plenty. The increase is driven by children aged 0-4 years who account for approximately 57% of skin infections seen from 2003-2007.
- Ethnic disparities are evident with a higher rate of serious skin infections amongst children of Maori ethnicity compared to non-Maori children.
- Admissions for serious skin infections are a manifestation of underlying social, economic and environmental factors as well as health service and access and quality issues. A comprehensive approach which addresses all these factors is required.
- The total cost of serious skin infections for the Bay of Plenty DHB in the 2009-2010 financial year was $1,140, 841. Based on this figure, a strategic approach aimed at preventing 20% of these admissions could save the Bay of Plenty DHB $228,168.
- The key recommendations of this project are grouped into four workstreams outlined below:

Summary of Key Recommendations
WORKSTREAM 1 : General and targeted awareness raising campaign
Aims: ▪ General awareness raising: Increase community awareness and understanding of serious skin infections across the wider Bay of Plenty ▪ Targeted awareness raising: Increase awareness and understanding of serious skin infections in high incidence communities in the Bay of Plenty (as identified by this report) ▪ Increase early detection, intervention and treatment of skin infections **Methods:** ▪ Disseminate statistics to make it clear why serious skin infections are a serious issue ▪ Develop key messages

- Conduct a multi media awareness campaign (utilising newspapers, radio, resources)
- Develop a Toi Te Ora - Public Health skin infection webpage and post key statistics and information for health professionals and the general public
- Provide a list of GPs, addresses and fees on the Toi Te Ora - Public Health website and update regularly
- Skin health promotion: utilise and adapt existing resources and develop new resources if required
- Raise awareness about environmental determinants of skin infections e.g. insect bites and include in promotional resources
- Assist with resource distribution and training where possible

WORKSTREAM 2 : Advocacy for service improvement

Aim:

- Advocate where there are opportunities for health service improvement, both through Toi Te Ora - Public Health and at Bay of Plenty DHB level

Methods:

- Actively promote links between public health, primary, hospital and community services
- Advocate for more accessible and affordable primary health services
- Explore the possibility of increasing funding for after hours GP services
- Support other Bay of Plenty DHB initiatives: e.g. the proposed hospital based eczema clinic and the 'Bay Navigator'
- Develop a clinical care pathway for the prevention and treatment of serious skin infections in children aged 0-14 years
- Advocate for more affordable treatment e.g. scabies treatment for large families. Explore pharmacy support for this
- Promote awareness of eligibility for WINZ and ACC support for serious skin infections
- Strengthen relationships with community and non health organizations
- Promote and support programmes which address the socio-economic and determinants of health

WORKSTREAM 3 : Increasing awareness and responsiveness of health professionals

Aims:

- To raise awareness amongst health professionals and service providers about the incidence and impact of serious skin infections
- Utilise clinical networks to deliver effective and co-ordinated care

Methods:

- Develop training seminars and web-based material for health professionals
- Support paediatric nurses to conduct eczema management training of health professionals in the community (e.g. practice nurses)
- Work with public health nurses, B4 school nurses and preschool nurses to promote skin health. Focus on schools in high incidence communities and low decile schools
- Engage and collaborate with health care providers who are able to reach Maori and Pacific children, parents and whanau

WORKSTREAM 4: Research opportunities

Aims:

- Identify opportunities for further research into serious skin infections in the Bay of Plenty

Methods:

- Further analyse hospital admission data to determine the extent of repeat admissions and household clustering of skin infections
- Collect and analyse primary care skin infection data
- Undertake a cost – benefit analysis to determine the average cost of ASH admissions for children aged 0 -14 compared to the cost of providing free or reduced GP consultation costs for children aged 0-14 years presenting with skin infections
- Support the paediatric skin infection and study undertaken by medical student if required.

Acknowledgements

Toi Te Ora – Public Health Service would like to acknowledge all of the stakeholders and members of the wider community who provided input and assistance to this report. This includes the provision and analysis of data, the sharing of information and ideas. Your input is greatly appreciated.

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List of Abbreviations

ACC	Accident Compensation Corporation
ALOS	Average length of stay
ASH	Ambulatory Sensitive Hospitalisation
Bay of Plenty DHB	Bay of Plenty District Health Board
BOP	Bay of Plenty
DN	District Nurse
EBOP	Eastern Bay of Plenty
ED	Emergency Department
GP	General Practice / Practitioner
ICD codes	International Classification of Disease codes
MoH	Ministry of Health
MOH	Medical Officer of Health
PHN	Public Health Nurse
PHO	Primary Health Organisation
PI	Pacific Island
TLA	Territorial/Local Authority
TTO	Toi Te Ora – Public Health Service
WBOP	Western Bay of Plenty
WBOPPHO	Western Bay of Plenty Primary Health Organisation
WINZ	Work and Income New Zealand

1 Introduction

The purpose of this report is to assess and describe the burden of illness related to cellulitis and serious skin infections in children aged 0-14 years in the Bay of Plenty district and identify key areas for intervention. The report was commissioned by the Bay of Plenty District Health Board Population Advisory Group.

1.1 Background

Cellulitis and skin infections are an important cause of morbidity, contributing to ethnicity and deprivation related health inequalities in New Zealand children.[1]

A recent study found that the incidence of serious skin infections almost doubled from 298.0/100,000 in 1990 to 547.3/100,000 in 2007.[2] The highest rates were observed in pre-school aged children, boys, Maori and Pacific children, those living in deprived neighbourhoods, urban areas and northern regions of New Zealand.

These findings are consistent with a previous report which found that hospitalisations from bacterial skin infections have increased, accounting for 2.3% of hospitalisations from 1989 to 1993 and 4.6% of hospitalizations from 2004 to 2008.[3] The report also found that Maori close contact skin infections were 2.5 times higher than that for the European / Other ethnic group.

Skin infections are common and can be adequately treated in the community setting. However, in a number of cases, serious skin infections develop which require hospitalization for often invasive treatments. Hospitalisations for serious skin infections are therefore considered to be 'ambulatory sensitive', that is, potentially preventable or avoidable through effective primary health care.[4] [5] The 'tip of the iceberg' analogy has often been used with regard to hospital admissions, reflecting a much wider problem at the community and primary care level. [6] [7] Previous New Zealand analyses have underestimated the incidence of serious skin infection in children, due largely to a lack of a consistent and valid case definition.[1]

Cellulitis and skin infections are a manifestation of underlying social, economic and environmental factors as well as health service access and quality issues. A comprehensive approach to intervention which addresses all of these factors is required in order to effectively and sustainably reduce the burden of illness from skin infections.[7]

1.2 Defining skin infections

The term 'skin infection' includes a number of conditions such as cellulitis, impetigo and abscesses of the skin and subcutaneous tissue, all of which are caused by bacterial infection. Hunt provides the following definitions:[6]

- ***Cellulitis*** is a diffuse, spreading acute inflammation of the skin, soft tissue or connective tissue, which can appear as red and swollen skin.
- ***Erysipelas*** is a superficial form of cellulitis with prominent lymphatic involvement, presenting as a painful lesion with an indurated and erythematous border.
- ***Impetigo*** (or school sores) is characterised by small infectious blisters, which later develop a honey coloured scab like crust.
- ***An abscess*** is a cavity containing pus.

1.3 Overview of disease process and clinical features

Skin infections are often the result of a series of events, usually in the following order:[6 8]

- An initial breach of the skin from insect, animal and human bites, trauma, surgery, skin conditions (such as eczema) or infestation such as scabies.
- Colonisation and invasion by pathogenic bacteria. The most common causative organisms are *Streptococcus pyogenes* (group A β-haemolytic streptococcus or GAS) and *Staphylococcus aureus* (*Staph aureus*).[9 10]
- Early disease that in some cases develops to severe disease requiring hospitalisation.

Infection starts with local tenderness, pain and erythema, which may spread rapidly. Fever, chills, nausea and vomiting may accompany or precede the skin changes.[8] This process can be rapid or take several days. Whilst treatment options are generally very effective (especially if intervention is early) potential complications of cellulitis can include:[8 9]

- local suppuration and skin necrosis
- deeper abscesses within the body (e.g. muscle, kidneys, bone and brain)
- septicaemia
- osteomylitis and septic arthritis
- acute glomerulonephritis
- recurrent cellulitis causing persistent lymphoedema.

1.4 Costs associated with cellulitis

Cellulitis is a leading cause of hospital admissions and therefore expenditure. In 2002 it was estimated that treatment of skin infections cost Starship Hospital more than $1 million dollars per year.[6]

The seven year cumulative cost of serious skin infections for the Bay of Plenty DHB from 2003/4 to 2009/10 was estimated at $5,808,652 (estimate based on average primary admission cost). The total cost of serious skin infections for the Bay of Plenty DHB in the 2009-2010 financial year was $1,140, 841 (estimate based on average primary admission cost).

Skin infections and cellulitis also involve significant financial and personal costs for families. Direct costs include GP fees, prescription and transportation costs. Less tangible or 'hidden costs' include hot water for washing extra linen, time off work and school. Physical and psychological costs may result from pain, stress, limited activity and scarring.[6]

1.5 Aims, objectives and methods

This report provides a health needs assessment of cellulitis and skin infections in children aged 0-14 years in the Bay of Plenty DHB. With the overall aim of reducing the burden of illness related to cellulitis and serious skin infections in children aged 0-14 years in the Bay of Plenty district, this report has four main objectives:

- To describe the burden of illness related to cellulitis and serious skin infections in children in the Bay of Plenty. This includes an overview of national and local epidemiology with a focus on analysing and describing the significance and size of the problem in the Bay of Plenty, including an analysis of relative rates, number of children affected each year and trends in incidence.
- To identify and describe inequalities, ascertain vulnerable groups - defined, for example, by age, ethnicity, and/or geographic location and identify contributing or exacerbating factors that may be useful in informing interventions.
- To provide an overview of relevant health services available in the region, identify gaps in service provision, and opportunities for intervention and service development.
- To provide a review of the literature and best practice to establish proven effective interventions and so develop an evidence base for effective intervention.

- To synthesise the above and develop recommendations on the scope of options for new initiatives, interventions and service.

To achieve these objectives, the following methods and approaches have been used:

- An analysis of the Bay of Plenty DHB hospital admissions data using a revised case definition, ICD 10 codes and categories provided by a recent study. [1]
- A review of the cellulitis literature, including work done in other DHBs and overseas.
- Consultation with stakeholders and service providers.

1.6 Report Structure

The report is presented in the following five sections:

Section 1: Presents the introduction, background, aims, objectives and methods.

Section 2: Provides an analysis of the extent of the problem in the Bay of Plenty.

Section 3: Reviews current services including gaps and opportunities in public health, primary and secondary care services.

Section 4: Presents key findings from a literature review on skin infections and cellulitis undertaken in New Zealand and overseas.

Section 5: Provides a summary of options for interventions.

2 Describing the burden of disease in the Bay of Plenty

This section describes national and local epidemiology of skin infections in children.

2.1 Provides an overview of serious skin infections in New Zealand

2.2 Presents an analysis of skin infection trends in the Bay of Plenty from 1996-2006

2.3 Provides an in-depth analysis of Bay of Plenty DHB hospital inpatient discharge data from 2003-2010 using primary and secondary ICD 10 Codes to determine:

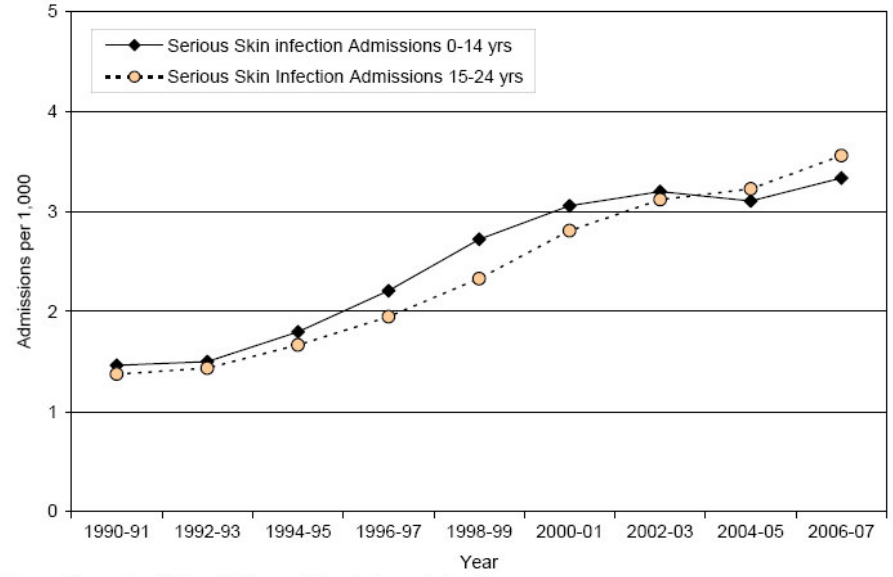
- relative rates, absolute burden and trends in the Bay of Plenty
- whether or not inequalities exist
- contributing factors (e.g. other skin conditions)
- vulnerable groups (age group/ethnicity/geographic location).

2.4 Presents a summary of the findings

2.1 Serious skin infection trends in New Zealand

New Zealand's hospital admission rates for childhood skin infections have increased in recent years. New Zealand (12.9 per 10,000) has about twice the hospitalization rate for 'true' cellulitis in 1-14 year olds, than Australia (6.8 per 10,000) and the USA (6.5 per 10,000).[6] Admissions are highest during summer and are also higher for Maori and Pacific children and those living in the most deprived areas.[3 6] During 1990-2007 in New Zealand, hospital admissions for skin infections rose progressively, with the most rapid rise occurring during the late 1990s (figure 1).[11]

Figure 1: Hospital admissions for serious skin infections in children and young people 0-24 years, New Zealand 1990-2007[11]



Source: Numerator-National Minimum Dataset; Denominator-Census

2.2 Analysis of serious skin infection distribution and trends in the Bay of Plenty 1996-2006 [11]

The following information is sourced from a report on the health of children and young people in the Bay of Plenty.[11] The data source and methods used are outlined below:

Data Source and Methods

Definition
Hospital Admissions and Deaths due to Serious Skin Infections in those aged 0-24 years.

Serious skin infections include: staphylococcal scaled skin syndrome, impetigo, cutaneous abscess, furuncle and carbuncle, cellulitis (excluding peri-orbital cellulitis), acute lymphadenitis (excluding mesenteric adenitis), pilonidal cysts, and other local infections of the skin and subcutaneous tissue.

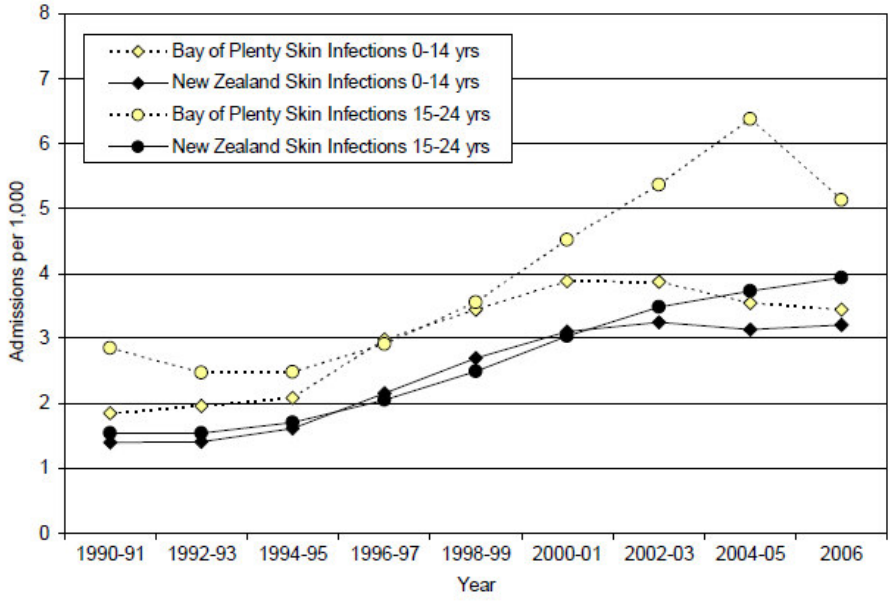
Data Source
Admissions Numerator: National Minimum Dataset: Hospital admissions of children and young people (0-24 years) with a primary diagnosis of a serious skin infection (ICD-9 680-686; ICD-10 L00-L08)
Deaths Numerator: National Mortality Collection: Deaths in children and young people (0-24 years) with a clinical code (cause of death) attributed to a serious skin infection (ICD-9 680-686; ICD-10 L00-L08)
Denominator: NZ Census

Indicator Category
Admissions: Proxy B-C; Mortality: Ideal B

Notes on Interpretation
The limitations of the National Minimum Dataset are discussed at length in Appendix 1. The reader is urged to review this Appendix before interpreting any trends based on hospital admission data.

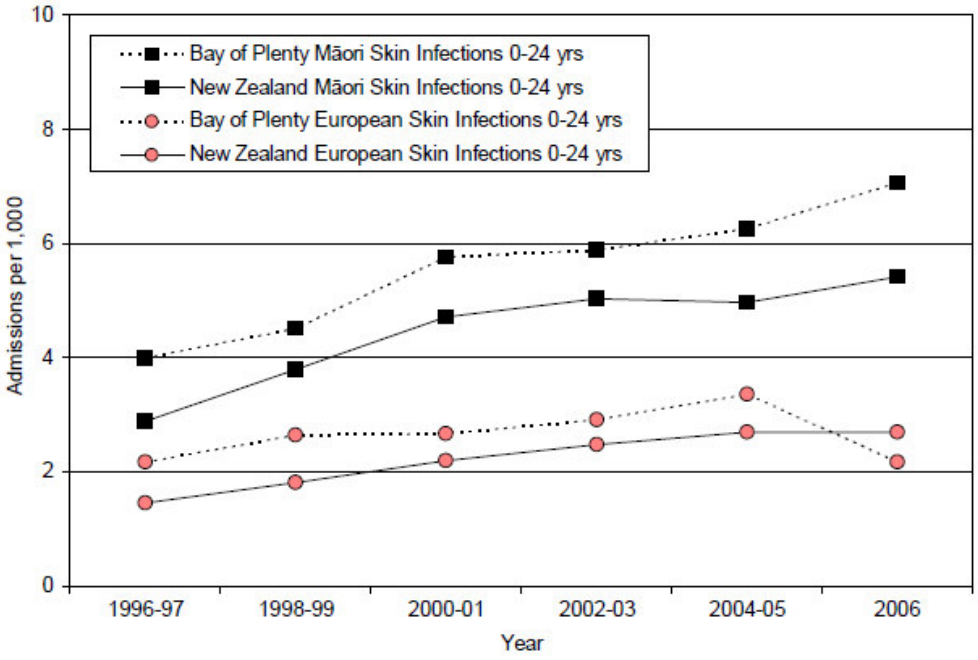
In the Bay of Plenty during 1990-2006 hospital admissions for serious skin infections increased for both children (aged 0-14) and young people (15-24 years). Admissions for both age groups were higher than the New Zealand average (figure 2).[11]

Figure 2. Hospital admissions due to serious skin infection in children and young people 0-24 years, the Bay of Plenty vs New Zealand.[11]



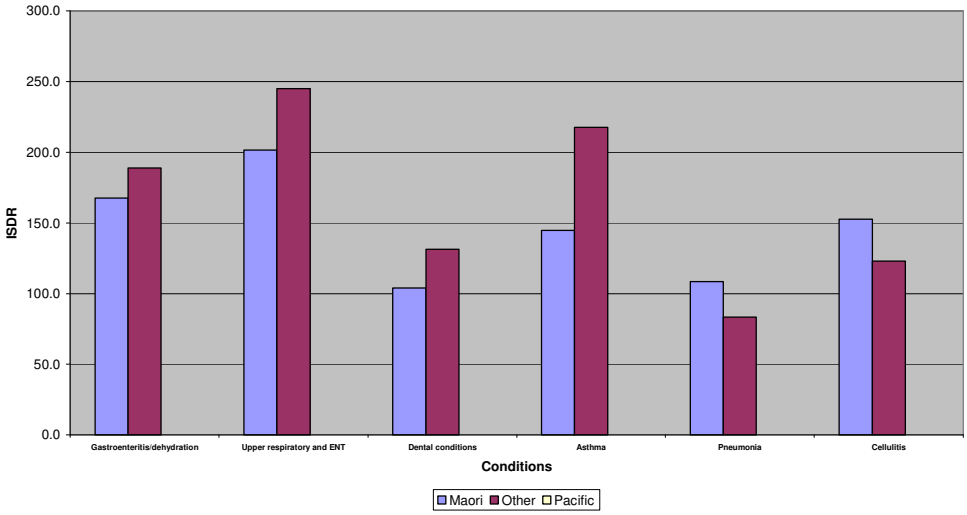
Admission rates were higher for both Bay of Plenty Maori children and young people during 1996-2006. Rates for both European and Maori children and young people were also generally higher than their respective NZ ethnic specific averages (figure 3).[11]

Figure 3. Hospital admissions due to serious skin infection in children and young people 0-24 years by ethnicity, the Bay of Plenty vs New Zealand 1996-2006.[11]



Ambulatory sensitive hospitalisations (ASH) are admissions to hospital that are potentially preventable through effective primary care interventions. Cellulitis is considered to be an 'ambulatory sensitive' condition. The Bay of Plenty DHB condition specific ASH report for the 0-4 age group for the year to 30 September 2009 also highlights the ethnic disparity for cellulitis amongst Maori children.[12]

Figure 4. ASH Indirectly Standardised Discharge Ratios for Top Six Conditions for the Bay of Plenty DHB of Domicile 00-04 Agegroup



2.3 Analysis of Bay of Plenty DHB Hospital Admission data 2003-2010

The following section utilizes a newly developed and validated case definition of serious skin infection[1] to describe the incidence these conditions in the Bay of Plenty from 2003-2010.

The data provides an analysis of the Bay of Plenty DHB hospital inpatient discharge data for children aged 0-14 years with a principal or additional discharge diagnosis from a defined list of serious skin infection International Classification of Disease (ICD) codes. Both primary and secondary diagnosis ICD 10 codes are used. Further data results are presented in Appendix 1.

Prevalence rates have been worked out as per 1000 based on the 2006 census Territorial/Local Authority (TLA) statistics to allow comparison across regions. Of note, population data showing the percentage of change between the 2006 census data and the 2011 projected population are presented in table 1 (0-14 years) and table 2 (0-4 years) below.

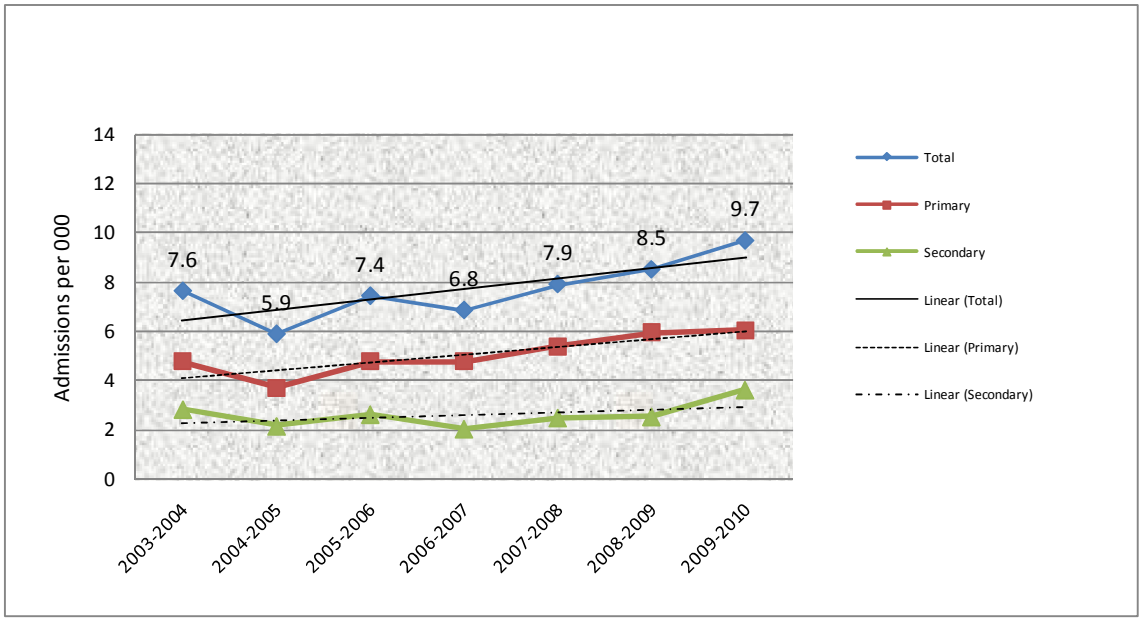
Table 1. 2006 census TLA population and 2011 TLA population projections for 0-14 years

TLA	0-14 years (total sex)		
	2006 Census data	**2011 projected pop.**	**Percentage change**
Western Bay of Plenty District	9,200	9,100	1.1% -
Tauranga City	22,000	23,600	7.3%
Whakatane District	8,600	8,200	4.7% -
Kawerau District	1,980	1,710	13.6% -
Opotiki District	2,480	2,230	10.1% -

Table 2. 2006 census TLA population and 2011 TLA population projections for 0-4 years

TLA	0-4 years (total sex)		
	2006 Census data	**2011 projected pop.**	**Percentage change**
Western Bay of Plenty District	2,590	2,750	6.2%
Tauranga City	7,120	7,990	12.2%
Whakatane District	2,590	2,870	10.8%
Kawerau District	620	580	6.5% -
Opotiki District	710	680	4.2% -

Figure 5. Hospital admissions for serious skin infections ICD codes 0-14 years BOP 2003-2010



Hospital admissions for serious skin infections are increasing over time. The increase is being led by children being admitted with a serious skin disease as their primary diagnosis. Approximately 66% of children have a primary diagnosis.

There are an underlying number of children being admitted for other health problems who have also been diagnosed with a serious skin disease. Approximately 34% of children have a secondary diagnosis of serious skin infection. This proportion is relatively static over time.

Figure 6. Serious skin infections by sex - ICD codes 0-14 years BOP 2003-2010

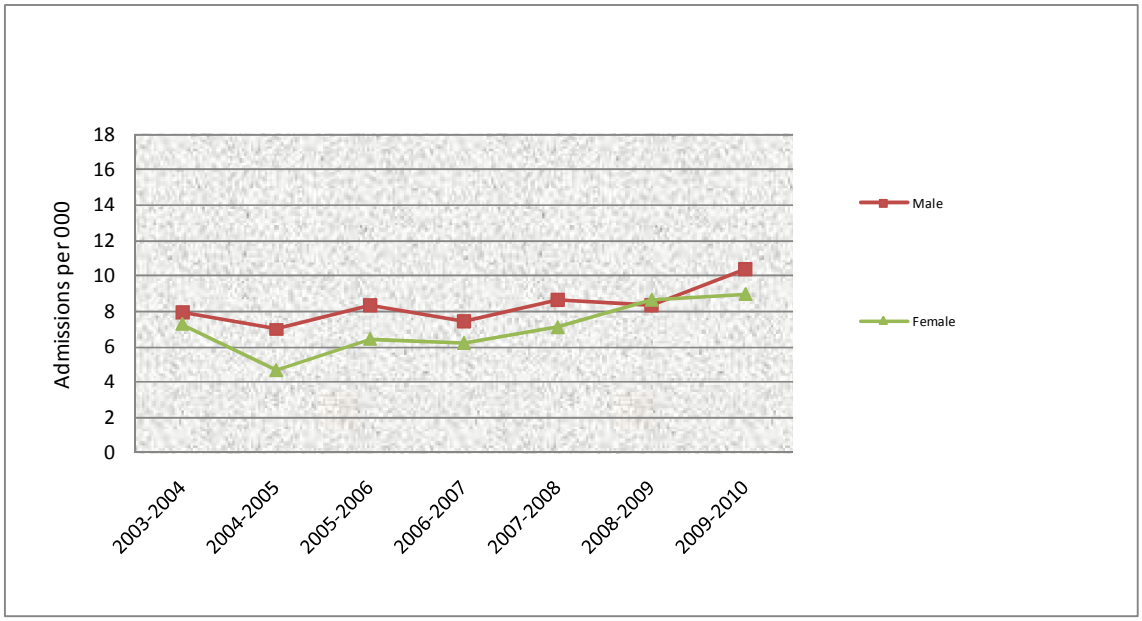
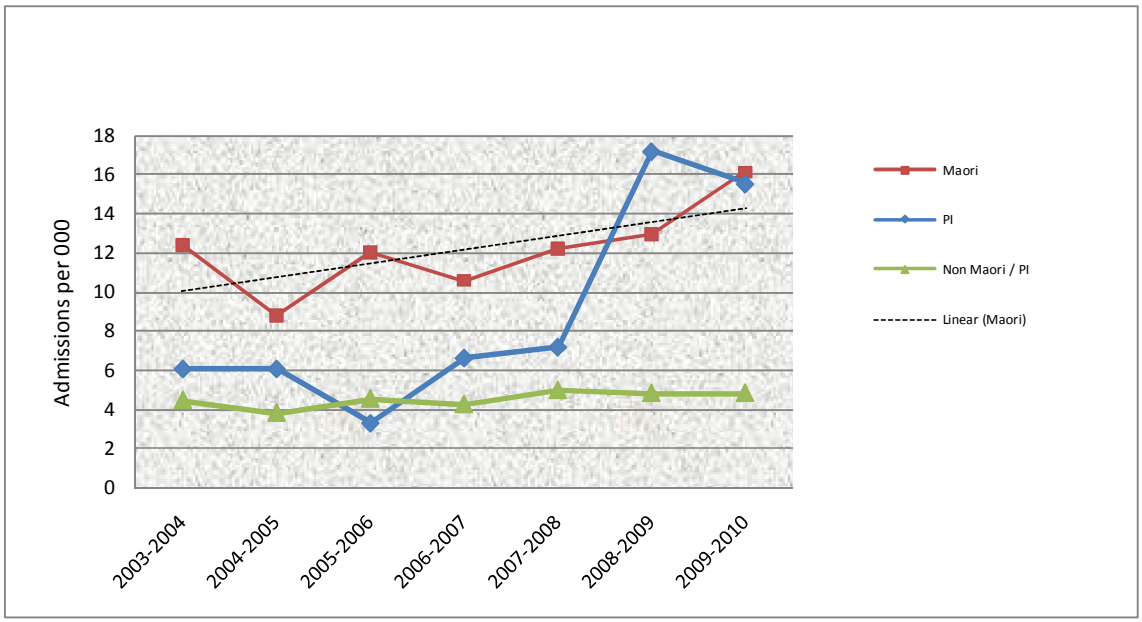


Figure 6 shows that there is generally a higher rate of serious skin diseases for male children.

Figure 7. Serious skin infections by ethnicity - ICD codes 0-14 years BOP 2003-2010



There is a very high rate of serious skin diseases amongst children of Maori ethnicity (approximately 62% of all infections) compared to non-Maori children and this rate is increasing over time.

Note: the numbers for children of Pacific Island (PI) ethnicity are very small hence the large fluctuations (approximately 18 admissions per year). This may also be exacerbated by ethnic miscoding on admission and non utilization of second and third level ethnicity data.[13] [14]

Ethnicity by Territorial Local Authority (TLA) areas

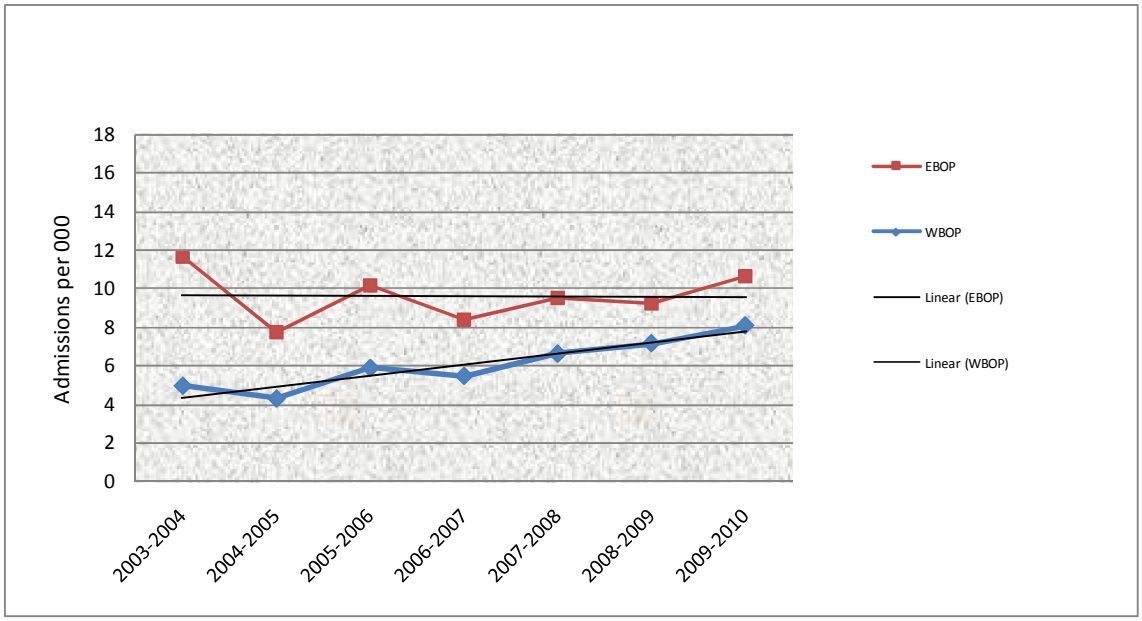
The table below shows the percentage of admissions for all serious skin infections (A, B, C & D) by ethnicity and TLA.

Table 3. Percentage of admissions by ethnicity and TLA

Ethnicity	Kawerau	Opotiki	Whakatane	Tauranga	WBOP
Maori	89%	87%	80%	45%	49%
NZ European	6%	10%	16%	41%	39%
Census 2006 Maori 0-14 years of age	80%	76%	58%	29%	27%

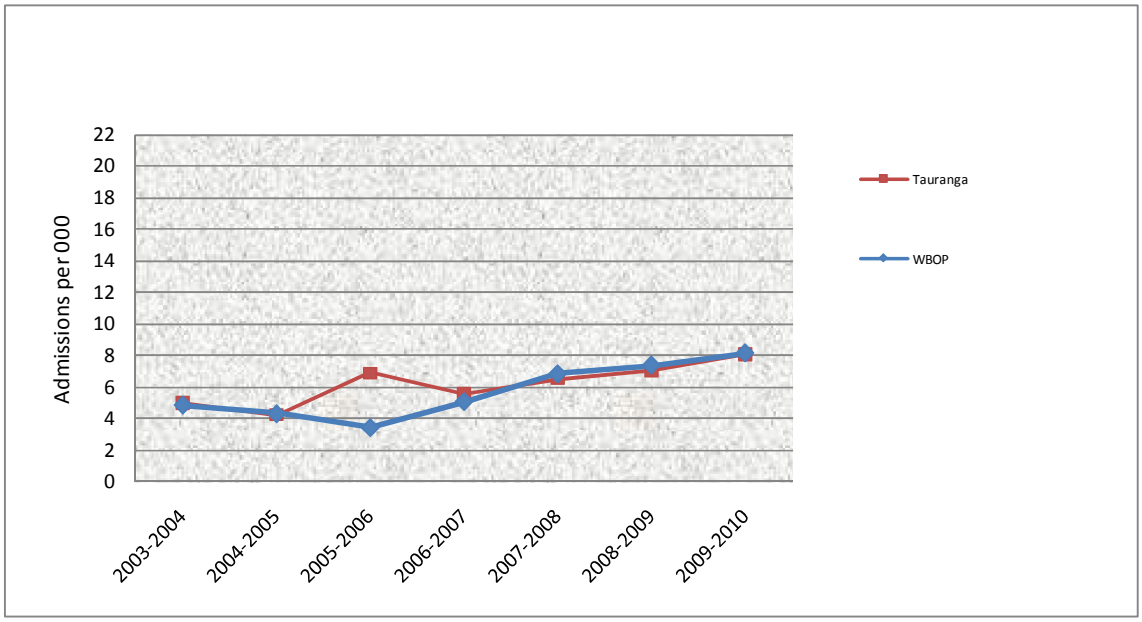
Maori are over represented across all TLA areas compared to the population representation of Maori children aged 0 to 14 years of age in the Bay of Plenty.

Figure 8. Serious skin infections by area - ICD codes 0-14 years BOP 2003-2010



There is a higher rate of serious skin infections in the Eastern Bay of Plenty compared to the Western Bay of Plenty. Both rates are increasing and the gap between the two regions is narrowing over time.

Figure 9. Serious skin infections in Western BOP - ICD codes 0-14 years BOP 2003-2010



The rates are very similar between Tauranga and the rest of the Western Bay of Plenty and both rates are increasing.

In Tauranga the location of patients with skin infections seems to be spread throughout the Census Area Units (CAU) that makes up the area. In the Western Bay of Plenty, Te Puke makes up 40% of the total skin infections seen.

Tauranga Central	9%
Yatton Park	8%
Gate Pa	7%
Welcome Bay	6%
Arataki	5%
Hairini	5%
Papamoa Beach East	4%
Papamoa Beach West	4%
Bellevue	4%
Brookfield	4%
Greerton	4%
Tauranga South	3%
Maungatapu	3%
Otumoetai North	3%
Pyes Pa	3%
Bethlehem	3%
Other (<3%)	26%

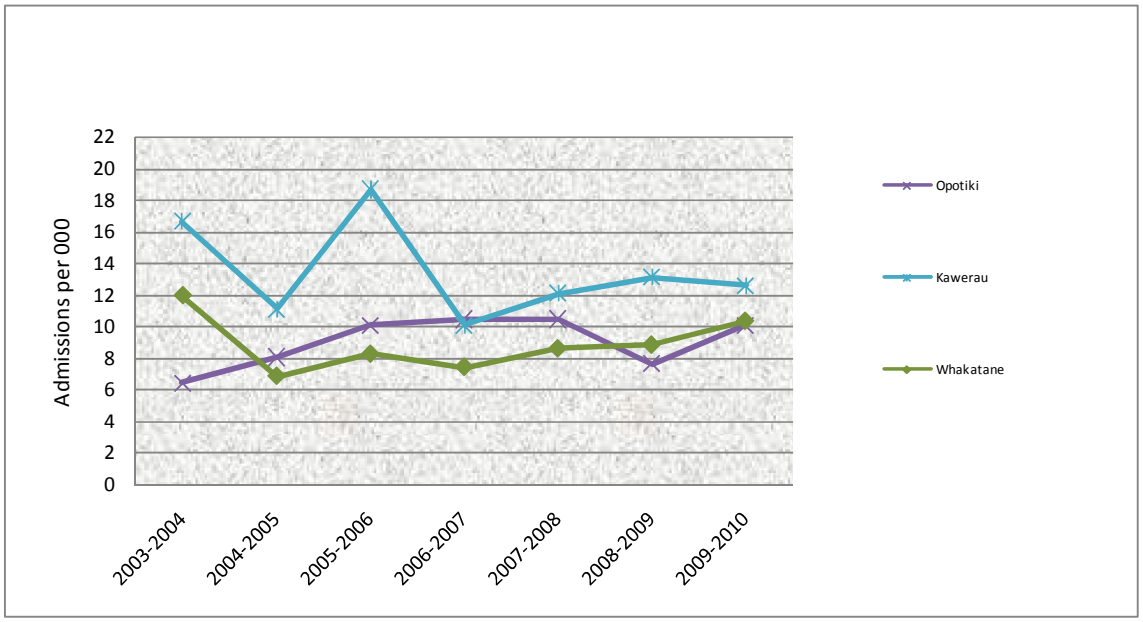
Te Puke Community East	29%
Te Puke Community West	11%
Katikati Community	10%
Kaimai	9%
Maketu Community	6%
Pongakawa	5%
Minden	5%
Rangiuru	4%
Aongatete	3%
Matakana Island	3%
Te Puna	3%
Waihi	3%
Other (<3%)	10%

The main areas to target families with 0 to 4 year old children or Maori families with 0 to 4 year old children for Tauranga TLA would be the following: Tauranga Central, Yatton Park, Gate Pa, Arataki, Welcome Bay, Papamoa Beach East and Tauranga South.

For the same group of children in the Western Bay of Plenty TLA, the main areas would be the following: Te Puke Community East, Katikati Community, Te Puke Community West, Rangiuru and Maketu Community. .

Note: the above areas are listed in order of the number of admissions per area.

Figure 10. Serious skin infections by EBOP - ICD codes 0-14 years BOP 2003-2010



In the Eastern Bay Of Plenty, there are marked differences between regions. Kawerau has the highest rate generally, followed by Opotiki then Whakatane. Whilst having a lower rate, Whakatane appears to be increasing over time.

Note: The numbers in Kawerau are smaller hence the large fluctuations by year.

In Whakatane and Opotiki, a mix of areas is represented in the number of infections.

Whakatane North	21%
Whakatane West	13%
Trident	13%
Taneatua Community	9%
Otakiri	8%
Waimana	7%
Allandale - Mokorua	6%
Te Teko	5%
Edgecumbe Community	4%
Ohope	3%
Coastlands	3%
Other (<3%)	9%

Opotiki	73%
Waiotahi	17%
Cape Runaway	6%
Te Kaha	3%
Oponae	2%

The main areas to target are families with 0 to 4 year old children or Maori families with 0 to 4 year old children. For Whakatane TLA this would be the following: Whakatane North, Whakatane West, Trident, Taneatua Community, Waimana, Te Teko, Allandale – Mokorua and Edgecumbe Community.

For the same group of children in the rest of the Eastern Bay of Plenty, the main areas would be the following: Kawerau TLA, Opotiki and Waiotahi.

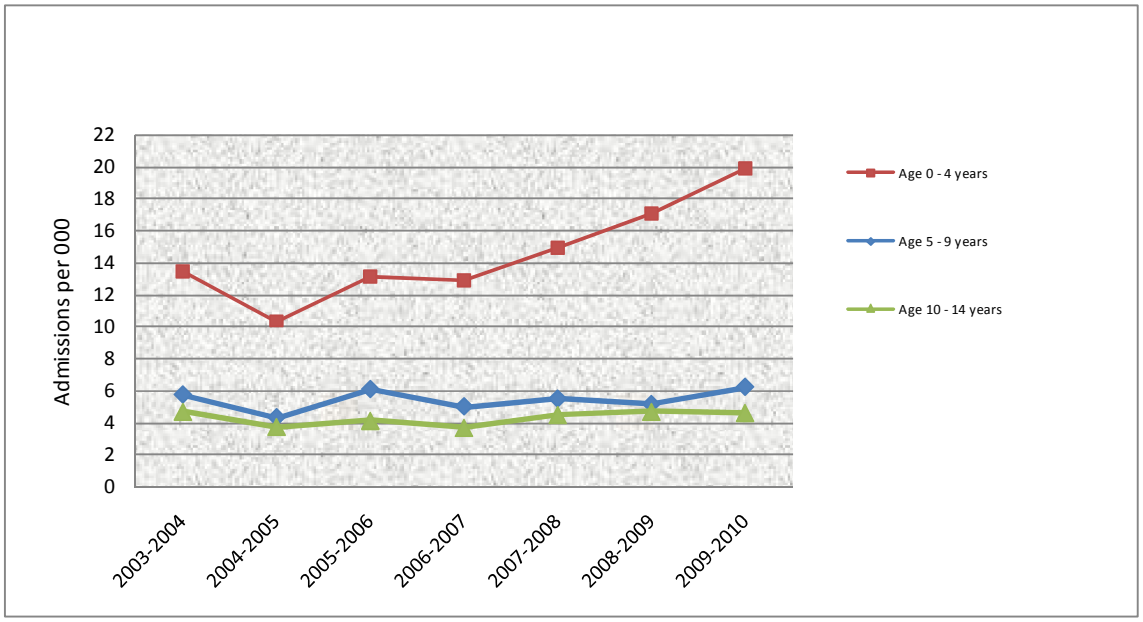
Note: the above areas are listed in order of the number of admissions per area.

There are marked differences in the proportion of children by TLA by ethnicity and age, more specifically whether Maori or not or under 5 years of age.

Table 4. The proportion of children by TLA by ethnicity and age.

TLA	Maori	Maori 0-4 years	Total 0-4 years	Non-Maori 0 - 4	Non-Maori
Kawerau	12%	13%	9%	3%	2%
Opotiki	10%	11%	8%	2%	2%
Whakatane	32%	31%	24%	10%	12%
WBOP	13%	14%	17%	23%	22%
Tauranga	32%	31%	41%	64%	61%

Figure 11. Serious skin infections by age groups - ICD codes 0-14 years BOP 2003-2010



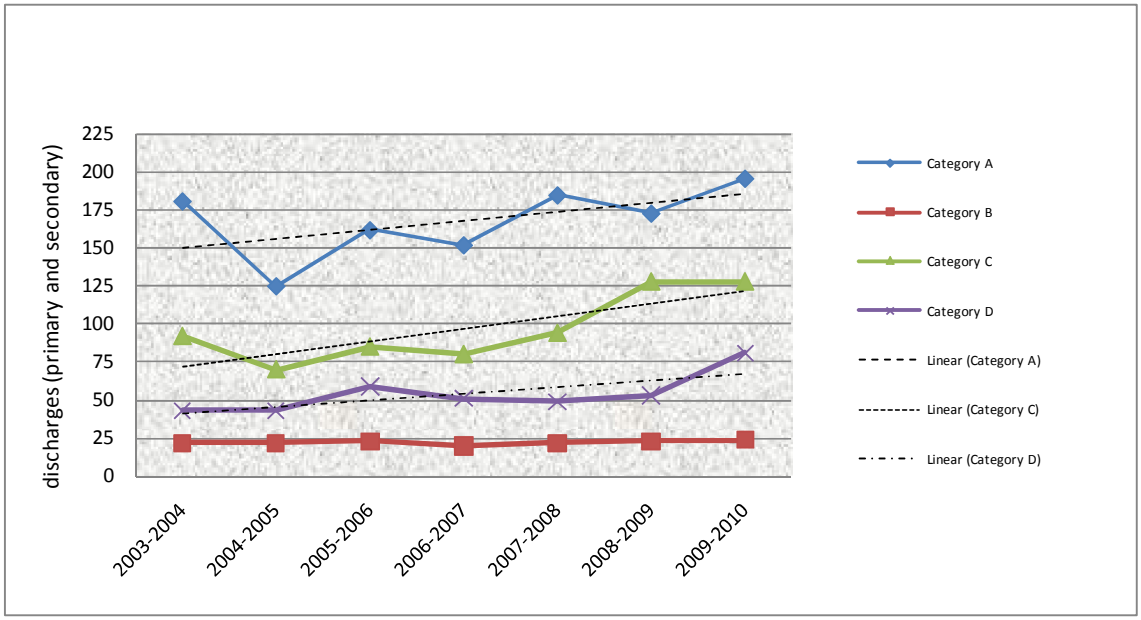
The increase in rates and volume is largely being driven by young children under the age of 5 years of age. The 0-4 year group makes up approximately 57% of the infections seen over the last 7 years in the total 0 -14 year group.

Maori Children under 5 years of age make up a large proportion of all Maori children seen, compared to non-Maori.

Table 5. Proportion of Maori and non Maori children seen per age group.

Age Groups	Maori	Non-Maori
0 to 4	63%	46%
5 to 9	21%	26%
10 to 14	16%	27%

Figure 12. Category A-D Serious skin infections - ICD codes 0-14 years BOP 2003-2010



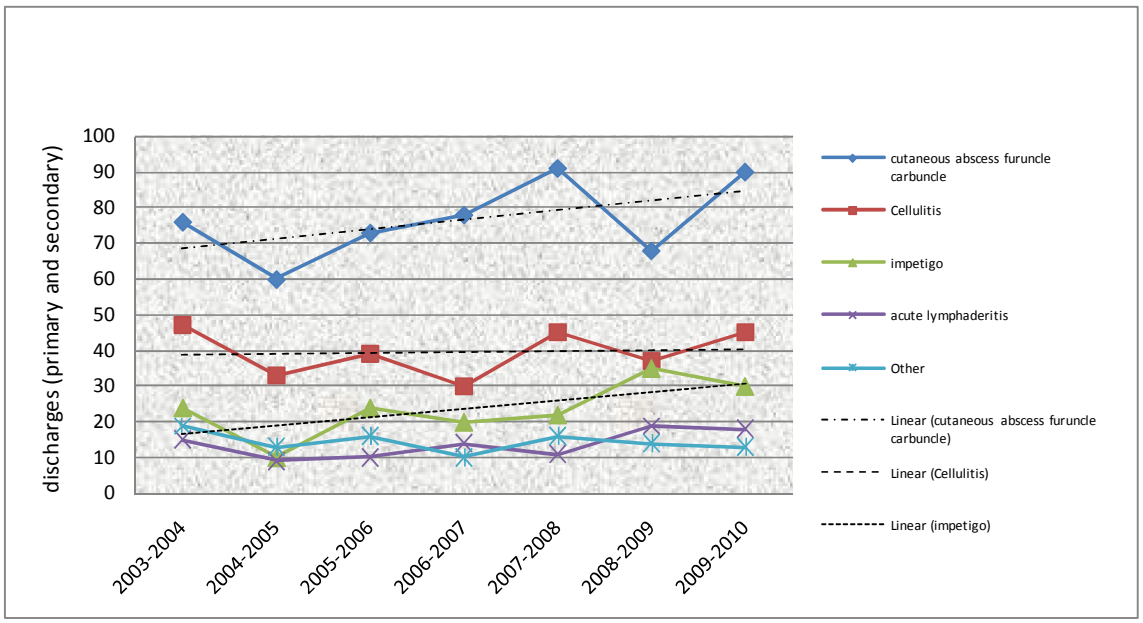
Category A Skin Infections – includes impetigo, cutaneous abscess, furuncle and carbuncle, cellulitis pyoderma and other infections of skin and subcutaneous tissue. Category A infections are increasing over time and make up approximately 49% of the Infections seen over the 7 years.

Category B Serious Skin Infections of atypical anatomical sites – includes erysipelas, abscess and cellulitis of the eyelid, orbit, external ear, nose, anal and reproductive sites. These infections make up approximately 7% of the infections seen over the 7 years.

Category C Serious Skin Infections secondary to primary skin disease – includes varicella with complications, scabies, dermatitis and eczema. This is on the increase and accounts for approximately 28% of the infections seen over 7 years. The increase is being driven by children under 5 years of age (82%).

Category D Skin Infections secondary to external trauma – includes insect / spider bites, post traumatic wound infections and open wound infection with foreign body. This category accounts for approximately 16% of the infections seen.

Figure 13. Category A skin infections - ICD codes 0-14 years BOP 2003-2010



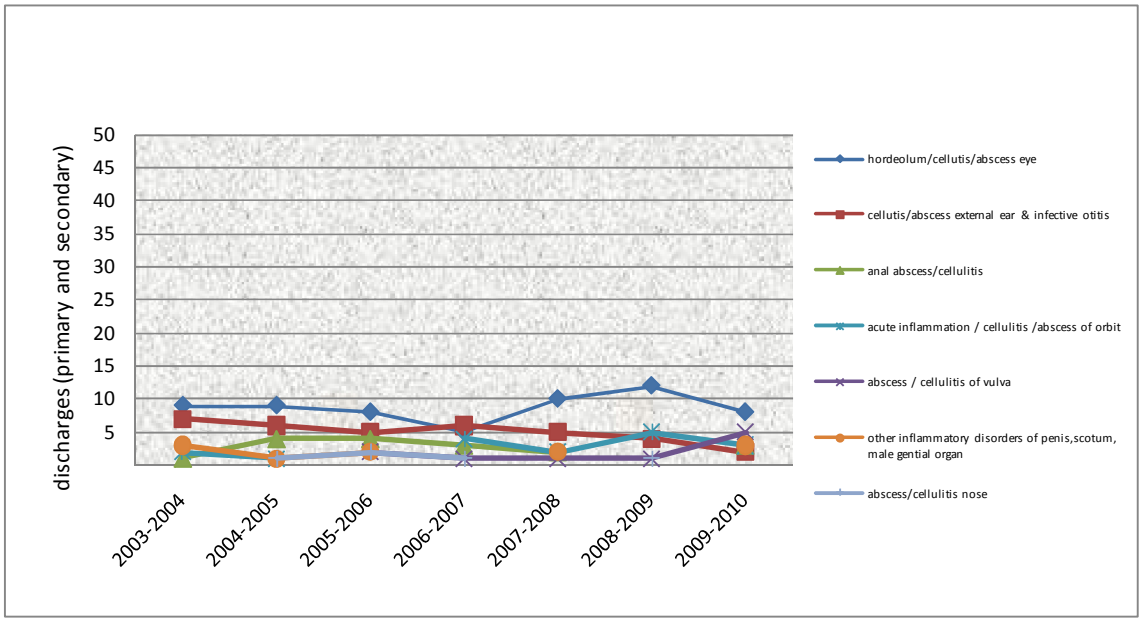
Of the category A infections, the general increase in numbers is being driven by increases in cutaneous abscess furuncle and carbuncle type infections (approx. 46%) and impetigo (approx. 14%). Cellulitis accounts for approximately 24% of category A infections seen.

Table 6. Category A infections by Territorial Local Authority (TLA) areas

Base: Total Serious Skin Infections (A,B,C & D)

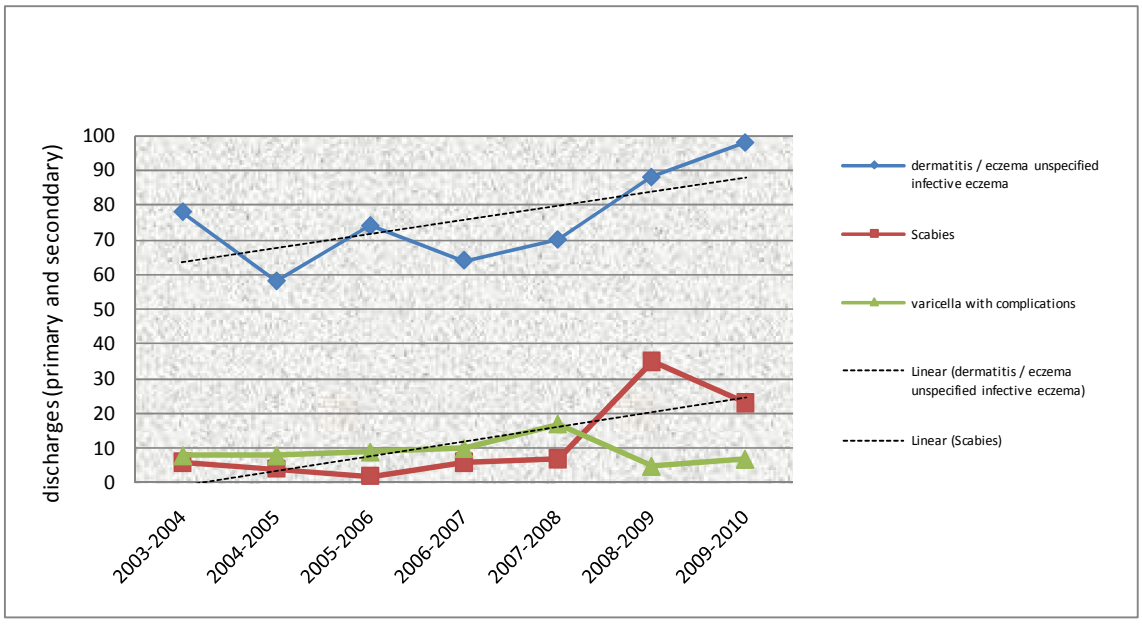
Category A	Kawerau	Opotiki	Whakatane	Tauranga	WBOP
cutaneous abscess furuncle carbuncle	28%	22%	24%	20%	28%
Cellulitis	7%	13%	14%	11%	11%
impetigo	9%	7%	8%	6%	5%
acute lymphaderitis	2%	1%	5%	5%	4%
other infections of skin and subcutaneous tissue	3%	1%	1%	4%	5%
pyoderma	0%	1%	1%	1%	1%
pilonidal cyst with abscess	0%	0%	0%	0%	0%

Figure 14. Category B skin infections - ICD codes 0-14 years BOP 2003-2010



Of the category B infections, there are generally low numbers of each type. The highest numbers seen are in infections related to eyes (approximately 39% of category B infections) and ears (approximately 22%).

Figure 15. Category C skin infections - ICD codes 0-14 years BOP 2003-2010



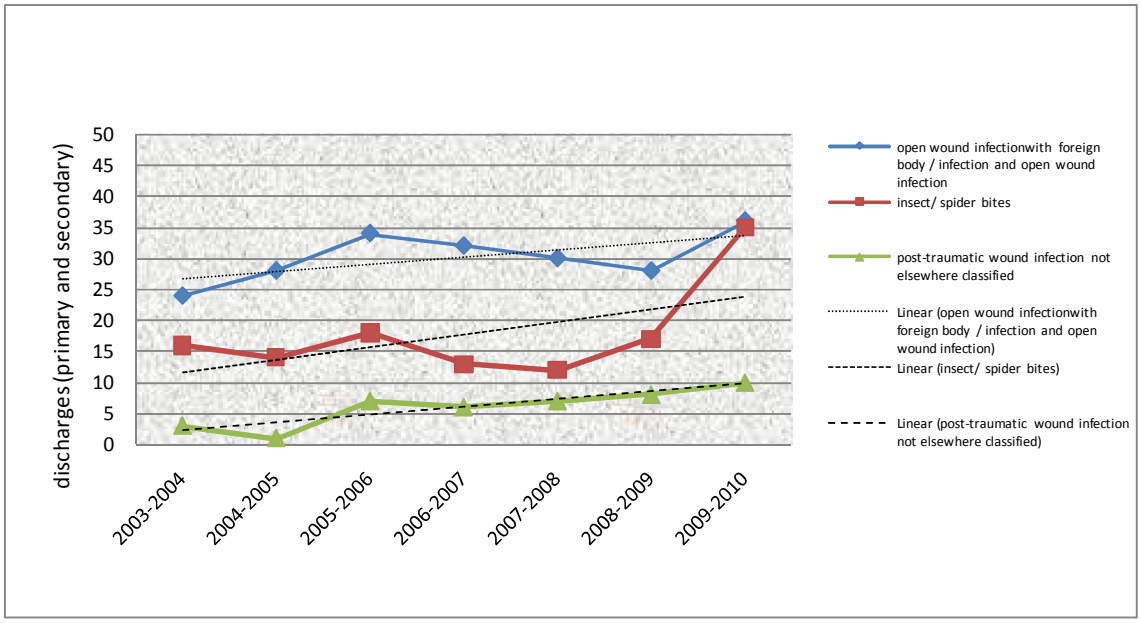
Of the category C infections, the general increase in numbers is being driven by increases in dermatitis and eczema type infections (approx. 78% of category C infections over 7 years). Scabies also appears to be increasing (approx. 12% of category C infections seen).

Table 7. Category C infections by Territorial Local Authority (TLA) areas

Base: Total Serious Skin Infections (A,B,C & D)

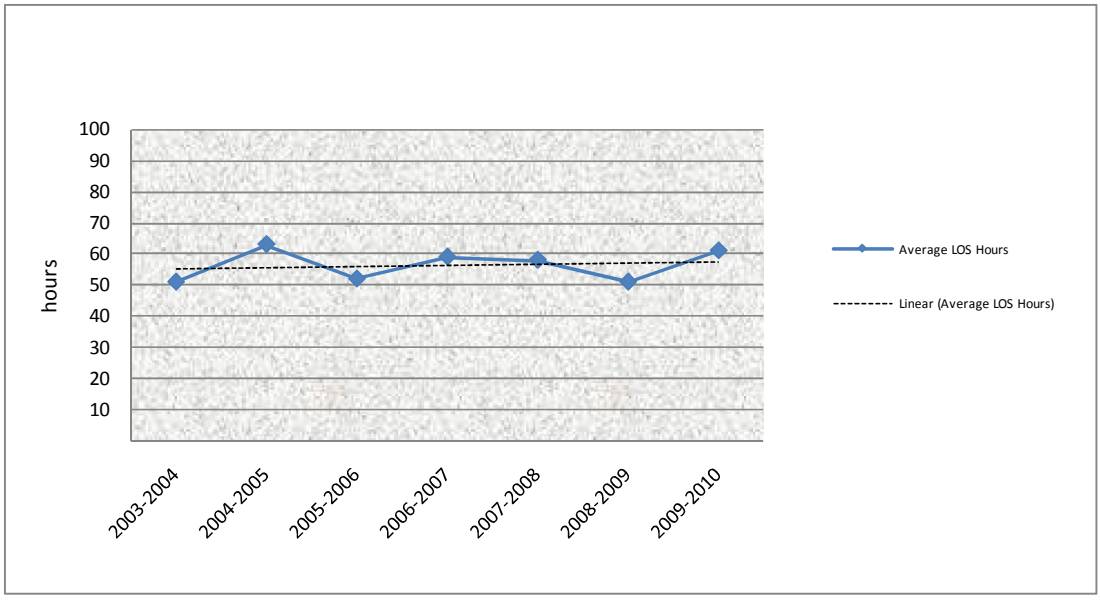
Category C	Kawerau	Opotiki	Whakatane	Tauranga	WBOP
dermatitis / eczema unspecified infective eczema	33%	30%	24%	20%	14%
Scabies	3%	1%	3%	4%	4%
varicella with complications	3%	2%	3%	3%	2%

Figure 16. Category D skin infections - ICD codes 0-14 years BOP 2003-2010



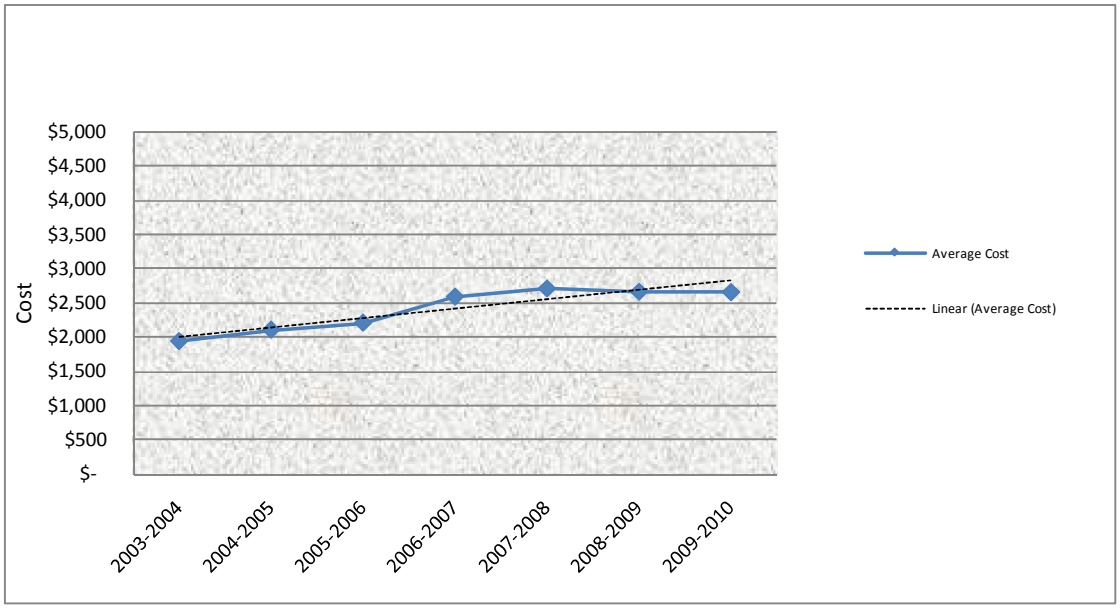
Of the category D infections, the highest numbers seen are in open wound infections (approx. 56% of category D infections) and insect/spider bites (approx. 33%).

Figure 17. Serious skin infections - average length of stay - ICD codes 0-14 years BOP 2003-2010



The overall average length of stay (ALOS) has remained very much the same with a slight downward trend; at approximately 56 hours or 2 ½ days. By category, categories A & C are similar at 60 and 61 hours respectively. Categories B and D are similar at 45 and 47 hours.

Figure 18. Serious skin infections by cost per admission ICD codes 0-14 years BOP 2003-2010



The average total cost per admission is increasing at approximately 6 % per annum, which is probably in line with general cost increases.

Table 8. The average and total costs for serious skin infections from 2003/4 to 2009/10.

BOPDHB Inpatients Admissions & Discharges - Primary & Secondary Diagnosis								
Children 0 - 14 years of age								
Serious skin infections - Category A,B,C & D ICD 10 codes *								
Source: BOPDHB IP data dump Sept 2010								
* Reference: C E O'Sullivan & M G Baker, Proposed epidemiological case definitionfor serious skin infection in children, Dept of Public Health, Wellington School of Medicine & University of Otago, Journal of Paediatrics and Child Health, 46, 2010, pp 176-183.								
Serious skin infections - Category A,B,C & D ICD codes								
	DischYear based Fin. Year							
	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	Grand Total
Primary	212	164	212	212	239	264	268	1,571
Secondary	126	96	117	91	111	113	161	815
Total	338	260	329	303	350	377	429	2,386
Average LOS Hours	51	63	52	59	58	51	61	56
Average LOS days	2.2	2.7	2.2	2.5	2.4	2.2	2.6	2.4
Average Cost	$ 1,936	$ 2,104	$ 2,209	$ 2,593	$ 2,713	$ 2,665	$ 2,659	
Total Cost (est. based on average primary cost)	$ 654,490	$ 546,934	$ 726,695	$ 785,702	$ 949,400	$ 1,004,590	$ 1,140,841	$ 5,808,652
Prevalence rate per 000 (based census 2006)	7.6	5.9	7.4	6.8	7.9	8.5	9.7	
Primary	4.8	3.7	4.8	4.8	5.4	6.0	6.1	
Secondary	2.8	2.2	2.6	2.1	2.5	2.6	3.6	
		9%	5%	17%	5%	-2%	0%	

Table 8 above summarises the average and total costs for serious skin infections from 2003/4 to 2009/10

2.4 Summary of key findings

The key findings from the above reports and data analysis are summarised as follows:

- Hospital admissions for serious skin infections are increasing in the Bay of Plenty and New Zealand overall
- The increase in rates and volume is largely being driven by children aged 0-4 years who account for approximately 57% of infections seen from 2003-2007.
- Ethnic disparities are evident, with a higher rate of serious skin diseases amongst children of Maori ethnicity (approximately 62% of all infections) compared to non-Maori children.
- There is a higher rate of skin infections in the Eastern Bay of Plenty compared to the Western Bay of Plenty but the gap is narrowing over time.
- Category A skin infections (including abscesses, impetigo, cellulitis) are the leading cause of hospitalizations (accounting for 49% of admissions from 2003-2007).
- Also of note is the increase in Category C infections which is being driven by increases in dermatitis and eczema type infections (approx. 78% of category C infections from 2003-2007). Scabies also appears to be increasing (approx. 12% of category C infections seen).
- The total cost of serious skin infections for the Bay of Plenty DHB in the 2009-2010 financial year was $1,140, 841 (estimate based on average primary admission cost).
- The seven year cumulative cost of serious skin infections for the Bay of Plenty DHB from 2003/4 to 2009/10 was estimated at $5,808,652 (estimate based on average primary admission cost).

3 Overview of current services and initiatives in the Bay of Plenty

A short questionnaire was developed and administered to a range of stakeholders to elicit information about current services and to identify perceived gaps and potential opportunities in the Bay of Plenty. The survey was conducted via email, phone or a face to face interview. A copy of the survey is located in Appendix 2.

Stakeholders interviewed included: district nurses, public health nurses, paediatric services, GPs, hauoras, Western Bay of Plenty Primary Health Organisation (WBOP PHO) representatives. The feedback is summarised below.

Stakeholder and Service provided	**Potential barriers to access / gaps in service**	**Opportunities / suggestions to reduce hospital admission rates**
District nurses (DNs) **Provide** ▪ Wound care and treatment ▪ Inter-agency care (e.g. between GP and DNs) ▪ Education re the prevention and management of skin infections ▪ Ongoing help (e.g. with wound care products) once infection manageable or client / family more independent **Most common age groups seen** ▪ Primary age **Three most common causes of skin infections** ▪ Infected bites (especially spider and insect) ▪ Infected eczema ▪ Impetigo	**Barriers to access** ▪ No barriers for clients to access district nursing service (free and provide home visits so no access barriers) ▪ Some district nursing clients voice barriers to accessing GP service in terms of: ○ GP / practice nurse fees (especially if more than one child over 6 yrs) ○ cost to fill a script ○ cost of transport to GP service	**Opportunities / suggestions** ▪ More GP appointments available ▪ Whole family approach (charge per family not per individual when more than one child / family member has a skin infection) ▪ Work and Income New Zealand (WINZ) linen grant ▪ Treat the whole family – improve hygiene for all ▪ Make Flucloxicillin (Fluclox) more palatable for children ▪ Use alternative to Fluclox ▪ Affordable hot water ▪ Affordable wound care products

Public health nurses **(PHNs) x three interviewed** **Provide** ▪ Home visiting/phone calls to make contact with parents ▪ In-depth health assessment, education to all whanau, advocacy. ▪ Make referrals to the appropriate services (e.g. GPs, Paediatrician) ▪ Treatment advice and support i.e. o whether or not treatment required o salt water baths for infection o emulsifier creams, eczema plans o advice support for meeting with GP o information sheets re eczema, skin infection, scabies, family treatment o hygiene groups with children completing worksheets/posters/book marks re skin infection, hygiene o follow up to ensure complete treatment **Most common age groups seen** Primary school age **Three most common causes of skin infections** **PHN 1** ▪ Impetigo ▪ Scabies/infected scabies ▪ Infected eczema **PHN 2** ▪ Infected/ongoing eczema ▪ Insect bites ▪ Scabies	**Barriers to accessing PHN** ▪ PHN is not always available when families ask. ▪ Phone contact is not always possible, ph no's are often incorrect or outdated at schools **Barriers to accessing GP (identified by PHNs)** ▪ Cost of attending GP ▪ Difficulty in getting prompt appointments ▪ Difficulty in communicating needs to the GP - appointment times are often rushed, no confidence to ask for large supplies of creams ▪ Often, the whole family is not treated due to cost so infection goes around and around the family ▪ Fluid home situations – children move from home to home, to different care givers and extended families ▪ Lack of knowledge re how to prevent and treat ▪ Feelings of hopelessness as the infections just continue to pass around the family members **Gaps in referral process** ▪ PHNs refer to the GP but often families won't/can't go ▪ When they do manage to go the infection is worse and/or spread further amongst the community ▪ When they are seen they often do not get all they should, i.e. infected eczema	**Opportunities / suggestions** ▪ Extra funding toward easing access to the GP or specialist nurse for skin related conditions ▪ A truly free GP service for children up to18yrs old, or ▪ Funding toward a free consultation service specifically designed for milder skin conditions to ease and speed access to earlier treatment ▪ Multi media awareness campaign re prevention and treatment of most common conditions ▪ Target parents / caregivers and children. ▪ Also target GP practices re the need to treat the whole family ▪ A follow up/treatment plan for management of scabies, eczema and impetigo given to all patients who present to a GP emergency centre or specialist nurse ▪ Referral on to the PHN to follow up on progress. ▪ An aggressive public relations programme aimed at early/easy/cost effective intervention and treatment of conditions ▪ Funding to provide a local work group to establish the needs and develop a working plan to address the needs of the community ▪ Awareness raising of the potential harm of untreated skin conditions. But only if there is an effective/accessible

PHN 3 ▪ Scabies ▪ Eczema ▪ Impetigo	treated with Fluclox p.o. However, often not given maintenance cream for the underlying eczema, or a cream with hydrocortisone for flare ups ▪ Often no management plan given nor any referral to the PHN to assist with a management plan ▪ The family is not viewed or treated on mass. Families are charged per individual for a consultation even if three children are fitted into the one 5 minute consultation ▪ There is virtually no swab taking, to look for more complex bacteria i.e. M.R.S.A.	treatment/medical provision to back it up. ▪ Education - getting the basic hygiene messages out there (e.g. showering each night using soap can prevent infection) **General comments** ▪ Cellulitis / skin infections admitted to hospital are but a small part of the epidemic within the community ▪ The community is living with a low/moderate grade tolerance to skin infections permanently
GP **Provides** ▪ Briefly – assessment and treatment including education about prevention after case finding , oral and IV treatment at home ▪ Education about when to seek help to prevent more extensive infection **Most common age groups seen** ▪ 4 -10rs and 65yrs+ **Three most common causes of skin infections** ▪ Eczema ▪ Infected cuts / grazes / wounds ▪ Varicose dermatitis	**Barriers identified** ▪ Transport is always an issue in rural areas, ▪ There is no cost for the under 6's	**Opportunities / suggestions** ▪ Education at parent group level, more regular contact with health visitor type person in the community ▪ Instituting a health visitor system in New Zealand **General comments** ▪ Skin infections often arise in children on the background of overcrowding, poverty, poor parenting and poor hygiene ▪ Addressing these issues will be most effective in decreasing admissions

Paediatric liaison nurse **Provides** ▪ Home visits and support/education, particularly if there is eczema involved as that makes treatment that much more difficult ▪ As my role is more with acute conditions and of a more serious nature, I tend to refer on to the PHNs or Wellchild providers as appropriate **Most common age groups seen** ▪ Toddlers and preschoolers. ▪ Then primary school aged children **Three most common causes of skin infections** ▪ Infected cuts / grazes / wounds ▪ Eczema ▪ Insect bites	**Gaps in referral system** ▪ Referrals come from secondary sources, i.e. Paediatricians, GPs Wellchild providers ▪ I am on a paediatric ward so not available to be referred to as a first port of call for treatment	**Opportunities / suggestions** ▪ Greater awareness of the risks associated with skin infections ▪ Cheaper access to treatment, i.e. scabies treatment, head lice treatment etc. ▪ More awareness at a primary health care level, i.e. Family Start workers etc. Usually treatment is basic and if adhered to, will bring results ▪ GPs need to ensure treatment advised is followed, i.e. antibiotics completed, creams applied as directed etc ▪ Good, consistent primary health support for families in the community **General comments** ▪ Almost invariably associated with high deprivation levels, overcrowding, poor health literacy and other health issues
Paediatric ward nurse **Provides** ▪ Treatment: antibiotics, wound care, education, referrals ▪ Currently working on a proposal to establish a hospital clinic for eczema **Most common age groups seen** ▪ 0-4 years followed by primary school aged children **Three most common causes of skin infections** ▪ Eczema	**Barriers / gaps identified** ▪ Transport ▪ Cost of GP visit, especially for large families with children over 6yrs ▪ Cost of treatment (e.g. for scabies treatment for large families) ▪ Education-parents are not able to recognize the signs of infection ▪ Many Maori / Pacific providers are very busy and it can be hard to get GP appointments and the rolls are often full ▪ Infected eczema can be	**Opportunities / suggestions** ▪ Education of parents/whanau to recognize the signs and symptoms of skin infections ▪ More wound swabbing to guide GP antibiotic choice (e.g. Erythromycin given for resistant, recurrent staph) ▪ need to ensure children can have prompt and affordable GP appointments

▪ Infected cuts/grazes/wounds ▪ Scabies/infected scabies	misdiagnosed and treated with hydrocortisone cream instead of antibiotics ▪ Need to take wound swabs at the onset of infection. We have had cases where children have had multiple courses of Fluclox and then found it was a Fluclox resistant strain ▪ Seeing more MRSA on the ward	**General comments** ▪ We are seeing higher rates of osteomyelitis on the ward (sometimes multi site) requiring up to 6 weeks in hospital, IV antibiotics and surgical intervention**.** This is Preventable
WBOP PHO **Provides** ▪ A very effective IV management project as part of the Co-ordinated Primary Options (CPO) service ▪ The patient pays for the first consultation, and then receives a full course of antibiotic therapy fully funded by BOPDHB **Most common age groups seen** ▪ Adults as for children it is often difficult to cannulate and maintain IV leur ▪ Also children need closer supervision as they can rapidly become unwell **Three most common causes of skin infections** ▪ Spider bites/pet bites ▪ Fungal infections (athletes foot) ▪ Wound infections	**Barriers / Gaps identified** ▪ Lack of mobile / home visiting nurse ▪ Clients have to present at GP clinic every day to receive treatment ▪ If there was a mobile nurse, the clients may only need to present to the GP every second day	**Opportunities / suggestions** ▪ Opportunities to expand the IV service and increase the number of clients seen ▪ Develop clear care pathways ▪ Support for mobile nurse(s)
Hauora - GP **Provides** ▪ Treatment, review appointments ▪ Community follow up by nurse, dressings by nurse, transport to hospital if needed	**Barriers / Gaps identified** ▪ Children rely on a parent to bring them, and sometimes parents don't realise the seriousness of the problem. ▪ Transport can be an issue for	**Opportunities / suggestions** ▪ Getting seen early, education issue (more education) ▪ In town the PHO has access to 3 days of IV

Most common age groups seen ▪ 2-5 yrs and then over 65's **Three most common causes of skin infections** ▪ Infected cuts / grazes / wounds ▪ Eczema ▪ Insect bites	older people as well ▪ Also not realising that leg wounds are particularly dangerous	antibiotics given in the community. This might be a useful service for our PHO to have as well
Hauora – practice nurse **Provides** ▪ Education about scabies, spread, treatment ▪ Provided transport for 12 people in 1 family requiring transport to see GP for medication for scabies ▪ Cellulitus; referrals to GPs after hours or no GP on site to ED, 2nd Ave for those that can afford to go ▪ Follow up-provide change of dressings if necessary and Betadine ▪ Advice for Betadine body wash from pharmacy ▪ Short assessment done ACC form if applicable print out to take with them **Three most common causes of skin infections** ▪ Scabies / infected scabies ▪ Infected cuts / grazes / wounds ▪ Eczema	**Barriers / Gaps identified** ▪ Very few problems, can provide transport to children to access GP ▪ Can make home visits if necessary. No cost to whanau ▪ Just not knowing the service is here to access is probably the main barrier. ▪ After hours or no GP on site patients go to ED or 2nd Ave clinic for those that can afford to go	**Opportunities / suggestions** ▪ Make the service more transparent to our enrolled population **General comments** ▪ More frequent over the last few years. ▪ I always ask if they have been swimming and where. Often they have in streams, dams and the harbour. Educate re the risk of infection ▪ Prevalent in more than one person in a family. ▪ Instruct re hand washing, showering and cleaning shower after use if have infections ▪ Stipulate importance of keeping infection area away from soap suds especially on lower limb and other body washing water ▪ Use own towels, pat dry. Keep wound area dry. Change immediately if wet
Parent of child admitted to the Hospital Emergency Department (ED) with cellulitis	**Barriers / Gaps identified** ▪ Cost of GP visit. Cellulitis infection occurred on a public holiday weekend and parent advised that visit to after	**Opportunities / suggestions** ▪ Cheaper after hours clinics open until later in evening (e.g. 23:00hrs) ▪ Rapid assessment and

	hours clinic would cost $70. ▪ However, after hours clinic closed at 2100 hrs. Parent and child advised to go to ED as infection was tracking up child's arm ▪ Child had to wait for 4 hours to be seen as ED was very busy with major road traumas. Parent told not to take child home as did need to be seen ▪ Child was treated with IV and oral antibiotics	treatment in a 'step down' unit – part of ED but for non – trauma patients who need to be seen and treated rapidly in a less acute setting after hours when no other services available so not tying up valuable ED time **General comments** ▪ This was an emergency as there was a risk of infection becoming systemic, but it was not a major trauma. Could have been dealt with in community rather than the Hospital ED had an after hours clinic been open ▪ Cost of visiting after hours clinic (up until 2100hrs) prohibitive to many parents (especially on public holidays and weekends)

3.1 Summary of key findings

Based on stakeholder and key informant interviews the most common causes of skin infections appear to be:

- infected cuts / grazes/ wounds
- underlying dermatitis / eczema
- scabies / infected scabies / impetigo
- insect bites

Key barriers identified:

- cost of GP visit (especially for children over 6yr olds)
- transport costs
- cost of treatments (e.g. scabies lotion to treat a whole family)

Opportunities / suggestions:

- Reduce costs for GP visits and improve after hours access
- Whole family approach (charge per family not per individual when more than one family member presents with a skin infection).
- Whole family assessment is most feasible and necessary in primary practice.
- Investigate cheaper treatments e.g. for scabies (e.g. single prescription on the youngest child's script with sufficient both for that child and whole family treatment)
- Address determinants of health / socio economic factors.
- Awareness raising campaign based on prevention, early detection and treatment of skin infections and basic hygiene messages.
- Follow up treatment plans and care pathways for children presenting with underlying skin conditions e.g. eczema, dermatitis. This would require cross disciplinary and cross site input for design and planning.

4 Literature review of effective intervention and best practice

Several projects and studies on cellulitis have been undertaken in New Zealand and overseas. These are discussed and the knowledge and expertise utilised to guide recommendations for the Bay of Plenty district.

Study and /or author	Key findings / best practice
Proposed epidemiological case definition for serious skin infection in children[1]	**Aims:** ▪ To develop and evaluate a good quality case definition of serious skin infections in children ▪ To use the case definition in future research and surveillance of serious skin infections. **Methods:** ▪ Testing the validity of existing and proposed case definitions by assessing their screening performance when applied to a population of paediatric skin infection cases ▪ The cases were identified by a chart review of 4 years admissions to a NZ hospital **Key findings:** ▪ Previous analysis of serious skin infections have underestimated the true burden of disease ▪ The new case definition produces a new case definition with 98.9% sensitivity and 98.8% specificity ▪ This should allow future researchers to produce more valid and comparable estimates of the true burden of serious skin infections.
Increasing hospitalizations for serious skin infections in New Zealand children 1990-2007[2]	**Aims:** ▪ The study aimed use a newly developed and validated case definition of serious skin infection to describe the incidence and epidemiology of these conditions in New Zealand children from 1990-2007 **Methods:** ▪ Hospital discharge data were analysed for all children 0-14 years from 1990-2007 with a principal or additional discharge diagnosis from a list of serious skin ICD codes **Key findings:** ▪ The incidence of serious skin infections almost doubled from 298.0/100,000 in 1990 to 547.3/100,000 in 2007 ▪ The highest rates were observed in boys, preschool aged children, Maori and Pacific children, those living in deprived neighbourhoods, urban areas and northern regions. ▪ Infections were significantly more frequent during summer and autumn compared to winter ▪ Worsening ethnic and socioeconomic health inequalities may be contributing to increasing rates.
Glen Innes serious	**Aims:**

skin infection prevention project (2003-2005)[7]	▪ To promote the importance of healthy skin and to reduce the occurrence of serious skin infections among people in Glen Innes. **Project Interventions:** ▪ Raising awareness about prevention of skin infections. ▪ Increasing early detection, early intervention and treatment. ▪ Improving the management of skin infection in primary care ▪ A collaborative and community based approach. ▪ Building relationships with health providers and community health care workers. ▪ Working with other sectors to address associated. environmental conditions that may promote skin infections, e.g. fleas, mosquito breeding habits, housing problems. **Achievements:** ▪ A significant reduction of Glen Innes cellulitis discharge rates over the 6 month period July to December 2003. **Best practice:** ▪ Draft best practice management of skin infections in General Practice (Appendix 1). ▪ The development of resources including a Skin Kit, information booklet, the *Skin Talk* newsletter and website: http://www.skininfections.co.nz/auck_project.htm **Project barriers identified:** ▪ Poverty and cultural issues (stigmatization and normalization of skin infections). ▪ Environmental factors. ▪ Lack of liaison and collaboration between hospital services, GPs and community providers in terms of referral mechanisms and hospital admission and discharges.
Starship hospital cellulitis case-control study[15]	**Key findings:** ▪ Cellulitis has a strong familial association. ▪ Of those children admitted to Starship hospital with cellulitis: o 31% had a personal history with cellulitis o 31% had a sibling with a past history of cellulitis o 27% had parents/caregivers with a past history of cellulitis. ▪ Cellulitis is over-represented in and associated with lower socio economic status. ▪ **Late presentation to the GP is a significant issue.** o 40% of children admitted with cellulitis presented late to a GP requiring immediate hospitalization. **Best Practice:** ▪ Starship Children's Health Clinical Guideline available at: http://www.starship.org.nz/assets/Uploads/Starship-Hospital-Content/Health-Professionals/Clinical-Guidelines/Cellulitis.pdf
The Greater Wellington region serious skin infection project (2004)[6]	**Aims:** ▪ To reduce the overall burden and disparity of serious skin infections in children and young people in the Wellington region through prevention and early intervention of disease. **Project interventions (actual and proposed):** ▪ Multiple determinants can impact on skin infections.

	Accordingly, proposed interventions were aimed at multiple levels and grouped into four work streams: **1. Socio-economic and environmental issues** o raise awarenesss of skin infections and links with environmental determinants. o strengthen relationships with community and non health organizations, community based initiatives. o investigate possibility of one off allowances with Work and Income for families with recurrent infections o housing and health assessments. o Include insect bite information in promotional resources, including training for community workers. Explore insect bite prevention programme. o raise awareness among health professionals re ACC cover for insect bites and complications. **2. Skin health promotion** o work with Ministry of Education around national standards, national promotion and funding of adequate hand washing and drying facilities. o collaborate with other agencies and organizations. Obtain accurate data on adequate hand washing and drying facilities in schools. o develop a skin resource pack, collate existing resources include 'skin kits' with plasters. o assist with resource distribution and training. **3. Healthcare services and research** o continue to improve access to primary care o investigate the possibility of making scabies treatments cheaper o adding skin infection checklist to paediatric admission notes o eczema management training of health professionals in community (e.g. practice nurses) o conduct a formal review of links and referral mechanisms between primary, hospital and community services Implement ways to improve links o conduct research on skin infections in the community and primary care **4. National best practice guidelines** o a formal proposal to develop new best practice guidelines should be made to the Paediatric Society and NZ Guidelines group
Evaluation of the Greater Wellington region serious skin infection project [16]	**The 2007 evaluation report key findings:** ▪ The Wellington skin project had been successful in its work with schools and embedded in to the work of public health nurses. ▪ The project also facilitated a small number of people obtaining financial assistance from Work and Income. ▪ However, the project was insufficiently resourced to operate over multiple areas.

	Evaluation recommendations: ▪ Involving primary care providers who are able to reach Maori and Pacific children. ▪ Where collaborative action is required, formalise work plans, consider contractual arrangements. ▪ Establish data collection protocols. ▪ Further research was suggested: o collecting skin infection data at primary care level o formally scope referral issues between primary and secondary services o analyse hospitalisation data to examine the extent of repeat admissions and household clustering of skin infections
Prevalence of impetigo in the Bay of Plenty and Lakes Districts[17]	**Aims:** ▪ To establish the prevalence of impetigo in the Bay of Plenty and Lakes Districts. **Report findings /recommendations:** ▪ Ascertaining prevalence rates proved difficult. ▪ Prospective research for future examination of impetigo prevalence rates ▪ Public health involvement to include promotion of hand hygiene ▪ Work on strategies aimed at reducing health inequalities and household overcrowding ▪ Education on prompt and appropriate management of impetigo ▪ Addressing the acceptance of impetigo as a childhood norm
Proposed extended school based clinics for skin infections and preventable conditions[18]	**Aim:** ▪ To extend school based sore throat clinics in South Auckland to include skin infections and injury prevention. **Project interventions:** ▪ An initial feasibility study will evaluate community. acceptability, sustainability and practicability of this approach ▪ These results will inform the main study, which will involve a randomized control trial of a staged roll out of school based interventions in 4 high risk suburban areas. ▪ Plan to commence the feasibility study in February 2010.
Accident Compensation Corporation (ACC)[8]	**Treatment of cellulitis:** ▪ Narrow spectrum beta-lactam antibiotics, such as flucloxacillin or a first generation cephalosporin are the treatment of choice for cellulitis. ▪ Broad spectrum antibiotics, third generation cephalosporins, and combination antibiotic therapy are not necessary when treating uncomplicated cellulitis. ▪ Intravenous (IV) antibiotics are used where there is evidence of systemic symptoms suggesting septicaemia, bacteraemia and high risk factors (e.g. HIV, diabetes). ▪ IV use may also be justified when there are compliance issues with an oral regime, or in primary care / home hospital settings. ▪ Antibiotics should be supplemented by wound care, good hygiene and treatment of underlying skin conditions. Elevation and immobilisation of the affected limb(s) may reduce the

	swelling.
IV management of cellulitis in primary community and care:	**Summary:** ▪ Cellulitis is amenable to community management because most admissions are short and IV antibiotics are the main intervention. ▪ IV management of adult patients with cellulitis are operating throughout New Zealand including WBOP, Waikato[19], Christchurch [20] and Auckland. [9 21] ▪ However, community IV management of cellulitis is more suitable for adults rather than children. ▪ As the focus of this review is children aged 0-14 years, community IV management guidelines / options will not be explored in depth.
Cochrane reviews [22] [23] [24]	**Interventions for impetigo (Review)**[22] **Objectives:** ▪ To assess the effects of treatments for impetigo, including waiting for a resolution **Selection criteria:** ▪ Randomised controlled trials of treatments for non-bullous and bullous, primary and secondary impetigo ▪ Fifty seven trials, with a total of 3533 participants were included in the review – which studied 20 different oral and 18 different topical treatments. **Key findings:** ▪ Topical antibiotics showed better cure rates than placebo and no topical antibiotic was superior. ▪ Topical mupirocin (bactroban) and topical fusidic acid are equally or more effective to oral antibiotic treatment for people with limited impetigo. ▪ It is unclear if oral antibiotics are superior to topical antibiotics for people with extensive impetigo. ▪ Penicillin was not as effective as most other antibiotics and resistance patterns against antibiotics should be taken into account in the choice of therapy. **Interventions for cellulitis and erysipelas (Review)** [23] **Objectives:** ▪ To assess the efficacy and safety of interventions for non-surgically acquired cellulitis. **Selection criteria:** ▪ Randomised controlled trials comparing two or more different interventions for cellulitis ▪ Twenty five studies with a total of 2488 participants were included in the review. **Key findings:** ▪ Macrolides/streptogramins were found to be more effective than penicillin antibiotics. ▪ Surprisingly oral antibiotics appeared to be more effective than IV antibiotics for moderate and severe cellulitis.

	▪ Although, the cochrane authors were unable to define the best treatment for cellulitis and most recommendations are based on single trials. ▪ The authors also identified a need for trials evaluate the efficacy of oral antibiotics against IV antibiotics in the community setting as there are service implications for cost and comfort. **Interventions to reduce Staphylococcus aureus in the management of atopic eczema (Review)** [24] **Objectives:** ▪ To assess the effects of interventions to reduce *Staphylococcus aureus* for treating infected or uninfected atopic eczema **Selection criteria:** ▪ Randomised controlled trials of people with atopic eczema who have been treated with a product intended to reduce *s.aureus* on the skin. ▪ Twenty one studies with a total of 1018 participants were included in the review. **Key findings:** ▪ The review failed to find clear evidence of benefit for antimicrobial interventions for people with atopic eczema, despite their widespread use. ▪ However, this finding may be due to the fact that the reviewed studies were small and poorly reported. Further large studies with long term outcomes and clearly defined participants were recommended.
Skin infections in developed countries	**Summary:** ▪ In Australia, impetigo and scabies are endemic within many Aboriginal communities.[25] In many remote Northern Territory (NT) Aboriginal communities the prevalence of streptococcal skin infection often exceeds 70%.[26] ▪ Household overcrowding, access to adequate water supplies, high humidity, education and implementation of personal hygiene are all identified risk factors. ▪ A link between pyoderma (skin infections) and acute rheumatic fever has been proposed[27] but not proven.[28] Researchers suggest that controlling skin infections will not only reduce morbidity from skin infections, but may also lead to reduced rates of acute rheumatic fever, rheumatic heart disease and acute post streptococcal glomerulonephritis (APSGN) - Reduced rates of APSGN may in turn lower the high rates of end-stage renal failure in Aboriginal adults.[26] ▪ The emergence of antibiotic resistance among skin bacteria and the community acquired methicillin resistant Staphylococcus aureus (CAMRSA) among remote indigenous communities in Australia are of serious concern. [29]

	▪ Skin infections are also on the rise amongst children from lower socio economic backgrounds in the United States of America – more specifically Texas [30] and Hawaii [31] and, as previously reported, New Zealand.[6 7]
Skin infections in developing countries[32]	**Key findings:** ▪ A comprehensive review on the global prevalence of skin infections in developing countries was undertaken by the World Health Organisation (WHO). ▪ A total of 18 prevalence studies were reviewed. A consistent finding of the review was that children present a higher prevalence rate than adults for skin infections. ▪ Data from bacteriological studies suggest that group A streptococci remain the main etiological agent of pyoderma in many tropical developing countries, followed by *Staphylococcus aureus*. ▪ Children from the Pacific Islands and Aboriginal communities in Australia had particularly high prevalence rates for skin infections and scabies.

5 Synthesis and recommendations

Based on the findings of the BOP data analysis, stakeholder feedback, and literature review the following recommendations have been made for public health and primary health care services

5.1 Public health

The causes of cellulitis and skin infections occur at multiple levels within a population. Consequently preventative interventions must also be multi faceted.

Disseminate information for action	▪ Make it clear to why serious skin infections are an important issue / problem. ▪ Disseminate BOP statistics showing skin infection and cellulitis trends. Highlight vulnerable/high incidence populations to key stakeholders and the wider community i.e. o Children aged 0 to 4 years especially those living in lower socio economic areas o Maori and Pacific children aged 0-14 years o Children with underlying skin conditions (e.g. eczema) ▪ Develop key messages: o skin infections are **preventable** o hospital admission rates for serious skin infections are increasing. o many admissions require surgery o some children develop serious complications including bone and joint infections ▪ Use local media e.g. newspapers and radio to promote awareness (depending on funding) ▪ Develop a TTO skin infection webpage and post key statistics and information for health professionals and the general public.
Address the determinants of health	▪ Skin infections often arise in children with a background of overcrowding, lower socio-economic status, poor hygiene. ▪ Strengthen relationships with community and non health organizations e.g. sports teams, promote the treatment of injuries with cleaning and the application of betadine and plasters ▪ Advocate and increase inter-sectoral collaboration where there are opportunities for health input into improving socio-economic conditions, e.g. healthy housing.
Raise awareness about the prevention of serious skin infections	▪ Run general and targeted awareness campaigns o targeted awareness raising aimed at high incidence populations and communities identified in section 2 of this report e.g. children aged 0-4 years living in the EBOP o more general campaigns to raise community awareness and to dispel the 'normalisation' of skin infections o consult with hauoras and establish partnerships with providers who are able to reach Maori and Pacific children, parents, whanau and with access to Kohanga reo, Kura

	Kaupapa's, new mothers groups, Plunket, Well Child ○ ensure all agencies that have contact with high risk children and their whanau have information about the prevention, early detection and treatment of cellulitis. ○ focus on schools in areas with highest rates of skin infections ○ ongoing consultation and engagement with communities/ whanau ○ use local media e.g. newspapers and radio to promote awareness (depending on funding)
Utilise existing health promotion / education materials and develop new resources if required	Utilise and adapt resources to provide information / education on the following: ○ what is cellulitis? (signs, symptoms, treatment) ○ why prevention is important, potential complications ○ first aid and 'clean cut cover' messages ○ promote hand and personal hygiene messages ○ investigate the development of 'skin kits' (depending on funding) include fabric plasters and information on caring for sores. Distribute to families and key stakeholders in high incidence areas ○ research and provide information about cheap solutions for cleaning wounds ○ fleas - raise awareness about the potential for infected bites, managing pets flea treatment, regular vacuuming ○ mosquitoes - provide advice sheets about preventing mosquito breeding, covering up and using repellent in high incidence areas ○ environmental factors - work with communities to remove dangerous items that can cause injury and create breeding grounds for mosquitoes from back yards / community areas. ○ promote general injury prevention messages ○ promote awareness of possible assistance from work and income (WINZ) e.g. to cover the cost of medication for insect bite prevention (e.g. DEET), and household items e.g. bedding, linen and flea bombs . ○ develop a TTO skin infection webpage and provide links to Auckland, Wellington websites and resource
Promote correct and prompt treatment of existing skin conditions to prevent infections	▪ A key finding of the BOP data analysis, stakeholder feedback and the literature review was that skin infections in children frequently occur as a result of pre-existing/chronic skin conditions e.g. eczema. ▪ Utilise and adapt existing information pamphlets available at: http://www.skininfections.co.nz/resources.htm to provide education on treatment of the following conditions: ○ eczema or atopic dermatitis – also refer to http://itchykids.org.nz/default.htm for good eczema resources ○ scabies ○ impetigo ○ fungal infections (e.g. athletes foot)

	▪ Develop clear, consistent clinical care pathways for children who have been diagnosed with the above skin conditions, ensure consistent PHNs/ GPs. ▪ Investigate the possibility of making treatments cheaper (e.g. extra funding for scabies treatments). ▪ Conduct eczema management training of parents and health professional in the community (e.g. practice nurses if a need is identified).
Investigate the potential for collaborative work with PHNs and B4 school nurses	▪ PHNs, B4 school / preschool nurses are in a key position to promote skin health to students in schools and ECCs ▪ Focus on schools in high incidence communities. ▪ Look to adapt the Regional Public Health Promoting Healthy Skin Programme which provides clear consistent messages around 1. first aid / wound care 2. hand and general hygiene 3. injury prevention 4. insect bites ▪ Develop a standardized skin resource pack, collating existing resources, creating new resources as required and make available to schools/children/parents/whanau/stakeholders. ▪ Develop suitable resources for preschoolers including early childhood centres and kohanga reo's. ▪ Obtain accurate data on the current state of hand washing and drying facilities in schools ▪ Find ways to support schools to improve hand hygiene facilities (where required) and overcome barriers with schools to improve hand washing and drying facilities ▪ Ensure the messages do not stigmatise – highlight the multi factoral nature of skin infections

5.2 Primary care

Late presentation to primary care is associated with hospital admissions.[12] Consequently, early access to primary care before children become systemically unwell is important to prevent hospital admissions. The following are recommendations to increase early detection, intervention and treatment of skin infections at primary care.

Increase early detection, early intervention and treatment	▪ Raise awareness about how to detect skin infections and promote the **'go to the doctor if'** message, i.e. ▪ If a sore or redness has any one of the following: o is the size of a 10 cent coin or bigger o has pus o is getting bigger o has red streaks coming from it o is not getting better within 2 days o any sore or redness near the eye needs to been by a doctor urgently.

	▪ Ensure parents whanau are well informed regarding the use of antibiotics prescribed and the importance of completing the course given to the child.
Increase accessibility to primary care	▪ Provide a list of GPs, addresses, hours and fees to families and all agencies that have contact with high risk children and their whanau and update regularly. ▪ Also place on TTO webpage ▪ Explore the possibility of increasing funding for after hours GP services ▪ Financial support for mobile nursing service/ practice nurses to conduct home visits following initial consultation ▪ involving primary care providers who are able to reach Maori and Pacific children
Increase affordability of primary care services	▪ One of the biggest barriers to primary care access in New Zealand for low income families is cost [33] [34] [35] ▪ Promote awareness about eligibility for ACC assistance for injuries received as a result of an accident (e.g. a cut or graze) or insect bites. ▪ Explore whether extra funding could be made available to enable cheaper access to primary care e.g. to enable a whole family approach (charge per family not per individual when more than one child / family member with skin infection). ▪ Investigate the possibility of funding mobile nurses/ practice to undertake home visits following consultations.
Research opportunities	▪ Undertake research / surveys of parents / whanau of children who have had hospital admissions for skin infections and document their 'journey including: o events leading to hospital admission o what was the initial event that lead to cellulitis? (trauma, bite, eczema) o what treatment did they try? o when did the parents first notice would looked wrong? o when and where did they go for help? o time frames o barriers to access ▪ A patient journey project could be undertaken by a research student. ▪ Collect skin infection data at primary care level ▪ Undertake a cost – benefit analysis to determine the average cost of ASH admissions for children aged 0 -14 compared to the cost of providing free or reduced GP consultation costs for children aged 0-14 years presenting with skin infections. ▪
Work to strengthen relationships and collaboration between primary, secondary and community services	▪ Review the referral processes between services in the region and identify gaps in the referral process. ▪ Raise awareness of the services provided and roles of primary, hospital and community organizations ▪ Promote database of community providers on TTO website

5.3 DHBs / secondary care

Admission of children to hospital for serious skin infections should not just be viewed as an 'illness event' but rather a 'window of opportunity' [36] for improving the health and wellbeing of children and tamariki and preventing future ASH admissions. It is beyond the scope of this project to make recommendations for secondary care, but a few ideas are suggested below:

- Utilise and adapt the Starship information pamphlets to provide discharge information and education to empower parents/whanau and help prevent recurrent admissions for skin infections.
- Dr Malcolm (Bay of Plenty DHB Whakatane Paediatrician) has undertaken an extensive literature review of evidence based approaches to skin infections which can be used to provide paediatric input into the proposed research, resources and care pathways.
- Support and promote hospital based initiatives e.g. the proposed hospital based eczema clinic.
- View hospital admissions as positive opportunities to strengthen links with the clients, whanau and primary care providers to prevent ASH readmissions.
- Further analyse hospital admission data to determine the extent of repeat admissions and household clustering of skin infections
- Also review data to determine the rates of osteomyelitis resulting from serious skin infections (as reported in stakeholder feedback)

5.4 Summary of recommendations

The total cost of serious skin infections for the BOPDHB in the 2009-2010 financial year was $1,140, 841. Based on this figure, a strategic approach aimed at preventing 20% of these admissions could save the Bay of Plenty DHB $228,168. A suggested approach is outlined in the four work streams below:

Summary of Key Recommendations

WORKSTREAM 1 : General and targeted awareness raising campaign

Aims:

- General awareness raising: Increase community awareness and understanding of serious skin infections across the wider Bay of Plenty
- Targeted awareness raising: Increase awareness and understanding of serious skin infections in high incidence communities in the Bay of Plenty (as identified by this report)
- Increase early detection, intervention and treatment of skin infections

Methods:

- Disseminate statistics to make it clear why serious skin infections are a serious issue
- Develop key messages
- Conduct a multi media awareness campaign (utilising newspapers, radio, resources)
- Develop a Toi Te Ora - Public Health skin infection webpage and post key statistics and information for health professionals and the general public
- Provide a list of GPs, addresses and fees on Toi Te Ora - Public Health website and update regularly
- Skin health promotion: utilise and adapt existing resources and develop new resources if required
- Raise awareness about environmental determinants of skin infections e.g. insect bites and include in promotional resources
- Assist with resource distribution and training where possible

WORKSTREAM 2 : Advocacy for service improvement

Aim:

- Advocate where there are opportunities for health service improvement, both through Toi Te Ora - Public Health and at Bay of Plenty DHB level

Methods:

- Actively promote links between public health, primary, hospital and community services.
- Advocate for more accessible and affordable primary health services
- Explore the possibility of increasing funding for after hours GP services
- Support other Bay of Plenty DHB initiatives: e.g. the proposed hospital based eczema clinic and the 'Bay Navigator'
- Develop a clinical care pathway for the prevention and treatment of serious skin infections in children aged 0-14 years
- Advocate for more affordable treatment e.g. scabies treatment for large families. Explore

pharmacy support for this
- Promote awareness of eligibility for WINZ and ACC support for serious skin infections
- Strengthen relationships with community and non health organizations
- Promote and support programmes which address the socio-economic and determinants of health

WORKSTREAM 3 : Increasing awareness and responsiveness of health professionals

Aims:
- To raise awareness amongst health professionals and service providers of the incidence and impact of serious skin infections
- Utilise clinical networks to deliver effective and co-ordinated care

Methods:
- Develop training seminars and web-based material for health professionals
- Support paediatric nurses to conduct eczema management training of health professionals in the community (e.g. practice nurses)
- Work with public health, B4 school and preschool nurses to promote skin health. Focus on schools in high incidence communities and low decile schools
- Engage and collaborate with health care providers who are able to reach Maori and Pacific children, parents and whanau

WORKSTREAM 4: Research opportunities

Aims:
Identify opportunities for further research into serious skin infections in the Bay of Plenty

Methods:
- Further analyse hospital admission data to determine the extent of repeat admissions and household clustering of skin infections
- Collect and analyse primary care skin infection data
- Undertake a cost – benefit analysis to determine the average cost of ASH admissions for children aged 0 -14 compared to the cost of providing free or reduced GP consultation costs for children aged 0-14 years presenting with skin infections
- Support the paediatric skin infection and study undertaken by medical student if required

Appendix 1. Data results and ICD code definitions

Data results

BOPDHB Inpatients Admissions & Discharges - Primary & Secondary Diagnosis
Children 0 - 14 years of age
Serious skin infections - Category A,B,C & D ICD 10 codes *
Source: BOPDHB IP data dump Sept 2010

* Reference: C E O'Sullivan & M G Baker, Proposed epidemiological case definitionfor serious skin infection in children, Dept of Public Health, Wellington School of Medicine & University of Otago, Journal of Paediatrics and Child Health, 46, 2010, pp 176-183.

Serious skin infections - Category A,B,C & D ICD codes

	DischYear based Fin. Year							
	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	Grand Total
Primary	212	164	212	212	239	264	268	1,571
Secondary	126	96	117	91	111	113	161	815
Total	338	260	329	303	350	377	429	2,386
Average LOS Hours	51	63	52	59	58	51	61	56
Average LOS days	2.2	2.7	2.2	2.5	2.4	2.2	2.6	2.4
Average Cost	$ 1,936	$ 2,104	$ 2,209	$ 2,593	$ 2,713	$ 2,665	$ 2,659	
Total Cost (est. based on average primary cost)	$ 654,490	$ 546,934	$ 726,695	$ 785,702	$ 949,400	$ 1,004,590	$ 1,140,841	$ 5,808,652
Prevalence rate per 000 (based census 2006)	7.6	5.9	7.4	6.8	7.9	8.5	9.7	
Primary	4.8	3.7	4.8	4.8	5.4	6.0	6.1	
Secondary	2.8	2.2	2.6	2.1	2.5	2.6	3.6	
		9%	5%	17%	5%	-2%	0%	

Gender

Male	181	159	190	169	197	191	236	1,323
Female	157	101	139	134	153	186	193	1,063
Male %	54%	61%	58%	56%	56%	51%	55%	55%
Female %	46%	39%	42%	44%	44%	49%	45%	45%
Male Prevalence rate per 000	7.9	7.0	8.3	7.4	8.6	8.4	10.4	
Female Prevalence rate per 000	7.3	4.7	6.4	6.2	7.1	8.6	8.9	

Ethnicity

Maori	215	153	209	184	212	225	280	1,478
PI	11	11	6	12	13	31	28	112
Non Maori / PI	112	96	114	107	125	121	121	796
Maori Prevalence rate per 000	12.4	8.8	12.0	10.6	12.2	13.0	16.1	
PI Prevalence rate per 000	6.1	6.1	3.3	6.7	7.2	17.2	15.6	
Non Maori PI Prevalence rate per 000	4.5	3.8	4.5	4.3	5.0	4.8	4.8	
Maori %	64%	59%	64%	61%	61%	60%	65%	62%
PI %	3%	4%	2%	4%	4%	8%	7%	5%
Non Maori / PI %	33%	37%	35%	35%	36%	32%	28%	33%

Region

EBOP	152	101	133	110	124	121	139	880
WBOP	155	134	184	171	207	224	253	1,328
EBOP Prevalence rate per 000	11.6	7.7	10.2	8.4	9.5	9.3	10.6	
WBOP Prevalence rate per 000	5.0	4.3	5.9	5.5	6.6	7.2	8.1	
EBOP %	45%	39%	40%	36%	35%	32%	32%	37%
WBOP %	46%	52%	56%	56%	59%	59%	59%	56%

Territorial Local Authority

Tauranga	110	94	152	124	144	156	178	958
Whakatane	103	59	71	64	74	76	89	536
Kawerau	33	22	37	20	24	26	25	187
WBOP	45	40	32	47	63	68	75	370
Opotiki	16	20	25	26	26	19	25	157
Tauranga Prevalence rate per 000	5.0	4.3	6.9	5.6	6.5	7.1	8.1	
Whakatane Prevalence rate per 000	12.0	6.9	8.3	7.4	8.6	8.8	10.3	
Kawerau Prevalence rate per 000	16.7	11.1	18.7	10.1	12.1	13.1	12.6	
WBOP Prevalence rate per 000	4.9	4.3	3.5	5.1	6.8	7.4	8.2	
Opotiki Prevalence rate per 000	6.5	8.1	10.1	10.5	10.5	7.7	10.1	
Tauranga %	33%	36%	46%	41%	41%	41%	41%	40%
Whakatane %	30%	23%	22%	21%	21%	20%	21%	22%
Kawerau %	10%	8%	11%	7%	7%	7%	6%	8%
WBOP %	13%	15%	10%	16%	18%	18%	17%	16%
Opotiki %	5%	8%	8%	9%	7%	5%	6%	7%

Age

Age under 1 year	39	35	48	39	70	79	77	387
Age 1 - 4 years	141	103	127	133	129	149	188	970
Age 0 - 4 years	180	138	175	172	199	228	265	1,357
Age 5 - 9 years	84	63	89	73	80	75	91	555
Age 10 - 14 years	74	59	65	58	71	74	73	474
Age under 1 year %	12%	13%	15%	13%	20%	21%	18%	16%
Age 1 - 4 years %	42%	40%	39%	44%	37%	40%	44%	41%
Age 0 - 4 years %	53%	53%	53%	57%	57%	60%	62%	57%
Age 5 - 9 years %	25%	24%	27%	24%	23%	20%	21%	23%
Age 10 - 14 years %	22%	23%	20%	19%	20%	20%	17%	20%
0 - 4 Prevalence rate per 000	13.5	10.4	13.1	12.9	14.9	17.1	19.9	
5 - 9 Prevalence rate per 000	5.8	4.3	6.1	5.0	5.5	5.2	6.3	
10 - 14 Prevalence rate per 000	4.7	3.7	4.1	3.7	4.5	4.7	4.6	

ICD 10 Category Coding

	DischYear based Fin. Year							
	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	Grand Total
Category A	181	125	162	152	185	173	196	1174
Category B	22	22	23	20	22	23	24	156
Category C	92	70	85	80	94	128	128	677
Category D	43	43	59	51	49	53	81	379
Total	338	260	329	303	350	377	429	2386

Category A ICD 10 codes (skin infections subchapter of ICD-10)

Category A	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	Grand Total
cutaneous abscess furuncle carbuncle	76	60	73	78	91	68	90	536
Cellulitis	47	33	39	30	45	37	45	276
impetigo	24	10	24	20	22	35	30	165
acute lymphaderitis	15	9	10	14	11	19	18	96
other infections of skin and subcutaneous tissue	16	5	15	9	9	13	10	77
pyoderma	1	6	1	1	6	1	2	18
pilonidal cyst with abscess	2	2			1		1	6
Total Category A	181	125	162	152	185	173	196	1174
Other	19	13	16	10	16	14	13	101

Category B ICD 10 codes (serious skin infections of atypical anatomical sites)

Category B	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	Grand Total
hordeolum/cellutis/abscess eye	9	9	8	5	10	12	8	61
cellutis/abscess external ear & infective otitis	7	6	5	6	5	4	2	35
anal abscess/cellulitis	1	4	4	3	2		3	17
acute inflammation / cellulitis /abscess of orbit	2	1		4	2	5	3	17
abscess / cellulitis of vulva			2	1	1	1	5	10
other inflammatory disorders of penis,scotum, ma	3	1	2		2		3	11
abscess/cellulitis nose		1	2	1		1		5
Total Category B	22	22	23	20	22	23	24	156

Category C ICD 10 codes (serious skin infections secondary to primary skin disease)

Category C	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	Grand Total
dermatitis / eczema unspecified infective eczema	78	58	74	64	70	88	98	530
Scabies	6	4	2	6	7	35	23	83
varicella with complications	8	8	9	10	17	5	7	64
Total Category C	92	70	85	80	94	128	128	677

Category D ICD 10 codes (serious skin infections secondary to external trauma)

Category D	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	Grand Total
open wound infectionwith foreign body / infection a	24	28	34	32	30	28	36	212
insect/ spider bites	16	14	18	13	12	17	35	125
post-traumatic wound infection not elsewhere clas	3	1	7	6	7	8	10	42
Total Category D	43	43	59	51	49	53	81	379

TLA Summary Table

	Kawerau	Opotiki	Whakatane	Tauranga	WBOP
Age Groups					
0 to 4	66%	64%	59%	56%	61%
10 to 14	15%	22%	16%	21%	19%
5 to 9	20%	14%	26%	23%	21%
Category					
A	50%	48%	51%	45%	52%
B	3%	6%	5%	8%	5%
C	36%	31%	32%	28%	22%
D	11%	15%	12%	19%	22%
Ethnicity					
Ethnicity	**Kawerau**	**Opotiki**	**Whakatane**	**Tauranga**	**WBOP**
Maori	89%	87%	80%	45%	49%
NZ European	6%	10%	16%	41%	39%
Census 2006 Maori 0-14 years of age	80%	76%	58%	29%	27%
Diagnosis					
Primary	63%	57%	68%	65%	71%
Secondary	37%	43%	32%	35%	29%
Code					
Category A	**Kawerau**	**Opotiki**	**Whakatane**	**Tauranga**	**WBOP**
cutaneous abscess furuncle carbuncle	28%	22%	24%	20%	28%
Cellulitis	7%	13%	14%	11%	11%
impetigo	9%	7%	8%	6%	5%
acute lymphaderitis	2%	1%	5%	5%	4%
other infections of skin and subcutaneous tissue	3%	1%	1%	4%	5%
pyoderma	0%	1%	1%	1%	1%
pilonidal cyst with abscess	0%	0%	0%	0%	0%
Category B	**Kawerau**	**Opotiki**	**Whakatane**	**Tauranga**	**WBOP**
hordeolum/cellutis/abscess eye	2%	2%	1%	4%	2%
cellutis/abscess external ear & infective otitis	1%	2%	2%	2%	1%
acute inflammation / cellulitis /abscess of orbit	0%	1%	0%	1%	1%
anal abscess/cellulitis	0%	1%	0%	1%	1%
other inflammatory disorders of penis,scotum, ma	0%	0%	1%	1%	0%
abscess / cellulitis of vulva	1%	1%	0%	1%	0%
abscess/cellulitis nose	0%	0%	0%	0%	0%
Category C	**Kawerau**	**Opotiki**	**Whakatane**	**Tauranga**	**WBOP**
dermatitis / eczema unspecified infective eczema	33%	30%	24%	20%	14%
Scabies	3%	1%	3%	4%	4%
varicella with complications	3%	2%	3%	3%	2%
Category D	**Kawerau**	**Opotiki**	**Whakatane**	**Tauranga**	**WBOP**
open wound infectionwith foreign body / infection	5%	9%	7%	10%	9%
insect/ spider bites	3%	4%	4%	6%	8%
post-traumatic wound infection not elsewhere clas	1%	3%	1%	2%	2%

Appendix 2. Stakeholder survey

(Survey sent via email and also replicated for phone and face to face interviews)

Kia ora,

I am currently working on a skin infection / cellulitis health needs assessment looking at admission data, the burden of disease, clinical pathways and services in place in the BOP. The overall aim is to reduce hospital admissions for preventable skin infections / cellulitis in children aged 0-14yrs

I would really like to hear your thoughts on cellulitis from the perspective of your practice.

If it is not too much trouble could you please reply to this email and answer the questions below?

Thank you,
Lindsay

Q1. In your opinion, what are the 3 most common causes of serious skin infections / cellulitis in the cases you see? (could you number them 1-3?)

eczema
insect bites
scabies / infected scabies
infected cuts / grazes /wounds
infected burns
fungal infections (e.g. athletes foot)
other(s) – (please state)

Q2. What are the most common sites for skin infections / cellulitis that you see?

Q3. Which are the most common age groups with skin infections / cellulitis that you see?

Q4. Could you please tell me about the services that you provide to children with skin infections / cellulitis?
(e.g. treatment, referrals, education for parents/ whanau, providing assistance with transport?)

Q5a. Can you identify any potential barriers for people accessing your service (cost, transport etc)?

Q5b. If yes what do you think would help reduce these barriers?

Q6. In your opinion, what do you think might reduce hospital admission rates for skin infections / cellulitis in children?

Q7. Can you identify any gaps the in the referral process for skin infections/ cellulitis?

Q8. Do you have any other comments / feedback you would like to make about skin infections / cellulitis.

Thank you,
Lindsay

Toi Te Ora - Public Health Service
P 07 577 3790
F 07 578 0883
M 021 02361833
W www.toiteorapublichealth.govt.nz/rheumatic_fever

Appendix 3. Draft best practice guidelines – GPs [6]

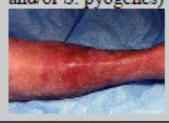
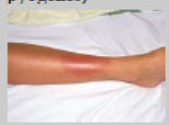
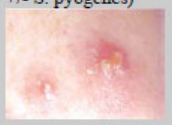
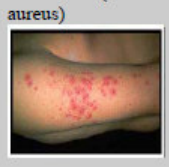
Draft Best Practice Management of Skin Infections in General Practice

Wound Care

- Remove crusts (impetigo)
- Debride necrotic tissue
- Incise and drain abscesses and boils
- Clean and cover open sores (gauze, cloth or fabric sticking plaster)
- Outline margins of inflammation with ink on diagnosis of cellulitis to monitor progression accurately

Medical Therapy

- Antibiotic of choice is that which is effective against the most likely pathogen, has least toxicity and narrowest spectrum of activity
- If there is a history of MRSA infection, empirical therapy should be guided by previous susceptibility data

Condition (Likely Organism)	Initial Treatment (7-10 days)		Alternative(s)
Cellulitis (S. aureus and/or S. pyogenes) 	Flucloxacillin OR Cephalexin[a]		Penicillin (if streptococcal) OR Erythromycin
Diabetic foot cellulitis (Multiple)	Amoxycillin-clavulanate OR Flucloxacillin		First-generation cephalosporin OR Clindamycin[b]
Erysipelas (S. pyogenes) 	Penicillin		Erythromycin
Impetigo (S. aureus +/- S. pyogenes) 	Local-ised	Topical mupirocin	Topical fusidic acid
	Wide-spread	Flucloxacillin OR Cephalexin[a]	Penicillin OR Erythromycin
Folliculitis (S. aureus) 	Super-ficial	Local antiseptic measures OR Topical mupirocin	Topical fusidic acid
	Deep	Flucloxacillin	Penicillin OR Erythromycin
Boils and abscesses (S. aureus) 	Flucloxacillin OR Cephalexin[a]		Erythromycin
Human and animal bites (Multiple)	Amoxycillin-clavulanate		Clindamycin[b]

a. Cephalexin better tolerated than flucloxacillin among children requiring a syrup b. Needs specialist endorsement

Flucloxacillin *Adult:* 250-500mg tds; *Child:* 25-50 mg/kg/day in 3-4 divided doses
Cephalexin *Child:* 25-50mg/kg/day in 3 divided doses
Penicillin (V) *Adult:* 250-500mg qid; *Child:* 25-50 mg/kg/day in 4 divided doses
Erythromycin (EES) *Adult:* 800mg bd; *Child:* 35-50 mg/kg/day in 3 divided doses
Amoxycillin-clavulanate *Adult:* 500mg tds; *Child:* 20-40 mg/kg/day in 3 divided doses
Clindamycin *Adult:* 150-450mg qid; *Child:* 8-25 mg/kg/day in 3-4 divided doses

Patient Education

Feature	Comments
Antibiotics	• Complete course • Don't share course among family members
Wound care	• Clean area with warm salty water • Dry with a clean cloth (discard) • Cover with clean gauze, cloth or fabric sticking plaster
When to return	• Getting worse • Not getting better (after 2 days) • Feel unwell or feel hot/have fever
Hygiene	• Wash body all over daily with clear water • Wash and dry hands thoroughly and regularly • Avoid sharing towels, clothing and bedding • Wash linen weekly and clothing regularly (hot wash while skin infected) • Avoid sharing bath and swimming water while skin infected • Keep fingernails short/clean to avoid skin breaks from scratching
Insect bites	• Use insect repellent and other mosquito and flea control measures • Identify (and treat) insect bites early • Avoid scratching (calamine and antihistamines may be useful)

Future events	• Visit GP if develop any sore or redness:
	  • Size of a 5 cent coin (or bigger)
	  • Near the eye (see Doctor urgently)

Relevant resources include: "Clean, Cut, Cover" card; "Go to the Doctor" card; "Skin Infections" pamphlet. Available from Charlotte Esser, Health Promotion Resource Centre (charlottee@adhb.govt.nz, Phone (09) 262 1855, Fax (09) 630 7431)

Referral to Hospital

- Bullae, necrosis or muscle involvement
- Cellulitis in neonate
- Deep seated abscess for incision and drainage
- Extensive and/or rapidly progressing disease
- Failure to respond to treatment in 48 hours
- Immunocompromised
- Orbital cellulitis
- Significant co-morbidity
- Signs of septicaemia (e.g. fever, tachycardia, hypotension)
- Suspected septic arthritis or osteomyelitis
- Uncertain diagnosis
- Unfavourable social circumstances

Recurrence

Condition	Management
Cellulitis and erysipelas	• Treat underlying tinea pedis and other skin conditions where applicable • Lymphoedema reduction (e.g. support stockings or bandages) • Consider erythromycin, penicillin or clindamycin prophylaxis for recurrent cellulitis (limited evidence to support this)
Impetigo	• First line: Nasal eradication of staphylococcal reservoir with topical mupirocin 2-4 times daily for 5 days • Second line: Culture other common sites for S. aureus (e.g. fingernails, perineum, toe webs and axillae) and eradicate if positive • Third line: Concurrent use of systemic antimicrobial such as rifampicin 300mg BD PO for 5 days
Folliculitis, boils and abscesses	• Assess for diabetes • Elimination of nasal carriage of S. aureus (see above)

Appendix 4. Strategic significance

Alignment with BOPDHB strategies and goals

- BOP DHB District Annual Plan 2009/2010[37] – Ambulatory sensitive hospital admissions; Healthy children, youth and families; Healthy Maori; Health equity; Primary care.
- BOP DHB District Strategic Plan 2005-2015[38] - Population health approach, healthy thriving communities.
- BOP DHB Statement of Intent 2010-2011[39]
- Te Ekenga Hou: Maori Health Strategic Plan 2008-2011.[40]
    - Tino Rangatiratanga - leveraging Maori potential to achieve Toiora;
    - Tuituinga Pou Hauora - ensure responsiveness of mainstream services;
    - He Ranga Hua Hauora - increase capacity of Maori providers and communities
- He Pou Oranga Tangata Whenua[41] – provides a framework to ensure that traditional tangata whenua values, knowledge and institutions are recognized as Toiora. (optimum health and wellbeing)

Alignment with Ministry of Health strategies

- The New Zealand Health Strategy[42] – public and population approaches to be at the centre of health sector activity with an emphasis on reducing inequalities
- He Korowai Oranga: Maori Health Strategy[43] and Whakatataka Tuarua - Maori Health Action Plan 2006-2011[44] - provide a framework for the Ministry, DHBs and key stakeholders to take a leadership role in improving Maori health outcomes.
- Whanau Ora Tool[45] - places whanau at the centre of public policy and validates cultural approaches to achieving improved health outcomes.
- An Integrated Approach to Infectious Disease [46] - classifies skin infections a medium priority disease from close physical contact.
- Health Targets - Moving towards healthier futures 2007/2008[3] - ambulatory sensitive admissions.

References

[1] O'Sullivan CE and Baker MG (2010). Proposed epidemiological case definition for serious skin infection in children. *Journal of Paediatrics and Child Health* 46, 176-183 (Accessed July 2010).

[2] O'Sullivan, CE, Baker, MG and Zhang, J (2010). Increasing hospitalizations for serious skin infections in New Zealand children, 1990-2007. *Epidemiolol.Infect.* 2010 Dec 15:1-11. [Epub ahead of print]

[3] Baker M et al. Close-contact infectious diseases in New Zealand: Trends and ethnic inequalities in hospitalizations 1989 to 2008. University of Otago, Wellington, June 2010. Available at: http://www.healthyhousing.org.nz/wp-content/uploads/2010/06/Close-Contact-IDs-in-NZ-June-2010.pdf (accessed July 2010).

[4] Ministry of Health (2007). Health Targets - Moving towards healthier futures 2007/2008. Wellington: New Zealand Ministry of Health. Available at: http://www.moh.govt.nz/healthtargets (accessed August 2010).

[5] Sheerin I et al (2006) Avoidable hospitalizations: potential for primary and public health initiatives in Canterbury, New Zealand. *NZ Med J* 2006; 119(1236). Available at: http://www.nzma.org.nz/journal/119-1236/2029/ (accessed August 2010).

[6] Hunt D (2004). Assessing and Reducing the Burden of Serious Skin Infections in children and young people in the Greater Wellington Region. Wellington: Capital and Coast DHB, Hutt Valley DHB, Regional Public Health, 2004. Available at: http://www.skininfections.co.nz/documents/Serious_Skin_Infections_Nov2004.pdf (accessed June 2010).

[7] Morgan C, Selak V, Bullen, C. (2004) Glen Innes Serious Skin Infection Prevention Project: Final Report 1 February 2003-31 January 2004. Available at: http://www.arphs.govt.nz/Publications_Reports/archive/GlenInnesSkinProject.pdf (accessed June 2010).

[8] Accident Compensation Corporation (2006). ACC Review: Cellulitis. Issue 25, ACC provider Development Unit. Available at: http://www.acc.co.nz/PRD_EXT_CSMP/groups/external_providers/documents/guide/prd_ctrb113166.pdf (accessed May 2010).

[9] Primary Options Auckland, Counties Manukau & Waitemata. Primary Options for Acute Care: Management of adult cellulitis. Available at: http://www.primaryoptions.co.nz/sites/site_files/1265/upload_files/Primary_Optio13.pdf (accessed June 2010).

[10] Health Protection Agency (2009). Investigation of skin, superficial and non-surgical wound swabs. National Standard Method BSOP 11 Issue 5. Available at: http://www.hpa-standardmethods.org.uk/pdf_sops.asp (accessed May 2010).

[11] Craig, E, Jackson, E and Han DY (2007). The Health of Children and Young People in the Bay of Plenty. Auckland: UniServices. Available at: http://www.bopdhb.govt.nz/PlanningFunding/PDFs/children07_part1.pdf (accessed August 2010).

[12] De Wet, N (2009) The Bay Of Plenty DHB condition specific report for the 00-04 age group for the year to 30 September 2009. Unpublished document.

[13] Wilson, N and Malcolm, J. Whakatane Bronchiolitis, NZ Paediatric Society 2009 (unpublished)

[14] Swan J, Lillis S, Simmons D (2009). Investigating the accuracy of ethnicity data in New Zealand hospital records: still room for improvement *NZMJ*, 4 August 2006; Vol 119 (No 1239) Page 1 to 7.

[15] Leversha A. Starship Hospital Cellulitis Case-Control Study. Preliminary results reported in Morgan C, Selak V, Bullen, C. (2004) Glen Innes Serious Skin Infection Prevention Project: Final Report 1 February 2003-31 January 2004. Available at: http://www.arphs.govt.nz/Publications_Reports/archive/GlenInnesSkinProject.pdf (accessed May 2010).

[16] Regional Public Health (2007). Evaluation of the reducing serious skin infections project. Wellington: Regional Public Health. Available at: http://www.skininfections.co.nz/documents/Skin%20Infections%20Evaluation.pdf (accessed May 2010).

[17] Bolton, P (2009). Prevalence of Impetigo in the Bay of Plenty. Unpublished report. Toi Te Ora-Public Health Service.

[18] Lennon, D (2009). Can we reduce Maori and Pacific school children's hospitalizations to Pakeha rates? Unpublished document.

[19] Goddard, J and Rademaker, L (2008). General Practitioner Initiated Community Management of Cellulitis. Final Report April 2008. Available at: http://www.waikatodhb.govt.nz/file/fileid/7845 (accessed May 2010)

[20] Evans, S and Hendry C (2009). Clinical audit as a method of validating or refuting nurses' 'intuition' about the efficacy of care options for patients in the community with acute cellulitis. Available at: http://www.nzichc.org.nz/images/pdfs/Acute_Cellulitis_Report_Final.pdf (accessed August 2010)

[21] Morgan C, Selak V, Bullen, C. (2004) Glen Innes Serious Skin Infection Prevention Project: Final Report 1 February 2003-31 January 2004. Appendix 10. Community IV Antibiotic Service Discussion Paper. Available at:

http://www.arphs.govt.nz/Publications_Reports/archive/GlenInnesSkinProject.pdf (accessed May 2010).

[22] Koning S et al (2009). Interventions for impetigo (Review). The Cochrane Collaboration. Published by John Wiley and Sons Ltd. Available at: http://onlinelibrary.wiley.com/o/cochrane/clsysrev/articles/CD003261/frame.html

[23] Kilburn SA, Featherstone P Higgins B and Brindle R (2010). Interventions for cellulitis and erysipelas (Review). The Cochrane Collaboration. Published by John Wiley and Sons Ltd. Available at: http://www2.cochrane.org/reviews/en/ab004299.html

[24] Birnie AJ, Bath-Hextall FJ, Ravenscroft JC and Williams HC. Interventions to reduce Staphylococcus aureus in the management of atopic eczema (Review). The Cochrane Collaboration. Published by John Wiley and Sons Ltd. Available at: http://www2.cochrane.org/reviews/en/ab003871.html

[25] Currie BJ and Carapetis JR. Skin infestations in Aboriginal communities in northern Australia,. *Australasian Journal of Dermatology*. 41 (3), 139-145.

[26] Cooperative Research Centre for Aboriginal Health. Healthy Skin Programme Statement. Available at: http://www.crcah.org.au/research/downloads/HS-Program-Statement-update-06.pdf (accessed July 2010)

[27] McDonald M, Currie BJ, Carapetis JR (2004). Acute Rheumatic Fever: a chink in the chain that links the heart to the throat*? Lancet Infect Dis* 4: 240-245

[28] Kaplan EL and Bisno AL (2006). Antecedent streptococcal infection in acute rheumatic fever. *Clin Infect Dis*. 43; 690-692 (Editorial commentary)

[29] Cooperative Research Centre for Aboriginal Health (2006). Filling the Gaps in the Healthy Skin Program. Available at: www.crcah.org.au/research/**filling_gaps_healthy_skin_program**.html (accessed August 2010)

[30] Allen CH, Patel BP and Endom EE (2004). Primary bacterial infections of the skin and soft tissues changes in Epidemiology and management. *Clinical Paediatric Emergency Medicine*. 5 (4), 246-255.

[31] Estivariz, CF, Park, SY and Hageman, JC et al. (2007). Emergence of community associated methicillin resistant Staphylococcus aureus in Hawaii, 2001-2003. *Journal of Infection*. 54, 349-357.

[32] World Health Organisation (2005). Epidemiology and Management of Common Skin Diseases in Children in Developing Countries. http://whqlibdoc.who.int/hq/2005/WHO_FCH_CAH_05.12_eng.pdf (accessed September 2010).

[33] Cited in Ministry of Health, National Heart Foundation of New Zealand (2010). Advice for the Ministry of Health for Best Practice for Rheumatic Fever Control. Available at:

http://www.paediatrics.org.nz/files/2010/Advice%20for%20the%20Ministry%20of%20Health%20for%20Best%20Practice%20for%20Rheumatic%20Fever%20Control-08%2006%2010.pdf (accessed August 2010).

[34] Schoen C, Doty MM (2004). Inequalities in access to medical care in five countries: findings from the 2001 Commonwealth Fund International Health Policy Survey. Health Policy. 2004;67: 309-322. Cited in New Zealand Rheumatic Fever Writing Group (2009). *Rheumatic Fever Guideline 3: Proposed Rheumatic Fever Primary Prevention Programme*. Available at: http://www.nhf.org.nz/files/Rheumatic%20Fever%20Guideline%203.pdf (accessed Nov 2009).

[35] Ministry of Health (2006). Tatau Kahukura: Maori Health Chart Book. Public Health Intelligence monitoring Report No.5. Wellington. Ministry of Health. 1-79. Available at: http://www.moh.govt.nz/moh.nsf/pagesmh/3395?Open (accessed August 2010)

[36] Ministry of Health (2004). Child and youth health toolkit: Ensuring access to appropriate health care services including well child and family health care and immunization. Wellington, Ministry of Health.

[37] BOPDHB (2009) District Annual Plan 2009/2010. BOPDHB. Available at: http://webfront/PDFs/BOPDHBDAP0910.pdf (accessed August 2010).

[38] BOP DHB District Strategic Plan 2005-2015. BOPDHB. Available at: http://webfront/PDFs/5444%20BOPDHB%20DSP_WEB.pdf (accessed August 2010).

[39] BOPDHB Statement of Intent (2009) Available at: http://webfront/PDFs/BOPDHB_SOI_0910.pdf (accessed August 2010).

[40] BPODHB (2008) Te Ekenga Hou: Maori Health Strategic Plan 2008-2011. Available at: http://webfront/PlanningFunding/maoriplanning.aspx (accessed August 2010)

[41] BOPDHB (20 He Pou Oranga Tangata Whenua. Available at: http://webfront/PlanningFunding/maoriplanning.aspx (accessed August 2010)

[42] Ministry of Health (2000). The New Zealand Health Strategy. Wellington: Ministry of Health Available at: http://www.moh.govt.nz/publications/nzhs (accessed August 2010).

[43] Ministry of Health, (2002). He Korowai Oranga: Maori Health Strategy. Wellington: Ministry of Health. Available at: http://www.moh.govt.nz/mhs.html (accessed August 2010).

[44] Ministry of Health (2002). Whakatataka (Maori Health Action Plan 2002-2005). Wellington. Ministry of Health. Available at: http://www.moh.govt.nz/moh.nsf/by+unid/2860946B115F26EACC25723B00032ADD?Open (accessed August 2010).

[45] Ministry of Health (2007). Ministry of Health. Whānau Ora Health Impact Assessment. Wellington: Ministry of Health. Available at: http://www.moh.govt.nz/moh.nsf/indexmh/whanau-ora-hia-2007?Open (accessed August 2010).

[46] Ministry of Health (2001). An Integrated Approach to Infectious Disease: Priorities for Action 2002-2006. Wellington. Ministry of Health. Available at: http://www.moh.govt.nz/moh.nsf/0/B1A861634F82C22CCC256AFA00792AF6/$File/integratedapproachtoinfectiousdisease-prioritiesforaction.pdf (accessed August 2010).