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National Healthy Skin Guideline

For the Diagnosis, Treatment and Prevention of Skin Infections for Aboriginal & Torres Strait Islander Children and Communities in Australia

2nd Edition | October 2023

Acknowledgement of Country

We acknowledge Aboriginal and Torres Strait Islander people as the Traditional Custodians of the land, sky and waters of Australia. We acknowledge the Elders and seek their wisdom in our work to improve the skin health of all children. We acknowledge the Aboriginal and Torres Strait Islander people who have contributed to the development of these guidelines, and Aboriginal and Torres Strait Islander clinicians and families across Australia who will use and benefit from the information contained in the guidelines.

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Cover artwork ‘Gathering Circles’, 2020

Gathering Circles tells the the story of the
SToP (See, Treat, Prevent) Skin Sores and Scabies Trial.

The circles represent the nine Aboriginal communities working with the SToP Trial. In Riches’ words, *“The circles vary in colour and composition, just as the communities hold their own unique identities”*

“The backdrop of pindan orange and coastal blues convey the land and sea setting that makes the Kimberley so beautiful. The dot painted trails show a connection between the communities, of both foot trails and song lines that unite the people”.

Follow Luke @joordah_art

The graphic design of this Guidelines was carried out by Kelli Savietto. She is proudly of Nyikina, Yawuru heritage from the Kimberley of Western Australia.

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The Australian Healthy Skin Consortium 2023

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The Australian Healthy Skin Consortium

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Suggested citation

The Australian Healthy Skin Consortium. *National Healthy Skin Guideline: for the Diagnosis, Treatment and Prevention of Skin Infections for Aboriginal and Torres Strait Islander Children and Communities in Australia* (2nd edition), 2023.

ISBN

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The Peter Doherty Institute for Infection and Immunity

Australasian Society for Infectious Diseases (ASID)

Public Health Association of Australia (PHAA)

Council of Remote Area Nurses of Australia (CRANA)

Queensland Aboriginal and Islander Health Council (QAIHC)

Heart Foundation

The Royal Australasian College of Physicians (RACP)

Healthy Skin, Healthy Kids Clinical Reference Group

Telethon Kids Institute (TKI)

Menzies School of Health Research (Menzies)

Acronyms and abbreviations

AD	Atopic dermatitis
ARF	Acute rheumatic fever
ARR	Adjusted relative risk
ASPGN	Acute post-streptococcal glomerulonephritis
BPG	Benzathine benzyl Penicillin G
BSA	Body surface area
CARPA	Central Australian Rural Practitioners' Association
CI	Confidence Interval
CPAR	Community Participatory Action Research
DA	Diethylcarbamazine and albendazole
FBE	Full Blood Examination
GRADE	Grading of Recommendations Assessment, Development and Evaluation
IDA	Ivermectin, diethylcarbamazine and albendazole
IM	Intramuscular
IVM	Ivermectin
LFT	Liver Function Test
MC	Molluscum contagiosum
MDA	Mass Drug Administration
MRSA	Methicillin-resistant *Staphylococcus aureus*
NT	Northern Territory
PBS	Pharmaceutical Benefits Scheme
PCR	Polymerase Chain Reaction
RHD	Rheumatic heart disease
S. aureus	*Staphylococcus aureus*
SAT	Screen and treat
SToP	SToP (See, Treat, Prevent) Skin Sores and Scabies Trial
Strep A	Group A Streptococcus, *Streptococcus pyogenes*
TBSA	Total body surface area
U&E	Urea and electrolytes
WA	Western Australia
WHO	World Health Organization

Definitions

Indigenous people	People who self-identify themselves as being part of a distinct cultural group who maintain their cultural and social identities and the traditional social, economic, cultural and political customs that are seen as separate from the dominant society or culture in a geographically distinct area. Indigenous people are descended from groups present within a geographically distinct traditional habitat or ancestral territories before current states and borders were defined.[1] There are > 200 distinct Aboriginal and Torres Strait Islander Nations across Australia.
Organisation for Economic Cooperation and Development (OECD)	A forum of 34 governments from democratic countries with market economies. OECD countries account for a substantial proportion of the world gross domestic product, world trade and energy consumption.[2]
World Bank Country Classification	All 189 World Bank member countries, plus 28 other economies with populations > 30,000, are classified by gross national income (GNI) per capita, in U.S. dollars in 2016, into four income groupings: low (<= $1,045), low-middle ($1,046-4,125), upper-middle ($4,126-12,735) and OECD (> $12,735).[2] In this review, countries were classified according to the 2022 fiscal year classification, rather than the classification at the time the study was conducted.[2]

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A/Professor Asha Bowen

A/Professor Glenn Pearson

Foreword

We respectfully acknowledge the many Aboriginal and Torres Strait Islander Nations that have cared for and stewarded the land, water, skies and seas of Australia for thousands of years. We acknowledge the wisdom and contribution of Elders caring for country that has never been ceded.

Healthy skin is important for overall health. The skin acts as a barrier to protect us. As the largest and only visible organ of the body, maintaining skin health is one aspect of holistic healthcare. Since colonisation, Aboriginal and Torres Strait Islander children and communities have not always been afforded the respect and dignity needed to maintain healthy skin. Whilst some Aboriginal and Torres Strait Islander Australians experience healthy skin, achieving healthy skin for all is a priority. This guideline helps clinicians with identification and holistic care to support Aboriginal and Torres Strait Islander Australians to maintain healthy skin.

This edition of the National Healthy Skin Guideline has a new focus with the addition of three skin conditions (atopic dermatitis, molluscum contagiosum and head lice) recognised for their high burden in Australian Aboriginal and Torres Strait Islander people. Impetigo, scabies, crusted scabies, fungal skin infections, atopic dermatitis, molluscum contagiosum and head lice are too often considered by health practitioners, and sometimes by affected people and families themselves, as minor irritants or even as “normal”. Yet research over the past two decades has proven that these skin diseases are important causes of morbidity and antecedent substantial mortality from invasive bacterial infection and autoimmune sequelae in Australian Indigenous communities and in many overseas populations.

While recognising that addressing the primordial factors underlying these conditions is required for sustainable control, there are “best-evidence” public health and therapeutic approaches that can right now make substantial improvements to individuals and their families and communities. These guidelines also recognises that each person, family and community are held by the strength of their culture, want the best health for their children and have the ability to address the challenges of skin health if complemented by health services that work through these strengths.

This updated guideline has taken into consideration changes in treatment availability or regulatory changes in therapeutic indications and is designed to help practitioners and policy makers diagnose, treat and prevent skin infections. The recommendations have been aligned with key source references that are used in different regions of Australia and links are provided to regional guidelines. The online version links to further resources, such as photographic descriptors. This guideline will have a reach not only throughout Australia but also to overseas communities.

Finally, while providing the most informed, evidence-based recommendations available, many gaps in knowledge and best practice are also highlighted, spanning health promotion to clinical and laboratory studies, and thus should serve as a stimulant and guide for further research on skin health.

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Summary of changes from 1st Edition (2018)

Chapter 1: Introduction

- Update to aims.
- Expansion of guideline to include evidence useful for the urban context.
- Inclusion of new conditions: atopic dermatitis, molluscum contagiosum and head lice.
- The abbreviation used for Group A Streptococcus throughout the guideline is 'Strep A' (previously 'GAS').

Chapter 2: Process for development of the National Healthy Skin Guideline

- Inclusion of updated systematic review and Scientific Advisory Group to inform Second Edition of the National Healthy Skin Guideline.

Chapter 3: Social determinants of health and primordial prevention of skin infections

- This chapter has been significantly expanded, updated and moved to the beginning of the guideline.
- Update to Environmental Health section (inclusion of Nine Healthy Living Practices).
- Close living and household **crowding** (previously Close living and household **overcrowding**).
- A new section on housing improvements is provided.
- Removed 'Current research underway' section.
- Removed 'Unanswered questions for future research' section.

Chapter 4: The evidence for skin disease control programs to reduce scabies, impetigo and head lice

- Chapter updated to include head lice studies.
- Inclusion of programs reported on since 2018.
- A new section on the recently published systematic review of Mass Drug Administration for scabies is provided.

Chapter 5: Recognition and diagnosis of skin infections

- A new section on training resources for community is provided.
- A new section on stigma and racism is provided.
- Inclusion of 'steps in preparing for clinic consultations in skin health'.
- Update to skin swab collection (removal of glass slides).

Chapter 6: Impetigo (skin sores)

- Updated recommendations for the treatment of impetigo.
- Inclusion of topical antibiotics for low burden disease (previously not recommended).
- Updated recommendations for prevention of impetigo - MDA may be of benefit in certain contexts (previously not recommended).
- Impetigo recognised as the result of infection with *Staphylococcus aureus* **and/or** *Streptococcus pyogenes* (previously 'or').

- Burden of skin infections provided (previously ‘prevalence of skin infections elsewhere in rural and remote Australia is also likely to be high, but precise numbers are unknown’).
- Removed ‘Current research underway’ section.
- Removed ‘Unanswered questions for future research’ section.

Chapter 7: Scabies

- Updated recommendations for the treatment of scabies.
- Amendment to weight bands in ‘Weight band dosing for oral ivermectin’.
- Update to Prevent Discussion ‘there is **high quality** evidence to support the use of MDA to control scabies in resource-limited communities’ (previously ‘**moderate quality**’).
- Removed ‘Current research underway’ section.
- Removed ‘Unanswered questions for future research’ section.

Chapter 8: Crusted scabies

- Updated recommendations for the treatment of crusted scabies, including additional steps in treatment regime.
- Removed ‘Crusted scabies control programs’ section.
- Removed ‘Current research underway’ section.
- Removed ‘Unanswered questions for future research’ section.

Chapter 9: Fungal Infections (Tinea)

- Updated recommendations for the treatment of Tinea.
- Further clinical description/detail in sections: Tinea capitis (scalp tinea), Tinea unguium / onychomycosis (nail tinea).
- **White spot**, previously referred to as **white hanky** for Pityriasis versicolor.
- Inclusion of oral griseofulvin doses.
- Inclusion of ‘Precautions with all oral anti-fungal agents (including terbinafine, griseofulvin, itraconazole, fluconazole)’.
- Inclusion of treatment recommendations for Pityriasis versicolor.
- Removed ‘Current research underway’ section.
- Removed ‘Unanswered questions for future research’ section.

Chapter 10: Atopic dermatitis

- This is a new chapter.

Chapter 11: Headlice

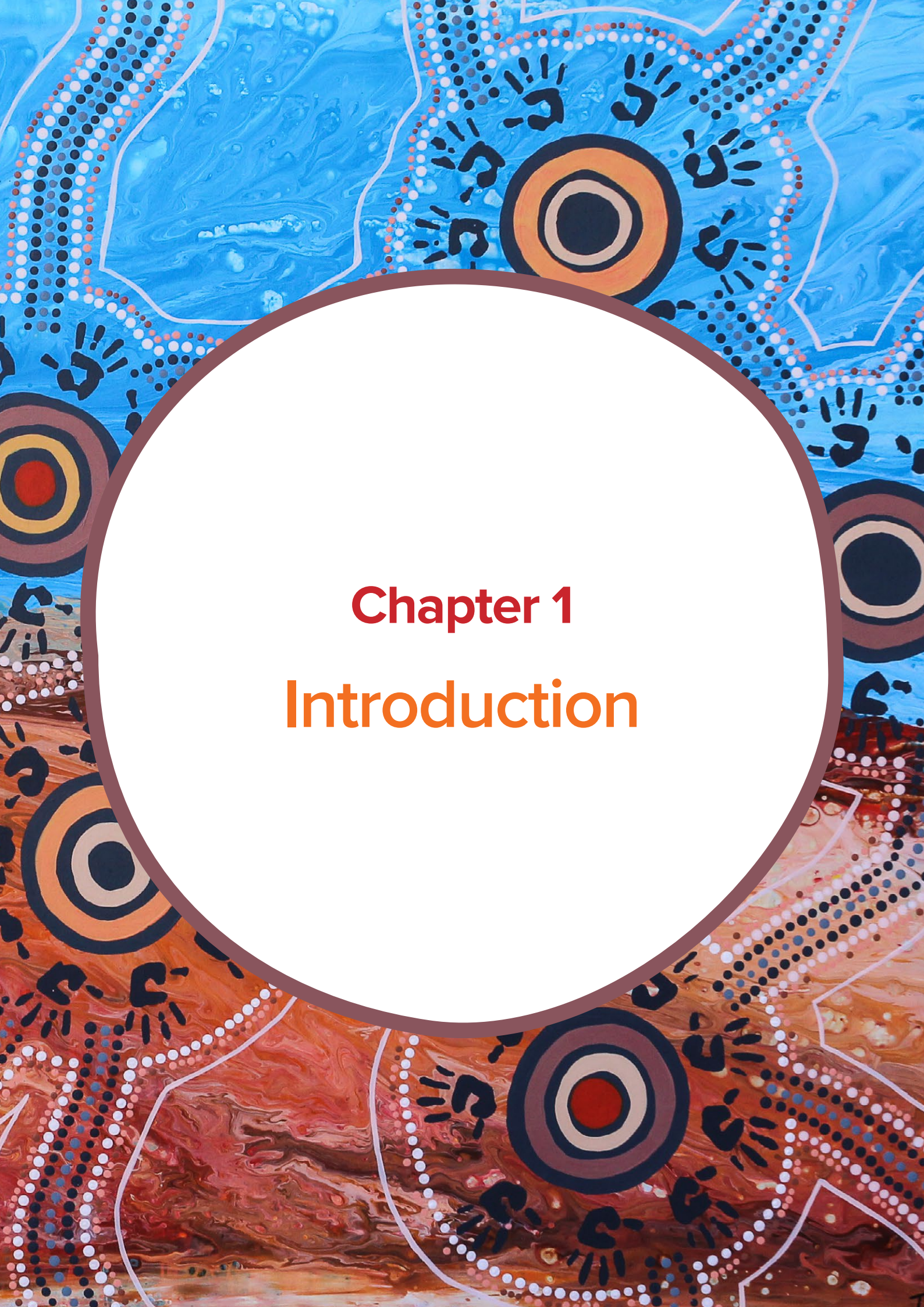
- This is a new chapter.

Chapter 12: Molluscum contagiosum

- This is a new chapter.

Chapter 13: Health Promotion Resources

- This is a new chapter.



Chapter 1

Introduction

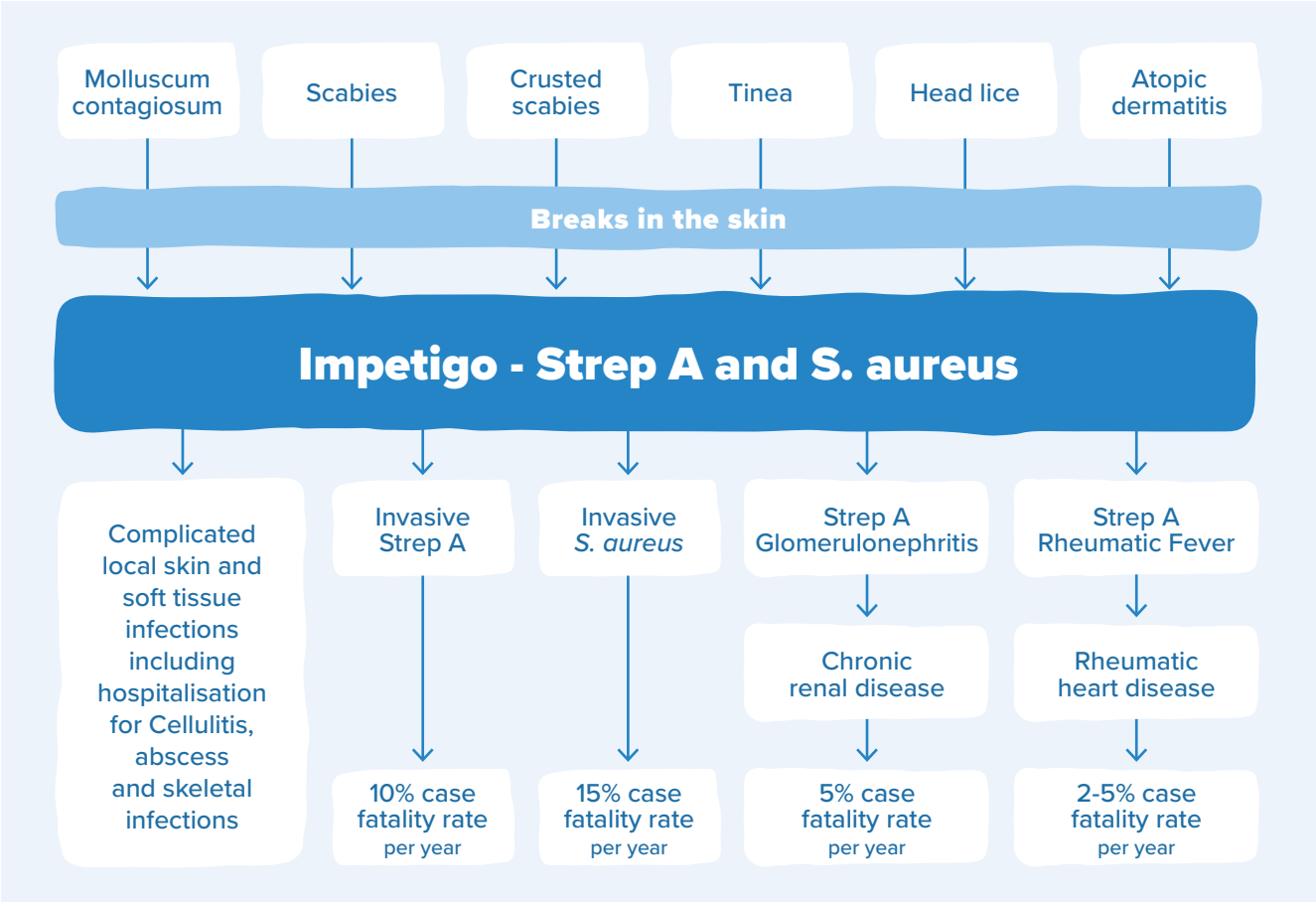
Background

Skin infections are widespread and are among the most prevalent and disabling diseases in the world. The Global Burden of Disease study (2010) found that skin infections were the fourth leading cause of non-fatal health burden, expressed as years lost to disability,[3] and noted an 'urgent need for the inclusion of skin disease prevention and treatment in national and global health policies'.[3] The study also noted that strategies to manage and control skin disease are an effective and necessary use of health resources.[3] Healthy skin is a human right.

Over the past thirty years, the epidemiology of skin infections in various Australian communities has been described and contributed significantly to global knowledge. Aboriginal and Torres Strait Islander children living in remote communities of Australia have the unenviable position as world leaders in burden of both impetigo (**Chapter 6**) and scabies (**Chapter 7**), owing to poorer living conditions, remoteness and distance from healthcare and service providers, lack of access to well-maintained health infrastructure (healthy housing, food security, safe drinking water, effective sanitation) and ongoing transmission of parasitic, bacterial and fungal skin infections.[4,5] These primordial factors and social determinants of health including avoidable and systematic health inequalities influence the ongoing high burden of skin infections and their downstream consequences (Figure 1).

Opportunities to achieve healthy skin include prevention activities, addressing healthcare provider knowledge about the overall impact of skin infections and generating an evidence base for more effective treatment and prevention recommendations. Below we address these three areas to arrive at the key aims of the Second Edition of the National Healthy Skin Guideline.

Figure 1. Complications of skin infections. Adapted from Engelman et al.[6]



Prevention

Primordial prevention strategies are the social, economic or environmental initiatives that can be undertaken to reduce the risk of skin infection. Strategies to improve living conditions through health hardware maintenance, community-based environmental health activities and housing programs are examples that have been recommended to reduce the transmission of skin infections.

Primary prevention strategies aim to stop the disease from progressing to a more serious complication. Primary prevention strategies are applied to a whole population or those at increased risk. Treatment of skin infections to improve overall health and wellbeing are examples of primary prevention. Treatment of impetigo is also a key component in the primary prevention of acute post streptococcal glomerulonephritis (APSGN) and acute rheumatic fever (ARF).

Secondary and tertiary prevention aims to limit the progression and reduce the severity of the disease through improved treatment. Secondary prevention strategies are in response to an initial infection and aim to prevent more serious sequelae from occurring. For example, following the initial treatment of crusted scabies, secondary prevention strategies aim to keep the patient scabies-free and living in a scabies-free environment, to avoid subsequent severe disease.

Preventing the morbidity and mortality that arise from bacterial infections with the skin as an entry point, e.g. skeletal infections, sepsis, severe soft tissue infections, APSGN and ARF, are examples of tertiary prevention.

Health impact of skin infections

Impetigo, scabies, fungal infections, atopic dermatitis and molluscum contagiosum are predominantly seen in the primary healthcare sector,[7] or not at all because they are considered 'normal' in Australian Aboriginal and Torres Strait Islander communities by children, their families and healthcare providers.[8] This ongoing epidemic of skin infection, which has remained essentially unchanged over five decades, has significant consequences (Figure 1).

As the largest organ of the body, the skin is visible to everyone. Skin infections are unsightly, painful and the ongoing inflammation associated with skin infections contributes to general poor health. Recurrent skin infections have other consequences for individual wellbeing, growth and educational development. Bacterial skin infections are usually caused by *Staphylococcus aureus* (*S. aureus*) and *Streptococcus pyogenes* (Strep A).

The risk of death from *S. aureus* sepsis and bloodstream infection, which has an estimated global incidence of between 20 to 50 cases/100,000 population per year, is between 5% and 25%. This equates to a greater number of deaths than HIV/AIDS, tuberculosis and viral hepatitis combined in industrialised countries.[9] In Australia and New Zealand, *S. aureus* sepsis has a mortality rate between 3% and 5% in children aged under 18 years, with poorer outcomes in Indigenous children of both countries.[10] Recent data confirms scabies as an important predisposing condition for fatal *S. aureus* sepsis.[11]

Worldwide, at least 163,000 people die from Strep A sepsis each year.[12] In addition, Strep A infection can result in acute rheumatic fever (ARF) and acute post streptococcal glomerulonephritis (APSGN) in children, which in turn has the long term consequences of chronic heart and kidney disease respectively. In industrialised countries, ARF and APSGN have been all but eliminated due to improvements in housing, hygiene and the evolution of accessible and effective clinical treatments.[13] However, even within resource-rich countries such as Australia, these conditions persist in communities where impetigo is endemic and where environmental and primordial factors have not been addressed, and the inequitable social determinants of health continue to contribute.

Evidence basis for recommendations

Systematic reviews of the best clinical treatment for skin infections have used randomisation in clinical trials as the criteria for inclusion.[14-19] This excludes a large body of available evidence, although lower quality, from resource-limited settings.[20-23] Non-randomised trials and observational studies may be the best and only available evidence in many poorer populations due to lower cost, feasibility[24] and for ethical considerations.[25] Furthermore, randomised controlled trials are often conducted in hospital outpatient clinics in resource-rich populations, and these findings may not be directly applicable to resource-limited settings where cultural practices, acceptability of treatments and access to these treatments may differ considerably. There is a lack of agreement on the best treatments and population health approaches for the prevention and control of skin infections, both for individuals and communities, in resource-limited settings.

Prior to our original systematic review in 2018, there had not been a review of the evidence that is externally valid to these populations. We therefore conducted a systematic review of studies in resource-limited settings regarding the prevention, treatment and public health management of impetigo, scabies, crusted scabies and fungal skin infections.[26] In 2022, we commenced the update of this systematic review assessing the diagnosis, treatment and prevention of skin infections (impetigo, scabies and crusted scabies, tinea, molluscum contagiosum, and head lice) in resource-limited settings. We also added atopic dermatitis as a chapter due to the frequency with which this is seen in Australian Aboriginal and Torres Strait Islander children. Both the original systematic review and the updated systematic review informed the development of this national evidence-based guideline for skin infections in Indigenous populations.

Additional evidence that was drawn on came from two Cochrane systematic reviews that summarise the evidence for treatment of impetigo[14] and scabies.[27] However, they predominantly include studies from urban, outpatient, non-epidemic settings, and hence extra work was needed to provide recommendations valid to the clinical setting. To complement this, the evidence for the guideline recommendations that relate to the heavy burden of skin infections in Australian Aboriginal and Torres Strait Islander children in remote settings has been summarised and assessed using the GRADE approach.[28]

Key aims

The key aims of this Second Edition of the National Healthy Skin Guideline are:

- **to provide guidance for the recognition of skin conditions;**
- **to provide practical prescribing principles for treatment of skin conditions;**
- **to evaluate evidence-informed strategies for public health control; and**
- **to identify strategies for achieving healthy skin and prevention of skin infections.**

Our current evidence suggests that although the burden of bacterial skin infections and parasitic skin infestations is highest in remote Aboriginal and Torres Strait Islander communities, there is also a significant burden for Aboriginal and Torres Strait Islander populations living within urban communities. Most Aboriginal and Torres Strait Islander Australians now live in cities and regional towns in Australia. This guideline has been further improved to provide advice and evidence to all Aboriginal and Torres Strait Islander Australians. As such, the recommendations in this Second Edition of the National Healthy Skin Guideline have attempted to provide evidence for all endemic situations where individual treatment and community-wide interventions are likely to be of benefit.

In the First Edition of the National Healthy Skin Guideline, impetigo, scabies, crusted scabies and tinea were identified as priority conditions needing guidelines for prevention, treatment and public health control. Recognising that up to 80% of Australia's Aboriginal and Torres Strait Islander population live in urban contexts, we have expanded the guideline to include evidence that will be useful for the urban context. The burden of head lice interacting with these conditions as well as atopic dermatitis and molluscum contagiosum are well recognised, and therefore these have been included in this edition. Whilst these were not included in the First Edition due to resource constraints, inclusion of these conditions will add value to the reader working with Indigenous children, their families and communities.

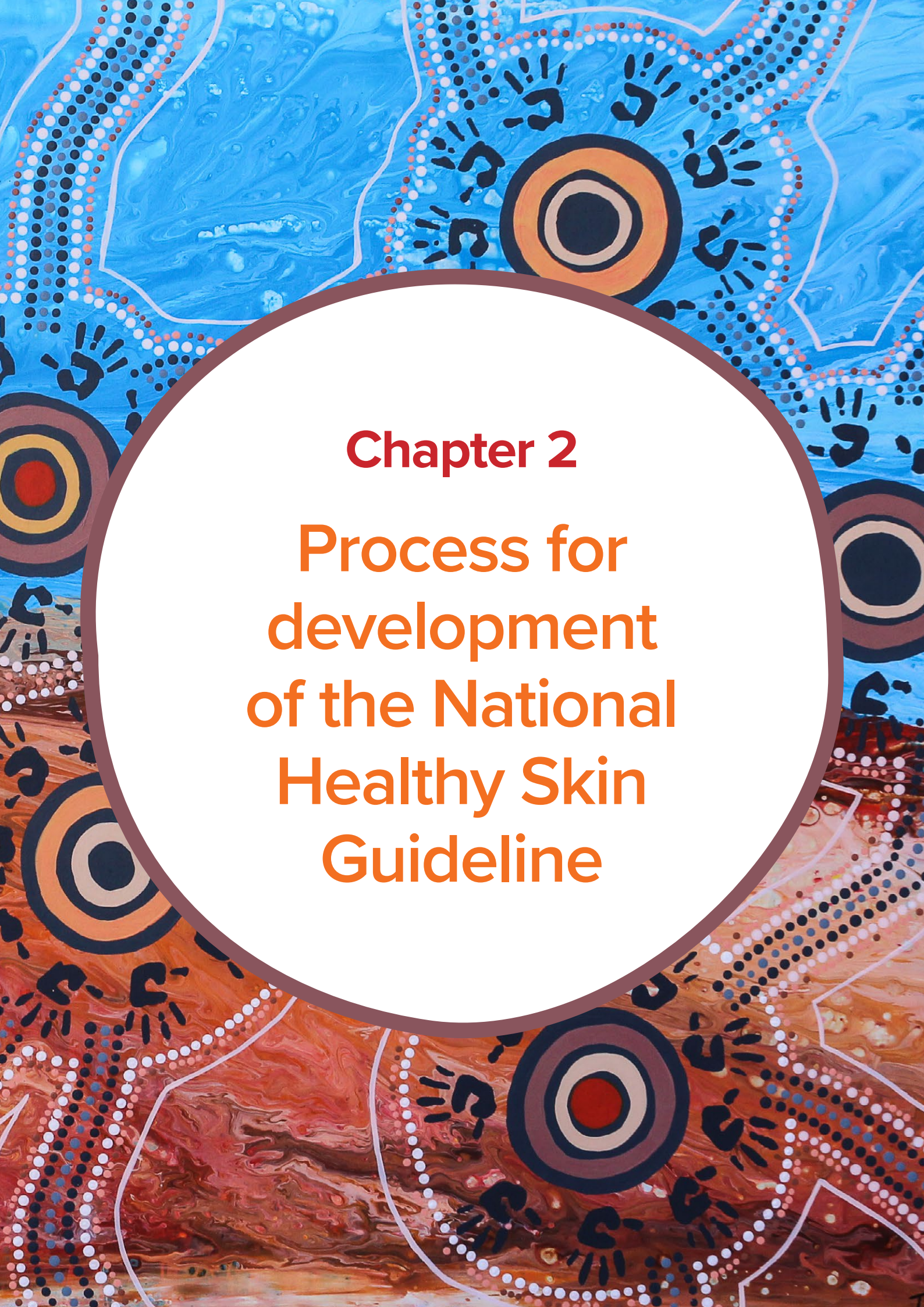
Target audience

This guideline provides a detailed discussion of the evidence regarding treatment of skin infections in endemic settings. We anticipate they will be helpful to healthcare providers who work in these settings to improve diagnosis and treatment of these skin infections.

Health professionals include medical, nursing, allied health and Aboriginal healthcare providers. For the purposes of this document, the terms 'Aboriginal,' 'Indigenous' and 'Aboriginal and Torres Strait Islander people' have been used respectively and interchangeably, in accordance with the references used. We recognise and acknowledge the strong diversity between Aboriginal and Torres Strait Islander cultures, and we do not intend to diminish any identity.

Outline of the guideline

This Second Edition of the National Healthy Skin Guideline has been developed to describe the available evidence for the diagnosis, treatment and prevention of skin infections and skin diseases that are commonly experienced by Aboriginal and Torres Strait Islander people in Australia. These include impetigo (also known as skin sores or pyoderma), scabies and crusted scabies, tinea of the skin, scalp and nails, atopic dermatitis, molluscum contagiosum and head lice. The available evidence has been graded and synthesised into tables and text to guide the reader in understanding the treatment recommendations that are summarised at the end of each chapter. These recommendations, which are aligned with key source references that are used in different regions of Australia for the management of skin infections including Therapeutic Guidelines: Antibiotic; the Central Australian Rural Practitioners Association (CARPA) Standard Treatment Manual; were also reviewed in the first iteration and the recommendations in this document were aligned with these documents where possible. This National Healthy Skin Guideline is available on the internet as a downloadable PDF. The companion visual clinical handbook including the evidence-based treatment recommendations has also been updated as a resource for healthcare workers. A quiz on the recognition and diagnosis of skin infections is also available: Recognition and diagnosis of skin infections. Health promotion resources are also linked to the guideline to aid communities and families in understanding actions that are needed to address skin infections.



Chapter 2

Process for development of the National Healthy Skin Guideline

Systematic review

The first step in the development of this guideline was a systematic review of the treatment and management of skin infections in resource-limited settings, conducted in 2018 and now updated for the Second Edition in 2023. Two separate searches were conducted in MEDLINE, PubMed, Embase, CINAHL, Cochrane and Web of Science. The first search was an update of the 2018 systematic review[26] using the same skin conditions (impetigo, scabies, crusted scabies and tinea) from 2018-2022. The second search included the addition of atopic dermatitis, molluscum contagiosum and head lice from 1960-2022. Reference lists of included studies and relevant systematic reviews and meta-analyses identified in the search were examined for additional eligible studies.

The Australian Healthy Skin Consortium Scientific Advisory Group

Although the evidence-based recommendations from the systematic review underpins this guideline, several practical considerations and nuances meant that a formal consensus process was required. The Scientific Advisory Group was established in August 2022 and comprised of expert clinicians in the field of skin infections (dermatologists, infectious disease specialists, general practitioners, public health experts and pharmacists) who oversaw the systematic review and the guideline recommendations through consensus meetings. The Scientific Advisory Group for the Second Edition is inclusive of Aboriginal and Torres Strait Islander clinicians alongside non-Indigenous clinicians working directly with Aboriginal communities.

Prior to conducting the systematic review and guideline development, the Scientific Advisory Group oversaw an evaluation of the First Edition. Surveys were sent to endorsing organisations, and clinicians likely to be familiar with and using the guideline any time between 2018 and 2022. The evaluation confirmed the importance and utility of the National Healthy Skin Guideline and provided a foundation for oversight of the next edition.

The formal consensus process with the Scientific Advisory Group enabled guideline development on a topic for which traditional evidence-based recommendations could not have been developed, considering the weak evidence-base identified in the systematic review. The Scientific Advisory Group members appraised and synthesised the evidence from the systematic review to inform the development of the recommendations and discuss the practical and clinical considerations of each treatment (e.g. availability, side effects, antimicrobial resistance, cost and expert clinical knowledge of efficacy). A formal consensus meeting was held in March 2023 with the members rating their agreement with each recommendation. After initial approval by the Lead Authors and Scientific Advisory Group members, all recommendations required 100% consensus by all Scientific Advisory Group members. All recommendations were finalised based on the evidence of the systematic review as well as clinical judgement and have been incorporated into this Second Edition of the guideline.

The treatment recommendations in the National Healthy Skin Guideline include only those medications that are available in Australia. Where the evidence supported the use of a medication available in Australia and practically able to be prescribed, this was included.

Level of evidence for grading recommendations

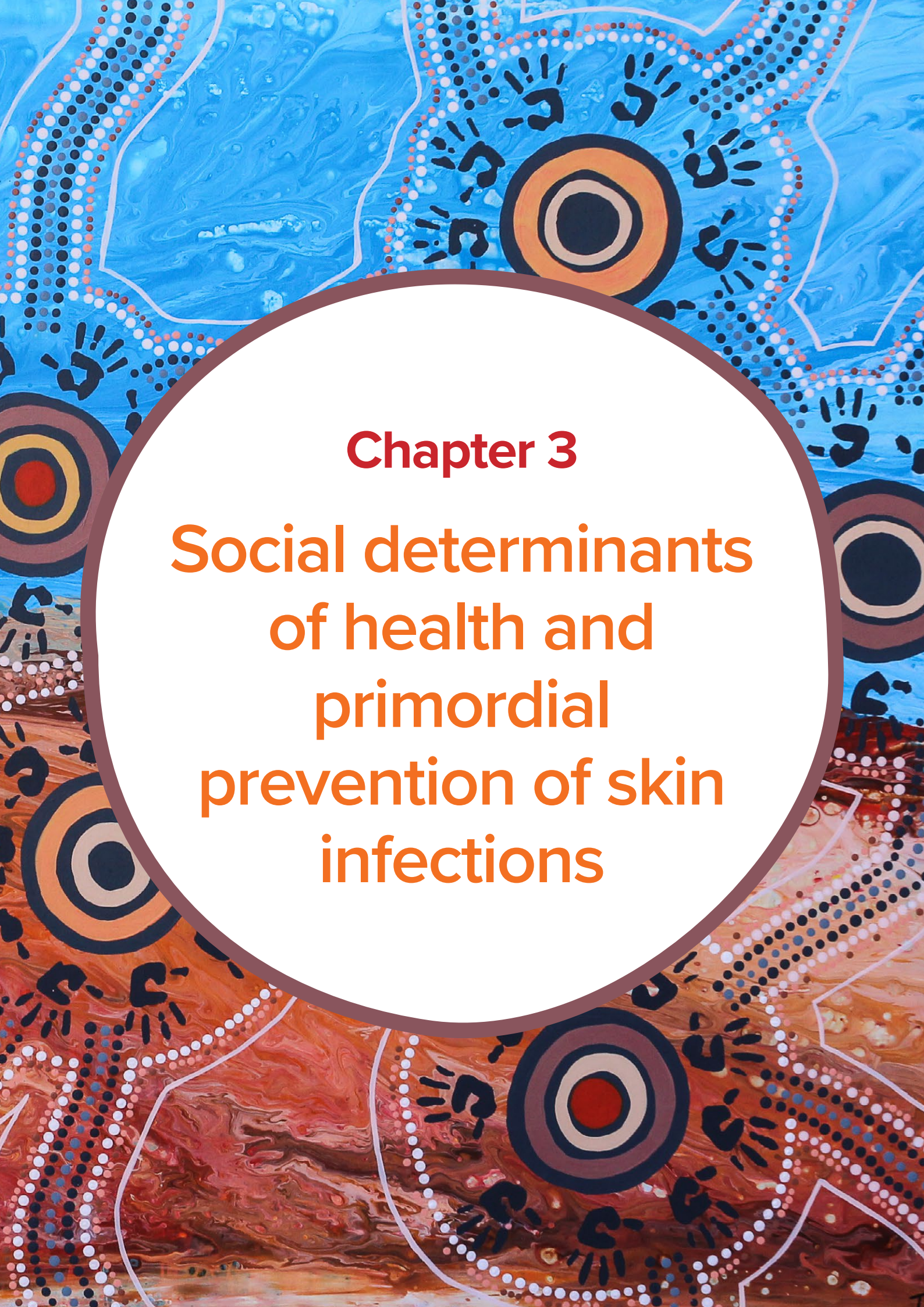
Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach:[29] an internationally recognised systematic and transparent approach to grading quality of evidence and strength of recommendations has been used in this document. The GRADE approach rates evidence across studies for specific clinical outcomes to link evidence-quality evaluations to recommendations in clinical guidelines. The GRADE codes according to the levels of evidence are shown in **Table 1** and **Table 2**:

Table 1. GRADE evidence grades.

Code	Quality of Evidence	Definition
A	**High**	Further research is very unlikely to change the level of confidence in the estimate of effect. i.e. • Several high-quality studies with consistent results
B	**Moderate**	Further research is likely to have an impact in current confidence in the estimate of effect and may change the estimate. i.e. • One high quality study • Several studies with some limitations
C	**Low**	Further research is very likely to have an important impact on the level of confidence in the estimate of effect and would likely change the estimate. i.e. • One or more studies with significant limitations
D	**Very Low**	Estimate of effect is very uncertain. i.e. • No direct research evidence • One or more studies with very significant limitations

Table 2. GRADE strength of recommendations.

Code	Quality of Evidence	Definition
1	**Strong**	**1A**: Strong recommendation, applies to most patients without reservation. Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present. **1B**: Strong recommendation, applies to most patients. Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present. **1C**: Strong recommendation, applies to most patients. Some of the evidence base supporting the recommendation is, however, of low quality.
2	**Weak**	**2A**: Weak recommendation. The best action may differ depending on circumstances of patients or societal values. **2B**: Weak recommendation. Alternative approaches likely to be better for some patients under some circumstances. **2C**: Very weak recommendation. Other alternatives may be equally reasonable. **2D**: No evidence available; expert consensus judgement.



Chapter 3

Social determinants of health and primordial prevention of skin infections

Skin infections are prevalent in Aboriginal and Torres Strait Islander communities in Australia, the consequences of ongoing colonisation, systemic racism, dispossession, inadequate housing, socioeconomic disadvantage, and consequent poverty. Improvements in health service delivery, housing, and overall socioeconomic and environmental conditions, are likely to result in improved skin health. Until this occurs, strategies to prevent skin infections are important and fall into one of four categories: primordial, primary, secondary, or tertiary. Primary prevention is the most developed strategy for management of skin infections, and this guideline has this as a major focus.

Primordial prevention is the prevention of risk factors, and generally addresses the social determinants of health to reduce the risk of skin infections. Social determinants are defined as 'the circumstances in which people grow, live, work, and age, and the systems put in place to deal with illness. The conditions in which people live and die are, in turn, shaped by political, social, and economic forces'.[31] Improvements in living conditions have been widely credited for the decreasing burden of acute rheumatic fever (ARF) and rheumatic heart disease (RHD) in most developed countries, including Australia.[32,33]

Environmental health

An individual's living environment, including air and water quality, housing maintenance, exposure to dust, waste disposal, and sewerage maintenance, impacts on their health. Most people in Australia have access to safe drinking water, electricity, rubbish management and appropriate wastewater removal services. Damage to water or electricity supplies can often be readily fixed in a timely and affordable manner. This is not the case for many remote-living Aboriginal families, who do not experience the same standards of environmental health enjoyed in the rest of Australia. The distance from regional towns often means that access to service providers and tradespeople is restricted, with maintenance of health hardware slower and more expensive. Similarly, due to socio-economic disadvantage, access to plumbing, electrical and other trades may be less affordable for some urban-living Aboriginal families. Several causes contribute to substandard housing for Aboriginal people, including the lack of investment from Australian, State and Territory Governments and a lack of coordinated planning, expenditure and monitoring between them.[34]

An example of a practical environmental health recommendation for skin health is where washing machines are unavailable, broken or awaiting repair, as it may not be possible to wash clothes and household linen in hot water to reduce the bacterial and parasitic load from skin fomites. In these circumstances, isolating clothing and linen in a sealed plastic bag and/or exposing to sunlight for one week is a commonly recommended alternative in order to kill the scabies mite or bacteria through ultraviolet light, heat and dehydration.[35,36] A recent experiment demonstrated that the isolation period should be at least 3 days in temperate dry conditions (22°C, 55% relative humidity) and 8 days in warm-humid conditions (26°C, 80% relative humidity) to kill the mites.[37] Older studies have shown that exposure to temperatures greater than 25°C at low humidity for more than 3-5 days, usually in the absence of an ongoing food supply (i.e. a human or animal host), is lethal to scabies mites.[38,39] However, access to the ability to wash clothes and linen is one of the Healthy Living Practices that can sustain healthy skin and efforts to restore or repair washing machines are important to skin health.

Strategies to improve environmental health are likely to have an impact on skin infections. The nine 'Healthy Living Practices'[39] have been widely adopted as a framework for addressing the links between housing and health for Aboriginal and Torres Strait Islander peoples. They have been adopted for communities and governments to consider the environmental determinants of health and help guide priorities for action (Table 3).

Table 3. Nine Healthy Living practices and how they relate to skin infections. Adapted from Health Habitat.

Healthy Living Practice	Explanation Relevant to Skin Infections
1. **Washing people**	Washing hands and bodies is directly associated with skin health. Studies overseas have confirmed hand washing with soap and water decreases impetigo rates.[40] Therefore, people who do not have access to: functional and regularly maintained hardware (taps, sinks and water); consumables (soap and towels); and information about the importance of washing hands and bodies to reduce the spread of disease, may experience poorer skin health.
2. **Washing clothes and bedding**	Washing clothing and bedding is an important way to reduce skin infections. A functional laundry tub and washing machine helps enable the washing of clothes and bedding. While rare, scabies mites may spread though clothes or bedding used by someone who has scabies. Scabies transmission through bedding and clothing is more likely from people with crusted scabies and very high mite burden. Fleas, lice and fungal infections may also spread through clothes or bedding and cause skin disruption which can lead to skin infections. Bacterial infections also pass from person to person via contact with household linen. Therefore, ensuring that people have facilities to wash clothes and bedding to kill bacteria, scabies mites and lice, may reduce the rates of skin infections.
3. **Removing wastewater safely**	Removing wastewater safely is important to reduce the risk of many infectious diseases. It is important that toilets and drains are functional, and that wastewater is treated and managed safely, away from the living environment. Wastewater is not a major contributor to the spread of skin infections but is an overall aspect of healthy living.
4. **Improving nutrition through the ability to store, prepare and cook food**	Access to potable water for drinking, cooking, and cleaning, is essential for overall health and wellbeing. Functional sinks, taps and stoves also aid the preparation of food in the home environment, which can contribute to good nutrition. Access to fresh fruits and vegetables, and the ability to find and consume traditional foods has also been linked to improved overall health.
5. **Reducing the negative impacts of overcrowding**	It is important that health hardware, e.g. hot water and wastewater systems, can cope with the number of people living in a house. Overcrowding increases the pressure on the health hardware which in turn can increase the risk of skin infections, and other infectious diseases. The risk of impetigo, ARF, and RHD in crowded households has been shown to be up to 1.7 – 2.8 times higher compared to uncrowded households. However, defining and measuring crowding can be complex, and identifying risk to individuals is difficult.[41] Efforts to reduce household overcrowding, or reduce the risk of overcrowded living circumstances, by building and maintaining appropriate health hardware for the number of occupants are important for overall health and wellbeing.

Healthy Living Practice	Explanation Relevant to Skin Infections
6. Reducing the negative effects of animals, vermin or insects	An individual's health can be negatively affected by contact with insects, animals, and vermin in the living environment. For example, contact with animals, insects and scabies mites can cause skin damage which increase the risk of secondary bacterial infection. Protection from insect bites (e.g. flyscreens on windows, removal of containers where water can pool for mosquito breeding) and animal bites (e.g. dog control programs) can reduce the rate of skin infection.
7. Reducing the health impacts of dust	Dust can be caused by unsealed roads and arid lands, making dust common in remote communities. Similarly, dust can contribute to poor health in urban environments where building sites are nearby. Dust can cause direct health problems by irritating the skin. For example, fungal spores contained in dust may lead to tinea.
8. Controlling the temperature of the living environment	Living environments that are too cool or too hot can cause illness. However, controlling the temperature of the environment may also have negative impacts. For example, air conditioning to cool very hot environments may lead to increased spread of infectious disease between people due to a closed environment with limited fresh air exchange enables bacteria to transmit from person to person.
9. Reducing hazards that cause trauma	Living in a house which is poorly maintained and contains rubbish and debris may increase the risk of minor skin damage from cuts, injuries and abrasions.

Close living and household crowding

One measure for structural household crowding is the American Crowding index which states that crowding occurs if there is more than one person per room, severe crowding occurs if there are more than 1.5 persons per room.[42] This American Crowding index, also defines functional crowding which is where the individual shares a sleeping room just to stay warm.[43] Whilst living in community with a wide network of family members has wellbeing benefits, the impact of crowded households on the health of Aboriginal and Torres Strait Islanders are significant. This is predominantly due to insufficient planning of housing and health hardware to accommodate fluctuating household size. Overcrowding can lead to increased accidents and injuries from poorly functioning or maintained health hardware, higher frequency of diseases including skin conditions, as well as psychosocial and emotional stress.[34] Household crowding may be temporary and desirable in circumstances such as extended family visits or for cultural reasons. Improved household designs are needed to account for fluctuating occupancy and to ensure that health hardware can adequately function with increasing or changing household sizes. This aspect of close living to connect with family has not been adequately accounted for in the many three-bedroom, one bathroom dwellings provided in remote or urban Australia, particularly in public housing.

Bennett et al[44] conducted a case-control study in New Zealand aiming to identify social and environmental risk factors for Strep-A pharyngitis and skin infections. Findings from this study illustrate the importance of adequate housing as a key strategy for reducing skin infections. Children who were Strep A carriers or had skin infections were more likely to report living in a crowded or severely crowded home compared to the healthy control cohort of children.

Housing improvements

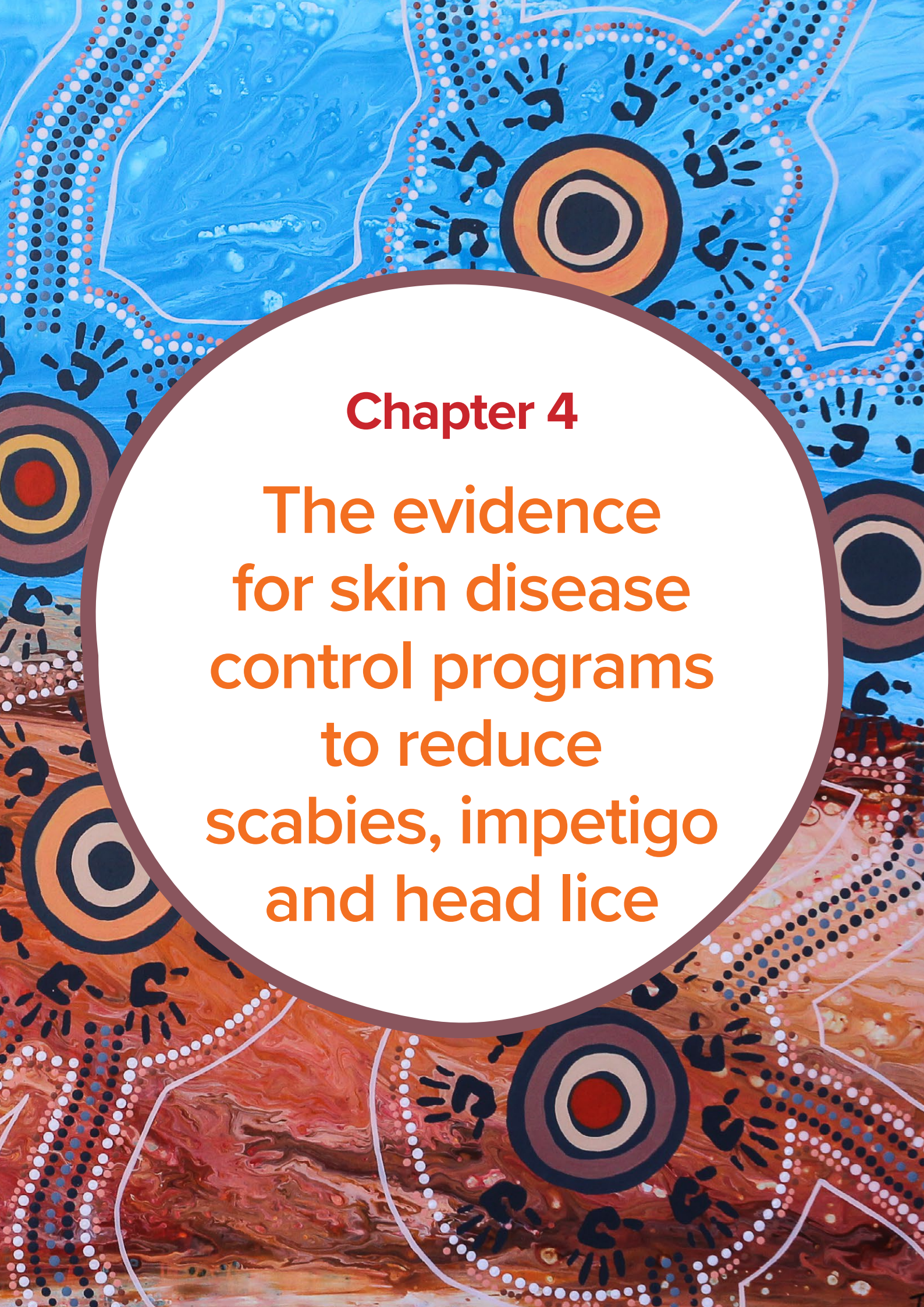
Bailie et al[45] conducted an evaluation of a housing initiative in ten remote Aboriginal communities in the Northern Territory, Australia. Outcomes included 'skin infections' without scabies and 'skin infections' with scabies. The initiative included construction of new houses according to specific environmental health standards and recommendations for demolition of houses deemed uninhabitable. While there was a strong association between improvement in household infrastructure and improvements in hygienic conditions of the houses, the prevalence of skin infection increased over the study period from 20% at the beginning to 25% at 10-month follow up, suggesting no effect. No significant reductions in household crowding were reported. The study interval of only 10 months may have been too short to observe health improvement or potentially the inability to reduce household overcrowding, due to insufficient new houses being built to add to the housing stock rather than just maintain and replace demolished houses. It is likely that any benefit from improved living conditions and housing on reducing the rate of skin infections will require a sustained effort over a longer timeframe, along with reductions in household crowding.

A New South Wales government report described a housing improvement program to assess and repair Aboriginal community housing across the state for 20 years using a pre-post intervention methodology.[46] The intervention group received household testing and repairs measured against 11 Critical Healthy Living Priorities (e.g., safety, facilities for washing people and clothes, removing waste, and preparing food), compared to no housing intervention. The report shows statistically significant improvements in the ability of the houses to support safe and healthy living for all Critical Healthy Living Priorities post-intervention.[46]

In 2014, a healthy skin initiative in an Aboriginal community in the Kimberley, Western Australia (WA) was implemented in response to an outbreak of APSGN.[47] The initiative was designed to reduce risk factors related to scabies and skin infections that placed children at risk of APSGN. The community in which the study was conducted was one of 106 sites in the Kimberley identified as having 'inadequate home design and equipment for healthy living' in a 2008 survey.[47] The environmental health initiatives included improving: home health hardware and plumbing, water and sewage drainage outside the homes, and dog health. The healthy skin initiative also included assessment and treatment for skin infections for children in the community, and a comprehensive health promotion campaign to increase awareness of the link between skin infections and other diseases. Analysis of the data before and after the initiative revealed a significant reduction in scabies (9.5% to 2.2% $p<0.0001$), as well as a reduction in APSGN cases.[47] The authors speculated that the overall incidence of skin infections may have shown a greater reduction after the initiative but the generally poor reporting of skin disease prior to the initiative meant that the 'before' data likely under-represented the true prevalence of skin infections in this community.

Investment in housing and healthy environments through ongoing new building and maintenance of homes remains a practical and evidence-based statement for prevention of skin infections. This includes building houses for Aboriginal families that have more rooms, living spaces and bathrooms addressing the needs to facilitate the strengths of families living and being together. Numerous reports document the impact of inadequate plumbing and poor maintenance of facilities on the ability to wash bodies, as well as the impact of household crowding on disease transmission.

Advocacy and efforts to improve access to functional and well-maintained bathrooms and sufficient space in homes to minimise disease transmission must continue, in order to reduce the excess burden of skin infections for Aboriginal and Torres Strait Islander children and communities. More research regarding environmental initiatives for public health prevention and control of skin infections is urgently needed. To improve equity in the social and cultural determinants of health, and achieve sustained improvements in skin health, comprehensive skin health programs need community involvement and empowerment, with the support of government policies and culturally appropriate governance structures.



Chapter 4

The evidence for skin disease control programs to reduce scabies, impetigo and head lice

Scabies infestations of humans have been a problem for thousands of years.[48] In recent decades, public health strategies for management of skin infections with a particular focus on scabies have changed the landscape of scabies treatment and control. In this chapter we outline the history of scabies control strategies throughout the world and the importance of scabies control in the management of impetigo and downstream complications of bacterial skin infections. In 2017, scabies and other ectoparasitoses were included on the World Health Organization's (WHO) program of Neglected Tropical Diseases.[49,50] This inclusion has provided a global drive for the promotion and implementation of scabies control programs in endemic countries, with benefits to impetigo. Whilst head lice is an additional ectoparasite, less attention has been paid to head lice. Nonetheless control of scabies with similar agents may have benefits to head lice control.

Whilst control programs based on administering treatment to many individuals at the same time have been well established (also known as mass drug administration [MDA]), this is only one of the many strategies needed to improve skin health for the whole population. MDA is one population health strategy that aims to reduce the social burden from a neglected tropical disease by treating an entire group of people for an infectious condition regardless of whether everyone has the condition or not. MDA's involve administering therapy to all community members regardless of symptoms. MDAs are a therapeutic option when the burden of skin infections in a community is high, for instance when scabies affects >10% of the population.[51]

Consultation, education and co-design with communities and primary care providers are essential for any proposed skin control program to ensure that it fits with community needs and expectations. Aboriginal community control, with Aboriginal health in Aboriginal hands, is now a familiar aspect of the health landscape to support the achievement of healthy skin. This is an important foundational principle to explore as part of a community decision as to whether MDA is included in the programmatic approach to control skin infections.

There is a long history of skin disease control programs that commenced in the late 1980s in Panama and has accelerated since the WHO adoption of scabies and other ectoparasites on the neglected tropical diseases list. In this chapter we outline the historical evidence and have further updated the chapter with programs reported on since 2018.

History of skin disease control programs

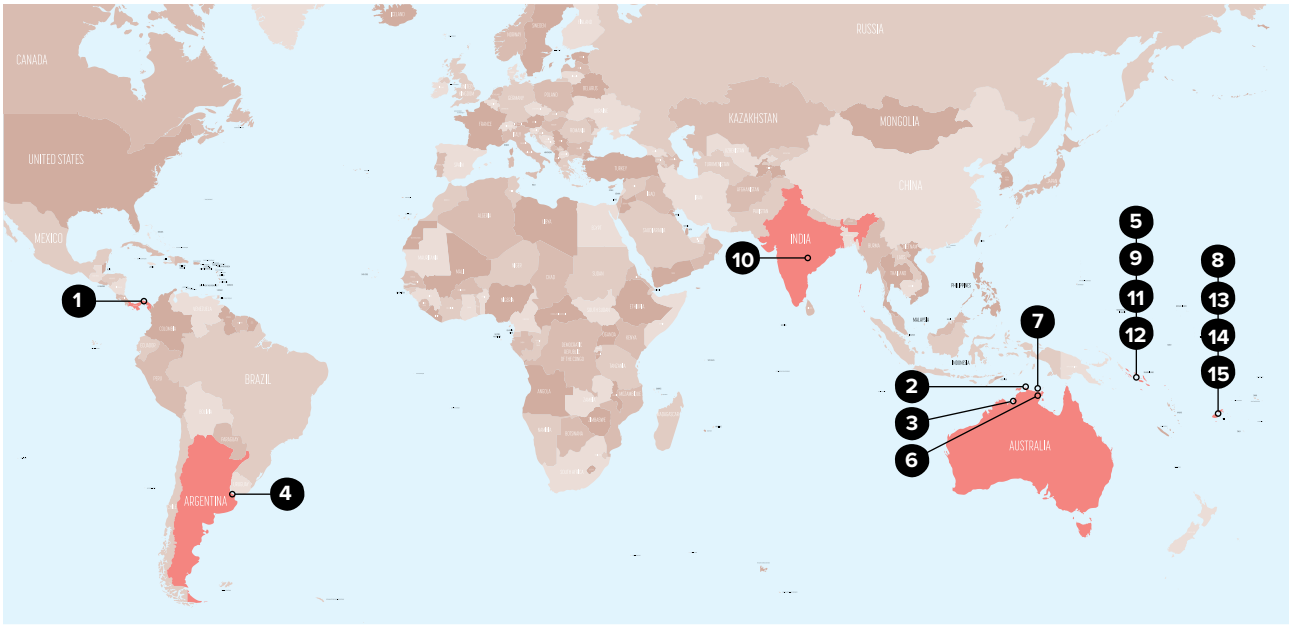


Figure 2. Locations of skin disease programs: **(1)** Panama. **(2)** Croker Island, NT. **(3)** Wadeye, NT. **(4)** Buenos Aires, Argentina. **(5/9/11/12)** Solomon Islands. **(6)** East Arnhem, NT. **(7)** Galiwinku, NT. **(8/13/14/15)** Fiji.

1. Permethrin MDA for scabies: Panama (1986-89)

Taplin *et al* conducted the first MDA study for scabies with topical permethrin cream between 1986 and 1989 in a remote Kuna Indian population in an island off Panama.[52] Scabies and Strep A impetigo prevalence at baseline were 33% and 32%, dropping to 1% and 2% respectively, three months later. The reduction in scabies was sustained with a simple scabies treatment program for new arrivals to the island. However, the program was terminated with the political turmoil of late 1989 in Panama and scabies prevalence rebounded to 12%. The rebound was a much lower prevalence than baseline indicating there is value in this approach.

2. Permethrin MDA for scabies: Minjilang, Croker Island, NT, Australia (1994)

In 1994, the knowledge gained from Panama was assessed in a topical permethrin MDA in a remote Aboriginal island community of the Northern Territory (NT) by Carapetis *et al*.[53] In addition to the population MDA, scabies cases and contacts were re-treated with topical permethrin and impetigo cases were treated with intramuscular (IM) benzathine benzyl penicillin. Scabies prevalence at 25 months fell from 32% to 6% ($p<0.001$) in children, and from 29% to 0% ($p=0.003$) in adults.[53] Impetigo prevalence in children fell from 69% at baseline to 30% at 9 months ($p=0.0002$) and remained stable for the remaining months of the study.

Figure 3. Croker Island, off the coast of the Northern Territory, Australia, the site of the second MDA study with permethrin.

This was the first community-wide effort to address skin infections in Australia. No further data on scabies or impetigo burden in the community has been published.

3. Permethrin MDA for scabies: Wadeye, NT, Australia (1990s)

Wong *et al* conducted a topical permethrin MDA in a large, remote, mainland NT Aboriginal community in the late 1990s[54] as part of a broader community-led skin program. The program consisted of screening children under five-years-old for impetigo and scabies, and an education program regarding cleaning homes, including washing floors with detergent, washing clothes and sheets, and airing mattresses in the sun. Adults in the same house as cases were re-treated with permethrin and houses were fumigated with a synthetic pyrethroid (Raid 25%). A community barbeque was held to encourage compliance with the permethrin application. Children with infected scabies were given IM benzathine benzyl penicillin. Scabies prevalence was 35% at baseline. At seven-month follow up, scabies prevalence had reduced to 4.1% in under five-year-olds ($p<0.0001$). Impetigo prevalence (that was not a result of secondarily infected scabies lesions) was reduced from 11% at baseline to 3.3% at seven months ($p=0.002$).

Figure 4. The Wadeye region of the NT, where a permethrin MDA for scabies was conducted in the late 1990s.

Wong *et al* published a follow up study to describe additional strategies of a comprehensive community skin health program that helped to sustain reduced prevalence of scabies and impetigo in the population.[55] Twelve months following the initial MDA, a second community treatment MDA day

occurred with additional activities including a community clean-up, local treatment teams delivering cleaning items, and 5% topical permethrin MDA. Promotional T-shirts were distributed, and a community barbeque was held to encourage compliance with treatment. Children were screened six weeks after the subsequent MDA and provided with permethrin for scabies or IM benzathine benzyl penicillin for impetigo. At 15-month follow up, scabies prevalence had reduced from 35% at baseline to 12% ($p<0.0001$) and non-scabies impetigo from 11% to 2% ($p=0.0005$). Putting these two years of skin control programs together, overall both scabies and impetigo prevalence was lower.

The evidence derived from these community wide activities in NT (Croker Island and Wadeye) confirm that multiple strategies in conjunction with topical therapy for scabies and treatment of impetigo with IM benzathine benzyl penicillin are effective in both island and mainland communities. Follow up was limited and scabies and skin sore rates subsequently returned to high levels in both communities.

4. Permethrin MDA for head lice: Argentina (1990s)

Chouela *et al* conducted an MDA in a kindergarten and primary school with 310 participants comprising 296 children as well as 14 staff members in Buenos Aires, Argentina.[56] The entire population, whether infested with head lice or not, was subject to hair washing with a neutral shampoo then a rinsing cream containing 1% permethrin. 247 participants had head lice at baseline, and 63 did not. At 15 and 30 days after treatment was applied, evaluation for clinical remission was performed using criteria including the absence of adult parasites, absence of nits, or 50% reduction of the same with regard to baseline consultation. The 81.5% head lice infestation prevalence dropped to 27.9% at 15 days. At 30 days, 22.0% remained infested, of whom 17 cases corresponded to children clinically cured at 15 days and later reinfested at 30 days. Remission rate was 61.5% at 15 days and 76.5% at 30 days. This is the only available study confirming the reduction in prevalence of head lice from community wide MDA treatment.

5. Ivermectin MDA for scabies: Solomon Islands (1997-2000)

Lawrence *et al* conducted an MDA for scabies using oral ivermectin in five small lagoon islands in the Solomon Islands over a three year period between 1997 and 2000.[57] The trial examined the feasibility of treating the whole population for scabies once or twice within two weeks, and whether this mass treatment could maintain scabies control. Throughout the study, treatment was offered to returning residents and overnight visitors, regardless of whether they had obvious scabies or not, to prevent re-introduction of scabies into the community. Those who were not eligible to receive oral ivermectin were offered topical permethrin.

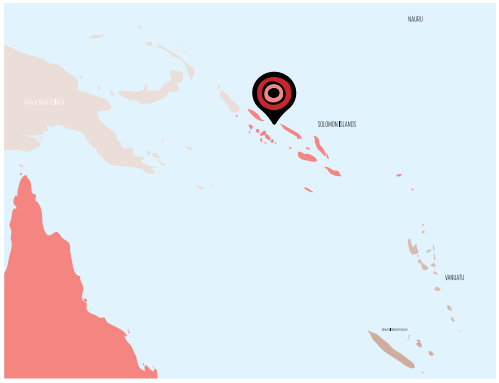


Figure 5. Five small lagoon islands in the Solomon Islands where an MDA trial using oral ivermectin took place between 1997 and 2000.

The prevalence of scabies, impetigo, and kidney disease (measured by haematuria) was recorded at baseline and at the end of the study. Over 95% of the population were treated during the study period, and scabies prevalence fell from 25% at baseline to a sustained prevalence below 1% ($p<0.001$), with no adverse events recorded. Prevalence of skin sores fell from 40% to 22% ($p<0.001$) and the proportion of children with haematuria fell over time ($p<0.002$).

Follow-up 15 years later confirmed that low scabies prevalence had been maintained with only one case of scabies found.[58]

6. East Arnhem Healthy Skin Program, NT, Australia (2004-2007)

Andrews *et al* conducted 'Healthy Skin Days' including encouragement of permethrin use from 2004 to 2007 in remote Aboriginal communities in the NT.[59] Flipchart health promotion materials were developed[60] to increase awareness and understanding of the condition among community members, with annual community skin days held to raise awareness, and children with diagnosed impetigo referred to the local clinics for treatment. Impetigo prevalence in children reduced from 46% at baseline to 32% at three months and 35% at three years. Scabies prevalence in children was 16% at baseline, 13% at three months and 16% at three-year follow up.[60]

7. Ivermectin MDA for scabies: Galiwinku, NT, Australia (2010-11)

Kearns *et al* conducted an oral ivermectin MDA study in 2010-11 in Galiwinku, a remote island Aboriginal community in the NT.[61] Oral ivermectin was provided to the entire community regardless of symptoms, with an additional dose provided to those diagnosed with scabies two to three weeks later. Those ineligible (pregnant women, children <5 years) to receive oral ivermectin were offered topical permethrin. The MDA was repeated 12 months later. Scabies prevalence reduced from 4% at baseline to 1% at six months, increased to 9% at 12 months and then reduced to 3% at 18 months after the second MDA. The authors attributed the increase at 12 months as being related to a scabies outbreak associated with a suspected case of crusted scabies in the community, although on further review, the diagnosis of crusted scabies was unconfirmed. It is more likely that there were multiple re-introductions of scabies from surrounding communities that were not part of the MDA, suggesting some of the challenges with conducting MDA in a single community without wider delivery in surrounding communities where scabies prevalence may also be high. A local and regional integrated strategy for scabies MDA is likely to be needed in remote Australia.

Figure 6. Galiwinku, located on Elcho Island, NT, was the location of an ivermectin MDA in 2010-2011.

8. Ivermectin MDA for scabies: Fiji (2012-13)

Romani *et al* conducted a controlled study of MDA for scabies in 2012-13 in three island communities in Fiji,[62] comparing permethrin MDA and ivermectin MDA to 'standard care' (administration of permethrin to affected persons and their contacts). In the permethrin group, 5% topical permethrin was administered on day one for all members of the community. For participants who had scabies at baseline, another dose was administered 7–14 days later. In the ivermectin group, oral ivermectin was administered as a single oral dose and offered again for participants infected with scabies at baseline 7–14 days after the initial dose. In this oral ivermectin group, permethrin was administered to those participants who were not able to use ivermectin (children <5 years or weighing less than 15 kg, pregnant and breastfeeding women, and the very frail). At the 12-month follow up, the greatest decline in scabies prevalence was seen in the ivermectin group from 32% to <2%, (relative reduction 94%). In comparison, scabies prevalence for those living in the community that had been randomised to the permethrin group reduced from 42% to 16% (62% relative reduction), and from 37% to 19% (49% relative reduction) in the standard care group. A reduction in impetigo was also noted in all groups, with the greatest reduction in the ivermectin group (67%). Although adverse events were more common in the ivermectin group, all events were mild and resolved quickly. At 24 months, the reduction in scabies and impetigo in the ivermectin communities was sustained.[63]

9. Ivermectin MDA for scabies: Solomon Islands (2015)

Romani *et al* conducted a single-arm, before-after community intervention in the Solomon Islands to assess the efficacy of MDA of ivermectin for scabies and impetigo, with coadministration of azithromycin for trachoma.[64] In 2015, MDA was offered to the entire population of Choiseul Province, Solomon Islands. For the ivermectin-based MDA (scabies and impetigo), participants were offered two doses of oral ivermectin 200 µg/kg 7–14 days apart using weight-based bands, or 5% permethrin cream 7–14 days apart if ivermectin was contraindicated (pregnant and breastfeeding women and children weighing less than 12.5kg). The regimen for the trachoma-based MDA is not reported here. The primary outcome was the prevalence of scabies and impetigo in ten randomly selected villages at 12 months compared with ten different randomly selected villages at baseline. At baseline, 1399 (84.2%) of 1662 people living in the first ten villages had their skin examined, of whom 261 (18.7%) had scabies and 347 (24.8%) had impetigo. At 12 months after MDA, 1261 (77.6%) of 1625 people in the second set of ten villages had their skin examined, of whom 29 (2.3%) had scabies (relative reduction 88%, 95% confidence interval [CI] 76.5–99.3) and 81 (6.4%) had impetigo (relative reduction 74%, 63.4–84.7).

10. Ivermectin MDA for scabies: India (2017)

Behera *et al* conducted a controlled oral ivermectin MDA in 2017 in 12 tribal villages in the Gadchiroli district in central India.[65] The primary outcome was prevalence of scabies two months after the treatment. Secondary outcomes were prevalence of scabies after twelve months of treatment and prevalence of impetigo after two and twelve months of treatment. Six villages each were allocated to the intervention and usual care (control) arm. In the intervention arm, oral ivermectin MDA was provided to scabies cases and their household contacts. In the usual care arm, scabies cases were referred to the nearest clinic for topical treatment as per the standard practice.

Figure 7. Map showing Gadchiroli, India, where an oral ivermectin MDA for scabies took place.

The prevalence of scabies in the intervention and usual care arm was 8.4% vs 8.1% at the baseline, 2.8% vs 8.8% at two months [adjusted relative risk (ARR) 0.21, 95% CI 0.11–0.38] and 7.3% vs 14.1% (ARR 0.49, 95% CI 0.25–0.98) at twelve months The prevalence of impetigo in the intervention and usual care arm was 1.7% vs 0.6% at baseline, 0.6% vs 1% at two months (ARR 0.55, 95% CI 0.22–1.37) and 0.3% vs 0.7% at 12 months (ARR 0.42, 95% CI 0.06–2.74).

11. Ivermectin MDA for head lice and scabies: Solomon Islands (2018)

Coscoine *et al* conducted a study to establish the baseline prevalence of head lice infestation in a rural community in the Solomon Islands and to assess whether MDA using ivermectin, at the lower dose of 200 ug/kg (the same regimen that has already shown to be effective for scabies treatment) would be an effective method to lower community prevalence of head lice.[66] The study was conducted in the campus area of a hospital, where hospital staff, children at the school and their families live on campus. All individuals living on the campus and all children and families of children attending the school were eligible for the study. Oral ivermectin was administered at baseline, with a second dose given seven days later to all study participants. Participants with contraindications to ivermectin treatment (weight below 12.5kg, pregnancy or breastfeeding) were offered malathion 0.5% lotion for head lice and permethrin 5% cream for scabies. The baseline prevalence of active head lice infestation

was 25.4% (95% CI 18.4±34.0). In all cases where active head lice infestation was identified, head lice eggs were also seen. The baseline prevalence of head lice eggs (with or without active head louse infestation) was 42.3% (95% CI 30.8±48.8). Scabies prevalence was 10.2% (95% CI 5.9±16.9), no cases of crusted scabies were identified. Participants were not re-examined for scabies as part of this study. 24/28 school-children (85.7%) were re-examined at 48 hours following ivermectin administration. The prevalence of active infestation decreased from 45.8% at baseline to 0%. At two weeks after MDA, the prevalence of active infestation had declined significantly (25.6% vs 2.5%, p <0.001). At three months, the prevalence of active head lice infestation remained significantly lower than at baseline (25.6% vs 7.5%, p <0.001). The prevalence of head lice eggs was unchanged at two weeks (42.3% vs 41.8%) but reduced significantly at three months (42.3% vs 19.6%, RR 53.7%, p < 0.001).

12. Ivermectin and azithromycin MDA for scabies and impetigo: Solomon Islands (2019)

Marks *et al* conducted an MDA for scabies and impetigo in remote island villages in the Solomon Islands.[67] Six communities were randomised to receive either ivermectin-based MDA or ivermectin-based MDA co-administered with azithromycin MDA. Scabies and impetigo prevalence were measured at baseline and 12 months. At baseline, scabies and impetigo prevalence were 11.8% and 10.1% in the ivermectin-only arm and 9.2% and 12.1% in the combined treatment arm. At 12 months, the prevalence of scabies and impetigo had fallen to 1.0% (95% CI 0.3–2.6%) and 2.5% (95% CI 1.4–4.5%), respectively, in the ivermectin-only treatment arm and to 0.7% (95% CI 0.2–1.8%) and 3.3% (95% CI 2.1–5.1%), respectively, in the combined treatment arms. There was no significant difference between the two groups (91.5% vs 92.4%, P=0.31), in the change from baseline to 12 months in scabies prevalence or the change in impetigo prevalence (75.2% vs 72.7%, P=.49).The proportion of impetigo lesions containing *Staphylococcus aureus* detected did not change (80% at baseline vs 86% at 12 months; no significant difference between arms) but the proportion containing *Streptococcus pyogenes* fell significantly (63% vs 23%, P < .01). At 3 months, 53% (8/15) of *S. aureus* isolates were macrolide-resistant in the combined treatment arm, but no resistant strains (0/13) were detected at 12 months. Although promising, there was no change in overall impetigo reduction with the addition of azithromycin, suggesting that ivermectin alone to treat scabies is sufficient to reduce secondarily infected lesions. This was similar to the findings of Romani *et al* in Fiji in 2015.

13. Ivermectin, diethylcarbamazine and albendazole MDA for scabies and soil-transmitted helminth: Fiji (2020)

Hardy *et al* conducted an MDA in 2020 to assess the safety of ivermectin and diethylcarbamazine and albendazole for scabies and soil-transmitted helminth in Fiji.[68] 1216 participants were randomised to receive diethylcarbamazine and albendazole (DA) and 2396 received a combination of all- ivermectin, diethylcarbamazine and albendazole (IDA). Adverse events were reported by 600 participants (16.7%), distributed equally between treatment groups, with most graded as mild (93.2%). Authors concluded that IDA has comparable safety to DA with the same frequency of adverse events experienced following community MDA. The combination approach may be effective in communities where scabies and soil transmitted helminths are concurrently a problem.

14. Ivermectin MDA for scabies- Fiji (2021)

Hardy *et al* conducted another MDA in 2021 comparing the effectiveness of control strategies on the community prevalence of scabies at 12 months on two Fijian islands.[69] Participants were randomised 1:1:1 to 2-dose ivermectin-based MDA (IVM-2), 1-dose ivermectin-based MDA (IVM-1) or screen and treat (SAT) with topical permethrin 5% for individuals with scabies and their household contacts. The

study found no significant difference between the MDA agents. At 12 months, scabies decreased in all groups: IVM-2: 1.3% (95% CI 0.6 to 2.5); IVM-1: 2.7% (95% CI 1.1 to 6.5); SAT: 1.1% (95% CI 0.6 to 2.0). The risk difference in scabies prevalence at 12 months between the IVM-1 and IVM-2 groups was 1.2% (95% CI −0.2 to 2.7, p = 0.10). Authors concluded that they found 1-dose ivermectin-based MDA to be noninferior to 2-dose for reducing scabies prevalence at 12 months, hence simplifying potential treatment strategies.

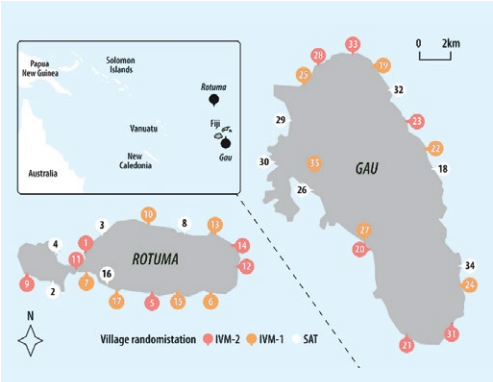


Figure 8. Map of study sites, village locations and treatment allocation for Hardy et al MDA in 35 villages on two Fijian islands.

15. Ivermectin MDA, Fiji (2018 – 2020)

Thean *et al* conducted a population-based before-after study of MDA for scabies and impetigo from 2018-2020 in the Northern division in Fiji.[70] The study population was offered a first dose of ivermectin, diethylcarbamazine and albendazole (IDA) as recommended for lymphatic filariasis MDA, followed by a second dose of ivermectin after 7–14 days. Dosage of ivermectin and diethylcarbamazine were administered according to height. One 400 mg tablet of albendazole was given as a standard dose. Permethrin cream 5% was offered as two doses separated by 7–14 days to individuals for whom ivermectin was contraindicated (aged < 2 years, height < 90cm, pregnant or potentially pregnant, breastfeeding an infant < 7 days old, taking warfarin or severely ill). The primary outcomes were incidence of hospitalisations with skin and soft tissue infections, and childhood invasive infections and post-streptococcal sequelae. Secondary outcomes included presentations to primary healthcare with skin infections and community prevalence of scabies and impetigo. The incidence of hospitalisations with skin and soft tissue infections was 17% lower after the intervention compared to baseline (388 vs 467 per 100,000 person-years; incidence rate ratio 0.83, 95% CI, 0.74 to 0.94; P=0.002). There was no difference in incidence of childhood invasive infections and post-streptococcal sequelae. Incidence of primary healthcare presentations with scabies and skin infections was 21% lower (89.2 vs 108 per 1000 person-years, incidence rate ratio, IRR 0.79, 95% CI, 0.78 to 0.82). Crude community prevalence of scabies declined from 14.2% to 7.7% (cluster-adjusted prevalence 12.5% to 8.9%; prevalence ratio 0.71, 95% CI, 0.28 to 1.17). Cluster adjusted prevalence of impetigo declined from 15.3% to 6.1% (prevalence ratio 0.4, 95% CI, 0.18 to 0.86). This is the first study to show that a scabies MDA has an impact on primary healthcare presentations for skin infections, an important reduction.

Systematic Review of Mass Drug Administration for Scabies

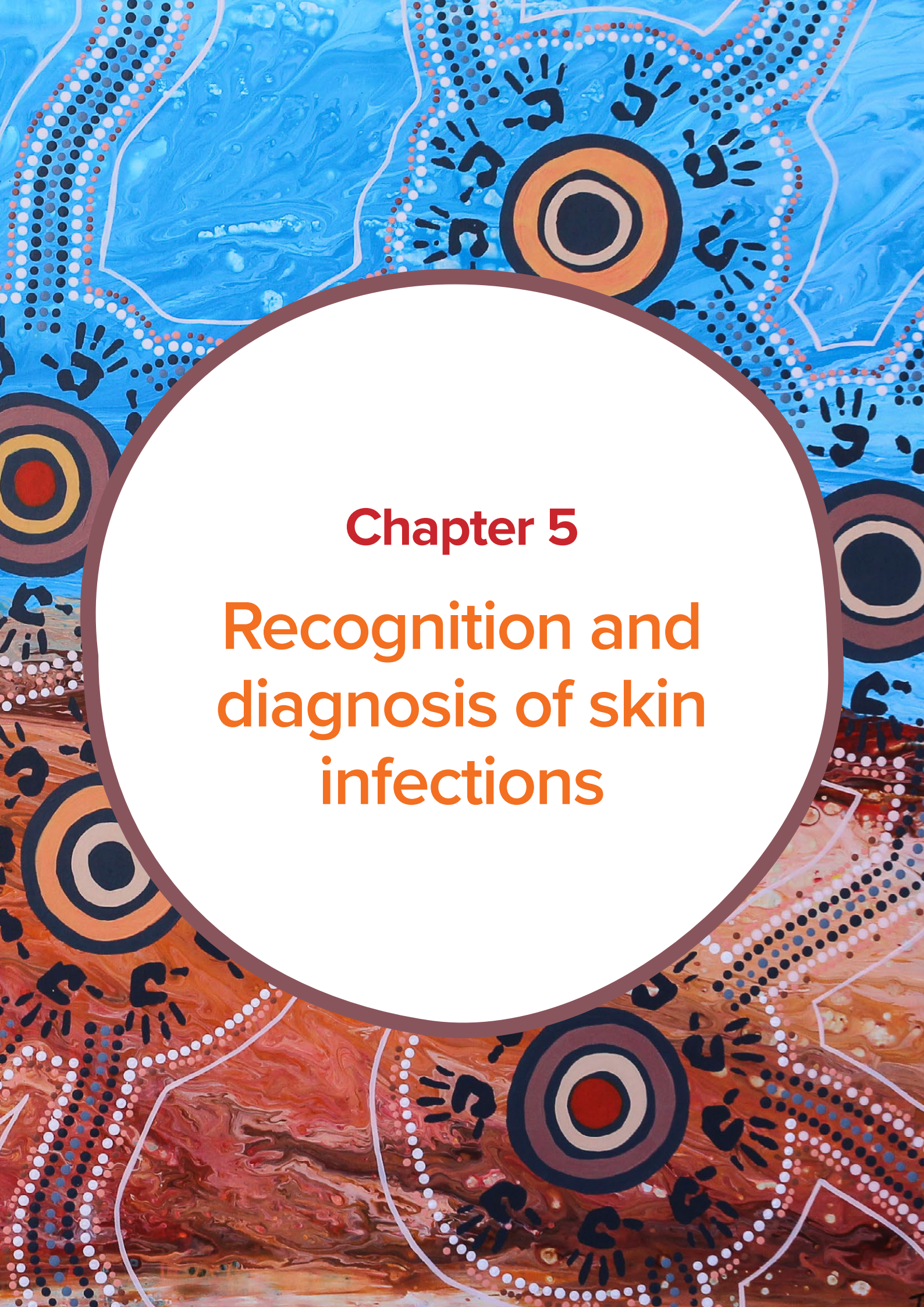
A systematic review of the above studies has recently been completed.[71] Most studies were conducted in the Oceanic region. Whilst there was heterogeneity between the 11 included studies, the overall reduction in scabies prevalence using MDA was 79%, and was comparable for either oral ivermectin or topical permethrin. However, in the only study that compared oral ivermectin with topical permethrin, the reduction in scabies with oral ivermectin was higher (see MDA Ivermectin Fiji trial 2012-13 above). There was a greater reduction in scabies prevalence in communities where scabies prevalence was >10% at baseline, equating to an 85% relative reduction in scabies prevalence. MDA for scabies also resulted in a 66% reduction in impetigo.

Summary

These studies show that MDA can be an effective strategy in reducing the burden of scabies and head lice and the associated prevalence of impetigo. The community setting and level of engagement have a large influence on the success of the program. The small island communities where many of these MDA programs have been performed have seen significant reduction in the burden of scabies and impetigo. However, in all cases scabies was sooner or later re-introduced from neighbouring communities, therefore addressing sustainability outside of the research context is an important element of implementation. Without efforts addressing the social determinants of health and a commitment to fund and focus on primordial prevention, the long-term benefits of MDAs will be sub-optimal. There are also persistent evidence gaps, including determining the best strategies for implementation in populations with high mobility, the presence of crusted scabies and its therapy, how many local and regional interconnected communities need to be involved, whether there is benefit of a second dose of ivermectin/permethrin (2 dose MDA) given to the whole population, how many repeat MDAs are needed for different rates of scabies and what is the optimum interval between MDAs (e.g. six months vs 12 months), what is the threshold of scabies prevalence for ceasing interval MDAs, and what is the additional benefit of MDAs where other strategies are already in place for public health management of skin infections.[72]

Taken together, for communities wanting to address the impact of skin pathogens (scabies, bacteria, head lice), MDA is a feasible, effective and likely acceptable strategy. However, widespread consultation and engagement is needed, together with consideration for including a regional approach covering multiple communities and thousands of people at once.

Skin and soft tissue infections are the largest contributors to primary healthcare for Aboriginal people living in remote Australia, and MDA may be one effective strategy amongst others to address this heavy burden.



Chapter 5

Recognition and diagnosis of skin infections

Skin infections are predominantly a visual diagnosis based on symptoms and recognition of a pattern of skin signs. Training of healthcare providers in the correct recognition of skin infections is an important priority, particularly where the burden is high. This is to ensure that the correct diagnosis is made and treatment is prescribed. Skin infections are often normalised by clinicians[73] and this leads to under treatment. Hence, remembering to always examine the skin and make the correct diagnosis is critical to implementing effective treatment. There are several elements to accurate diagnosis of skin infections discussed below. The availability and approach to collection of diagnostic tests is also outlined, although these remain a lower priority when access to diagnostic laboratories is limited in much of regional and remote Australia. Where diagnostic laboratories are available in urban settings, these tests may be helpful if the infection does not respond to the standard treatment. There is also an increasing use of telehealth to send images, and more recently real-time video dermoscopy of skin pathology, to specialists for advice.

Training resources for healthcare workers

The correct identification of skin infections is challenging, as it requires the development of a strong knowledge of the various different appearances of the skin in health and disease. It is also challenging because the skin is the largest organ of the body and needs examination from head to toe, which is time consuming. Clinical photographs are a tool to aid in the training and diagnosis of skin infections and have long been used in dermatology to assist in the recognition of skin diseases. *Recognising and Treating Skin Infections* is a useful resource developed by the Cooperative Research Centre for Aboriginal and Tropical Health (now the Lowitja Institute) and the Menzies School of Health Research in the Northern Territory as part of the East Arnhem Healthy Skin Program in 2004. The 2009 version has been widely used:

https://www.lowitja.org.au/content/Document/Lowitja-Publishing/Healthy-Skin-Flipchart-Aug09.pdf

and is a great resource for enhancing clinical diagnosis. With the First Edition of the National Healthy Skin Guideline, this flipchart was updated to its 3rd edition to be used as an accompanying resource, Recognising & Treating Skin Infections: A visual clinical handbook (2018):

https://infectiousdiseases.telethonkids.org.au/siteassets/media-images-wesfarmers-centre/national-healthy-skin-guideline_recognising--treating-skin-infections-3rd-ed.-2018.pdf

An online quiz for recognising skin infections is also available and may be used for training purposes. As of July 2023, the First Edition of the National Healthy Skin Guideline has been viewed >10,000 times, downloaded >3,500 times, and the quiz for knowledge assessment completed >300 times. The National Healthy Skin Guideline, visual clinical handbook and quiz can be used together to aid in the recognition of skin infections.

Training of healthcare providers working in settings where skin infections are endemic is a key priority to ensure accurate diagnosis. We strongly recommend training on the recognition of skin infections for all new healthcare providers working in endemic settings. We recommend these modules are regularly updated and available freely on the internet for ease of access and in paper format where internet connectivity is unreliable. The above resources can be implemented across health services as a training program for new healthcare workers.[74]

Training resources for community

Underpinned by a Community Participatory Action Research (CPAR)[75] approach, and acknowledging the importance of embedding culture within health,[76] a suite of Healthy Skin Resources have been co-designed and developed (**Chapter 13**). The Handbook for Community Care Workers in the Pilbara was co-designed with community members, the local Aboriginal Controlled Community Health Organisation and researchers, and is a model for community resources. It can be found at:

https://infectiousdiseases.telethonkids.org.au/siteassets/media-docs---wesfarmers-centre/handbook-for-healthy-skin.pdf

Yarning with Elders and community members highlighted the importance of creating cultural resources that clinicians, health providers and community members could use to help reduce the burden of skin infections and ongoing related illnesses.[77] Health promotion resources that include culture and language can also empower Aboriginal and Torres Strait Islander people to discuss treatment options with clinicians and decide the most appropriate one for their family and communities.[78]

Normalisation of skin infections

Skin infections often go untreated because they are extremely common, recurrent, and not always recognised as important. This 'normalisation' occurs at all levels, from the parents/carers[79] to the healthcare provider.[8] Interviews with parents and carers showed that children were only brought to the clinic if the skin infection resulted in pain or fever,[79] both of which are relatively uncommon symptoms for scabies or impetigo, where itch and irritation are more usual. Similarly, healthcare providers can also under-appreciate the burden of skin infection in their patients. A hospital-based study in Western Australia in 2015-2016 showed that only 21% of children were retrospectively documented to have a skin infection, whereas >50% of a matched cohort of children were prospectively found to have a skin infection ($P<0.001$).[8] This suggests that skin infections are overlooked by healthcare providers in more than half of children admitted to hospital in a high prevalence setting. Overcoming this normalisation requires a more targeted approach to educating healthcare providers on the need to diagnose, document and treat skin infections. Familiarity with and recognition of skin infections is important in addressing the normalisation which may be a contributor to ongoing high burden. It is also a reminder to offer health education and health promotion resources at all clinic visits for skin conditions, to improve knowledge and accessing care.

Stigma and racism

Long-lasting and widespread misconceptions about people with a skin condition contribute to discrimination and stigmatization.[80] Visibility of skin changes causes prejudice that patients themselves are responsible for the disease by neglecting body hygiene. Fear of judgment and stigma pertaining to health topics is not a new concept in research[80-82] but an important one. In Australia, the enduring effects of colonialism continually impacting Aboriginal and Torres Strait Islander children, families and communities,[83] underlie the stigma and fear of judgment surrounding skin infections and scabies in children. Racism and prejudice are important barriers to healthcare service utilisation in some Aboriginal and Torres Strait Islander communities.[84] Failure of healthcare providers to use interpreters and translate health information contributes to the continued health inequities and is a form of institutionalised racism.[85]

Culturally responsive, patient-centred care in the Aboriginal and Torres Strait Islander healthcare setting requires self-reflexivity to avoid further contributing to victim blaming and inciting feelings of shame,[86,87] both of which have been shown to negatively impact on health service utilisation.[84,85] Health resources in local language may also increase awareness.

Preparing for clinic consultations in skin health

- **Familiarise yourself with training materials and health promotion.**
- **Take a non-judgemental approach.**
- **Always examine the skin and document your findings.**
- **Learn the local language for skin conditions and bush medicine treatments available.**
- **Consult experts where uncertain.**

Diagnostic tests

Diagnostic tests can support clinical recognition of skin infections/infestations where access to a diagnostic laboratory is available. In certain conditions, including tinea capitis, onychomycosis and crusted scabies, diagnostic tests are strongly recommended to support the clinical diagnosis and guide management. Laboratory-confirmed presence of scabies mite is a mandatory requirement for confirming crusted scabies as a notifiable disease in the NT. However, access to a laboratory diagnosis in the remote setting is limited where this condition is most common. Beyond dermoscopy and skin scrapings for microscopy, the diagnostic tests for scabies are less well developed and remain in the research phase. Where available, dermoscopy can be a useful diagnostic tool to visualise mites and burrows *in vivo* and guide the placement of confirmatory skin scrapings. The characteristic finding on dermoscopic examination is a dark, triangular shape that represents the head of the mite within a burrow ('delta wing' sign).[88] Note: mites can be difficult to detect in patients with highly pigmented skin. A point of care diagnostic assay (e.g. lateral flow assay, simplified dermoscopy, PCR) is a priority for addressing scabies burden, with some progress being made on a PCR diagnosis.[89]

In impetigo, swabs for bacteriological culture are useful if antibiotic resistance is suspected or if the infection fails to respond to standard treatment, but not essential for commencing treatment.

Atopic dermatitis, head lice and molluscum contagiosum remain clinical diagnoses, and do not require diagnostic sampling.

The below section provides guidance on collecting the appropriate specimens for diagnostic confirmation, when available and indicated. When diagnostic testing is needed, we recommend contacting your local diagnostic laboratory to confirm the appropriate collection and transportation methods.

Skin swabs

Skin swabs for bacterial culture (impetigo) are recommended if the diagnosis is uncertain or the impetigo is not responding to standard treatment.

Swabs are used to identify bacterial pathogens resulting in impetigo:

1. If the wound is dry (no pus), wet the tip of the swab with a few drops of sterile normal saline and roll the swab over the surface of the sore. Alternatively, you can lift the crust with a sterile needle to swab the base of the sore.
2. Starting at the centre of sore, roll swab gently to edges, collecting any pus on the way.

3. Put swab into swab tube, push top down firmly.
4. Label the specimen appropriately, and complete the test request form.
5. Store the sealed swab at room temperature in the specimen collection bag with the sample form for transport.

Skin scrapings

Traditional scabies has a low mite burden with an estimated 10 – 15 mites/person. In contrast, people with crusted scabies may have several million mites on their bodies. Skin scraping to observe the scabies mites is an essential component of the diagnosis of crusted scabies, but not usually recommended with classical scabies.

For fungal infections, the person should be told not to use any topical treatment (creams, ointments, antiseptics, powders, etc) for at least two days before skin scrapings are taken. Skin fungi will remain viable for about 30 days, however, delay between specimen collection and processing increases the chance of deterioration and contamination. Specimens should be kept in a cool dark place, at less than 30°C, but not refrigerated.

Skin scrapings are used for diagnosis of scabies, and fungal infections.

1. Begin by labelling the frosted end of the glass slide, and the slide holder, or the collection jar (a urine container with the yellow lid is suitable), with patient details. Use a sharp pencil to label the slide so that the details do not rub off.
2. **For scabies**: DO NOT scrape the sore. Use a magnifying glass (or dermatoscope if available) to find the burrow marks and scrape firmly from the edge using a scalpel blade (#10) to collect as much skin as possible. Repeat in at least three different places. Place scrapings onto slide then cover with a few drops of paraffin oil, then return to the slide holder and close securely. Check it is correctly labelled.
3. **For fungal infections**: Collect skin scrapings by running a scalpel blade (#10) held at a 90° angle to the skin across the affected area using light pressure, being careful not to break the skin. A glass slide can be used in a similar manner and may be better tolerated in children. Hold the open urine jar underneath to collect the scrapings. The scaliest site(s) should be selected for the skin scraping. For multiple lesions, scrape in several places using a new scalpel blade and collection jar each time. Replace lid on container and check it is correctly labelled.
4. Store at room temperature in specimen collection bag with completed sample form for transport.

Nail clippings (for nail tinea)

1. Begin by labelling the collection jar (a urine container with the yellow lid is suitable), with patient details.
2. Taking specimens from affected nails that are thickened and misshapen can be difficult. The nail should be clipped back until the crumbling portion of the nail is reached. Chalky debris from under the nail should be scraped out using a scalpel blade (#10) and collected in a sterile specimen jar. Replace lid on container and check it is correctly labelled.
3. Store at room temperature in specimen collection bag with sample form for transport.

Hair pluckings (for scalp tinea)

1. Begin by labelling the collection jar (a urine container with the yellow lid is suitable) with patient details.
2. Skin scrapings should be taken from the affected scalp skin using the technique described above. In addition, a few hairs from the affected scalp should be plucked using non-toothed, non-serrated forceps and collected in the same sterile specimen jar. Replace lid on container and check that it is correctly labelled.
3. If available, a disposable toothbrush can be used as an alternative method to collect scalp scale and hairs and may be better tolerated by children. The affected scalp is massaged by the bristles, creating a negative charge so that the bristles pick up hairs and scalp scales. The toothbrush can then be sent to the laboratory.
4. Store in specimen collection bag with sample form at room temperature for transport.

Note: Cut/clipped hair is of no use as the fungi penetrate the upper hair follicle closest to the scalp and won't be found on the distal end that has been cut for sampling.

Infection caused by *Microsporum* organisms will fluoresce bright green under a filtered ultraviolet (Woods) light, and *Trichophyton schoenleinii* will fluoresce dull blue. This method is of no use for other fungal infections and may not be available in most clinical settings.

Chapter 6

Impetigo (skin sores)

Overview

Impetigo, also known as skin sores, school sores or pyoderma, is a highly contagious skin infection, and can be found on any part of the body where there are breaks in skin integrity. Breaks in the skin occur from minor trauma due to cuts, lacerations, tinea, atopic dermatitis, insect bites, head lice or scabies infestation (**Figure 1, Chapter 1**).[90-92] Alongside minor trauma, infestation with the scabies mite (**Chapter 7**), tinea (**Chapter 9**) or head lice (**Chapter 11**) are a major contributing factor in resource-limited settings and tropical regions.[93-95]

Impetigo is the result of infection with *Staphylococcus aureus* and/or *Streptococcus pyogenes* (group A beta haemolytic Streptococcus [Strep A]). Skin sores are most often caused by Strep A in tropical areas[7,93] or *S. aureus* in temperate climates, however both pathogens may co-occur in impetigo. Many healthy people carry *S. aureus* on their skin or in their nose without causing any other symptoms. Strep A may be carried in the throat. Skin Strep A is usually transmitted between people in the days immediately before impetigo develops. The onset is sudden, and sores may not cause pain or discomfort.

Where living conditions, tropical climates and poverty intersect, there is an increasing burden of skin infections. These social determinants of health in Australia are a result of colonisation, dispossession of land and ongoing systemic racism. Addressing these factors is part of the overall solution to reducing the burden of skin infections.

Observational studies over four decades in northern Australia have found that Australian Aboriginal and Torres Strait Islander children living in remote communities have the highest burden of impetigo worldwide.[96] An estimated 45% of children (almost one in every two children) have impetigo at any one time,[96] the highest documented burden in the world. There is a clear relationship between the prevalence of skin sores in children and the level of household crowding.[97]

The Koolungar Moorditj Healthy Skin project is the first co-designed Australian study to describe skin health and disease in urban-living Aboriginal children. Findings from the pilot study with 80 urban-living Aboriginal participants aged 0-18 years revealed a 43% (34/80) lifetime prevalence of bacterial skin infections and a 5% (4/80) point prevalence of bacterial skin infections.[98]

Skin infections, predominantly scabies with secondary infection with *S. pyogenes* and *S. aureus*, affect many infants in the first month of life, with the median timing of first clinic presentation in the NT at two months of age, and 82% of children presenting to the clinic with an episode of impetigo before 12 months of age.[99] In WA, skin infections, predominantly impetigo, are the chief reason for presentation to the clinic, with 72% of all children aged 0–5 years presenting at least once each year for skin infections[100] and 15% of infants admitted to hospital in the first year of life with a skin infection.[101] This heavy burden of skin infections is under-appreciated.[73]

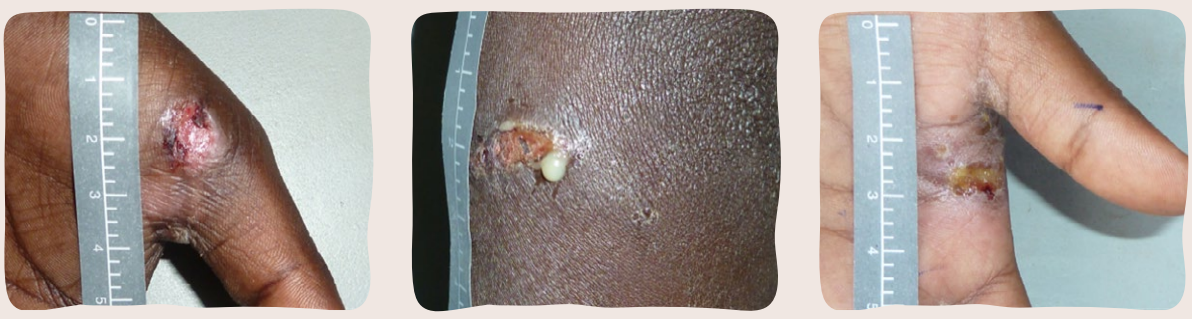


Figure 9. Purulent impetigo.

Consequences of untreated impetigo

Untreated impetigo has serious consequences, which include *S. pyogenes* and *S. aureus* sepsis,[102] bone and joint infections,[103] and pneumonia,[104] as well as post-infectious sequelae including acute rheumatic fever (ARF) progressing to rheumatic heart disease (RHD) in some individuals and acute post streptococcal glomerulonephritis (APSGN).[105]

Treatment of all impetigo is a high priority to heal the skin and prevent more serious complications.

Figure 10. Small (1-2 mm) pustules/pus filled bumps can be seen between each of the fingers in the web space.

Identify

Impetigo or skin sores are often round or linear, 1-2cm in size and pus-filled which progress to form a thick crust. They often commence as blisters containing a clear honey-coloured fluid that develops into pus before a crust forms on the skin. The crusts protect the underlying healing skin. The crust is thick and irregular and causes tethering of the skin, and eventually falls off leaving a flat, dry, pale lesion on the surface. This process takes up to 30 days without treatment, shortened to seven days with antibiotics (**Figure 11**).

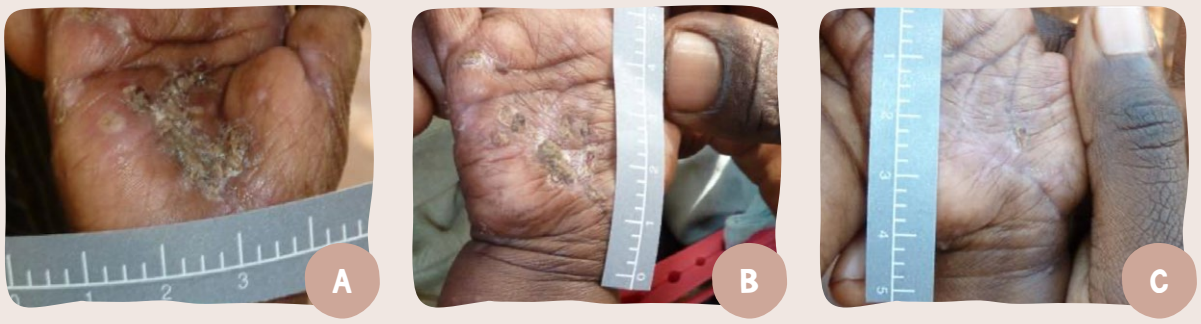


Figure 11. Impetigo progression. From left to right, image A has evidence of sores filled with pus (purulent); image B is crusted and progressing towards healing with tethering of the underlying skin; and image C contains evidence of recent impetigo and can be described as flat, dry sores. These images were taken before treatment (image A), during treatment (image B) and after treatment (image C) has been completed 1 week after the baseline photo was taken.[95] Source: Skin Sore Trial, 2014.[103]

Once impetigo is diagnosed based on the appearance of the sores as purulent or crusted, treatment should be initiated. Flat, dry sores are almost healed and do not need to be treated. Swabs to detect bacteria may be useful if the sores do not respond to standard treatment.

If impetigo is present, consider and examine for evidence of scabies infestation (**Chapter 7**), tinea (**Chapter 9**), atopic dermatitis (**Chapter 10**) or head lice (**Chapter 11**).

Treat and prevent

Recommendations for the treatment and prevention of impetigo

Identify		
✓	Due to the serious consequences if left untreated, impetigo should be recognised and always treated as a high priority.	
Treat		
✓	**First line treatment:** Trimethoprim + sulfamethoxazole 160+800 mg (child 1 month or older: 4+20 mg/kg up to 160+800 mg) orally, twice daily for 3 days (Table 4). **OR** A single weight band dose of IM benzathine benzyl penicillin (BPG) (Table 5).	**GRADE 1A**
✓	**For patients with sulfonamide antibiotic allergy:** Cefalexin 500 mg (child: 20 mg/kg up to 750 mg) orally, 8-hourly for 3–7 days. Cease after 3 days if lesions resolved.	
✓	**For patients with immediate or delayed severe hypersensitivity to penicillins use:** Trimethoprim + sulfamethoxazole 160+800 mg (child 1 month or older: 4+20 mg/kg up to 160+800 mg) orally, twice daily for 3 days.	
✓	Topical 2% mupirocin ointment can be applied directly to the sores for two or less sores, twice a day for 5 days.	**GRADE 1A**
✗	Oral penicillin G **IS NOT** recommended for treatment of impetigo.	**GRADE 2D**
Prevent		
✓	Ivermectin mass drug administration (MDA) to control impetigo and scabies may be of benefit in resource-limited communities or where scabies impacts >10% of the community.[51]	**GRADE 1A**
✗	Azithromycin **SHOULD NOT** be added to an ivermectin MDA as ivermectin alone is effective for the control of impetigo and scabies.	
✓	Washing hands once a day with soap and water is effective in the treatment and prevention of impetigo. There is no benefit to using antibacterial soap over regular soap.	
✓	An adequate supply of water for washing and cleaning may reduce the incidence of impetigo and scabies, but the evidence is not high quality.	**GRADE 2C**
✓	There is a role for community-based active screening for impetigo followed by referral for treatment where prevalence is high (>10% of children).	
✓	There is insufficient evidence to support the installation of swimming pools in remote communities for the sole purpose of reducing the prevalence of impetigo, however swimming pools for recreation have health and wellbeing benefits.	
✓	Children with impetigo should be excluded from school until treatment has commenced and open sores should be covered with watertight dressings.	**GRADE 2D**

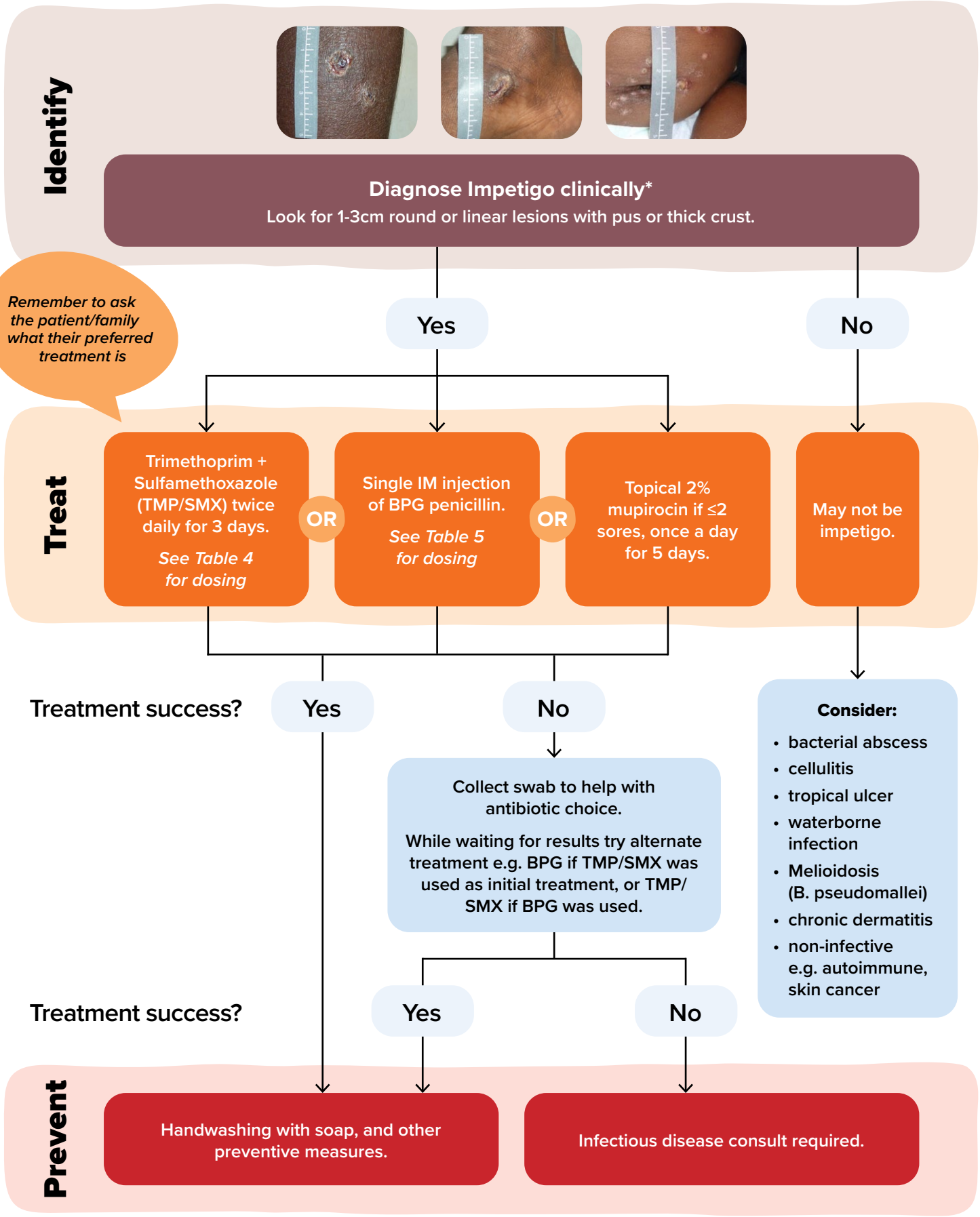
Table 4. Weight band dosing for oral trimethoprim-sulfamethoxazole (4mg/kg/dose of trimethoprim component) twice daily for 3 days.

Weight Band	Syrup Dose (Give morning and night) Trimethoprim-sulfamethoxazole is 40mg trimethoprim/5ml	Tablet Dose (Give morning and night) Tablets are 160/800 of trimethoprim/ sulfamethoxazole components
3 - < 6kg	1.5 mL (12mg BD)	N/A
6 - < 8 kg	3 mL (24 mg BD)	N/A
8 - < 10 kg	4 mL (32 mg BD)	N/A
10 - < 12 kg	5 mL (40 mg BD)	N/A
12- < 16 kg	6 mL (48 mg BD)	N/A
16- < 20 kg	8 mL (64 mg BD)	N/A
20- < 25 kg	10 mL (80 mg BD)	½ tablet (80mg BD)
25- < 32 kg	12.5 mL (100 mg BD)	¾ tablet (120mg BD)
32- < 40 kg	16 mL (128 mg BD)	¾ tablet (120mg BD)
≥40kg	20 mL (160 mg BD)	1 tablet (160mg BD)

Table 5. Weight band dosing for Benzathine benzyl Penicillin G (BPG).

Weight Band	Injection Dose 1 syringe contains 900mg BPG in 2.3ml
Child	
<10kg	450,000 units (0.9mL)
10 - < 20kg	600,000 units (1.2mL)
≥ 20kg	1,200,000 units (2.3mL)

Figure 12. Impetigo treatment algorithm.



*If impetigo infection is present, consider and examine for evidence of scabies infestation. Follow instructions in Chapter 7.

Discussion

Treatment

The recommendations for treatment of impetigo in this guideline are based on available evidence, but must also take into account 'real world' conditions experienced by healthcare providers working in Aboriginal and Torres Strait Islander communities or providing care to these families in urban settings.[106] We evaluated the evidence available from around the world and recommendations from other Australian guidelines. However, while there may be good evidence for the proven efficacy of a particular treatment, if that treatment is not always easily available or not registered in Australia for impetigo treatment (e.g. Fusidic acid 2%), we provided suitable alternatives.

Impetigo is caused by *S. pyogenes* and *S. aureus*. Based on studies conducted in Australia, *S. pyogenes* is the pathogenic driver of infection in these settings.[95] Despite rising rates of methicillin-resistant *S. aureus* (MRSA), antibiotics directed at *S. pyogenes* alone will treat infection. Oral trimethoprim-sulfamethoxazole has the additional benefit of treating both pathogens including MRSA and leads to a reduction in MRSA bacterial load. There is high quality evidence to support the use of oral trimethoprim-sulfamethoxazole or intramuscular (IM) benzathine benzyl penicillin G (BPG) for the treatment of impetigo (GRADE 1A)[26]. Oral trimethoprim-sulfamethoxazole has fewer side effects.[95] Oral cefalexin is an alternative in children allergic to trimethoprim-sulfamethoxazole or penicillin. Cefalexin is recommended for its antibiotic activity against *S. pyogenes* and methicillin-susceptible *S. aureus* (MSSA), and is preferred over flucloxacillin due to palatability, fewer doses per day and ability to administer with or without food. This is based on clinical experience and antibiotic susceptibility profile when MSSA rates are known to be below 10%. Clinical trials have tested beta-lactam antibiotics for a 7-day course, but not shorter. However, the success of a 3-day course of trimethoprim-sulfamethoxazole in the Skin Sore Trial, suggests that antibiotic courses shorter than seven days are likely to be effective.[95] Therefore, the authors of this guideline suggest that if lesions are improved after three days of cefalexin, the cefalexin may be ceased at this time.

The treatment regimen should be decided by the healthcare provider with the family, based on their knowledge of the patient and/or carer, their family circumstances and the family preference.[84] The preferred regimen is twice daily oral trimethoprim-sulfamethoxazole for three days.[95] If compliance with this regimen is uncertain, a single daily dose of oral trimethoprim-sulfamethoxazole (8mg/kg of the trimethoprim component) for five days provides an opportunity for directly observed therapy at the clinic, school or other service provider or may be simpler for the family. A single dose of IM BPG may be the best option for some families as no further doses are required. However, IM BPG is painful and children may then be reluctant to return to the clinic for future care.[84,95]

In the Skin Sore Trial, the microbiological clearance of *S. pyogenes* (Strep A) was the same with oral trimethoprim-sulfamethoxazole as it was for IM BPG, but clearance of *S. aureus*, including MRSA, was significantly higher with trimethoprim-sulfamethoxazole.[95] Therefore, trimethoprim-sulfamethoxazole is the preferred treatment in areas where *S. aureus* (and MRSA) rates are high.

Oral penicillin G is not recommended for treatment of impetigo in resource-limited settings (GRADE 2C). Treatment failure with oral penicillin was reported more often than with IM BPG.[20] In non-resource-limited settings, oral penicillin has been shown to be less effective than most other oral antibiotics, such as erythromycin or flucloxacillin.[14]

Topical therapies such as 2% mupirocin are useful when there are a limited number of sores (≤ 2) and where resistance to topical antibiotics is not a concern. For people with more than two sores, topical antibiotic creams such as mupirocin are not recommended due to the risk of resistance developing with a heavy individual bacterial load. This is also a risk in contexts where the burden of

impetigo is high in nearby children (e.g. community or classroom) as rapid selection for community level resistance may occur (GRADE 2C).[107-110] There is no evidence that other topical therapies, e.g. papaya cream, are beneficial in treating impetigo. The decision to include topical antibiotics for low burden (≤ 2 sores) disease has been reached by the Scientific Advisory Group after much debate, to balance the potential evidence-based benefits of ease of treatment for families with the antimicrobial resistance risk.

There was no evidence for or against the use of topical antiseptic washes or topical antiseptics in the control of impetigo.

Currently, there is no available published evidence to support the use of complimentary therapies, bush medicines or traditional treatments for impetigo. However, there is longstanding traditional wisdom available within Aboriginal and Torres Strait Islander communities on keeping skin strong and healthy. This knowledge and application of bush medicines in health and disease is an important part of cultural wellbeing and should be supported as a complement to the prescription of evidence-based treatments for impetigo described above. We encourage further research in this area to ensure that care and treatment of impetigo bridge Western and Aboriginal and Torres Strait Islander values. Honey has been shown to be bactericidal against skin pathogens in vitro.[111] Further research is needed.

Prevention

Scabies and impetigo often co-exist. Anti-parasitic agents used in MDA programs (e.g. ivermectin, permethrin) have shown an additional benefit in reducing the burden of impetigo indirectly. While there was not enough evidence to support MDA for impetigo alone in resource-limited settings, there is high quality evidence where scabies is common to support the use of oral ivermectin MDA above standard of care permethrin treatment to reduce the burden of impetigo.[62] To date, most MDA studies for skin disease control have been conducted in island communities which may mean that these findings cannot be applied directly to highly mobile populations living in resource-limited mainland communities. MDA programs for scabies have shown a significant reduction in scabies, impetigo and clinic presentations for skin and soft tissue infections.[70] Additionally, MDA programs require a high level of community ownership and engagement to achieve the success that has been seen in research trials. The recently published MDA for > 100,000 people in Fiji confirmed that mass treatment of scabies resulted in fewer clinic and hospital presentations for all skin infections.[112]

There were no studies that assessed the effect of a community skin health program on impetigo alone. There was one study describing the effect of a community skin health program on the prevalence of scabies and impetigo.[55] Active screening by trained local community workers over a 3-year period was associated with increased treatment uptake and led to a 15% absolute reduction in prevalence of impetigo. Where skin sores affect > 10% of the population, skin control programs should be actively pursued. The Australian evidence to support this will be available in the coming year.[113]

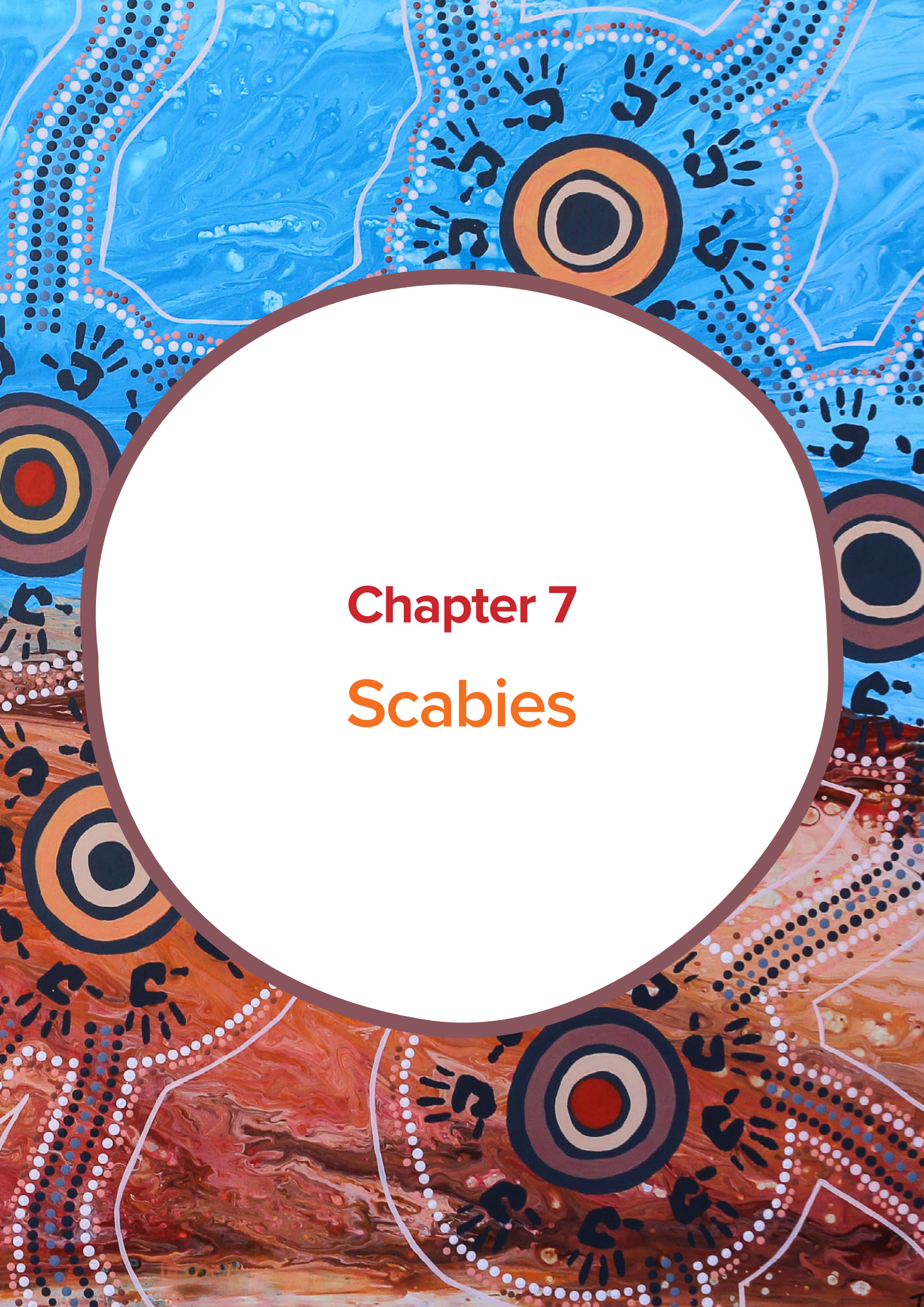
Treatment combined with comprehensive skin control measures such as health promotion, environmental interventions and screening are likely to have added benefit to conventional clinical treatment regimens in sustaining a reduction in population prevalence of scabies and impetigo (GRADE 2C).[55] High quality, randomised studies with control communities who do not receive the additional interventions would define the measurable benefit over standard treatment alone.

Washing hands once a day with soap is effective in the treatment and prevention of impetigo in resource-limited settings (GRADE 1A).[40,114] There is no benefit to the use of antibacterial soap over regular soap.[40,114]

There is low quality evidence that an adequate supply of water for washing and cleaning will reduce the incidence of impetigo in resource-limited populations (GRADE 2C).[115] However, promotion of good hygiene practices, improved water supply and improved housing infrastructure including maintenance of plumbing and household bathrooms in resource-limited settings are unlikely to cause harm and should be encouraged. Further studies are required to determine whether there is a measurable benefit in the management of impetigo.

The regular use of swimming pools is likely to lead to improvements in skin health, but currently there is insufficient evidence to support the installation of swimming pools in remote communities for the sole purpose of reducing the prevalence of impetigo.[116]

Currently, there is no evidence to support the need for housing improvement programs for the reduction of impetigo alone in resource-limited settings, although improvements in housing are likely to lead to improvement in the general health in these communities. It is a human right to have safe, well maintained and healthy living environments.



Chapter 7

Scabies

Overview

Scabies infection of the skin is the result of an infestation by the mite *Sarcoptes scabiei* var. *hominis*.[6] Scabies only occurs in humans, and results in intensely itchy skin lesions.[18,117] Scratching due to scabies causes a break in the skin as a barrier,[117] which can result in secondary bacterial infection.[18,117] Scabies mites crawl, but do not fly or jump, so the main mode of transmission occurs through skin-to-skin contact. Rarely, transmission through contact with infected objects such as sheets or clothing[17,48] can occur but is more likely from people with crusted scabies (**Chapter 8**) and very high mite burden.[118]

Scabies is a very common skin infection in tropical climates and is endemic in remote northern Australia. Remote living Australian Aboriginal and Torres Strait Islander children have some of the highest reported rates of scabies in the world,[119] with up to 35% of children in some communities affected at any time.[96] The prevalence of scabies documented in remote Aboriginal communities in the NT is high, ranging from 16.1% to 35%.[53,54,59] Community wide surveillance programs for skin infections are needed to improve the targeted prevention activities.

The estimated global prevalence of scabies in 2010 was over 100 million people,[120] with the highest point prevalence of scabies in the resource-limited settings of Panama (78% of children <2 years), Fiji (44% of 5 to 9-year-olds) and Australia.[119] Scabies is now classified by WHO as a Neglected Tropical Disease (NTD)[121] because it is a surrogate for poverty, it causes significant stigmatisation, is associated with chronic kidney disease and rheumatic heart disease (RHD) in tropical settings,[122] and is highly responsive to control through MDA.

Consequences of untreated scabies infection

Scabies is intensely itchy especially at night and can disrupt sleep resulting in difficulty concentrating, along with other impacts on wellbeing. Scabies can also transmit to close contacts if untreated.

Scratching the skin as a result of scabies leads to secondary bacterial skin infections, which can result in bone and joint infections, abscess, cellulitis and sepsis. Sepsis can lead to death in a small proportion of cases. Infections from Strep A can cause acute post streptococcal glomerulonephritis (ASPGN), which can lead to chronic kidney disease. Skin infections may also lead to ARF, progressing to RHD in some individuals.[123]

To prevent the secondary bacterial infections, treatment and prevention of scabies should be a high priority. Treatment of scabies also reduces the overall community burden of impetigo.[70]

Identify

Scabies mites are transferred by direct contact with skin and can burrow into the skin very quickly. The intense itching is caused by the host's immune response to the mite and its eggs and is more severe at night. The itching may not commence immediately after infestation—typically 4–6 weeks after the initial infection, but within days in individuals who have been previously infested with scabies. Even after treatment, the itching can persist for four weeks or longer ('post-scabetic itch'), and in patients with debilitating itch, short-term use of topical corticosteroids (as per Box 5 in **Chapter 10**, Atopic Dermatitis) can be helpful.

The mites burrow into the skin leading to the development of small bumps (papules), pustules, blisters and/or tiny linear burrows that contain the mites and their eggs. Scabies papules and scratch marks are commonly found in the web spaces between fingers and toes, and on the inner surfaces of the wrists and elbows (Figure 13). Scabies mites preferentially infest hairless skin, hence other common

sites include the areolae of the nipple (women) and the scrotum (men). If untreated, scabies can induce an allergic-type rash (eczematous morphology) all over the skin, including the torso and limbs. Infants may have widespread lesions affecting their whole body involving the head, neck, palms and soles of the feet, but typically present with pustules on the palms and soles. This is also a common finding in the frail elderly. Scabies papules are usually absent on the head and face except in the immunosuppressed and those under one year of age.

Scabies remains predominantly a clinical diagnosis. The case definition of scabies is an intensely itchy rash with small bumps on the skin in a typical distribution pattern involving the web spaces between the fingers, toes or other parts of the body.[124] Where available, dermoscopy can be a useful diagnostic tool to visualise mites and burrows *in vivo* and guide the placement of confirmatory skin scrapings. The characteristic finding on dermoscopic examination is a dark, triangular shape that represents the head of the mite within a burrow ('delta wing' sign).[88] Note: mites can be difficult to detect in patients with highly pigmented skin. Point of care molecular and lateral flow tests would improve the sensitivity of scabies diagnosis and will be needed to license new treatments in the future. Research is progressing towards this.[89]

If scabies infestation is present, consider and examine for evidence of impetigo (Chapter 6).

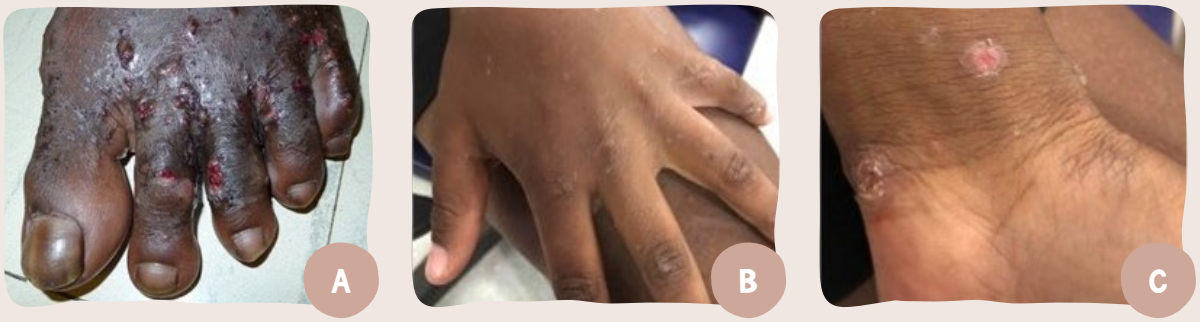


Figure 13. Scabies progression. Image A shows papules and the eroded base of blisters consistent with scabies infestation; image B shows papules that associated with itch would be diagnostic for scabies; image C shows lesions on the back of the wrist with features of recent bacterial infection that suggest scabies infestation.

Treat and prevent

Recommendations for the treatment and prevention of scabies infection

Identify		
✓	Due to the serious consequences if left untreated, scabies should be recognised and treated as a high priority.	
✓	Treatment of scabies reduces itch leading to better sleep and daytime concentration.	
✓	Treatment of scabies reduces clinical need for treatment of skin and soft tissue infections.	
Treat		
✓	Topical permethrin 5%. Repeat the application in 7 days as topical permethrin is not ovicidal. Instructions for applying the scabies creams are provided in Box 1. *NOTE: Topical permethrin achieves faster symptom resolution than oral ivermectin.* **OR** Oral ivermectin 200micrograms/kg for children over the age of 5 years (or over 15kg) and for non-pregnant/non-breastfeeding adults. Repeat the dose in 7 days as oral ivermectin is not ovicidal (Table 6).	**GRADE 1A**
✗	Ivermectin **CANNOT** be used in pregnant or breastfeeding individuals, or in children who weigh less than 15kg or are under 5 years of age.	
✓	Household and intimate contacts who are asymptomatic need treatment for scabies with a single dose of ivermectin or single application of topical permethrin.	**GRADE 1C**
✓	The standard application of whole-body treatment for topical creams is strongly recommended.	**GRADE 1D**
✓	Topical Permethrin can be used in infants <6 months old, where alternatives (e.g. crotamiton) are unavailable.	**GRADE 2D**
✓	Topical benzyl benzoate 25% emulsion can be applied to dry skin from neck down and left on for 24 hours. Repeat in 7 days.	**GRADE 1C**
✓	Topical benzyl benzoate 25% is safe in pregnant people living in resource-limited settings.	**GRADE 2C**
✓	Topical crotamiton is safe in infants, but oral ivermectin (for >5 years of age) or permethrin (for >6 months) is recommended above topical crotamiton.	

Prevent		
✓	Ivermectin mass drug administration (MDA) to control impetigo and scabies may be of benefit in resource-limited communities where scabies prevalence is > 10%.[51]	**GRADE 1A**
✓	Azithromycin **SHOULD NOT** be added to an ivermectin MDA as ivermectin alone is effective for the control of impetigo and scabies.	
✓	Treatment of asymptomatic household contacts with a single dose of either oral ivermectin or topical permethrin is recommended for the community control of scabies.	**GRADE 1C**
✓	Treatment of cases and contacts is recommended in scabies outbreak situations.	**GRADE 2C**
✓	An adequate supply of water for washing and cleaning may reduce the incidence of impetigo and scabies, but the evidence is not high quality.	
✓	Children with scabies should be excluded from school until treatment has commenced with their first dose of treatment and open sores should be covered with watertight dressings.	
✓	Wash all clothes, towels & sheets with hot water & dry them in the sun. If unable to wash linen, seal items in a plastic bag for least 3 days. Carpeted floors & fabric furniture should be vacuumed.	
✗	Benefits of dog health programs for the community control of human scabies infestations have not been established.	

Table 6. Weight band dosing for oral ivermectin (~ 200 µg/kg).

Weight Band	Dose
15 – 24 kg	3 mg (1 tablet)
25 – 35 kg	6 mg (2 tablet)
36 – 55 kg	9 mg (3 tablet)
56 – 65 kg	12 mg (4 tablet)
66 – 79 kg	15 mg (5 tablet)
>80 kg	18 mg (6 tablet) or 200 µg/kg (rounded up to the nearest 3 mg)
*Oral ivermectin cannot be used in children less than 5 years of age or under 15kg, and in pregnant or breastfeeding individuals.	

Box 1. Application of topical permethrin for scabies.

- Rub the cream on clean, dry skin after bath/shower at the end of the day. The cream needs to be left on for 8 hours under clean pyjamas or clothes.
- For babies under 6 months — leave on for 6–8 hours.
- Start with the head including scalp and face — avoid eyes, lips, mouth, mucous membranes.

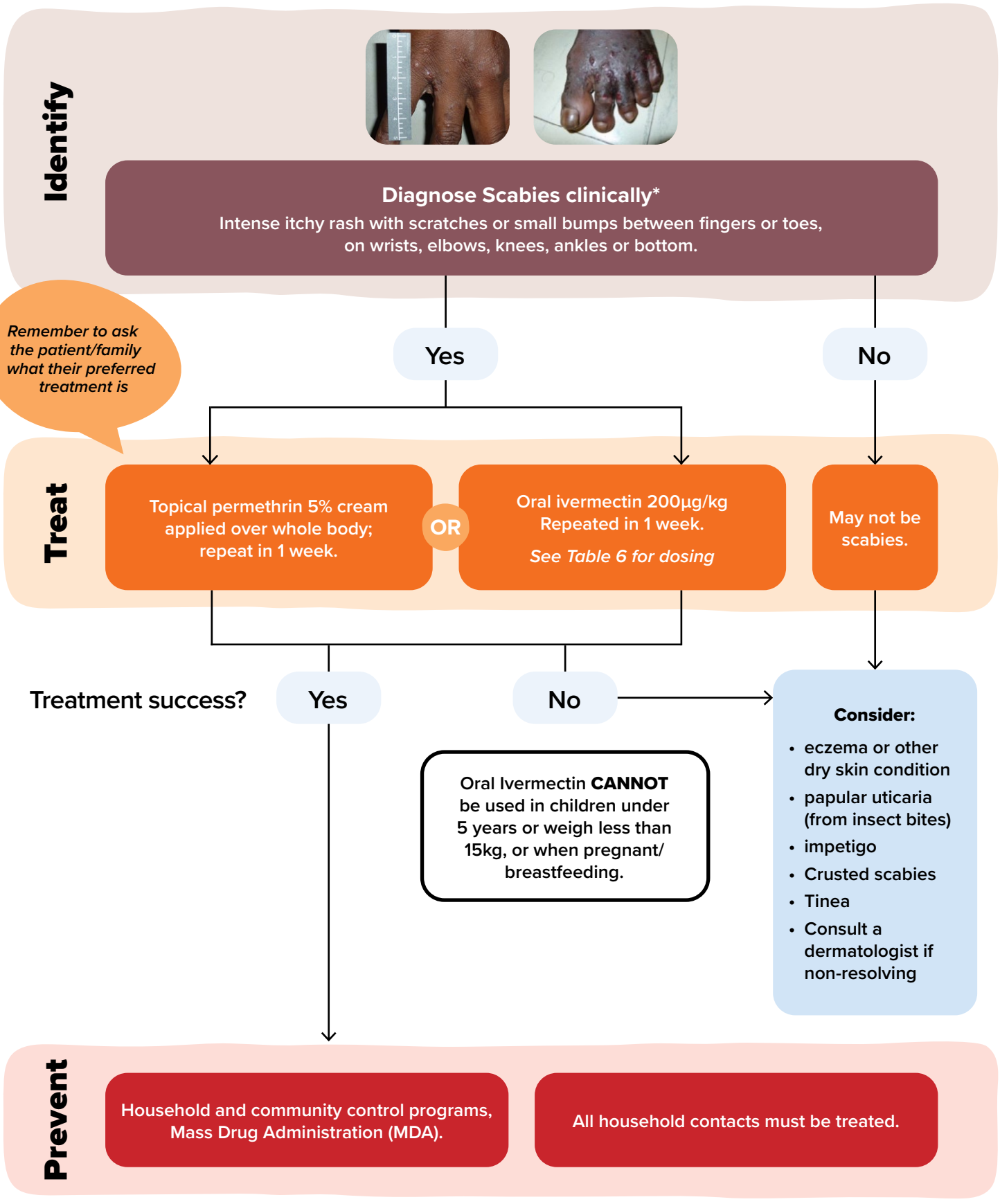
If hair very thick or infestation very bad, discuss with the patient whether cutting their hair of shaving their head would be acceptable to them as part of their treatment.

- Work carefully down the whole body. **ALWAYS INCLUDE**:
  - Between **fingers and toes, soles of feet, under nails**
  - Body creases — **behind ears, under jaw, neck, armpits, groin, bottom, under breasts**
  - Joints and joint creases — **elbows, knees, heels**
- Put on hands again after washing, put on child's hands again before bed.
- Make sure no skin is missed especially the back, buttocks and difficult to reach spots.

Repeat treatment in 1 week to kill any new mites that hatch after first application.

NOTE: Look for evidence of secondary bacterial skin infection (i.e. pustules, crusting, ooze, discharge, pain, fever, systemic symptoms) and treat as per impetigo (Chapter 6) where present.

Figure 14. Scabies treatment algorithm.



*If scabies infestation is present, consider and examine for evidence of impetigo. Follow instructions in Chapter 6.

Discussion

Treatment

The recommendations for treatment of scabies in this guideline are based on available evidence, but must also take into account 'real world' conditions experienced by healthcare providers working with Aboriginal communities and families.[106] We evaluated the evidence available from around the world and recommendations from other state-based guidelines. However, while there may be good evidence for the proven efficacy of a particular treatment, if that treatment is not always easily available (e.g. crotamiton), or not registered in Australia for scabies treatment (e.g. topical ivermectin or lindane), we provided suitable alternatives.

There is high quality evidence for the use of oral ivermectin for community wide use in children > 5 years old and non-pregnant adults (GRADE 1A), where community prevalence studies show the prevalence is ≥ 10%.[51] There is a small amount of evidence supporting the use of permethrin over and above oral ivermectin in people with classical scabies[125-127] due to the faster clinical cure and symptomatic relief achieved in some of the studies.[125,126] However, this effect was not sustained over the course of any of the studies and oral ivermectin was equally effective at achieving clinical cure after several weeks of follow up. Therefore, we have recommended either topical permethrin or oral ivermectin for treatment of scabies. Over time, laboratory studies have demonstrated that the scabies mite has developed resistance to ivermectin and topical permethrin. Due to these risks in endemic settings where scabies is affecting many community members, we have preferenced permethrin OR ivermectin for the treatment of scabies to spread the resistance pressure.

Patient preference for treatment must also be taken into account when prescribing, as more rapid relief of the itch with topical permethrin may be preferred over the simplicity of swallowing an oral tablet. In resource-limited settings not experiencing epidemic rates of scabies, or communities with high re-infection rates due to resident cases of crusted scabies, topical permethrin cream for the treatment of classical scabies may be preferred by affected community members due to the faster clinical response. However, clinicians can also use oral ivermectin with the confidence that this agent is equally effective over time and is much simpler. The secondary hypersensitivity eruption (eczematous rash) can be treated with short-term topical corticosteroid ointments for more rapid relief of itch and rash. This treatment can be commenced after the first dose of scabies-directed therapy. Refer to the 'Atopic Dermatitis' section (**Chapter 10**) for further instruction.

There is low quality evidence to support the use of topical permethrin above topical crotamiton in adults and children aged over four years of age (GRADE 2C).[128] Crotamiton can be difficult to source, therefore we recommend using topical permethrin over crotamiton in all age groups, if crotamiton is not available for infants.

Either topical benzyl benzoate or topical permethrin is safe for the treatment of scabies in pregnant individuals living in resource-limited settings (GRADE 2C).[129] For consistency with other guidelines, comfort, and availability, we have recommended topical permethrin in pregnancy.

There is no evidence to support modified applications of topical treatments for scabies over standard treatment regimens. The standard application of head-to-toe treatment is recommended (GRADE 1D). See **Box 1** for details on permethrin application.

Prevention

An MDA for scabies may be a useful intervention in a community where scabies prevalence is above 10%[51] as one of the strategies employed for control of a neglected tropical disease. Consideration of an MDA requires appropriate planning, consultation and community ownership to progress. The details of scope, consent, logistics, ethics and adverse events need to be clearly discussed with stakeholders and community members before embarking on an MDA. Without this consultation, the reported success rates of MDA may not be achieved locally. In contrast, an MDA is strongly recommended in communities that are supportive, are fully informed about the risks and benefits, and are provided with the opportunity to lead the planning, implementation and evaluation of the MDA program.[55,72,106]

In areas where scabies is endemic and outbreaks are common, there is a greater availability of evidence to support the use of oral ivermectin[130] over topical agents.[62] In communities preferring the MDA method to reduce the prevalence of scabies and impetigo, rather than individual treatment of only those with scabies, oral ivermectin may be a superior agent for community-wide use in older children and non-pregnant adults[62] as well as being more practical to administer to a large number of people.

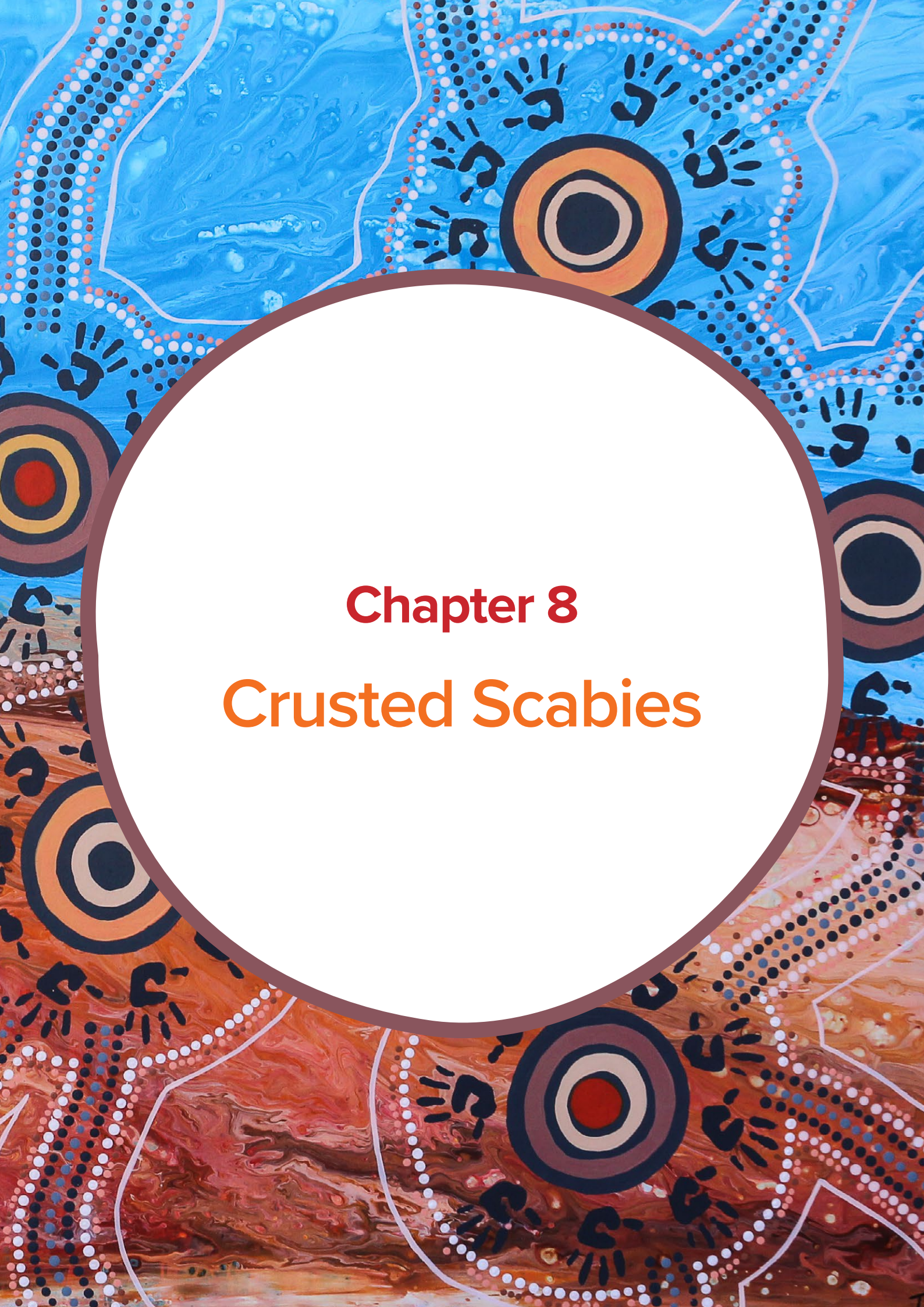
There is high quality evidence to support the use of MDA to control scabies in resource-limited communities (GRADE 1A).[64,65,67,69,70,131-133] In addition to MDA, there is moderate quality evidence for comprehensive control programs combining health promotion, education, hygiene practices, environmental interventions and screening as likely to be of benefit when added to standard treatment regimens for scabies (GRADE 2B) and are likely to sustain a reduction in the population prevalence of scabies and impetigo.[134] Further studies are required to determine whether there is any additional benefit of these comprehensive measures. However, high quality studies using control communities who do not receive the additional interventions would be useful in determining the measurable benefit over standard treatment or MDA alone.

For the treatment of asymptomatic contacts of individual cases, there were no studies comparing efficacy between agents. Therefore, treatment with oral ivermectin or topical permethrin is recommended. When treating asymptomatic contacts, a single dose is needed. Treatment of household contacts is recommended for the community control of scabies in resource-limited settings (GRADE 2C).[135] Treatment of cases and contacts is recommended in scabies outbreak situations (GRADE 2C), however, high quality studies comparing treatments during outbreaks are required before different treatments can be recommended over the current first line therapy recommended for routine use.

There is low quality evidence that an adequate supply of water for washing and cleaning will reduce the incidence of scabies in resource-limited populations (GRADE 2C). Promotion of good hygiene practices, safe water supply and better housing should be advocated for as general health improvements in resource-limited settings. This approach may be a target for future research to determine whether there is a measurable benefit in the management of classical scabies. High-quality water supplies are essential to overall good health including skin health and access to this is a human right.

High quality studies assessing the clinical effectiveness of washing clothing and bed linen, storage of items in plastic bags, exposure to sunlight and household spraying with insecticides are required before these measures can be strongly recommended as adjuncts in the control of classical scabies in resource-limited settings. Whilst practical and common in many of the scabies skin control programs, there is limited evidence for or against these activities, as they have not been compared with a control where these additional activities were not incorporated.

The scabies mite that infests dogs (causing mange) does not cause human infestation.[136,137] Benefits of dog health programs for the community control of human scabies infestations have not been established.



Chapter 8

Crusted Scabies

Overview

Crusted scabies is due to *Sarcoptes scabiei var. hominis*, the same mite that causes classical scabies. Crusted scabies occurs because the host's immune system cannot control the infestation, and the mites multiply rapidly. Classical scabies infestations are thought to involve only 5 to 15 scabies mites,[48,117] whereas people with crusted scabies are infested with thousands to millions of mites.[18,117] There is a spectrum of severity, from mild cases to severe hyperkeratotic (crusting) dermatosis.117 In Central Australia, crusted scabies has been associated with human T-cell lymphotropic virus 1 (HTLV–1) infection,[138] a virus which suppresses the immune system. However, most cases have no identifiable immunological deficit.

Crusted scabies affecting someone in the household or community in all age groups may be an important contributor to the heavy burden of classical scabies in young children due to stigma, 'shame', under-diagnosis, and frequent recurrences.139 Although relatively rare in urban settings of Australia, crusted scabies is a notifiable disease in remote Aboriginal communities in the Northern Territory (NT) of Australia.[140] The global incidence rates for crusted scabies is yet to be described. Considerable progress has been made in improving recognition, treatment, education and facilitating a 'scabies-free environment' approach for those affected with crusted scabies to reduce recurrences.[141] Crusted scabies may be less common in other states of Australia, but there is limited data available to confirm this, as it is not a notifiable disease in any other jurisdiction. Crusted scabies cases may lead to outbreaks in other residential settings e.g. aged care, boarding schools, dialysis units, etc.

Individuals with crusted scabies are extremely infectious as their shed skin contains live mites that can infect other household or community members.[61,117] The social stigma associated with scabies, particularly crusted scabies, is significant. Affected individuals often do not present for treatment to health services based on past experiences of stigma and shame, and fear of being isolated in hospital. The approach to the diagnosis and treatment of crusted scabies must be approached with respect and sensitivity, with education provided about decision making and infection control requirements.[117,139]

Consequences of untreated crusted scabies infection

Individuals with crusted scabies have lower life expectancy, frequent hospitalisations and may develop secondary bacterial complications.

Household contacts of unmanaged crusted scabies have high risk of recurrent scabies, skin sores, poor sleep, disruption of school and work. Skin sores are associated with chronic heart and renal disease.

Crusted scabies is highly infectious and individuals with crusted scabies may act as core transmitters for further scabies outbreaks in affected communities. Effective management of individuals with crusted scabies is essential to the community-wide control of scabies.

Identify

Crusted scabies is often not itchy, due to the host's impaired immune response. The rash appears as scaling and crusting of skin, usually on the hands and feet but occasionally affecting other sites.[142-144] Deep fissures or cracks can develop within the crusting on the palms and soles (**Figure 15**). Nail thickening can occur and crusting will often accumulate under the nails. Cases can range from mild, with only a few patches of crusting, to severe infestation covering the entire body. Crusted scabies may be misdiagnosed as other conditions such as tinea, psoriasis or eczema/dermatitis.

Prompt and correct diagnoses of crusted scabies is important to save time and resources, and to prevent further outbreaks of scabies in the community. Crusted scabies is a clinical diagnosis (A), confirmed with skin scraping for laboratory testing (B).[35]

A: Clinical appearance

- Thickened scaly and crusted plaques, often not itchy compared to classical scabies.
- Preferentially affects the hands and feet, also found on abdomen, buttocks and axilla.
- Scale may have distinctive creamy colour.
- May look similar to tinea, psoriasis, or eczema/dermatitis.

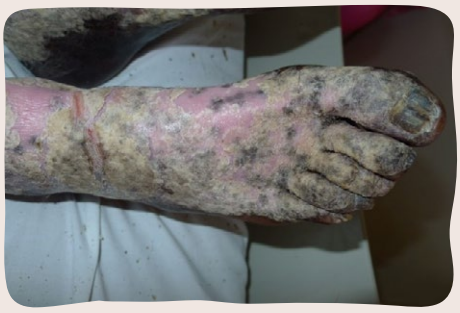


Figure 15. Depigmented skin with areas of thick crust as evidence of crusted scabies.

B: Skin scrapings to detect mites on microscopy

- Positive results that confirm the presence of mites greatly increases the likelihood that the skin condition is truly crusted scabies. The absence of mites from skin scrapings does not rule out the possibility of crusted scabies as transport delays or insufficient sampling may contribute to a false negative result.
- In the NT, a positive skin scraping is required to meet the case definition of crusted scabies. If crusted scabies is present, consider and examine for evidence of impetigo (Chapter 6).

Severity grade of crusted scabies at diagnosis

A grading scale for crusted scabies to aid treatment decisions has been developed by clinicians in the NT.[143] After thoroughly examining the entire body surface area, refer to Table 7 to generate the clinical score to aid in decision making. For each category of A-D, choose the lowest appropriate score relevant to the patient. Each category A-D has a total of 3 points. Sum the results of each category (A-D) to find the total score. Grade 1 is a score of 4-6 points; Grade 2 is a score of 7-9 points and Grade 3 a score of 10-12 points.

Due to stigma and fear of hospitalisation, particularly in those with recurrent episodes of crusted scabies, the clinical experience to manage patients safely in their communities in the NT has developed. Based on this, Grade 1 crusted scabies may be managed in the community if appropriate supports and clinical experience are in place. This includes regular assistance with application of topical therapies and treatment of all household contacts. The biggest factor in prevention of recurrent crusted scabies episodes for vulnerable individuals has been living in a scabies-free environment, hence regular skin checks and early treatment of any contacts who develop scabies is a priority. Where the supports and clinical expertise are not available, Grade 1 crusted scabies cases should be admitted to hospital. Grade 2 and 3 crusted scabies need hospitalisation as the condition may be life threatening due to bacterial sepsis. The application of topical treatments to resolve the skin lesions more rapidly will also be supported in hospital. Discussion with patients about the infection control isolation procedures in hospital to ensure they are informed and prepared is a priority. Refer to Table 7 for further details about the grading score and how this relates to treatment.

Table 7. Crusted Scabies Grading Scale. After thoroughly examining the entire body surface area, for each category of A – D, choose the lowest appropriate score relevant to the patient. Each category A-D has a total of 3 points. Sum the results of each category (A-D) to find the total score. Grade 1 is a score of 4-6 points; Grade 2 is a score of 7-9 points and Grade 3 a score of 10-12 points.[142]

Category	Description			Score
A. Distribution & extent of crusting	Wrists, web spaces, feet only OR <10% total body surface area (TBSA)			1
	As above + forearms, lower legs, buttocks, trunk OR 10–30% TBSA			2
	As above + scalp OR >30% TBSA			3
B. Crusting/ shedding	Mild crusting (<5mm deep); minimal skin shedding			1
	Moderate crusting (5-10mm deep); moderate skin shedding			2
	Severe crusting (>10mm deep); profuse skin shedding			3
C. Past episodes of crusted scabies	Never had it before			1
	1–3 prior hospitalisations OR depigmentation of elbows and/or knees			2
	≥4 prior hospitalisations OR depigmentation as above and/or legs/ back OR residual skin thickening or scaly skin			3
D. Skin condition	No cracking or pus			1
	Any of: multiple pustules, weeping sores, superficial skin cracking			2
	Deep skin cracking with bleeding, widespread pus			3
Scoring	**Grade 1 = 4-6**	**Grade 2 = 7-9**	**Grade 3 = 10-12**	**Total**

Treat and prevent

Recommendations for the treatment and prevention of crusted scabies

Identify		
✓	Crusted scabies is highly infectious and may result in scabies outbreaks in affected communities. Prompt treatment and control efforts are essential.	
✓	To keep crusted scabies patients in a scabies-free environment, requires regular skin checks of children and family members and early treatment of scabies when it occurs.	
Treat		
✓	Oral ivermectin 200 micrograms/kg once a day on days 0, 1 and 7 combined with second daily topical keratolytics and topical scabicide and topical keratolytic (see below) for Grade 1 crusted scabies until cured. **Refer to the **Table 6** ('Scabies' **Chapter 7**) for ivermectin dosing.*	**GRADE 1B**
✓	For more extensive crusted scabies (Grades 2–3), referral to hospital and treatment as per Therapeutic Guidelines: https://tgldcdp.tg.org.au/topicTeaser?guidelinePage=Antibiotic&etgAccess=true#	
✗	Ivermectin **CANNOT** be used in pregnant or breastfeeding individuals, or in children under 5 years or age or who weigh less than 15kg. Clinical assessment of the risks and benefits of ivermectin in these circumstances and severe crusted scabies is needed. Consult infectious diseases for advice.	**GRADE 1A**
✓	After bathing, apply topical scabicide to entire body every second day, then twice a week until cured. Topical benzyl benzoate 25% lotion (diluted with 3 parts water in ages 6–23 months and equal parts water 24 months – 12 years). **OR** Benzyl benzoate 25% lotion mixed with tea tree oil for adults. **OR** Permethrin 5% cream if benzyl benzoate is not available or not tolerated due to skin irritation/burning.	**GRADE 1B**
✓	Alternate the topical scabicide with application of topical keratolytics to the affected areas only (crusted or thickened skin). Calmurid® cream (10% urea + 5% lactic acid in moisturising cream).	**GRADE 1B**
✓	Intensive supportive treatment is required for patients.	**GRADE 1B**
✓	Coordinated case management in the home may be of benefit, including regular review after discharge to assess for signs of reinfection.	**GRADE 2C**
✓	Clip long nails to better facilitate treatment of the subungual skin where mites can accumulate.	
Prevent		
✓	Individuals who have had crusted scabies are at high risk of recurrence. To prevent this, regularly assess their skin for signs of scabies infection and keep skin moisturised and in good condition. Treat all household contacts if any develop classical scabies and aim for a scabies-free environment for these individuals.	
✓	Life-long follow up while living in scabies endemic area is recommended.	

Treatment regimen

The described treatment regimen has been developed over many years by clinicians in the NT.[143,145] This has been the basis for the One Disease Crusted Scabies treatment guidelines summarised below.[35] We describe below the treatment regimen for Grade 1 crusted scabies if community-based treatment is occurring. Longer treatment is needed for Grade 2 and 3, and this is done in a hospital.

1. Once diagnosed with Grade 1 crusted scabies, daily reviews are recommended at the local clinic. Give the appropriate dose of oral ivermectin (**Table 6, Chapter 7**) with food or milk on days 0, 1 and 7.
2. In addition to the oral medication, alternating topical therapies each day is needed. After bathing, apply either the topical scabicide ointment or topical keratolytic cream as below.
3. Clipping the fingernails to better facilitate treatment of the subungual skin where mites can accumulate will help. The fingertips should also be soaked in an appropriate scabicide as per below.
4. Daily bathing followed by application of topical scabicide alternated with keratolytic ointments is needed to aid in clinical cure. Soaking or scrubbing crusts with a sponge each day and before applying scabicide or keratolytic will also help the cream penetrate the skin more effectively.
5. For the first week of treatment, apply Benzyl benzoate 25% lotion every second day after bathing. Following this, apply Benzyl benzoate 25% 2 – 3 times every week until cured. Apply head to toe as per Box 1 and leave on for 24 hours. Wash off after 24 hours. Topical 5% Permethrin can be used if Benzyl benzoate 25% lotion is not available or if skin irritation occurs. Do not use Benzyl benzoate on infants less than 6 months and dilute if under 12 years old or there is skin irritation.
6. Apply a topical keratolytic, such as Calmurid® cream (10% urea + 5% lactic acid in moisturising cream) after bathing on alternate days to benzyl benzoate/permethrin application and only to areas of crusted or thickened skin. Calmurid will soften the skin crusts and help the benzyl benzoate or permethrin cream penetrate the skin better.
7. Clothes, bed sheets and towels should be washed in hot water daily and dried in the sun. If a washing machine is not available, leave clothes, linen and bedding in a sealed plastic bag to kill any mites. Vacuum the floors and furniture in the house, and the floors and seats in cars, to remove mites or skin flakes.
8. Household contacts should be treated for scabies (**Chapter 7**) and regularly checked for scabies infections as part of a comprehensive approach.

Prevent

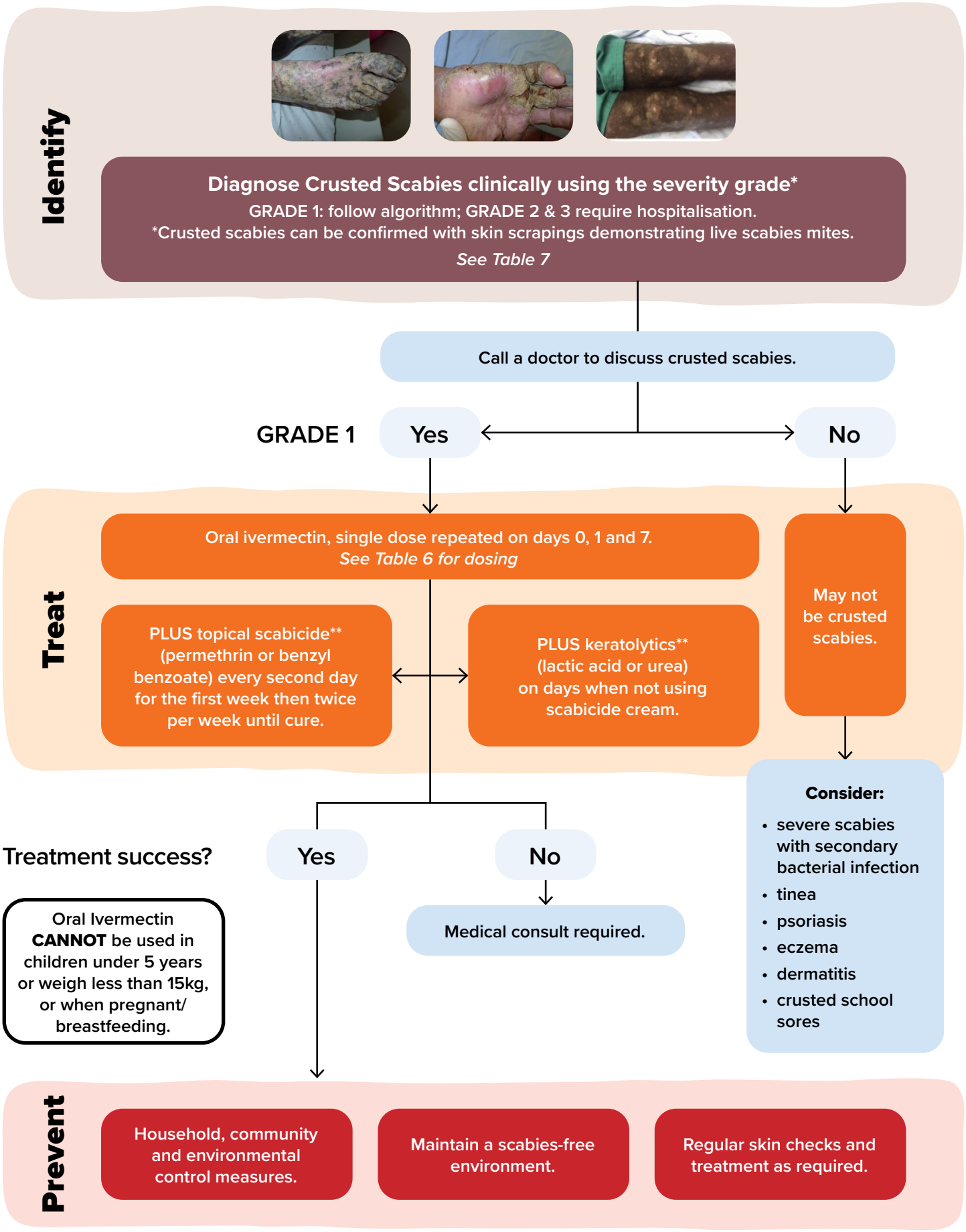
Models of care

Community-based support for individuals with crusted scabies and their families within their homes has been effective in the NT using a chronic disease model of care.[139] However, there is currently not enough evidence to recommend any one preventive measures for crusted scabies control in other resource-limited settings. Keeping the persons skin in good condition and living in a scabies-free environment have been adopted as key strategies to prevent reinfection in the susceptible host.

Environmental control

Environmental measures are recommended to decontaminate the environment, where the heavy infestation of scabies mites can survive for several days in the absence of the human host, including the washing of clothing and bed linen.[117] In addition, household spraying or fogging with insecticides has been recommended by expert consensus in some clinical guidelines to prevent transmission via fomites.[35,146]

Figure 16. Crusted scabies treatment algorithm.



*If crusted scabies is present, consider and examine for evidence of impetigo.

Discussion

The recommendations for treatment of crusted scabies in this guideline are based on available evidence, but must also take into account 'real world' conditions experienced by healthcare providers working with Aboriginal communities and families.[106] We evaluated the evidence available from around the world and recommendations from other state-based guidelines.

Improvements in the management of crusted scabies over two decades in the NT[106,146] have resulted in a combined focus of early treatment in community for Grade 1 crusted scabies if appropriate and aligned with coordinated case management and family support. For Grades 2 and 3 crusted scabies, initial care is in hospital with coordinated case management and family support once discharged to community and home.[139]

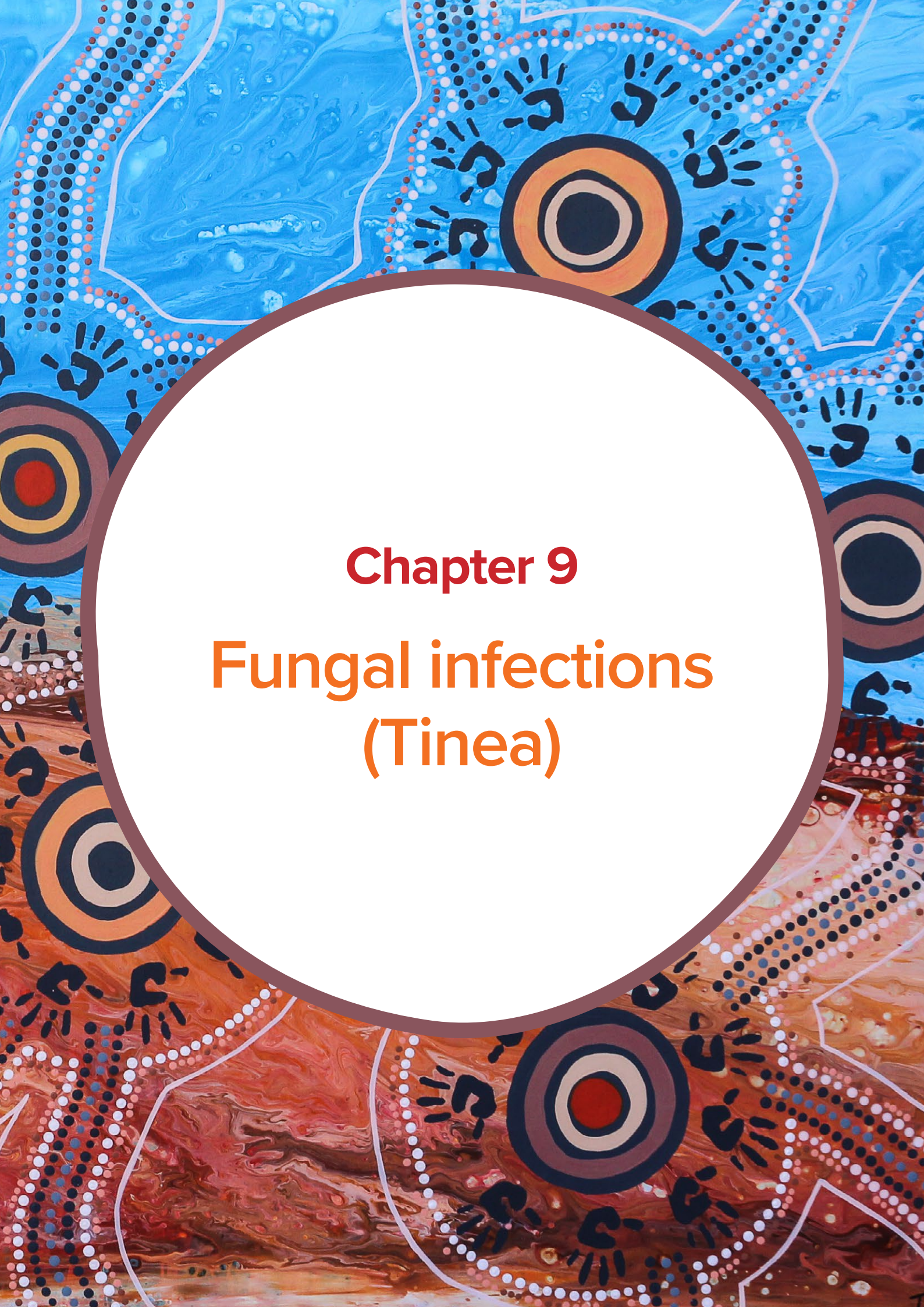
This coordinated approach to crusted scabies in the NT is underpinned by crusted scabies now being a notifiable disease and the efforts of the non-profit organisation One Disease to establish models of care. One Disease is no longer active and has transitioned these models of care to local health service providers.

Elsewhere outside of the NT, the expertise and coordinated care needed for management of Grade 1 crusted scabies, may not be available. In this circumstance, admission to hospital for all grades of crusted scabies may be more appropriate. This may also be required in a scabies outbreak in a residential care facility where there is a case of crusted scabies, to provide early and effective treatment and care for the individual with crusted scabies.

There is evidence of moderate quality to support the use of oral ivermectin with topical scabicides and keratolytics for crusted scabies (GRADE 1B).[143,145] Further trials in resource-limited populations would be beneficial to explore more effective treatments.

Patients with crusted scabies in resource-limited settings require intensive supportive treatment (moderate quality evidence - GRADE 1B).[143,145] This model of care as described above has been developed to prevent recurrences. An individual with crusted scabies remains at lifelong risk of recurrence. To reduce this risk, regular skin checks for scabies to commence early treatment, keeping the skin in good condition with daily moisturiser application and maintaining a scabies-free environment where the individual and household members are educated and aware of the signs and symptoms of scabies, have been identified as important strategies.

Coordinated case management in the home may be of benefit (low quality evidence - GRADE 2C).[139]



Chapter 9

Fungal infections (Tinea)

Overview

Superficial fungal infections of the skin, hair or nails are known as tinea. Infections are classified according to the site of the human body affected.[147] Tinea can involve the body (tinea corporis, ringworm), feet (tinea pedis, athlete's foot), scalp (tinea capitis, kerion), groin folds (tinea cruris, jock itch) or nails (tinea unguium, onychomycosis). Tinea is caused by infection with dermatophytes of the genera *Epidermophyton*, *Microsporum* and *Trichophyton*.[16,148] Dermatophytes can be anthropophilic (person-to person spread), zoophilic (spread from animals such as cats, dogs and cattle to humans) or geophilic (spread from the environment to humans).

Pityriasis versicolor, also known as 'white spot', is not a dermatophyte infection, but rather caused by an overgrowth of yeast on the skin (see below 'Other fungal infections').

Tinea is common in hot, wet climates. Between 10-20% of the world's population are affected by fungal skin infections.[16] Estimates of the disease burden have generally focused on the prevalence of the organisms causing tinea, rather than the clinical disease.[149,150] The World Health Organisation has estimated that 7-33% of children in resource-limited countries are affected by scalp tinea,[7] and 11% are affected by nail tinea.[151] Estimates of the tinea burden in northern Australia are not well established;[152] however, tinea was recorded in 7% of children prospectively assessed for skin infections on admission to hospital in WA,[73] and 4.3% of participants had concurrent tinea in a treatment trial for impetigo in the NT.[95]

Tinea is highly contagious, and if one person in a household is infected, it is likely that other household members will also be infected. Tinea is usually spread between humans by direct contact, from floors/bathrooms, or sharing contaminated objects (e.g. combs, hat, clothing, shoes, socks, towels, beds). Some species are present in dogs or cats and can transfer to humans, but this is not the most common source of infection. Infections often last a long time and are difficult to cure. The extensive tinea corporis commonly seen in remote northern Australian Aboriginal communities is predominantly caused by the anthropophilic dermatophyte *Trichophyton rubrum*.[152,153] As such, even with successful individual treatment, re-infection from untreated contacts and family members is very common.

Consequences of untreated tinea

All forms of tinea can cause discomfort and itch. Breaks in the skin as a result of scratching and lesions themselves may become secondarily infected with Strep A and *S. aureus*. Kerion, onychomycosis, and other complications of tinea are well documented,[154] but may be misclassified as they are frequently under-recognised. 'Normalisation' of fungal infections by clinicians has also been noted in remote Australia.[73] As with other pruritic skin conditions, tinea predisposes to bacterial skin infections and the other sequelae can be stigmatised and is challenging to treat. Treatment of fungal infections should be a high priority, including to prevent secondary infections with *S. aureus* and Strep A.

Identify

Tinea corporis (ringworm)

Tinea corporis (ringworm) usually starts as a scaly patch on the body. It is typically red in colour but can appear lighter or darker in different skin tones. It is often itchy, but not always. Left untreated, it will typically spread outwards with central clearing forming a ring-shaped lesion, hence the common name 'ringworm' (**Figure 17 Image A**). Multiple small patches can spread to join and form a single large, scaly patch (**Figure 17 Image B**).

If tinea corporis is suspected, the patient should always be examined for evidence of scalp and nail tinea; as the presence of either of these will alter the treatment approach (i.e. oral antifungals should be prescribed rather than topical antifungals).

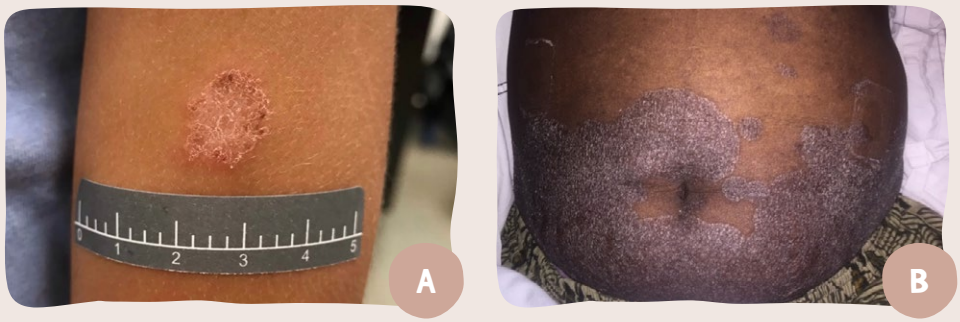


Figure 17. Tinea presentation. Image A (left) shows the features of redness, scale and ring-shaped lesion that are typical of tinea corporis. Image B (right) demonstrates more extensive tinea corporis with features of scale, confluence of the ring-shaped lesion and a darker appearance.

Tinea capitis (scalp tinea)

Tinea capitis (scalp tinea) usually presents as scaling of the scalp, which may be localised to a certain area or diffuse over the entire scalp. Over time, there is often associated hair thinning or hair loss. Scalp itch may be present. More typical features of ringworm may be present over the neck, ears and face; and should be examined for if scalp tinea is suspected. Occasionally, scalp tinea can present as an inflammatory kerion; which appear as a boggy pus-filled lesion typically associated with localised hair loss (Figure 18). Kerion's can be several centimetres in diameter, tender to palpation and are often associated with enlarged regional lymph nodes and fever. Oral antifungals should be prescribed for kerion.

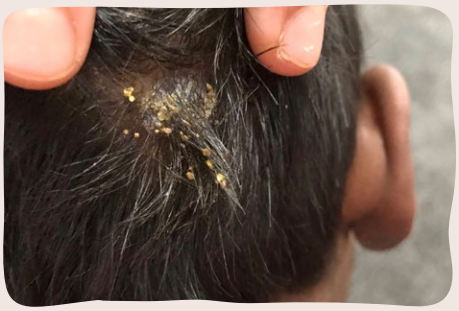


Figure 18. A round, boggy lesion of the scalp with overlying scale. There is evidence of associated hair loss and hair breaking. These are classic features of kerion.

Tinea unguium / onychomycosis (nail tinea)

Tinea unguium / onychomycosis (nail tinea) typically presents with white or yellow nail discolouration, thickening and crumbling of the nail plate (**Figure 19**). There may also be chalky, flaky debris between the nail and the nail bed. It can affect toenails and/or fingernails. Diagnosis of tinea is generally made based on appearance of the skin, but if there is any uncertainty about the cause, the infection is not responding to treatment, or has increased in severity, skin scrapings, hair pluckings (for scalp

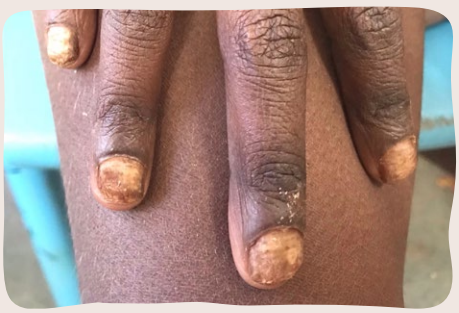


Figure 19. Fingernails showing the irregular, dystrophic and crumbly features of tinea unguium.

tinea) or nail clippings (for nail tinea) may be useful to confirm diagnosis and treatment. If tinea unguium is identified, the patient should always be examined for evidence of scalp and body tinea to ensure effective treatment. Oral antifungals should be prescribed for tinea unguium.

Other fungal infections

Pityriasis versicolor (white spot)

Pityriasis versicolor (white spot) appears as round or oval patches associated with light scale. They can appear white on darker skin tones, and red to tan-coloured on lighter skin tones; hence the name “versicolor” (multiple colours). Pityriasis versicolor typically develops over the trunk, including the shoulders and back, chest, upper arms, neck and occasionally the face. It is generally not associated with itch, but patients may want treatment to improve the appearance. The evidence for treatment was not appraised in the systematic review, but common treatments for this are recommended below.

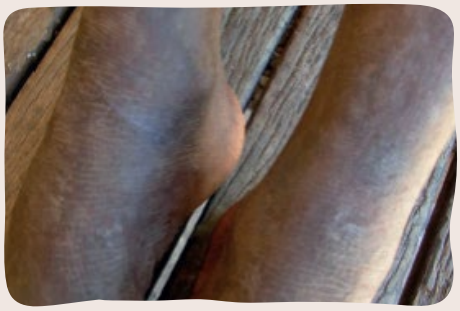


Figure 20. Pityriasis versicolor (white spot).

Treat and prevent

Recommendations for the treatment and prevention of tinea

Identify		
✓	Tinea should be recognised and treated as a priority.	
✓	Inspection of all body surfaces, especially nails and scalp is required, particularly in immune-compromised hosts or those receiving dialysis.	
✓	Features of tinea include itchy skin with a scale, dystrophic and crumbly nails and hair loss.	
✓	Skin scraping, hair plucking or nail clipping should be sent for fungal culture to confirm diagnosis of tinea corporis, tinea capitis or onychomycosis, respectively.	
Treat		
Tinea of the skin (tinea corporis)		
✓	**Topical Treatment (indicated for small, localised skin infections):** **Terbinafine 1% cream** twice a day for 2 weeks or until resolved completely. **OR Miconazole 2%** twice a day for 4-6 weeks and for 2 weeks after rash is cleared.	**GRADE 2C**
✓	**Oral treatment (indicated for generalised skin infections, or infections involving the scalp or nails):** Oral terbinafine as per dosing once a day for 2-4 weeks* **See Table 8 for dosing and Box 2 for precautions with oral terbinafine.*	**GRADE 2C**
✓	Oral fluzonazole 150mg once a week for 6 weeks (for adults).	
✓	Oral griseofulvin as per dosing once a day for 2-4 weeks* Continue treatment for 1-2 weeks after resolution. **See Table 9 for dosing and Box 3 for precautions.*	
✓	**For refractory tinea following skin scrapings:** Use itraconazole and seek expert advice re dosing from infectious diseases specialist or dermatologist.	
Tinea of the scalp (tinea capitis)		
✓	Oral terbinafine (see Table 8 for dosing) once a day for 4-6 weeks (or until clinically resolved, i.e. no scale, no inflammation, evidence of hair regrowth). **See Box 2 for drug interactions for terbinafine.*	**GRADE 1B**
✓	Oral griseofulvin as per dosing once a day for 4-8 weeks* (or until clinically resolved, i.e. no scale, no inflammation, evidence of hair regrowth). **See Table 9 for dosing.*	**GRADE 1B**

✓	Oral itraconazole or oral fluconazole, may also be effective for those who do not tolerate Terbinafine. Seek expert advice re dosing from infectious diseases specialist.	**GRADE 1B**
✓	Consider repeating the hair pluck for fungal culture at the end of the oral anti-fungal treatment course, if uncertainty persists regarding clinical resolution. Treatment should be extended whilst awaiting results of hair pluck which may take 2-4 weeks.	
✓	Antifungal shampoos e.g. ketoconazole in conjunction with oral treatment may limit the spread of scalp tinea	
Nail tinea (onychomycosis)		
✓	Oral terbinafine* once a day for 6 weeks (fingernails) or 12 weeks (toenails). **See Table 8 for dosing.*	**GRADE 1A**
✓	Oral griseofulvin once a day for at least 4 months for fingernails and at least 6 months for toes nails * **See Table 9 for dosing.*	**GRADE 2C**
✗	Combinations of topical therapy and oral therapy for nail tinea are **NOT** recommended.	**GRADE 1B**
✗	Surgical avulsion prior to treatment of nail tinea is **NOT** recommended.	**GRADE 2D**
Prevent		
✓	Anti-fungal soap is recommended as an adjunct to treatment as a preventative measure against tinea.	**GRADE 1C**
✓	Check household or community pets for features of dermatophyte infection and seek treatment as needed.	
✓	Clinical assessment of household contacts recommended as they may also have tinea which leads to reinfection.	
✓	Avoid sharing pillows, towels, hair combs or brushes; hair elastics / scrun-chies; hats and scarves used on the head in patients with tinea capitis.	
✓	Avoid sharing clothes, towels and bedlinen in patients with tinea corporis.	

Table 8. Oral terbinafine doses for tinea.

Weight Band	Dose — 1 tablet contains 250mg of terbinafine
10 - < 20kg	**¼ tablet** (62.5 mg) once daily
20 - < 40 kg	**½ tablet** (125 mg) once daily
≥ 40kg	**1 tablet** (250mg) once daily

*If possible, wait until after pregnancy and breastfeeding before treating.

Note: splitting tablets worsens the bitter taste of terbinafine for children. This may be masked with chocolate flavourings e.g. Nutella or chocolate syrup.

Box 2. Precautions and blood testing for oral terbinafine.

- Serious side effects can develop after 4 weeks of treatment including skin rashes, raised liver transaminases and neutropenia. Treatment lasting for more than 2 weeks needs medical supervision and blood testing.
- In a person with acute or chronic liver disease, kidney disease, aged >40 years, or drinks too much alcohol — check Full Blood Examination (FBE), Urea & Electrolytes (U&E), Liver Function Test (LFT) before treatment.
  - If LFTs abnormal — **retest after 2 weeks of treatment**
  - If LFTs get worse — **consider giving half the usual dose**
  - **Retest LFTs, U&E and FBC again after another 2 weeks**
- If adult with no risk factors — check FBE, U&E, LFT after 2 weeks then every 4 weeks of treatment.
- If child on treatment > 4 weeks — check FBE, U&E and LFT at 4 weeks. If child has medical comorbidities then test FBE, U&E and LFT at 2 weeks.
- If symptoms of low white cell count or liver toxicity (e.g. fever, nausea, jaundice, abdominal pain, sore throat) — cease medication and check LFTs, U&E and FBC.
- Wait until after pregnancy and breastfeeding before treating, if possible.

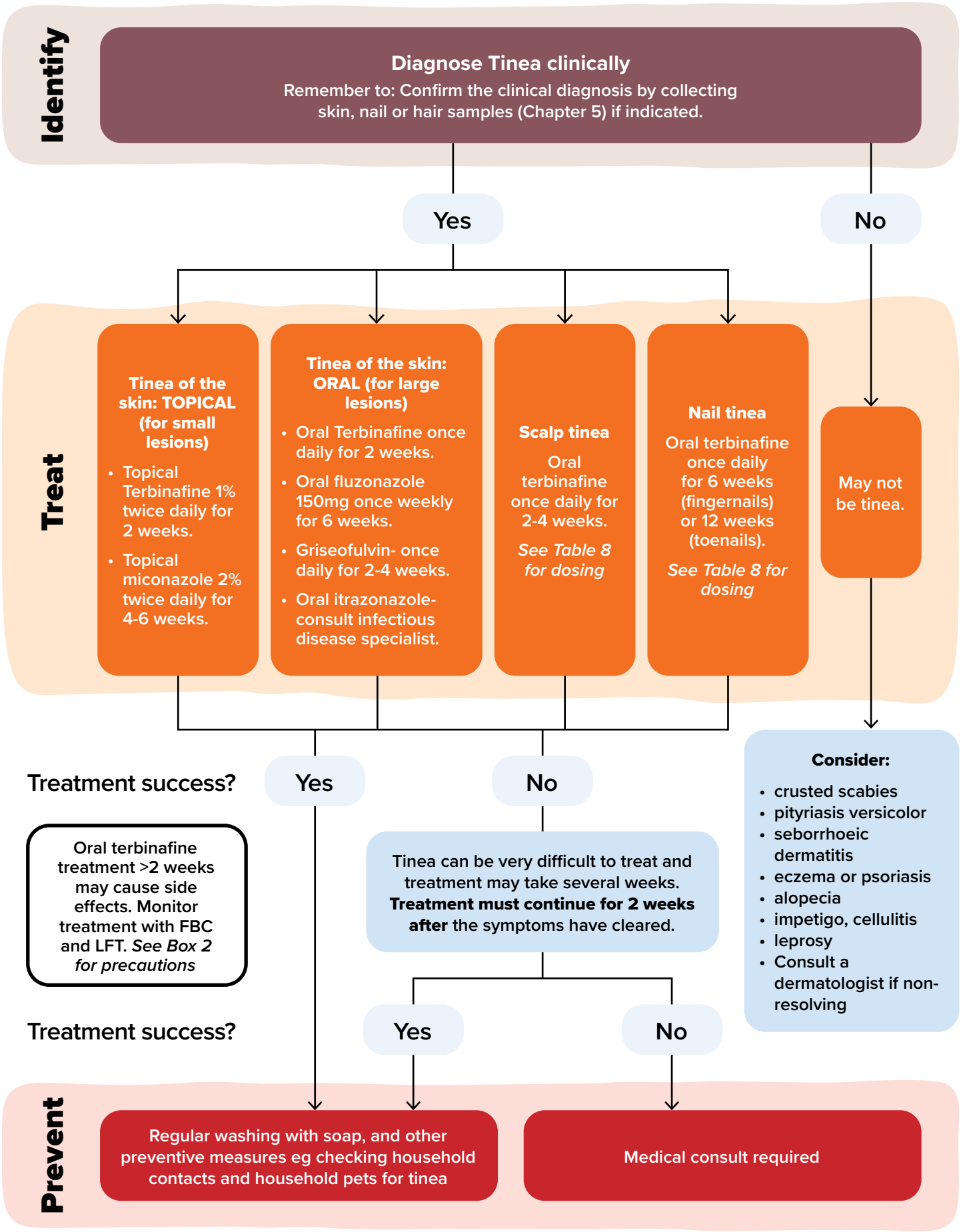
Table 9. Oral griseofulvin doses.

Age Group	Dose
Children 1 month > 12 years	**10-20mg/kg (to a maximum of 500mg)** once daily. If using the higher dose, reduce dose when clinical improvement occurs.
>12 years to 18 years	**500 mg daily.** Up to 1 gram daily can be used for severe infections; reduce dose once response occurs.
Adults	**500 mg daily.** Up to 1 gram daily can be used for severe infections; reduce dose once response occurs.
*Griseofulvin should be administered with a high fat meal or milk to increase absorption and reduce stomach upset. **Oral Griseofulvin can be compounded as a liquid (250mg/mL) for patients who do not tolerate tablet formulation.	

Box 3. Precautions with all oral anti-fungal agents (including terbinafine, griseofulvin, itraconazole, fluconazole).

- ALL oral anti-fungal agents have potential drug interactions and a thorough drug interaction screen should be performed prior to their prescription.
- Many oral anti-fungal agents should be avoided during pregnancy and when breastfeeding – check product information.
- In patients with severe liver disease, terbinafine, griseofulvin and fluconazole are contra-indicated. Itraconazole is the preferred oral agent; specialist advice should be sought.
- In patients with renal insufficiency, the dose of terbinafine needs adjusting down and specialist advice should be sought.
- Perform baseline laboratory tests (FBE, U&E, LFT) prior to prescribing oral anti-fungals if the patient has risk factors including multiple concurrent medications, acute or chronic liver disease, kidney disease, aged >40 years, or alcohol misuse. If adult with no risk factors — check FBE, U&E, LFT after 2 weeks. If child on treatment > 4 weeks — check FBE, U&E and LFT at 4 weeks.
- Blood tests should be repeated every 4 weeks for the duration of therapy.
- Oral antifungal medications should be ceased, and specialist opinion sought if the patient develops laboratory abnormalities or clinical symptoms indicating low white cell count or liver abnormality (i.e. fever, mouth ulcers or sore throat, unusual bruising, tiredness / fatigue) or liver toxicity (i.e. dark urine, pale stool, yellowing of whites of eyes and skin, abdominal pain, nausea).

Figure 21. Tinea treatment algorithm.



Recommendations for treatment and prevention of Pityriasis versicolor

Identify	
✓	Pityriasis versicolor should be recognised – finer scale, no raised itch and often not itchy which differentiates it from tinea.
✓	If diagnosis unclear — collect skin scrapings for microscopy.
Treat	
✓	**Topical Treatments:** **Ketoconazole 2%** shampoo – Rub on affected skin once a day and leave for 3 to 5 minutes then wash off. Repeat daily for 5 days. *AND* shampoo hair every day for 1 week. **OR** **Selenium sulfide 2.5%** shampoo Rub on affected skin once a day and leave on for 10 minutes then wash off. Repeat daily for 7-10 days or until lesions have resolved. *AND* shampoo hair every second day for 2 weeks. **OR** **Econazole 1%** foaming solution topically, once a day at night to wet skin (leave overnight and wash off the following morning), for 3 nights. *NOTE: No scale means treatment has worked. It may take several months for colour to return to skin even after successful treatment. Repeat treatment if necessary as it can often come back even after successful treatment.*
✓	**Oral treatment:** If pityriasis versicolor does not respond, use fluconazole 400 mg orally, as a single dose.
Prevent	
✓	Early treatment when identified.
✓	Pityriasis versicolor has a tendency to recur. For this reason, it is helpful to advise patients to continue with a maintenance regime, i.e. Econazole 1% foaming solution performed 1 night per month, or Selenium sulfide 2.5% / Ketoconazole 2% shampoo used fortnightly.
✓	Avoid sharing of towels and bedlinen minimise household spread.

Discussion

The recommendations for treatment of tinea in this guideline are based on available evidence, but must also take into account 'real world' conditions experienced by healthcare providers working with Aboriginal families and communities.[106] We evaluated the evidence available from around the world and recommendations from other state-based guidelines. However, while there may be good evidence for the proven efficacy of a particular treatment, if that treatment is not always easily available e.g. the various trialled topical azole creams or not registered in Australia for tinea treatment e.g. itraconazole, we provided suitable alternatives.

Daily soap use may be of benefit in the treatment of tinea generally,[155] however, due to low quality evidence this is recommended in combination with oral or topical antifungal treatment (GRADE 2C). There is no evidence to support any added benefit of triclosan soap over normal soap. It has been shown that domestic laundering at 60°C (as opposed to 30°C) is required to completely eliminate dermatophytes from clothing; these temperatures are unlikely to be achieved with hand-washing of clothing, inability to access heating of water for washing clothes, or a malfunctioning washing machine.[156]

Tinea of the skin only (Tinea corporis (body), Tinea pedis (feet), Tinea cruris (groin), Tinea manuum (hands), Tinea faciei (face))

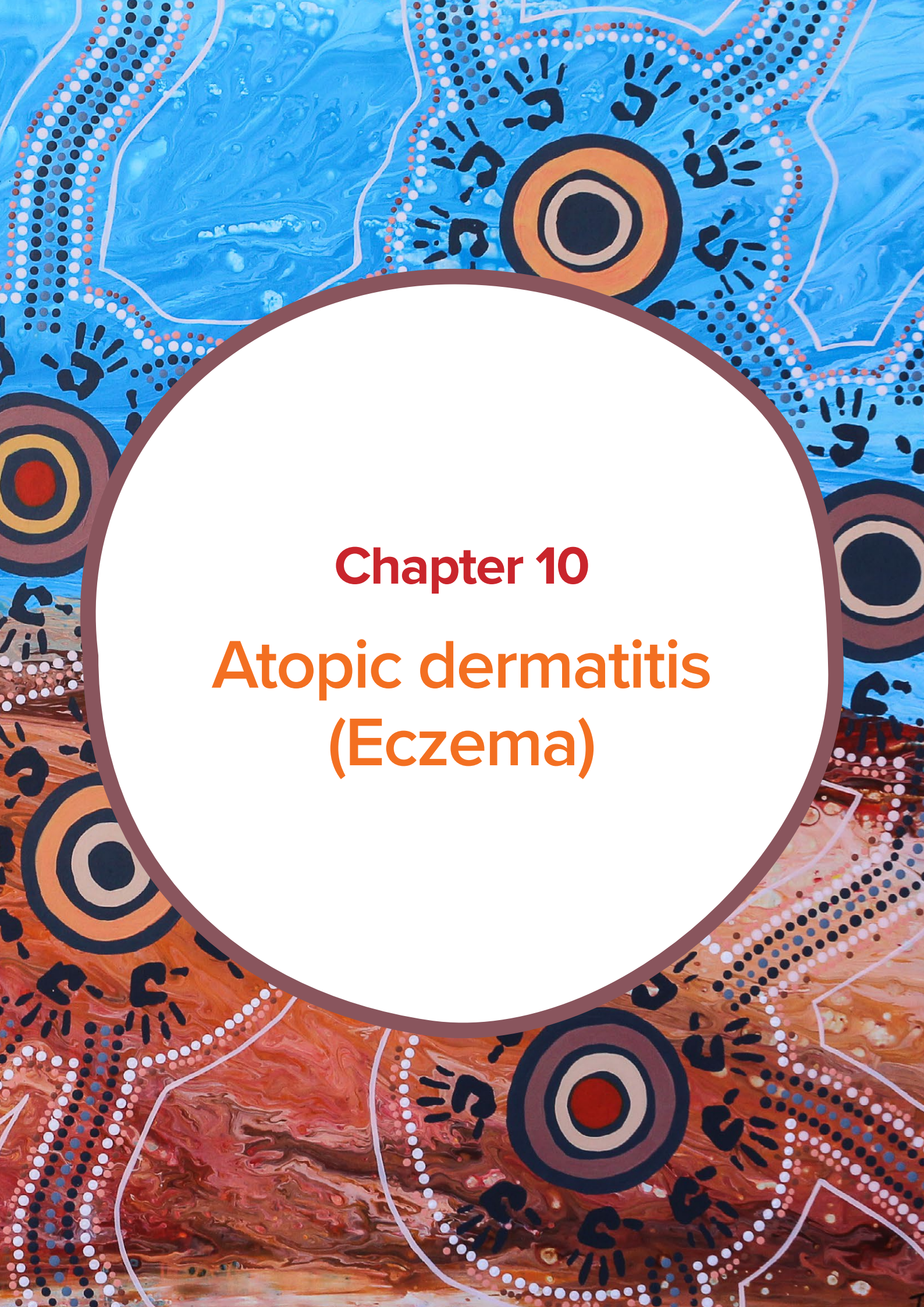
There is low quality evidence for oral terbinafine,[157] oral griseofulvin,[158,159] oral itraconazole[158-161,157] or oral fluconazole[26] (GRADE 2C). There is high quality evidence that oral itraconazole is superior to oral terbinafine (GRADE 1B).[157,160] However, itraconazole is not available on the PBS for this indication, and is not on formulary in many clinics. As such, ordering/prescription is needed for individual patients who fail to respond to terbinafine as first-line treatment. Due to drug interactions and caution in prescribing in liver or kidney disease, expert advice from infectious disease specialists, dermatologists or pharmacists on dosing and duration should be sought. New studies comparing itraconazole to other agents have been conducted since the First Edition of this National Healthy Skin Guideline, and itraconazole may become more widely used for dermatophyte infection in the years ahead.

Tinea of the skin and hair follicles (Tinea Capitis (scalp), kerion)

Tinea capitis is difficult to treat, requiring ongoing treatment for several months and mycological cure is challenging. There is moderate quality evidence for oral griseofulvin, terbinafine and fluconazole having similar efficacy for tinea capitis (GRADE 1B)[26,162] in resource-limited settings, first-line treatment should be the agent that is most affordable and available.[163] To streamline treatment regimens in remote communities, terbinafine has been recommended for scalp tinea.

Tinea of the nails (Tinea unguium/onychomycosis)

For tinea unguium, clinical treatment with oral terbinafine is recommended (GRADE 1A).[164,165] There is no added benefit to the use of combinations of topical therapy and oral therapy for tinea unguium in resource limited settings (GRADE 1B).[165] Surgical avulsion prior to treatment of onychomcyosis is not recommended (very low quality evidence – GRADE 2D).[166] High quality studies assessing photodynamic therapy (PDT) regimens for tinea unguium are required to determine the utility of this therapy in resource-limited settings.



Chapter 10

Atopic dermatitis (Eczema)

Overview

Atopic dermatitis (AD), also known as eczema, is a common chronic relapsing inflammatory skin condition affecting both adults and children. In the majority of patients, AD begins in childhood, usually before the age of 5 years, and may continue into adulthood.[167] AD is characterised by intense itch and excoriation, with erythematous, thickened and fissured skin. AD increases the risk of bacterial skin infection.[168,169]

AD is the most common chronic inflammatory skin condition in children and young people; however, its prevalence varies across countries, geographic regions and genetically similar populations.[170,171] Recently, the population prevalence of AD in Australia was estimated to be 20.3% in one-year-olds[172] and 16% in four-year olds.[173] A higher AD prevalence is generally observed in urban settings relative to rural populations.[170,174] This implicates environmental factors (i.e. industrialization and an urban lifestyle) in the pathogenesis of AD.[171] A recent systematic review of the prevalence of AD in urban-living Indigenous children in high income countries found that current and severe symptoms of AD were more common in Indigenous children compared with their non-Indigenous peers, with children having a higher prevalence than adolescents.[175]

Consequences of untreated atopic dermatitis

AD and bacterial skin infections are intertwined, in that poorly managed AD predisposes to recurrent bacterial skin infections; while secondary infection of AD contributes to more severe disease.[18] AD adversely impacts general health, school performance, quality of sleep, concentration and overall quality of life in affected children and their families.[176,177] In AD, S. aureus colonizes the skin, exacerbating and contributing to more severe disease, as well as increasing the risk of impetigo, cellulitis and abscess.[178] Untreated bacterial skin infections can lead to serious complications including sepsis, post-infectious glomerulonephritis and rheumatic heart disease.[179] Poorly controlled AD also increases the risk of secondary viral infections including eczema herpeticum, while thickening of the skin (lichenification) and changes to pigmentation can lead to impacts on social and emotional wellbeing.

Identify

Essential features that must be present in the diagnosis of patients with atopic dermatitis:

- Intense itch.
- Typical appearance including dry skin, scratch marks and redness with age-specific patterns. Patterns includes:
    - Facial, neck, and extensor involvement in infants and children.
    - Flexural lesions in any age group.
    - Sparing of the groin and axilla.
- Chronic or relapsing history that started early in life.
- May be accompanied by other atopic conditions e.g., asthma, allergic rhinitis, or a history of these in family members.

There is a wide range of differential diagnoses for AD including other types of eczema/dermatitis, inherited dry skin conditions, psoriasis, and scabies.

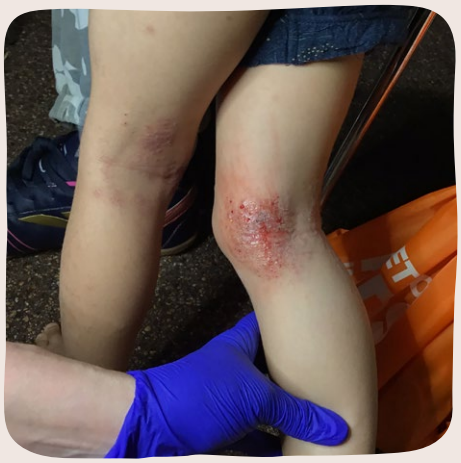


Figure 22. Infected AD on the right knee flexure showing erythema, weeping and crusting, with non-infected eczematous changes to the left.

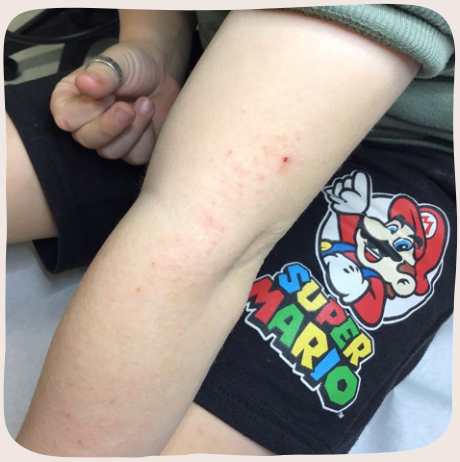


Figure 23. Dry, erythematous, papular changes of AD on the extensor surface of the arm.

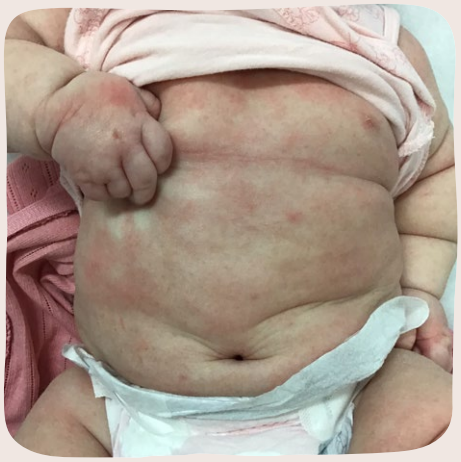


Figure 24. Widespread xerosis and erythematous papules consistent with generalised AD of infancy.

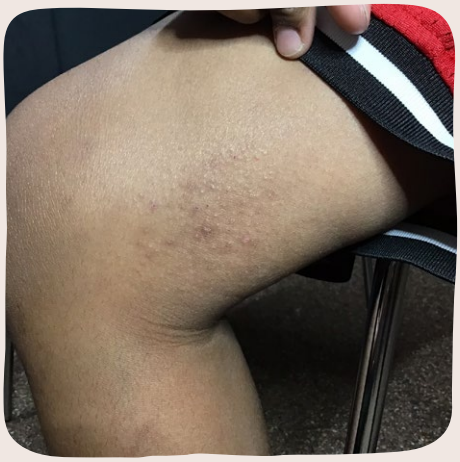


Figure 25. Lichenified papules of AD on the right medial thigh, with post-inflammatory hyperpigmented macules at sites of treated AD.

Treat and prevent

Recommendations for the treatment and prevention of atopic dermatitis

Identify		
✓	Skin appears inflamed, red, itchy, and dry.	
✓	In infants, atopic dermatitis often starts as a dry red rash on the cheeks and around the mouth, often made worse by drooling.	
✓	As children grow older, the rash may be on the arms, legs, or in other areas where they are able to scratch.	
✓	In teenagers, eczema is often on the inside of the elbows and knees, on the hands and feet, and around the eyes.	
✓	Adults may also suffer from atopic dermatitis, with a similar distribution to teenagers.	
Treat		
Mild to moderate AD		
✓	Apply moisturiser daily in a thick layer. *See **Box 4** for moisturiser recommendations.*	**GRADE 2C**
✓	Use of non-soap cleansers is recommended (i.e., soap-free wash or soap substitute).	
✓	Topical corticosteroids are recommended if not responsive to regular use of moisturisers. Twice-daily application of topical corticosteroids is generally recommended for the treatment of AD; however, evidence suggests that once-daily application of some corticosteroids may be sufficient. Corticosteroids should be continued until the skin feels smooth and is itch-free before a gradual taper to the minimum frequency that keeps the skin clear of signs of inflammation. *See **Box 5** for potency of topical corticosteroids.*	
✓	Pimecrolimus 1% cream is recommended for maintenance treatment of AD on the face or eyelids in patients more than 3-months-old who have failed to have satisfactory control with intermittent topical corticosteroids, or where a contraindication to topical corticosteroids exists. Seek expert advice from a dermatologist.	
✗	The use of topical antihistamines for the treatment of AD is not recommended.	
✗	There is insufficient evidence to recommend the general use of antihistamines as part of the treatment of atopic dermatitis.	

Moderate to severe / refractory AD		
✓	If the above treatments fail, refer to a specialist dermatology service (telehealth may be an option with expertise in Aboriginal skin health in some states) for further management with phototherapy or systemic agents.	
✓	Use of wet-wrap therapy with topical corticosteroids can be recommended for patients with moderate to severe AD to decrease disease severity during flares. *See **Box 6** for instructions on applying wet wrap.*	**GRADE 2C**
✓	Dilute bleach baths can be used for AD to prevent recurrent skin infections. *See **Box 7** for instructions on how to perform a bleach bath.*	
✓	Check serum vitamin D levels to ensure this is within the recommended range for patient sex and age-group. Supplement with oral vitamin D if below recommended range.	
Bacterial skin infection and atopic dermatitis		
✓	Treat bacterial skin infections associated with AD as per impetigo (Chapter 6).	**GRADE 2B**
✗	Do not use topical antibiotics in AD.	
Prevent		
✓	Bath or shower once a day using warm (not hot) water and keep it short (5-10 minutes). Avoid using soap. A bath oil can be added to the bath and a soap-free wash can be used if required. Care must be taken with bath oil use in older children as it can make the bath very slippery.	**GRADE 1C**
✓	After bathing/showering, pat-dry the skin and apply moisturiser over whole body and face (Box 4).	
✓	Avoid scratching the skin and keep the nails trimmed short.	
✓	Avoid triggers to prevent flares of AD. These include soaps, shampoos, shower gels and bubble baths, prickly or rough clothing (including wool), overheating, overdressing, sweat, friction, direct contact with grass and sand, prolonged exposure to chlorine and salt water or emotional stress.	

Box 4. Moisturiser recommendations for AD.

- Regular application of moisturiser will improve the skin barrier and should be done immediately after bathing or showering as this is when moisturisers are best absorbed. Apply the moisturiser to damp skin, then pat dry.
- Moisturise the whole body including the face once to twice daily.
- The drier the skin, the thicker the moisturiser needs to be. Ointments (thick and greasy) are more effective at moisturising the skin than creams, and creams are more effective at moisturising the skin than lotions (light and watery).
- Ointments do not contain preservatives, and so are less likely to sting when compared with creams or lotions.
- Creams or lotions are a good choice during hot and humid seasons when thick, greasy ointments are uncomfortable.
- Creams or lotions may also be preferable on hair-bearing skin in older children, teenagers and adults to prevent folliculitis.
- Avoid moisturisers that contain food derived proteins (e.g., goat milk, nut oils) and fragrance.
- Creams and lotions often contain alcohol as a preservative which can sting when applied to open skin. If this occurs, use an ointment until the skin has improved to a level that a cream can be reintroduced.

Box 5. Topical corticosteroid potency.

Mild corticosteroids (LOW potency)

Suitable for flaring AD over the eyelids. Apply 1-2 times daily until the skin is smooth and itch-free, followed by a slow taper to the minimal effective dose.

- Hydrocortisone acetate 1% ointment or cream (30g or 50g tube)

Moderate corticosteroids (MEDIUM potency)

Suitable for flaring AD over the face, neck and skin folds. Apply 1-2 times daily until the skin is smooth and itch-free, followed by a slow taper to the minimal effective dose.

- Methylprednisolone aceponate 0.1% fatty ointment, ointment or cream (15 g tube) *
- Methylprednisolone aceponate 0.1% lotion (20mL bottle) *#

Potent corticosteroids (HIGH potency)

Suitable for flaring AD over the torso and limbs. Apply 1-2 times daily until the skin is smooth and itch-free, followed by a slow taper to the minimal effective dose (not for use on the face or skin folds).

- Betamethasone dipropionate 0.05% ointment or cream (15g tube) *
- Mometasone furoate 0.1% ointment or cream (15g tube) *
- Mometasone furoate 0.1% ointment or cream (50g tube)
- Mometasone furoate 0.1% lotion (30mL bottle) *#

* PBS streamlined authority numbers exist for prescription of increased quantities of these topical corticosteroids for corticosteroid-responsive dermatoses, such as atopic dermatitis (AD). As AD is a chronic condition, patients will require a prescription with repeats. In addition, increased quantities are generally necessary as the topical steroids are packaged in small volumes. The quantity of tubes/bottles that can be prescribed using the PBS streamlined authority numbers is determined by the percentage body surface area (BSA) affected by AD (i.e., 10-20% BSA allows for 2 tubes, while >80% BSA allows for 10 tubes). Please refer to https://www.pbs.gov.au/pbs/home.

Topical corticosteroid lotions are generally only prescribed for atopic dermatitis affecting the scalp. Please refer to ***Box 4 Moisturiser recommendations for AD*** regarding moisturiser formulations (i.e., ointment, cream, lotion), as these recommendations also apply to topical corticosteroid formulations.

Box 6. Application of wet-wrap therapy for the treatment of AD.

Wet dressings are best applied at night before bed and usually help with better sleep. Wet dressings are usually applied every night until the eczema clears and then every second night for one week after to make sure the eczema settles.

How to apply wet dressings:

1

After bathing, pat dry the skin.

2

Apply cortisone ointment to all eczema areas on the face and body.

3

Put cotton clothes in a bowl of lukewarm water then wring them out.

4

Put the wet layer of clothing on your child.

5

Put a dry layer on top.

6

Leave the wet wraps in place for 20 mins.

7

Remove wet wraps.

8

Apply moisturiser to the whole body and face after the wet wraps are removed.

Box 7. Instructions on how to perform a bleach bath.

Why are bleach baths used?

Children with eczema are more prone to skin infections. Bleach baths reduce the number of bacteria on the skin. They may be recommended to treat children with infected eczema and children who have repeated skin infections. Bleach baths are often used in combination with other eczema treatments to help with the itch and treat infection. These may include bath oils, moisturisers, topical corticosteroids, wet dressings and antibiotics.

What you will need:

- ✔ Unscented bleach (containing 4.2% sodium hypochlorite) e.g. White King bleach
- ✔ 10L bucket
- ✔ 12mL measure (20mL syringe or measuring cup) **OR**
  ¼ measuring cup depending on which of the recipes you choose to use
- ✔ Bath oil (1 capful of bath oil can be added if the skin feels very dry)
- ✔ Fresh clean towels

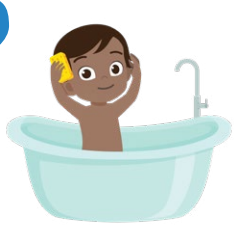
1

Fill a standard sized bath tub to half full of lukewarm water.
1 capful of bath oil can be added if the skin feels very dry.

2

Add 1/4 cup of White King bleach
OR Add 12mL of White King bleach to every 10L of water.

3



Wash the face and scalp whie in the bath avoiding the eyes.

4

Gently wipe any crusts off the skin while in the bath.

5

Your child can soak in the bath for up to 10 mins, no longer.

6

You do not have to rinse after bathing.

7

Use a fresh towel to pat the skin dry.

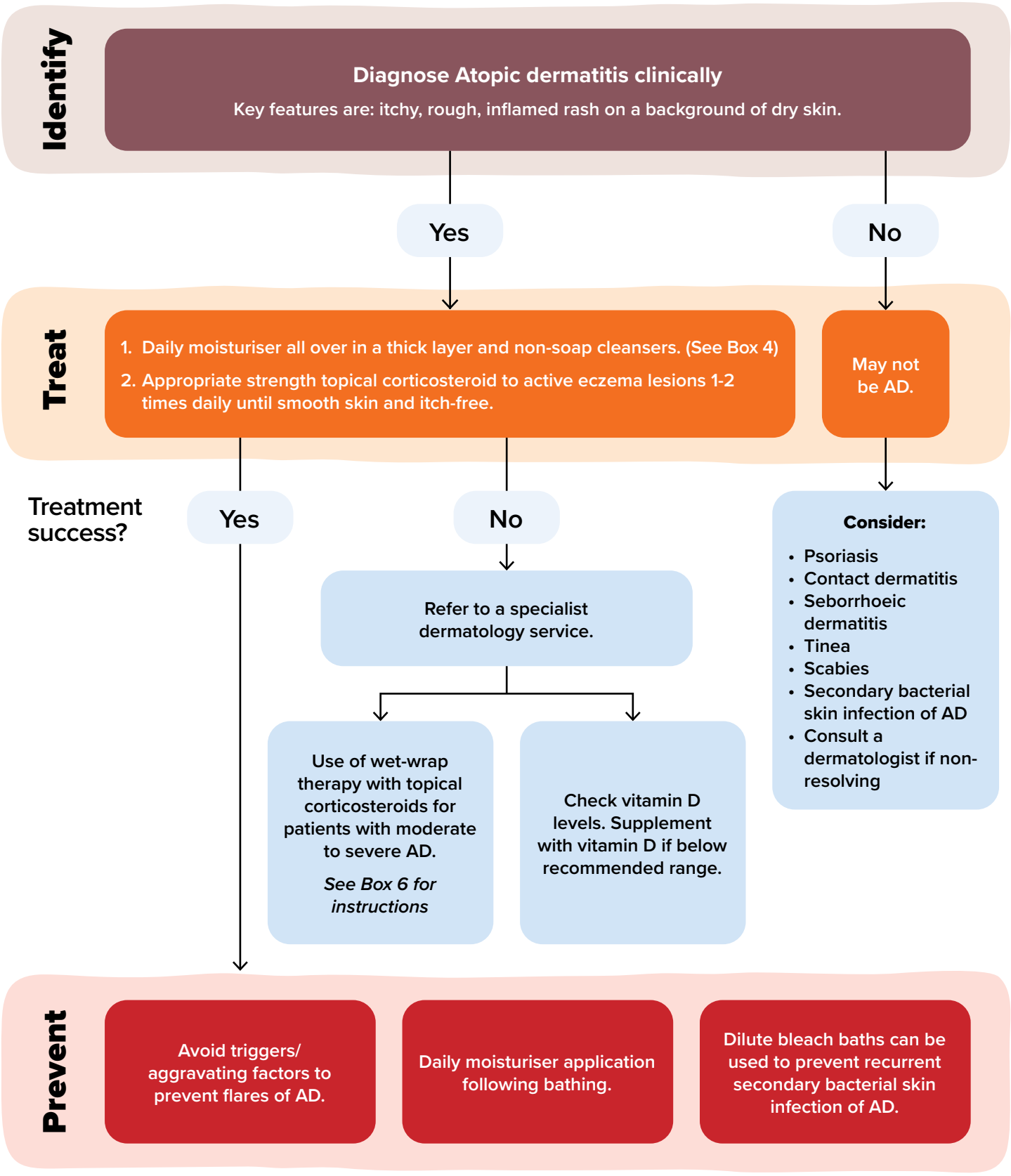
8

Apply moisturiser to the whole body and face as soon as your child gets out of the bath and is dry.

9

If a cortisone ointment has been prescribed, apply it to all eczema areas as directed before the moisturiser.

Figure 26. Atopic dermatitis treatment algorithm.



Discussion

Atopic dermatitis has been included in the National Healthy Skin Guideline for the first time due to the high, yet underappreciated burden for Australian Aboriginal and Torres Strait Islander people, and the significant interaction with other skin infections e.g., impetigo. Similarly, where the focus is only on skin infections, recognition and treatment of AD can be missed. We have reviewed the available literature on the treatment of AD in low to moderate income settings, of which the literature is modest. Here we have prioritised affordable, accessible, and available treatments for AD in this chapter to improve knowledge and access for treatment of AD.

Treat

Mild to moderate atopic dermatitis

Daily use of moisturisers for mild to moderate AD can reduce disease severity and the need for pharmacological intervention. Sorbolene cream is the most widely available moisturiser that is inexpensive and comes in large volumes. Sorbolene with 10% glycerin in a tub may be preferred during cooler weather.

Topical corticosteroids used once or twice daily are recommended if not responsive to regular use of moisturisers. Due to the practicalities of applying moisturiser and topical steroids after showering, we have recommended once daily. Guidance on bathing has also been provided (**Box 7**).

Pimecrolimus 1% cream (a topical calcineurin inhibitor) is recommended for maintenance treatment once AD is under control and is therefore not recommended as first-line treatment. Topical pimecrolimus cream is particularly useful in thin-skinned areas such as the face and lips. It will often sting in active flares but is good at keeping the AD away and reducing the use of steroids in this area.

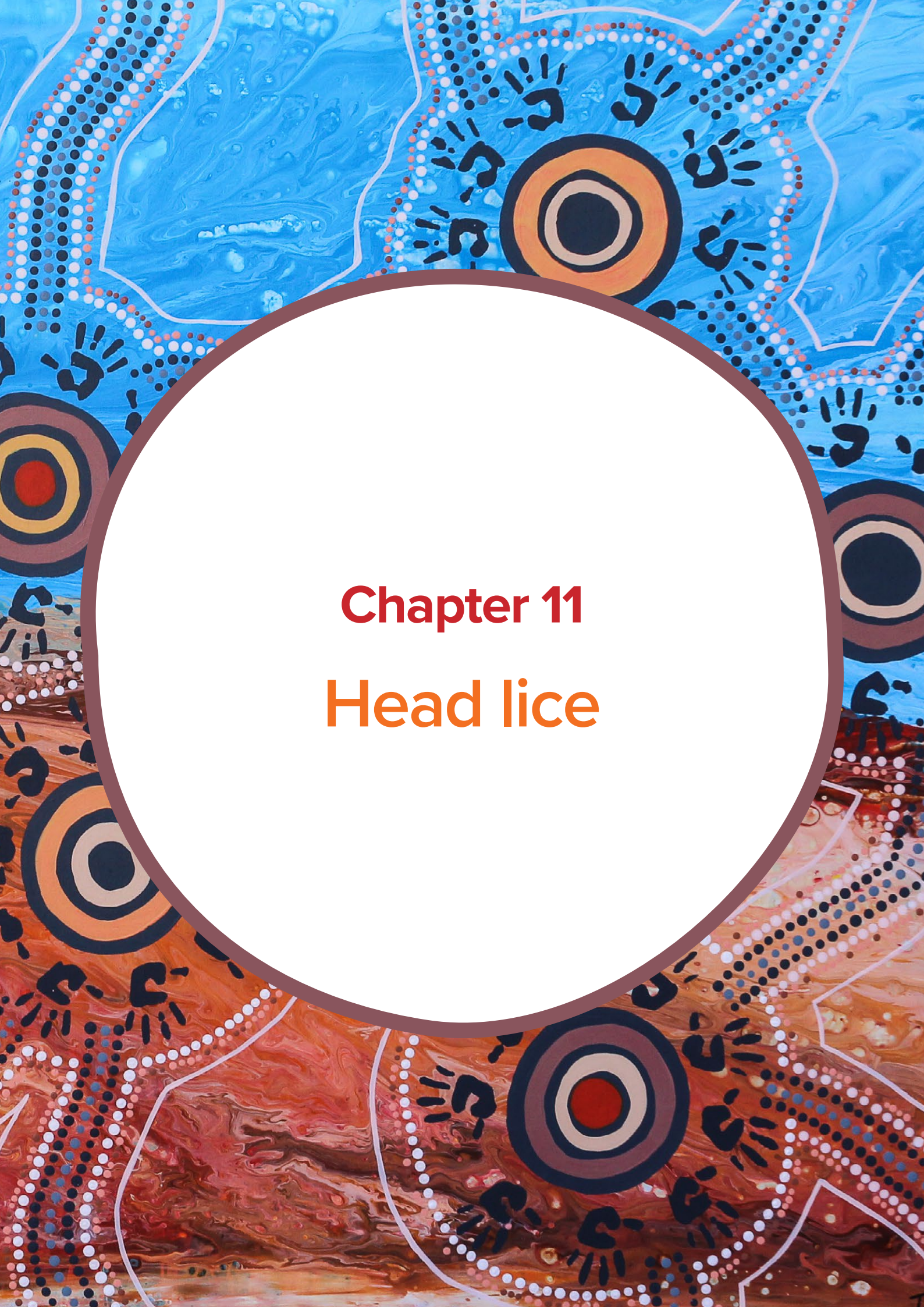
Moderate to severe atopic dermatitis (treatment typically under the care of a dermatologist)

If treatments for mild to moderate AD do not work, refer to a specialist dermatology service. For moderate to severe/refractory AD, there is low quality evidence for dilute bleach baths[180] in addition to standard care or oral vitamin D[181] in the treatment of moderate-severe/refractory AD (GRADE 2C). Wet wrap therapy is recommended for moderate to severe AD (**Box 6**).

Prevent

Avoiding triggers for AD, bathing daily and applying a daily moisturiser that is thick (sorbolene cream) is recommended to prevent flare-ups of AD. For flare-ups of AD, topical corticosteroid creams are recommended to manage AD. The cream is to be applied to the skin once daily until the skin is smooth and itch-free, then gradually reduce to the minimum amount that keeps the skin smooth.

The Australian College of Rural and Remote Medicine (ACRRM) have a national tele-dermatology service that rural and remote GPs can sign up to (https://www.acrrm.org.au/resources/digital-health/tele-derm) for systemic treatment of moderate to severe/refractory AD.



Chapter 11

Head lice

Overview

Head lice ('the head louse') is a hematophagous ectoparasite, Pediculosis humanus capitis, readily transmitted by direct head-to-head contact. Head lice is a common and costly global public health problem,[182] including in high, middle and low-income countries. Although it affects mostly children, adults can also become infected.[183] Head lice is the third most commonly reported outbreak in childcare centres and schools in Australia, with rates of up to 35% reported in school-aged children.[184] Whilst there are no published studies on the prevalence of head lice in remote Australia, the See, Treat, Prevent (SToP) Trial[113] measured the considerable burden of head lice in remote Kimberley communities of WA. These results are yet to be published.

Consequences of untreated head lice

Head lice cannot only lead to severe anaemia,[185] disturbed sleep and poor school performance,[186] but also breaks in the epidermis of the scalp due to severe itching which can cause secondary bacterial infections,[187] tinea, kerion and impetigo of the scalp in Australian Aboriginal and Torres Strait Islander children.[188] In this way, headlice can predispose to Strep A infection and post-infectious complications, such as glomerulonephritis and rheumatic fever.[189]

Identify

The adult louse is a small visible insect 1-3 mm in length. It has six legs, and its colour varies from tan to greyish white. The lice do not have wings and they are not able to jump or fly. They are normally found close to the scalp as they feast on blood and have also been known to occur on the eyebrows. The adult lice lay eggs that are fixed to the hair strand.

Check for live lice to confirm infestation. If eggs (nits) are seen, conditioner combing with a fine-tooth comb may be needed to confirm infestation with live adult lice.

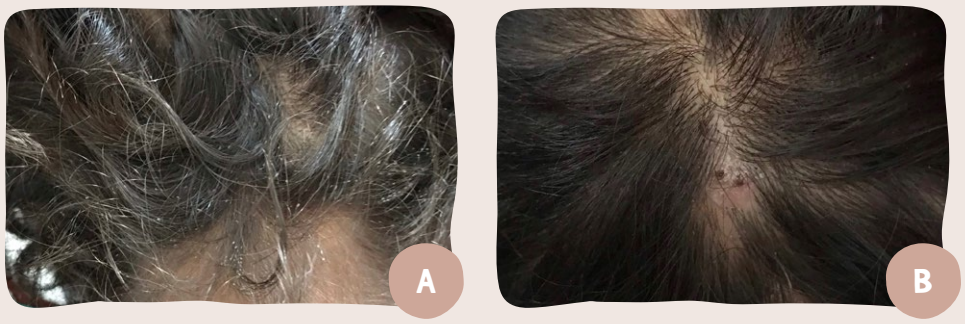


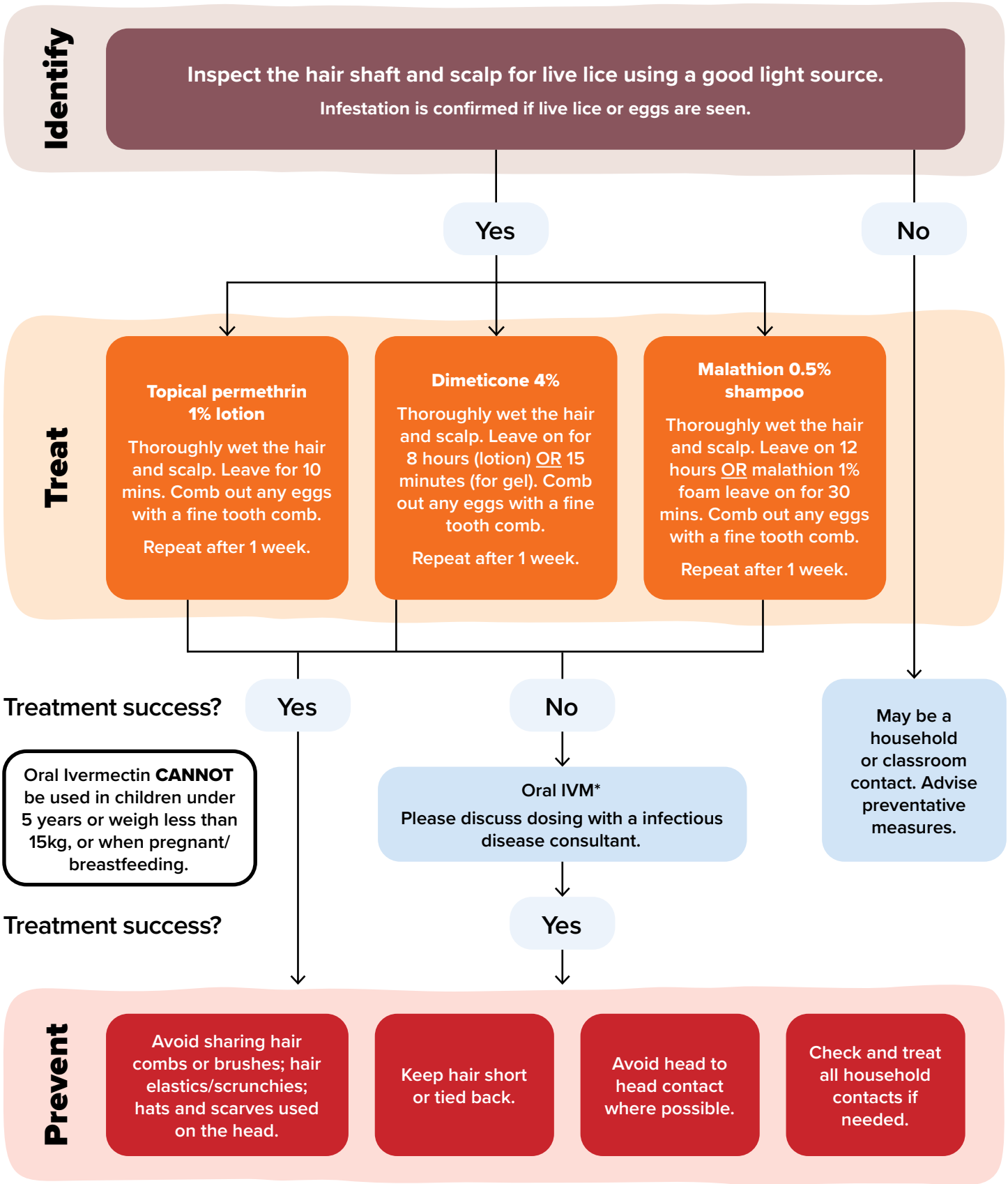
Figure 27. Headlice. From left to right, image A shows nits (white) on the shaft of the hair close to the scalp; image B shows nits and live adult lice on the scalp with crusting of the lesions.

Treat and Prevent

Recommendations for treatment and prevention of head lice

Identify		
✓	Inspect the hair shaft and scalp for live lice using a good light source.	
✓	Look for eggs (nits) stuck on hair shaft near the scalp. Eggs are common above the ears and around the hairline.	
✓	Infestation is confirmed if live lice or eggs are identified. Start treatment.	
✓	Look for infected sores. If infected sores are identified, treat for impetigo (Chapter 6).	
✓	Check other children and adults in household and treat them if needed.	
Treat		
✓	**Topical pyrethrin shampoo.** Repeat treatment after 1 week. **OR Dimeticone 4%.** If using lotion, leave on for at least 8 hours then rinse out with warm water OR if using fast-acting gel, leave on for 15 minutes then rinse out with warm water. Repeat treatment after 1 week. **OR Malathion 0.5% shampoo**, leave on for 12 hours, then rinse out with warm water. Repeat treatment after 1 week. **OR Malathion 1% foam**, leave on for 30 minutes then rinse out with warm water. Repeat treatment after 1 week.	**GRADE 2C**
✓	A combination of topical treatment and thorough combing of the hair with a head lice comb is needed to remove live lice and eggs.	
✓	In between the weekly treatments described above, rub a thick layer of conditioner through dry hair daily. Whilst it is conditioned, comb hair with head lice comb to remove live lice and eggs.	
✓	For refractory head lice or when topical treatment is unavailable, oral ivermectin can be used for children over the age of 5 years (or over 15kg) and for non-pregnant/non-breastfeeding adults. Please seek further advice from an infectious disease consultant on dosing.	**GRADE 1C**
✗	Ivermectin **CANNOT** be used in pregnant or breastfeeding individuals, or in children under 5 years of age or who weigh less than 15kg.	
Prevent		
✓	Avoid sharing hair combs or brushes; hair elastics / scrunchies; hats and scarves used on the head.	
✓	Keep hair short or tied back.	
✓	Avoid head-to-head contact where possible.	

Figure 28. Headlice treatment algorithm.



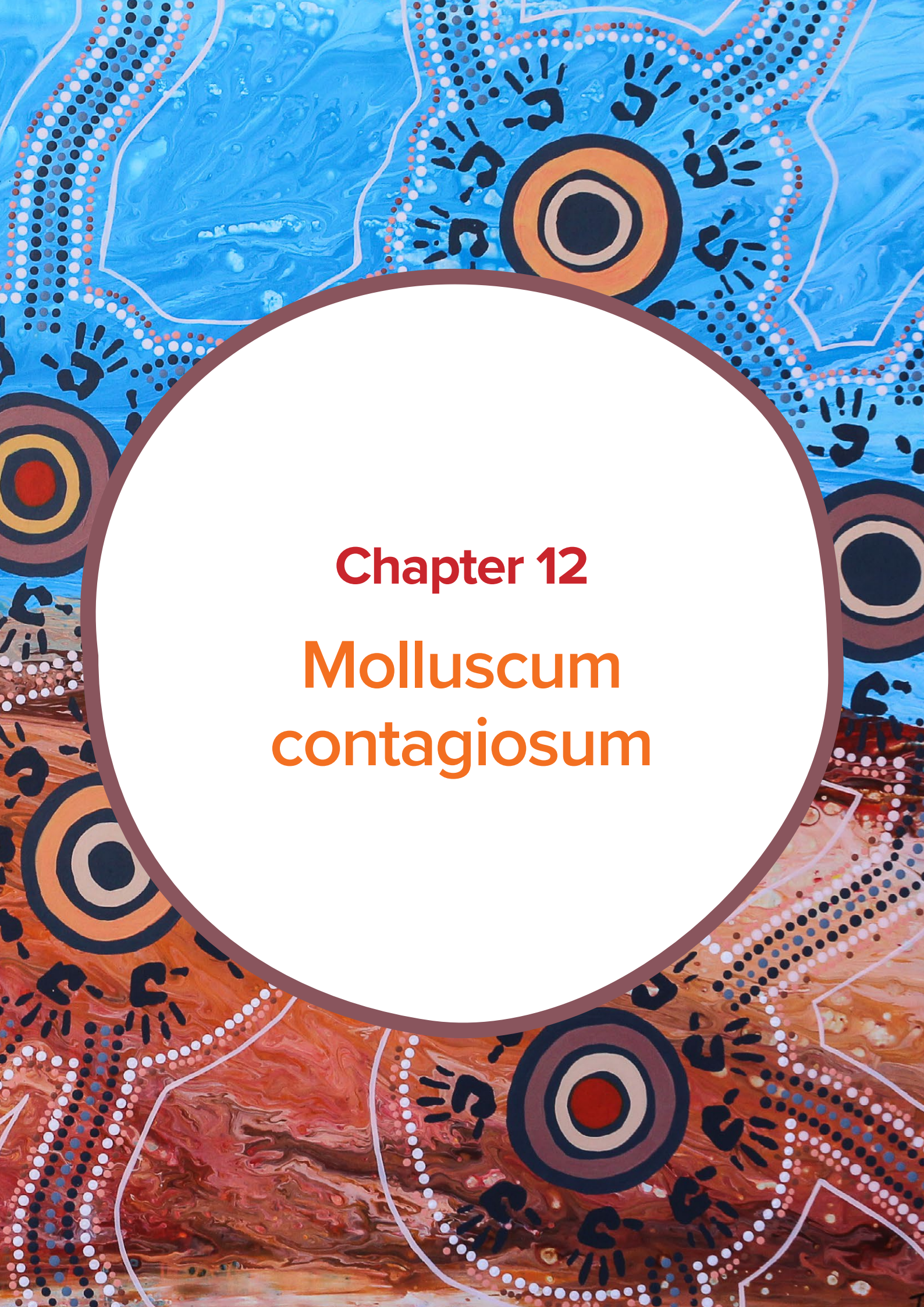
Discussion

The recommendations for treatment of head lice in this guideline are based on available evidence, but must also take into account 'real world' conditions experienced by healthcare providers working with Aboriginal families and communities.[106] We evaluated the evidence available from around the world and recommendations from other state-based guidelines. However, while there may be good evidence for the proven efficacy of a particular treatment, if that treatment is not always easily available (e.g., malathion shampoo, permethrin shampoo), or not registered in Australia for head lice treatment (e.g., oral ivermectin), we have provided suitable alternatives.

There is low quality evidence to support the use of either pyrethrins, dimeticone or malathion shampoos for treating head lice. (GRADE 2C)[56,190-195] Dimeticone as a non-antimicrobial barrier has become the preferred treatment and is available in most remote clinical and rural/urban pharmacies. Some resistance to permethrin has been detected in head lice. Conditioner can also be used to aid in detection of head lice if dimeticone shampoos are not available or are too costly. Regular combing with a fine-tooth comb with conditioner in hair is essential for the treatment of head lice. The recommendation to use conditioner and comb through daily is a practical one. Low-cost hair conditioners in a large bottle that are affordable to the family are appropriate.

There is low to moderate quality evidence for the use of oral ivermectin for the treatment of head lice (GRADE 1C).[66,195-199] This has not yet been funded for treatment of head lice in Australia hence, we recommend ivermectin only for refractory head lice and recommend discussing dosing regimen with an infectious diseases specialist. Ivermectin must be avoided in children < 5 years or < 15 kg, and pregnant/breastfeeding individuals.

Problems associated with head lice include infected sores, high transmission to siblings and classmates, and distress from scratching. Standard prevention strategies for head lice should be maintained-avoiding head-to-head contact where possible, including through sharing of hair combs/brushes, hair elastics, hats, etc. Encourage the family to continue fine-tooth combing post treatment.



Chapter 12

Molluscum contagiosum

Overview

Molluscum contagiosum (MC) is a common viral infection caused by a poxvirus (molluscum contagiosum virus [MCV]). It is seen most often in children, eczema (atopic dermatitis) sufferers and the immunocompromised. MC is contagious and spreads by skin-to-skin contact and through warm water, including baths and heated pools. Many children are affected, and it commonly passes between children in the same household. While typically asymptomatic, MC lesions can be itchy and MC infection may induce surrounding eczema. MC papules can also occasionally become secondarily infected with bacteria.

Molluscum contagiosum has been included for the first time in this edition of the National Healthy Skin Guideline due to the frequency of it being found in children, the risk of secondary bacterial infections, and community consultations which identified this as a common but poorly understood condition. The chapter has not been formatted in the same way as other chapters as there are few effective, available treatments for this condition which self-resolves over months to years. It is important for clinicians to be aware of this condition and to make an accurate diagnosis to avoid costly treatment occurring and to reassure families that it will resolve.

MC is highly infectious so accurate diagnosis and advice on prevention is also a priority.

Identify

The diagnosis of MC is made clinically by characteristic appearance of the lesions. The infection causes small skin-coloured, umbilicated (central dimple) papules (Mollusca). Mollusca are usually found in crops and most commonly occur at sites where skin rubs on skin, and at sites of trauma. The average number of mollusca is 30, although numbers can be in the hundreds. Lesions are usually 1-3mm in diameter but can grow to 10cm.

MC can induce eczema around the lesions, known as 'molluscum eczema.' Mollusca often become inflamed prior to resolution, and this is referred to as the 'BOTE' (Beginning Of The End) sign. This inflammation typically represents the body's immune response against the virus; however, occasionally it is a sign of secondary bacterial skin infection.

MC is usually self-limiting, with lesions lasting anywhere from 3 months to 3 years.[200] It is important to be aware that small pit-like scars will often occur at the site of old mollusca spots – this can occur with or without treatment. Once MC has cleared, re-infection is extremely rare.

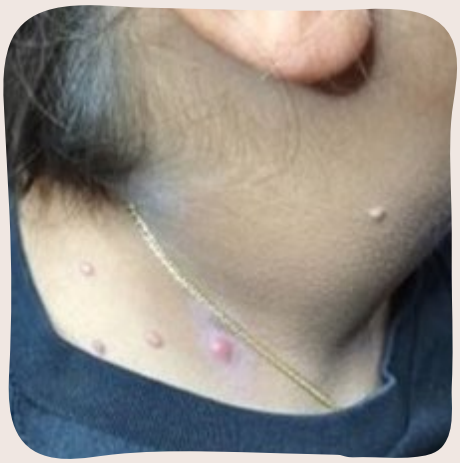


Figure 29. The raised, smooth, pink lesions of Molluscum contagiosum with evidence of central pedunculation on the neck of a child.

Treatment

General recommendations

- Actively treat eczema (whether it is background atopic dermatitis or 'molluscum-induced eczema') (**Chapter 10**) to prevent autoinoculation and secondary bacterial skin infection.
- Keep nails short and hands clean to avoid auto-inoculation by scratching.
- Shower, rather than bath, if MC is confirmed, to avoid spread to other parts of the body or other children in the bathtub.
- Avoid sharing towels/clothing/linen as this may reduce the spread.
- Avoid swimming in heated pools.
- Keep lesions covered with clothing or bandages to avoid the spread to others.
- Moisturise the skin daily using a cream or ointment.
- Complete resolution will happen when an immune response develops, which may take 3-months to 3-years.
- Lesions often become inflamed (erythematous and swollen) but antibiotic treatment is usually not required.
- Reassure patients that MC will spontaneously resolve.

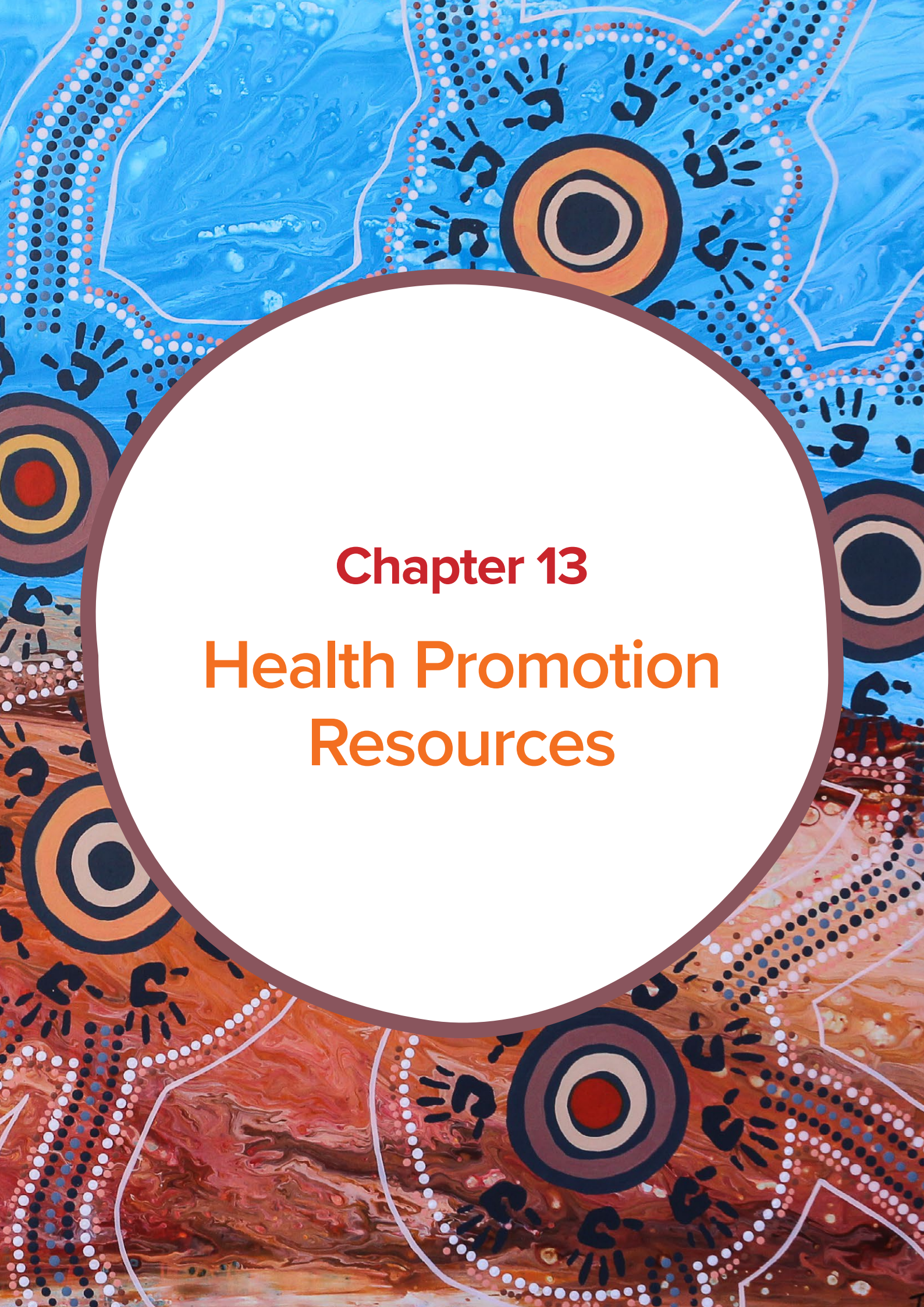
In addition to the above general measures, a watchful waiting approach is typically taken in young children (i.e., <6 years) given most treatments are painful or irritating. Older children and adults may prefer to treat MC, particularly if lesions are persistent and troublesome. Advantages of treatment include reducing: autoinoculation (the spread of lesions on the patient), the risk of transmission to others, secondary bacterial skin infection with scarring, and social stigma.[201,202] In this situation, there are many different treatment options that can be tried, but none are perfect.

Specific treatment options

- Tape stripping can be effective but is often painful.
    - Put waterproof tape on the lesions (e.g., duct tape) and stick this to the bumps for 1-2 days then pull it off. Continue this every few days if tolerated until the bumps have disappeared.
- Over the counter wart paints (that include salicylic acid) or prescription topical retinoid creams can be used effectively to initiate an immune response to MC.
    - Treat small areas of mollusca at a time and protect the surrounding skin by applying petroleum jelly around the periphery of the area to be treated.
- Cantharidin is a topical treatment which generally does not cause scarring. Refer to specialist dermatology services for the use of cantharidin treatment.
- Physical treatments are occasionally used, including cryotherapy or gentle curettage (under topical local anaesthesia). Scarring may be worse following these treatments than with conservative management.
- If secondary bacterial infection (pus or crust) forms, treat as per impetigo (**Chapter 6**).

Prevention

Molluscum contagiosum can spread to other parts of the body through autoinoculation and bathing, or to siblings through swimming, shared bathwater, and shared towels. An accurate diagnosis of MC followed by counselling of the family of activities that will prevent transmission is important. The lesions will self-resolve with time but may be troubling or become secondarily infected. Seek specialist dermatology advice if treatment is being considered.



Chapter 13

Health Promotion Resources

Overview

Skin infections and skin diseases are readily recognisable as visual diagnoses. Throughout the guideline, photographs of these lesions on Aboriginal and Torres Strait Islander children have been included to enhance clinician recognition and accurate diagnosis. Following on from accurate diagnosis, evidence-based treatment guidelines have been curated for ease of access, and all known prevention activities to limit the spread of these infections at an individual and community level have been discussed. The process of identification, treatment and prevention will lead to overall healthy skin for Aboriginal and Torres Strait Islander Australians.

In addition, health promotion activities to improve health literacy and knowledge, and enhance familiarity with skin conditions at a family, community and clinician level, are useful to prevent further skin diseases or flare-ups. To accompany this edition of the National Healthy Skin Guideline, an approach to health promotion activities in partnership with Aboriginal and Torres Strait Islander communities and families is presented, followed by examples of resources that have been developed using this model.

Community involvement in the co-design process of the development of healthy skin resources is essential. The following principles provide guidance on how these resources might be considered and developed.

Health Promotion is defined by the World Health Organization as:

> *"The process of enabling people to increase control over, and to improve, their health. To reach a state of complete physical, mental, and social well-being, an individual or group must be able to identify and to realize aspirations, to satisfy needs, and to change or cope with the environment. Health is, therefore, seen as a resource for everyday life, not the objective of living. Health is a positive concept emphasizing social and personal resources, as well as physical capacities. Therefore, health promotion is not just the responsibility of the health sector but goes beyond healthy lifestyles to well-being".*

Developed on the principles of advocacy, enablement and mediation in The Ottawa Charter,[203] health promotion continues to direct health public policy, enable equity and sustainability, provide shared power and visions among sectors, and most importantly empower individuals to be actively involved in their health outcomes. Established in 1986 at the first International Conference for health promotion, the Ottawa Charter has been fundamental for a new age of public health.[204]

History of health promotion

While health promotion principles advocate, enable and mediate for global equitable outcomes, programs developed for Indigenous and culturally diverse populations have historically not considered or included their needs and priorities. While developed with good intent, many health promotion initiatives have not been successful in engagement, implementation or outcomes given the lack of local community knowledge, input, and context.[205] For Australian Aboriginal and Torres Strait Islander people, the language of health promotion has often been that of the Western colonisers and ideologies with little or no consideration for an Indigenous cultural lens.[206] This has resulted in a lack of or limited community engagement and sustainability.[207] In recent times, Indigenous academics and organisations have stipulated the importance of including a cultural lens when developing, implementing, and evaluating health programs. Programs must be developed with a co-design

approach where communities collaborate in every element of the process, from articulating their health needs and priorities, to evaluating the outcomes.[208,209] Challenging historical Western methods of health promotion requires a shift from traditional practices to a multi-worldview approach, where culture, medicine and science intersect. Creating culture in health is a priority, not a secondary aspect.[76]

Health promotion with a cultural lens

Sharing stories using art, music, song, and dance has been the Indigenous way of knowing, doing and being for millenia. In recent times, these methods have become well-received strategies to help promote health and wellbeing among Australian Aboriginal and Torres Strait Islander people.[210] The 2000s in Australia saw an influx of hip-hop projects produced throughout remote, rural, and urban Aboriginal and Torres Strait Islander communities.[211-213] Similarly, visual resources such as flip charts, posters and booklets used in health promotion are replacing historical Western 'text heavy' resources.[214-216] These strength-based approaches facilitate equity and are more likely to be well-received and ensure sustainability.

Healthy skin promotion and resources

In 2004, the Lowitja Institute and Menzies School of Health Research partnered to develop the first 'Recognising and Treating Skin Infections' flipchart. This was co-designed with Aboriginal community researchers and since then has been updated three times: in 2009, 2018 and 2023. It is widely used by clinicians and researchers for training in healthy skin. In 2018, this resource was adapted in partnership with Pilbara (WA) community members to create the 'Beat the Bugs' cultural care workers manual.[217] The 'Beat the Bugs' manual followed a Community Participatory Action Research approach, and has been foundational to the next steps described below.

In 2016, the first Healthy Skin hip-hop video 'Gotta Keep it Strong' was co-created with the Noongar Njaki Njaki community living in Merredin, WA. In 2020, teenagers from the Dampier Peninsular (WA) came together to write and record 'Hip Hop 2 SToP' to highlight the importance of environmental health activities in the prevention of skin infections.

As part of the SToP Trial[113] and underpinned by Community Participatory Action Research,[210,218,219] a strengths-based health promotion approach was conducted to compliment biomedical treatments in reducing the burden of skin infections in Aboriginal children residing in Western Australia. Community leaders prioritised prevention activities as part of the biomedical model to reduce the burden of skin infections. Yarnings with Elders and community members (**Photo 1**) were conducted in both remote and urban settings to establish what resources were required focusing on healthy skin. These yarnings revealed the importance of community leadership to facilitate a cultural lens for language, art and/or song and dance to be included in the resources. While resource development varied according to community context, each resource was created using a two-way learning approach where community members guided the process ensuring language, artwork and context (**Photos 2, 3, and 4**) were appropriately translated. Employment of community members and commissioning of artwork remained consistent and were prioritised across communities.

Photo 1. Elders Frances Nanguri, Jane Gimme, Angie Tchooga, Elizabeth Nyumi and Helen Nagomara yarn with Telethon Kids Institute employees Tracy McRae and Slade Sibosado during co-design of the Wirrumanuku Puyu Palya healthy skin book in Kukutja language. Photo taken in the Wirrimanu community of Balgo in the East Kimberley.

Photo 2. Collecting traditional medicines knowledge at Women's camp for Gija Storybook

Photo 3. Traditional medicine for Gija Storybook

Photo 4. Filming the HipHop2SToP music video on location with the young people of Beagle Bay

Treatment and health promotion

Following the principles outlined in The Ottawa Charter, these healthy skin resources aim to empower individuals and communities to be actively involved in their own health outcomes. These resources were recommended by Elders and community members as culturally supportive tools to strengthen knowledge about treatment and prevention of skin infections. Based on this recommendation, we anticipate the visual aids and cultural translation in the resources can faciliate meaningful conversations between clinicians and individuals. While the cultural context may vary depending on geographical location, the biomedical content remains consistent. Table 10 outlines all resources and how they can be sourced.

Table 10. Healthy Skin Resources

COVER			
TYPE	BOOK	BOOK	BOOK
TITLE	*Strong Skin Story*	*Berrembi jarragboo-boorroo Wajawoorroo men'gawoom Gijam*	*Wirrumanuku Puya Palya (Safe Skin)*
YEAR	2023	2023	2023
AUTHOR / ORGANISATION	Telethon Kids Institute	Warmun community and Telethon Kids Institute	Balgo community and Telethon Kids Institute
DESCRIPTION	This booklet provides clear and concise key facts, including pictures, for an understanding of scabies, skin sores. It explains what scabies and skin infections look like and how to treat them.	This story book provides key facts, including pictures, for an understanding of scabies, skin sores. It explains what scabies and skin infections look like and how to treat them. It also includes traditional bush medicines knowledge and how these medicines can keep skin healthy. The booklet is translated into Gija language and English.	This booklet provides clear and concise key facts, including pictures, for an understanding of scabies, skin sores using Kukatja language. It explains what scabies and skin infections look like and how to treat them. It also includes local community context and pictures.

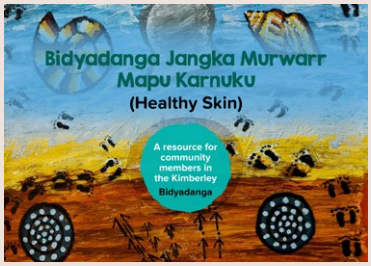
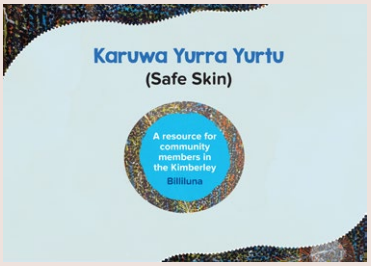
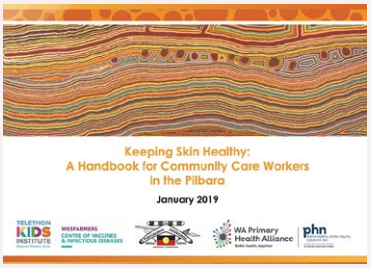
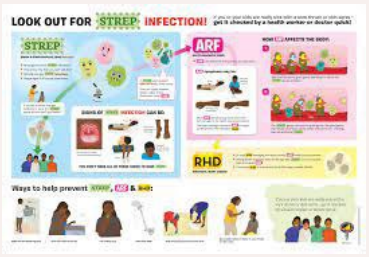
COVER			
TYPE	BOOK	BOOK	BOOK
TITLE	*Bidyadanga Jangku Murwarr Mapu Karnuku (Healthy Skin)*	*Gorna Bardoon (Good Skin)*	*Karuwa Yurra Yurtu (Safe Skin)*
YEAR	2023	2023	2023
AUTHOR / ORGANISATION	Bidyadanga community and Telethon Kids Institute	Ardyaloon community and Telethon Kids Institute	Billiluna community and Telethon Kids Institute
DESCRIPTION	This booklet provides clear and concise key facts, including pictures, for an understanding of scabies, skin sores using Kara Jarri language. It explains what scabies and skin infections look like and how to treat them. It also includes local community context and artwork.	This booklet provides clear and concise key facts, including pictures, for an understanding of scabies, skin sores using Bardi Jawi language. It explains what scabies and skin infections look like and how to treat them. It also includes local community context and pictures.	This booklet provides clear and concise key facts, including pictures, for an understanding of scabies, skin sores using Jaru language. It explains what scabies and skin infections look like and how to treat them. It also includes local community context and artwork.

Table 10. Healthy Skin Resources (continued)

COVER			
TYPE	BOOK	MUSIC VIDEO	FLIPCHART
TITLE	*Yarra Yurtu Jarrja (Good Skin) Ngarrmanu*	*HipHop2SToP*	*"Beat the Bugs" Keeping Skin Healthy: A Handbook for Community Care Workers*
YEAR	2023	2020	2019
AUTHOR / ORGANISATION	Mulan community and Telethon Kids Institute	Dampier Peninsula communities and Telethon Kids Institute	Telethon Kids Institute, Wesfarmers Centre for Vaccines and Infectious Diseases, Puntukurnu Aboriginal Medical Service, WA Primary Health Alliance, Perth North, Perth South Country WA
DESCRIPTION	This booklet provides clear and concise key facts, including pictures, for an understanding of scabies, skin sores using Walmajarri language. It explains what scabies and skin infections look like and how to treat them. It also includes local community context and artwork.	Children from the Dampier Peninsula communities wrote the lyrics and produced this video about healthy skin and environmental health. Goolarri Media Productions from Broome produced this video on location in the Dampier Peninsula.	This flipchart was developed for Community Care Workers in the Pilbara and provides clear and concise key facts, including pictures, for an understanding of a range of skin conditions. It includes cartoon pictures on how to 'Beat the Bugs' and keep your family's skin healthy.

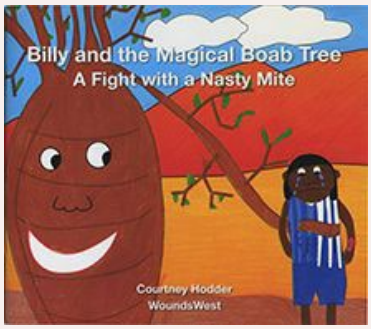
COVER			
TYPE	MUSIC VIDEO	VIDEO	BROCHURE
TITLE	*Gotta Keep it Strong*	*Strep Infection*	*Strep Acute Rhematic Fever & Rheumatic heart disease Brochure*
YEAR	2016	2017	2016
AUTHOR / ORGANISATION	Njaki Njaki Community of Merredin and Merredin Aboriginal Project Inc. (MAPI), University of Western Australia, Centre for Aboriginal Medical and Dental Health and Telethon Kids Institute	Kimberley Aboriginal Medical Service (KAMS)	Kimberley Aboriginal Medical Service
DESCRIPTION	Children from Merredin community wrote the lyrics and produced this video about keeping skin strong. This video was produced by Indigenous Hip Hop Projects on location in Merredin.	Building on the resources developed previously by KAMS,[220,221] this two minute video describes Strep A, ARF and RHD infection, disease progression, prevention and management.	This brochure uses the same messaging and images as the Strep A, ARF and RHD poster described below, but presented as a smaller medium for distribution among community members.

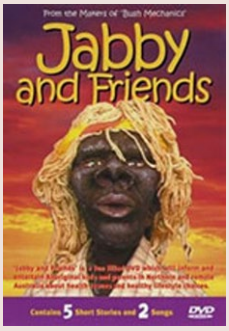
Table 10. Healthy Skin Resources (continued)

COVER			
TYPE	POSTER	FLIPCHART	POSTER
TITLE	*Look Out for Strep Infection Poster*	*Acute Rheumatic Fever Patient Teaching Tool*[222]	*When to go to the Clinic; symptoms of APSGN*
YEAR	2016	2015	2015
AUTHOR / ORGANISATION	Kimberley Aboriginal Medical Service	Kimberley Aboriginal Medical Service	Kimberley Aboriginal Medical Service
DESCRIPTION	Designed for presentation in shared environments (i.e., the local clinic), this poster provides information on the signs and symptoms of Strep A, ARF and RHD, management of each condition and ways to prevent disease while detecting any illness early.	This flipchart with culturally appropriate visual aids was predominately designed for patients with a new ARF diagnosis, providing education on causes, treatment and methods of preventing future infection.	Following the APSGN outbreak in the Kimberley (WA) materials were developed by KAMS with the aim of increasing health seeking behaviour for APSGN symptoms. This poster outlined the key symptoms present in children with the primary recommendation of attending the clinic/hospital as soon as possible.

COVER			
TYPE	FLYERS / POSTERS	BROCHURES	FLIPCHART
TITLE	*Derby Shire 'in-house' skin infection resources*	*Mabu Buru Environmental Health Yarning Brochures*	*Recognising and treating skin conditions*
YEAR	2014	2012	2009
AUTHOR / ORGANISATION	Shire of Derby/West Kimberley	Environmental Health, Kimberley Public Health Unit (KPHU)	Menzies School of Health Research
DESCRIPTION	Available on request from Derby Shire Environmental Health Team.	Produced by an Environmental Health Promotion Officer at KPHU, the three brochures were themed around Healthy Homes, Personal Hygiene and Dog Health[207]	This flip chart was developed to assist Aboriginal Health Workers, health practitioners, and community workers with the recognition and treatment of scabies, skin sores, tinea, and other skin conditions in Aboriginal and Torres Strait Islander people. The development of the flipchart was a collaborative effort between Aboriginal communities, Menzies School of Health Research, the Cooperative Research Centre for Aboriginal Health (now the Lowitja Institute), and several other key organisations.

Table 10. Healthy Skin Resources (continued)

COVER			
TYPE	CHILDREN'S BOOK	POSTERS / RESOURCE PACKAGE	FLIPCHART
TITLE	*Billy and the magical Boab tree: a fight with a nasty mite*	*No Germs on Me*	*Healthy skin story: scabies, skin sores and tinea*[223]
YEAR	2009	2008	2007
AUTHOR / ORGANISATION	University of Western Australia	Northern Territory Department of Health and Families	Menzies School of Health Research
DESCRIPTION	Produced by Courtney Hodder with support by WoundsWest, this project aimed to develop a book for children throughout the Kimberley (WA) in an effort to reduce the prevalence and incidence of scabies among Indigenous and non-Indigenous children.	The *No Germs on Me* campaign raised awareness of the importance of handwashing in schools, at home and in the community to prevent the spread of diarrhoeal and respiratory illnesses. The aim of the campaign was to motivate men, women and children to regularly wash their hands with soap after going to the toilet, after changing babies' nappies and before touching food.	This flipchart provides clear and concise key facts, including pictures, for an understanding of scabies, skin sores and tinea. Information is given on identification, how infections are spread, and the control and prevention of an infection.

COVER	
TYPE	DVD
TITLE	*Jabby and Friends*[224]
YEAR	2006
AUTHOR / ORGANISATION	Desert Pictures and Big Mama Productions for Kimberley Public Health Unit
DESCRIPTION	*Jabby and Friends* is a DVD which entertains and informs Aboriginal children and parents in Northern and Remote Australia about health issues and healthy lifestyle choices. *'Under your Skin'* combines a short story with songs to inform about scabies.

Appendix

Appendix A: Other skin resources

The following resources have been used in the development of this guideline:

- **Skin Infection protocol (KAMSC and WACHS)**
  https://static1.squarespace.com/static/5b5fbd5b9772ae6ed988525c/t/6400446b61e52f057891ea0a/1677739117908/Skin_Infections_In_Children_Kimberley_Clinical_Protocol_KAHPF_endorsed_12122019.pdf

- **CARPA Remote Primary Health Care Manuals - Standard Treatment Manual**
  https://www.remotephcmanuals.com.au/home.html

- **Managing Crusted Scabies in Aboriginal Communities (2017 Ed), One Disease**
  https://onedisease.org

- **Managing Households with Recurrent Scabies (2017 Ed), One Disease**
  https://healthinfonet.ecu.edu.au/healthinfonet/getContent.php?linkid=611924&title=Managing+households+with+recurrent+scabies%3A+2017+edition&contentid=27858_1

- **Healthy Skin Program: Guidelines for Community Control of scabies, skin sores, tinea and crusted scabies in the Northern Territory**
  https://digitallibrary.health.nt.gov.au/prodjspui/handle/10137/698

- **Therapeutic Guidelines: Antibiotic**
  https://tgldcdp.tg.org.au/index

- **International Foundation for Dermatology Protocols**
  https://www.ilds.org/resource/

- **Healthy Skin and ARF Prevention Team Page (Telethon Kids Institute)**
  https://www.telethonkids.org.au/our-research/early-environment/end-rhd/healthy-skin-and-arf-prevention/

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Notes

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