

ACADEMIC

Solving a mighty mite problem

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"Imagine you are a wealthy philanthropist with unlimited funds. Discuss the problem of scabies in the New Zealand-Australia-Pacific area. How will you use your wealth to correct the problem?"

Introduction

Scabies is an extremely itchy skin disease caused by infestation of the mite, *Sarcoptes scabiei* var. *hominis*.^{1,2} Incidence of scabies was estimated globally at 455 million per year, causing 3.8 million years lived with disability, and our Pacific region is one of the most affected areas in the world.^{3,4} Scabies is primarily transmitted via skin-to-skin contact, where the female mite burrows into the skin, causing a hypersensitivity reaction on the trunk and limbs.⁵ Scabies is often labelled as a disease of poverty and overcrowding.^{1,6,7} Spread requires close personal contact, resulting from crowded housing conditions and institutional settings such as prisons, schools, hospitals, and care homes.¹⁵ Stepping into the shoes of a wealthy philanthropist with unlimited funds, there is great opportunity to correct this problem of scabies in the New Zealand-Australia-Pacific area. In order to reach as close to elimination as possible, a five-pronged approach is proposed, as there is no one simple solution.

Burden of Scabies

Mite burrows can lead to skin breaches and have direct downregulating effects on host immunity. Secondary infection from the bacteria *Streptococcus pyogenes* and *Staphylococcus aureus* can cause impetigo, cellulitis, and abscesses. Further progression may result in post-streptococcal glomerulonephritis and acute rheumatic fever.¹⁶ Afflicted individuals can experience unbearable itching, causing bleeding and sensitive wounds. Consequences of these visible and painful lesions range from mental distress, lack of sleep, and social stigmatization, to uncertainty of cure and burden of downstream disease.^{6,8} Due to the nature of spread, outbreaks can easily affect families and wider communities.

Understanding Determinants of Scabies

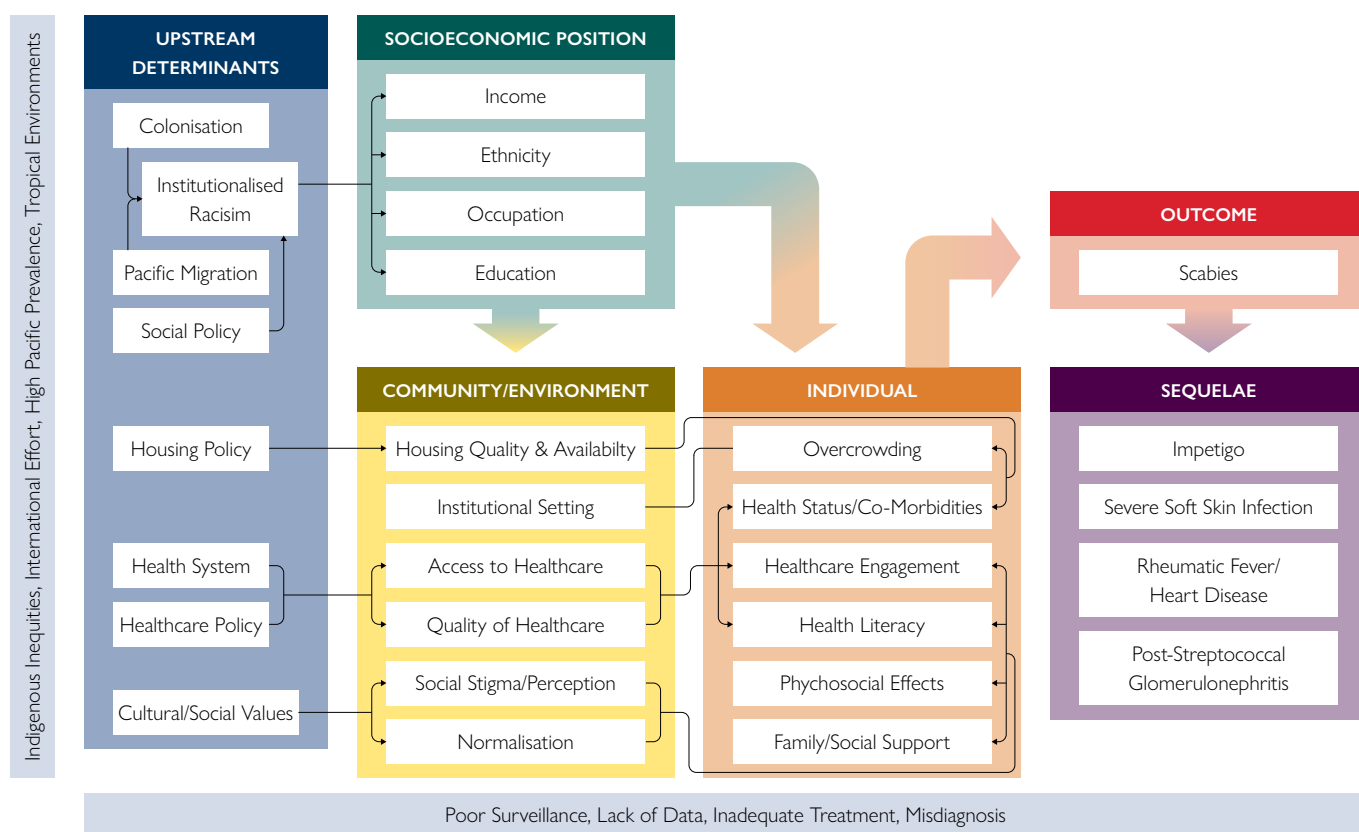
The social determinants that contribute to scabies operate from an individual to a national, and even global level. As depicted in Figure 1, there are a range of factors that reinforce inequitable scabies outcomes in our New Zealand-Australia-Pacific region. Identifying the various pathways that lead to scabies will guide the approach to correcting the problem. New Zealand, Australia, and the Pacific Islands have marked differences in population size, ethnic diversity, land mass, governmental structures, economic worth, and historical contexts, to name a few. Thus, the determinants of scabies in each region will differ. Correcting the problem of scabies in such varied environments will require multiple strategies and interventions at a range of upstream and downstream levels.

1. IDENTIFYING PREVALENCE

It is vital to accurately quantify the burden of scabies in the New Zealand-Australia-Pacific region before any intervention. A 2015 systematic review aimed to identify the prevalence of scabies worldwide, yet concluded the overall quality of studies was poor.¹⁰ However, islands of the Pacific were noted to be the most affected, with the highest prevalence in the general population found to be in Papua New Guinea at 71%.¹⁰ Indigenous communities of Northern Australia were also recognised to have high scabies prevalence.¹⁰ Prevalence data dating back to the 1970s showed that scabies disproportionately burdened Māori and Pacific populations.^{11,12} Thus, there is a need for updated data to re-quantify the effect of scabies in these vulnerable groups. Providing funding for high-quality national studies to measure disease occurrence in New Zealand, Australia, and the Pacific Islands allows for identification of areas or population groups that are most affected. This information is crucial for targeting where scabies control strategies should be implemented. Continued measurements over time can also illustrate the potential successes of attempts at scabies reduction.

2. STREAMLINING DIAGNOSIS

Early and accurate detection of a scabies case is critical for initiating treatment and to prevent further spread. However, the practice of clinically diagnosing scabies can be challenging, as there are limited signs specific to an infestation.⁵ The International Alliance for the Control of Scabies developed a criteria for scabies diagnosis which factors in patient history, physical examination findings, and direct visualisation of mites.¹³ Although this provides great opportunity for consistency and standardisation, there is still need for additional practices, tools, and tests that offer accurate diagnosis, especially in low-resource or remote areas.¹ Current strategies such as light microscopy, videodermatoscopy, and histopathological diagnosis can be limited by high cost and lengthy turnaround time.¹⁴ To date, no point-of-care or simple laboratory test has been established and refined for routine use. Continued research into genomic sequencing, serological assay, and molecular-based techniques would benefit from increased funding to expand investigations of new diagnostic tools and methods. For instance, several polymerase chain reaction methods show potential for rapid and accurate diagnosis; however, their validity is limited by lack of testing in humans.¹⁵ Creating and utilising low-cost equipment can allow for delivery of high-quality care to more rural and remote areas of Northern Australia and the Pacific Islands. For example, initial trials into the use of affordable video microscopes as tools for scabies diagnosis found they were just as effective as costly video dermatoscopes.¹⁶ In addition, expansion of convolutional neural networks, a type of artificial intelligence, to recognise the appearance of scabies lesions in combination with imaging could be another accurate, quick, and low-cost diagnostic tool.¹⁷ Various strands of investigation have been discussed, all advantageous in differing ways. Therefore, provid-

Figure 1 — Social Determinants of Scabies in the New Zealand-Australia-Pacific Area⁹

ing funding into these diverse research fields allows a broad toolkit to be available to clinicians making a scabies diagnosis.

3. EFFECTIVE TREATMENTS

Many treatments for scabies are available; however, there are still several gaps in knowledge and accessibility that exist. Permethrin cream is widely used; however, there is often poor compliance among index cases and contacts due to skin irritation, inadequate application, and inconvenience.¹⁸ In New Zealand, 5% permethrin cream is fully funded by the government; however, the more practical and effective oral ivermectin requires special authority so is less accessible.¹⁹ Regarding ivermectin, further study is needed into its safety in young children and pregnant women, as well as optimising dosage.²⁰ Within the same family as ivermectin, moxidectin may be a promising alternative.²¹ Moxidectin has a longer half-life, which covers the entire scabies mite life cycle, so may be suitable as a single oral dose. *In vitro* studies have found moxidectin is superior to ivermectin for scabies treatment.²² Further exploration may result in development of treatments which are more effective, safe, and tolerable than what is currently available. This is another area of research that should be provided funding to advance investigations.

In terms of a program or strategy for treating scabies, mass drug administration (MDA) is a method of delivering treatment to whole communities regardless of whether individuals have a positive diagnosis of scabies. The aim is to aggressively interrupt transmission of the mites, thereby reducing and preventing cases.²³ A global systematic review of 12 scabies MDA programmes using ivermectin demonstrated on average a 22% absolute and 73% relative reduction of scabies prevalence.²⁴ The Skin Health Intervention Fiji Trial (SHIFT) trial involving three Fijian islands resulted in a 94% relative reduction of scabies after 12 months and maintained an 89% relative reduction after 24 months, demonstrating the prolonged protection and effect of MDA.²⁵ The World Scabies Program is an organisation that has implemented successful MDA interventions in Fiji and the Solomon Islands.²⁶ Philanthropic partnership could allow for the extension of MDA programs into other Pacific Islands. Despite the success of MDA

in some settings, the political and social nuances of mass treatment may be less acceptable in higher-income urban settings of New Zealand and Australia. This illustrates why a multi-faceted approach is essential for correcting the problem of scabies.

4. IMPROVING UPSTREAM FACTORS

Disparities in scabies burden between indigenous and non-indigenous populations are prevalent in New Zealand and Australia.^{10,12} There are a range of scabies risk factors — such as overcrowded housing, health status, health literacy, and lack of engagement with primary care — which are all associated with low socioeconomic status. Māori and Pasifika in New Zealand, and Aboriginal communities in Australia, are more likely to be negatively impacted by all these determinants, and hence, experience worse health outcomes.^{27,28} Poor housing and living conditions, associated with low economic status, are recognised drivers of scabies transmission.^{7,27} In New Zealand, there is a housing and overcrowding crisis that disproportionately affects Māori and Pasifika.²⁹ Only 4% of NZ Europeans live in crowded housing conditions, compared with 38% of Pasifika and 20% of Māori.³⁰ In Australia, 24% of state-owned and managed Indigenous housing is classed as overcrowded.³¹ Charitable organisations across New Zealand and Australia such as the Housing Foundation, Habitat for Humanity, and the Foundation for Indigenous Sustainable Health all build and repair homes for sustainable living.^{32–34} Partnership and financial contribution to these groups could allow more people to live in healthy homes. Countries such as Singapore have seen a positive impact on the burden of skin infections, including scabies, and their complications, such as post-streptococcal glomerulonephritis, with government-led improvements in housing.³⁵ Therefore, improving housing quality in communities with a high burden of scabies can contribute to a reduction in prevalence by cutting off key transmission methods of the mites. Scabies is so tightly interwoven with communities of high deprivation, ethnic inequities, and risk of comorbid and downstream disease, that its spread will continue to be perpetuated unless upstream determinants of health are addressed.

5. ACKNOWLEDGING CULTURAL VALUES

Māori, Pasifika and Aboriginal cultural beliefs which wrestle with colonial European structures may negatively impact their engagement with healthcare, personal perceptions, social interactions, and health literacy, which can all contribute to a greater burden of scabies disease. An example is the Māori concept of “*whakamā*” which approximates to feelings of shame, inferiority, inadequacy, and self-doubt.³⁶ Social exclusion, stigmatisation, and embarrassment are commonly experienced by those with scabies.⁸ Manifestations of *whakamā* can result in isolation from social supports and reduced health-seeking behaviour.^{1,27} Among Aboriginal and some Pacific cultures, scabies may be “normalised” and perceived as harmless or minor due to its common occurrence.³¹ Skin infections can be believed to clear up on their own, and hence, some are less likely to report infestation, seek help, and participate in education.^{28,37} A skin health program operating in remote Aboriginal communities of East Arnhem, Australia implemented routine scabies screening, treatment in clinics and homes, and distribution of permethrin cream. Despite their efforts, prevalence remained unchanged after five years, as they were unable to achieve adequate levels of community involvement.³⁸ There is a need for collaborative, empowering, and mana-enhancing approaches which encourage people to engage with treatment. This is an area where funding further research and qualitative studies would be valuable to understand the perspectives of communities most burdened by scabies. Aboriginal people generally seek traditional bush medicine over Western medicine as they feel more in control of their health.³⁹ Tea tree oil aligns with Indigenous healing culture and demonstrates scabicide properties.⁴⁰ Incorporating this traditional ingredient into treatment programmes may result in greater cultural acceptance. Pacific people's individual health is reflected in the wellbeing of their family and communities — a more holistic view.⁴¹ Acknowledging Māori cultural beliefs during patient interactions can improve health literacy and health outcomes.³⁹ These are all important perspectives that could be reflected in social campaigns. Integrating cultural beliefs and maintaining community engagement will underpin the success of any scabies intervention.

Conclusion

Current health systems and structures in place do little to protect vulnerable populations from poor scabies outcomes. Diagnosis is difficult, even by experienced clinicians, and current treatments are not always effective. Delay in initial diagnosis often means close contacts are already infected, and the cycle of spread continues. With the unlimited resources of a wealthy philanthropist, five areas to receive generous funding have been identified with the goal of correcting the problem of scabies in the New Zealand-Australia-Pacific region:

1. Data collection and prevalence studies
2. Development of accurate, rapid, low-cost diagnostic tools
3. Enhancing current treatment and expanding treatment programs
4. Looking upstream to improve housing quality
5. Understanding cultural beliefs to strengthen engagement

There is no simple solution for eliminating scabies. Without accurate diagnostic methods, data from prevalence studies may not be reliable. A miracle cure will provide little benefit if not socially acceptable and culturally safe. Aggressive treatment campaigns are not a substitute for improving quality of housing, access to healthcare, and socioeconomic status. The factors that contribute to poor scabies outcomes all work in tandem, so attending to only some will not be enough. With unlimited funds comes limitless opportunity; thus, all five areas described must be addressed to effectively combat scabies.

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