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REVIEW ARTICLE

The Identification, Management, and Control of Scabies in Australian Aboriginal and Torres Strait Islander Communities

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Abstract:

Background:

Scabies is an unfortunately neglected tropical skin disease. Scabies occurs in Australia, however it is drastically more common amongst select socioeconomically disadvantaged groups. Amongst these, Aboriginal and Torres Strait Islander communities are affected particularly severely, likely secondary to rampant overcrowding.

Methods:

This literature review has comprehensively explored the relevant evidence available since the year 2000.

Objectives:

The objective of this article is to provide updates on the identification, management, and control of scabies in Aboriginal and Torres Strait Islander communities. The article also aims to reveal issues with these factors that may be contributing to the inflated prevalence of scabies amongst these groups.

Conclusions:

Diagnosis currently depends upon clinical examination, dermatoscopy, and skin scraping microscopy; all of which are prone to error. In Australia, topical permethrin remains first-line treatment, however resistance is developing. Other management aspects to consider are environmental measures and treating secondary infections. Scabies prevention is far more cost-effective than managing advanced individual cases, typically ensured through mass drug administration of permethrin or ivermectin. Sustained prevention can prove troublesome for some communities. In order to address the status of scabies as a neglected tropical disease, these issues must be managed first.

Keywords:

Aboriginal, Australia, control, diagnosis, identification, prevention, scabies, sarcoptes scabiei, Torres Strait Islander, treatment

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Background:

Caused by the mite *Sarcoptes scabiei var. hominis*[1,2], scabies affects up to 300 million people worldwide[3,4]. *S. scabiei* is distributed worldwide, though favours socially disadvantaged populations in tropical areas[1,2,5]. In Australia, scabies is endemic amongst many Aboriginal and Torres Strait Islander populations[1,6], with up to 90% of specific communities being infected[7]. Such prevalence rates, which are particularly high amongst infants[3,8,9], place some of these groups amongst the most affected in the world[9-11].

S. scabiei is transmitted from person-to-person via direct contact. In classical scabies this process requires approximately 20 minutes of close contact – as in holding hands or during sexual contact[2,3]. Fomite transmission is considered negligible[3]. With mite hyper-infestation, known as crusted scabies, transmissibility is increased. Naïve hosts may become infected after much briefer periods of direct contact, and possibly via fomites[12].

Classical scabies presents as a host allergic skin response[3] and, consequently, symptoms may not manifest until six weeks after initial infestation[2,12]. Cases develop intensely pruritic papules or burrows in an acral distribution[9,13]. Secondary bacterial infections from scratching can occur[9,13]. Infection with group A *Streptococcus* (GAS) can result in long-term sequelae, such as acute rheumatic fever (ARF), post-streptococcal glomerulonephritis (PSGN), and rheumatic heart disease (RHD)[2,4,14]. Crusted scabies manifests as plaques, extensive scale, and deep fissures due to hyperkeratosis, induced by infestation with millions of mites[10]. Conversely, crusted scabies may not be pruritic[2].

The sheer prevalence of scabies amongst underserved populations, including Aboriginal and Torres Strait Islander people, and its status as a neglected tropical disease[1,6], highlights the importance of clinicians developing a better understanding of this condition. Given the potentially severe complications of scabies, it is of utmost importance to identify cases early, manage them appropriately, and control future scabies occurrences. However necessary, a task such as this is not without its challenges.

Methodology:

Search Strategy:

The literature included in this review has been retrieved from PubMed, Medline (Ovid), and Cochrane Library journal databases, via James Cook University's (JCU's) Journal Library. Multiple Boolean operators allowed a multi-dimensional search phrase with many keywords to be used. The search phrase was "(sarcoptes scabiei OR scabies) AND (Aboriginal OR Torres Strait Islander OR (Indigenous AND Australia)) AND (identification OR diagnosis OR treatment OR management OR prevention OR control)". The literature search was conducted on the 15th of May, 2017; and therefore does not include articles that have been published after this date.

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Inclusion Criteria:
Studies were included if they were accessible within James Cook University's Journal Library; located on PubMed, Medline (Ovid), or Cochrane Library databases; English language; and published after the 1st of January, 2000. Initially, only articles published within the past 10 years were included, however this was later extended due to a lack of results. Although this resulted in the undesirable inclusion of some older studies, it was deemed necessary in order to retrieve a reasonable number of articles for inclusion within this literature review. The other three inclusion criteria were required for logistical reasons.

Exclusion Criteria:
Articles were excluded if any of the following were applicable: article was a letter to the editor or compilation of letters to the editor; study population was outside or did not include Aboriginal and Torres Strait Islander persons; and the study measured a disease process other than scabies, whereby scabies may have been a risk factor. These exclusion criteria prevented articles that referred to study populations or other medical diagnoses outside of those within this literature review from impairing or skewing data results.

Results:

The initial literature search returned 83 results across the three databases. Duplicates were removed, and 48 unique articles remained. After inclusion criteria were applied 40 articles remained. The exclusion criteria were applied and 24 articles remained for full-text analysis and inclusion in the literature review. This provided a good range of references, including systematic reviews and original analytical research papers, however some articles were quite old. Figure 1 displays the results throughout the literature search process.

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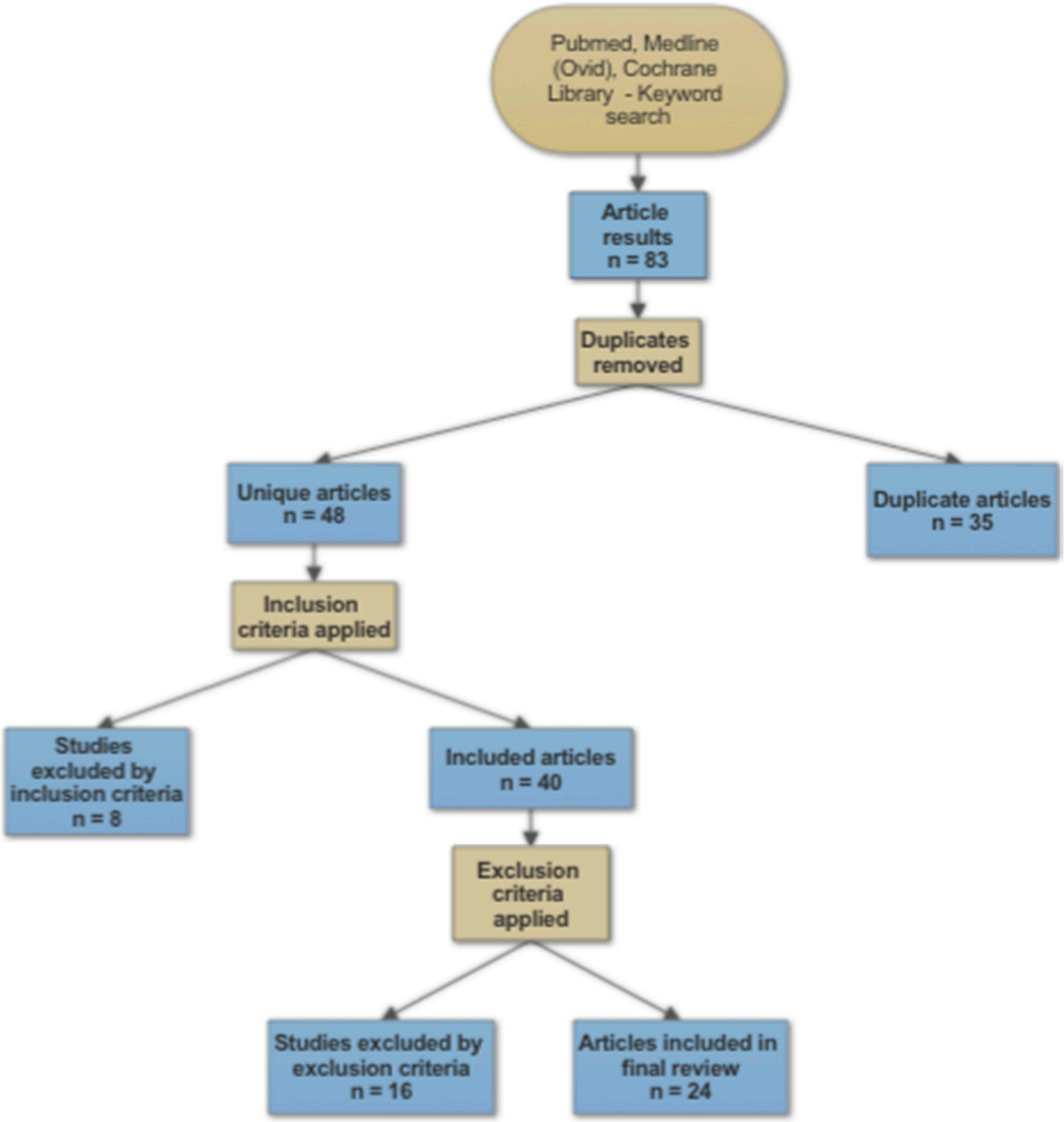

Figure 1: *Completed methodology for the literature review*

Discussion:

Identification of Scabies:

Currently, there is no efficient way to diagnose scabies[4,12]. Diagnosis depends heavily upon the assessment of clinical features, presenting as intensely pruritic papules or burrows, favouring the finger webs, flexor aspects of the wrists, extensor aspects of the elbows, periumbilical skin, buttocks, ankles, penis in males, and periareolar region in females[12]. The itch is worse at night, causing sleep disturbances and impaired function at work or school[9,13]. Unfortunately, burrows, a hallmark sign of scabies infection, are often absent in tropical areas[12]. Furthermore, concomitant eczema or impetigo can obscure the presentation and misleadingly favour various differential diagnoses (Table 1)[2,12].

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Table 1: *Differential diagnoses for scabies infections*[2,12]

Classical Scabies Differential Diagnoses				Crusted Scabies Differential Diagnoses
Insect Bites	**Infectious**	**Dermatitis**	**Immune-Mediated**	
Mosquitos Midges Fleas Bedbugs	Folliculitis Impetigo Tinea Viral exanthems	Eczema Contact dermatitis	Papular urticaria Bullous pemphigoid Pityriasis rosea	Psoriasis Seborrheic dermatitis

If there are multiple household members with pruritis, the clinical suspicion of scabies increases[2]. A presumptive diagnosis may be made if there is a history of pruritis worsening at night, in conjunction with the typical distribution of skin signs and a history of positive-case contact[12]. Symptoms can persist for several weeks after curative treatment, possibly due to dead mites or remnant products in the skin[12], however a response to empirical treatment allows clinicians to *presume* a diagnosis of scabies[2]. The accuracy of this is often questioned though – a positive response to treatment cannot exclude the spontaneous resolution of another dermatological disease, and a negative response to treatment does not exclude scabies[12].

The use of India ink to detect burrows is somewhat outdated, but can prove useful for some patients[2,12]. Dermatoscopy can be used also to visualize the “delta sign”, representing a mite’s mouth, or the “jet with contrail pattern”, representing a mite and its burrow[2]. Whilst this non-invasive, point-of-care technique may be informative, it is acknowledged that there is a lack of studies assessing its efficacy in diagnosing scabies[12].

The only way to definitively diagnose scabies is by skin scraping analysis under light microscopy, directly identifying mites, eggs, eggshell fragments, or mite faecal pellets[12]. Skin scraping microscopy has a high specificity but low sensitivity (<50%)[12]. The fact that scabies can occur from infestation with as few as five mites on the body makes direct detection in skin scraping(s) unlikely[2,12]. In these instances, the histological appearance shows a non-specific, delayed hypersensitivity reaction[12]. The sensitivity of skin scraping analysis increases in crusted scabies due to the number of mites[2], however the sensitivity of such a test is also influenced by the clinical presentation (unscratched lesions have a higher yield), number of sites sampled, and sampler’s experience[12].

A scabies PCR diagnostic test has been previously trialed, but has poor sensitivity due to the low mite burden required to incite disease[12]. Intradermal skin testing with whole-mite extract is implausible due to an inability to culture sufficient quantities of *S. scabiei*, and due to the varied composition, potency, and purity of

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extracts obtained from animal models[12]. Antibody detection via enzyme-linked immunosorbent assays may prove a useful diagnostic tool in the future, given it is known that the host mounts a measurable immunoglobulin G response to mite infestation. Currently, assays rely on whole-mite preparations derived from *suis* and *vulpes* varieties, providing test sensitivities up to 84% in some animal species[12]. Unfortunately, the use of these assays on humans has resulted in sensitivities similar to skin scraping microscopy[12]. This is somewhat unsurprising, given the known genetic differences between animal and human scabies varieties[2,3,12,14]. If assays can be developed from mites more closely related to *S. scabiei var hominis*, antibody detection may become a reasonable means of diagnosing scabies in the future[4].

Management of Scabies:

First-line treatment for classical scabies in Australia is topical permethrin 5% cream, which is applied to the entire body, excluding the head and neck, and washed off eight hours later[2,15]. Permethrin is active against all stages of the mite's lifecycle and so repeat doses are not required, assuming it is applied adequately[2].

Research performed in Northern Australia has suggested permethrin is effective at treating index cases, though issues with treatment uptake and compliance with total-body application have been cited[16]. Treatment uptake amongst index cases was approximately 70%, however it was markedly less amongst asymptomatic contacts, more so in areas with a higher scabies-burden[16]. Inconvenience, unpleasantness of treatment, and perceived low personal benefit contributed to this[16]. The latter likely resulting from high re-acquisition rates[16], secondary to overcrowding and a mobile population making disease control difficult[16]. Total-body application compliance was impaired by: overcrowding, hot temperatures, high humidity, little privacy (to apply the cream), and poor facilities (to wash it off)[16].

Evidence suggests that in some Aboriginal and Torres Strait Islander communities, *S. scabiei* is developing resistance to topical permethrin[3,12]. This is likely to prove harmful in the future, and should encourage strict compliance with local guidelines. Though financial cost should not restrict Aboriginal and Torres Strait Islander patients from accessing permethrin due to Medicare's Indigenous Access Program, permethrin's costliness can limit its use in many developing tropical countries[12]. Second-line treatment for scabies in Australia is topical benzyl benzoate 25%. It commonly causes skin irritation and needs to be diluted in water for children and infants. The agent is applied to the whole body and washed off after 24 hours. The need for a repeated dosing in 7 – 14 days[2,15] combined with total-body application poor compliance factors (inconvenience, lack of privacy, etc.)[16] may result in reduced community compliance.

Oral ivermectin is the third-line treatment for scabies, and is indicated in topical treatment failure, extensive infection (for the individual or community), or poor topical compliance[15]. The broad-spectrum anti-parasitic drug only affects mites,

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warranting a repeat dose 7 – 14 days later to kill newly hatched parasites. Adverse effects are usually mild and transient, and include: itch, headache, abdominal pain, joint pain, and dizziness[2]. Due to concerns about neurotoxicity, ivermectin is not recommended for any of the following: <5 years old, <15kg heavy, pregnant or breastfeeding, and very elderly or frail[2,4]. When both are administered correctly, oral ivermectin is not as effective as topical permethrin at treating classical scabies[2]. Similar to permethrin, *S. scabiei*'s resistance to ivermectin is increasing[3].

With emerging resistance, attention has shifted towards alternative acaricides[3]. Tea tree oil and aloe vera have shown promising results in small studies, though further assessment is required[3,17].

The evidence regarding treating bedding, clothes, and carpets with anti-parasitic agents and hot laundering has been controversial[2]. The current thought is that because classical scabies involves so few mites[12,18], transmission or re-infestation via fomites is negligible[3]. Given *S. scabiei* is only able to survive off the human skin for 24 – 36 hours[3] and the duration of topical treatment applications, it is unlikely any mites on fomites would be able to survive long enough for a suitable host – assuming all household contacts complete treatment simultaneously[2]. However, the near-nil negative impact of taking environmental measures should also be considered.

Scratching can commonly lead to excoriations and promote secondary bacterial infection[19,20]. Concomitant scabies infection underlies up to 70% of *Streptococcus pyogenes* infections in select Aboriginal and Torres Strait Islander communities[3,8,9], possibly amplified by mite-released complement inhibitors[21]. Infective complications can range from skin and soft tissue infections including impetigo, cellulitis, and necrotizing fasciitis; to septicaemia and potential death. Additionally, if GAS is involved, post-streptococcal complications including PSGN, ARF, and RHD can ensue[11]. These complications can have a marked impact on individuals and their communities, prompting expedient treatment[9]. Antibiotic selection should be determined by culture and sensitivities. In remote settings where the most likely infective cause is methicillin-resistant *Staphylococcus aureus* or *S. pyogenes* combined oral trimethoprim and sulfamethoxazole, or intramuscular benzathine penicillin (for *S. pyogenes*) are common suggestions[7,9]. Given antibiotic resistance patterns can vary greatly, clinicians should follow local antibiotic guidelines whenever possible[7,20].

Although crusted scabies is uncommon, extensive skin involvement increases the risk of severe complications[2,10]. Treatment for crusted scabies requires hospital admission for isolation and intensive treatment including topical scabicides, oral ivermectin, and topical keratolytics[10]. Frequency and duration of treatments is typically determined based on the severity of the diagnosis (Figure 2)[1]. Environmental measures are required for the effective management of crusted scabies, due to the involvement of millions of mites[2,10].

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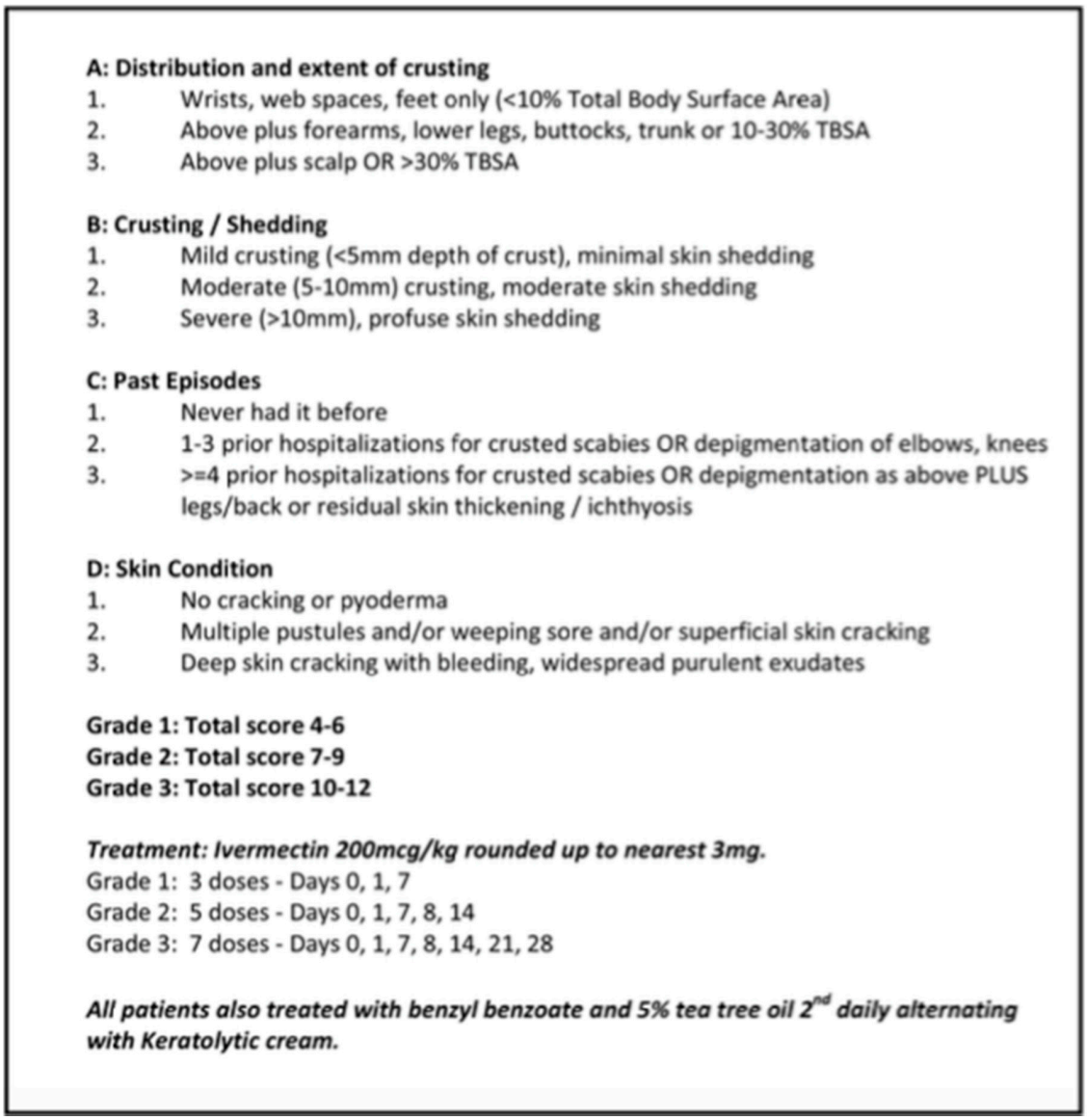

A: Distribution and extent of crusting

1. Wrists, web spaces, feet only (<10% Total Body Surface Area)
2. Above plus forearms, lower legs, buttocks, trunk or 10-30% TBSA
3. Above plus scalp OR >30% TBSA

B: Crusting / Shedding

1. Mild crusting (<5mm depth of crust), minimal skin shedding
2. Moderate (5-10mm) crusting, moderate skin shedding
3. Severe (>10mm), profuse skin shedding

C: Past Episodes

1. Never had it before
2. 1-3 prior hospitalizations for crusted scabies OR depigmentation of elbows, knees
3. >=4 prior hospitalizations for crusted scabies OR depigmentation as above PLUS legs/back or residual skin thickening / ichthyosis

D: Skin Condition

1. No cracking or pyoderma
2. Multiple pustules and/or weeping sore and/or superficial skin cracking
3. Deep skin cracking with bleeding, widespread purulent exudates

Grade 1: Total score 4-6
Grade 2: Total score 7-9
Grade 3: Total score 10-12

Treatment: Ivermectin 200mcg/kg rounded up to nearest 3mg.
Grade 1: 3 doses - Days 0, 1, 7
Grade 2: 5 doses - Days 0, 1, 7, 8, 14
Grade 3: 7 doses - Days 0, 1, 7, 8, 14, 21, 28

All patients also treated with benzyl benzoate and 5% tea tree oil 2nd daily alternating with Keratolytic cream.

Figure 2: *Royal Darwin Hospital's severity grading scale for crusted scabies*[1]

Control of Scabies:

Scabies outbreaks affect Aboriginal and Torres Strait Islander communities for a number of reasons, including overcrowding[9,22]. Managing an outbreak requires collaboration between the local public health unit, physicians, nursing staff, and facility infection control in order to detect cases, and implement infection control and environmental measures early to limit transmission[2].

The most effective means of controlling a scabies outbreak is through mass drug administration (MDA)[2,16]. Opinions are mixed with regards to the favoured drug for MDA[4], yet ivermectin is generally considered superior to permethrin in international studies[2]. Although no study has been performed that directly

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compares the efficacy of ivermectin to permethrin for MDA in Aboriginal and Torres Strait Islander patients, both are effective MDA agents in this population[4,8,18]. Ivemectin must be given on an empty stomach, with which non-compliance may impair community-based MDA and further promote resistance[4].

The larger issue with controlling scabies outbreaks is the concept of sustained prevention following MDA[7]. Sustained prevention may be more difficult to implement because it requires foundational change in order to minimize the precipitating factor(s)[13]. If this refers to addressing overcrowding, as it does for many Aboriginal and Torres Strait Islander communities, then housing must be improved[2,13]. This task is not without challenges. Obviously there are going to be issues with the implementation of this, such as a large financial cost. Even the initial assessment of overcrowding can prove difficult due to the mobile nature of many community members, resulting in misleading data and an under- representation of the issue[23]. However, studies have shown that the cost of achieving sustained prevention is generally less than the cost of managing individual advanced cases with repeated hospitalisations and retrievals[6-8,13].

A number of community-based control programs conducted in Aboriginal and Torres Strait Islander communities in the Northern Territory (including the "Healthy Skin" project) have shown promising results by combining active screening regimens and annual treatment days with health education initiatives and environmental interventions to address scabies[3,20,24]. Ultimately though, it is regular re-screening, community education, and community involvement that is crucial for controlling scabies[6,24].

The International Alliance for Control of Scabies (IACS) works with various health programs to increase awareness and further develop suitable treatments and scabies surveillance measures, in order to control forthcoming outbreaks[2]. In the future, these measures will hopefully allow better scabies control.

Conclusion:

Scabies is a neglected tropical disease with a large global burden of disease, particularly affecting Aboriginal and Torres Strait Islander people in Australia[1,6]. The diagnosis currently depends upon clinical examination and skin scraping microscopy; both being error-prone techniques[4,12]. Many cases and contacts are treated presumptively, perhaps in error[12], typically with a topical agent[2]. Other aspects of scabies management include environmental measures and treating secondary infections[2,12,19]. Evidence has established that the most effective way to manage scabies is by controlling and preventing outbreaks[6-8,13], namely through MDA[2,16]. Some communities have faced issues with sustained prevention[9,22], however evidence suggests that efforts to regularly re-screen, and educate and involve the community are more cost-effective than managing advanced individual cases following community relapse[6-8,13].

As evidence suggests, further efforts should be devoted to developing a reasonable diagnostic tool[4,12]. Currently, this seems as if it will come from the development of more effective serological methods such as antibody detection[4]; however that may change as the field advances. As *S. scabiei* develops increasing resistance to permethrin and ivermectin[3,17], alternative acaricides should be better assessed. Lastly, a greater proportion of funding should be invested in the prevention of scabies, as this is the most effective method of control[6-8,13]. If these recommendations can be acted on, steps can be taken to address the status of scabies amongst Aboriginal and Torres Strait Islander communities.

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