1   **REVIEW ARTICLE**

2   **The Identification, Management, and Control of Scabies in**

3   **Australian Aboriginal and Torres Strait Islander**

4   **Communities**

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10   **Abstract:**
11   *Background:*
12   Scabies is an unfortunately neglected tropical skin disease. Scabies occurs in
13   Australia, however it is drastically more common amongst select socioeconomically
14   disadvantaged groups. Amongst these, Aboriginal and Torres Strait Islander
15   communities are affected particularly severely, likely secondary to rampant
16   overcrowding.
17
18   *Methods:*
19   This literature review has comprehensively explored the relevant evidence available
20   since the year 2000.
21
22   *Objectives:*
23   The objective of this article is to provide updates on the identification, management,
24   and control of scabies in Aboriginal and Torres Strait Islander communities. The
25   article also aims to reveal issues with these factors that may be contributing to the
26   inflated prevalence of scabies amongst these groups.
27
28   *Conclusions:*
29   Diagnosis currently depends upon clinical examination, dermatoscopy, and skin
30   scraping microscopy; all of which are prone to error. In Australia, topical
31   permethrin remains first-line treatment, however resistance is developing. Other
32   management aspects to consider are environmental measures and treating
33   secondary infections. Scabies prevention is far more cost-effective than managing
34   advanced individual cases, typically ensured through mass drug administration of
35   permethrin or ivermectin. Sustained prevention can prove troublesome for some
36   communities. In order to address the status of scabies as a neglected tropical
37   disease, these issues must be managed first.
38
39   *Keywords:*
40   Aboriginal, Australia, control, diagnosis, identification, prevention, scabies,
41   sarcoptes scabiei, Torres Strait Islander, treatment
42
43

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].

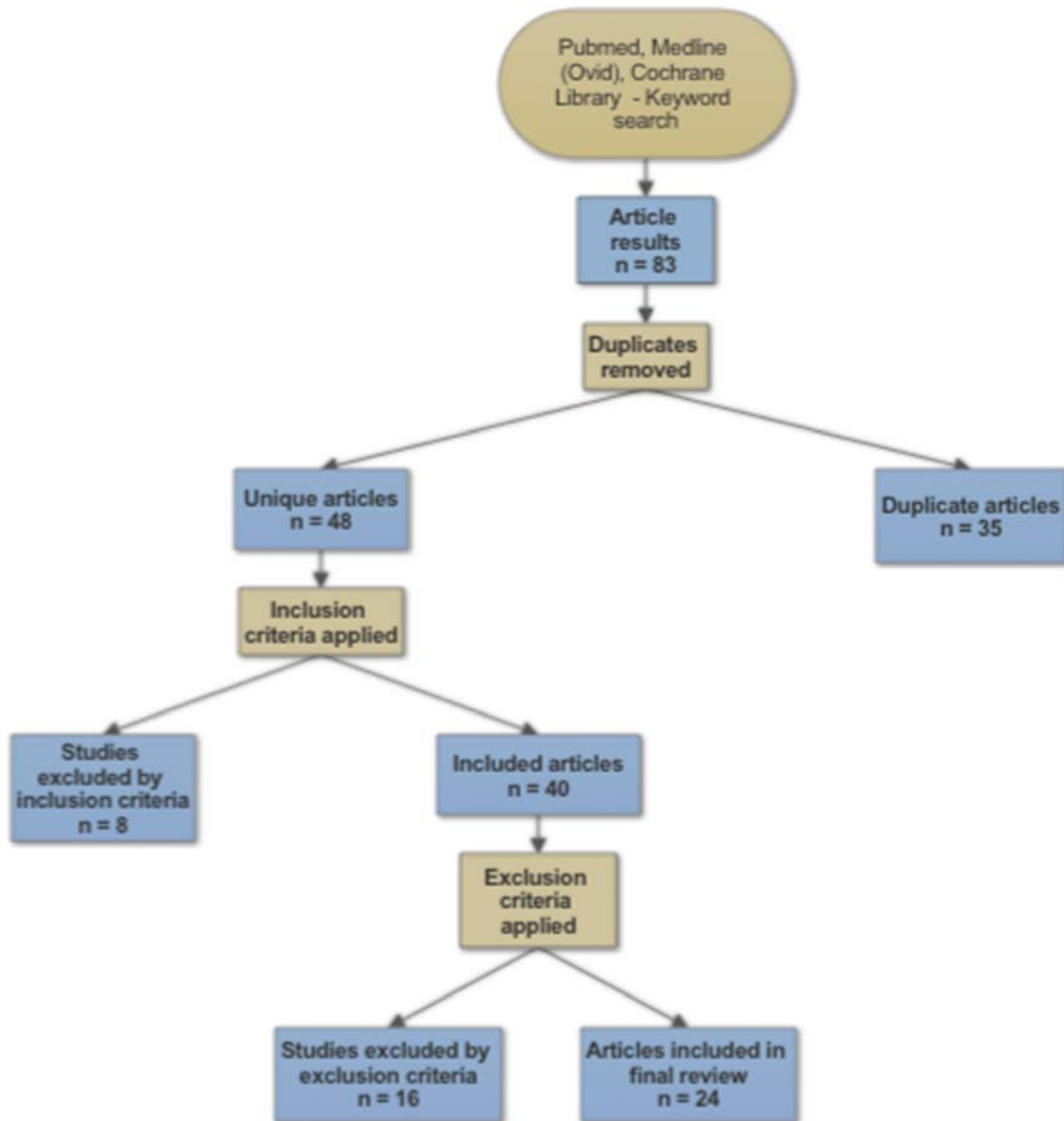
Classical scabies presents as a host allergic skin response[3] and, consequently, symptoms may not manifest until six weeks after initial infestation[2,12]. Cases develop intensely pruritic papules or burrows in an acral distribution[9,13]. Secondary bacterial infections from scratching can occur[9,13]. Infection with group A *Streptococcus* (GAS) may 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.

89
90   ***Inclusion Criteria:***
91   Studies were included if they were accessible within James Cook University's
92   Journal Library; located on PubMed, Medline (Ovid), or Cochrane Library databases;
93   English language; and published after the 1st of January, 2000. Initially, only articles
94   published within the past 10 years were included, however this was later extended
95   due to a lack of results. Although this resulted in the undesirable inclusion of some
96   older studies, it was deemed necessary in order to retrieve a reasonable number of
97   articles for inclusion within this literature review. The other three inclusion criteria
98   were required for logistical reasons.
99
100   ***Exclusion Criteria:***
101   Articles were excluded if any of the following were applicable: article was a letter to
102   the editor or compilation of letters to the editor; study population was outside or
103   did not include Aboriginal and Torres Strait Islander persons; and the study
104   measured a disease process other than scabies, whereby scabies may have been a
105   risk factor. These exclusion criteria prevented articles that referred to study
106   populations or other medical diagnoses outside of those within this literature
107   review from impairing or skewing data results.
108
109   **Results:**
110   The initial literature search returned 83 results across the three databases.
111   Duplicates were removed, and 48 unique articles remained. After inclusion criteria
112   were applied 40 articles remained. The exclusion criteria were applied and 24
113   articles remained for full-text analysis and inclusion in the literature review.
114   Figure 1 displays the results throughout the literature search process.
115

116
117   ***Figure 1:*** *Completed methodology for the literature review*
118
119   **Discussion:**
120   ***Identification of Scabies:***
121   Currently, there is no efficient way to diagnose scabies[4,12]. Diagnosis depends
122   heavily upon the assessment of clinical features, presenting as intensely pruritic
123   papules or burrows, favouring the finger webs, flexor aspects of the wrists, extensor
124   aspects of the elbows, periumbilical skin, buttocks, ankles, penis in males, and
125   periareolar region in females[12]. The itch is worse at night, causing sleep
126   disturbances and impaired function at work or school[9,13]. Unfortunately,
127   burrows, a hallmark sign of scabies infection, are often absent in tropical
128   areas[12]. Furthermore, concomitant eczema or impetigo can obscure the
129   presentation and misleadingly favour various differential diagnoses (Table 1)[2,12].

130
131   ***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

132
133   If there are multiple household members with pruritis, the clinical suspicion of
134   scabies increases[2]. A presumptive diagnosis may be made if there is a history of
135   pruritis worsening at night, in conjunction with the typical distribution of skin signs
136   and a history of positive-case contact[12]. Symptoms can persist for several weeks
137   after curative treatment, possibly due to dead mites or remnant products in the
138   skin[12], however a response to empirical treatment allows clinicians to *presume* a
139   diagnosis of scabies[2]. The accuracy of this is often questioned though – a positive
140   response to treatment cannot exclude the spontaneous resolution of another
141   dermatological disease, and a negative response to treatment does not exclude
142   scabies[12].
143
144   The use of India ink to detect burrows is somewhat outdated, but can prove useful
145   for some patients[2,12]. Dermatoscopy can be used also to visualize the "delta sign",
146   representing a mite's mouth, or the "jet with contrail pattern", representing a mite
147   and its burrow[2]. Whilst this non-invasive, point-of-care technique may be
148   informative, it is acknowledged that there is a lack of studies assessing its efficacy in
149   diagnosing scabies[12].
150
151   The only way to definitively diagnose scabies is by skin scraping analysis under light
152   microscopy, directly identifying mites, eggs, eggshell fragments, or mite faecal
153   pellets[12]. Skin scraping microscopy has a high specificity but low sensitivity
154   (<50%)[12]. The fact that scabies can occur from infestation with as few as five
155   mites on the body makes direct detection in skin scraping(s) unlikely[2,12]. In these
156   instances, the histological appearance shows a non-specific, delayed
157   hypersensitivity reaction[12]. The sensitivity of skin scraping analysis increases in
158   crusted scabies due to the number of mites[2], however the sensitivity of such a test
159   is also influenced by the clinical presentation (unscratched lesions have a higher
160   yield), number of sites sampled, and sampler's experience[12].
161
162   A scabies PCR diagnostic test has been previously trialed, but has poor sensitivity
163   due to the low mite burden required to incite disease[12]. Intradermal skin testing
164   with whole-mite extract is implausible due to an inability to culture sufficient
165   quantities of *S. scabiei*, and due to the varied composition, potency, and purity of

166   extracts obtained from animal models[12]. Antibody detection via enzyme-linked
167   immunosorbent assays may prove a useful diagnostic tool in the future, given it is
168   known that the host mounts a measurable immunoglobulin G response to mite
169   infestation. Currently, assays rely on whole-mite preparations derived from *suis* and
170   *vulpes* varieties, providing test sensitivities up to 84% in some animal species[12].
171   Unfortunately, the use of these assays on humans has resulted in sensitivities
172   similar to skin scraping microscopy[12]. This is somewhat unsurprising, given the
173   known genetic differences between animal and human scabies varieties[2,3,12,14].
174   If assays can be developed from mites more closely related to *S. scabiei var hominis*,
175   antibody detection may become a reasonable means of diagnosing scabies in the
176   future[4].
177
178   ***Management of Scabies:***
179   First-line treatment for classical scabies in Australia is topical permethrin 5%
180   cream, which is applied to the entire body, excluding the head and neck, and washed
181   off eight hours later[2,15]. Permethrin is active against all stages of the mite's
182   lifecycle and so repeat doses are not required, assuming it is applied adequately[2].
183
184   Research performed in Northern Australia has suggested permethrin is effective at
185   treating index cases, though issues with treatment uptake and compliance with
186   total-body application have been cited[16]. Treatment uptake amongst index cases
187   was approximately 70%, however it was markedly less amongst asymptomatic
188   contacts, more so in areas with a higher scabies-burden[16]. Inconvenience,
189   unpleasantness of treatment, and perceived low personal benefit contributed to
190   this[16]. Disease control is rendered extremely difficult due to high re-acquisition
191   rates, fueled by overcrowding and population mobility[16]. Total-body application
192   compliance was impaired by: overcrowding, hot temperatures, high humidity, little
193   privacy (to apply the cream), and poor facilities (to wash it off)[16].
194
195   Evidence suggests that in some Aboriginal and Torres Strait Islander communities,
196   *S. scabiei* is developing resistance to topical permethrin[3,12]. This is likely to prove
197   harmful in the future, and should encourage strict compliance with local guidelines.
198   Though financial cost should not restrict Aboriginal and Torres Strait Islander
199   patients from accessing permethrin due to Medicare's Indigenous Access Program,
200   permethrin's costliness can limit its use in many developing tropical countries[12].
201   Second-line treatment for scabies in Australia is topical benzyl benzoate 25%. It
202   commonly causes skin irritation and needs to be diluted in water for children and
203   infants. The agent is applied to the whole body and washed off after 24 hours. The
204   need for a repeated dosing in 7 – 14 days[2,15] combined with total-body
205   application poor compliance factors (inconvenience, lack of privacy, etc.)[16] may
206   result in reduced community compliance.
207
208   Oral ivermectin is the third-line treatment for scabies, and is indicated in topical
209   treatment failure, extensive infection (for the individual or community), or poor
210   topical compliance[15]. The broad-spectrum anti-parasitic drug only affects mites,
211   warranting a repeat dose 7 – 14 days later to kill newly hatched parasites. Adverse

212   effects are usually mild and transient, and include: itch, headache, abdominal pain,
213   joint pain, and dizziness[2]. Due to concerns about neurotoxicity, ivermectin is not
214   recommended for any of the following: <5 years old, <15kg heavy, pregnant or
215   breastfeeding, and very elderly or frail[2,4]. When both are administered correctly,
216   oral ivermectin is not as effective as topical permethrin at treating classical
217   scabies[2]. Similar to permethrin, *S. scabiei*'s resistance to ivermectin is
218   increasing[3].
219
220   With emerging resistance, attention has shifted towards alternative acaricides[3].
221   Tea tree oil and aloe vera have shown promising results in small studies, though
222   further assessment is required[3,17].
223
224   The evidence regarding treating bedding, clothes, and carpets with anti-parasitic
225   agents and hot laundering has been controversial[2]. The current thought is that
226   because classical scabies involves so few mites[12,18], transmission or re-
227   infestation via fomites is negligible[3]. Given *S. scabiei* is only able to survive off the
228   human skin for 24 – 36 hours[3] and the duration of topical treatment applications,
229   it is unlikely any mites on fomites would be able to survive long enough for a
230   suitable host – assuming all household contacts complete treatment
231   simultaneously[2]. However, the near-nil negative impact of taking environmental
232   measures should also be considered.
233
234   Scratching can commonly lead to excoriations and promote secondary bacterial
235   infection[19,20]. Concomitant scabies infection underlies up to 70% of
236   *Streptococcus pyogenes* infections in select Aboriginal and Torres Strait Islander
237   communities[3,8,9], possibly amplified by mite-released complement inhibitors[21].
238   Infective complications can range from skin and soft tissue infections including
239   impetigo, cellulitis, and necrotizing fasciitis; to septicaemia and potential death.
240   Additionally, if GAS is involved, post-streptococcal complications including PSGN,
241   ARF, and RHD may ensue[11]. These complications can have a marked impact on
242   individuals and their communities, prompting expedient treatment[9]. Antibiotic
243   selection should be determined by culture and sensitivities. In remote settings
244   where the most likely infective cause is methicillin-resistant *Staphylococcus aureus*
245   or *S. pyogenes* combined oral trimethoprim and sulfamethoxazole, or intramuscular
246   benzathine penicillin (for *S. pyogenes*) are common suggestions[7,9]. Given
247   antibiotic resistance patterns can vary greatly, clinicians should follow local
248   antibiotic guidelines whenever possible[7,20].
249
250   Although crusted scabies is uncommon, extensive skin involvement increases the
251   risk of severe complications[2,10]. Treatment for crusted scabies requires hospital
252   admission for isolation and intensive treatment including topical scabicides, oral
253   ivermectin, and topical keratolytics[10]. Frequency and duration of treatments is
254   typically determined based on the severity of the diagnosis (Figure 2)[1].
255   Environmental measures are required for the effective management of crusted
256   scabies, due to the involvement of millions of mites[2,10].
257

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.

258
259   ***Figure 2:*** *Royal Darwin Hospital's severity grading scale for crusted scabies*[1]
260

261   ***Control of Scabies:***
262   Scabies outbreaks affect Aboriginal and Torres Strait Islander communities for a
263   number of reasons, including overcrowding[9,22]. Managing an outbreak requires
264   collaboration between the local public health unit, physicians, nursing staff, and
265   facility infection control in order to detect cases, and implement infection control
266   and environmental measures early to limit transmission[2].
267
268   The most effective means of controlling a scabies outbreak is through mass drug
269   administration (MDA)[2,16]. Opinions are mixed with regards to the favoured drug
270   for MDA[4], yet ivermectin is generally considered superior to permethrin in
271   international studies[2]. Although no study has been performed that directly
272   compares the efficacy of ivermectin to permethrin for MDA in Aboriginal and Torres

273 Strait Islander patients, both are effective MDA agents in this population[4,8,18].
274 Ivemectin must be given on an empty stomach, with which non-compliance may
275 impair community-based MDA and further promote resistance[4].
276
277 The larger issue with controlling scabies outbreaks is the concept of sustained
278 prevention following MDA[7]. Sustained prevention may be more difficult to
279 implement because it requires foundational change in order to minimize the
280 precipitating factor(s)[13]. If this refers to addressing overcrowding, as it does for
281 many Aboriginal and Torres Strait Islander communities, then housing must be
282 improved[2,13]. This task is not without challenges. Obviously there are going to be
283 issues with the implementation of this, such as a large financial cost. Even the initial
284 assessment of overcrowding can prove difficult due to the mobile nature of many
285 community members, resulting in misleading data and an under- representation of
286 the issue[23]. However, studies have shown that the cost of achieving sustained
287 prevention is generally less than the cost of managing individual advanced cases
288 with repeated hospitalisations and retrievals[6-8,13].
289
290 A number of community-based control programs conducted in Aboriginal and
291 Torres Strait Islander communities in the Northern Territory (including the
292 "Healthy Skin" project) have shown promising results by combining active screening
293 regimens and annual treatment days with health education initiatives and
294 environmental interventions to address scabies[3,20,24]. Ultimately though, it is
295 regular re-screening, community education, and community involvement that is
296 crucial for controlling scabies[6,24].
297
298 The International Alliance for Control of Scabies (IACS) works with various health
299 programs to increase awareness and further develop suitable treatments and
300 scabies surveillance measures, in order to control forthcoming outbreaks[2]. In the
301 future, these measures will hopefully allow better scabies control.
302
303 ## Conclusion:
304 Scabies is a neglected tropical disease with a large global burden of disease,
305 particularly affecting Aboriginal and Torres Strait Islander people in Australia[1,6].
306 The diagnosis currently depends upon clinical examination and skin scraping
307 microscopy; both being error-prone techniques[4,12]. Many cases and contacts are
308 treated presumptively, perhaps in error[12], typically with a topical agent[2]. Other
309 aspects of scabies management include environmental measures and treating
310 secondary infections[2,12,19]. Evidence has established that the most effective way
311 to manage scabies is by controlling and preventing outbreaks[6-8,13], namely
312 through MDA[2,16]. Some communities have faced issues with sustained
313 prevention[9,22], however evidence suggests that efforts to regularly re-screen, and
314 educate and involve the community are more cost-effective than managing
315 advanced individual cases following community relapse[6-8,13].
316

317   As evidence suggests, further efforts should be devoted to developing a reasonable
318   diagnostic tool[4,12]. Currently, this seems as if it will come from the development
319   of more effective serological methods such as antibody detection[4]; however that
320   may change as the field advances. As *S. scabiei* develops increasing resistance to
321   permethrin and ivermectin[3,17], alternative acaricides should be better assessed.
322   Lastly, a greater proportion of funding should be invested in the prevention of
323   scabies, as this is the most effective method of control[6-8,13]. If these
324   recommendations can be acted on, steps can be taken to address the status of
325   scabies amongst Aboriginal and Torres Strait Islander communities.
326

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References:

1. Davis, J. S.; McGloughlin, S.; Tong, S. Y. C.; Walton, S. F.; Currie, B. J. A novel clinical grading scale to guide the management of crusted scabies. PLoS: Negl Trop Dis 2013;7(9). Available online: https://www-ncbi-nlm-nih-gov.elibrary.jcu.edu.au/pmc/articles/PMC3772049/ (accessed on 15/05/2017).

2. Hardy, M.; Engelman, D.; Steer, A. Scabies: A clinical update. Aust Fam Physician 2017;46(5):264 - 8.

3. Holt, D. C.; McCarthy, J.; Carapetis, J. R. Parasitic diseases of remote Indigenous communities in Australia. Int J Parasitol 2010;40(10):1119 - 26.

4. Thomas, J.; Peterson, G. M.; Walton, S. F.; Carson, C. F.; Naunton, M.; Baby, K. E. Scabies: an ancient global disease with a need for new therapies. BMC Infectious Diseases 2015;15:250.

5. Kline, K.; McCarthy, J.; Pearson, M.; Loukas, A.; Hotez, P. J. Neglected tropical diseases of Oceania: review of their prevalence, distribution, and opportunities for control. PLoS: Negl Trop Dis 2013;7(1). Available online: https://www-ncbi-nlm-nih-gov.elibrary.jcu.edu.au/pmc/articles/PMC3561157/ (accessed on 15/05/2017).

6. Wong, L. C.; Amega, B.; Barker, R.; Connors, C.; Dulla, M. E.; Ninnal, A.; Cumaiyi, M. M.; Kolumboort, L.; Currie, B. J. Factors supporting sustainability of a community-based scabies control program. Australas J Dermatol 2002;43(4):274 - 7.

7. Whitehall, J.; Kuzulugil, D.; Sheldrick, K.; Wood, A. Burden of paediatric pyoderma and scabies in North West Queensland. J Paediatr Child Health 2013;49(2):141 - 3.

8. Clucas, D. B.; Carville, K.; Connors, C.; Currie, B. J.; Carapetis, J. R.; Andrews, R. M. Disease burden and health-care clinic attendances for young children in remote aboriginal communities of northern Australia. Bull World Health Organ 2008;86(4):275 - 81.

9. McMeniman, E.; Holden, L.; Kearns, T.; Clucas, D. B.; Carapetis, J. R.; Currie, B. J.; Connors, C.; Andrews, R. M. Skin disease in the first two years of life in Aboriginal children in East Arnhem Land. Australas J Dermatol 2011;52(4):270 - 3.

10. Lokuge, B.; Kopczynski, A.; Woltmann, A.; Alvoen, F.; Connors, C.; Guyula, T.; Mulholland, E.; Cran, S.; Foster, T.; Lokuge, K.; Burke, T.; Prince, S. Crusted scabies in remote Australia, a new way forward: lessons and outcomes from the East Arnhem Scabies Control Program. Med J Aust 2014;200(11):644 - 8.

11. Romani, L.; Steer, A. C.; Whitfeld, M. J.; Kaldor, J. M. Prevalence of scabies and impetigo worldwide: a systematic review. Lancet Infect Dis 2015;15(8):960 - 7.

12. Walton, S. F.; Currie, B. J. Problems in diagnosing scabies, a global disease in human and animal populations. Clin Microbiol Rev 2007;20(2):268 - 79.

13. Gilmore, S. J. Control strategies for endemic childhood scabies. PLoS One 2011;6(1). Available online: https://www-ncbi-nlm-nih-

375   gov.elibrary.jcu.edu.au/pmc/articles/PMC3026796/ (accessed on
376   15/05/2017).
377   14. Currie, B. J.; Carapetis, J. R. Skin infections and infestations in Aboriginal
378   communities in northern Australia. Australas J Dermatol 2000;41(3):139 -
379   43.
380   15. Marquardt, T. Managing skin infections in Aboriginal and Torres Strait
381   Islander children. Aust Fam Physician 2014;43(1):16 - 9.
382   16. La Vincente, S.; Kearns, T.; Connors, C.; Cameron, S.; Carapetis, J.; Andrews, R.
383   Community management of endemic scabies in remote aboriginal
384   communities of northern Australia: low treatment uptake and high ongoing
385   acquisition. PLoS: Negl Trop Dis 2009;3(5). Available online: https://www-
386   ncbi-nlm-nih-gov.elibrary.jcu.edu.au/pmc/articles/PMC2680947/ (accessed
387   on 15/05/2017).
388   17. Walton, S. F.; McKinnon, M.; Pizzutto, S.; Dougall, A.; Williams, E.; Currie, B. J.
389   Acaricidal activity of Melaleuca alternifolia (tea tree) oil: in vitro sensitivity of
390   sarcoptes scabiei var hominis to terpinen-4-ol. Arch Dermatol
391   2004;140(5):563 - 6.
392   18. Kearns, T. M.; Speare, R.; Cheng, A. C.; McCarthy, J.; Carapetis, J. R.; Holt, D. C.;
393   Currie, B. J.; Page, W.; Shield., J.; Gundjirryirr, R.; Bundhala, L.; Mulholland, E.;
394   Chatfield, M.; Andrews, R. M. Impact of an Ivermectin Mass Drug
395   Administration on Scabies Prevalence in a Remote Australian Aboriginal
396   Community. PLoS: Negl Trop Dis 2015;9(10). Available online: https://www-
397   ncbi-nlm-nih-gov.elibrary.jcu.edu.au/pmc/articles/PMC4627839/ (accessed
398   on 15/05/2017).
399   19. Tasani, M.; Tong, S.; Andrews, R. M.; Holt, D. C.; Currie, B. J.; Carapetis, J. R.;
400   Bowen, A. C. The Importance of Scabies Coinfection in the Treatment
401   Considerations for Impetigo. Pediatr Infect Dis J 2016;35(4):374 - 8.
402   20. Andrews, R. M.; Kearns, T.; Connors, C.; Parker, C.; Carville, K.; Currie, B. J.;
403   Carapetis, J. R. A regional initiative to reduce skin infections amongst
404   aboriginal children living in remote communities of the Northern Territory,
405   Australia. PLoS; Negl Trop Dis 2009;3(11). Available online: https://www-
406   ncbi-nlm-nih-gov.elibrary.jcu.edu.au/pmc/articles/PMC2775159/ (accessed
407   on 15/05/2017).
408   21. Mika, A.; Reynolds, S.; Pickering, D.; McMillan, D.; Sriprakash, K. S.; Kemp, D.
409   J.; Fischer, K. Complement inhibitors from scabies mites promote
410   streptococcal growth--a novel mechanism in infected epidermis? PLoS: Negl
411   Trop Dis 2012;6(7). Available online: https://www-ncbi-nlm-nih-
412   gov.elibrary.jcu.edu.au/pmc/articles/PMC3398963/ (accessed on
413   15/05/2017).
414   22. Andrews, R. M.; McCarthy, J.; Carapetis, J. R.; Currie, B. J. Skin disorders,
415   including pyoderma, scabies, and tinea infections. Pediatr Clin North Am
416   2009;56(6):1421 - 40.
417   23. Warchivker, I.; Tjapangati, T.; Wakerman, J. The turmoil of aboriginal
418   enumeration: mobility and service population analysis in a central Australian
419   community. Aust NZ J Public Health 2000;24(4):444 - 9.

420   24. Wong, L. C.; Amega, B.; Connors, C.; Barker, R.; Dulla, M. E.; Ninnal, A.;
421   Kolumboort, L.; Cumaiyi, M. M.; Currie, B. J. Outcome of an interventional
422   program for scabies in an Indigenous community. Med J Aust
423   2001;175(7):367 - 70.