

# Disease burden and health-care clinic attendances for young children in remote Aboriginal communities of northern Australia

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**Objective** To determine the frequency of presentations and infectious-disease burden at primary health care (PHC) services in young children in two remote Aboriginal communities in tropical northern Australia.

**Methods** Children born after 1 January 2001, who were resident at 30 September 2005 and for whom consent was obtained, were studied. Clinic records were reviewed for all presentations between 1 January 2002 and 30 September 2005. Data collected included reason for presentation (if infectious), antibiotic prescription and referral to hospital.

**Findings** There were 7273 clinic presentations for 174 children aged 0–4.75 years, 55% of whom were male. The median presentation rate per child per year was 16 (23 in the first year of life). Upper-respiratory-tract infections (32%) and skin infections (18%) were the most common infectious reasons for presentation. First presentations for scabies and skin sores peaked at the age of 2 months. By 1 year of age, 63% and 69% of children had presented with scabies and skin sores, respectively.

**Conclusion** These Aboriginal children average about two visits per month to PHC centres during their first year of life. This high rate is testament to the disease burden, the willingness of Aboriginal people to use health services and the high workload experienced by these health services. Scabies and skin sores remain significant health problems, with this study describing a previously undocumented burden of these conditions commencing within the first few months of life. Appropriate prevention and treatment strategies should encompass early infancy to reduce the high burden of infectious diseases in this population.

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Une traduction en français de ce résumé figure à la fin de l'article. Al final del artículo se facilita una traducción al español. الترجمة العربية لهذه الخلاصة في نهاية النص الكامل لهذه المقالة.

## Introduction

There is a disproportionate disease burden in remote Aboriginal communities compared with the general Australian population.<sup>1–5</sup> These discrepancies begin at birth: the perinatal mortality rate for Aboriginal infants in Darwin is three times that of the non-indigenous population.<sup>6</sup> Health problems in these communities are similar to those seen in developing-country contexts.<sup>1,7–9</sup> Indigenous children suffer from a wide variety of diseases including some rarely, if ever, seen in the non-indigenous population since improvements in economic and living conditions led to a reduction in the burden of infectious diseases.<sup>1</sup>

Primary health care (PHC) centres, including both Aboriginal-community controlled health services and government-run clinics, are present in most remote communities in Australia. Staff numbers vary but usually include a

nurse clinic manager and Aboriginal health workers. Additional clinical nursing staff members vary depending on the size of the PHC centre and are supported by either resident or visiting medical officers. Skin infections and infestations are among the most common reasons for children in these communities to present to PHC centres.<sup>10</sup> These conditions remain a significant public-health problem in developing countries and among indigenous populations in industrialized nations. In resource-poor communities worldwide, scabies prevalence in the general population is up to 10%.<sup>11</sup> In remote Aboriginal communities in Australia's Northern Territory, scabies is endemic, with up to 50% of children and 25% of adults infested at some times.<sup>12,13</sup>

Secondary infection of scabies lesions is common. Group A streptococcal pyoderma is very common in Aboriginal children in the Northern

Territory,<sup>14,15</sup> with 50–70% of cases reported to be secondary to scabies.<sup>12,13</sup> Group A streptococcal pyoderma leads to acute poststreptococcal glomerulonephritis,<sup>16,17</sup> and underlies most cases of invasive group A streptococcal infections, especially in tropical regions.<sup>18,19</sup> Links between scabies and high rates of acute rheumatic fever in remote Aboriginal communities in the Northern Territory have also been postulated.<sup>20</sup> With rates of poststreptococcal disease in these communities being among the highest in the world,<sup>21,22</sup> prevention of scabies and skin sores in this region could have far-reaching implications.

We aimed to review clinic presentations in the first few years of life within two remote Aboriginal communities of Australia to assess the level of health-care seeking behaviour in this context and to determine the burden of scabies, skin sores and other infectious diseases.

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## Methods

A retrospective review of clinic records was done in two PHC centres in the remote East Arnhem region of the Northern Territory, Australia. These were two of six communities participating in the East Arnhem Regional Healthy Skin Project, a regional collaboration to reduce the prevalence of scabies, skin sores and associated chronic diseases in the participating communities, located about 500 km east of Darwin.

The two communities included in the medical-record review each had a population of about 800 people. The clinics are the only PHC centres in the communities. For the purposes of the review, the study population comprised all children born after 1 January 2001, who were resident in the two communities as of 28 September 2005, for whom we had consent to review their health records (age range 0–4.75 years).

Ethics approval was obtained from The Human Research Ethics Committee of the Northern Territory Department of Health and Community Services and Menzies School of Health Research.

The record review was undertaken during October and November 2005. Data were collected for all presentations recorded in the child's clinic file during a period of 3 years and 9 months (1 January 2002 to 30 September 2005).

Data collected were: the date of each presentation, the child's height and weight, any infectious reason for presentation, antibiotic prescription and any referral to hospital. Recorded reasons for presentation and classifications used were the following: scabies (either noted specifically or with reference to scabies treatment given); skin sores (any mention of skin sores or other presumed bacterial infections of the skin including boils, carbuncles, abscesses, ulcers and pustules); tinea (tinea, ringworm, fungal skin infection or treatment with tinea medication); ear disease (mention of any middle-ear infection or symptoms of such an infection, including acute and chronic suppurative otitis media or otitis media with effusion); throat infection (throat or tonsils red, pink, sore, inflamed or infected or the presence of pharyngitis or laryngitis); acute poststreptococcal glomerulonephritis; acute rheumatic fever (probable or confirmed diagnosis); lower-respiratory-tract infection (presence of pneumonia, bronchitis, bronchiolitis, chest infection or crackles or

Table 1. Reasons for presentation of children at two remote community health clinics, East Arnhemland, January 2002 to September 2005<sup>a</sup>

Reasons for presentation	Number of presentations <sup>b</sup>	Number of children presenting <sup>b</sup>	Median of presentations <sup>c</sup>
Non-infectious cause	2494 (34.3)	173 (99.4)	8 (5–11)
Upper respiratory tract infections (URTI)	2313 (31.8)	172 (98.9)	7.5 (4–11)
Scabies and/or skin sores	1328 (18.3)	160 (91.9)	4 (2–6)
Scabies	569 (7.8)	131 (75.3)	3 (1–4)
Skin sores	1081 (14.9)	154 (88.5)	2 (1–5)
Ear disease	1288 (17.7)	159 (91.4)	3 (1–6)
Febrile illness	1082 (14.9)	160 (92.0)	3 (1–4)
Diarrhoea	1021 (14.0)	153 (87.9)	3 (1–6)
Lower respiratory tract infections (LRTI)	779 (10.7)	139 (79.9)	2.5 (1–5)
Throat infection	206 (2.8)	91 (52.3)	1 (1–2)
Tinea	184 (2.5)	83 (47.7)	1 (1–2)
Acute poststreptococcal glomerulonephritis	6 (0.1)	2 (0.0)	–
Acute rheumatic fever	1 (0.0)	1 (0.0)	–
<b>Total presentations</b>	<b>7273 (100)</b>	<b>174 (100)</b>	<b>23 (13.5–30)</b>

<sup>a</sup> Total presentations = 7273, total of cause = 12 484, as more than one reason may be recorded per visit. Data were analysed using Stata version 9.1.<sup>23</sup>

<sup>b</sup> Percentage presented in parentheses.

<sup>c</sup> Median number of presentations in the first year of life among those children who did present and for whom data is available for entire first year; interquartile range presented in parentheses.

a combination of symptoms suggestive of these conditions); upper-respiratory-tract infection (any mention of an upper-respiratory-tract infection, cold or flu or symptoms of an infection including cough, runny nose or blocked nose, but not including sore throat in the absence of other symptoms); diarrhoea (diarrhoea or fluid, loose or watery bowel motions recorded); and other febrile illness (temperature of > 37.5 °C or the child noted to be febrile with no temperature recorded). Multiple reasons could be recorded for each presentation.

Multiple presentations on the same day were recorded as the one presentation. Presentations with missing or incomplete dates were excluded.

Data were analysed in Stata version 9.1.<sup>23</sup> Data were examined per child or per presentation. Continuous skewed data were expressed as medians (interquartile range) and dichotomous data as percentages. Median presentations in the first and fourth years of life are reported for children for whom data was collected for that entire year of life. Dichotomous data were compared by use of two methods: relative risk with 95%

confidence intervals (CI); and generalized estimating equations.

## Results

There were 198 children in the study population. Clinic records were reviewed for 174 children (80%). In total, there were 7273 presentation records reviewed for these 174 children. The date was incomplete or missing for a further 75 presentations, which were excluded from the study. Due to the nature of the study, and the study period used, children were followed for varying lengths of time. Data were collected from birth for 126 children, and for the entire first year of life for 114 children (the remaining 12 children were aged < 1 year at the time of the record review). The study population was 55% male.

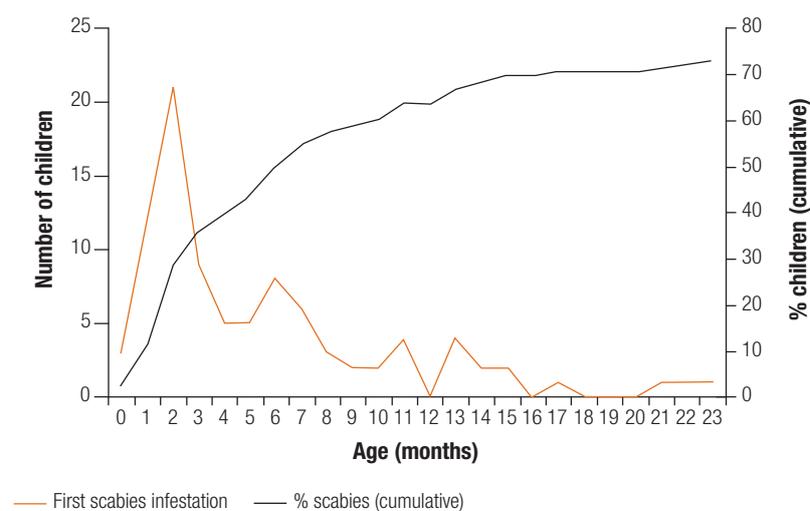
There was a median of 16 (interquartile range, IQR: 10–22) presentations per child per year over the study period. During the first year of life, the median number of presentations per child was 23 (IQR: 13.5–30). In contrast, older children presented less frequently, with those aged 3 years having

a median of 5 (IQR: 3–9) presentations per child. At least one infectious condition was reported for two-thirds (65.7%) of presentations, with a median of 2 (IQR: 1–2) infection-related problems per presentation and up to 6 at a single consultation.

Upper-respiratory-tract infection was the most common reason for presentation among those specifically monitored, noted in 32% of presentations, and seen at least once in 172 (99%) children. The number of presentations for upper-respiratory-tract infections was almost equal to that for all non-infectious reasons (34%). Skin sores, scabies or both were the next most common reason for presentation, seen at 18% of presentations. Of the 174 children, 160 (92%) had at least one presentation over the study period with skin sores or scabies. The median number of presentations in the first year of life was 3 (IQR: 1–4) for scabies and 2 (IQR: 1–5) for skin sores. Other common reasons for presentation to the PHC centre were ear disease, febrile illness, diarrhoea and lower-respiratory-tract infection (Table 1).

Scabies was recorded in a higher proportion of presentations in children aged < 1 year than in those aged 1–4 years (8.8% versus 6.8%,  $P = 0.007$ ), whereas skin sores were more common in the older age group (10.5% among those aged < 1 year compared with 19.0% among those aged 1–4 years,  $P < 0.001$ ). Children aged < 1 year

Fig. 1. Presentations for scabies in two remote communities in East Arnhemland, January 2002 to September 2005<sup>a</sup>



<sup>a</sup> Data were analysed in Stata version 9.1.<sup>23</sup>

who had scabies were 6.9 (95% CI: 5.8–8.2) times more likely to have skin sores at that presentation than those without scabies. Having scabies increased the risk of skin sores by 4.4 (95% CI: 3.9–4.9) times in children aged 1–4 years.

Of the 126 children for whom data were collected from birth, 92 (73%) and 108 (86%) presented at least once with scabies and skin sores, respectively. All of these children had presented for the first time with scabies and skin sores before they reached 2 years, with the exception of one child

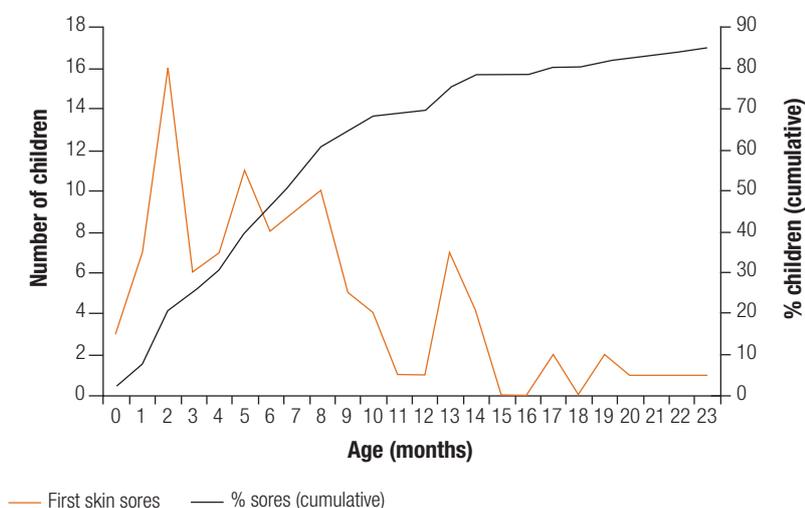
whose first presentation with skin sores was at age 31 months. By the age of 1 year, 63% and 69% of all children (and 87% and 81% of those ever seen with the conditions) had presented with scabies and skin sores, respectively. A large peak in first presentations for both scabies and skin sores occurred at the age of 2 months (Fig. 1 and Fig. 2).

## Discussion

Access to primary health care is a critical component of a healthy start to life. However, Aboriginal children born into the two communities reviewed in our study spend substantial time in clinics in the first year of life. Some of these visits would be for well-baby checks, but with 50% of infants presenting 23 times or more in the first year of life – about twice each month – the disease burden is clearly very high. The high frequency of presentation for medical care is also a testament to the willingness of Aboriginal people to use health services and the high workload experienced by these health services. Others have shown that Aboriginal health services in other parts of the country are similarly faced with high work loads and complex health-care needs, with more problems being dealt with per consultation than in Australian general practice.<sup>24,25</sup>

Our study represents only those cases presenting for medical care, we did not review the records for 20% of the target population and were therefore unable to determine the disease

Fig. 2. Presentations for skin sores in two remote communities in East Arnhemland, January 2002 to September 2005<sup>a</sup>



<sup>a</sup> Data were analysed in Stata version 9.1.<sup>23</sup>

burden among this group. Absence from the clinic does not mean absence of disease, and the true burden of disease may well be even higher. Given the extraordinarily high rates of clinic presentations among the study group, illness in childhood becomes the norm, and many more instances of ill health probably remain undiagnosed.

Although our study shows that children use the health services, access to specialist care is very limited. Aboriginal health workers make up 65% of health professionals working in the community-controlled sector, but often a lower proportion in government clinics.<sup>26</sup> Very young children are accessing medical care more, and these barriers and weaknesses will therefore have a disproportionate impact on this vulnerable group.

We describe a very high burden of disease due to respiratory-tract infections, scabies and skin sores at a very young age, clearly demonstrating that skin infections or infestations are almost universal in young Aboriginal children, and one of the most common reasons for children to present to clinics in these communities.

Respiratory-tract infections are a prominent cause of hospitalizations among young Aboriginal children,<sup>27,28</sup> and this study indicates that they also represent most of the infectious-disease burden at the PHC level. In order to ensure that hospitalization (necessitating removal of the child from their community) is minimized, there is a need for adequate treatment of children with these infections at PHC centres and early identification of patients more likely to have severe illness. Intervention to prevent respiratory-tract infections would result in a decreased workload at PHC centres. A better understanding of the causes of these infections, including the pathogens involved, is needed. Research before the introduction of the seven-valent pneumococcal vaccine in Australia showed that Aboriginal children are infected heavily with bacterial pathogens such as *Streptococcus pneumoniae* and *Haemophilus influenzae*, and that bacterial and viral coinfections are common in children with lower-respiratory-tract infections.<sup>29–31</sup> Vaccination against bacterial pathogens alone will not reduce the burden of infections of the upper and lower respiratory tracts, viral vaccines (from respiratory syncytial virus

and influenza to adenovirus and rhinovirus) are also likely to benefit these children.

Our study identified a previously undocumented burden of scabies and skin infections starting within the first few months of life. There are few longitudinal studies of scabies and many community-based studies are episodic and focus on the overall burden. While other studies also indicate that scabies is more common in young children than in older age groups,<sup>32,33</sup> we believe this to be the first study to demonstrate the very early age at which scabies is first acquired by almost all infants in this setting. In addition to the individual burden, monitoring of scabies and skin infections among young infants may well be a useful indicator of scabies prevalence within the broader community.

The reliance on clinic data and population figures and the semi-subjective nature of a diagnosis of scabies are limitations of this study. Furthermore, clinic data might not accurately reflect the true burden of disease in a community because not all cases will present to the clinic. As such, levels reported here are likely to be an underestimate. Furthermore the diagnosis of illnesses based solely on clinic notes is problematic. Diagnoses and sufficient detail are often not recorded and classifications of diseases may thus underestimate or overestimate the actual disease burden. Data are likely to be more accurate for obvious health problems with objective signs (e.g. skin sores), but less so where diagnosis is more subjective, such as with scabies and upper-respiratory-tract infections. Nevertheless the skin-sore data reported here, and possibly the scabies data, are, if anything, likely to underestimate true levels.

Appropriate treatment of scabies in these communities is problematic. Recommended treatment of scabies in children ages < 2 months of age in these communities is with 3 days of 10% crotamiton cream,<sup>34</sup> this is less efficacious than 5% permethrin cream, although failure rates with both crotamiton and permethrin might be higher in children under 1 year of age than in older children.<sup>35–38</sup>

Oral ivermectin has been successful in community-based treatment programmes for scabies in Papua New Guinea,<sup>39</sup> the Solomon Islands<sup>40</sup> and

Vanuatu,<sup>41</sup> and has been used to treat millions of adults for nematode infections.<sup>42</sup> Although there are limited data on the safety of ivermectin in children, it is being increasingly used in children aged > 5 years for both individual therapy and in community scabies programmes. Ivermectin will probably have an increasing role in younger children as safety data accumulate. Because of their close personal contact with adults and other children, young children with scabies and skin sores can potentially spread infections to large numbers of community members. To achieve a sustainable decrease in scabies prevalence in communities, adequate treatment of these children is important.

Treating individual cases of scabies is time consuming, expensive and ineffective.<sup>43–45</sup> A successful community-based scabies programme has been described in Panama,<sup>46</sup> and this has been adapted and implemented in individual remote Aboriginal communities in the Northern Territory, Australia. These community based programmes involved mass treatment with 5% permethrin cream, community clean-up days, screening and education.<sup>12,43,47</sup> A reduction in scabies from 32.3% to less than 10% was seen in children in one community and maintained for > 2 years, with incidence and severity of pyoderma also substantially decreased.<sup>12</sup> However, in some communities initial reductions were achieved, but levels returned towards preintervention levels within 1 year.<sup>43</sup> There is high mobility between houses and communities in this region, which is likely to result in the reintroduction of scabies. Treating communities in isolation is unlikely to produce a sustainable decrease. The East Arnhem Regional Healthy Skin Program is a regional collaboration to reduce scabies, skin sores and associated chronic diseases. An expansion of the previously mentioned programmes, it involves six communities in the region and began in 2004.

Recommendations from this work for improved control of scabies, pyoderma and other high-burden infections include syndromic treatment protocols, community child screening and treatment of cases and contacts where appropriate and a focus on regional coordinated approaches, such as the “healthy skin days”. In addition, it is crucial to continue efforts to address the underlying causes of these

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extremely high rates of scabies and bacterial skin infections: overcrowding, difficulties with sanitation and continuing socioeconomic disadvantage.<sup>13</sup>

The situation in these communities in remote tropical Australia is likely to be similar in other countries in the region and elsewhere where scabies remains a problem.<sup>11</sup> In conclusion, this study found that very young children are at high risk of skin infections and especially scabies. Further research into

safe and effective treatments for scabies in this age group is needed. ■

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**Competing interests:** None declared.

## Résumé

### Charge de morbidité et présentation dans les dispensaires des jeunes enfants appartenant à des communautés aborigènes éloignées du Nord de l'Australie

**Objectif** Déterminer la fréquence de présentation dans les services de soins de santé primaire et la charge de morbidité des jeunes enfants de deux communautés aborigènes éloignées du Nord de l'Australie.

**Méthodes** Ont participé à l'étude les enfants nés après le 1<sup>er</sup> janvier 2001, résidant à cet endroit le 30 septembre 2005 et pour lesquels un consentement avait été obtenu. On a relevé dans les registres des dispensaires toutes les présentations d'enfants entre le 1<sup>er</sup> janvier 2002 et le 30 septembre 2005. Parmi les informations recueillies figuraient les motifs de la présentation (en cas de pathologie infectieuse), ainsi que la prescription d'antibiotiques et l'orientation vers un hôpital éventuelles.

**Résultats** On a recensé 7273 présentations dans un dispensaire, de 174 enfants de 0 à 4,75 ans, dont 55 % de garçons. La médiane du taux de présentation par enfant et par an était de 16 (23 au cours de la première année de vie). Les infections des voies respiratoires supérieures (32 %) et les lésions cutanées

(18 %) étaient les causes infectieuses les plus courantes de présentation. Les premières présentations pour une gale ou une lésion cutanée atteignaient un pic pour l'âge de 2 mois. Après 1 an, 63 et 69 % respectivement des enfants avaient été présentés pour une gale ou une lésion cutanée.

**Conclusion** En moyenne, ces enfants aborigènes étaient présentés deux fois par mois dans un centre de santé primaire pendant leur première année de vie. Ce taux élevé de fréquentation témoigne de la forte morbidité, de la volonté des populations aborigènes de recourir à ces services et de l'importante charge de travail qui pèse sur ces derniers. La gale et les lésions cutanées restent des problèmes de santé importants, représentant une charge de morbidité notable dès les premiers mois de la vie, comme l'atteste, pour la première fois, la présente étude. Les stratégies de prévention et de traitement appropriées doivent englober la petite enfance pour réduire la forte charge de morbidité due aux maladies infectieuses dans cette population.

## Resumen

### Carga de morbilidad y visitas a consultorios entre los niños pequeños en comunidades aborígenes remotas del norte de Australia

**Objetivo** Determinar la frecuencia de visitas y la carga de morbilidad infecciosa en los servicios de atención primaria (AP) entre los niños pequeños en dos comunidades aborígenes remotas de zonas tropicales del norte de Australia.

**Métodos** Se estudió a una población de niños que habían nacido después del 1 de enero de 2001 y residían en la zona al 30 de septiembre de 2005, tras obtener el consentimiento informado oportuno. Se examinaron los datos clínicos correspondientes a todas las visitas realizadas entre el 1 de enero de 2002 y el 30 de septiembre de 2005. Entre los datos recopilados figuraban el motivo de la visita (si era un proceso infeccioso), la prescripción de antibióticos y la posible derivación a un hospital.

**Resultados** Se consideraron en total 7273 visitas a consultorios de 174 niños de 0 a 4,75 años, el 55% de los cuales eran varones. La tasa mediana de visitas por niño y año fue de 16 (23 en el primer año de vida). Las infecciones de las vías respiratorias superiores (32%) y las infecciones cutáneas (18%) fueron las

causas infecciosas más frecuentes de visita al consultorio. Las primeras visitas por sarna o heridas cutáneas presentaban un pico a la edad de dos meses. Al año de edad, el 63% y el 69% de los niños habían acudido con sarna y heridas cutáneas, respectivamente.

**Conclusión** Los niños aborígenes estudiados hicieron como promedio unas dos visitas al mes a los centros de atención primaria durante su primer año de vida. Esa elevada tasa refleja la carga de morbilidad existente, la voluntad de la población aborigen de usar los servicios de salud y el gran volumen de trabajo a que deben hacer frente esos servicios. La sarna y las heridas cutáneas siguen siendo problemas sanitarios importantes en esa población, y el estudio pone de relieve por primera vez que esas afecciones suponen una carga ya en los primeros meses de vida, de modo que, para conseguir reducir la alta morbilidad infecciosa en esa población, las estrategias de prevención y tratamiento deben abarcar el periodo neonatal.

## ملخص

## عبء المرض ومراجعة عيادات الرعاية الصحية لدى صغار الأطفال في المجتمعات النائية للسكان الأصليين في شمال أستراليا

استدعت مراجعة العيادات. ووصلت أولى المراجعات بسبب الجرب، والتهابات الجلد إلى ذروتها في عمر شهرين. وعند بلوغ العام الأول، بلغت نسبة الأطفال الذين راجعوا مرافق الرعاية الصحية الأولية بسبب الجرب نحو 63% وبسبب التهابات الجلد نحو 69% على التوالي. **الاستنتاج:** بلغت زيارات هؤلاء الأطفال الأصليين لمراكز الرعاية الصحية الأولية نحو زيارتين في المتوسط خلال السنة الأولى من العمر. إن هذا المعدل المرتفع لهو حيز شاهد على عبء المرض، ورغبة السكان الأصليين في الانتفاع من الخدمات الصحية، وجسامة عبء العمل الملقى على عاتق هذه الخدمات الصحية. فالجرب، والتهاب الجلد لا يزالان يمثلان مشاكل صحية ملموسة، وتوضح هذه الدراسة عبء هذه الحالات التي تبدأ في الأشهر الأولى من العمر، والتي لم يسبق توثيقها. ومن ثم ينبغي أن تشمل استراتيجيات المعالجة، والوقاية المناسبة فترة الطفولة المبكرة بغيّة تقليص العبء المرتفع للأمراض المعدية بين السكان.

**الهدف:** التعرّف على تكرار مراجعة مرافق الرعاية الصحية الأولية، وعبء الأمراض المعدية بين صغار الأطفال في مجتمعين نائيين للسكان الأصليين في المنطقة الإدارية في شمال أستراليا. **الطريقة:** أدرج في الدراسة الأطفال الذين ولدوا بعد الأول من كانون الثاني/يناير 2001، من الذين كانوا يقطنون في مواقع الدراسة في 30 أيلول/سبتمبر 2005، وتم الحصول على موافقتهم على الدراسة. وروجعت سجلات العيادات لجمع من راجعوا بين الأول من كانون الثاني/يناير و30 أيلول/سبتمبر 2005. وتضمّنت المعطيات المجمعة سبب المراجعة (إذا كانت أمراضاً معدية)، والمضادات الحيوية الموصوفة، وحالات الإحالة إلى المستشفيات. **الموجودات:** بلغ عدد مراجعات العيادات نحو 7273 مراجعة لنحو 174 طفلاً ممّن تتراوح أعمارهم بين 0 و4.75 عاماً، ويمثّل الذكور نحو 55% منهم. وبلغ متوسط معدل المراجعة لكل طفل سنوياً نحو 16 مرة (منها 23 مرة في السنة الأولى من العمر). وكانت عداوى الجهاز التنفسي العلوي (32%) والعداوى الجلدية (18%) من أكثر أسباب العدوى شيوعاً والتي

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