The social determinants of otitis media in Aboriginal children in Australia: are we addressing the primary causes? A systematic content review

CURRENT STATUS: UNDER REVIEW

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DOI: 10.21203/rs.2.13978/v1

SUBJECT AREAS
Health Policy

KEYWORDS
otitis media, ear disease, hearing, social determinants of health, Aboriginal and Torres Strait Islander, Aboriginal, Indigenous, children, Australia
Abstract

Background Aboriginal and Torres Strait Islander children experience some of the highest rates of otitis media in the world. Key risk factors for otitis media in Aboriginal children in Australia are largely social and environmental factors such as overcrowded housing, poverty and limited access to services. Despite this, little is known about how to address these risk factors. A scoping content review was performed to determine the relationship between social determinants of health and otitis media in Aboriginal and Torres Strait Islander children as described by peer-reviewed and grey literature.

Method Search terms were established for location, population and health condition. The search terms were used to conduct a literature search using six health research databases. Following the exclusion process, articles were scoped, analysed and categorised using scoping parameters and a social determinants of health framework.

Results Housing-related issues were the most frequently reported determinants for otitis media (56%). Two articles (4%) directly investigated the impact of social determinants of health on rates of otitis media within Aboriginal and Torres Strait Islander children. The majority of the literature (68%) highlight social determinants as playing a key role in the high rates of otitis media seen in Aboriginal populations. There were no intervention studies targeting social determinants as a means to reduce otitis media rates among Aboriginal and Torres Strait Islander children.

Conclusions This review identifies a disconnect between otitis media drivers and the focus of public health interventions within Aboriginal and Torres Strait Islander populations. Despite consensus that social determinants play a key role in the high rates of otitis media in Aboriginal and Torres Strait Islander children, the majority of literature consists of intervention studies aimed at developing vaccines and antibiotics. This review highlights the need for otitis media intervention studies to shift away from a purely
biomedical model and toward investigating the underlying social determinants of health. By shifting interventions upstream, otitis media rates may decrease within Aboriginal and Torres Strait Islander children, as focus is shifted away from a treatment-focussed model and toward a more preventative model.

Introduction

Otitis media (OM) is one of the leading causes of disease among Aboriginal and Torres Strait Islander children in Australia. OM refers to inflammation and infection of the middle ear and is classified as acute OM, OM with effusion or chronic suppurative OM. There are currently inadequate services to deal with ear and hearing health within Aboriginal communities in Australia and high demand for services is expected to continue in coming years. The World Health Organisation have identified OM in its various forms as a major health issue for Aboriginal and Torres Strait Islander children, despite the fact that OM is preventable and treatable, and is far less common for non-Aboriginal children in Australia. The gap in prevalence of OM between Aboriginal and non-Aboriginal children in Australia has consistently been associated with social determinants, particularly housing-related issues. OM can impact upon educational outcomes and employability for Aboriginal and Torres Strait Islander people who are more likely to be socially and economically disadvantaged than non-Aboriginal Australians.

Key risk factors for OM in Aboriginal children in Australia include overcrowded housing, poor housing conditions, exposure to tobacco smoke, malnutrition, socioeconomic disadvantage and limited access to services. Aboriginal children in Australia experience OM at similar rates, frequency and severity as children living in developing nations, despite the overall high standard of living in Australia. The prevalence of OM in some Aboriginal communities in Australia is close to 10 times higher than the 4% identified by The World Health Organisation as being a serious public health problem requiring urgent attention. This puts Aboriginal children in Australia as one of the most at risk populations for otitis media in the world.

Significant health gaps have persisted in Aboriginal populations in Australia since the British invaded Australia in 1788. These health gaps are highlighted by the gap in life-expectancy between Aboriginal and non-Aboriginal Australians, with Aboriginal children
born between 2010-2012 expected to live 10.05 years younger than non-Aboriginal children.\textsuperscript{12} Furthermore, social and economic disadvantage have been underscored as significant contributing factors to these poor health outcomes.\textsuperscript{7} Therefore, social determinants of otitis media in Aboriginal children in Australia need to be better understood in light of evidence supporting the impact of poor housing, exposure to tobacco smoke and socioeconomic disadvantage on the prevalence and persistence of OM in Aboriginal children in Australia.

This review aims to identify how social determinants are addressed in grey and peer-reviewed literature, regarding both drivers of OM and proposed interventions aimed at minimising the health burden of OM among Aboriginal and Torres Strait Islander children. This review aims to identify gaps in the literature and guide further research, policy development and service provision.

\textbf{Methods}

Given the broad nature of the research objective, a scoping content review was conducted to explore available research, to evaluate the need for further investigation, to describe key themes and to identify gaps in the literature. The framework proposed by Arksey and O’Malley\textsuperscript{13} for conducting a scoping content review was adapted for this study and is detailed below.

\textbf{Research Question and Search Strategy}

This study was carried out between December 2016 and September 2017 at Western Sydney University campuses in Campbelltown, Parramatta and Kingswood, located in the Greater Western Sydney district of Sydney, Australia. Following the establishment of the research objective in December 2016, the search strategy was developed between February and March 2017 by implementing inclusion and exclusion criteria, and keywords (see Table 1). The location was limited to Australia. Included literature was limited to English only and no time constraints were placed on the date of publication. The population of focus was established by two criteria: individuals of Australian Aboriginal identity and children aged 12 years old or younger. Health condition terms related to OM and middle ear disease, and study type included peer-reviewed and grey literature.

The establishment of keywords, search parameters, databases to be used, as well as conducting the literature search, and reporting, collating and analysing the results occurred between March 31 and April 31, 2017. Keywords were established and agreed
upon by the research team with the assistance of university library staff for the parameters: location, population and health condition. The selected databases were chosen upon consensus and the search was conducted independently by each research team member and the assisting librarian to limit bias. Boolean operators were applied in the literature search within PubMed, ProQuest, Scopus, Informit, Medline and Google Scholar. For the Google Scholar literature search, multiple searches were conducted due to search box restrictions (see Table 1). Location keywords were substituted by selecting results from Australia only and each of the OM-related terms were searched for separately. The population keywords were searched with Boolean operators consistent with other database searches and is detailed in the Table 1.

Table 1. Search Strategy and Keywords

| Parameters    | Inclusion                                      | Exclusion                             | Keywords                                                                 |
|---------------|------------------------------------------------|---------------------------------------|--------------------------------------------------------------------------|
| Location      | Australia                                     | Outside Australia                     | (Abstract) Australia OR “New South Wales” OR NSW OR Queensland OR QLD OF Victoria OR VIC OR Tasr OR TAS OR Adelaide OR “Northern Territory” OR OR “Western Australia” OR “Western Australia” WA |
| Language      | English                                       | Not written in English                | Select for English only                                                  |
| Time          | Any                                           | None                                  | N/A                                                                      |
| Population    | Aboriginal and Torres Strait Islander Children/Aboriginal Children 0-12 years old in Australia. | Non-Aboriginal Australians of any age or Aboriginal individuals older than 12 years old. | (Title) Aborigin* OR “Torres St Islander” OR “Indigenous Australian” OR “Native Australian” AND Child* OR Infant* OR Infancy OR Kid* OR Neonate* OR Toddler* OR Baby OR Pediatric OR Paedia* |
The first step in selecting the literature was to exclude any duplicate papers. This was done using EndNote (electronic referencing software). Google Scholar results were limited to the first two pages, given the large number of results yielded and the strict time constraints for conducting the literature search. An Excel spreadsheet was created to categorise the literature based on the following parameters: author, title, year, within Australia, ‘Aboriginal-related term’, ‘OM-related term’ and full text available. The literature was then systematically evaluated based on these criteria and included or excluded accordingly. Where there was any uncertainty regarding the suitability of an article, consensus on whether to include the article(s) was reached by the research team.

Collating, Analysing and Reporting Results

Following selection of the included literature, two separate Excel spreadsheets were created to analyse and report the results. One spreadsheet contained the peer-reviewed literature and the other contained the grey literature. The articles were systematically

| Phenomena/Target | Otitis media and ear disease-related pathology | Not concerned with Otitis media or ear-disease-related pathology | (Title) “Otitis media” OR “Middle ear” OR “glue ear” OR ‘infection” OR Ear OR Hearing OR “bulging eardrum” |
|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| Study/Literature type | Published primary research and grey literature (including qualitative, quantitative and mixed method design) included in databases indicated*. | Published literature not included in the databases indicated. | N/A |

Google Scholar Modified Search

1. **Australia AND Aborigin* OR “Torres Strait Islander” OR “Indigenous Australian” OR “Native Australian” AND Child* OR Inf OR Infancy OR Kid* OR Neonate* OR Toddler* OR Baby OR Babies OR Pediatric OR Paediatric AND “bulging eardrum”

2. **Australia AND Aborigin* OR “Torres Strait Islander” OR “Indigenous Australian” OR “Native Australian” AND Child* OR Inf OR Infancy OR Kid* OR Neonate* OR Toddler* OR Baby OR Babies OR Pediatric OR Paediatric AND “Otitis media”

3. **Australia AND Aborigin* OR “Torres Strait Islander” OR “Indigenous Australian” OR “Native Australian” AND Child* OR Inf OR Infancy OR Kid* OR Neonate* OR Toddler* OR Baby OR Babies OR Pediatric OR Paediatric AND “Middle ear”

4. **Australia AND Aborigin* OR “Torres Strait Islander” OR “Indigenous Australian” OR “Native Australian” AND Child* OR Inf OR Infancy OR Kid* OR Neonate* OR Toddler* OR Baby OR Babies OR Pediatric OR Paediatric AND “ear infection”

5. **Australia AND Aborigin* OR “Torres Strait Islander” OR “Indigenous Australian” OR “Native Australian” AND Child* OR Inf OR Infancy OR Kid* OR Neonate* OR Toddler* OR Baby OR Babies OR Pediatric OR Paediatric AND “glue ear”

*Databases: PubMed, ProQuest, Scopus, Informit, Medline and Google Scholar.
analysed based on the following parameters: ‘are social determinants mentioned?’, ‘what section are social determinants mentioned?’, ‘what social determinants are mentioned?’, ‘are social determinants mentioned as drivers of OM?’, ‘are social determinants discussed in regards to interventions for OM?’, ‘what is discussed in regards to future directions?’, ‘are interventions related to social determinants or mentioned but not fundamental to the discussion or conclusion?’, and ‘are social determinants related to one of three key areas of the Aboriginal and Torres Strait Islander social determinants of health framework?’-adapted from Department of Health and Ageing (HealthInfoNet)\textsuperscript{14}, as shown in Figure 2.

Results

The literature search was conducted using six specified databases and the exclusion process is detailed in Figure 1. The search yielded 186 results, 69 duplicates were excluded and a further 19 articles were excluded based on location of the studies. 98 articles were screened by title and article type, with 47 excluded based on irrelevance of the title and one article was excluded due to the article type (unpublished thesis). Following the screening process, 50 articles were included in the study. Of the 50 included articles, 40 were peer-reviewed and 10 were grey literature articles.

Figure 1. Search Strategy and Results

Drivers and Intervention

Following the exclusion process, the content of the included literature was evaluated by how OM related social determinants were addressed. 34 (68%) peer-reviewed and grey articles were identified as discussing social determinants, with 17 (34%) discussing social determinants as a significant factor for driving the high rates of OM and 17 (34%) articles identifying the need to address social determinants to reduce the high rates of OM in Aboriginal children. Of the 17 articles that discuss social determinants as important for OM management, 11 articles failed to discuss this in detail - these articles did not provide specific recommendation or evidence for further research and policy development. For example, Sparrow et al\textsuperscript{15}(p14) state “the key to improving chronic middle ear disease must be by addressing living standards and general health”. Although this type of statement is true and does acknowledge an important issue, the article does not pursue this theme further.

Further evaluation of the scoping criteria related to the social determinants of health revealed that 16 (32%) articles failed to mention social determinants at all and only four
articles (8%) were identified as providing in-depth analysis of social determinants and as key risk factors. These four articles presented social determinants as key for future intervention and provided supported recommendations to help address social determinants linked to OM. For example, Jacoby et al\textsuperscript{16}(p602) state “there is a need for more input by Indigenous Australians in developing programs, increased funding and improved access to nicotine replacement therapy”. Lastly, the most significant finding was that despite a large majority (68%) of the literature discussing social determinants as having some degree of impact on the presence of OM in Aboriginal children, there were no studies within the literature that proposed or investigated a social determinants-focussed intervention.

Aboriginal and Torres Strait Islander Social Determinants of Health Framework

In addition to the social determinants-related scoping criteria, the literature was comprehensively assessed using the social determinants of health framework for Australian Indigenous populations.\textsuperscript{14} The social determinants of health framework identifies three key areas of health for Indigenous populations, with the literature addressing housing, employment, education and income most frequently (32%) in relation to high rates of OM in Aboriginal children. Community involvement, social networks and family support were discussed by few articles (16%) and even fewer mentioned culture, history and connection to land (8%). Moreover, over 50% of the peer-reviewed articles (n=22) failed to address any of the three key areas of the social determinants of health framework.

Figure 2. Social Determinants Framework for Aboriginal and Torres Strait Islander Health

Social Determinants

Housing-related social determinants were reported most frequently within the literature, with 28 (56%) reports of housing related risk factors for OM (18 specifically related to overcrowded housing). The next most frequently discussed social determinant was exposure to tobacco smoke, with 11 articles (22%) discussing this as a significant determinant for OM. Low socioeconomic status, low income and poverty (20%), access to services (18%), hygiene (16%), and education of the primary caregiver (14%) were among the most frequently mentioned determinants. Other reported determinants for OM were employment status and employment opportunities (12%), nutrition (12%), community involvement in service provision and planning (6%), and cultural and language differences (n=4). Sun et al\textsuperscript{17}(p8) explain that improved housing for Aboriginal populations is
desperately needed, as “overcrowding is the single most important and most consistent risk factor for upper respiratory tract carriage (presence of bacteria), and consequently, the development of OM in Indigenous children”. It is therefore important to note, that of the 40 peer-reviewed articles, only Jacoby et al\(^{18}\) examined overcrowded housing and its impact on OM associated bacterial carriage. Jacoby et al\(^{18}\) provide thorough analysis on aspects of overcrowding, such as the number of adults, children and rooms within a household and its impact on otitis media occurrence. More specifically, the greater the number of people, the greater the number of children and the fewer rooms within a house, the greater the risk of developing OM.\(^{18}\) Unfortunately, this article did not identify any means to address these issues and only highlights the seriousness of the housing problems faced by many Aboriginal communities within Australia.

**Future Directions**

A detailed analysis was performed on what recommendations were made in the literature for the public health management of OM Aboriginal and Torres Strait Islander children. 31 (62\%) of the peer-reviewed and grey articles failed to discuss social determinants in future directions at all. 23 articles (46\%) primarily recommended further research into antibiotic treatment and vaccine development, and the need for greater understanding of otitis media associated bacterial carriage to better understand the effectiveness of antibiotics and vaccines. Only five (10\%) articles presented detailed recommendations for future research and policy development intended to address social determinants to reduce the high rates of OM in Aboriginal children.

**Discussion**

Otitis media is one of the leading causes of preventable disease amongst Aboriginal and Torres Strait Islander children, and has been determined by The World Health Organisation to be a serious public health issue requiring urgent attention.\(^{1-3,11}\) OM occurs primarily during developmental years and can drastically impact upon speech and language development, which is likely to influence educational outcomes and prospective employability- precursors to potentially life-long socioeconomic disadvantage and poverty.\(^5\)

This study identifies how social determinants are addressed within grey and peer-reviewed literature, and summarises the primary determinants of OM and management recommendations within the literature. This study highlights gaps between drivers of OM
and recommended interventions within the literature. Given the significance of the gap in the literature, further research aimed at identifying more effective management of the social determinants of OM within Aboriginal children is warranted. Furthermore, the inter-related nature of the social determinants of health is emphasised throughout this paper and helps to underline the challenge that an exclusively biomedical model poses in addressing specific aetiology.\textsuperscript{19(p73-74)}

Notably, a shift in ways to manage OM in Aboriginal populations is desperately needed. This review demonstrates that there is an unbalanced research focus towards medical interventions in contrast to developing an understanding of how to address key social determinants driving high rates of OM in Aboriginal children in Australia. Using the social determinants of health framework, this review has identified significant shortcomings in the literature and the current public health management of OM in Aboriginal children in Australia. The social determinants of health framework used within this study identifies three key areas of Aboriginal health that are largely neglected by the available grey and peer-reviewed literature in relation to OM management. Although the literature mentions various social determinants that are consistent with the framework (e.g. housing, education, employment, community engagement, culture and history), none of the included articles evaluated these key areas of Aboriginal health with the objective to establish effective sociodemographic or environmental-focussed interventions for OM. Further, the key social determinants of OM can be argued to stem from the persistent social, economic and cultural discrimination experienced by Aboriginal populations in Australia. Using the social determinants of health framework, this review highlights the need to preserve Aboriginal culture, strengthen Aboriginal self-determination, respect and support Aboriginal connection to land, empower Aboriginal communities, improve education and employment opportunities for Aboriginal people, and address poor housing conditions and overcrowding within Aboriginal communities. Such an approach is needed to help eliminate the cycle of disadvantage that contributes to the social determinants driving ill-health and OM in Aboriginal children in Australia.

Housing-related determinants were reported almost three times more than the next most frequently reported risk factor. Despite acknowledgement of the association between housing and the prevalence of OM in Aboriginal children, there were no intervention studies within the literature that investigated how to effectively address the issue of housing in Aboriginal populations. Despite the fact exposure to cigarette smoke and poor hygiene were not acknowledged as being directly related to housing within this review,
these risk factors are likely to be influenced to some degree by the home environment, given the high rates of smoking within the home.\textsuperscript{15,16} It is evident that addressing the home environment is fundamental to adequately manage OM in Aboriginal populations. Moreover, further research into housing as a determinant of OM and as a means for intervention is desperately needed, given the lack of information available to adequately deal with this facet of Aboriginal health.

Addressing housing issues in Aboriginal communities is a complex issue, particularly when considering the importance of connection to land in contrast with the importance of the physical structure itself. It can be said that the efforts of government housing programmes have been heavily focussed on the logistics. For example, funding and physical infrastructure, with little acknowledgement of the need to develop culturally appropriate housing policies and pathways.\textsuperscript{20(p207)} Carson et al\textsuperscript{20(p219)} stress the lack of intervention studies that link housing to Aboriginal health outcomes and the ability to develop policy is limited as a result. The lack of intervention studies is also highlighted by this review, as no intervention studies looking at social determinants and Aboriginal health outcomes were identified within the literature. Intervention studies are crucial for policy development and although remoteness, and political and social barriers exist for improving housing and infrastructure in Aboriginal communities,\textsuperscript{20} a shift in focus towards more culturally appropriate housing policy and provision is urgently needed.

Exposure to tobacco smoke is a major contributing factor for Aboriginal children developing OM. Aboriginal children who are exposed to tobacco smoke in the home and who do not attend day-care are at the greatest risk of developing otitis media.\textsuperscript{18} This is not to say that home-care by parents and family is problematic, however given the high rates of smoking within the home environment,\textsuperscript{18} it is a particularly important issue for consideration for Aboriginal populations. Jacoby et al\textsuperscript{18} indicate that children who are exposed to tobacco smoke in the home who also attend day-care are at a lower risk of developing OM, presumably because the time spent at day-care means less time exposed to tobacco smoke in the home. Therefore, day-care attendance may be a protective factor for Aboriginal children developing OM, specifically for those children who are exposed to tobacco smoke in the home. It is important to note, that day-care attendance has previously been associated with a greater risk of OM, and further research may help to explain this relationship. Given the influence exposure to tobacco smoke has on the risk of developing OM, creating greater awareness and developing policy aimed at cigarette
prevention initiatives may help to reduce the prevalence of OM within Aboriginal populations.

Education and employment of the primary caregiver is an important determinant for Aboriginal children developing OM. However, no paper within the reviewed literature discussed this any further than listing it as a significant contributing factor. It is important to highlight that low-level education and lack of employment opportunities consign many Aboriginal and Torres Strait Islander people to levels of poverty.\textsuperscript{21(p108)} Furthermore, education that excludes culture and native language has been demonstrated to adversely impact individuals by disempowering Aboriginal communities and harming the cultural identity of these communities.\textsuperscript{20} Therefore, greater effort to provide culturally relevant schooling is more likely to lead to both improved educational and health outcomes in comparison to efforts aimed at improving attendance rates for Aboriginal students in a westernised schooling system.\textsuperscript{20} This highlights the need for a shift in research and policy development that focusses on engaging Aboriginal communities in the delivery of culturally appropriate schooling.

Aboriginal community involvement is an area that requires greater emphasis and encouragement from public health promoters, policy makers and service providers. Programmes such as the ‘Healthy Ears, Happy Kids’,\textsuperscript{9} ‘Aboriginal Otitis Media Project’,\textsuperscript{22} and ‘Hearing and Ear Health and Language Services’ (HEALS)\textsuperscript{23} help to draw attention from government and non-government organisations towards the seriousness of the burden OM in Aboriginal communities in Australia. Furthermore, these programmes have been shown to help educate and empower Aboriginal communities and health workers to manage OM more effective and culturally safe way.\textsuperscript{9,22-23} Given the historical marginalisation, neglect and subjugation of Aboriginal populations in Australia, empowering Aboriginal communities to manage health services, develop and implement research, and provide recommendations is essential to overcome issues of mistrust, and consequently, improve cultural access to essential services.

Evaluation of recommendations and advice for OM management within the literature shows that there is a significant focus on analysing OM associated bacterial carriage in Aboriginal children, and this focus is being driven by the desire to develop more effective antibiotics and vaccines. It is important to note that this type of approach has been the focus of the majority of research for a number of years with no significant improvement
seen in the rates of OM in Aboriginal children, as identified by this review. Therefore, a lack of adequate recommendation regarding the management of OM in Aboriginal children within the literature is evident. This is highlighted by the failure to identify how to effectively manage the principal drivers of OM, which include poverty, overcrowded housing, poor housing conditions and exposure to tobacco smoke.

While this review presented a comprehensive analysis of both peer-reviewed and grey literature, this study excluded unpublished masters and doctoral theses. Despite this, findings by Vickers and Smith\textsuperscript{24} following review of the Cochrane Library, found only one of 878 systematic reviews included data from theses that could have significantly altered the conclusions of the 878 reviews. Moreover, there is limited benefit of including theses in systematic reviews, as they rarely influence the conclusions, and retrieving and analysing unpublished dissertations involves considerable time and effort.\textsuperscript{24} The timeframe of this project also limited the number of selected databases and consequently the number of papers that were included within the study. However, 50 articles still provide comprehensive scope of the literature to enable thorough analysis, detailed explanation and well supported recommendations. Using Google Scholar presented limitations in search function, as search box options within the database meant that a modified search was needed to fulfil the specified search strategy and to remain consistent with searches performed on the other selected databases.

Conclusions

There is overwhelming consensus within the reviewed literature that Aboriginal and Torres Strait Islander children experience disproportionately high rates of otitis media when compared to non-Aboriginal children. The high rates of otitis media are linked to poor housing conditions, overcrowded housing, exposure to tobacco smoke, education level, and overall social and economic disadvantage. Furthermore, there is disparity between the drivers of OM and current interventions aimed at reducing the burden of OM in Aboriginal populations in Australia. Current interventions are primarily focused on interventions such as developing vaccines and antibiotics. Although development of vaccines and antibiotics are essential to the provision of high-quality clinical care for OM, a broader public health lens is required to address the underlying social factors driving the gap in OM rates between Aboriginal and non-Aboriginal children in Australia. It is important to mention that the Aboriginal understanding of health includes “body, mind, spirit, land, environment, custom, socioeconomic status, family and
community”. This understanding of health significantly differs from mainstream models of health, which typically involve the pursuit to merely limit ill-health. Therefore, policy and services founded upon this restricted understanding of health is likely to be restrictive in its ability to address the much more holistic Aboriginal understanding of health, which includes how people live, work and interact with their everyday environments, and the importance of community for the individual. The drivers of OM in Aboriginal children are primarily sociodemographic, yet the literature overwhelmingly stems from a medical framework. Further research into how social determinants contribute to OM and what interventions may be beneficial to address OM associated social determinants in Aboriginal children in Australia is recommended. Most importantly, intervention studies aimed at delivering culturally suitable housing in Aboriginal communities will help public health policy development and consequently, health outcomes and OM rates amongst Aboriginal and Torres Strait Islander children. Furthermore, the social determinants of health framework used in this review should be considered for further research, when implementing primary care guidelines and for the development of public health policy for Aboriginal and Torres Strait Islander populations.

Abbreviations

OM: Otitis Media

Declarations

Ethics approval and consent to participate: Not applicable.
Consent for publication: Not applicable.
Availability of data and materials: Data are available through the corresponding author.
Competing interests: The authors declare that they have no competing interests.
Funding: Not applicable.
Authors' contributions: All authors have read and approved the final manuscript.
JD: protocol development, literature search, data collection, data collation, data analysis, interpretation of results and was the major contributor to writing the manuscript.
TD: protocol development, literature search, interpretation of results, reporting of results and contributed to writing the manuscript.
JM: literature search, interpretations of results, reporting of results and contributed to writing the manuscript.
Acknowledgements: Not applicable.

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Figures
Figure 1

Search Strategy and Results
Figure 2

Social Determinants Framework for Aboriginal and Torres Strait Islander Health

Supplementary Files

This is a list of supplementary files associated with the primary manuscript. Click to download.
DeLacy et al Results Data SDH OM Indig Child Aus.xlsx