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Short Communication

Hearing loss among Australian Aboriginal infants and toddlers: A systematic review

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ABSTRACT

Aim: Australian Aboriginal and Torres Strait Islander children have among the highest rates of otitis media (OM) and associated conductive hearing loss in the world. OM begins early in life and is well-documented in the research literature. In contrast, audiology data for the infant and toddler age-groups are limited. This review aimed to summarise the recent literature on hearing loss among Aboriginal and Torres Strait Islander infants and toddlers.

Methods: Systematic literature review. PubMed and ScienceDirect databases were searched for relevant journal articles. Key search terms were "Aboriginal", "children", "hearing loss", "otitis media", and their relevant synonyms. Journal articles published before 2000 were excluded.

Results: Only two journal articles met review inclusion criteria. Ear disease and associated conductive hearing loss was significantly higher among Aboriginal and Torres Strait Islander than non-Aboriginal and Torres Strait Islander children. No intervention studies were found.

Conclusions: More research is needed to evaluate hearing health outcomes of medical (including surgical) and audiological interventions in this high-risk population.

1. Introduction

Australian Aboriginal and Torres Strait Islander children have among the highest reported rates of otitis media (OM) and associated conductive hearing loss in the world [1,2]. It is well-established that OM begins early in life in this population, and that it will persist into childhood, adolescence and adulthood [3,4]. The adverse effects of OM and subsequent childhood hearing loss are well-known, and include delayed speech/-language development, poor school attendance, lower academic achievement, reduced social and economic well-being, and increased risk of youth offending [5]. Given the extent of OM in the Aboriginal and Torres Strait Islander population, significant efforts continue to be made to address this on-going public health emergency, including implementing evidence-based recommendations [6].

There is very little in the audiology literature on hearing loss among Aboriginal and Torres Strait Islander infants and toddlers. The research for this age group has understandably prioritized the investigation of OM characteristics, improved diagnosis and assessment of middle ear disorders, and the impact of various prevention and treatment strategies aimed at reducing OM severity and prevalence. Reducing the prevalence of ear disease should in turn reduce the prevalence of associated conductive hearing loss. The majority of available audiology data is drawn from Government reports and studies of school-age children, including audiological outcomes of clinical trials to prevent and treat OM and associated conductive hearing loss. Reliable information on hearing levels among infants and toddlers is lacking. The Australian Institute of Health and Welfare 2018 report on the Northern Territory Outreach Hearing Health Program shows 66% service recipients were 6–20 years of age, 25% were 3–5 years, and only 8% less than 3 years of age. Around 30% of those less than 3 years of age had hearing loss, and 52% of 3–5 years of age.

The aim of the present paper is to perform a systematic review of the peer-reviewed literature on hearing loss among Aboriginal and Torres Strait Islander infants and toddlers. Given that the public health threat of OM and associated conductive hearing loss is unlikely to be resolved in the near future, this information should inform current initiatives aimed at improved early childhood development.

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2. Methods

A systematic literature review was conducted using the PubMed and ScienceDirect databases. The main search strategy used the terms and keywords "Aboriginal", "infants", "toddlers", "hearing loss", "otitis media" and their relevant synonyms (i.e., "Indigenous", "hearing impairment"): "hearing loss"[MeSH Terms] OR ("hearing"[All Fields] AND "loss"[All Fields]) OR "hearing loss"[All Fields]; "otitis media"[MeSH Terms] OR ("otitis"[All Fields] AND "media"[All Fields]) OR "otitis media"[All Fields]; "infant"[MeSH Terms] OR "infant"[All Fields] OR "infants"[All Fields]; aboriginal[All Fields] OR (first[All Fields] AND ("Nation"[Journal] OR "nation"[All Fields]) OR Indigenous[All Fields].

Following this search strategy, titles and abstracts were read and reviewed, and, when appropriate, included for further study. The selected articles were read completely, and their references were hand-searched.

2.1. Inclusion/exclusion criteria

The following inclusion criteria were used to assess article suitability for this review: (1) the study population was Australian Aboriginal and Torres Strait Islander, (2) the study population was the 0–3 year age group, and (3) the study reported hearing/audiology outcomes.

Journal articles published before 2000 were excluded. The implementation of Universal Newborn Hearing Screening in high-income nations has enabled the identification of permanent congenital or early-onset hearing impairment in newborns and infants, thus providing the opportunity for greater accuracy in the diagnosis of hearing sensitivity in this age group.

Data were extracted as proportions.

3. Results

The systematic review found only two journal articles for inclusion in the present study (Table 1).

3.1. Journal article 1

The Audiology Department of Townsville Hospital in northern Queensland performed a retrospective chart review of infants referred through the Universal Newborn Hearing Screening Program between August 2004 and March 2009 [7].

A total of 211 infants (Aboriginal and Torres Strait Islander n = 54, non-Aboriginal and Torres Strait Islander n = 157) were seen for initial audiology review. The proportion of non-Aboriginal and Torres Strait Islander infants who passed their review (83/157, 52.9%) was significantly higher (p = 0.0042) than Aboriginal and Torres Strait Islander infants (16/54, 29.6%). The prevalence of conductive hearing loss was significantly higher (p = 0.0141) among Aboriginal and Torres Strait Islander infants (19/54, 35.2%) than non-Aboriginal and Torres Strait Islander infants (28/157, 17.8%), suggesting ear disease as the probable cause of hearing loss. Indeed, the prevalence of middle ear pathology was significantly higher (p = 0.0495) among Aboriginal and Torres Strait Islander (18/54, 33.3%) than non-Aboriginal and Torres Strait Islander infants (28/157, 17.8%). The authors further noted that middle ear pathology and the associated conductive hearing loss were persistent among the Aboriginal and Torres Strait Islander participants into their first year of life.

3.2. Journal article 2

The Kalgoorlie Otitis Media Research Project in Western Australia performed a prospective study of children born in Kalgoorlie Regional Hospital between April 1999 and January 2003 [8]. The hearing screening pass rate was significantly lower (p = 0.003) among Aboriginal neonates (N = 51, 82%) than non-Aboriginal neonates (N = 121, 97%), lending support to the suspicion of early ear disease as the most likely reason for hearing screening failure. It was also significantly lower (p < 0.0001) among 1-2 month-old Aboriginal infants (N = 34, 56%) than non-Aboriginal infants (N = 116, 90%), again lending support to previous studies that report early ear disease among Aboriginal and Torres Strait Islander populations.

Audiology assessments were performed during ENT consultations for infants and toddlers aged 6–23 months (Aboriginal N = 61, Non-Aboriginal N = 169). Hearing loss was significantly more common among Aboriginal than non-Aboriginal children (OR = 5.40, 95%CI 2.68-10.89). A moderate to severe hearing loss was measured in 39% of Aboriginal 6-11 month-old infants (vs 10% of non-Aboriginal infants), and among 32% of Aboriginal 12-23 month-old toddlers (vs 7% non-Aboriginal toddlers). The paper does not clarify the nature of the hearing loss, however it is likely to be conductive/mixed in nature given the reported evidence of middle ear disease.

Table 1
Summary of systematic review.

	Journal article 1	Journal article 2
Year of publication	2012	2008
Location of study	Townsville, QLD, Australia	Kalgoorlie, WA, Australia
Authorship	Aithal, S., Aithal, V., Kei, J., & Driscoll, C.	Lehmann, D., Weeks, S., Jacoby, P., Elsbury, D., Finucane, J., Stokes, A., … Coates, H.
Study design	Retrospective cross sectional	Prospective longitudinal
Year(s) of data collection	August 2004–March 2009	April 1999–January 2005
Study setting	Regional public hospital	Regional community
Population		
Total	N = 211 infants	N = 280 infants/toddlers
Aboriginal and Torres Strait Islander	n = 54	n = 100
Non-Aboriginal and Torres Strait Islander	n = 157	n = 180
Selection criteria	Failed neonatal AABR screen, attended follow-up audiology review	Parental consent for infants born in the regional public hospital April 1999–January 2003, parent(s) intending to stay in the region for the next 2 years
Age range (months)	0–6 months	6–23 months
Audiology assessment personnel	Paediatric audiologists	Paediatric audiologist
Audiology assessment method(s)	Auditory Brainstem Response, Otoacoustic Emissions, High-Frequency Tympanometry	Visual Reinforcement Orientation Audiometry
Hearing loss %	Overall 53% Aboriginal and Torres Strait Islander 70.4% non-Aboriginal and Torres Strait Islander 47.1%	Moderate to severe hearing loss: 39% Aboriginal 6-11 month-old infants (10% non-Aboriginal infants) 32% Aboriginal 12-23 month-old toddlers (7% non-Aboriginal toddlers)
Type of hearing loss %	Conductive hearing loss: Aboriginal and Torres Strait Islander 35.2%, non-Aboriginal and Torres Strait Islander 17.8%	Not reported

4. Discussion

This systematic review revealed that the recent research literature on hearing loss among Aboriginal and Torres Strait Islander infants and toddlers is limited. The studies available suggest that a significant proportion of Aboriginal and Torres Strait Islander children present with

hearing loss in the newborn, infant and toddler age groups, and that it is most probably a conductive hearing loss secondary to ear disease. The proportion of these Aboriginal and Torres Strait Islander children is significantly higher than their non-Aboriginal and Torres Strait Islander counter-parts.

No studies of interventions to prevent, treat, or mitigate hearing loss in this population were found, and although research is understandably focused on reducing OM in this age group, concurrent research on the effectiveness of auditory rehabilitation options is vital. Given the well-documented on-going and long-term prevalence of OM in this Aboriginal and Torres Strait Islander age group, audiology data for this cohort of infants/toddlers is warranted to inform rehabilitation options, which should include both communication strategies and amplification devices. Current initiatives aimed at optimizing childhood outcomes for Aboriginal and Torres Strait Islander infants/toddlers living in remote communities would benefit from an epidemiology study of hearing loss in this population, as well as investigations of the adverse effects of hearing loss during critical years of neurodevelopment (0–3 years), and the relationship between hearing loss and early childhood developmental milestones.

The advent of Universal Newborn Hearing Screening has created the opportunity to identify Aboriginal and Torres Strait Islander neonates with early middle ear pathology, as well as Aboriginal and Torres Strait Islander neonates with congenital and early-onset sensorineural (permanent) hearing impairment. The referral pathways to specialist medical services and amplification options are well-established for children with severe or profound hearing impairment. However, access to these services continues to be a challenge for Aboriginal and Torres Strait Islander infants living in both urban settings and remote communities. Aboriginal and Torres Strait Islander infants and children with otitis media and associated conductive hearing loss require appropriate evidence-based ear health care delivered by their local primary health service, with appropriate referrals to specialist audiology and ENT consultations. The high turnover of professional staff in remote health services and limited skills and knowledge again compromises the needs of these children.

More research is needed to provide evidence of effective service delivery methods, such as telehealth and outreach specialist services on the hearing health outcomes of infants and toddlers. The success of outreach specialist services to remote communities is also heavily influenced by community engagement and participation. The importance of community-led research and clinical service delivery cannot be underestimated [9,10]. Health promotion activities, within the context of community-identified public health concerns, should also make a significant contribution to reducing ear disease and the associated conductive hearing loss among Aboriginal and Torres Strait Islander infants and toddlers.

5. Conclusion

Despite the highest reported rates of otitis media among Australian Aboriginal and Torres Strait Islander infants and toddlers, the prevalence and severity of associated conductive hearing loss is not known. Two studies, one of selected high-risk neonates and another a birth cohort study confirm the vast difference in hearing loss among Aboriginal and Torres Strait Islander infants and toddlers compared to non-Aboriginal and Torres Strait Islander peers. No high-quality studies of hearing health outcomes of medical (including surgical) or audiological interventions have been reported. These data are needed for communities, policy, and programmes to improve ear and hearing health, and help close the gap in education and employment opportunities in remote communities.

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Competing interests

No competing interests for any author.

Ethical approval statement

Not applicable.

Contributorship statement

The first draft of the manuscript was written by AK. Co-author AL read the manuscript and provided feedback to AK. Revisions were made by AK, and sent to AL for approval prior to submission.

Conflict of interest

None.

Declaration of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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