

Ear disease and hearing loss: a descriptive study of Aboriginal children living in metropolitan South Australia

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Submitted: 16 February 2023; Accepted: 18 April 2023

Abstract

Objective: This article aims to describe the rates of middle ear disease in Aboriginal children living in metropolitan Adelaide.

Methods: Data from the Under 8s Ear Health Program (population-based outreach screening) were analysed to identify rates of ear disease and the referral outcomes for children identified with ear conditions during screening.

Results: In total, 1598 children participated in at least one screening between May 2013 and May 2017. Males and females were equally represented; 73.2% had one or more abnormal findings on otoscopy at the first screening visit, 42% had abnormal tympanometry, and 20% registered a “fail” on otoacoustic emission testing. The referral pathway for children with abnormal findings included referrals to their GP, Audiology, and Ear Nose Throat (ENT) Departments. Also, 35% (562/1598) of the children screened required referral either to a GP or Audiology, and 28% of those referred (158/562) or 9.8% (158/1598) of the total number of children screened required further ENT management.

Conclusions: High rates of ear disease and hearing problems in urban Aboriginal children were detected in this study. Existing social, environmental, and clinical interventions need to be evaluated. Closer monitoring including data linkage may assist to better understand the effectiveness, timeliness, and challenges of public health interventions and follow-up clinical services to a population-based screening program.

Implications for Public Health: Aboriginal-led population-based outreach programs such as the Under 8s Ear Health Program augmented by seamless integration with education, allied health and tertiary health services should be prioritised for expansion and continued funding.

Key words: ear disease, aboriginal children, data linkage, metropolitan south australia

Introduction

Long-term self-reported ear or hearing problems in Aboriginal children in Australia were over twice the rate for non-Aboriginal children (6.9% compared to 3%) in 2018–2019.² A high prevalence of otitis media is a major health issue for Aboriginal Australians,^{3,4} in particular, suppurative otitis media in young children. This can lead to unrecognised hearing impairment,⁵ developmental delay in speech and language skills, impacts on school learning and attendance, behavioural problems, and auditory processing difficulties.^{6–10} Further, there is evidence that hearing impairment can

reduce long-term educational attainment, employment options, and may even increase the risk of incarceration for Aboriginal people.^{9,11–13} Otitis media in Aboriginal children occurs more frequently, with an earlier onset and is more severe and more persistent than in non-Aboriginal children.⁵

Sixty percent of global childhood hearing loss is preventable.¹⁴ Public health measures include addressing social and environmental risks (such as housing and sanitation), screening, and early detection. The latter can be achieved through routine health assessments and

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Aust NZ J Public Health. 2023; Online: <https://doi.org/10.1016/j.anzjph.2023.100061>

targeted ear health screening. Early identification allows timely intervention to prevent hearing loss.¹⁵

To date, research has focused on the middle ear pathology of Aboriginal children living in rural and remote settings. The data on the prevalence of ear health conditions and hearing loss in urban Aboriginal children are limited.^{16,17}

Objectives

1. To describe the rates of middle ear disease in Aboriginal children living in metropolitan Adelaide and participating in the Under 8s Ear Health Program.
2. To describe the referral pathways and outcomes for Aboriginal children with ear disease identified by the Under 8s Ear Health Program.

Note: The study utilised clinical data collected by Watto Purrunga Aboriginal Health Service, Adelaide.

Methodology

The Under 8s Ear Health Program (U8EHP) is a population-based outreach service auspiced by Watto Purrunga Aboriginal Health Service (Northern Adelaide Local Health Network, SA Health). The service provides culturally appropriate primary care services and hospital step-down services to Aboriginal people living in the northern and western areas of metropolitan Adelaide. The U8EHP was originally funded under the South Australian Government’s commitment to the Council of Australian Governments National Partnership Agreement on Closing the Gap in Health Outcomes for Aboriginal Australians. The program goal is to improve early detection

Figure 1: Referral pathway for Under 8s Ear Health Program.

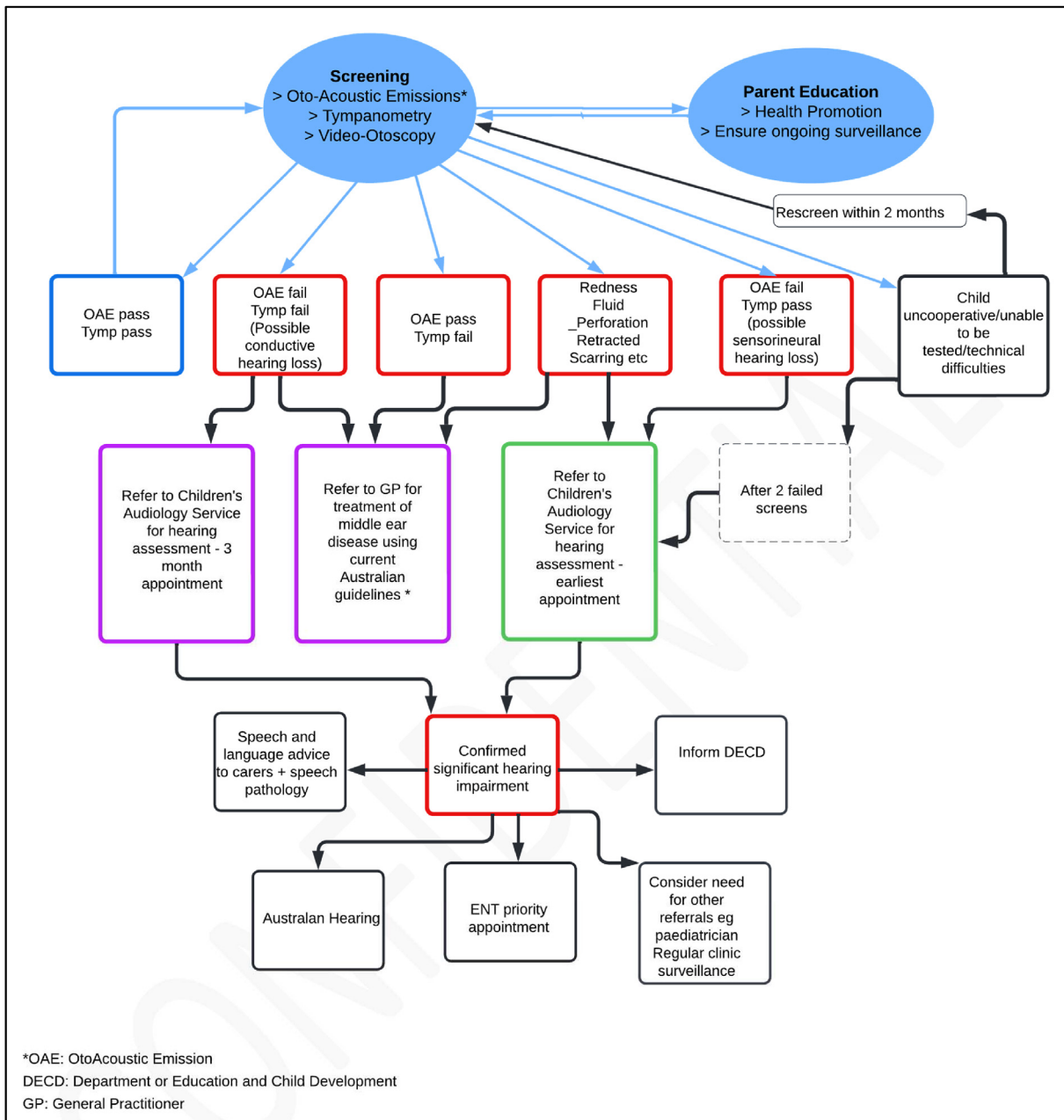
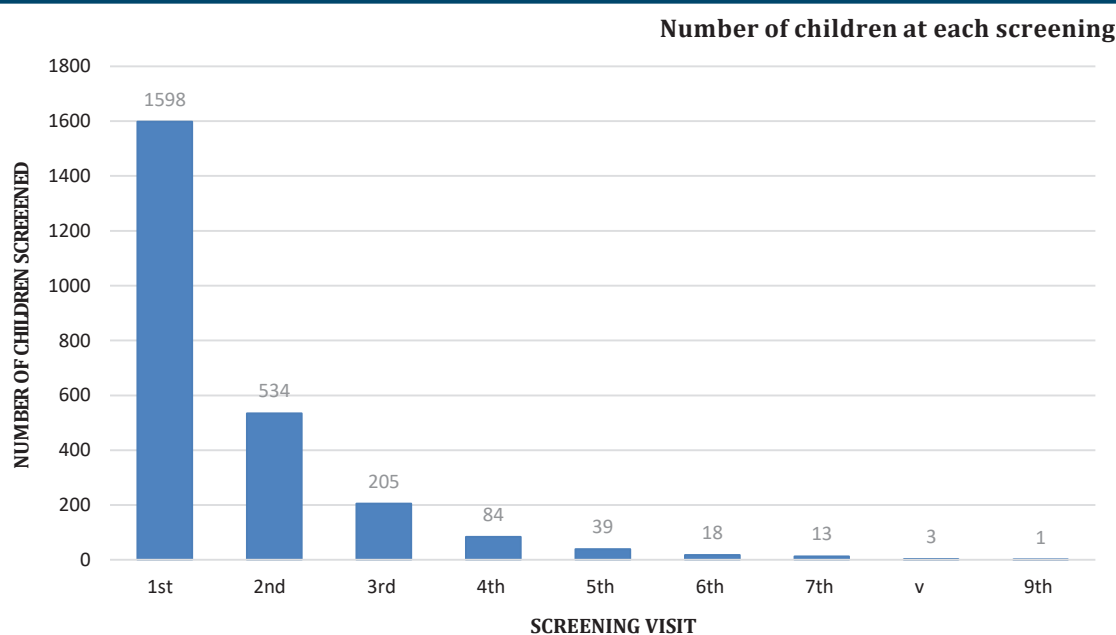


Figure 2: Under 8's ear health program: Number of children at each screening.



and management of otitis media and hearing loss in young Aboriginal children. The HealthinfoNet¹⁸ and SA Health¹⁹ websites provide current information on U8EHP.

The U8EHP has three main elements: ear and hearing screening (video otoscopy, tympanometry, otoacoustic emissions testing), ear health promotion, and access to health and education services. This paper focuses only on the first element, namely the ear and hearing screening program.

The U8EHP originally commenced in 2013 as the Under 5s Ear Health Program to improve early detection and management of otitis media and hearing loss in Aboriginal children. Extensive logistic support, advocacy, and strategic guidance were provided by a Public Health Clinician based in Watto Purrinna. The program was delivered as an outreach service based in early childhood centres/schools by establishing an agreed schedule of screening visits at sites with higher enrolments of Aboriginal children. It consisted of screening, initial diagnosis, and referral conducted by a Senior Aboriginal Health Practitioner with additional registered nurse qualifications who was also the Ear Health Coordinator, and an Aboriginal Health Worker/Practitioner. Both had comprehensive training in ear and hearing screening including video otoscopy, tympanometry, and otoacoustic emissions (OAE) testing. Video otoscopy enables images to be viewed and captured on a smart device, and the terms otoscopy and video otoscopy are used interchangeably in this article. OAE detects sound emissions from the inner ear and is especially useful in screening for hearing loss in young children. The program team worked closely with early childhood/school staff to engage and support parents/family members of Aboriginal children to participate and access relevant services for their child.

Using a family inclusive approach typical of best practice in Aboriginal Health, children aged 6–8 years were also offered screening if requested by families. The success of this approach backed by evidence of need led to an expansion of its remit in 2017 to its current status.

Planned annual screening was offered to all children in the program with rescreening as required, such as technical difficulties or to monitor resolution of acute ear disease including middle ear effusion. Written parental consent was an essential prerequisite for participation in the program. Consent included data storage and use for research and publication.

The South Australian public hospital electronic record system was searched to identify children with abnormal screening results who had appointments at the Women's and Children Hospital Ear Nose and Throat or audiology departments. Case-notes of these children were reviewed to ascertain whether the child was seen and the outcomes at attendance. Data were deidentified for analysis. STATA v15.1 was used to conduct descriptive and inferential statistics. The box below provides the definitions used in the study, and [Figure 1](#) describes the screening and referral pathway for screened children.

Diagnostic criteria⁽¹⁾ –

Acute otitis media (AOM) is defined as an otoscopic finding of a red and/or bulging ear drum in one ear (UniAOM) or both ears (BiAOM)

Otitis media with effusion (OME) is defined as an otoscopic finding of any fluid in one ear (UniOME) or both ears (BiOME)

A type A tympanogram is normal.

A type B tympanogram (flat) may confirm a clinical diagnosis of OME.

A type C tympanogram (peaked) indicates a retracted ear drum due to upper respiratory illnesses, a developing or recovering ear infection or Eustachian tube dysfunction.

Results

Between May 2013 and May 2017, 1598 Aboriginal children participated in at least one screening visit where both ears were assessed for any abnormality. The family inclusive approach resulted in children over 8 years of age also being screened. Most children attended one screening, with smaller proportions returning for repeat

Table 1: Referral outcomes for children with abnormal screening results.

Total number of children at first screening N = 1598	Result of ear health screening	Number (%)	Referred to GP/CaFHS	Referred to ENT ^a	Improved hearing ^b
OAE results at screening (n=1598)	Passed both ears	1170 (73%)			
	Fail one ear	158 (10%)	72 (45.6%)	17 (10.7%)	43 (31%)
	Fail both ears	160 (10%)	112 (70%)	32 (20%)	46 (28.7)
	Need retest	110 (7%)	37 (33.6%)	14 (12.7%)	16 (14.5%)
Otoscopy findings at screening (n=1598)	Normal	1408 (88.1%)			
	Unilateral AOM	86 (5.4%)	38 (44.2%)	9 (10.5%)	13 (15.1%)
	Unilateral OME	65 (4.1%)	13 (20%)	5 (7.7%)	10 (15.3%)
	Bilateral AOM	19 (1.9%)	11 (57.9%)	3 (15.8%)	4 (21%)
	Bilateral OME	16 (1%)	6 (37.5%)	1 (6.2%)	3 (18.7%)
	Unilateral OME&AOM	4 (0.2%)	3 (75%)	0	0
Tympanometry results at screening (n=1598)	Normal	858 (54%)			
	Unable to test	70 (4.4%)			
	Type B	221 (14%)	179 (80.9%)	38 (17.2%)	70 (31.6)
	Type C	369 (23%)	24 (6.5%)	10 (2.7%)	14 (3.8)
	Type B OR C	80 (5%)	67 (83.7%)	9 (11.2%)	23 (28.7%)
Total			562 (35%)	138 (9.8)	242 (43)

OAE: Oto Acoustic Emission; GP: General Practitioner; CaFHS: Child and Family Health Services; ENT: Ear Nose Throat Dept.

^adenominator is total number for that result category.

^bdenominator is number referred to GP/CaFHS for that category.

visits (Figure 2). Unless otherwise specified, the results refer to the first screening visit.

The mean age of children was 6.26 years (range 0.15–15.5 years), and the median age was 8.5 years at first screening. The age range was evenly distributed between children aged over 8 years (30.3%), children aged 5 to <8 years (28.4%), and children aged 3 to <5 years (25.1%). There was a smaller proportion of children aged <3 years (16.1%).

Males and females were equally represented (50.9% male and 49.1% female). This gender distribution was maintained for the 2nd–6th ear health screenings.

Video otoscopy clinical findings

Only 26.8% of children had normal findings, with 73.2% having one or more abnormal findings (scarring, fluid in ear, retracted eardrum or perforation). Scarring was the commonest abnormal finding, present in 36.9% of first screening visits and ranged from 35.7% (4th screening) to 100% (8th screening). A retracted eardrum was the second most common abnormal finding, affecting 9.9% of children at first screening, and ranged from 2.6% (5th screening) to 11.7% (3rd screening). Fluid in the ear was found in 5.5% and perforation in 1.7% of children at first screening. Occlusive ear wax was discovered in one or both ears of 23% (363) of children, requiring rescreening after resolution of the problem.

The prevalence of unilateral or bilateral otitis media was 6.8% (109/1598), and the prevalence of unilateral or bilateral otitis media with effusion was 5.3% (85/1598). Overall, 11.8% of children received otoscopic diagnoses at the first screening. The proportions of otoscopic findings remained roughly equivalent for subsequent screenings.

Tympanometry and OAE findings

Just over half (54%) of children had normal tympanometry findings, and 4% were unable to be tested either due to an active ear problem at the time of the assessment or because of the difficulty many young children have with being examined. In the 42% with abnormal tympanometry, 4% had a type B finding, 23% had a type C finding, and 5% had type B or C.

In terms of OAE findings, there were a greater proportion of “unable to complete” results in the under 3 age group (24%) compared to the older age groups: 4% in the 3–5-year age group and 2% in the 5–8, and over 8-year age group. The reasons were similar to those stated above for tympanometry. A considerable proportion of children within each age group recorded a “fail” result and the overall OAE “fail” rate was 20%. This rate was consistent across the age groups although the highest proportion of “fail” results was recorded in the 1- to 3-year age group (28%), followed by the 3- to 5-year age group (24%). The lowest proportion of “fail” results were recorded in the over 8 age group (15%).

Referral outcomes

Table 1/Figure 3 shows the referral outcomes for children with abnormal screening results. They display the same information and are included for ease of data readability. 35% (562/1598) were referred either to a GP or Audiology. 138 children were subsequently referred to ENT specialists by these providers. Hence, 28% of those seen by a GP or Audiology, or 9.8% of the total number of children screened required tertiary-level assessment. A detailed breakdown of these numbers follows.

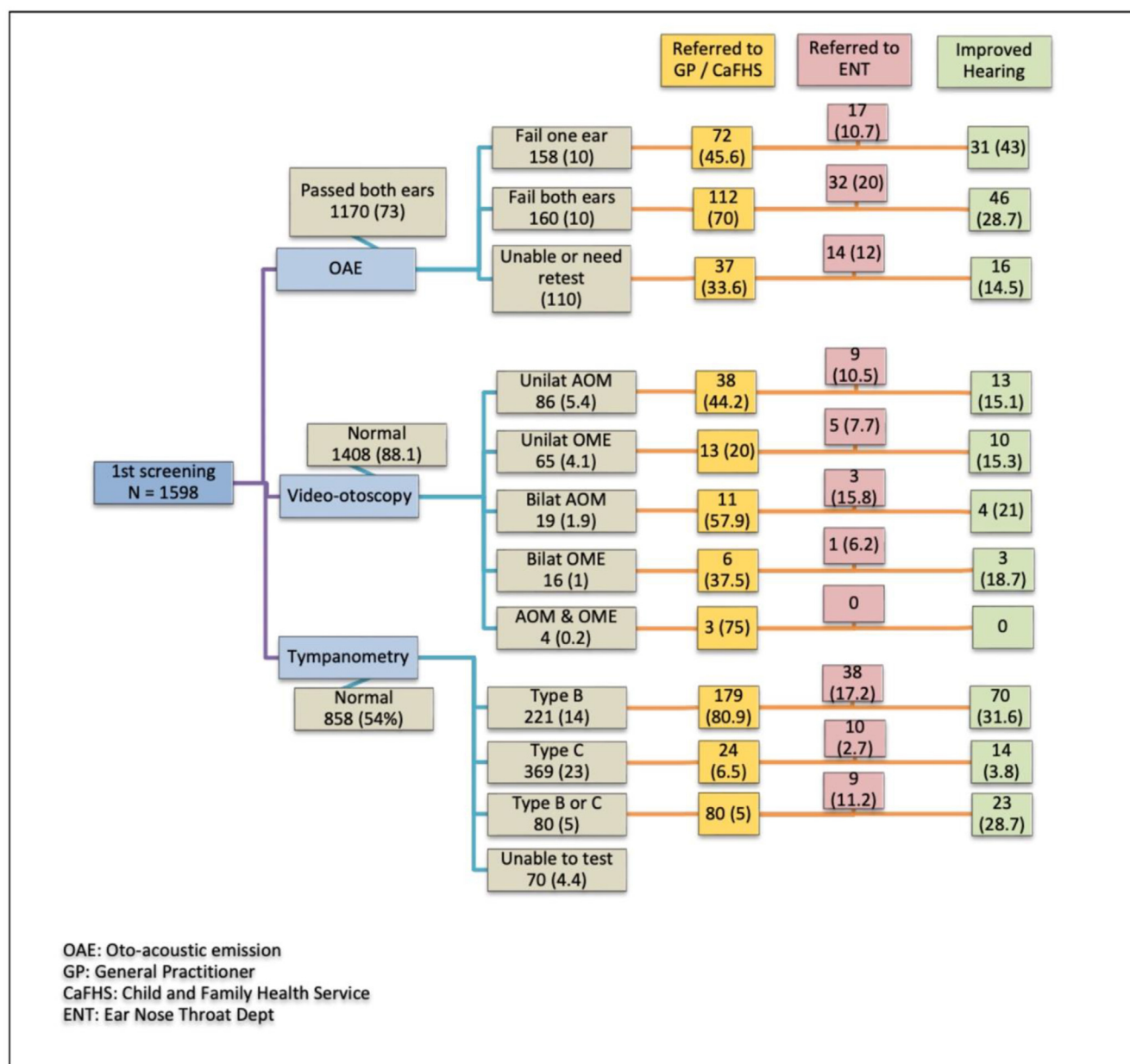
45.6% of the children with a unilateral “fail” result on OAE, and 70% of those with a bilateral “fail” were referred either to a GP or Audiology and 10% of those with a unilateral “fail” and 20% of those with a bilateral “fail” result were referred to the ENT department.

44.2% of children with unilateral Acute Otitis Media (AOM), and 57.9% of children with bilateral AOM were referred to their GP/Audiology, with 10.5% and 15.8% being subsequently referred to ENT.

80.9% of children with a type B finding on tympanometry were referred to their GP/Audiology and of these, 17.2% were subsequently referred to ENT; 6.5% of those with a type C finding were referred to their GP/Audiology, with 2.7% being subsequently referred to ENT.

At hospital attendance, improved hearing was noted in 14.5% of OAE “needing retest”, 15.1% of unilateral AOM, 21% of bilateral AOM, 15.3% of unilateral Otitis Media with Effusion (OME), 18.7% of bilateral OME, and 28.7% of those with type B or type C tympanogram.

Figure 3: Referral outcomes for children with abnormal screening results (numbers in brackets are percentages).



Missed appointments

Of the 562 children referred to GP/Audiology, 360 (64%) had hospital clinical notes available for review/analysis; 317 (88%) children attended for care, leaving a small group of 43 children whose families

appeared to have difficulties bringing the child to the hospital. Table 2 shows the number of missed appointments for these children. In total, there were 350 missed appointments.

Number of missed appointments per child	Number of children
1	11
2	8
3	8
4	8
5	5
6	1
8	2

Discussion

A 2014 review of otitis media in Australian Indigenous children by Jervis-Brady et al. found the prevalence of acute otitis media ranged from 7.1% to 12.8%, chronic otitis media from 10.5% to 30.3%, and tympanic membrane perforation from 31.0% to 50.0%.³ Our study found a prevalence of 6.8% for acute otitis media, 5.3% for otitis media with effusion, and 1.7% for perforation. The lower perforation rate is similar to other data from metropolitan Adelaide showing a perforation rate of 1.2%²⁰ and may reflect the relatively easier access to timely healthcare compared to rural and remote regions. However, this is still considerably higher than the 0.1% national prevalence of

tympanic membrane perforation amongst non-Aboriginal children.²¹ A high rate (73.2%) of abnormal otoscopy findings in our study are comparable with studies in rural communities reporting OM and its complications in up to 73% of children under 12 months of age, and in 91% of children overall.^{22,23}

A South Australian study²⁰ provides one of the few comparisons of hearing loss between urban and remote settings and uses the same audiologic approach as our study to assess the ears and hearing of Aboriginal children aged 5–12 years. The researchers assessed 809 children from the remote Anangu Pitjantjatjara Yankunytjatjara (APY) Lands of South Australia and 1756 children from metropolitan Adelaide. Combining all ages, approximately 73% of children living in the APY lands did not pass a 20dB HL 4 kHz frequency hearing test bilaterally compared to approximately 36% of children living in metropolitan Adelaide. 40% of children in our study were under 5 years of age and 27.63% of these children failed OAE at the first screening. With an overall OAE “fail” rate of 20%, our study findings also indicate a high prevalence of detected hearing loss. Even if the hearing loss is episodic, this would adversely impact a child’s speech and language development.

Approximately 1 in 3 Aboriginal children in our study (562/1598) needed further assessment for an ear condition and 1 in 10 (158/1598) needed ENT management. However, this could be an under estimation due to loss of follow-up and clinical data. The available data from the referral pathways indicates that closer monitoring and data linkage is needed to better understand the effectiveness, timeliness, and challenges of follow-up services. This is particularly true for some families (as reflected by the missed appointments) for whom barriers to accessing care could include competing priorities, transportation difficulty, and concerns about cultural safety at a tertiary hospital.

OME can often be a silent disease, without the obvious intermittent discharge associated with chronic suppurative otitis media. Anecdotally, the high prevalence of otitis media in Aboriginal communities has caused some families to have a higher tolerance for ear disease thereby inadvertently underestimating the need for follow up or treatment.²⁴ Compounding the problem is that parents, carers, and educators may also be less likely to consider ear disease as a possible cause of learning delay or behavioural problems. In addition, metropolitan primary care practitioners may assume that Aboriginal children living in urban areas experience middle ear disease at similar rates to non-Aboriginal children.

Preventing the detrimental impact of middle ear disease on hearing at a critical time of childhood speech and language development is vital.^{25,26} The Australian Institute of Health and Welfare 2018–2019 report suggests rates of hearing loss increase steadily with age and reported hearing loss rates of 43% for children 7 and over.²

Our study adds to the knowledge from several other descriptive studies on the prevalence of ear conditions in Aboriginal children and is consistent with other ear health studies conducted in urban South Australia.²⁰ Although it is a cross-sectional study, the high rates of abnormal findings are of concern and call for urgent public health intervention. Social and environmental determinants of health must be addressed since factors such as inadequate housing, passive tobacco smoking, inequitable access to health care, and food insecurity disproportionately impact Aboriginal communities.^{27,28} Early detection and prompt treatment need to be complemented

where necessary by educational, speech, and hearing support. The health literacy of educators and families also deserves attention. Hence, a culturally safe “all of system” approach is needed to respond to the rates of ear conditions in Aboriginal children living in urban South Australia. Government policies and strategies on ear health should take a holistic and equity-based approach in conjunction with other public health measures.

Limitations

We based our definitions of ear health conditions on the 2010 “Recommendations for clinical care guidelines on the management of Otitis Media in Aboriginal and Torres Islander populations.^{1”} These were updated in 2020 and include additional diagnoses such as episodic otitis media. Our study may have therefore underestimated the extent of ear disease.

24% of children under the age of 3 were unable to complete OAE assessment. Although it emphasises the difficulty of assessing hearing in preverbal children and the consequent paucity of studies on hearing outcomes for younger children, it is nevertheless a limitation of our data.

The hearing outcomes of children referred to GP/Audiology or the Women’s and Children’s Hospital ENT are descriptive data with no inferential analysis. Only 22% of children screened in the community had clinical data available. Hence, the impact of the screening program could not be studied for all children screened.

The data did not include socioeconomic variables, parental smoking rates, childcare attendance rates, and housing characteristics, thereby preventing examination of the contribution of these factors to the prevalence of ear disease.

Further public health implications

Although 77% of Aboriginal people live in urban areas of South Australia, and the epidemiology of otitis media may be different for rural and urban communities. A clear understanding of the prevalence of ear conditions and hearing loss is important for estimating the burden of disease in Aboriginal children and their communities, and for subsequent planning and appropriate health resources allocation within health promotion and prevention, audiological and surgical services within the state. Aboriginal-led population-based outreach programs such as the Under 8s Ear Health Program augmented by seamless integration with education, allied health and tertiary health services should be prioritised for expansion and continued funding.

Further recommendations

1. Policies and strategies to improve the in-home built environment for Aboriginal communities can assist in reducing the prevalence of skin infections, respiratory infections and gastrointestinal infections thereby preventing consequences such as otitis media, trachoma, acute rheumatic fever, and rheumatic heart disease.
2. Codesigning health promotion programs with local Aboriginal communities to ensure cultural safety.
3. Standardising and prioritising referral processes to expedite Aboriginal children’s access to specialist ENT services.
4. Transportation support to assist low-income urban families to attend health appointments.

5. Outreach GP services to early childhood settings with significant enrolments of Aboriginal children for timely follow-up of abnormal screening findings including treatment and referrals.

Ethical approval

Ethics approval to analyse the data was provided by the SA Department for Health and Wellbeing and the SA Aboriginal Health Research Ethics Committee.

Acknowledgements

The authors gratefully acknowledge the children in the U8EHP and their families for their willing involvement in the study. We also acknowledge the following for their support of the study, facilitating data collection, and statistical guidance: Staff and leadership of Watto Purrinna Aboriginal Health Service, the Child and Family Health Service of South Australia, the SA Department of Education and Child Development, Dr David Johnson for his contributions to the South Australian Aboriginal Ear Health Strategy, Dr Colin Forster, Kathleen Stacey, Eunice Aston, Tania Axleby-Blake, Sheryl Boniface and Dr Kamalesh Venugopal (Wellbeing SA).

Conflicts 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.

Funding

Nil.

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