

Review of ear health and hearing



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Introduction

The level of ear disease in the Aboriginal population remains much higher than that of the general Australian population, particularly in many rural and remote communities, but there is evidence of some improvement in recent years [1] [2].

Rates of otitis media (OM) in some Aboriginal communities are among the highest in the world [3] [4], with patterns similar to those seen among disadvantaged populations in developing countries [5]. The level and severity of OM is generally of great concern, but, reflecting the heterogeneity of the Aboriginal population and the environmental conditions in which they live, the prevalence of OM varies greatly between communities [6].

The World Health Organization considers a population with a prevalence of chronic eardrum perforations of greater than 4% to be at high risk, constituting a major public health problem requiring immediate attention [6] [7]. In many Indigenous communities, the prevalence of chronic suppurative otitis media (CSOM) (which

involves eardrum perforation) among infants, children, adolescents, and adults exceeds this level.

Otitis media

Little is known of the ear health of Indigenous people prior to colonisation, but it is likely that the high levels of CSOM observed among Indigenous children in recent decades were not common. Records between the late 1800s and the mid 1900s made few references to ear discharge in Indigenous people. However, by the 1970s, studies demonstrated that there were very high rates of ear disease among the children of many Aboriginal populations [\[8\]](#). These findings raised questions about the health impact of imposed lifestyles and living conditions on Indigenous people and support suggestions that OM, and specifically suppurative OM, only emerged as a health problem after colonisation [\[8\]](#) [\[9\]](#) [\[4\]](#).

In the late 1970s, the National Trachoma and Eye Health Program (NTEHP) conducted a comprehensive survey of more than 60,000 Aboriginal people nationwide, including an assessment of ear disease [\[10\]](#). Otitis media was defined as the presence of wet or dry perforations and/or 'glue ear' (it should be noted, however, that distinguishing between wet and dry perforations can be difficult in practice). OM was found in 11% of those surveyed [\[10\]](#) [\[11\]](#). More than 16% of Indigenous children under 10 years of age had OM in one or both ears, with approximately 57% of ears with OM having a wet perforation and almost 36% having a dry perforation - in total, more than 92% of all ears with OM had evidence of a perforation [\[10\]](#). The highest levels of OM were found in the arid and remote areas of central and Western Australia, and the lowest in the more densely populated coastal regions and in the Torres Strait. It is likely, however, that the survey may have underestimated the extent of otitis media with effusion (OME) [\[12\]](#). The NTEHP survey provided valuable national data on the continuing problem of CSOM for rural and remote Aboriginal communities. It was also significant as it highlighted the association between OM and poor living standards [\[10\]](#) [\[13\]](#).

Non-Indigenous children frequently present with acute otitis media (AOM), but early studies suggested that this form of the disease (involving inflammation of the middle

ear and symptoms of earache, fever and irritability, but without perforation of the tympanic membrane) is not characteristic of the disorder Aboriginal infants [14] [15]. Acute, suppurative otitis media, characterised by a rapid and apparently painless perforation of the eardrum, and discharge of purulent material (pus) is usually the first stage of the disease among Aboriginal infants [16] [17]. If OM in non-Indigenous children does become chronic, it is not generally characterised by perforation, and is variously termed otitis media with effusion, serous otitis media, or secretory otitis media [1]. OM in non-Indigenous children is often self-limiting (even in bacterial cases), typically resolves with age, and is seldom seen among children older than 8 years [18] [19]. Chronic suppurative otitis media (CSOM) occurs rarely among non-Indigenous Australians, who typically benefit from good living conditions and access to adequate health care, but high rates are common among Aboriginal children. It is also not uncommon for Aboriginal people to continue to suffer from CSOM throughout adolescence [19] and into adulthood. Pain is often absent with CSOM, so patients may delay seeking treatment. A number of studies conducted in the last decade have also reported perforation rates among adolescent and adult Aboriginal people that are markedly higher than those of the wider Australian population [2] [20].

Factors contributing to otitis media among Aboriginal people

A longitudinal study of otitis media in rural Aboriginal infants has advanced the understanding of its natural history and causal factors [21] [22]. The study has demonstrated that effusion or acute inflammation of the middle ear - or both - can occur in Aboriginal infants within weeks of birth. Early infection of the nasopharynx (the area of the upper throat behind the nose), with bacterial respiratory pathogens known to cause OM, precedes the development of middle-ear effusion in most cases (the median age of colonisation was 28 days) [5]. The early onset, chronic nature, and severity of OM in Aboriginal infants are thought to be caused, at least in part, by this early and persistent nasopharyngeal colonisation with multiple species of pathogenic respiratory bacteria. Otoscopic signs of AOM (such as a bulging tympanic membrane) are relatively common in the first 2 years of life, and symptoms

are usually lacking, atypical, or so short-lived that they are rarely recognised by health staff.

Organisms responsible for otitis media

Three bacterial pathogens appear to predominate as the cause of OM:

Streptococcus pneumoniae (25-50%) *Haemophilus influenzae* (15-30%), and *Moraxella catarrhalis* (3-20%) (according to international literature) [23] [4]. In children less than 2 years of age, a significant proportion of respiratory pathogens was isolated from ear discharge. When CSOM occurred, discharging ears most often yielded gram-negative bacilli such as *Proteus* spp., coliforms, *Pseudomonas* spp. and *Staphylococcal aureus*. *S. pneumoniae* and *H. influenzae* were rarely isolated from chronically discharging ears [24] [4].

As part of a program providing paediatric otolaryngology services to three Aboriginal communities in New South Wales (NSW), a study was carried out to identify potentially pathogenic bacteria in the middle-ear effusions in 27 Aboriginal children undergoing myringotomy [25]. Antibiotic use and symptomatic upper respiratory infection in the month prior to surgery was documented. Positive cultures were obtained from 13 children with the following potentially pathogenic organisms identified in 11 children: *Staphylococcus Pseudomonas H. influenzae Moraxella Achromobacter Enterobacter* and *Corynebacterium*.

Of OM caused by *H. influenzae*, almost all strains appear non-typable rather than capsulated type b strains [26] [4]. (Generally, *H. influenzae* type B is the most virulent, but some non-typable strains are also pathogenic.) *Chlamydia trachomatis* has been implicated in chronic OME, but even in trachoma-endemic regions this agent plays no significant role in ear disease for Aboriginal children [27] [4].

When the bacterial cause of OM is found, the same organism can usually be isolated from the nasopharynx [4]. Nasopharyngeal isolation may assist in determining the bacterial aetiology of OM, but it is not very specific (other pathogens not present in the middle ear fluid are also isolated from the nasopharynx in about 40% of cases). Nasopharynx infection with respiratory viruses occurs frequently among Aboriginal

infants, and viral respiratory infections are known to be associated with OM in other populations. Viral infections cannot explain the early onset of OM in Aboriginal infants, but the interaction of bacteria and viruses may be of biological significance. Research efforts have not yet focused on these effects in Aboriginal populations.

Persistent bacterial colonisation has been attributed to cross-infection stemming from overcrowded living conditions, poor hygiene, high carriage rates of bacterial pathogens, and the prevalence of multiple bacterial strains [5] [28] [29]. Many rural and remote Aboriginal communities have poor housing with inadequate access to water, sewerage systems, and waste removal [30], increasing the risk of infectious ear disease [2]. The precise role of environmental and other factors is less clear for Indigenous people living in urban areas, but some aspects are likely to be of importance. Variations in the prevalence of tympanic membrane perforation between urban and rural localities have also been attributed also to environmental differences.

Levels of otitis media

Studies conducted over the past 15 years or so provide some insights into current levels of OM within the Indigenous population. The studies have reported a number of different measures of OM and hearing loss, so great care should be exercised in comparing the results. Many have been based on small (and not necessarily representative) samples, and the criteria used in assessing the presence of disease may have varied. Many studies do not state what time of the year they were undertaken (clearly an important aspect for any disease showing seasonal fluctuations, as does ear disease), and lack of age standardisation precludes direct comparisons.

A recent longitudinal study of 41 Aboriginal infants from a northern tropical island community off the coast of the Northern Territory revealed the endemic nature of OM in some communities [21]. The study examined infants shortly after birth and monthly thereafter. By 8 weeks of age, 21 of 22 Aboriginal infants had clinical or audiological signs of effusion or acute inflammation, while only three of 10 non-Aboriginal infants had signs of OME and none had signs of AOM. By 3 months of age, otitis media was

present in the entire Aboriginal cohort, with acute inflammation identified in 28% of infants and effusion in 72% [18] [31]. All Aboriginal infants experienced repeated or persistent infections throughout their first year of life [18] [21] [31]. Overall, Aboriginal infants were four times more likely than a comparison group of non-Aboriginal infants to develop AOM and three times more likely to develop OME [31]. Over the course of the study, 37% of all Aboriginal infants experienced a perforation at least once, with the mean age of first perforation being 5.6 months. Of those infants who had reached 6 months of age or more by the end of the study, 33% had experienced perforation of the eardrum within their first 6 months. Among those infants who experienced perforation, one-third had perforations that persisted for more than 60 days [18].

A series of studies conducted in the late 1980s and early 1990s demonstrated the variable levels of OM observed among urban and rural populations. A 1989 study of the ear health of 642 Aboriginal schoolchildren living in the Eastern Goldfields region of Western Australia reported perforation rates ranging from 14% in urban areas to 67% in remote areas [32]. A study of urban Aboriginal and Torres Strait Islander schoolchildren from Brisbane reported markedly lower perforation rates (less than 2%) [19]. Not all urban studies report such low perforation rates [33], but the results of the Brisbane study add to a growing body of findings that suggest that, in time, the pattern of OM in some urban Indigenous populations may shift toward that seen for non-Indigenous Australians [2].

A survey of ear disease undertaken between 1988 and 1989 among Aboriginal people living in remote and urban communities in Western Australia was one of the first studies to suggest a change in the pattern of OM in some Aboriginal communities [2]. Prevalence estimates derived from published graphical data revealed generally lower rates among urban Aboriginal people in most age groups. In the urban community, just over 5% of Aboriginal people had ear perforations. Age-specific prevalences of perforation were approximately: 5.5% in children aged 0-4 years; 2% in the 5-14 age group; 14% in the 15-24 age group; and 2% among those aged 25 years or older. These prevalences contrast markedly with those reported for the remote communities, for which around one-fifth of Aboriginal people were found to have perforations. For these communities, around three-tenths of children aged 0-

14 years had perforations. Even for those aged 25 years or older, 8-9% had perforations.

These levels of perforation for Aboriginal adults are similar to those reported for 100 Aboriginal adults studying or working near Darwin, among whom 6% of eardrums were perforated [34]. In contrast, a brief survey conducted between 1992 and 1994 found ear discharge among 31% of women and 22% of men in an isolated Aboriginal community in the Northern Territory [20].

High levels of disease have been described in some inner city areas, and for those urban communities where ear disease is less prevalent it is still much more common than in the non-Indigenous population [19] [2]. Generally though, rates of OM for Aboriginal people in urban areas are lower than in rural and remote Aboriginal communities. Several studies of urban populations drew particular attention to the reduced frequency of perforation among urban Aboriginal people [19] [2]. The studies note that when Indigenous and non-Indigenous Australians have comparable living conditions the patterns of OM are more similar.

Hearing loss

Hearing loss is significantly worse in Indigenous communities than in the wider population. When it occurs in the first few years of life - a critical period of child development - it has major implications for speech and language development and learning [4] [2]. These negative effects are likely to be compounded in Aboriginal children, many of whom have to adapt to an educational environment where the language and culture differs from that of their home environment [4] [34].

Developmental, educational, and vocational consequences are compounded by continued poor access to therapy, hearing aids, special teachers, classroom sound-field systems, and other rehabilitative programs [4] [35].

A recent education inquiry has highlighted the impact of ear disease and hearing loss on the educational achievement of Indigenous students. The findings of the inquiry were documented in *Katu Kalpa: Report on the Inquiry into the Effectiveness of Education and Training Programs for Indigenous Australians* [36]. The report

identified ear disease and associated hearing loss as one of the most significant learning barriers faced by Indigenous students. The hearing needs of Indigenous people have received specific attention and funding under the current National Indigenous English Literacy and Numeracy Strategy [\[37\]](#)

Hearing loss, and its impact on education, exacerbates the disadvantages generally faced by Indigenous people and increases their risk of coming into contact with the criminal justice system [\[4\]](#) [\[38\]](#). Poor education and unemployment were important indicators for contact with the judicial system and were common features among the 99 deaths investigated by the Royal Commission into Aboriginal Deaths in Custody [\[39\]](#).

Detecting hearing loss

Pneumatic otoscopy and tympanometry methods can be used to detect OM. A Northern Territory study comparing screening tests for OM for Aboriginal children aged 3-18 years demonstrated strong agreement between pneumatic otoscopy and tympanometry results [\[40\]](#). In a screening of 255 remote area Aboriginal school children both methods were shown to be good predictors of hearing loss [\[41\]](#).

Hearing impairment can also be detected in the classroom. In a Queensland Aboriginal community, school teachers who used a questionnaire based on physical and behavioural characteristics indicative of hearing loss were able to predict hearing loss when audiometry findings were compared for the same children. The questionnaire was 67% sensitive in detecting hearing loss greater than 30 dB and was 81% specific. Teacher-based methods may be more useful in Aboriginal populations than other populations because of higher prevalence and chronicity of poor hearing levels [\[3\]](#).

Prevalence of hearing loss

The prevalence of hearing loss among Aboriginal people is high, but varies across communities and its true extent remains unclear [\[4\]](#) [\[41\]](#). Various studies have endeavoured to document the burden of hearing loss within Indigenous communities, but differences in the methods and criteria used to determine hearing

loss have often led to large differences in reported prevalences, making comparison between studies virtually impossible [42]. In spite of the lack of uniformity in reporting, however, it is clear that many Aboriginal communities bear a disproportionate burden of conductive hearing loss.

The hearing loss associated with chronic otitis media in Aboriginal paediatric populations is generally less than 60 dB [7]. (A hearing loss of more than 20 dB may have significant negative social consequences and a loss of 35 dB almost certainly will.) Children presenting with perforated eardrums, particularly those with bilateral CSOM, experience significantly worse hearing loss than those with otitis media with effusion [1] [41]. Half of those children with bilateral CSOM experience hearing loss of greater than 35 dB and very few escape without some residual loss [7].

Individual studies provide examples of the varying levels of hearing loss observed across different Aboriginal populations. Boswell and colleagues' recent longitudinal study of otitis media in Aboriginal infants identified conductive hearing loss within 2 months of birth [21] [42]. Losses of up to 40 dB were reported in this very young age group, with the mean hearing loss estimated at 22 dB. The assessment of hearing loss at such an early age is, however, unusual. Hearing screening is much more frequently conducted among children of school-age and estimates of the prevalence of hearing loss in this population are numerous.

A study of four remote communities in the same Northern Territory district reported hearing loss ranging from 35% to 74% [43]. For three of the four communities, the majority of childhood hearing impairment was mild, occurred in only one ear, and affected smaller proportions of children with increasing age. In contrast, the majority of hearing impaired children in the fourth community suffered hearing loss at levels classified as moderate or worse, experienced loss in both ears, and failed to show a decline in the prevalence of loss with increasing age. A subsequent study of Aboriginal schoolchildren living also in a remote region of the Northern Territory demonstrated varying levels of hearing impairment with different middle ear conditions [41]. This study found a hearing loss exceeding 25 dB in 16% of ears, with average losses of just over 20 dB in ears with OME, and 30 dB in ears with perforated eardrums.

Studies of urban Indigenous schoolchildren demonstrated variability in levels of hearing loss, but did not report the extremely high prevalences found in some rural and remote communities. For example, only 5% of a sample of Aboriginal and Torres Strait Islander children from schools in Brisbane failed a hearing assessment when screened for a loss of 15 dB [19]. On the other hand, 36% of ears tested in a sample of Aboriginal schoolchildren from Sydney revealed a loss of 25 dB or more, and 21% had a loss of 30 dB or more [33].

The findings for research in Kwinana, a southern Perth suburb, were similar to those for the Sydney study, with 20% of 142 Aboriginal children having a hearing loss of 30 dB or greater [2]. Moderate or severe hearing loss (45 dB or greater) was found in only 0.7% of the children living in Kwinana. These levels were much lower than those reported for two remote Aboriginal communities studied at the same time - 43% of 97 Aboriginal children living in Wiluna and 41% of 122 living in Bidyadanga (known previously as La Grange) had some hearing loss (30 dB or greater), and 8.2% and 7.9% respectively had moderate or severe loss (45 dB or greater). The study of Kwinana and other Western Australian communities found that almost 10% of 52 Aboriginal people aged 25 years or older living in Kwinana had moderate or severe hearing loss (45 dB or greater), as did 15% of 102 living in Wiluna and 14% of 105 living in Bidyadanga. Other studies have failed to demonstrate similar levels among adult Aboriginal people, but they confirm that many Aboriginal adults continue to suffer from slight or mild hearing loss.

Among Aboriginal adults studying or working in or around Darwin, a slight loss (16-25 dB) was identified in 34% of ears, a mild loss (26-40dB) in 12% of ears, a moderate loss (41-55 dB) in 3% of ears, a severe loss (71-90 dB) in 1% of ears and a profound loss (91 dB or more) in 2% of ears [44]. Levels and rates of hearing loss among Indigenous university students studying in Brisbane were lower but still notable. The study found 15.5% had a unilateral or bilateral hearing loss of 16 dB or more. For the majority of hearing impaired students the loss was unilateral and classified as slight [45].

Policies and strategies for the prevention and management of OM and hearing loss

Introduction

A definitive understanding of the causes of the consistently higher prevalence of OM among Indigenous people has yet to be reached [6] [32]. However, some study findings suggest that Aboriginal children may be increasingly likely, in time, to develop OME rather than CSOM, or to remain free of chronic ear disease altogether [2] [3] [4]. Such a change in the Aboriginal pattern of OM may occur in response to improved primary health care services [28], enhanced access to effective ear-health programs [2] and the wider use of antibiotics [14].

The profound socioeconomic disadvantage in many Aboriginal communities is reflected in exposure to environmental risk factors, inadequate health-related infrastructure and health services [46], ineffective treatment [28] poor nutritional status and exposure to passive smoking [5] [46]. Strategies to prevent the onset of OM need to address social and environmental problems, such as poor housing, overcrowding, and limited access to nutritious food. Other prevention strategies include improving personal hygiene; encouraging breastfeeding; discouraging smoking; and encouraging swimming and vaccination [1] [47] [48] [4].

There has been a focus on school-age Aboriginal children for ear health management programs – due largely to the ease of access to this group. With the onset of OM in infancy and the development of chronic disease in early childhood [42] [32] the focus needs to be widened [34]. It is now recognised that, if adverse childhood developmental and educational effects are to be minimised, diagnosis and effective medical and audiological management of Aboriginal infants with OM and conductive hearing loss should be initiated before the development of chronic disease [18] [4] [31] [42] [6] [32]. Community education regarding behavioural strategies for reducing adverse developmental consequences associated with hearing loss is also essential [6].

It is important to encourage early intervention by ensuring that the family or caregiver is aware of the increased risk of OM faced by many Aboriginal children, aware that the onset of OM may occur within the first months of life, and aware that clinical care should be sought as soon as possible after a child develops ear pain or discharge

[47]. Clinical staff need to know that otoscopic examination for OM should be a part of any assessment of a sick child, and that it should be conducted at least every 3 months at well-baby visits. Once otitis media is detected, appropriate follow-up is essential. The early detection of hearing loss can be facilitated by periodic questioning of the family or caregiver about a child's hearing and speech development. Middle ear disease, therefore, like many of the health problems of Indigenous people, requires a comprehensive approach that combines health and medical interventions with social and economic strategies.

The current policy approach acknowledges that ear disease and hearing loss must be considered within a comprehensive population-based approach to family, maternal and child health. A National Aboriginal and Torres Strait Islander Child and Maternal Health Policy Framework is currently under development [37]. Universal neonatal hearing screening is being considered in Australia, with Victoria and WA having already implemented pilot programs [4].

The use of antibiotics

Controversy remains regarding the role of antibiotics in prevention, but antibiotics are recommended (under certain conditions) for the management of all forms of OM other than dry perforation [47]. High doses and prolonged courses of antibiotics may be required [6] [7] [47].

In the general population, acute otitis media may resolve in up to 80% of children with analgesics alone – antibiotics increase this rate to 94% [4]. In populations of otitis-prone children, such as those from Aboriginal communities, antibiotics are recommended at the initial onset of OM (in view of the risk of suppurative complications), and they should be continued for longer than 5 days. Prolonged courses of antibiotics can reduce the number of new episodes of OM in children with recurrent ear infections by 42%.

In the north of Australia in the Aboriginal population generally, there had been an increasing and higher level of resistance to penicillin and ceftriaxone in pneumococci isolated from patients with invasive disease [49] [4] [50]. In a NT study of hospitalised Aboriginal children conducted in the mid 1990s, 27% of the

pneumococci carried in the nasopharynx of children demonstrated intermediate penicillin resistance and 34% demonstrated intermediate ceftriaxone resistance [51] [4]. Levels of pneumococcal resistance to penicillin decreased again following the introduction of the pneumococcal conjugate vaccine, but this situation will require ongoing monitoring. A trial of antibiotic treatment in the NT showed that many mothers could not comply with effective treatment because they lacked refrigerators. If they used a neighbour's refrigerator there was a tendency to forget the medicine. Medicine left at room temperature attracted sugar-ants and siblings [52] [4].

The place of surgery

If medical management of CSOM fails, there may be a necessity for surgery [53] [4]. For Aboriginal children the uptake of surgery appears to be less than for non-Aboriginal children [4]. Similarly, there may be a role for surgery in children with chronic OME and hearing loss greater than 35dB. Parents must be aware that any discharge through the inserted ventilation tubes must be treated aggressively with antibiotics to prevent the development of CSOM.

Sound amplification

The adverse effects of even mild hearing loss have been well known for some time [54] [55], but finding a culturally acceptable form of amplification for Indigenous children has presented some problems [44] [56]. As OM in many Aboriginal children is accompanied by a persistent discharge, the use of traditional hearing aids with ear moulds is not satisfactory. A bone-conduction hearing aid is generally more appropriate [7] and has met with some success [57], but some people have questioned its aesthetic acceptability [58]. Personal amplification for children with perforated eardrums is complicated also by our limited understanding of the short-term hearing fluctuations that are often associated with perforation and discharge [41].

Several forms of classroom amplification appear more promising for Aboriginal children with OM-related hearing loss. Sound-field amplification systems – designed to raise the teacher's voice by 10-15 dB – are recommended for schools in which the majority of children have a hearing loss of greater than 15 dB. At an individual level,

the introduction of FM amplification devices almost 20 years ago was described as a 'significant breakthrough' for hearing-impaired Indigenous children [59]. Designed for children with a hearing loss of greater than 30-35 dB, these personal amplification systems (consisting of microphones and portable FM radios) transmit the teacher's voice to lightweight non-occluding headphones [7].

General issues

Despite repeated calls for comprehensive programs and services incorporating community, medical, and educational strategies [4] [60] [46] the prevention and management of OM and associated hearing loss has been hindered by numerous factors:

- a frequent lack of effective primary health care services
- poor access to specialist services
- poor compliance with medical interventions
- a failure to recognise fully the underlying importance of poor social conditions in OM and hearing loss
- an incomplete understanding of the aetiology of OM in Aboriginal communities
- uncertainty regarding the most appropriate clinical practice [61] [28]

However, the lack of knowledge is considered a less important problem than the failure to apply existing knowledge [35]. Health programs are essential to control OM and hearing loss among Indigenous Australians, but reducing the burden of disease and associated complications will require a comprehensive and intersectoral approach that:

- addresses the environmental causes of OM
- specifically targets prevention
- increases early intervention [37].

General strategies

The first systematic national response to ear disease and hearing loss among Indigenous people was the National Aboriginal and Torres Strait Islander Hearing Strategy 1995-1999 [37] [62]. The strategy focused on strengthening the capacity of

comprehensive primary health care services to address ear disease and hearing loss in the 0-5 years age group. This included providing ear health training programs through Aboriginal community-controlled health services, the employment of Aboriginal health workers, and the supply of audiological equipment [4].

A review of the strategy led to the release of the *Report on Commonwealth Funded Hearing Services to Aboriginal and Torres Strait Islander Peoples: Strategies for Future Action* [37]. This report provides a set of policy principles and strategies to guide future action in the following areas: service delivery; workforce; access to, and the relationships between, primary, secondary, and tertiary ear health and hearing services; research; intersectoral collaboration; and local linkages. The need for action is particularly acute in remote, poorly-serviced areas, where persistently high levels of chronic OM and OM-related hearing loss among children reflect the limited effectiveness of current health services and inadequate access to tertiary hearing services [37].

The Commonwealth Hearing Services Program (CHSP), 2001 was aimed at reducing the prevalence of hearing loss in the community and the consequences of hearing loss for clients. One of the performance indicators for the program was the proportion of eligible Aboriginal and Torres Strait Islander people receiving hearing assistance under the program in relation to the total volume of program clients. The Commonwealth Government provides funding for CHSP (administered by the Office of Hearing Services) and the National Aboriginal and Torres Strait Islander Hearing Strategy (administered by the Office for Aboriginal and Torres Strait Islander Health (OATSIH)) [4]. Benefits under the CHSP include free hearing assessments, rehabilitation, and supply and fitting for hearing aids for children and adults. A recent review of the CHSP found an inequitable distribution of funds, with evidence the hearing needs of Aboriginal children were not being met [37].

The need to ensure the application of existing knowledge led to the first systematic review of OM in Australia [61]. Funded by the National Hearing Strategy and undertaken by NACCHO (National Aboriginal Community Controlled Health Organisation), with the assistance of an expert steering committee, the *Systematic review of existing evidence and primary care guidelines on the management of otitis*

media in Aboriginal and Torres Strait Islander populations documented what is known about the management of OM and identified research priorities.

This review led in turn to the development of *Recommendations for clinical care guidelines on the management of otitis media in Aboriginal and Torres Strait Islander populations* [47]. Prepared by a multi-disciplinary team based at the Menzies School of Health Research and the Office for Aboriginal and Torres Strait Islander Health Otitis Media Technical Advisory Group, this report looks at prevention, diagnosis, prognosis, management, and the practical considerations in health care delivery. It highlights the significant technical challenges involved in the clinical management of OM, and provides a diagnostic algorithm and six treatment algorithms. The recommendations outline the circumstances in which antibiotics and other medical therapies, audiological interventions, and surgical interventions are recommended for the various forms of OM.

Since correct diagnosis is really the key to the effective management of established disease, the guidelines provide a useful algorithm to assist in making diagnoses. Recommendations for the management of OM consider separately the management of:

- otitis media with effusion (OME)
- acute otitis media (AOM)
- acute otitis media with perforation
- recurrent acute otitis media (rAOM)
- chronic suppurative otitis media (CSOM)
- dry perforation [47].

If effectively implemented, the recommendations will improve the clinical management of OM in Indigenous populations [37]. The evidence-based guidelines should improve clinical practice by reducing uncertainty, improving consistency, and facilitating the implementation of medical interventions. The framework should lead to better health and less harm, and may reduce costs in the health sector [61]. However, researchers warn that information regarding the costs as well as the benefits of evidence-based health care interventions should be incorporated into

updates of the current clinical guidelines and made available to communities and families [35].

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