The role of Indigenous Health Workers in ear health screening programs for Indigenous children: a scoping review

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Abstract

Objective: To identify and describe the involvement of Indigenous Health Workers within ear health screening programs for Indigenous Peoples in Australia, Canada, the US and New Zealand.

Methods: Peer-reviewed and grey literature sources were systematically searched to identify evidence. This scoping review was conducted in accordance with the scoping review extension of the Preferred Reporting Items for Systematic reviews and Meta-Analyses guidelines.

Results: Forty pieces of evidence were included in this review. While almost all included studies identified the critical role of Indigenous Health Workers in ear and hearing health, Indigenous leadership and involvement in research projects and service delivery varied significantly and none of the included studies reported Indigenous health worker perspectives. Approximately half of the authorship teams had at least one Indigenous author.

Conclusions: There is a clear need for Indigenous leadership in ear and hearing health research and programming. Specialist teams involved in health service delivery and research need to enable this transition by understanding and privileging Indigenous leadership and investing in appropriate training for non-Indigenous specialists providing care in Indigenous health contexts.

Implications for public health: These findings are discussed in terms of opportunities to improve Indigenous ear and hearing health research and programming.

Key words: otitis media, Indigenous Canadians, Aboriginal and Torres Strait Islander, Community Health Workers, ear health screening

Despite the differences in time and place, Australia, Canada, the US and New Zealand share a similar colonial history, with the lived experience of colonisation and its continuing impact on health and social inequities similar for Indigenous Peoples in these countries (Supplementary File 1).[1] In these four high-income countries, the prevalence of ear disease and hearing loss is greater among Indigenous children than among their non-Indigenous counterparts.[2,3] For example, in Australia, ear and hearing problems among Indigenous children have been estimated as occurring at nearly three times the rate of those in non-Indigenous children (8.4% compared with 2.9%, respectively).[4] Indigenous children experience otitis media (OM) more frequently, for longer periods of time, and with more complications.[4] Key risk factors associated with a higher incidence of OM for Indigenous populations include rural and remote locations, crowded housing, poverty and social disadvantage, passive smoking and limited access to health and hearing services.[5] Hearing loss due to OM can impact speech, literacy, communication, social skills and cognitive development, which directly affects future educational outcomes, employment opportunities, interactions with the criminal justice system and social and emotional wellbeing.[6] Given the ongoing high burden of OM among Indigenous Peoples, the model of care must adapt to provide more equitable community-based and trans-disciplinary health services encompassing prevention, early intervention, community awareness and education and support for families from a child's birth into adolescence.[5,7]

Outreach visits by ear specialists to Indigenous communities are often infrequent, irregular and too short to allow for the necessary follow-up; as such, frontline primary health care services, including Indigenous Health Workers (IHWs), have a central role in the effective and sustainable prevention and treatment of ear disease.[7-9] IHWs are responsible for the delivery of a range of health services from community-based prevention programs to primary, secondary and tertiary services.[10,11] IHWs are becoming an increasingly indispensable workforce due to their ability to build on relationships of trust with communities and deliver healthcare that

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meets patient needs. There is a growing body of evidence linking the involvement of IHWs in service delivery to improved outcomes for Indigenous Peoples both clinically and socially, including health promotion and prevention and management of chronic disease.[12,13] However, IHWs are limited in their ability to meet the needs of their communities when working within Western systems and medicalised ideologies of health that inadequately recognise Indigenous understandings of wellbeing and ways of working.[14] As such, IHW provision of feedback and leadership in program evaluation is critical to the ear health of Indigenous Peoples.

While the IHW workforce is increasingly recognised as being essential to the provision of culturally safe healthcare to Indigenous communities,[10] there is currently inadequate understanding of the role of IHWs within ear health screening programs. This is partly due to a lack of recognition of IHW education and qualifications, IHW status within mainstream health service and academic settings, ear health and hearing screening skills developed through education and training, and the level of support and supervision received regarding ear and hearing health.[8,15] As such, the aim of this scoping review was to identify and describe the involvement of IHWs within ear health screening programs for Indigenous Peoples in four high-income countries. These countries share similar histories of colonisation and current health outcomes for Indigenous Peoples, yet differing treaty processes, health systems and recognition of the importance of Indigenous wellbeing. We anticipated the scoping review would identify opportunities to better support IHWs' engagement within ear and hearing screening, including the requirement for specialised training and upskilling, and could be used to advocate for greater investment in this workforce.

Methods

We conducted a scoping review following the standard four-step Joanna Briggs Institute (JBI) scoping review procedure.[16] In accordance with scoping review methodologies,[17,18] a review protocol detailing the search strategy, planned data extraction and synthesis was made publicly available.[19] The Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines (Supplementary File 2) were followed for the reporting of this scoping review.[20]

Eligibility criteria

Papers were deemed eligible for inclusion if they were published in English from 1 January 2000 until September 2021 and reported the involvement of IHWs in ear health screening programs or strategies implemented in Indigenous communities within Australia (Aboriginal, Torres Strait Islander), the US (Native American, Amerind), Canada (First Nations, Inuit, Métis), or New Zealand (Māori). For the purposes of this review, ear health screening programs were understood as any provision of services that included ear health and hearing screening via both objective and subjective clinical measures.

Information sources

Literature was identified by systematically searching the following indexed databases: OVID Medline, OVID Emcare, CINAHL, Scopus, Sociological Abstracts, PsychInfo, and Informit (Indigenous Collection, New Zealand Collection, Rural and Remote Health Database, Aboriginal and Torres Strait Islander health bibliography). The Australian Indigenous HealthInfoNet was also searched, as this is a known repository of community publications and reports. The following community and governmental websites were further searched for grey literature: Deadly Ears Program, National Aboriginal Community Controlled Health Organisation, NSW Department of Health, and the Ramahyuck District Aboriginal Corporation. Reference lists of articles included in this review were manually searched to identify any additional papers.

Search strategy

We developed a search strategy using both subject headings and keywords. Initial searches assisted in refining the search strategy, with the final search terms incorporating concepts of *ear health*, *hearing loss*, *health practitioner, Indigenous health worker*, *Indigenous health service*, *Australia*, *Canada*, *United States of America*, and *New Zealand*. The search strategy was modified according to the design of each database (Supplementary File 3).

Selection of sources

Search results were imported into Covidence (https://www.covidence.org/, Veritas Health Innovation Ltd, Melbourne, Australia) and duplicates were removed. A multi-step process was followed to screen the papers with each step of the screening process conducted by two independent reviewers (JS, MA). The reviewers were not masked to the author or journal names at any stage of the process. After title and abstract screening, all potentially relevant papers were sourced for full-text review. All articles were available to the authors through our institution's library. Full-text papers were assessed in detail using the inclusion criteria with reasons for exclusion documented. Discrepancies during the screening process were resolved through reviewer consensus discussions.

Data charting and variables

Data extraction was conducted by two reviewers (MA, BP), reviewed by two Indigenous researchers (LQ, RW) and the senior author (JS), and facilitated using a Microsoft Excel spreadsheet. Extracted data were mapped to pre-defined variables: authors, publication year, publication title, country, study aim, recruitment method, methodology IHW involvement, IHW terminology, study population, outcome measures, conclusions, and recommendations. Where data were missing or not clear, the researchers contacted the first author of the source papers for additional information and clarification.

Quality appraisal

While scoping review guidelines do not endorse conducting a quality appraisal of full-text papers,[16] this review has utilised the Aboriginal and Torres Strait Islander Quality Appraisal Tool.[21] The decision to utilise this quality appraisal tool was made in part because of the high representation of included studies from Australia, but more so the opportunity this tool provided in assessing the inclusion of Indigenous communities and IHWs across the included studies. The Aboriginal and Torres Strait Islander Quality Appraisal Tool is a set of 14 appraisal questions created to address the lack of attention to Indigenous epistemologies and values in standardised critical appraisal tools by offering guidance on how to assess the validity and contextual relevance for Indigenous health research.[21]

Both an Indigenous (LQ) and non-Indigenous reviewer (BP) completed the quality appraisal independently and then came together to discuss any discrepancies between scores. Questions in the tool include community consultation, involvement, leadership, and governance in research projects, data sovereignty of both existing and created data, the use of Indigenous research paradigms and strengths-based approaches (where Indigenous research paradigms are understood as those that reflect Aboriginal and/or Torres Strait Islander ways of knowing, being, and doing, based off knowledges and lived experiences of Aboriginal and Torres Strait Islander Peoples[21]), as well as policy translation, community benefit and capacity strengthening for Aboriginal and Torres Strait Islander Peoples. The 14 questions are scored as: yes (Y), partially (P), no (N), and unclear (U).[21]

Synthesis of data

Descriptive analyses, such as frequencies and proportions, were performed in Microsoft Excel using the built-in data analysis functions. There was minimal qualitative data extractable, so findings were combined with study recommendations and categorically synthesised to identify common attributes and findings across the included studies.

Results

Sources of evidence

On 9 July 2021, the systematic search identified 1018 publications (Figure 1). After the removal of duplicates, 720 publications were reviewed. Title and abstract screening identified 89 publications for full-text review. During the full-text review process, where the Indigenous status of health workers was unclear or there was limited information on the level of IHW involvement, we attempted to contact the authors for further information. An additional six papers and reports were identified from grey literature searches. As a result, screening identified 40 papers for inclusion in this scoping review.

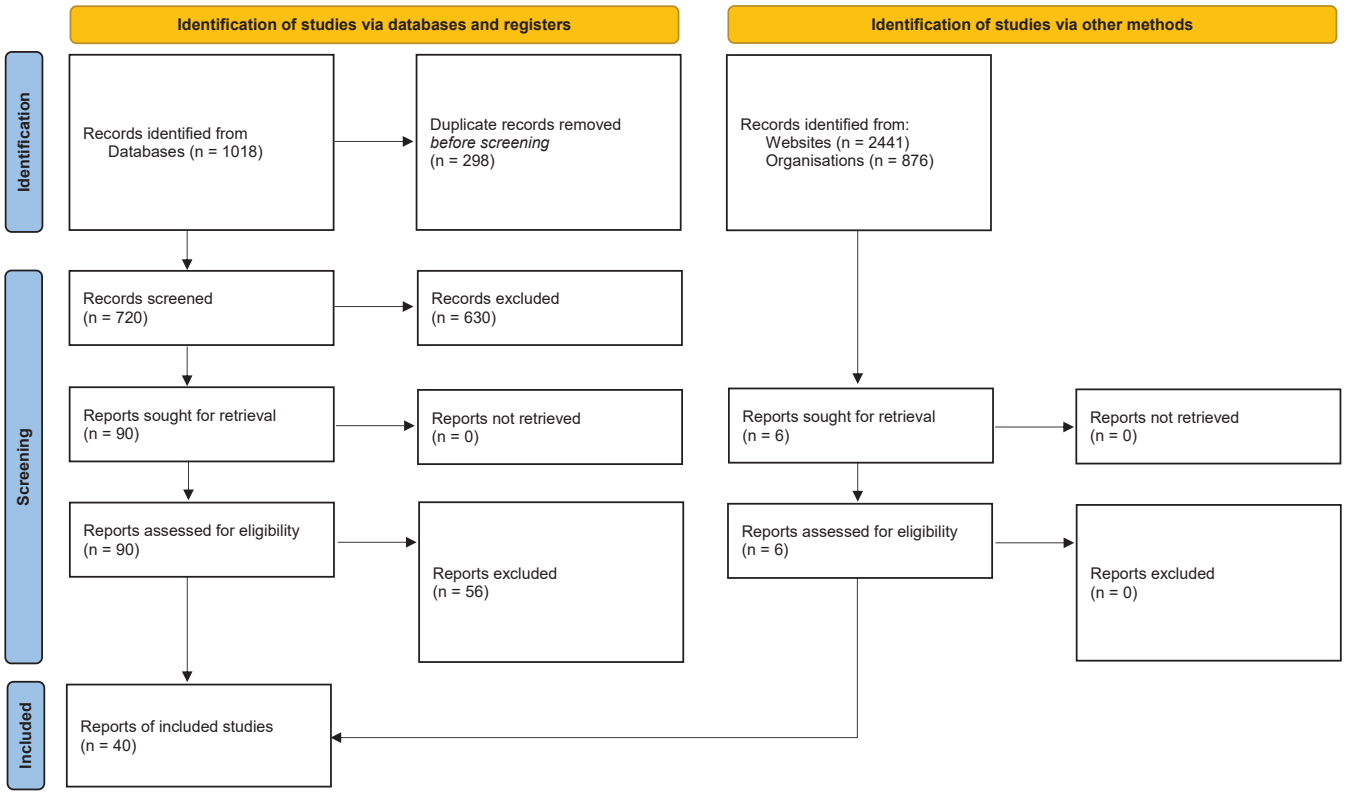
Quality appraisal

Two reviewers (LQ, BP) independently appraised the 33 (82.5%) peer-reviewed publications from Australia.[21] The reviewers had an inter-rater reliability score of 12.2 out of 14, calculated as the mean number of identical scores per article, indicating a high level of agreement (Supplementary File 4). The majority of articles included in the appraisal performed poorly across all measures of the tool, with only seven[22-28] of the 33 articles satisfying seven (50%) or more of the appraisal measures (Table 1).

Characteristics of sources of evidence

Of the 40 publications included in this review, 33 were from Australia, five were from the US and two were from Canada (Table 2). Program evaluation was the most common study design (N=11),[3,7,9,23,24,28-33] followed by descriptive reports (N=8),[5,15,22,25,34-37] exploratory studies (N=4),[38-41] cohort studies (N=4),[6,26,27,42] cross-sectional studies (N=3)[27,43-45] and feasibility studies (N=3)[46-48]; the remaining studies used a variety of analytical techniques and study designs. The language used to define IHWs varied across the studies, with Aboriginal health worker or AHW being employed most frequently (N=14)[6,15,22,25-27,29,32,33,38,39,43,46,49] and Indigenous health worker or IHW the second most commonly used term (N=6)[3,7,30,48,50,51] (Supplementary File 5). Three of the included studies only mentioned IHWs in their discussion or recommendations for future work.[6,32,48] These papers proposed IHWs as a potential solution to existing ear health screening

Figure 1: PRISMA flow diagram.[20]



challenges; however, these studies did not actively engage IHWs in any capacity within their research project or ear health screening program.[6,32,48]

Results of individual sources of evidence

Largely, the publications included in this review were measuring outcomes related to ear health screening programs involving IHWs in some capacity. Projects successfully increased the number of children screened[3,5,7,29,32] and identified telehealth as feasible and relatively accurate for clinical diagnosis and management of OM.[30,35,36,46-48,51-53] As documented in the literature, studies consistently reported high levels (ranging from 42% to 64%) of OM among Indigenous children.[26,27,33,42,49] Some included studies reported increased OM knowledge and correct diagnosis resulted in improved child behaviour,[22,31,38,43] school performance,[22,38] family life[22,38] and physical health.[43] Three studies primarily focused on strengthening ear health screening skills and confidence for IHWs[9,15,51] and one study stressed the importance of providing specialised training for non-Indigenous Health Workers to generate a better understanding of Indigenous health contexts.[35] Challenges research teams faced in maintaining the success of their screening programs included the resource-intensive nature of programs,[30] high healthcare and teaching staff turnover,[35,40] limited OM knowledge in communities and schools,[39,40] service accessibility[35,39] and limited evaluation methods.[35,43] Potential solutions to these challenges included supportive infrastructure,[24] funded staff and staff training opportunities,[24,37,51] as well as strategic multi-level collaborations across health, environmental and educational departments, especially in remote areas.[5,28,37,41,44] Authors highlighted the importance of community control and support for successful programs and research[25,41,45] and the importance of engaging in local contexts.[37]

Synthesis of evidence

Despite recognition of the importance of IHWs in ensuring culturally safe and appropriate ear screening programs almost ubiquitously across the studies in this review, IHW involvement in the research programs significantly varied. Five of the included studies did not utilise IHWs in any capacity for their projects but mentioned them in either their results or recommendations as potential solutions to current program limitations.[26,30,32,48] IHW involvement was synthesised into three overarching domains: service delivery, contribution to

Table 1: Results of the critical appraisal using the Aboriginal and Torres Strait Islander Quality Appraisal Tool.[21]

Author/Year	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14
Abbott et al. 2016[54]	N	N	Y	Y	N	N	N	N	N	N	P	N	P	N
Aboriginal and Islander Health Worker Journal 2003[22]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Adams et al. 2004[29]	N	N	N	N	N	N	N	Y	N	P	Y	U	Y	U
Ching et al. 2020[23]	Y	Y	Y	Y	P	N	N	N	Y	Y	Y	Y	N	Y
Clements 2005[24]	Y	Y	Y	Y	Y	U	U	Y	Y	Y	Y	Y	Y	Y
Couzos et al. 2003[49]	Y	Y	Y	Y	U	N	N	Y	Y	N	N	P	N	U
Couzos et al. 2005[25]	Y	Y	Y	Y	P	N	U	Y	N	Y	N	Y	N	P
Doyle et al. 2010[43]	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Durham et al. 2018[44]	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Eikelboom et al. 2003[9]	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y
Elliott et al. 2010[46]	Y	Y	N	N	Y	N	N	N	N	N	N	N	Y	N
Howard et al. 2006[38]	N	N	Y	N	N	N	N	N	N	N	N	N	N	N
Jacups et al. 2017[30]	N	N	N	N	N	N	N	N	N	N	N	P	N	N
Jacups et al. 2020[51]	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Jeffries-Stokes et al. 2004[39]	N	N	N	N	N	N	N	N	N	N	N	N	Y	N
Kong et al. 2021[55]	N	N	Y	N	N	N	N	N	N	N	N	N	N	N
Lehmann et al. 2008A[6]	Y	N	N	N	N	N	N	N	N	N	N	P	N	N
Lehmann et al. 2008B[26]	Y	P	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	N
McCarthy M. 2010[36]	N	N	N	N	N	N	N	N	N	N	N	P	N	N
McSwan et al. 2001[40]	N	N	N	N	N	N	U	N	N	N	N	N	N	N
Nguyen et al. 2015[50]	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N
Pearce et al. 2009[47]	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Rees et al. 2020[5]	Y	N	N	N	Y	N	N	N	N	P	P	Y	N	N
Reeve et al. 2014[32]	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Smith et al. 2006[48]	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Smith et al. 2012[7]	Y	N	Y	N	Y	N	N	N	U	P	Y	Y	Y	N
Smith et al. 2015[3]	N	N	N	N	N	N	N	N	N	N	N	Y	N	N
Stroud et al. 2020[37]	N	N	N	P	N	N	N	N	N	N	P	P	N	N
Swift et al. 2020[27]	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	U	Y	Y	Y
Walker et al. 2013[64]	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Williams et al. 2009[33]	N	Y	N	N	N	N	N	N	N	N	N	Y	Y	Y
Young et al. 2016[28]	Y	Y	Y	Y	Y	N	U	N	Y	Y	Y	Y	P	Y
Young et al. 2017[41]	N	N	Y	N	N	N	N	N	N	N	N	N	N	N

Notes:
Where Y = yes, P = partially, N = no, U = unclear

Table 2: Characteristics of included studies.

Study	Country	Study Aim	Methods for data collection and analysis	Participant characteristics and sample size
Abbott et al. 2016[54]	Australia*	Determine whether watchful waiting is non-inferior to immediate antibiotics for urban Aboriginal and Torres Strait Islander children with AOM without perforation	A non-inferiority multi-centre randomised controlled trial protocol	Children aged 2 – 16 years with AOM who are considered at low risk for complications
Aboriginal and Islander Health Worker Journal 2003[22]	New South Wales, Australia	Program was developed in response to concerns raised by the Aboriginal Students and Parents Association	Descriptive report	Indigenous children on the south coast of NSW (Katungal Aboriginal Medical Service) (N=72)
Adams et al. 2004[29]	Victoria, Australia	Describe the Gippsland Regional Indigenous Hearing Health Program (GRIHPH)	Audit and evaluation of ear health screen outcomes and management	Aboriginal children under 11 (N=126)
Ayukawa et al. 2014[34]	Quebec, Canada	Describe the extent of hearing problems, some solutions adapted to the north, and the training and role of Inuit hearing specialists.	Descriptive report	N/A
Billard 2014[35]	Quebec, Canada	Describe the Hearing and Otitis Program (HOP), its model of service delivery, the roles of the different contributors to the program, the challenges and avenues to ensure community-based aspects of the program are maintained.	Community-based model, descriptive report	N/A
Ching et al. 2020[23]	Australia*	Develop a parent-report measure to assess listening behaviours of young Aboriginal and Torres Strait Islander children below six years of age to increase detection of hearing/listening problems.	Co-design approach with AHW and early childhood teachers to develop the Parents' Evaluation of Listening and Understanding Measure (PLUM) listening skills questionnaire.	Aboriginal and Torres Strait Islander families with at least one child under six years of age (N=438)
Clements 2005[24]	Western Australia, Australia	Evaluate the Hearing Health Program which aims to improve both the service delivery to clients and hearing health outcomes for the Aboriginal and Torres Strait islander children in the Ipswich and West Moreton District.	Program evaluation	Indigenous children in the Ipswich and West Moreton District
Couzos et al. 2003[49]	Australia*	Compare the effectiveness of ototopical ciprofloxacin (0.3%; CIP) with framycetin (0.5%), gramicidin, dexamethasone (FGD) eardrops (5 drops twice daily for 9 days) together with povidone-iodine (0.5%) ear cleaning as treatments for chronic suppurative otitis media (CSOM) in Aboriginal children.	Community-controlled, community-based, multicentre, double-blind, randomised controlled trial	Children aged less than 15 years with at least 2 weeks of otorrhoea and TM perforation were eligible for inclusion. (N=111)
Couzos et al. 2005[25]	Australia*	Describe methodological issues and principles that underpin community-controlled health research and its practical application.	Descriptive report of community-controlled health research methods	N/A
Doyle & Ristevski 2010[43]	Western Australia, Australia	Understand health and education professionals' perceptions of the benefits and barriers of different ear health programs used in lower primary school classes.	Exploratory study with 25-item questionnaire with 9 closed and 16 open ended questions.	Health and education staff providing services to children in kindergarten to year three primary school classes. (N=61)
Durham et al. 2018[44]	Queensland, Australia	Identify which combination of activities, and at which level, hold the potential to facilitate systems changes to better support ear health among Aboriginal and Torres Strait Islander children	Mixed Methods: Review of available documents/policies/frameworks, as well as surveys and interviews	Community leaders, educators, healthcare workers and service providers involved in work with Aboriginal and Torres Strait Islander children and families. (N=27)
Eikelboom et al. 2003[9]	Western Australia, Australia	Gather feedback and evaluation from Aboriginal healthcare students undertaking a tele-ology course developed for primary care providers.	Pilot study and evaluation of tele-otology course	Students who were either completing the first year of their course or second year/ already practicing as health care workers. (N=30)
Elliot et al. 2010[46]	Queensland, Australia	Determine the feasibility of integrating a mobile telehealth-enabled ear, hearing, and vision-screening service with existing community-based health services for Aboriginal and Torres Strait Islander children in Australia.	Collaborative community intervention	Aboriginal and Torres Strait Islander children between 0 and 16 years, attending schools and day care centres in the South Burnett region of Queensland. (N=442)
Howard et al. 2006[38]	Northern Territory, Australia	Identify the impacts of conductive hearing loss on family life	Interviews	Aboriginal Health Workers, Aboriginal mothers, nurses working in Aboriginal communities. (N=10)
Hunter et al. 2007[42]	Minnesota, United States of America	Determine hearing screening results of an American Indian birth cohort	Prospective cohort study	Maternal eligibility criteria were: >16 years old, American Indian (or infant's father was American Indian). (N=421)
Jacups et al. 2017[30]	Western Australia, Australia	Review an innovative service provision model, developed by the regional Health and Hospital Service (HHS) which aimed to mitigate patient risk associated with long wait times for ENT surgery, and present findings alongside the clinical and hearing outcomes of patients, as a quality assurance process to inform the development of improved ENT services within the region. Findings may be applicable to other Health services faced with a backload of elective surgical waitlists that routinely place patients at increased risk.	Surgical cohort audit	Long term category 2 ENT surgical waitlisted Indigenous children 0-15 were reviewed from referral data submitted to the regional referral hospital; each record was clinically assessed for inclusion in the surgical cohort. (N=16)

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Table 2 cont.: Characteristics of included studies.

Study	Country	Study Aim	Methods for data collection and analysis	Participant characteristics and sample size
Jacups et al. 2020[51]	Queensland, Australia	(1) Outline primary health care clinicians' current ENT concerns; (2) Gain ENT stakeholders' perspectives in the current gaps and barriers to ENT services in the region; (3) Make recommendations for a new ENT service model.	Participatory action research; mixed-methods study: primary health care (PHC) clinician's survey, stakeholder discussion forum and follow-up stakeholder survey	Clinicians and stakeholders with vested interest in ear and hearing health service delivery in Cape York. (N=37)
Jeffries-Stokes et al. 2004[39]	Western Australia, Australia	Explore perceptions, knowledge and experience of otitis media (OM) and barriers to compliance with treatment among Aboriginal people of the Kalgoorlie-Boulder area, Western Australia.	Qualitative applied research with a holistic design of naturalistic enquiry, analysed with grounded theory	Community members of the Wongutha Aboriginal community in Kalgoorlie-Boulder. (N=78)
Kleindienst 2014[53]	Alaska, United States of America	Investigate (1) the value of combining tympanometry with video otoscopy for otolaryngologists' remote diagnoses of OM and (2) the reliability of on-site audiologists' interpretation of tympanometry compared to the off-site interpretation.	Observational study	Audiologists and otolaryngologists from Alaskan health services. (N=11)
Kokesh et al. 2008[52]	Alaska, United States of America	Determine if video otoscope still images of the tympanic membrane taken in remote clinics are comparable to an in-person microscopic examination for follow-up care.	Comparative concordance, diagnostic reliability	Alaskan Native patients who had TT placement in the prior two years. (N=35)
Kong et al. 2021[55]	Northern Territory, Australia	Improve the ear and hearing health of Aboriginal children living in the Northern Territory.	Open cohort stepped-wedge cluster randomised superiority trial protocol.	Communities in the Northern Territory.
Lehmann et al. 2008[6]	Western Australia, Australia	(1) Identify important, avoidable risk factors for OM in Aboriginal and non-Aboriginal children in the Kalgoorlie-Boulder area of Western Australia; (2) to understand how these risk factors arise and interact in the complex causal pathways in order to develop effective intervention strategies.	Prospective cohort study	Aboriginal and non-Aboriginal children born in Kalgoorlie Regional Hospital. (N=280)
Lehmann et al. 2008[26]	Western Australia, Australia	Report the burden of OM in Aboriginal as well as non-Aboriginal children aged <2 and assess the use of TEOAEs in the first three months of life in predicting subsequent risk of OM before age 2 years	Cohort study	Aboriginal and non-Aboriginal children born in Kalgoorlie Regional Hospital. (N=280)
Martin et al. 2017[31]	Oregon, United States of America	Determine the sustainability of a community-based noise-induced hearing loss and tinnitus prevention program in three different types of American Indian settings.	Analysis of records of ear testing carried out over a 6-year period in three primary schools in Perth.	Participants were 4th and 5th grade children and interested community members from three communities in Oregon (N=200)
McCarthy 2010[36]	New South Wales, Australia	Describe how the Royal Institute for Deaf and Blind Children (RIDBC) Teleschool was adapted to increase uptake among remote Indigenous communities.	Descriptive report	N/A
McSwan et al. 2001[40]	Queensland, Australia	Reduce the incidence and effects of OM in two target community; raise community awareness of OM over a year (1997); raise teacher and child awareness of OM on children's learning; improve learning outcomes of children suffering from OM; have teachers develop strategies and materials to reduce effects of children's hearing loss; empower students to exercise control over their learning; embed appropriate practices in local communities; produce a kit of learning materials and teacher resources for each school	Interviews	People involved in program implementation were recruited to participate in phone interviews or personal interviews (i.e. principals, teaching aides, ACCHS workers).
Milera J & Elarde T. 2012[15]	Australia*	Provide an overview of the NACCHO Ear and Hearing Training for the AHW Workforce Project	Descriptive report (presentation – grey literature)	N/A
Nguyen et al. 2015[50]	Queensland, Australia	Assess the cost-effectiveness of a supplemental mobile telemedicine-enabled ear health screening and surveillance service for Indigenous children living in regional communities compared with the existing outreach screening and surgical service alone.	Cost-utility analysis	Community members from Cherbourg, Queensland.
Pearce et al. 2009[47]	Australia*	Explore the feasibility of an alternative means of delivering services	Pilot program	Individuals needing hearing aid fitting and tuning (N=5)
Rees et al. 2020[5]	New South Wales, Australia	Present the development and implementation of the Hear our Heart Ear Bus Project (HoHEBP) within a regional city in western NSW, Australia. Explore how the program supports families of both Indigenous and non-Indigenous children with OM.	Qualitative narrative of the development, implementation, and refinement of the HoHEBP.	Children accessing HoHEBP services (N=1290) and directors of HoHEBP (N=3)
Reeve et al. 2014[32]	Western Australia, Australia	Reduce waiting lists for ENT specialist and improve primary ear health care.	Retrospective audit of medical records before and after implementation of an ear health program	School children in Aboriginal communities in the Fitzroy Valley of Western Australia. (N=858)
Robler et al. 2020[45]	Alaska, United States of America	Clearly describe how stakeholder/community involvement and participation influenced the design of this community randomized trial.	Community-engaged research, focus groups	Community members and stakeholders within the healthcare and education sectors (N=116)

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Table 2 cont.: Characteristics of included studies.

Study	Country	Study Aim	Methods for data collection and analysis	Participant characteristics and sample size
Smith et al. 2006[48]	Queensland, Australia	Compare the accuracy of assessments made in the conventional face-to-face (FTF) manner with assessments made using pre-recorded information, i.e., history and video recording of the ears, nose, face, and throat.	Pilot study of the accuracy of pre-recorded video in ENT assessments	Patients who attended outreach clinics at a regional hospital in a central Queensland Indigenous community were invited to participate (N=58)
Smith et al. 2012[7]	Queensland, Australia	Examine the outcomes of the first three years of operation of the screening service.	Retrospective review of service activity between January 2009 and December 2011.	Children accessing school screening services. (N=1053)
Smith et al. 2015[3]	Queensland, Australia	Examine whether there were changes in screening activity, fail and referral rates over time.	Retrospective review of service activity over a six-year period, from Jan 2009–Dec 2014.	Children accessing mobile ear screening service in South Burnett. (N=3105)
Stroud et al. 2020[37]	Western Australia, Australia	This paper provides a historical perspective of the current situation and discusses each of the recommendations from Aboriginal Health Practitioners working within their community.	Descriptive report	N/A
Swift et al. 2020[27]	Western Australia, Australia	Determine the prevalence and risk factors associated with OM in Aboriginal infants residing in an urban area.	Prospective cohort study	Aboriginal children living in the South Metropolitan Perth area, enrolled prior to 12 weeks of age. (N=125)
Walker et al. 2013[64]	Western Australia, Australia	Explore health professionals' views about Australian Indigenous people's health and the delivery of healthcare to them in the Pilbara region of Western Australia.	Interviews, thematic analysis	Health professionals located across diverse regions in the Pilbara. (N=28)
Williams et al. 2009[33]	Western Australia, Australia	Describe diagnoses and correlates of middle ear disease in Aboriginal primary school children in a targeted school-testing program in Perth, Western Australia	Retrospective review of service activity between November 1998 - November 2004	Aboriginal children accessing screening services in three urban primary schools. (N=119)
Young et al. 2016[28]	New South Wales, Australia	Describe and evaluate Hearing EAr health and Language Services (HEALS), a New South Wales (NSW) health initiative implemented in 2013 and 2014 as a model for enhanced clinical services arising from Aboriginal health research.	Case-study with mixed-methods evaluation (service delivery data audit and semi-structured interviews)	All patients accessing services during the study period were included in the audit. (N=653). Caregivers of children who received services and health service professionals were invited to partake in interviews. (N=38)
Young et al. 2017[41]	New South Wales, Australia	Describe stakeholder perspectives on the structure and processes of the HEALS programme that led to the improved access to specialist health services for Aboriginal families	Interviews, thematic analysis	Workers from partnering ACCHS as well as parents/caregivers of children who participated in HEALS. (N=37)

Note:
*Where * indicates multiple sites*

the research project and participation in research (Supplementary File 6). In terms of service delivery, IHWs were most commonly responsible for the delivery of ear screening programs.[3,5,7,22,24,25,28,29,32,33,35,46,47,49,50,52] IHWs also acted as a liaison between community members and audiology programs,[30,35,36] coordinated referrals and follow-ups,[32,46] delivered ear health education[24,31] and assisted families in the coordination of appointments and accommodation.[22,36] Four studies provided service delivery training to IHWs, including OM diagnosis, video-otoscopy, tympanometry and telehealth software[34,52,54,55]; two studies provided research training including research skills, evidence-based management of OM and data collection.[6,54] IHWs contributed to the development and design of two research projects[23,37] and assisted with research coordination in six studies.[6,25,27,39,46,54]
While nine studies included IHWs as participants,[9,28,38-41,43,44,51] these studies did not ask the IHWs about their specific involvement in ear health programming, rather they were asked about the impact of hearing loss on family life, perceptions of OM among communities, and to evaluate training or screening programs. Further, in seven out of nine studies that included IHWs as participants, IHWs did not constitute the majority of respondents and the respondents' Indigenous status was not clarified, making it impossible to determine which data reflected IHW perspectives.[28,38-41,43,51] Four studies funded positions for IHWs in order to minimise the burden of research on community health services and provide an opportunity for the professional development of the health workers.[25,28,46,54]

None of the included studies reported asking IHWs about their perspectives on the implementation of ear screening in their communities, therefore, a meta-synthesis of IHW perspectives was not possible. One grey literature report on the outcome of a national training program for IHWs in Australia was the only source to include quotations from IHWs reflecting on the success of the program in strengthening ear health screening skills and confidence among participants.[15]
Due to the limited data available from IHWs' perspectives, the reviewers sought to understand the role of Indigenous researchers in the field of ear and hearing health by determining, where possible, the Indigenous status of authors across the included studies. Of the 174 authors of sources included in this review, 43 authors were confirmed as identifying as Indigenous, 124 were confirmed as non-Indigenous, and seven were not able to be verified either way. Of the 43 Indigenous authors, 18 were confirmed as either current or former IHWs. Further, 23 out of 40 (57.5%) authorship teams had at least one Indigenous author. To further explore the role of Indigenous communities in the included projects, the reviewers examined the acknowledgement sections of the included publications. Twenty-three authorship teams expressed gratitude for the support of Indigenous communities, organisations, health services, or IHWs[3,6,7,23,25-29,31-33,35,39,41,42,45,46,49,51,53-55]; eight authorship teams did not mention

Indigenous organisations[5,9,30,34,43,44,47,48] and nine publications did not have an acknowledgements section.[15,22,24,33,36,38,40,50,52]

Discussion

This review identified 40 studies where the involvement of IHWs workers was discussed in relation to ear health screening programs for Indigenous children in Australia, Canada, New Zealand and the US. However, none of these studies reported IHW perspectives on their role in the delivery of ear and hearing health programming for Indigenous children. Nevertheless, these studies highlight the importance of IHWs in the delivery of culturally safe ear health programming and emphasise the critical role of community collaboration in ensuring the success of preventive ear health and screening services.

Summary of evidence

This review highlights the need to prioritise IHW involvement and leadership in the delivery of ear and hearing health programs and provides the necessary evidence base for future research in this area. Multiple benefits would come from a culturally responsive and reflexive approach to ear and hearing health for Indigenous communities that emphasises the need for changed service delivery models to include Indigenous leadership opportunities, flattened hierarchies, cultural training for non-Indigenous specialists and adequate support for IHWs involved in ear and hearing health programming. First and foremost, ensuring IHWs have direct input into the development, delivery and evaluation of ear health screening programs through the establishment of leadership roles in this area will ensure cultural safety of ear and hearing health programs and will improve the quality of care for patients.[13] Additionally, IHWs are well placed to identify the strengths and limitations of ear screening programs and have the capacity to raise awareness of ear disease among Indigenous communities.[56] IHWs must be central in the development, implementation, delivery, evaluation and enhancement of ear and hearing health services; this level of involvement is necessary to achieve increased screening and, therefore, improved ear health for Indigenous children.[57] Similar to findings from O'Donovan and colleagues' review of community health workers' roles in ear disease, few of the included studies demonstrated long-term results.[56] While the papers included herein all referenced IHWs, there was limited involvement across the entirety of research programs and in leadership roles.

IHWs provide a variety of health services, from community prevention to primary, secondary and tertiary care for Indigenous communities and are becoming an increasingly qualified workforce.[11,58] Dickinson[59] has described the seamless connection between the professional and personal roles of IHWs in their communities. While often challenging, IHWs explain navigating their visibility and availability as a health worker in their community as necessary to providing quality care; a responsibility described by IHWs as poorly understood by their non-Indigenous colleagues.[60] This is one example of the many idiosyncrasies between Indigenous health paradigms and a dominant culture's understandings of health, which stress the fundamental role of IHWs in matters of Indigenous health. The Australian Government has acknowledged the significance of IHWs for Indigenous health and as such, has allocated funds for the expansion of services offered by IHWs, including programs to address avoidable deafness.[61] To ensure targeted and strategic use of Indigenous healthcare budgets, the work, treatment, utilisation, workforce integration and leadership of IHWs must be centred in discussions of Indigenous health priorities and related budgetary allocation. The Centre of Research Excellence in Ear and Hearing Health of Aboriginal and Torres Strait Islander Children (CRE ICHEAR) has similarly called for the need to prioritise Indigenous leadership in ear health programs and research projects to ensure Indigenous leadership in the future.[37] Ongoing programming should publicly report information about Indigenous involvement in service provision to enable a more comprehensive understanding of current efforts in Indigenous ear health; reporting and measuring progress on targets is part of the national Closing the Gap agreement in Australia.[62] Despite the established importance of IHWs as core members of the healthcare team,[10] papers included in this review provided limited opportunities for IHWs to express their opinions regarding ear health services. Most of the included studies adequately described the role and capacity of IHWs in ear and hearing health screening; however, providing a more in-depth discussion of the process of Indigenous community and health worker engagement and contribution to studies and screening programs would benefit other programs.[56]

Limitations

The majority of the publications included in this review were from Australia (N=33), which may be partially due to the focus on Australian contexts in the grey literature search; this explains the frequent use of the terminology Aboriginal Health Worker, or AHW, as this is the commonly used terminology in Australia.[63] The systematic search did not identify any articles from New Zealand eligible for inclusion in this review, highlighting a limited evidence base regarding IHW involvement in ear screening in New Zealand. Further, the systematic search identified few non-research programs; it is likely that IHW involvement in ear screening is therefore understated. Seven of the 40 studies included in this review did not undergo quality appraisal from an Indigenous perspective because the tool used to perform appraisal is specific to publications related to Aboriginal and Torres Strait Islander Peoples, that is, the Australian context. In addition, the quality appraisal tool[21] used for evaluation herein was published after the majority of the studies included in this review. As such, items included in the appraisal tool may have been considered during the establishment, development and conduct of the various studies but may not have been reported in the published studies. As such, in this review, we can only recognise that studies did not report on aspects related to Indigenous community involvement. Furthermore, despite best efforts to include all relevant terms for IHWs, there is no uniform definition of IHW across the countries included in our search, and as such, some works may have been missed. Finally, despite contacting the primary authors of included papers, we were unable to confirm the Indigenous status of seven authors and therefore, Indigenous representation on authorship teams may be underreported.

Conclusions

Ear and hearing health research and programming must prioritise Indigenous leadership. Specialist healthcare and research teams supporting ear and hearing health service delivery for Indigenous children must shift professionally, culturally and institutionally to enable this needed transformation. This includes investing in

cultural safety training for non-Indigenous specialists, providing adequate upskilling opportunities and interrogating whiteness and the mainstream health systems in which they operate. Understanding, privileging and strengthening Indigenous leadership will strengthen ear and hearing health services by ensuring community needs are articulated and adequately addressed. Indigenous and IHW leadership will contribute to long-term ear and hearing health as well as sustainable prevention programming for Indigenous communities.

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Supporting Information

Additional supporting information may be found in the online version of this article:

Supplementary File 1: Note on Terminology.

Supplementary File 2: Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist.

Supplementary File 3: Search strategy.

Supplementary File 4: Inter-rater reliability score.

Supplementary File 5: IHW Terminology.