The effectiveness of Ear Nose and Throat outreach programs for Aboriginal and Torres Strait Islander Australians: a systematic review

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Abstract

Background: Aboriginal and Torres Strait Islander children experience a higher prevalence of ear, nose, and throat (ENT) diseases than non-Indigenous children. Many programs exist that aim to prevent and treat these diseases. Culturally appropriate and timely specialist outreach services may help improve access, service use, and outcomes but there has been a lack of rigorous evaluation of ENT outreach programs to date.

Objective: To examine the ability of ENT outreach programs to improve health outcomes among Aboriginal and Torres Strait Islander people

Methods: We performed a systematic literature search of nine databases (Medline, CINAHL, PsychINFO, Embase, Cochrane, Scopus, Global health, Informit Rural health database and Indigenous collection) and grey literature sources for primary studies evaluating ENT outreach services for Aboriginal and Torres Strait Islander Australians. Two authors independently evaluated the eligible articles and extracted relevant information.

Results: Of the 506 studies identified, 15 were included in this review. These 15 studies evaluated eight different programs/activities. Studies were heterogeneous in design so a meta-analysis could not be conducted. Seven studies measured health-related outcomes in middle ear or hearing status; six reported overall positive changes one reported no clinically significant improvements. Five programs/activities and their corresponding studies involved Aboriginal and Torres Strait Islander people and organisations in delivery and evaluation, but involvement in program or study design was unclear.
Conclusion: While some studies demonstrated improved outcomes, the overall ability of ENT programs/activities to improve health outcomes for Aboriginal and Torres Strait Islander children is unclear. The impact of ENT outreach may be limited by a lack of evidence quality, a lack of coordination of services, and the provision of potentially unsustainable services. Improvements in the quality of evidence, service coordination and sustainability would likely improve health outcomes.

Strengths and limitations of this study

- Studies were identification based on a clearly defined and extensive search strategy based on a priori inclusion and exclusion criteria
- Study appraisal was performed using a relevant tool for mixed methods studies
- The involvement of Aboriginal and Torres Strait Islander people in all aspects of programs and their evaluation was examined

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Introduction

Aboriginal and or Torres Strait Islander people represent the oldest continuous living culture in the world, despite ongoing inequities since colonisation [1]. Aboriginal and or Torres Strait Islander children experience a markedly higher prevalence of ear, nose, and throat (ENT) diseases compared to non-Indigenous children [2-4]. Complex historical, cultural and economic factors experienced by Aboriginal and or Torres Strait Islander people since colonisation have interacted with behavioural and biological risk factors to influence this prevalence [2, 4].

The main condition contributing to this prevalence is otitis media, which is the inflammation of the middle ear, usually caused by bacterial and viral pathogens [4]. Compared to non-Indigenous children, Aboriginal and or Torres Strait Islander children tend to experience this
preventable and treatable condition at a younger age, more frequently, persistently, and severely, and with more serious complications [3, 5]. Community-based studies have shown the prevalence of otitis media and its complications at up to 73% in those under 12 months of age, and whole communities with otitis media affecting 91% of children [5]. This prevalence is likely perpetuated by socioeconomic factors including poverty, overcrowding, poor nutrition and infrastructure, exposure to cigarette smoke, and limited access to primary health care and treatment [3, 4, 6, 7].

The conductive hearing loss that results from untreated, chronic suppurative otitis media is responsible for the greatest burden of educational, social, and financial sequellae [3]. This is estimated to be 10-30% among Aboriginal and Torres Strait Islander children, well above the World Health Organisations cut off for ‘a massive public health problem requiring urgent attention’, which they quote as above 4% [3]. Hearing loss contributes to early learning difficulties including speech delays with resulting low self-esteem, poorer education outcomes [8, 9] and a significant economic burden [4]. This significant impact affects their long-term quality of life and life opportunities.

The majority of otitis media is managed in primary healthcare with referral to ENT specialists for assessment and surgical interventions where appropriate [10]. In Australia, referral to ENT specialists care is complex and varies across jurisdictions, with limited access to public ENT clinics [11]. However, in rural and remote settings, Aboriginal and or Torres Strait Islander children face wait times that are longer than recommended for audiology testing and ENT services, with a higher likelihood that these services are unavailable. While the practice of most ENT surgeons in Australia is largely confined to metropolitan areas, fewer participate in outreach clinics to rural and remote areas [11]. To access ENT specialist services, patients are generally required to overcome barriers including travel, culturally inappropriate services, and unfamiliar health-system processes [12, 13]. Furthermore, the
current system fails to routinely deliver care that aligns with government guidelines [14], nor provide culturally safe and accessible clinical pathways. Outreach services mobilise the expertise of health care teams and individual practitioners away from their usual place of work, generally to an underserviced area. This may take the form of traditional fly-in-fly-out services, or newer remote telemedicine enabled services. These services may be in a unique position to combat the challenges faced by the current system, with evidence for improved access, outcomes, service use, and less disruption to patient and family life when employed with well-functioning primary care services [15-18]. The aim is to provide a service that is truly accessible by the Aboriginal and or Torres Strait Islander community.

While the role and benefits of outreach services are generally well recognised, rigorous evaluation of existing outreach programs is lacking, including those pertaining to ENT specialties, and as such, little is known about the impact and outcomes of such programs [19, 20]. The result is the implementation of programs without sufficient planning or evidence base [2]. This review aims primarily to examine the ability of ENT outreach programs to improving Aboriginal and Torres Strait Islander health outcomes, and secondarily to elucidate factors predicting success, and barriers to success of such programs.

Methods

Study design

This study is a systematic review of peer-reviewed and grey literature and is reported using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement guidelines [21]. The study was registered with PROSPERO International prospective register of systematic reviews (CRD42019134757) [22].

Eligibility criteria
This review sought to identify studies that supplied ENT outreach services to Aboriginal and or Torres Strait Islander Australians and provided data to evaluate their aims. Studies were included according to the following criteria

- Population: all or predominately Aboriginal or Torres Strait Islander Australian participants
- Intervention: ENT outreach services including but not limited to screening, management, or rehabilitation of ENT disease
- Comparator: as determined by the nominated study
- Outcome: as determined by the nominated study
- Study design: all study types

The search was limited to English language studies published between 2000-2018 inclusive. Studies were excluded if they did not provide primary data; or if they were descriptive only or aimed to identify the incidence or prevalence of disease without intervention or referral for subsequent treatment. The former criteria are applied as it necessarily precludes an objective evaluation, while the latter is applied as programs without intervention or referral pathways do not improve the health of Aboriginal and or Torres Strait Islander Australians [23].

Search strategy

Nine online databases (Medline, CINAHLs, PsychINFO, Embase, Cochrane, Scopus, Global health, Informit Rural health database and Indigenous collection) were searched for published articles between December 2018 and January 2019. An example search is provided in Appendix 1. A grey literature search of relevant government and non-government websites was conducted including the Rural Doctors Network, Australian Indigenous HealthInfoNet, Australian Institute of Health and Welfare, Rural Health, The Lowitja Institute, Australian state and national government health departments. Where conference papers were identified or a study’s full text unavailable, contact was made with authors to source original data. The
reference lists of included studies, and other systematic reviews identified in the literature search, were screened for additional eligible studies.

**Study selection process**

Following duplicate removal, the first and second author screened a random sample of 25% to identify studies congruent with the inclusion criteria. Discrepancies were resolved by consensus between the two authors and the first author screened the remaining studies. This process was repeated for articles identified in the grey literature. The first and second authors independently assessed full texts for eligibility. Discrepancies were resolved by consensus, generating a final list of studies for inclusion.

**Data extraction and synthesis**

Data from included studies were extracted according to program characteristics (Program name and aims, operating years, State/Territory, Area, Setting, Disease focus, Indigenous capacity building) and evaluation characteristics (study aim, study type, outcome measures, participant number and age, main findings). The first and second authors independently extracted a sample of texts and reviewed results, with discrepancies identified and resolved by consensus. The first author extracted the remaining texts according to consensus. Where studies also reported on outreach services of other specialties, only ENT-specific outcomes were included in this report. Studies were analysed in a qualitative synthesis. Meta-analysis was deemed inappropriate due to the small study sample sizes, mixed methods study inclusion, and the heterogeneity of the study designs and outcome.

**Risk of bias**

Risk of bias was assessed using the Mixed Methods Assessment Tool (MMAT) [24]. The first and second authors independently assessed a sample of studies and reviewed results with discrepancies identified and resolved by consensus. The first author assessed the remaining texts according to consensus.
Results

Study selection

The database search, grey literature, and hand search identified 930, 34 articles, and 5 studies respectively, with 506 remaining following duplicate removal. Of the 506 studies that were screened, 434 were excluded and 72 underwent full-text review. A further 54 were excluded ultimately leaving 15 articles included in the review (Figure 1).
Figure 1. PRISMA flow chart

Records identified through database searching (n = 930)
- Additional records identified through other sources (n = 39)

Records after duplicates removed (n = 506)
- Records screened (n = 506)
  - Records excluded (n = 434)

Full-text articles assessed for eligibility (n = 72)
- Studies included in qualitative synthesis (n = 15)
  - Full-text articles excluded, with reasons (n = 57)
    - Not outreach programs
    - No data provided to support evaluation
    - Full text unavailable
    - Incidence/prevalence data only
    - Outdated version of report with undated version available
Program characteristics

Table 1 provides the program/activity characteristics of included studies
| Reference          | Program/activity name (where given) and aims                                                                 | Operating years | State/Territory Area Setting | Disease focus                                                                 | Program/activity details                                                                                                                                                                                                 | Indigenous capacity building |
|--------------------|----------------------------------------------------------------------------------------------------------------|----------------|-----------------------------|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| AIHW, 2018 [25]    | 1. Northern Territory Outreach Hearing Health Program: Provide outreach services for the early detection, treatment, & management of ear diseases and hearing health problems | 2007-2017      | NT Regional/Remote Community & health | Otitis media, eustachian tube dysfunction                                      | Service delivery: health education, promotion and prevention, outreach audiology services, ENT teleotology services, Clinical Nurse Specialist (CNS) services                                                | Not stated                    |
| Durham et al., 2018 [26] | 2. Deadly Ears Aboriginal and Torres Strait Islander Ear Health Program: Early detection, monitoring, and treatment to reduce incidence & impact of Otitis Media and Conductive Hearing Loss | 2007-present   | Qld Urban, regional, remote Community, health, education | Otitis media                                                                   | Multi-sectoral activities at different levels of the health system (policy, service providers, local community) including provision of support & training to service providers and mobile ENT services | Involvement of AHWs/IHWs, partnership with community-controlled health organisations |
| Elliott et al., 2010 [27] | 3. The Mobile Telemedicine Enabled ear-health screening and surveillance (MTESS) service: Supplements Deadly Ears to complement and extend existing community-based services by providing more comprehensive assessment of high-risk children in South Burnett | 2009-2014      | Qld Urban, regional, remote Community, health, education | Otitis media                                                                   | Screening clinics conducted at schools, clinical results uploaded to a database where ENT surgeons remotely reviewed the results and devised treatment plans. ENT outreach clinics were held every 6 months, facilitating review and surgery for select patients at the local hospital. | Involvement of AHWs/IHWs, partnership with community-controlled health organisations |
| Nguyen et al., 2015 [28] |                                                                                                                   |                |                             |                                                                               |                                                                                                                                                                                                                         |                               |
| Smith et al., 2015 [29] |                                                                                                                   |                |                             |                                                                               |                                                                                                                                                                                                                         |                               |
| Smith et al., 2013 [30] |                                                                                                                   |                |                             |                                                                               |                                                                                                                                                                                                                         |                               |
| Smith et al., 2012 [31] |                                                                                                                   |                |                             |                                                                               |                                                                                                                                                                                                                         |                               |
| Fernee and Sockalingam, | 4. ENT Outreach Project Prevent, identify and treat ear disease                                                      | 1998-2000      | Qld Remote                  | Otitis media                                                                   | Patients identified through the Project underwent surgical procedures,                                                                                                                                                     | Not stated                    |
| Year | Initiative | Description | Location | Specialties | Access to Care | Key Outcomes |
|------|------------|-------------|----------|-------------|----------------|--------------|
| 2002 [32] | and hearing loss | Community, health | performed in or close to patients’ home communities with subsequent post-surgical follow-up | Gruen et al., 2001 [12], Gruen et al., 2006 [33] | 5. Specialist Outreach Service in the NT (SONT) Improve access to appropriate specialist care, provide general surgery, gynaecology, ophthalmology and ENT visits to ten communities. | 1990 - 2001 NT, Remote, Community, health Multiple surgical specialities, including ENT Visiting-specialist clinics in general surgical, ophthalmological, gynaecological, and ENT specialties operate on a sessional basis. New & follow-up patients seen in communities with equipment brought by the specialist. Minor procedures completed on site, complex procedures required patient travel to hospital | Not stated |
| 2016 | 6. Eye and Ear Surgical Support Service (EESSS) Improve hearing outcomes for remote living children | Qld, Remote Health Otitis media | Direct flight charter of group of patients to a regional private hospital for ENT surgery. Post-operative clinical review occurred in communities by telehealth review (day 1 and 6 weeks) and audiology by visiting audiologist (6-8 weeks). | Jacups et al., 2017 [14], Jacups et al., 2018 [13] | 6. Eye and Ear Surgical Support Service (EESSS) Improve hearing outcomes for remote living children | 2016 Qld Remote Health Otitis media | Involvement of IHWs, partnership with community-controlled health organisations |
| 1986-2002 | 7. ENT Outreach Program (no name) Provide ENT outreach for consultations, surgery, post-operative follow-up and fitting of hearing aids | WA Regional, remote Community, health Otitis media | Myringoplasty surgical procedure for children with Chronic suppurative otitis media (CSOM) during a weeklong ENT team visit (surgeon, registrar, audiologist, anaesthetist), post-operative follow-up | Mak et al., 2000 [34], Mak et al., 2004 [35] | 7. ENT Outreach Program (no name) Provide ENT outreach for consultations, surgery, post-operative follow-up and fitting of hearing aids | 1986-2002 WA Regional, remote Community, health Otitis media | Involvement of AHWs and Aboriginal Research Assistants, partnership with community-controlled health organisations |
| 2009- | 8. Electronic Health Program | WA Otitis media | Clinical services are provided via a | Reeve et al., | 8. Electronic Health Program | 2009- WA Otitis | Partnership with |
| Year | Description                                                                 | Location                                                                 |
|------|-----------------------------------------------------------------------------|--------------------------------------------------------------------------|
| 2014 | Improve management of middle ear pathology in the Fitzroy Valley via increased access to primary healthcare and ear, nose and throat (ENT) specialists. | Fitzroy Valley                                                             |
| 2012 | Remote media Community, health, education small hospital in Fitzroy Crossing and community health outreach to communities and schools throughout the Fitzroy Valley | Fitzroy Crossing, community-controlled health organisations |

Legend:
- Aboriginal Health Workers: AHWs
- Indigenous Health Workers: IHWs
- New South Wales: NSW
- Queensland: QLD
- South Australia: SA
- Tasmania: TAS
- Victoria: VIC
- Western Australia: WA
- Australian Capital Territory: ACT
- Northern Territory: NT
Publication dates of included studies span 2000 – 2018, with most published since 2010. Most studies evaluated programs for greater than twelve months. Those evaluated for less than twelve months represented feasibility studies [27], or a program of two months’ duration [13, 14]. All programs focused on the management of ear disease or sequellae, predominately otitis media.

Overall, eight programs were represented by 15 studies. The National Partnership on Northern Territory (NT) Remote Aboriginal Investment activities is represented by the NT Outreach Hearing Health Program (HHP) and evaluated by the Australian Government [25]. Queensland (Qld) Deadly Ears Aboriginal and Torres Strait Islander Ear Health Program was evaluated in one study that examined the alignment between the program framework and systems thinking concepts [26]. A supplement to Deadly Ears, The Mobile Telemedicine Enabled ear-health screening and surveillance (MTESS) service was evaluated by five studies [27-31]. These studies evaluated service feasibility in terms of community acceptance, integration, and practical feasibility [27]; program outcomes after three years [31]; changes in hospital referral patterns [30]; changes in screening patterns [29]; and the cost-effectiveness [28]. A new service model within the Eye and Ear Surgical Support Service (EESSS) via CheckUp Australia, where patients were chartered to a regional basin for ENT services, was evaluated by two studies [13, 14]. The first evaluated the clinical and hearing outcomes of participants following the intervention [14] while the second compared model cost with existing services and alternative approaches [13]. The Specialist Outreach Service in the NT (SONT) was evaluated by two studies across different time points [12, 33]. The first examined program effectiveness and identify barriers to specialist access [12], while the second assessed program effects on access, referral patterns, and care outcomes [33]. The outcomes of ENT surgical interventions as part of an unspecified outreach program were evaluated by two studies at two different time points [34, 35]. The remaining two programs
were an ENT Outreach Project [32] and an Electronic Health Program, [36] which were evaluated by single studies.

Two programs took place in the NT [12, 25, 33], four in Qld [13, 14, 26-32] and two in Western Australia (WA) [34-36]. Settings varied with two programs providing school or community based screening with outreach follow up [27-31, 36], four programs facilitating visiting specialists to local communities providing clinics or surgical intervention [12-14, 32-35], while two were state-based programs and frameworks delivered services across multiple settings [25, 26].

Interventions varied in nature with two programs providing ear screening services with telemedicine enabled ENT follow up [27-31, 36], three programs providing surgical interventions for the management of ear disease [13, 14, 32, 34, 35], two providing multiple services as part of state-wide programs [25, 26] and one program providing fly-in-fly-out ENT specialist clinics [12, 33].

There was varying involvement of Aboriginal and Torres Strait Islander people in program design, service delivery or evaluation with only studies associated with the MTESS reporting ongoing involvement in all three stages [27-31]. Five programs had stated involvement or partnerships with Aboriginal Community Controlled Health Services (ACCHSs) engaged Aboriginal Health Workers (AHWs) or Indigenous Health Workers (IHW) in program/activity or evaluation [13, 14, 26, 29-31, 34-36].

Table 2 provides details of study evaluation characteristics.
| Reference (Author, date) | Study aims | Design | Outcome measures | Participants | Main findings |
|--------------------------|------------|--------|------------------|--------------|--------------|
| AIHW, 2018 [25]          | Evaluate Hearing Health Program ear and hearing health outreach services between July 2012 and December 2017 | Repeat cross-sectional & pre-post study | Service delivery, rates of ear disease, hearing status, demand for ear & hearing health services & other follow-up services, outcome of children after exiting the program, regional analysis, progress against benchmarks | N: not stated | Service delivery targets met, but numbers fell in 2017. Young people with ≥1 ear disease decreased from 66% to 61%, with hearing loss decreased from 55% to 45%. Over 3,000 young people are still waiting for hearing health services at end 2017 |
| Durham et al., 2018 [26] | Examine the alignment between Deadly Ears efforts and core concepts of system thinking. Identify potential strategies and levels of intervention to facilitate systems changes to better support ear health | Qualitative | Framework evaluated according to the 5 levels of intervention as outlined by the Intervention Level Framework: paradigm, goals, system structure, feedback and delays, and structural elements | Steering Committee members; Deadly Ears Program staff; Community members | Three key areas where further work is needed to drive sustained improvements: 1) build the governance structures needed for paradigm shift to achieve a multi-sectoral approach; 2) develop shared system level goals; 3) develop system-wide feedback processes |
| Elliott et al., 2010 [27] | Determine feasibility of integrating a mobile telehealth-enabled ear, hearing, & vision-screening service with existing community-based health services | Quantitative non-randomised | Community acceptance, integration with existing community-based services, the technical/practical feasibility of presenting diagnostic information for telemedicine consultations | N: 760 | 59% of children screened during the first 6 months, 41% failed ≥1 components of the ear-screening assessment and were all referred to community health services for management and/or follow up review, 12% had signs of hearing impairment. 157 referrals made to ENT specialist for online review, 3 tele-otology clinics were conducted and 59 cases were reviewed |
| Nguyen et al., 2015 [28] | Assess cost-effectiveness of supplemental mobile telemedicine-enabled ear | Retrospective costing study | Cost, outcomes of screening and treatment, and incremental cost-effectiveness ratio (ICER) | Deadly Kids N: ~350, MTESS N: | Compared with the Deadly Ears Program, the probability of an acceptable cost-utility ratio at a willingness-to-pay threshold of |
| Study | Objective | Methodology | Results |
|-------|-----------|-------------|---------|
| Smith et al., 2015 [29] | Examine whether there were changes in screening activity, fail and referral rates over the 6 years of service delivery in the study area | Retrospective review of service activity | The service has provided 5539 screening assessments. Mean screening failure rate for children outside of postcode 4605 (Cherbourg/Murgon area) was 22% (range 17–29%) and 38% for children living inside postcode 4605 (range 34–41%). While screening activity increased by over 50% since 2009, there has been a slight reduction in the proportion of children failing assessment has reduced from 33% in 2009 to 26% in 2014. |
| Smith et al., 2013 [30] | Examine whether the introduction of the telemedicine service led to changes in hospital referral trends at Royal Children's Hospital (RCH) in Brisbane and Cherbourg hospitals | Retrospective review of service activity | At baseline (2006-08), there were 329 ENT outpatient appointments. Of these, 166 (51%) were failure-to-attends (FTAs). Between 2009-11, there were 105 appointments, of which 40 (38%) were FTAs. At baseline, 100 children received surgical procedures at RCH; between 2009-11 there were 43. In 2009-11, 136 children were booked to receive surgical procedures at Cherbourg hospital, and 117 (86%) were completed. |
| Smith et al., 2012 [31] | Examine the outcomes of the first three years of operation of MTESS | Retrospective review of service activity | 2111 screening assessments were carried out at 21 schools, average screening rate was 85%. Over 50% of assessments resulted in a referral to the ENT specialist (for online assessment) or local doctor (for treatment). 20 specialist ENT online clinics were conducted |
| Year | Study Details | Methods | Results |
|------|---------------|---------|---------|
| 2006 | Gruen et al.  Assess the effects of Outreach clinics on access, observed outcomes in remote communities in Australia. | Population-based observational study | Increase in access to care, improved outcomes |
| 2001 | Gruen et al. Identify barriers to accessing specialist care in the remote NT. Describe the Specialist Outreach Service (SOS) Pilot Project, and evaluate the effectiveness of this model in improving access to specialist services. | Mixed methods | Identify and address barriers to accessing specialist care |
| 2002 | Fernee and Sockalingam Demonstrate improvement in mean & individual hearing thresholds following 3 different middle-ear surgical procedures. Investigate the effect of each procedure on hearing thresholds. | Retrospective case-control study | Improvement in mean & individual hearing thresholds following middle-ear surgery. Effect of each surgical procedure on hearing thresholds |
| 2001 | Gruen et al. | Mixed methods | Numbers of consultations with specialists, average cost per consultation, perceived barriers to accessing hospital-based outpatient care, and perceived impact of specialist outreach on these barriers |
| 2006 | Gruen et al. Assess the effects of Outreach clinics on access, observed outcomes in remote communities in Australia. | Population-based observational study | Increase in access to care, improved outcomes |
| 2001 | Gruen et al. Identify barriers to accessing specialist care in the remote NT. Describe the Specialist Outreach Service (SOS) Pilot Project, and evaluate the effectiveness of this model in improving access to specialist services. | Mixed methods | Identify and address barriers to accessing specialist care |
| 2002 | Fernee and Sockalingam Demonstrate improvement in mean & individual hearing thresholds following 3 different middle-ear surgical procedures. Investigate the effect of each procedure on hearing thresholds. | Retrospective case-control study | Improvement in mean & individual hearing thresholds following middle-ear surgery. Effect of each surgical procedure on hearing thresholds |
| 2001 | Gruen et al. | Mixed methods | Numbers of consultations with specialists, average cost per consultation, perceived barriers to accessing hospital-based outpatient care, and perceived impact of specialist outreach on these barriers |
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| 2002 | Fernee and Sockalingam Demonstrate improvement in mean & individual hearing thresholds following 3 different middle-ear surgical procedures. Investigate the effect of each procedure on hearing thresholds. | Retrospective case-control study | Improvement in mean & individual hearing thresholds following middle-ear surgery. Effect of each surgical procedure on hearing thresholds |
| 2001 | Gruen et al. | Mixed methods | Numbers of consultations with specialists, average cost per consultation, perceived barriers to accessing hospital-based outpatient care, and perceived impact of specialist outreach on these barriers |
| Study Reference | Study Title | Study Design | Research Question | Study Population | Study Outcomes |
|-----------------|-------------|--------------|-------------------|------------------|----------------|
| Jacups et al., 2017 [14] | Review service provision model as a quality assurance process to inform the development of improved regional ENT services | Case series | Collaboration process, clinical and hearing outcomes, cost-savings | 16: (2 non-Indigenous) Age: 4-17 years | Surgeries successfully completed for 16 children, mean waitlist time of 1.2 years. Pre-surgery pure-tone average hearing thresholds were reported at left: 30.9 dB, right: 38.2 dB. Most presentations for bilateral OM with effusion (69%). Postsurgical follow up indicated successful clinical outcomes in 80% of patients & successful hearing outcomes in 88% of patients. Telehealth for post-operative review enabled a minimum cost saving of AUD$21,664 for these 16 children. |
| Jacups et al., 2018 [13] | Identify the least costly model of ENT surgical access for remote living children | Retrospective costing evaluation | Incremental cost difference between base case (model 1) and two alternative approaches (model 2, 3) measured from health system perspective, and the patient and family perspective | 16: (2 non-Indigenous) Age: 4-17 years | The least costly model offered low-risk ENT surgery from a remote setting hospital, with high use videoconference technology: TeleHealth (Model 3) could save $3626-$5067/patient, compared with patients travelling to a regional public hospital (Model 1). A direct flight charter transfer to a regional private hospital (Model 2) reduced the cost by $2178-$2711/patient when compared with standard care (Model 1). |
| Mak et al., 2000 [34] | Assess the outcome of operations performed in Kimberley hospitals for middle-ear disease | Descriptive study | Otoscopic and audiometric outcomes review (intact tympanic membrane and air-bone gap ≤ 25 dB at review ≥ 6m post-operation) | N: 273 Age: 3.9yrs-67.2 yrs (74% < 20yrs) | 53% success rate; increasing age predicted success. Only 83 patients had post-operative follow-up records. |
| Mak et al., 2004 [35] | Assess the outcomes of myringoplasties to identify factors associated with a successful outcome | Prospective case series | Success (intact tympanic membrane and normal hearing 6m+ post-op), closure of the perforation, post-op hearing | N: 58 Age: 5-15 years | 49% were successful, 72% resulted in closure or reduction in size of the perforation, 51% resulted in hearing improvement. No association observed between success or... |
| Study                  | Intervention                                                                 | Methodology                  | Outcome Description                                                                                                                                 |
|------------------------|------------------------------------------------------------------------------|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Reeve et al., 2014 [36]| Reduce long waiting lists for ENT specialist review and improve primary ear health care | Retrospective evaluation    | Improvement in hearing, perforation size, and presence of serous aural discharge at time of surgery. Screened increased from 148/18 months to 710. Nearly twofold increase in patients referred to ENT (32, 66). Reduced median waiting time from 141 days – 22 days for ENT review using telehealth. Increased essential information – otoscopy, audiometry and tympanometry. Primary care management in accordance with guidelines improved. |
There was heterogeneity in study aims where six studies aimed to evaluate intervention effects on health-related outcomes [14, 25, 29, 32, 34, 35], four studies aimed to evaluate program effectiveness on accessibility and referral pathways [30, 31, 33, 36], two aimed to conduct cost analyses of delivered and proposed models of care [13, 28], two aimed to assess program feasibility or identify barriers to care [12, 27], and one aimed to examine the alignment between a program framework and the concepts of systems thinking [26]. This heterogeneity is also reflected in study types with five retrospective reviews of service activity [29-31, 34, 36], two retrospective costing studies [14, 28], two case series [14, 35], three mixed method analyses [12, 26], one repeat cross-sectional study [25], one quantitative non-randomised study [27], one retrospective case-control study [32] and one population based observational study [33]. Outcome measures were equally heterogeneous with data based on qualitative and quantitative methods including, but not limited to screening rates, hearing thresholds, middle ear and tympanic membrane status, referral rates, waiting time for services, appropriateness of primary care management, and cost difference. Most outcome measures provided data that supported, but did not directly allow for, the rigorous evaluation of broader program aims. While studies such as cost analyses [13, 28] did not directly link to program aims, they provide important information regarding feasibility and sustainability of program implementation. Outreach programs appeared to have increased service delivery levels, but this was frequently reported without reference to baseline rates [26, 33] making the change difficult to quantify. Three programs reported decreased waiting times for ENT review or surgery [14, 31, 36], but these remained lengthy for a number of children in the NT HHP [25]. Of the eight programs, six were evaluated by studies that measured health-related outcomes in either middle ear or hearing status. Five studies reported overall positive changes in middle ear and/or hearing health [14, 25, 29, 34, 35] and one reported no clinically significant
improvements [32]. The state-wide NT HHP program reported decreasing the need for follow up, medical or surgical treatment [25] while local services increased the number of follow up referrals within three programs [30, 31, 36]. Programs did not increase the demand on outpatient services [30, 33].

Risk of bias

All papers were empirical studies and were suitable for appraisal using the MMAT (Appendix 2). Overall, the quality of studies was generally poor with only two of the 15 studies scoring ‘yes’ on all five MMAT measures.

Discussion

This review examined the ability of ENT outreach programs to improve health outcomes among Aboriginal and Torres Strait Islander children and included 15 studies of eight programs. We found that while study outcome measures were linked to program aims, these links could be peripheral or did not provide sufficiently rigorous data to evaluate programs. Study characteristics varied widely but overall, positive changes were seen in middle ear and/or hearing health in five of the eight programs [14, 25, 29, 34, 35]. These results should be interpreted carefully as all measures of service delivery, referral rates, attendance rates, wait times, were difficult to contextualise given a lack of baseline data and inter-study variation in the methods and clinical thresholds used to monitor changes.

Despite these limitations, these six programs appear to produce positive results in the communities which they are delivered. However, the limited quantity and quality of evidence, a lack of coordination of programs, and the appropriateness and acceptability of services is likely contributing to the ongoing burden of ear disease in Aboriginal and or Torres Strait Islander children [2]. Although over 50 current or recent ear health programs exist across Australia [37], we found a paucity of literature evaluating their programs. This is consistent with a recent review of physical activity programs for Aboriginal and Torres Strait
Islander people that found that while many programs existed, few were comprehensively evaluated [38]. Among the included studies, there was marked heterogeneity in the setting and nature of interventions and evaluation, including their outcome measures. A lack of standardised systems for monitoring changes in incidence and prevalence of ear disease limits the ability to measure and attribute changes in disease states to the actions of a program [26, 39]. However, regular evaluation in the form of continuous quality improvement frameworks have been shown to improve the quality of healthcare for Aboriginal and or Torres Strait Islander children as well as health outcomes in other areas including antenatal care, immunisations, smoking, alcohol consumption, diabetes, cardiovascular disease, and cervical screening [40, 41]. Several ear health indicators that are potentially extractable from electronic health records have been recommended [41]. Though these indicators have only been validated in the primary health setting so far, there is potential for their use in the ongoing evaluation of ENT outreach programs.

Sustainable outreach benefits in disease prevention, treatment, and management may occur with coordinated service delivery [2, 42]. We are limited in our ability to draw conclusions regarding the coordination of all Australian ENT services as many programs do not provide evaluation data that could be included in this systematic review. The included programs took place across three states, Qld, the NT and WA, in multiple settings. Services were delivered as part of, or in association with numerous programs with little to no evidence of interaction or coordination between these programs in terms of aims, service delivery, coverage, or funding bodies. Effective outreach programs require efficient integration of incoming ENT services with existing primary health care services and the broader community [17]. One program, the MTESS, reported integration with the community through the local AHW and close alignment with primary care services to be important factors in success [29, 30] and this is recommended to strengthen future program delivery.
There is currently a discordance between service delivery and burden of disease [15]. A significant barrier to coordination is the lack of population level data detailing the epidemiology of ear disease in Aboriginal and or Torres Strait Islander children [26, 39] as strategic delivery of services is limited when need cannot be directly pinpointed. A national outreach service register has been suggested as a way of identifying areas of over or under supply [17]. The MTESS reports the probability of service uptake in areas was directly linked to the provision of services [28], reiterated by the HHP where audiology, ENT, and clinical nurse specialist service numbers dropped following a shortage of available specialists [25]. The result is ad-hoc service delivery contributing to a lack of coordination, inequity and unsustainable service delivery [16-18, 42]. Finally, while outreach programs play a role in improving the health of Aboriginal and or Torres Strait Islander children, they form only one piece of the puzzle. Coordination is required between multiple sectors to effectively address the socioeconomic and historical aetiology of ear disease. While the DEDKDC Framework prioritised multi-sector collaboration and coordination, there was little evidence of these activities [26].

Outreach programs are often large and multi-faceted, leading to complexities in evaluation. Studies that are fragmented from program aims impede the development of program learnings and limits the ability of past programs to critically inform the development of future programs. The scarcity of program evaluation hinders a global assessment of factors predicting success, or barriers to success of ENT outreach programs, as originally planned in this review. However, factors known to impact on the success of outreach programs are regular and predictable service, and communication with and accountability to the community [18]. The frequency and regularity of outreach events in programs included in this review were largely unclear and a lack of accountability leads to irregularity and unpredictability, creating issues with delayed follow up and inadequate support [18].
Furthermore, this review revealed a deficiency in collaboration with communities in planning, service delivery, and evaluation of included programs, indicating a lack of communication with and accountability to the community. This finding is consistent with the literature where the status quo sees services for Aboriginal and or Torres Strait Islander peoples developed without their input [43]. Acceptable healthcare delivery relies on effective collaboration, which necessitates the genuine involvement of Aboriginal and Torres Strait Islander people and valuing of traditional practices [44, 45]. MTESS service highlighted the importance of this process in their ability to sustain integration of the service with primary healthcare and the deliver ongoing convenient and timely services [29]. Furthermore, activities run under the DEDKDC Framework were reported to have greater attendance where AHWs were present [46]. Other recommendations for sustainability include an adequate primary care and specialist base, a multidisciplinary framework centred in primary care, funding and coordination that recognises responsibilities primary, secondary and tertiary care and regular evaluation. [18].

There is a strengthened resolve when Aboriginal and Torres Strait Islander people are involved in the planning, running and evaluation of ENT outreach clinics. Codesign and capacity building must be part of any outreach program and continual re-evaluation is strongly recommended. There is also a need to ensure services are complemented by programs that add value and with translational research outcomes that support communities. Working solutions backed by evidence and community benefits need to be published and supported broadly to apply to local conditions.

Conclusion

This review discovered a paucity of evaluation of ENT outreach programs for Aboriginal and Torres Strait Islander children. Fifteen evaluations of eight programs were identified that were heterogeneous in study design and of variable methodological quality. While individual
studies reflected positive outcomes of programs, including positive changes in middle ear and/or hearing health from six programs, the ability of these programs to improve the overall ear-health status of Aboriginal children remains unclear. These findings suggest that the effectiveness of ENT outreach programs may be limited by a lack of coordination of services and the provision of potentially unsustainable services. There were also low levels of involvement of Aboriginal and Torres Strait Islander people in program and evaluation design and delivery and we recommend greater involvement in all future program and evaluation aspects to strengthen their impact and outcomes.

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