

BMJ Open Effectiveness of ear, nose and throat outreach programmes for Aboriginal and Torres Strait Islander Australians: a systematic review

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To cite: Gotis-Graham A, Macniven R, Kong K, *et al.* Effectiveness of ear, nose and throat outreach programmes for Aboriginal and Torres Strait Islander Australians: a systematic review. *BMJ Open* 2020;**10**:e038273. doi:10.1136/bmjopen-2020-038273

► Prepublication history and additional materials for this paper is available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2020-038273>).

Received 05 March 2020
Revised 08 October 2020
Accepted 17 October 2020



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ABSTRACT

Objective To examine the ability of ear, nose and throat (ENT) outreach programmes to improve health outcomes among Aboriginal and Torres Strait Islander people.

Methods We conducted a systematic literature search of nine databases (Medline, CINAHL, PsycINFO, 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 people. This review included English language studies of all types, published between 2000 and 2018, that supplied ENT outreach services to Aboriginal and Torres Strait Islander Australians and provided data to evaluate their aims. Two authors independently evaluated the eligible articles and extracted relevant information. Risk of bias was assessed using the Mixed Methods Assessment Tool.

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 programmes/activities and their corresponding studies involved Aboriginal and Torres Strait Islander people and organisations in delivery and evaluation, but involvement in programme or study design was unclear.

Conclusion While some studies demonstrated improved outcomes, the overall ability of ENT programmes 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 quality evidence, service coordination and sustainability. Community codesign and supporting and resourcing local capacity must be a component of outreach programmes and ongoing evaluation is also recommended. Improvements in these areas would likely improve health outcomes.

PROSPERO registration number CRD42019134757.

INTRODUCTION

Aboriginal and or Torres Strait Islander people represent the oldest continuous living cultures in the world, and have experienced ongoing inequities since colonisation.¹ Aboriginal and or Torres Strait Islander

Strengths and limitations of this study

- The review examined the involvement of Aboriginal and Torres Strait Islander people in all aspects of programme development, execution and evaluation.
- The authors employed a robust strategy with a priori inclusion and exclusion criteria to identify relevant studies. Studies were identification based on a clearly defined and extensive search strategy based on a priori inclusion and exclusion criteria.
- The authors appraised studies using a study appraisal was conducted using a relevant tool for mixed-methods studies.
- This review was primarily limited by heterogeneity of study design which precluded meta-analysis of results.

children suffer from an alarmingly higher prevalence of ear, nose and throat (ENT) diseases compared with non-indigenous children.²⁻⁴ This marked disparity is a result of the interaction between complex historical, cultural and economic factors experienced by Aboriginal and or Torres Strait Islander people as a result of colonisation, and epidemiological and behavioural risk factors such as nutrition.^{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 Aboriginal and or Torres Strait Islander children tend to sustain this preventable and treatable condition at a younger age, more frequently, persistently and severely, and with more serious complications than non-indigenous children.^{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 healthcare and treatment.^{3 4 6 7}

The conductive hearing loss that results from untreated, chronic suppurative otitis media (CSOM) is responsible for the greatest burden of educational, social and financial sequelae.³ CSOM is estimated to be 10%–30% among Aboriginal and Torres Strait Islander children, well above the WHO 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 an appreciable economic burden.⁴ This considerable 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. The practice of most ENT surgeons in Australia is largely confined to metropolitan areas, and few participate in outreach clinics to rural and remote areas.¹¹ To access ENT specialist services in these areas, 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 healthcare teams and individual practitioners away from their usual place of work, generally to an underserved 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 programmes is lacking, including those pertaining to ENT specialties, and as such, little is known about the impact and outcomes of such programmes.^{19 20} The result is the implementation of programmes without sufficient planning or evidence base.² This review aims primarily to examine the ability of ENT outreach programmes to improve Aboriginal and Torres Strait Islander health outcomes, and secondarily to elucidate factors predicting success, and barriers to success of such programmes.

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-Analyses statement guidelines.^{21 22}

Eligibility criteria

We sought to identify studies that supplied ENT outreach services to Aboriginal and or Torres Strait Islander Australians and provided data to evaluate their aims and included studies 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.

We limited the search to English language studies published between 2000 and 2018 inclusive. We excluded studies 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 screening programmes without intervention or referral pathways do not improve the health of Aboriginal and or Torres Strait Islander Australians.²³

Search strategy

We conducted a systematic search of nine online databases (Medline, CINAHL, PsycINFO, Embase, Cochrane, Scopus, Global health, Informit Rural health database and Indigenous collection) for published articles between December 2018 and January 2019. An example search is provided in online supplemental appendix 1. We conducted a grey literature search of relevant government and non-government websites in August 2019 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, we contacted authors to source original data. We screened the reference lists of included studies and other systematic reviews identified in the literature search 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 and resolved discrepancies consensus and the first author screened the remaining studies. This process was repeated for articles identified in the grey literature. Both authors independently assessed full texts for eligibility and resolved

discrepancies by consensus, generating a final list of studies for inclusion.

Data extraction and synthesis

We extracted data from included studies according to programme characteristics (programme 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. We analysed studies in a qualitative synthesis and deemed meta-analysis inappropriate due to the small study sample sizes, mixed-methods study inclusion, and the heterogeneity of the study designs and outcome.

Risk of bias

The Mixed Methods Assessment Tool (MMAT) was used to assess risk of bias.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.

Patient and public involvement

Patients and the public were not involved in study design.

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 we screened, 434 were excluded and full-text review was conducted for 72 studies. A further 54 studies were subsequently excluded; 15 articles that met the eligibility criteria and were therefore included in the review (figure 1).

Programme characteristics

Publication dates of included studies span 2000–2018, with most published since 2010. Most studies evaluated programmes for greater than twelve months. All programmes focused on the management of ear disease or sequellae, predominately otitis media.

Overall, we found 15 studies that evaluated eight programmes. Table 1 provides the programme/activity characteristics of included studies.

The National Partnership on Northern Territory (NT) Remote Aboriginal Investment activities is represented by the NT Outreach Hearing Health Programme (HHP) and evaluated by the Australian Government.²⁵ Queensland (Qld) Deadly Ears Aboriginal and Torres Strait Islander Ear Health Programme was evaluated in a study that

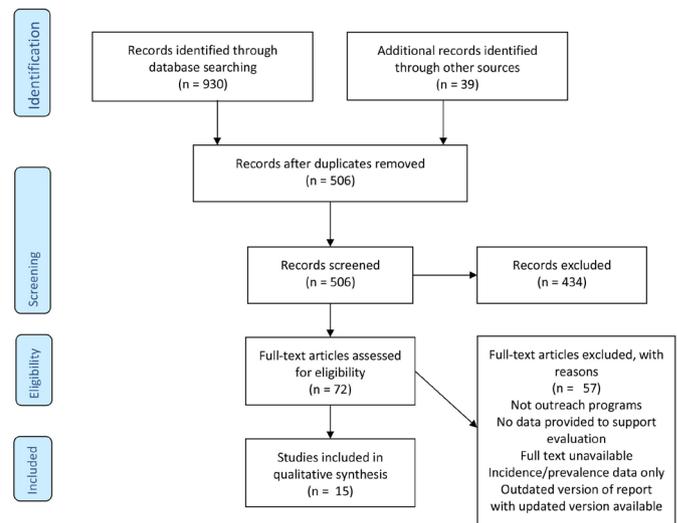


Figure 1 PRISMA flow chart. PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

examined the alignment between the programme 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 that evaluated service feasibility²⁷; programme outcomes²⁸; hospital referral patterns²⁹; screening patterns³⁰ and cost-effectiveness.³¹ A new service model within the Eye and Ear Surgical Support Service via Check-up Australia, where patients were chartered to a regional basin for ENT services, was evaluated by two studies, examining clinical and hearing outcomes¹⁴ and cost comparisons.¹³ The Specialist Outreach Service in the NT was evaluated by two studies of programme effectiveness and barriers to specialist access¹² and programme outcomes.³² The outcomes of ENT surgical interventions in an unspecified outreach programme were evaluated by two different studies.^{33 34} The remaining two programmes were evaluations of an ENT Outreach Project³⁵ and an Electronic Health Programme.³⁶

Two programmes took place in the NT,^{12 25 32} four in Qld^{13 14 26–31 35} and two in Western Australia (WA).^{33 34 36} Settings varied with two programmes providing school or community based screening with outreach follow-up,^{27–31 36} four programmes facilitating visiting specialists to local communities providing clinics or surgical intervention,^{12–14 32–35} while two were state-based programmes and frameworks delivered services across multiple settings.^{25 26} Interventions varied in nature with two programmes providing ear screening services with telemedicine enabled ENT follow-up,^{27–31 36} three programmes providing surgical interventions for the management of ear disease,^{13 14 33–35} two providing multiple services as part of statewide programmes^{25 26} and one programme providing fly-in-fly-out ENT specialist clinics.^{12 32}

There was varying involvement of Aboriginal and Torres Strait Islander people in programme design, service delivery or evaluation with only studies associated with

**Table 1** Programme characteristics of included studies

Reference (author, date)	Programme/activity name (where given) and aims	Operating years	State/territory area setting	Disease focus	Programme/activity details	Indigenous capacity building
AIHW, 2018 ²⁵	1. Northern Territory Outreach Hearing Health Programme: Provide outreach services for the early detection, treatment, & management of ear diseases and hearing health problems	2007–2017	NT Regional/Remote Community and health	Otitis media, eustachian tube dysfunction	Service delivery: health education, promotion and prevention, outreach audiology services, ENT teleotology services, Clinical Nurse Specialist services	Not stated
Durham, 2018 ²⁶	2. Deadly Ears Aboriginal and Torres Strait Islander Ear Health Programme: Early detection, monitoring, and treatment to reduce incidence and impact of Otitis Media and Conductive Hearing Loss	2007–present	Qld Urban, regional, remote Community, health, education	Otitis media	Multisectoral activities at different levels of the health system (policy, service providers, local community) including provision of support and training to service providers and mobile ENT services	Involvement of AHWs/IHWs, partnership with community-controlled health organisations
Elliott, 2010 ²⁷ Nguyen, 2015 ³¹ Smith, 2015 ³⁰ Smith, 2013 ²⁹ Smith, 2012 ²⁸	3. The Mobile Telemedicine Enabled ear-health screening and surveillance 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
Ferne, 2002 ³⁵	4. ENT Outreach Project Prevent, identify and treat ear disease and hearing loss	1998–2000	Qld Remote Community, health	Otitis media	Patients identified through the Project underwent surgical procedures, performed in or close to patients' home communities with subsequent post-surgical follow-up	Not stated
Gruen, 2001 ¹² Gruen, 2006 ³²	5. Specialist Outreach Service in the NT 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 and 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
Jacups, 2017 ¹⁴ Jacups, 2018 ¹³	6. Eye and Ear Surgical Support Service Improve hearing outcomes for remote living children	2016	Qld Remote Health	Otitis media	Direct flight charter of group of patients to a regional private hospital for ENT surgery. Postoperative clinical review occurred in communities by telehealth review (day 1 and 6 weeks) and audiology by visiting audiologist (6–8 weeks).	Involvement of IHWs, partnership with community-controlled health organisations
Mak, 2000 ³³ Mak, 2004 ³⁴	7. ENT Outreach Programme (no name) Provide ENT outreach for consultations, surgery, postoperative follow-up and fitting of hearing aids	1986–2002	WA Regional, remote Community, health	Otitis media	Myringoplasty surgical procedure for children with Chronic suppurative otitis media during a weeklong ENT team visit (surgeon, registrar, audiologist, anaesthetist), postoperative follow-up	Involvement of AHWs and Aboriginal Research Assistants, partnership with community-controlled health organisations

Continued

Table 1 Continued

Reference (author, date)	Programme/activity name (where given) and aims	Operating years	State/territory area setting	Disease focus	Programme/activity details	Indigenous capacity building
Reeve, 2014 ³⁶	8. Electronic Health Programme Improve management of middle ear pathology in the Fitzroy Valley via increased access to primary healthcare and ENT specialists.	2009–2012	WA Remote Community, health, education	Otitis media	Clinical services are provided via a small hospital in Fitzroy Crossing and community health outreach to communities and schools throughout the Fitzroy Valley	Partnership with community-controlled health organisations

AHWs, Aboriginal Health Workers; ENT, Ear, nose, and throat; IHWs, Indigenous Health Workers; NSW, New South Wales; NT, Northern Territory; Qld, Queensland; WA, Western Australia.

the MTESS reporting ongoing involvement in all three stages.^{27–31} Five programmes had stated involvement or partnerships with Aboriginal Community Controlled Health Services engaged Aboriginal Health Workers (AHWs) or Indigenous Health Workers in programme/activity or evaluation.^{13 14 26 28–30 33 34 36} Table 2 provides details of study evaluation characteristics.

There was heterogeneity in study aims where six studies aimed to evaluate intervention effects on health-related outcomes,^{14 25 30 33–35} four studies aimed to evaluate programme effectiveness on accessibility and referral pathways,^{28 29 32 36} two aimed to conduct cost analyses of delivered and proposed models of care,^{13 31} two aimed to assess programme feasibility or identify barriers to care,^{12 27} and one aimed to examine the alignment between a programme framework and the concepts of systems thinking.²⁶ This heterogeneity is also reflected in study types with five retrospective reviews of service activity,^{28–30 33 36} two retrospective costing studies,^{14 31} two case series,^{14 34} three mixed-method analyses,^{12 26} one repeat cross-sectional study,²⁵ one quantitative non-randomised study,²⁷ one retrospective case-control study³⁵ and one population-based observational study.³² 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 programme aims. While studies such as cost analyses^{13 31} did not directly link to programme aims, they provide important information regarding feasibility and sustainability of programme implementation. Outreach programmes appeared to have increased service delivery levels, but this was frequently reported without reference to baseline rates^{26 32} making the change difficult to quantify. Three programmes reported decreased waiting times for ENT review or surgery,^{14 28 36} but these remained lengthy for a number of children in the NT HHP.²⁵

Of the eight programmes, 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 30 33 34} and one reported no clinically significant improvements.³⁵ The statewide NT HHP programme reported decreasing the need for follow-up, medical or surgical treatment²⁵ while local services increased the number of follow-up referrals within three programmes.^{28 29 36} Programmes did not increase the demand on outpatient services.^{29 32}

Risk of bias

All papers were empirical studies and were suitable for appraisal using the MMAT (see online supplemental 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 programmes to improve health outcomes among Aboriginal and Torres Strait Islander children and included 15 studies of eight programmes. We found that while study outcome measures were linked to programme aims, these links could be peripheral or did not provide sufficiently rigorous data to evaluate programmes. Study characteristics varied widely but overall, positive changes were seen in middle ear and/or hearing health in five of the eight programmes.^{14 25 30 33 34} 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 programmes 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 programmes, 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 programmes exist across Australia,³⁷ we found a paucity of literature evaluating their programmes. This is consistent with a recent review of physical activity programmes for Aboriginal and Torres Strait Islander people that found

**Table 2** Evaluation characteristics of included studies

Reference (author, date)	Study aims	Design	Outcome measures	Participants no (N) Age	Main findings
AIHW, 2018 ²⁵	Evaluate Hearing Health Programme ear and hearing health outreach services between July 2012 and December 2017	Repeat cross-sectional and pre–post study	Service delivery, rates of ear disease, hearing status, demand for ear and hearing health services and other follow-up services, outcome of children after exiting the programme, regional analysis, progress against benchmarks	N: not stated Age: under 21 years	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 3000 young people were still waiting for hearing health services at end 2017
Durham, 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 Programme 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, 2010 ²⁷	Determine feasibility of integrating a mobile telehealth-enabled ear, hearing and 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 Age: 0–16 years	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 teleology clinics were conducted and 59 cases were reviewed
Nguyen, 2015 ³¹	Assess cost-effectiveness of supplemental MTESS service, compared with the existing outreach screening and surgical service alone	Retrospective costing study	Cost, outcomes of screening and treatment, and incremental cost-effectiveness ratio	Deadly Kids N: ~350. MTESS N: 780 Age: 3–18 years	Compared with the Deadly Ears Programme, the probability of an acceptable cost-utility ratio at a willingness-to-pay threshold of \$A50 000/QALY was 98% for the MTESS service. This cost effectiveness arises from preventing hearing loss & subsequent reduction in associated costs.
Smith, 2015 ³⁰	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	Total number of completed assessments, total number of patients failing at least one screening test, overall proportion of failed screening assessments per year	N: 3105 Age: not stated	The service 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 was a slight reduction in the proportion of children failing assessment reduced from 33% in 2009 to 26% in 2014.
Smith, 2013 ²⁹	Examine whether the introduction of the telemedicine service led to changes in hospital referral trends at Royal Children's Hospital in Brisbane and Cherbourg hospitals	Retrospective review of service activity	No of ENT outpatient appointment and failure-to-attend, no of surgical procedures completed	N: 329 (2006–8); 105 (2009–11) Age: not stated	At baseline (2006–08), there were 329 ENT outpatient appointments. Of these, 166 (51%) were failure-to-attends (FTAs). Between 2009 and 2011, there were 105 appointments, of which 40 (38%) were FTAs. At baseline, 100 children received surgical procedures at RCH; between 2009 and 2011 there were 43. In 2009–2011, 136 children were booked to receive surgical procedures at Cherbourg hospital, and 117 (86%) were completed

Continued

Table 2 Continued

Reference (author, date)	Study aims	Design	Outcome measures	Participants no (N) Age	Main findings
Smith, 2012 ²⁸	Examine the outcomes of the first 3 years of operation of MTESS	Retrospective review of service activity	Screening service activity, screening assessments results, referral and review by ENT surgeon, waiting times from referral to specialist assessment	N: 1053 Age: 0–18 years	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 during which 415 patients were reviewed. 55% of online review cases resulted in appointments at the next ENT outreach clinic for further review and/or surgery
Fernee, 2002 ³⁵	Demonstrate improvement in mean and individual hearing thresholds following three 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	N: 38 Age: 5–24 years	Lower, non-statistically significant post-operative air conduction thresholds at 5–7 months for combined surgical procedures. Most significant improvement in hearing thresholds occurred at 2000 Hz. Tympanoplasty and adenoidectomy, combined with myringotomy, led to the greatest improvements in hearing thresholds. A large proportion of subjects had incomplete postoperative results.
Gruen, 2001 ¹²	Identify barriers to accessing specialist care in the remote NT, describe the SOS Pilot Project, and evaluate the effectiveness of this model in improving access to specialist services	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	N: 25 remote health practitioners, patients and specialists Age: N/A	Perceived barriers included geographic remoteness, poor doctor-patient communication, poverty, cultural differences, and the structure of the health service. Between 1993 and 1999, there were 5134 SOS and non-SOS outreach consultations in surgical specialties. Intensive outreach practice increased total consultations by up to 441% and significantly reduced the number of transfers to hospital outpatient clinics ($p < 0.001$)
Gruen, 2006 ³²	Assess the effects of outreach clinics on access, referral patterns, and care outcomes in remote communities in Australia.	Population-based observational study	Access, referral patterns, care outcomes	N: 2368 Age: all (median=19)	ENT outreach was not regular, being of no or low intensity (<6 months between visits). 246 new ENT problems were seen, with 151 referrals made. Of all problems, 18.3% had emergency referral, 30.9% elective referral, 12% opportunistic referral. Relative risk of regular outreach for timely completion of referrals was 1.25 (0.66–1.76, 96% CI) for ENT surgeons. Availability of regular outreach not associated with significant overall increase in referrals
Jacups, 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: (two non-indigenous) Age: 4–17 years	Surgeries successfully completed for 16 children, mean waitlist time of 1.2 years. Presurgery 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 \$A21 664 for these 16 children.

Continued

Table 2 Continued

Reference (author, date)	Study aims	Design	Outcome measures	Participants no (N) Age	Main findings
Jacups, 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: (two 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 \$A3626–\$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 \$A2178–\$A2711/patient when compared with standard care (model 1).
Mak, 2000 ³³	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 ≥ 6 m postoperation)	N: 273 Age: 3.9 years–67.2 years (74% <20 years)	53% success rate; increasing age predicted success. Only 83 patients had postoperative follow-up records.
Mak, 2004 ³⁴	Assess the outcomes of myringoplasties to identify factors associated with a successful outcome	Prospective case series	Success (intact tympanic membrane and normal hearing 6 months +postoperative), closure of the perforation, postoperative hearing improvement	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 hearing improvement and perforation size, or the presence of serous aural discharge at time of surgery.
Reeve, 2014 ³⁶	Reduce long waiting lists for ENT specialist review and improve primary ear healthcare	Retrospective evaluation	Access no of children screened for ear disease, effectiveness-referral letter completeness (history, otoscopy, tympanometry, audiometry), patient management and waiting time until first ENT contact	N: 710 Age: 0–18 years	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 to 22 days for ENT review using telehealth. Increased essential information—otoscopy, audiometry and tympanometry. Primary care management in accordance with guidelines improved.

ENT, ear, nose and throat; MTESS, mobile telemedicine-enabled ear health screening and surveillance; QALY, quality-adjusted life-year; SOS, Specialist Outreach Service.

that while many programmes 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 programme.^{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 programmes.

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 programmes do not provide evaluation data that could be included in this systematic review. The included programmes took place across three states, QLD, the NT and WA, in multiple settings. Services were delivered as part of, or in association with numerous programmes with little to no evidence of interaction or coordination between these programmes in terms of aims, service delivery, coverage or funding bodies. Effective outreach programmes require efficient integration of incoming ENT services with existing primary healthcare services and the broader community.¹⁷ One programme, 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 programme delivery.

There is currently a discordance between service delivery and burden of disease,¹⁵ consistent with the Inverse Care Law⁴³ which asserts that medical care is inversely related to population need. 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,³¹ 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}

While outreach programmes play a role in improving the health of Aboriginal and or Torres Strait Islander children, they form only one piece of the puzzle. Given the long-term impacts of childhood hearing impairment on educational, social and economic achievement systematic and coordinated efforts to improve the social determinants of health, including education and housing, have been recommended for almost 20 years¹⁹ but are yet to be realised. Coordination is required between multiple sectors to effectively address the socio-economic and historical aetiology of ear disease. While the DEDKDC Framework prioritised multi-sector collaboration and coordination, there was little evidence of these activities.²⁶ We strongly recommend a national, community-controlled and community-led comprehensive, multisectoral sustainable programme to improve ear health and its inextricable broader social determinants. This national approach should include prospective data collection with mechanisms for implementation and rigorous assessment of intervention effectiveness that are acceptable to Aboriginal and or Torres Strait Islander people. It would be important for such multidisciplinary and collaborative initiative to include an economic component to determine whether the cost of such an initiative would outweigh the health and societal outcomes of current practices and usual care. We suggest that a codesigned, adequately resourced and successfully implemented comprehensive initiative would have definitive health, cost and broader benefits.

Outreach programmes are often large and multifaceted, leading to complexities in evaluation. Studies that are fragmented from programme aims impede the development of programme learnings and limit the ability of past programmes to critically inform the development of future programmes. As such, we would encourage regular, long-term and comprehensive evaluation of future ENT outreach programmes by studies whose aims closely align to programme aims, evaluated against robust, clinically significant hearing health outcomes. The scarcity of programme evaluation hinders a global assessment of factors predicting success, or barriers to success of ENT outreach programmes, as originally planned in this review. However, factors known to impact on the success of outreach programmes are regular and predictable service, and communication with and accountability to the community.¹⁸

The frequency and regularity of outreach events in programmes included in this review were largely unclear. This 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 programmes, 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.⁴⁴ Acceptable healthcare delivery relies on effective collaboration, which necessitates the genuine involvement of Aboriginal and Torres Strait Islander people and valuing of traditional practices.^{45 46} The importance of community education and its role in the timely management of otitis media has also been identified as a supportive strategy.² The 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.³⁰ Furthermore, activities run under the Deadly Ears Deadly Kids Deadly Communities (DEDKDC) Framework were reported to have greater attendance where AHWs were present.⁴⁷ Programme sustainability may be further supported by an adequate primary care and specialist base, a multidisciplinary framework centred in primary care, funding and coordination that recognises the responsibilities of primary, secondary and tertiary care, and regular evaluation.¹⁸

There is a strengthened resolve when Aboriginal and Torres Strait Islander people are integral leaders in the planning, operating and evaluation of ENT services in their community and in defining their value. Community codesign and the supporting and resourcing of local capacity must be part of any outreach programme and ongoing evaluation is strongly recommended. Services that are community owned and driven and that promote local knowledge can be complemented by external programmes where there is community buy in and where value can be added working solutions backed by evidence and community benefits need to be published and be supported broadly and resourced adequately to apply to local conditions.

CONCLUSION

This review discovered a paucity of evaluation of ENT outreach programmes for Aboriginal and Torres Strait Islander children. Fifteen evaluations of eight programmes were identified that were heterogeneous in study design and of variable methodological quality. While individual studies reflected positive outcomes of programmes, including positive changes in middle ear and/or hearing health from six programmes, the ability of these programmes to improve the overall ear health status of Aboriginal children remains unclear. This is of grave concern given the burden of disease and associated repercussions of ongoing disease. These findings suggest that the effectiveness of ENT outreach programmes 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 programme and evaluation design and delivery and we recommend greater involvement in all future programme and evaluation aspects to strengthen their impact and outcomes.

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Contributors AG-G developed the review protocol, completed all title and abstract screening, full-text reviews and data analysis. She completed the risk of bias assessment with RM. AG-G also drafted and revised the manuscript. RM developed the initial review question and assisted writing the review protocol and completed the full-text reviews, reviewed all data of included studies and completed the risk of bias assessment with AG-G. She also critically appraised the draft manuscript. KG assisted with developing the initial review question, and critically appraised the draft manuscript and assisted with revisions. KK reviewed all included articles for consensus, and critically appraised the manuscript. All authors have given final approval for publication.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data relevant to the study are included in the article or uploaded as online supplemental information.

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