

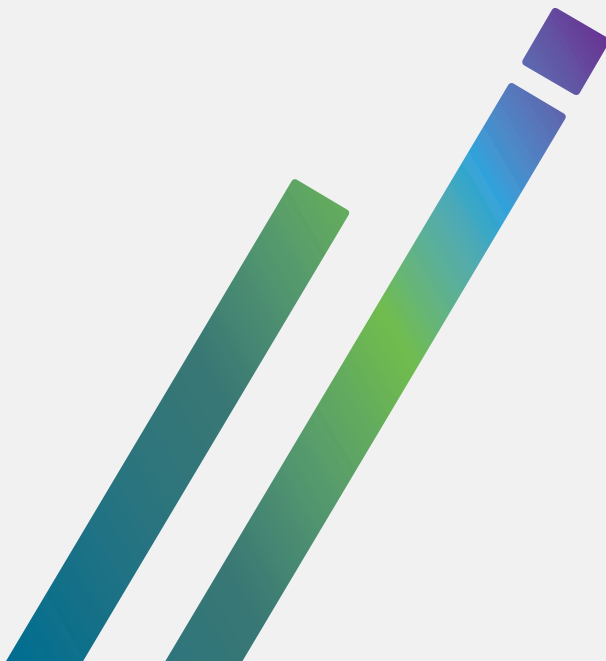


Australian Government  
Australian Institute of  
Health and Welfare



# Queensland's Deadly Ears Program

Indigenous children receiving services  
for ear disease and hearing loss  
2007–2019

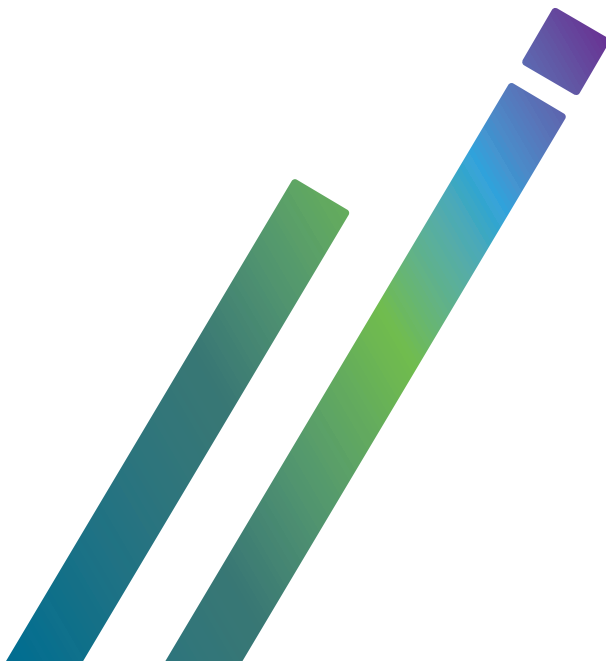


**AIHW**



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# Summary

Aboriginal and Torres Strait Islander children experience disproportionately higher rates of ear disease and associated hearing loss, with greater frequency and severity, than non-Indigenous children.

Queensland's Deadly Ears Program (the Program) aims to reduce the rates and impact of ear disease and hearing loss on Aboriginal and Torres Strait Islander children by providing a range of frontline services. These include building capability of local primary and allied-health services in its partner communities, as well as direct clinical services with children and families through the delivery of ear, nose and throat (ENT), audiology, speech pathology and occupational therapy services.

The Program provides access to tertiary specialist ear and hearing services for Aboriginal and Torres Strait Islander children from communities across rural and remote Queensland. Referrals into the Program target children and young people whose middle ear disease and associated hearing loss has not been responsive to primary health management. To the end of 2019, services were generally provided twice a year in 11 rural and remote communities or regions across Queensland.

This report presents a summary of the ENT and audiological services provided by the Deadly Ears Program between 2007 and 2019 and an overview of change in ear and hearing health for children receiving services between 2015 and 2019. It focuses on children and young people's experiences with ear conditions and associated hearing loss. It also looks at variations between regions, referrals to and from the Program, and outcomes of children and young people who received multiple services from the Program.

## Deadly Ears services provided

At Deadly Ears outreach clinics from 2007–2019, children and young people aged under 18 were offered an integrated service where they would be seen by both an ENT specialist and an audiologist. Where surgery could be delivered by the Program in that location, children and young people who required surgery within the Program's scope were also offered a surgical service during the same visit.

From 2007 to 2019, 6,140 children and young people had a total of 18,212 visits to a Deadly ears service. Multiple types of services can be received in a single visit.

Between 2007 and 2019:

- **5,938** children and young people received **17,557** ENT clinic services.
- **1,250** children and young people received **1,854** ENT surgery services.
- Starting from 2008, **11,826** audiology services were provided to **4,502** children and young people.

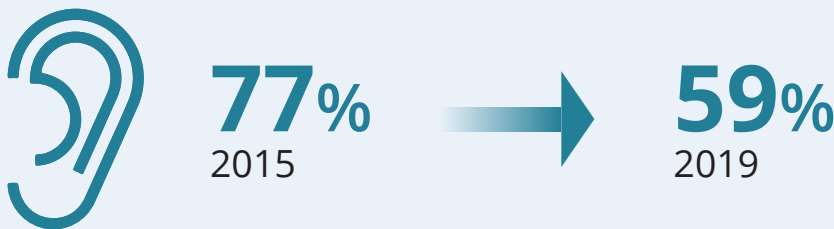
## Ear conditions in children and young people improved over time

Between 2015 and 2019, 64% of the 2,586 children and young people who attended an ENT clinic service had an ear condition in at least 1 ear at their first service. The most common type of ear condition was otitis media with effusion (21%)—that is, a collection of fluid in the middle part of the ear, behind the ear drum.

Among the 651 children and young people who attended at least 2 ENT clinic services between 2015 and 2019:

- 77% had at least 1 type of ear condition at their first service, decreasing by 18 percentage points to 59% at their latest service.
- The proportion of children and young people with otitis media with effusion approximately halved, from 35% at the first service to 16% at the latest service.

### The proportion of children and young people with at least 1 ear condition decreased between 2015 and 2019



Source: Deadly Ears Program data collection.

## Three in 5 children with hearing loss improved over time

In the 5-year period 2015 to 2019, 41% of 2,355 children and young people had hearing loss at their first audiology service—19% had unilateral hearing loss (1 ear), and 22% had bilateral hearing loss (both ears).

Children and young people with no ear conditions generally experienced better hearing than those with an ear condition. Among those with an ear condition at their first ENT clinic and audiology service, just over half (55%) experienced some form of hearing loss. In comparison, about 14% of children without an ear condition at their first service had hearing loss.

There are different types of hearing loss, including conductive, sensorineural and mixed. At their first audiology service, 39% of children and young people had conductive hearing loss—that is, hearing loss that results from dysfunction of the outer or middle ear. Conductive hearing loss is commonly associated with the presence of a middle ear condition, including otitis media. Additionally, 2.0% of children had sensorineural hearing loss—hearing loss that results from dysfunction in the inner ear (especially the cochlea).

For children and young people who attended multiple services (2 or more) over time and who had a confirmed hearing status at their first service (that is, did not have a finding of ‘unable to be determined’), the proportion with conductive hearing loss decreased from 64% (288 children) to 35% (161 children) between the first and latest service. In the critical 0–4 age group, the proportion with conductive hearing loss decreased from 65% (128 children) at the first service to 38% (75 children) at their latest service.

**The proportion of children aged 0–4 with conductive hearing loss decreased between their first and latest Deadly Ears service**



Source: Deadly Ears Program data collection.

Among those who had 2 or more services over time and had conductive hearing loss at their first service (total: 228 children; left ear: 225 children; right ear: 221 children):

- 60% (left ear: 136; right ear: 134) had improved at their latest service—that is, moved from a higher degree of hearing loss to a lower degree or no hearing loss
- the rates of bilateral conductive hearing loss decreased from 59% (171 children) to 26% (74 children) between the first and latest service.

Among those who attended 2 or more audiology services (707 children), the proportion with hearing within normal limits increased from 23% at their first service to 55% at the latest service.



# 1 Introduction

Ear and hearing health refers to a range of ear conditions, hearing loss and the interaction between them. Otitis media—inflammation and infection of the middle ear—is the main ear condition affecting Aboriginal and Torres Strait Islander children. If left untreated, otitis media has the potential to cause persistent and potentially permanent hearing loss.

While ear conditions, including otitis media, are common childhood illnesses, they are largely preventable and treatable. There are several factors which contribute towards the increased frequency and severity of ear infections in Aboriginal and Torres Strait Islander children, including an increased likelihood of:

- poor living conditions including household overcrowding and inadequate access to functional water and hygiene facilities
- lack of access to a healthy diet
- exposure to second-hand smoke
- living in a low socioeconomic area
- limited access to health services (Burns & Thomson 2013; Jervis-Bardy et. al. 2014).

Ensuring access to health services is particularly important for Indigenous children in communities with greater prevalence of middle ear disease and hearing loss. Services may be inaccessible due to geographic, social or cultural reasons (AIHW 2016).

Children and young people who do not have regular access to health services may have ear conditions left undetected and untreated, leading to the development of chronic ear conditions and causing persistent and potentially permanent damage to a child's hearing.

Hearing loss in childhood can lead to a lifetime of disadvantage, initially through a detrimental impact on a child's learning and language development, which may lead to behavioural problems, early school leaving, limited employment options and increased contact with the criminal justice system (Burns & Thomson 2013).

## Ear and hearing health in Queensland

Despite an existing body of research and increased awareness of the high rates of middle ear disease and associated conductive hearing loss (see Glossary) in Indigenous children, there is limited information available from primary health-care services on the prevalence of these conditions. This can make it difficult for tertiary services, such as the Deadly Ears Program, to effectively plan for and prioritise services to those most in need. A standardised national indicator measuring ear conditions and hearing loss at the primary health level has been proposed and is currently under consideration as a new measure within the Indigenous primary health care National Key Performance Indicators data collection.

Based on the Australian Bureau of Statistics National Aboriginal and Torres Strait Islander Health Survey, in 2018–19, an estimated 7% (19,100 children) of Indigenous children and young people aged 0–14 in Australia had a self-reported long-term ear or hearing problem (ABS 2019a). The rate was the same in Queensland, with an estimated 7% (5,700 children) of Indigenous children reporting an ear or hearing problem (estimate should be used with caution due to a relative standard error of between 25% and 50%) (ABS 2019b).

As part of the 2018–19 survey, a voluntary hearing test was also performed for those aged 7 and over. From the hearing test, an estimated 29% (42,200 children) of Indigenous children aged 7–14 in Australia had measured hearing loss in 1 or both ears. In Queensland, around 1 in 3 (34%; 14,400 children) Indigenous children were estimated to have measured hearing loss in 1 or both ears. In this age group (7–14), an estimated 8% (3,500 children) of Indigenous children in Queensland reported an ear or hearing problem (estimate should be used with caution due to a relative standard error of between 25% and 50%) (ABS 2019b). This shows that self-reported data may underestimate the true extent of hearing loss, and some children may need further medical review for undiagnosed or untreated hearing loss (ABS 2019a).

In 2012, the Deadly Ears Program conducted research on the prevalence rates of middle ear problems and associated hearing loss in the Doomadgee community. Of 138 Indigenous school children ranging in age from 4 to 9 years who received an ear and hearing check, 74% failed the screen (that is, failed 1 or more of otoscopy, tympanometry and audiometry) and 44% had some level of hearing loss determined by diagnostic audiology. Based on this study, the Deadly Ears Program estimated that 40–50% of Indigenous children in similar communities could be experiencing fluctuating hearing loss at any time (State of Queensland 2016).

## The Deadly Ears Program

The Deadly Ears Program was established by the Queensland Government to address the high rates of chronic middle ear disease and conductive hearing loss among Aboriginal and Torres Strait Islander children in Queensland. It sits as part of the Children’s Health Queensland Hospital and Health Service.

Clinical services were first delivered in 2007, when the Deadly Ears Program sat as part of the Royal Children’s Hospital in Brisbane. The Program was expanded in 2008 after securing 5 years of additional funding in the 2008 Queensland State Budget. This funding was used to establish the Program with the responsibility for delivering:

- clinical outreach services to rural and remote communities and regions across Queensland
- state-wide policy leadership to enhance coordination across health, early childhood development and education sectors.

Since 2010 the Program has also received funding from the Australian Government through the Healthy Ears—Better Hearing, Better Listening Program. In 2013, the Queensland Government committed ongoing funding to the Deadly Ears Program.

In 2016 the Deadly Ears Program collaborated with a range of health and education agencies to develop the Queensland Government policy to address middle ear disease and hearing loss, known as Deadly Kids, Deadly Futures (2016–2026). In addition to delivering clinical outreach services, the Program works with a network of agencies to deliver on Deadly Kids, Deadly Futures. This includes supporting children and families in rural and remote locations, implementing changes across sectors, and trialling modes of service delivery to improve outcomes in health, early childhood development and education, all of which is coordinated through a state-wide Steering Committee.

## Outreach services

The Program's outreach services were initially solely focused on ear, nose and throat (ENT) specialist and audiological review and have since expanded to include nurse-led and multidisciplinary allied-health clinics.

The Deadly Ears Program's frontline services currently include:

- enabling local health services to provide the best possible care to children within their communities who are at risk of middle ear disease. This ensures local health services have the organisational support, equipment and skill sets needed to regularly conduct ear and hearing checks, prioritising 0–4 year olds, and to treat them using best-practice clinical guidelines
- delivering integrated ear and hearing health specialist clinics and surgery in targeted communities to children who have been referred in with concerns regarding chronic middle ear disease and conductive hearing loss. These services include:
  - ear and hearing health information for children and parents
  - assessment and treatment of children by an ENT specialist
  - surgical intervention
  - diagnostic audiology review
  - specialist nursing review
  - targeted engagement by speech pathology and occupational therapy
- using telehealth to support the delivery of ENT, nursing and allied-health services described above
- collaborating and coordinating care with other visiting and referral services relevant to the above.

More information on Deadly Ears Program service delivery can be found in Chapter 2.

## About the data in this report

The data used in this report are gathered by staff employed by the Deadly Ears Program. The child's middle ear status is diagnosed by an ENT specialist and the child's hearing status is diagnosed by an audiologist.

It is important to note that children and young people who receive Deadly Ears services are not a random sample of the Aboriginal and Torres Strait Islander population in Queensland. As the Deadly Ears Program provides tertiary services, generally requiring a referral from primary health care, children and young people with worse ear and hearing health are more likely to be captured in the data collection. Hence, the Deadly Ears Program data is 'clinic presentation data' rather than 'population data'.

The Program does not accept referrals for adults. However, there are small numbers of adults in these data. Sometimes an adult may be seen opportunistically (e.g., a parent asks the ENT specialist for an assessment) or the patient has turned 18 years while in the Program's care before being referred on as an adult.

In this report, 'children and young people' refers to Indigenous Australians aged under 18, however, as explained above, a small number of adults are included in these data.

There are a number of factors which may influence the data and/or ear and hearing health outcomes of children and young people in the Deadly Ears Program, including:

- Otitis media and associated conductive hearing loss have their foundations in the social determinants of health. Children who receive services from the Deadly Ears Program may subsequently continue their exposure to adverse contributing factors like social disadvantage and inadequate housing conditions that contribute to the inability to maintain good health in the home.
- Given the tertiary diagnostic context of the Program's ENT and audiology services, in general local services should refer children and young people with middle ear and associated concerns when an ear condition has not been responsive to the recommended primary health management guidelines. In practice, recommended primary health management is not always undertaken, with referrals not always documenting the history or management of the disease. The Program would also see children who presented opportunistically, with clinicians assessing children who were either siblings of patients or who presented at the clinic with concerned parents.
- Children and families would attend face-to-face appointments with the Deadly Ears clinicians while the Program visited the local health service, and this generally occurred approximately every 6 months. Given the fluctuating nature of otitis media and the associated hearing loss, a child could attend without significant disease but be re-booked for further review owing to the child's referral and history highlighting significant ear and hearing concerns.

In this report, some comparisons are made between the Deadly Ears Program and the Northern Territory Remote Aboriginal Investment Hearing Health Program (NTRAI Program) to provide insights into any differences or similarities in the experiences of ear disease and hearing loss across these 2 programs. However, these comparisons should be interpreted with caution due to differences in the way the 2 programs operate. See Box 4.2 and Box 5.5 for more information.

Box 1.1 details some of the challenges associated with identifying and managing ear and hearing health in Indigenous children.

### **Box 1.1: Challenges with ear and hearing health surveillance**

For Aboriginal and Torres Strait Islander children, the importance of strong and consistent ear and hearing health surveillance within the primary health setting is well understood. Ideally, children need to have access to regular and age-appropriate ear and hearing health checks in line with the *Recommendations for Clinical Care Guidelines on the Management of Otitis Media in Aboriginal and Torres Strait Islander Populations* (the OM Guidelines).

It is acknowledged that these local primary health services often deal with chronic disease and acute health problems beyond just ears and hearing. Often these services report that it is difficult to undertake regular ear and hearing health surveillance. This means there is a potential gap in knowledge about the extent of otitis media and related problems in local communities. The data contained within this report is predicated on the right children being referred, at the right time and in the right place. However, if children miss having regular ear and hearing health checks, then it increases the likelihood that children with chronic otitis media and associated impacts exist in a community without identification and management, and are therefore not seen by the Deadly Ears Program.

More information on the Deadly Ears Program data collection and factors which may influence the findings of this report can be found in Appendix A.

Supplementary tables with data for all figures in the report are available on the AIHW website <https://www.aihw.gov.au/reports/indigenous-australians/queenslands-deadly-ears-program/data>

## 2 Deadly Ears service delivery

### Key findings

- From 2007 to 2019, over 6,100 children and young people attended about 18,200 visits with the Deadly Ears Program.
- Around 17,600 ENT clinic assessments, 11,800 audiology assessments and 1,900 ENT surgery services were delivered through the Deadly Ears Program to these children.

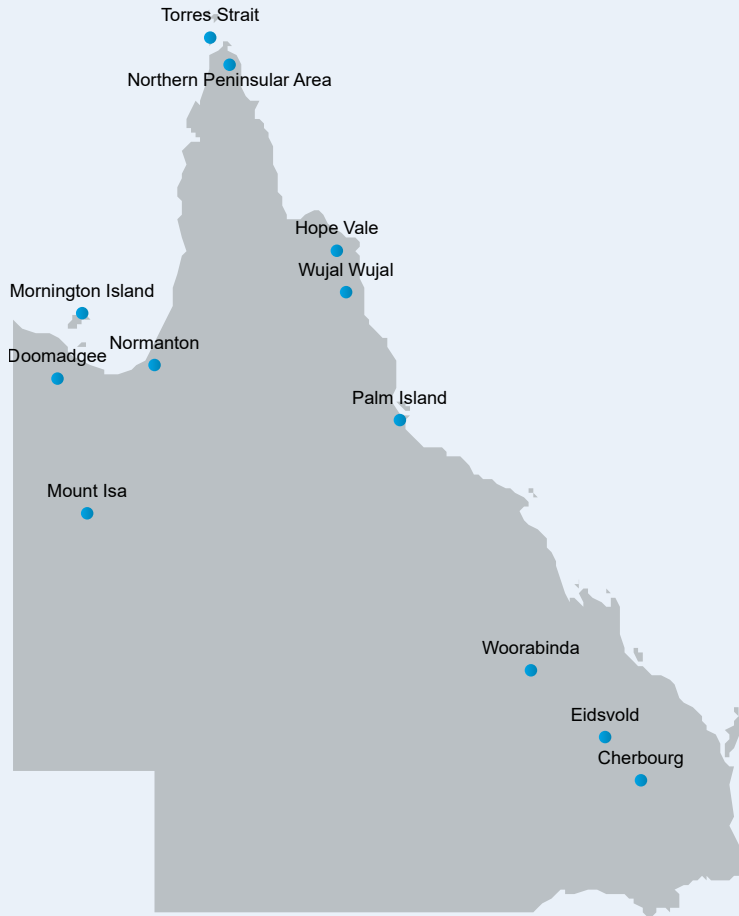
This chapter provides information on the delivery of Deadly Ears Program services, including service locations and an explanation of the different types of services provided, as well as explaining how children and young people move through the Program. It also looks at the number of ENT clinic assessment, audiology assessment and ENT surgery services provided by the Program each year.

### Outreach services

The Program currently delivers services to 11 locations (covering communities and regions) across Queensland (Figure 2.1). These are:

- Cherbourg
- Doomadgee
- Hope Vale (clinic only, no surgery)
- Mornington Island
- Mount Isa (providing access for children from surrounding communities in addition to Mount Isa)
- Normanton
- Northern Peninsula Area (providing access for children from Bamaga, New Mapoon, Injinoo, Seisia and Umagico)
- Palm Island
- Thursday Island (clinic and surgery) and Torres Strait Outer Islands (clinic only)
- Woorabinda
- Wujal Wujal (clinic only, no surgery).

**Figure 2.1: Deadly Ears Program service locations**



*Note:* Services to the Central Queensland community of Eidsvold ended in 2014 due to significant reductions in the need for this type of specialist service. Services to Palm Island, Normanton, and Thursday Island / Torres Strait commenced in 2011.

*Source:* Deadly Ears Program data collection.

In each of these locations, the Program was initially invited by the local community to deliver services as a result of their concern for the ear and hearing health of the community's children. This established a partnership between the Program and each community. A key feature of the Deadly Ears Program is the ability to offer access to specialist services 'close to home'. In some parts of Queensland, access to paediatric ENT services from a remote community would ordinarily involve considerable travel. For example, without the Deadly Ears Program, a child from Mornington Island requiring specialist ENT services would be referred to Townsville as the closest tertiary ENT referral hospital.

Children can be referred into the Deadly Ears Program from a range of sources, including from primary health care and audiologists. See Chapter 3 for more information on referrals.

Box 2.1 summarises the types of outreach services provided by the Deadly Ears Program. More information on these services can be found in the relevant sections later in this chapter.

### **Box 2.1: Summary of Deadly Ears service types**

**Visit:** when a child or young person attends a Deadly Ears service within a single trip. A child or young person may have multiple kinds of services (for example, ENT clinic and audiology assessment, and ENT surgery) in a visit.

**ENT clinic assessment:** an assessment of a child or young person's ear health by an ENT specialist, including diagnosis and treatment of ear conditions, as well as providing ear and hearing health information for children and their families. The ENT specialist may also refer the child on for further follow-up services, including Deadly Ears ENT surgery. The majority of children who attend an ENT clinic assessment will also attend an audiology assessment.

**Diagnostic audiology assessment:** an assessment of a child or young person's hearing health by an audiologist, including diagnosis of hearing loss. If required, the audiologist will refer the child for further treatment and follow-up.

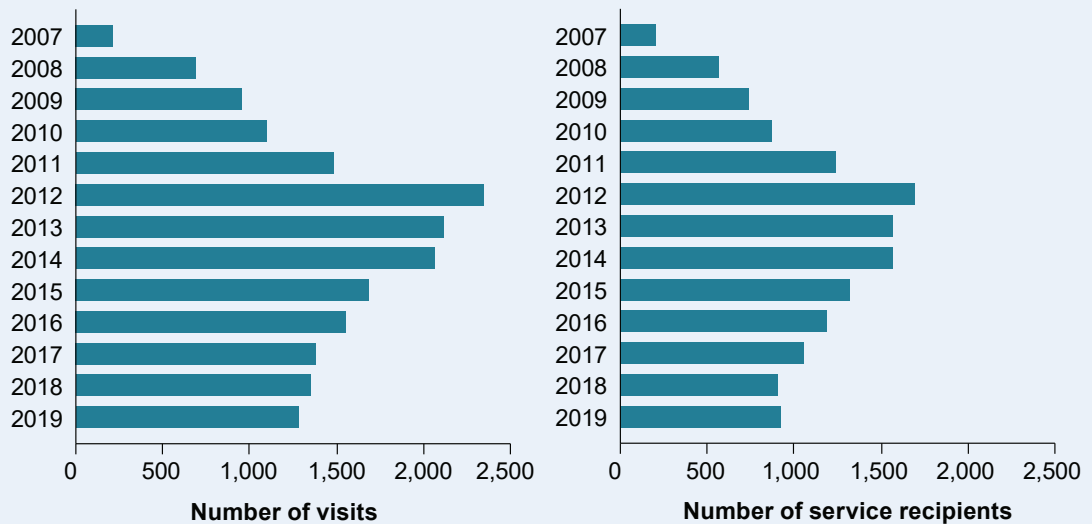
**ENT surgery service:** if a child or young person is identified at their ENT clinic assessment as requiring surgery for their ear condition, they will be offered ENT surgery in the same Deadly Ears visit (if available, and within the Program's scope).

The Program does not accept referrals for adults. However, there are small numbers of adults in these data. Sometimes an adult may be seen opportunistically (e.g., a parent asks the ENT specialist for an assessment) or the patient has turned 18 years while in the Program's care before being referred on as an adult.

A patient journey, highlighting the pathway of children and young people as they move through the Program, is shown in Figure 2.2.



**Figure 2.3: Number of Deadly Ears visits and service recipients, 2007–2019**



Note: As children and young people can receive multiple visits across years, the sum of the service recipients across years does not equal the total number of service recipients between 2007 and 2019.

Source: Deadly Ears Program data collection.

This trend is largely due to the Program’s cessation of its ear and hearing screening outreach to targeted communities in 2013, and a move towards building local primary health capacity to undertake surveillance as part of routine and opportunistic child health checks, prioritising children aged 0–4 years old. The Program also began tightening its referral criteria from 2012. From this point, referrals were routinely reviewed against the *Recommendations for Clinical Care Guidelines on the Management of Otitis Media in Aboriginal and Torres Strait Islander Populations* (the OM Guidelines). From mid-2014 the Program updated its clinical and surgical protocols following review by its ENT Specialist Reference Group. Concurrently, additional workforce development was offered by the Program to local primary health services to improve primary health management of children with middle ear concerns and enhance subsequent appropriateness of referrals.

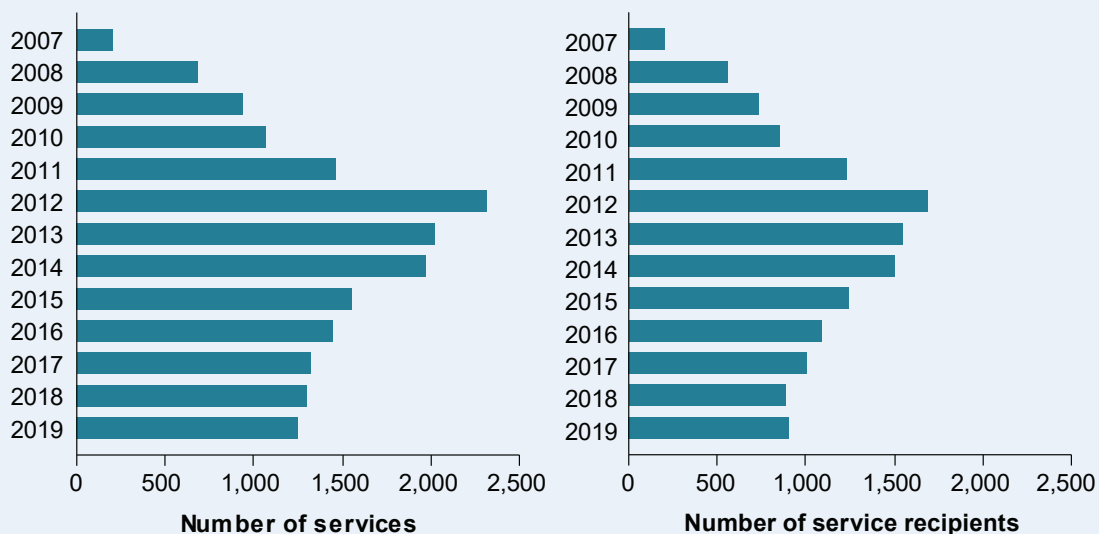
As a result, after 2012 the Program’s intake was more likely to reflect children whose middle ear problems had not been resolved with primary health management and therefore warranted tertiary ENT and audiological assessment and consideration for further surgical, medical and rehabilitation intervention (including fitting of hearing aids and access to early intervention). As such from 2012 there was a decrease in the number of children requiring a tertiary ENT assessment and subsequent surgical services by the Program.

## ENT clinic assessment

Between 2007 and 2019, the Deadly Ears Program delivered 17,557 ENT clinic services to 5,938 children and young people. The number of ENT clinic services provided each year increased from 209 in 2007 to 2,318 in 2012, and gradually decreased to 1,255 in 2019 (Figure 2.4).

The number of children and young people who received ENT clinic services each year also increased between 2007 and 2012, from 209 to 1,687 children, before decreasing to 908 children in 2019. See the explanation below Figure 2.4 for a description of the changes to the Program that underpin this trend in service delivery.

**Figure 2.4: Number of ENT clinic services and service recipients, 2007–2019**



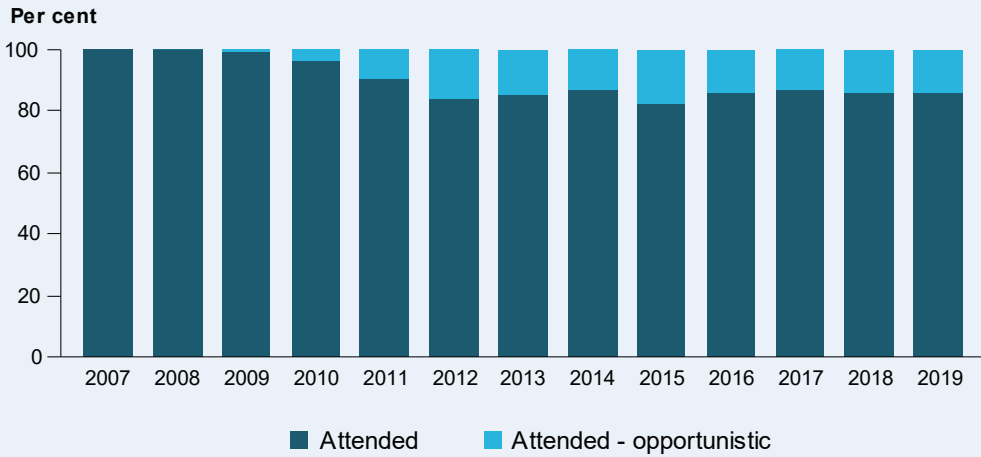
*Note:* As children and young people can receive multiple services across years, the sum of the service recipients across years does not equal the total number of service recipients between 2007 and 2019.

*Source:* Deadly Ears Program data collection.

Children and young people who received ENT clinic services either had a referral from a health-care provider (e.g., general practitioner) and attended the clinic for their appointment or attended opportunistically without an appointment—for example they were a sibling of a child with a booking.

In 2019, 82% of children who received ENT clinic services attended with an appointment, while 18% attended opportunistically. The proportion of children who attended opportunistically was low (less than 5%) in the first few years after the Program’s commencement, likely due to a delay in consistent recording for opportunistic attendances. In 2011, the proportion increased to 12% and remained stable between 2012 and 2019 at around 16%–21% (Figure 2.5).

**Figure 2.5: ENT clinic service recipients, by year and attendance type**

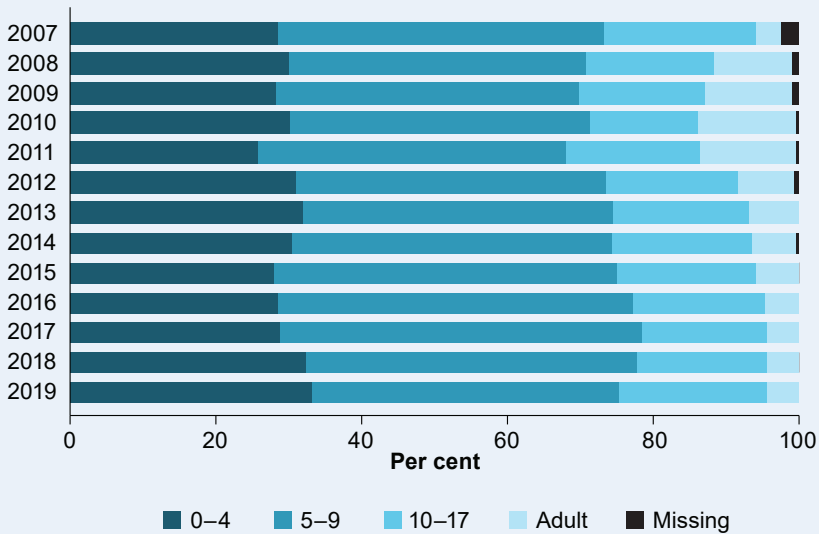


*Note:* For children and young people who attended more than 1 ENT clinic service in a calendar year, their attendance type at their first service in that year is used.

*Source:* Deadly Ears Program data collection.

Most children and young people who received an ENT clinic service were aged under 10 (between 68% and 79%, depending on the year). Each year between 2007 and 2019, between 41% and 50% of children and young people who received an ENT clinic service were aged 5–9, and between 26% and 33% were aged 0–4 (Figure 2.6).

**Figure 2.6: ENT clinic service recipients, by year and age group, 2007–2019**



Note: For children and young people who attended more than 1 ENT clinic service in a calendar year, their age group at their first service in that year is used.

Source: Deadly Ears Program data collection.

## Audiology assessment

Audiology is provided as part of Deadly Ears’ ENT outreach clinics. Deadly Ears Audiology is not a stand-alone service but forms 1 component of the ENT outreach clinic. Children are therefore only able to access Deadly Ears Audiology through a referral for Deadly Ears ENT clinic assessment. It is worth noting that referrals are accepted directly from audiology services (e.g., Hearing Australia) when a need for ENT assessment is identified.

The audiology component of the Program’s ENT outreach clinics has expanded significantly in recent years and now aims to see over 90% of children who attend an ENT consultation. The audiology assessment test battery has expanded over time and now includes a comprehensive case history, including speech, development and functional questionnaires; impedance audiometry; otoacoustic emissions (where indicated); and age-appropriate behavioural audiometry including visual reinforcement audiometry for younger children.

For every child seen for audiology, an overall diagnosis of their hearing status on that visit is recorded. These hearing statuses include:

- hearing within normal limits
- conductive hearing loss (unilateral or bilateral—this is, 1 or both ears)
- sensorineural hearing loss (unilateral or bilateral)
- mixed hearing loss (unilateral or bilateral)
- unable to be determined (for when hearing thresholds are not able to be measured).

See Box 5.1 for definitions of the above hearing statuses.

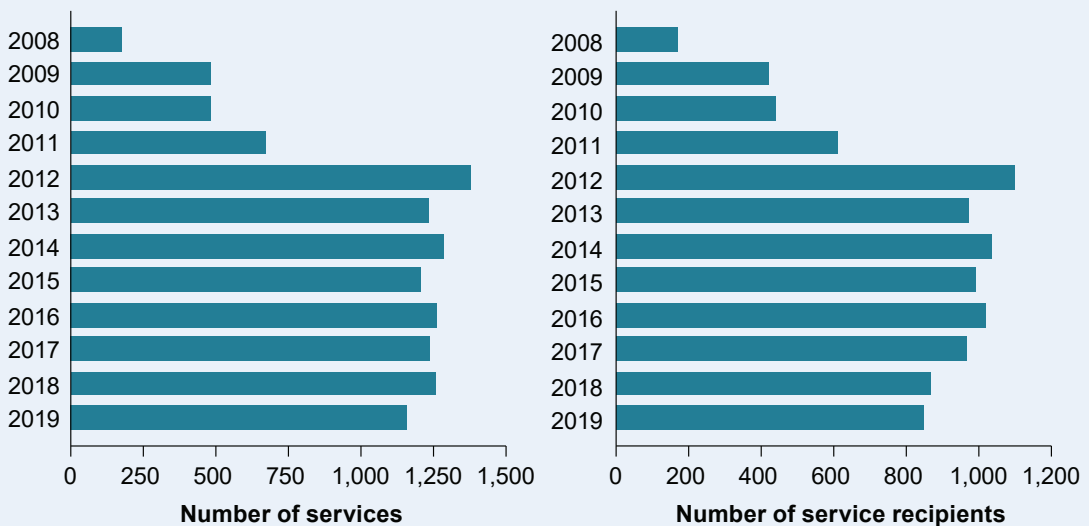
For children and young people found to have any type of hearing loss, a severity rating of the hearing loss is also recorded (mild, moderate, severe or profound) based on the grades of hearing impairment outlined in the OM guidelines. For children with hearing concerns, recommendations and onward referrals will also be made with the family, as required, to other hearing and early intervention services, such as rehabilitation audiology (through Hearing Australia), speech pathology and occupational therapy.

To further support children’s hearing and to coordinate hearing care across multiple services, all ear and hearing outcomes and recommendations from Deadly Ears ENT clinics with consent are shared with relevant service providers such as early years, education, primary health and other specialist health services.

The Deadly Ears Program began providing audiology services in 2008. From the commencement of this service until 2019, 11,826 audiology services were provided to 4,502 children and young people.

The number of audiology services provided each year increased from 180 in 2008 to 1,376 in 2012. From then until 2019, around 1,200–1,300 services were delivered each year (Figure 2.7).

**Figure 2.7: Audiology services and service recipients, 2008–2019**

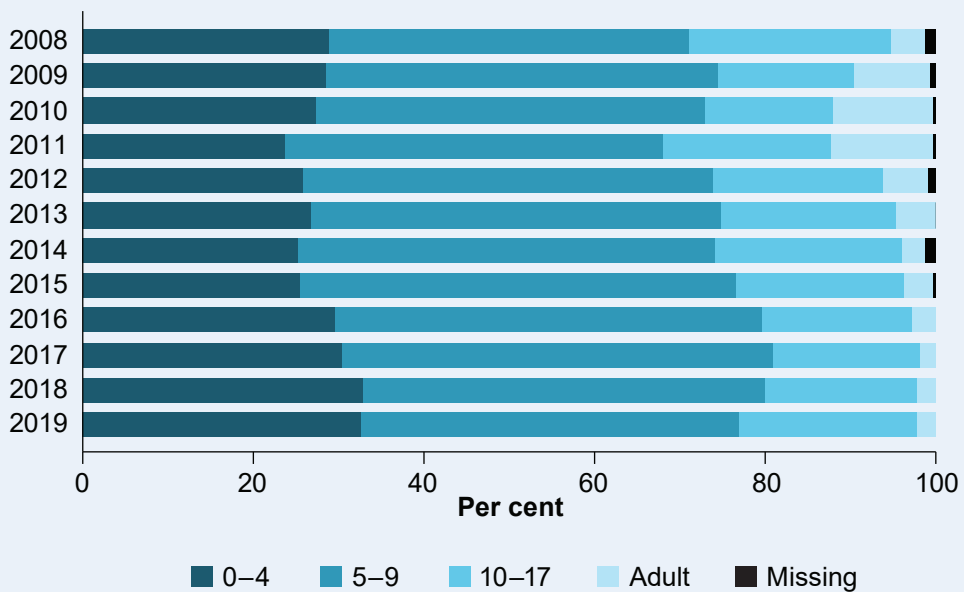


*Note:* As children and young people can receive multiple services across years, the sum of the service recipients across years does not equal the total number of service recipients between 2008 and 2019.

*Source:* Deadly Ears Program data collection.

The increase in audiology services and recipients between 2008 and 2012 correlates to an increase in the number of ENT clinic services and service recipients seen in Figure 2.4. From 2012 to 2019, the number of audiology services and recipients remained stable. This trend can be attributed to a number of factors including a tightening of intake referral criteria, an increase in audiology workforce capacity, advancements in testing protocols for younger children and a Program decision for all children (where possible or required) to undergo an audiology assessment as part of the ENT consult. Each year between 2008 and 2019, between 42% and 51% of children and young people who had an audiology assessment were aged 5–9, and between 24% and 33% were aged 0–4 (Figure 2.8).

**Figure 2.8: Audiology service recipients, by age, 2008–2019**



*Note:* For children and young people who attended more than 1 audiology service in a calendar year, their age group at their first service in that year was used.

*Source:* Deadly Ears Program data collection.

## ENT surgery

In communities where surgery is possible, the Deadly Ears ENT outreach service provides both clinical and surgical services in the same week, with clinic occurring early in the visit followed by surgical days. In general, children who receive an ENT clinic service who are assessed as requiring surgery that is within the Program's scope will be offered a surgical appointment in the same week.

The Deadly Ears Program's ability to provide surgery in remote locations is governed by the state's Clinical Services Capability Framework (CSCF) and this also governs the scope of any surgery able to be performed. As a result, there are some locations where the Program does not offer a surgical service. For children requiring surgery, they will either be offered:

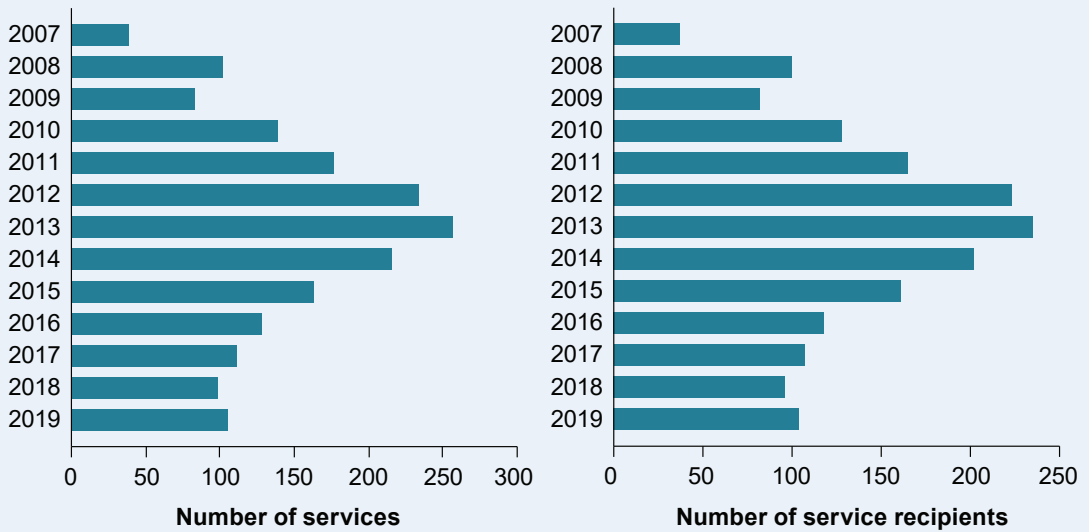
- a surgical service by the Program during the same visit
- a referral to another Deadly Ears surgical visit. For example, children from the outer islands of the Torres Strait may be referred to the Program's next visit to Thursday Island
- a referral to the relevant public hospital for the region if the Program does not offer a surgical service to that location, or if the surgical need is outside the Program's surgical scope (e.g., tonsillectomy).

The surgical procedures undertaken by the Program address chronic or persistent otitis media and/or correct the impacts from the disease. They include:

- examination under anaesthetic of ears with aural toileting. This procedure involves clearing wax, discharge, debris or foreign bodies from the ear canal
- myringotomy with or without grommet insertion. This is an incision into the tympanic membrane to remove fluid from the middle ear and allow ongoing aeration of the middle ear space until Eustachian tube function returns
- adenoidectomy. This is removal of the adenoids from the post-nasal space, as adenoids are often focal points for infections and contribute to dysfunction of the Eustachian tube
- myringoplasty. This involves the repair of the tympanic membrane, commonly to fix chronic perforations attributed to otitis media conditions or iatrogenic causes due to grommets. Under the CSCF, the Program can perform transcanal or endaural approaches in most surgical locations, plus post-auricular myringoplasties only in locations with a designated operating room (Mount Isa and Thursday Island).

Between 2007 and 2019, the Deadly Ears Program provided 1,854 ENT surgery services to 1,250 children and young people. The number of ENT surgery services delivered each year increased from 38 to 257 services between 2007 and 2013, before decreasing to 106 services delivered in 2019. A similar trend was seen for the number of children and young people receiving ENT surgery services (Figure 2.9).

**Figure 2.9: ENT surgery services and service recipients 2007–2019**



*Note:* As children and young people can receive multiple services across years, the sum of the service recipients across years does not equal the total number of service recipients between 2008 and 2019.

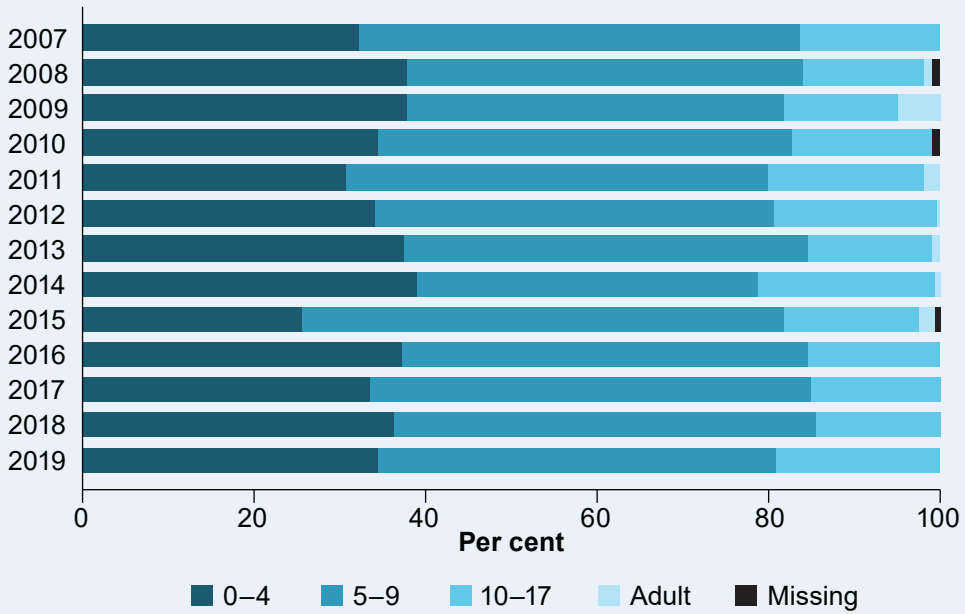
*Source:* Deadly Ears Program data collection.

As noted earlier, the Program undertook a number of actions that may influence the trends over time, including:

- tightening of its referral criteria described previously, beginning in 2012
- updating of its clinical and surgical protocols in 2014
- providing further capacity building of local primary health services so their activity better aligned with the OM guidelines.

From 2007 to 2019, between 40% and 57% of children and young people who received an ENT surgery service each year were aged 5–9. Around 26% to 38% were aged 0–4 (Figure 2.10).

**Figure 2.10: ENT surgery service recipients, by age, 2007–2019**



*Notes*

1. For children and young people who attended more than 1 ENT surgery service in a calendar year, their age group at their first service in that year is used.
2. 'Missing' means there was no data on age group available.

*Source:* Deadly Ears Program data collection.

### 3 Demand for Deadly Ears and follow-up services

#### Key findings

- From 2015 to 2019, over 1,700 referrals were accepted by the Deadly Ears Program from other health-care professionals.
- Over the same time period, the Deadly Ears Program made around 1,500 referrals to providers, such as Hearing Australia, for further treatment and assessment.

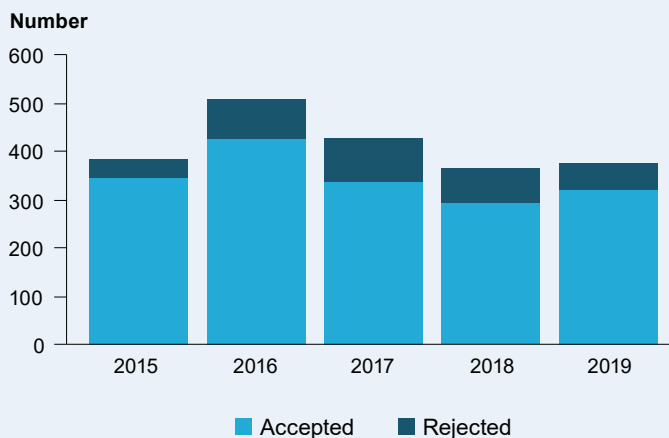
This chapter presents information regarding referrals to and from the Deadly Ears Program between 2015 and 2019. Information on ear conditions and hearing health is limited to this time period due to the migration of the Deadly Ears database onto the state-wide *Qchild* system in mid-2014.

The Program accepts and processes referrals according to the referral guidelines outlined in the OM guidelines, and the Queensland Health Clinical Prioritisation Criteria (i.e., Deadly Ears referral guidelines), which outlines the requirements of primary health management prior to referral to specialist services (State of Queensland, 2020).

#### Referrals in

Between 2015 and 2019, the Deadly Ears Program accepted a total of 1,718 referrals from other health-care providers. Over this time period, an additional 340 referrals were rejected as they were not in line with the Deadly Ears referral guidelines (Figure 3.1).

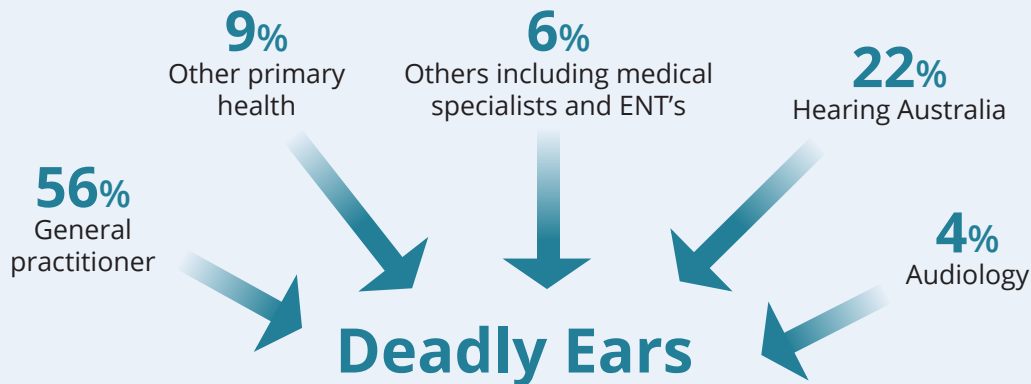
**Figure 3.1: Accepted and rejected referrals into the Deadly Ears Program, 2015–2019**



Source: Deadly Ears Program data collection.

The most common health-care provider type to refer to the Deadly Ears Program was general practitioner (56%), followed by Hearing Australia (22%) (Figure 3.2).

**Figure 3.2: Accepted referrals into the Deadly Ears Program, by referrer type, 2015–2019**



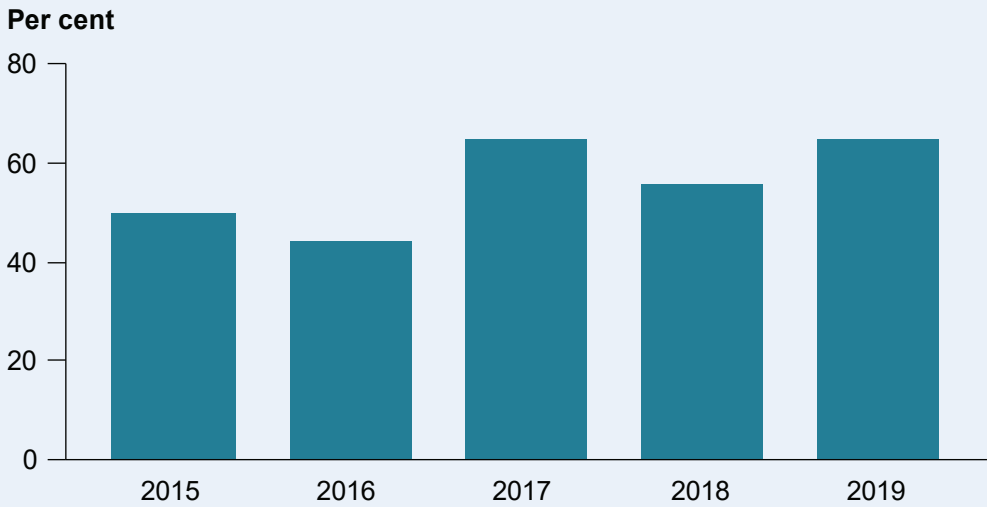
*Note:* Excludes 3% of referrals which did not contain information on where they were from.

*Source:* Deadly Ears Program data collection.

Referrals to the Deadly Ears Program can be assessed against the Deadly Ears referral guidelines to determine if the referral was clinically appropriate. Between 2015 and 2019, 60% of referrals that were accepted met the Deadly Ears referral guidelines while 28% did not (12% were not yet categorised). The proportion of referrals that were in line with the Deadly Ears referral guidelines increased over time, from 34% in 2015 to 67% in 2019. This change corresponds with the Program either directly providing or facilitating training for local child health and primary health staff in routine ear and hearing health surveillance from approximately 2013.

Among the 1,718 referrals to the Deadly Ears Program between 2015 and 2019, 48% (827 children) were accepted as a 'new referral', that is, they had not been referred for a Deadly Ears service before. Over this time period, over half (56%) of new and accepted referrals were for children aged 0–4. The proportion of new and accepted referrals that were for children aged 0–4 fluctuated over time, increasing from 50% in 2015 to 65% in 2019 (Figure 3.3).

**Figure 3.3: Proportion of new and accepted referrals into the Deadly Ears Program for children aged 0–4, 2015–2019**

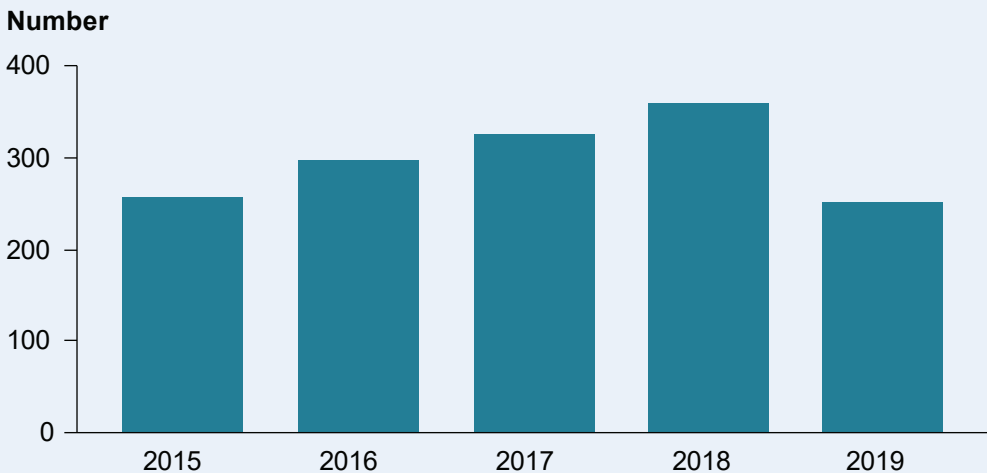


Source: Deadly Ears Program data collection.

## Referrals out

Between 2015 and 2019, 1,492 referrals were made from the Deadly Ears Program to other service providers. The number of referrals made each year increased until 2018, with a decrease in 2019 (Figure 3.4).

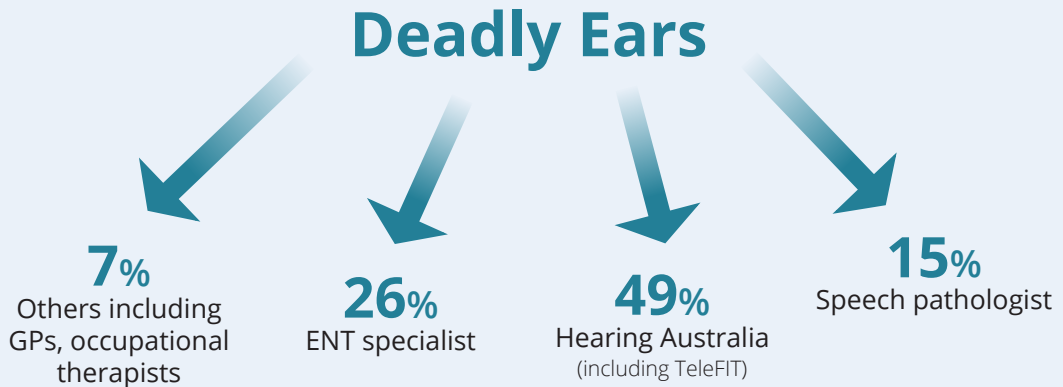
**Figure 3.4: Referrals from the Deadly Ears Program, 2015–2019**



Source: Deadly Ears Program data collection.

Most referrals from Deadly Ears were to Hearing Australia (49%) for rehabilitation assessment including fitting of hearing aids, or to an ENT specialist (26%) for review of issues outside of the Program’s scope or other required treatment not able to be offered by the Program at that location (e.g., surgery).

**Figure 3.5: Referrals from the Deadly Ears Program, by where referral was to, 2015–2019**



*Note:* Excludes 3% which did not contain information on where the referral was to.

*Source:* Deadly Ears Program data collection.

At the end of 2019:

- 64% of referrals out since 2015 had been completed—that is, the child had been seen by the service referred to, and care had been provided
- around 12% of referrals sent from the Deadly Ears program had been accepted by the service but the child had yet to be seen or was still undergoing care
- 5% of referrals had been sent and were awaiting acceptance by the service
- around 4% of referrals had lost contact with the child
- 15% of referrals were unable to progress and the child had not been able to engage with the service referred to. This was usually because the child had relocated or was generally unable to be contacted, or did not attend scheduled appointments.

## 4 Ear conditions among Deadly Ears service recipients

### Key findings

- From 2015 to 2019, around 3 in 5 (64%) children and young people had at least 1 ear condition at their first recorded service.
- Among children who attended at least 2 clinic services between 2015 and 2019, 77% had at least 1 type of ear condition at their first service, decreasing by 18 percentage points to 59% at their latest service.
- The proportion of children and young people with OME (the most common condition) decreased from 35% at their first service to 16% at their latest service.
- Around 2 in 5 (left ear: 45%, right ear: 43%) children who had an ear condition at their first service experienced a decrease in the severity of their ear condition over time.

This chapter presents information on the ear conditions of Deadly Ears service recipients from 2015 to 2019. Information on ear conditions and hearing health is limited to this time period due to the migration of the Deadly Ears database onto the state-wide *Qchild* system in mid-2014.

Given the fluctuating potential of otitis media and the associated hearing loss, a child could attend without significant disease but be re-booked for further review owing to the child's referral and history highlighting significant ear and hearing concerns.

Children and young people who received an ENT clinic service will have information recorded on their ear condition status, and as such, only children who have attended an ENT clinic service are included in this chapter. Box 4.1 lists the relevant terminology, abbreviations and definitions associated with service delivery to address middle ear conditions.

It is worth noting that otitis media is not a single diagnosis. It can present in many varied and different forms and refers to a group of diagnoses, as described in Box 4.1, that can affect 1 or both ears at different times.

## Box 4.1: Ear condition terminology, abbreviations and definitions

**Tympanic membrane (TM):** refers to the ear drum, a membrane which divides the external auditory canal from the middle ear.

**No ear condition:** an intact and normal TM with an air-filled middle ear. Also referred to as an aerated middle ear.

**Patent grommet:** a patent grommet or tympanostomy tube in situ in the TM allowing ventilation of the middle ear.

**Eustachian tube dysfunction (ETD):** failure of 1 or more of the Eustachian tube (ET) functions which include maintaining normal middle ear air pressure, draining fluid from the middle ear, and protecting the middle ear from nasal secretions or sounds. In childhood, inadequate opening of the ETs is the most common form of ETD with resulting negative pressure in the middle ear and retraction of the TM.

**Acute otitis media (AOM):** general term for both AOM without perforation and AOM with perforation. It is the presence of fluid behind the TM plus at least 1 of the following: bulging TM, fever, ear pain or irritability.

**AOM without perforation:** presence of fluid behind the TM, plus at least 1 of the following: bulging TM, red TM, fever, ear pain or irritability. A bulging eardrum and/or ear pain are the most reliable indicators of AOM without perforation.

**AOM with perforation:** AOM presentation with discharge of pus through a perforation in the TM for less than 2 weeks. The perforation is usually very small (a pinhole) when the TM first ruptures. The perforation can heal and re-perforate after the initial onset of AOM with perforation.

**Otitis media with effusion (OME):** the presence of fluid behind the TM without any acute symptoms. Other terms have also been used to describe the type of OME (including 'glue ear', 'serous otitis media' and 'secretory otitis media'). OME may be episodic or persistent.

**Discharging grommet:** a grommet or tympanostomy tube in situ in the TM, with discharge passing from the middle ear, through the grommet lumen. Purulent discharge is commonly associated with incomplete water precautions following insertion of grommets. Serous discharge is common during the early postoperative period. This process of discharging is also known as tympanostomy tube otorrhoea.

**Dry perforation:** presence of a perforation (hole) in the TM without any signs of discharge, infection or fluid behind the TM. In other definitions this can also be referred to as inactive CSOM or CSOM without discharge.

**Retraction:** a condition where a part or all of the intact TM is pulled inward, initially this can be as a result of persistent negative middle ear pressure, due to ETD.

**Chronic suppurative otitis media (CSOM):** persistent ear discharge through a perforation in the TM lasting 2 weeks or more. On otoscopy, the perforation must be viewed and be greater than or equal to 2% of the pars tensa (the tense part of the TM).

**Cholesteatoma:** a cyst formed due to accumulation and abnormal growth of ear skin cells in a retraction pocket or through a perforation of the TM, or in the middle ear space. Due to hyperproliferation of the skin cells the cyst grows, becoming space-occupying, often with infection. A cholesteatoma caused by middle ear disease most often occurs in the attic region of the TM. Cholesteatomas, where untreated, are arguably the most destructive form of middle ear disease.

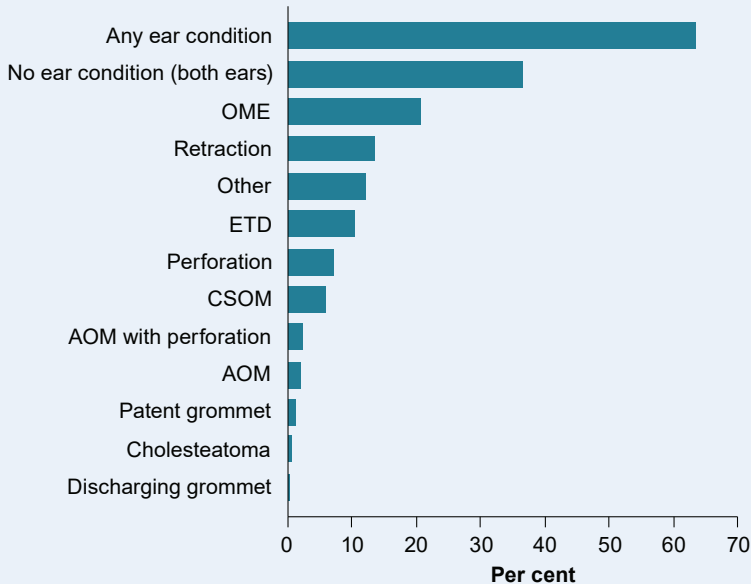
**Other:** a finding of 'unable to be determined'. This often occurs if a child has wax obscuring the view of the TM, or where the child has been unable to be examined.

*Source: Deadly Ears Program (unpublished); Darwin Otitis Guidelines Group 2010.*

From 2015 to 2019, 2,586 children and young people received at least 1 ENT clinic service. At their first recorded service in this time period, 36% (945 children) had no ear condition while 64% (1,641 children) had at least 1 type of ear condition. The most common types of ear conditions were:

- otitis media with effusion (OME)—the build-up of fluid in the middle ear (535 cases; 21%)
- retraction—where the ear drum is pulled inwards, associated with negative pressure in the middle ear space (349 cases; 14%)
- Eustachian tube dysfunction (ETD)—any issue with the usual function of the Eustachian tubes (272 cases; 11%) (Figure 4.1).

**Figure 4.1: Types of ear conditions at their first service, among children and young people who received at least 1 ENT clinic service, 2015–2019**



*Notes*

1. For children and young people who received multiple ENT clinic services over time, their ear condition status at their first ENT clinic service was used.
2. The sum of the ear conditions exceeds the total with any ear condition as children and young people can have more than 1 ear condition at any time.

Source: Deadly Ears Program data collection.



**Almost 2 in 3 children (64%) had at least 1 ear condition**

The proportion of ear conditions varied with age, with younger children generally having a higher proportion of ear conditions than older children and young people (Figure 4.2). Between 2015 and 2019:

- 71% of children aged 0–4 had at least 1 ear condition at their first recorded service
  - nearly 1 in 3 (31%) had OME and 1 in 10 (10%) had ETD
- 62% of children and young people aged 5–9 had an ear condition
  - nearly 1 in 5 (19%) had OME as the most common condition
- 54% of young people aged 10–17 had an ear condition
  - nearly 1 in 5 (19%) had retraction as the most common condition.

**Figure 4.2: Most common ear condition, among children and young people who received at least 1 ENT clinic service, by age group, 2015–2019**



*Note:* For children and young people who received multiple ENT clinic services over time, their ear condition status and age group at their first ENT clinic service was used.

*Source:* Deadly Ears Program data collection.

### **Box 4.2: How do the findings of the Deadly Ears Program and Northern Territory Remote Aboriginal Investment Hearing Health Program (NTRAI Program) compare?**

For the past decade the Australian Government has funded the Northern Territory Government to provide hearing health services to Indigenous children and young people aged under 21 in the Northern Territory. Similar to the Deadly Ears Program, the NTRAI Program provides outreach ENT and audiology services, especially in remote areas with high demand and a lack of local services. There are some differences in the way these programs operate which may impact their comparison, including:

- They use different systems for determining a child's eligibility to receive services. The Deadly Ears Program accepts and processes referrals according to the OM guidelines and the Queensland Health Clinical Prioritisation Criteria, whereas the NTRAI Program uses priority classifications developed specifically for the NTRAI Program to ensure those with worse ear and hearing health are prioritised for services.
- The NTRAI Program provides ENT teleotology services whereas the Deadly Ears Program provides ENT assessments face-to-face. This may influence the results from the analyses, as the tools and methods used to assess ear health and make diagnoses may differ between the 2 methods.

Despite these differences, comparing the ear and hearing health findings from these programs can provide useful insights, including:

- A similar proportion of children from the Deadly Ears Program (64%) and the NTRAI Program had at least 1 ear condition (62%) (noting that the Deadly Ears Program uses ear condition status at a child's first recorded service whereas the NTRAI Program uses the latest recorded service).
- For both programs, the most commonly diagnosed ear condition was OME (Deadly Ears: 21%; NTRAI: 25%).
- Children in the NTRAI Program had a higher proportion of CSOM (9.3%) and dry perforation (15%) than children in the Deadly Ears Program (5.7% and 7.2%, respectively).
- In both programs, around 1 in 3 children aged 0–4 and around 1 in 5 aged 5–9 had OME (the 6–10 year age group from the NTRAI Program has been used for comparison with the 5–9 age group from Deadly Ears).

*Source: AIHW 2020; Deadly Ears Program data collection.*

Box 4.3 examines the 'minimum prevalence' of ear disease in the Indigenous population in Deadly Ears Program locations.

### **Box 4.3: Prevalence of ear disease in Deadly Ears Program locations**

In order to understand more about the burden of ear conditions in different locations, the 'minimum prevalence' of ear conditions among Deadly Ears service recipients can be calculated. The minimum prevalence is the number of children who attended a Deadly Ears service and were found to have an ear condition expressed as a proportion of the total eligible population.

This is a 'minimum' estimate because any children who have an ear condition but do not receive a Deadly Ears service are not included in the numerator. In addition, due to the episodic nature of ear disease, children might not necessarily present with ear disease at the point in time that they attend a Deadly Ears clinic, further reducing the size of the numerator. As such, the minimum prevalence does not provide a complete picture of the prevalence of ear conditions within this population and should be interpreted with caution.

Between 2015 and 2017, 13% of the eligible Indigenous population aged 0–14 accessed a Deadly Ears service and had an ear condition at that service. The estimated minimum prevalence varied by age:

- 11% of eligible children aged 0–4 had an ear condition
- 20% of eligible children aged 5–9 had an ear condition
- 8% of eligible children aged 10–14 had an ear condition.

See Appendix B for further information on the methodology and more detailed estimates of minimum prevalence across Deadly Ears service locations.

## Changes over time

This section presents the changes in children and young people's experiences with ear conditions over time, to better understand the effectiveness of the services received through the Deadly Ears Program. In this chapter and subsequent chapters, information is presented on changes between the child's first service and the child's latest service, for children who had at least 2 services within the specified time period. The child's latest service refers to their most recent visit in the relevant time period.

It is important to note that:

- Changes over time in ear conditions may be due to factors outside the control of the Program including the influence of the social determinants of health in the environment around a child after they are seen by the Program, or the natural decrease in the rates of ear disease as children grow older.
- Ear condition status at the latest recorded service does not necessarily reflect the final outcomes for children and young people, as some of these children and young people may still require further services to see an improvement in ear conditions.

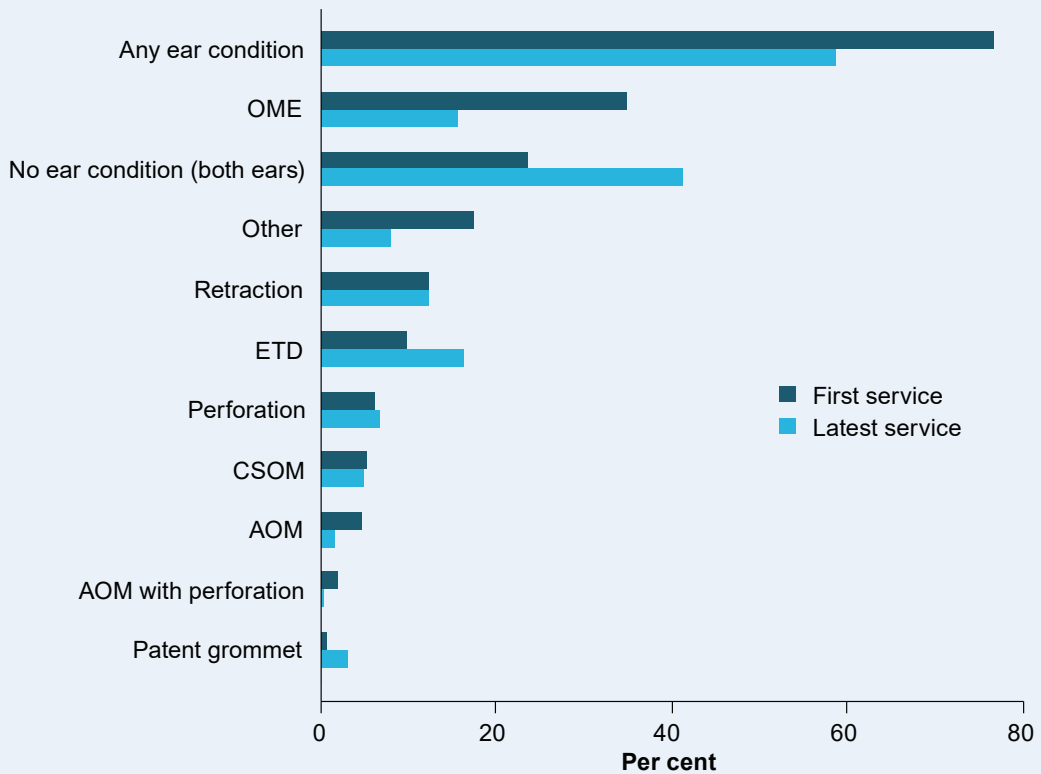
Between 2015 and 2019, 651 children and young people received at least 2 ENT clinic services. This includes only children who were seen by the Deadly Ears Program for a continuous unbroken period, that is, they were not discharged or removed at any point between their first and latest service (children discharged at their latest attended service were included). Children and young people who attended their first ENT clinic service prior to 2015 have also been excluded.

Among these children and young people, improvements in the following were seen:

- 77% of children and young people had at least 1 ear condition at the first service, and this decreased to 59% at the latest service
- the proportion of children and young people with OME was 35% at the first service, and this decreased to 16% at the latest service.

The proportion of children and young people experiencing dry perforation, ETD and patent grommets increased slightly between first and latest service in this period (Figure 4.3).

**Figure 4.3: Change in ear conditions between first and latest service among children and young people who received more than 1 ENT clinic service, 2015–2019**

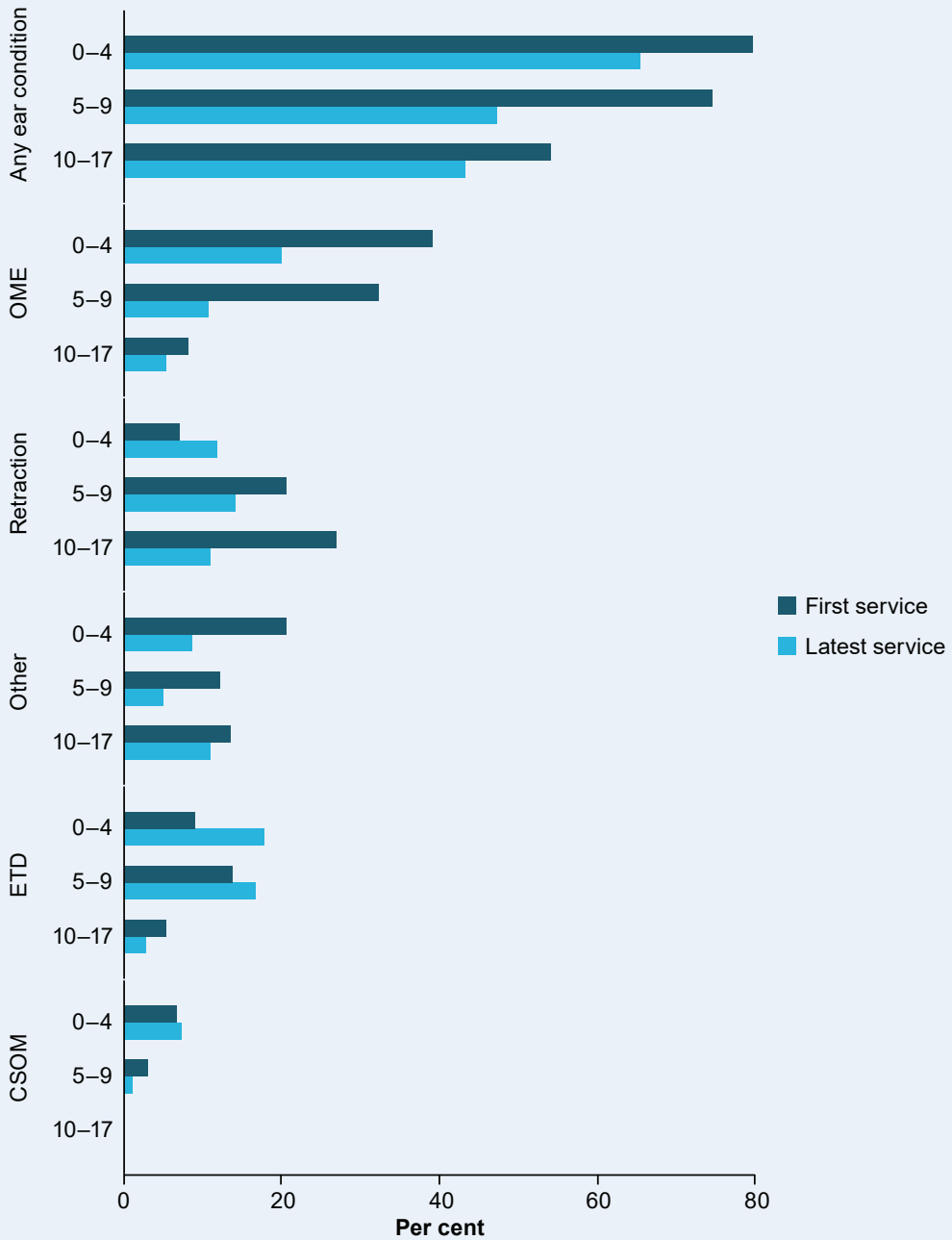


Source: Deadly Ears Program data collection.

Improvements in ear condition status over 2015 to 2019 were experienced across all age groups (Figure 4.4):

- Children aged 5–9 at their first service had the greatest decrease in children with any ear condition, decreasing by 28 percentage points between first and latest service (from 75% to 47%), and the proportion with OME decreased by 21 percentage points, from 32% to 11%.
- Children aged 0–4 at their first service had the highest proportion of any ear condition at their first service (80%), but this decreased to 66% at the latest service.
- The proportion of children and young people aged 10–17 with an ear condition decreased from 54% at their first service to 43% at the latest service.

Figure 4.4: Change in proportion of selected ear conditions between first and latest service, by age at first service, 2015–2019



Note: Based on age group at first service.

Source: Deadly Ears Program data collection.

## Change in severity of ear conditions over time

Another way to understand children and young people's experiences with ear conditions is to assess whether they have had changes in the severity of ear conditions over time. However, ear conditions are varied and it can be difficult to grade the severity of these conditions. The list of conditions below represent an attempt to rank middle ear conditions by severity. The difference in severity from 1 condition to another should not be interpreted as being on a continuous linear scale. That is, they are listed in order of severity, but the rank does not denote the actual severity of any single condition in relation to another condition. For instance, a cholesteatoma is not twice as severe as OME. The rankings are a general assessment of these conditions and individual children's experiences with these ear conditions may differ.

The ear conditions from Box 4.1 can be ranked from least to most severe:

- 0 No ear condition (least severe)
- 1 Patent grommet
- 2 Eustachian tube dysfunction (ETD)
- 3 Acute otitis media (AOM)
- 4 Acute otitis media (AOM) with perforation
- 5 Otitis media with effusion (OME)
- 6 Retraction
- 7 Dry perforation
- 8 Discharging grommet
- 9 Chronic suppurative otitis media (CSOM)
- 10 Cholesteatoma (most severe).

See Box 4.4 for more information on defining a change in the severity of ear conditions for the purposes of this report.

#### Box 4.4: Change in severity of ear conditions over time

**Improved:** a change in ear condition status from a more severe ear condition to a less severe ear condition (e.g., from CSOM to AOM), or from any ear condition to no ear condition.

**Deteriorated:** a change in ear condition status to a more severe ear condition (e.g., from dry perforation to cholesteatoma), or from no ear condition to any ear condition.

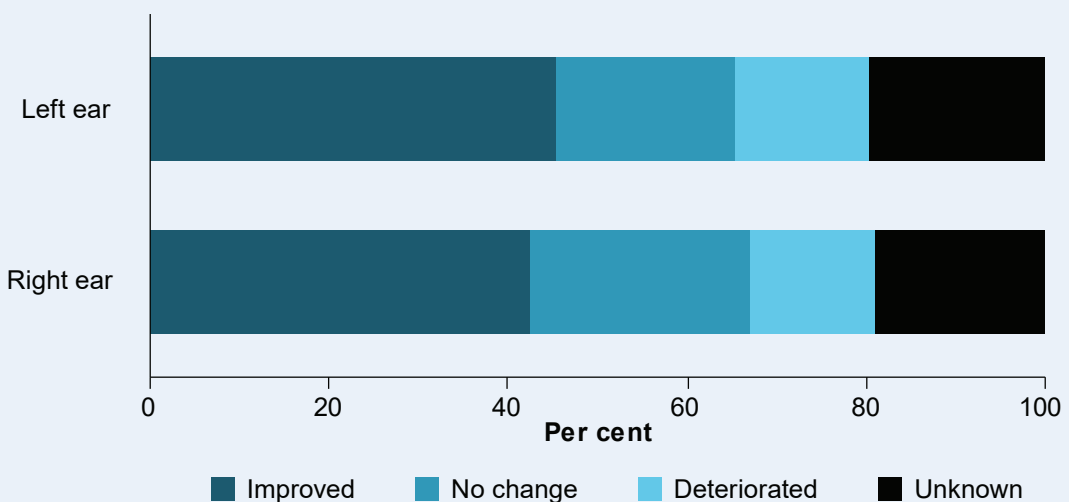
**No change:** no change in ear condition status, including those with no ear condition at both first and latest service, and those with the same ear condition or same severity of ear condition at both first and latest service.

**Unknown:** a change in ear condition status to and/or from an 'other' ear condition.

Between first and latest service from 2015 to 2019, among the 498 children who had at least 1 ear condition at their first service:

- A higher proportion of children and young people experienced improvement (left ear: 45%, right ear: 43%) in their ear condition status than deterioration (left ear: 15%, right ear: 14%) in their ear condition status.
- Around 1 in 5 children had no change in the severity of their ear condition (left ear: 20%, right ear: 24%) (Figure 4.5).

**Figure 4.5: Change in severity of ear conditions over time among children and young people with ear condition at their first service, left and right ear, 2015–2019**



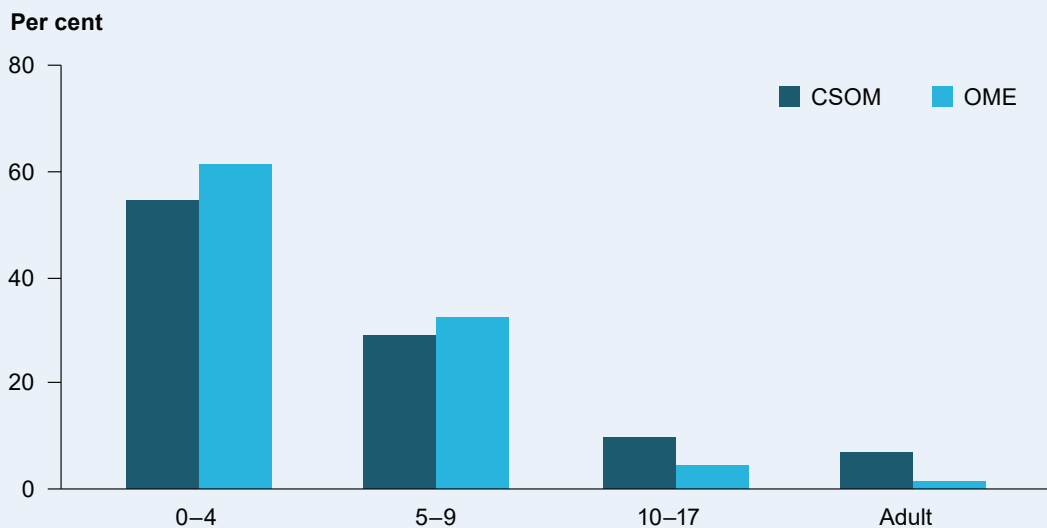
Source: Deadly Ears Program data collection.

## Experiences of ear disease

This section presents information to help better understand the experiences of children and young people with otitis media, including the forms producing significant impacts in this population, OME and CSOM.

Between 2015 to 2019, 176 children and young people were diagnosed with CSOM and 577 with OME for the first time in the Deadly Ears Program. For both CSOM and OME, the most common age at first diagnosis was 0–4 years (55% and 62%, respectively) (Figure 4.6), noting that this may reflect the increased targeting of Deadly Ears services to children in this age group.

**Figure 4.6: Age distribution of children and young people at first CSOM or OME diagnosis, 2015–2019**



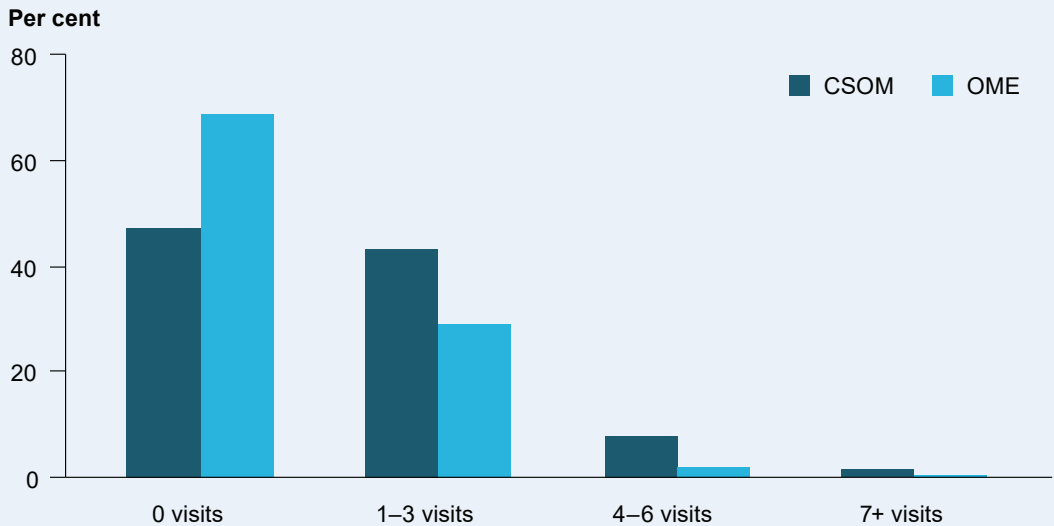
*Note:* Excludes children and young people with missing information for age.

*Source:* Deadly Ears Program data collection.

## Number of visits before and after CSOM or OME diagnosis

Around 2 in 3 (69%) children diagnosed with OME were diagnosed at their first Deadly Ears visit. For children diagnosed with CSOM, almost half (47%) were diagnosed at their first visit (Figure 4.7).

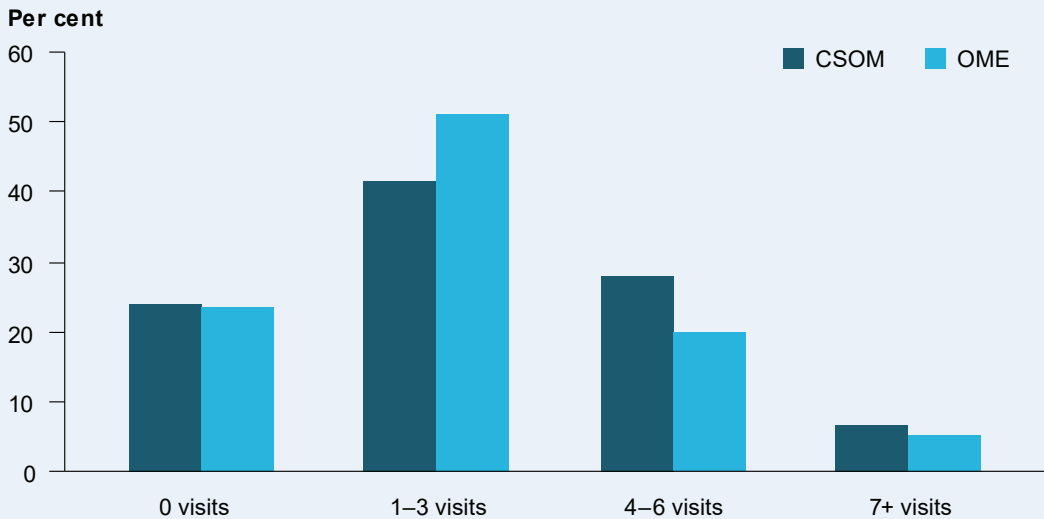
**Figure 4.7: Number of Deadly Ears visits before first diagnosis of CSOM or OME, 2015–2019**



Source: Deadly Ears Program data collection.

After the first diagnosis, children with CSOM tended to have more subsequent Deadly Ears visits than those with OME (Figure 4.8). Around 2 in 5 (42%) children with CSOM had 1–3 visits, compared with around half (51%) of children with OME. A higher proportion of children and young people with CSOM had 4 or more visits after their first diagnosis, compared with those with OME (28% compared with 20%).

**Figure 4.8: Number of Deadly Ears visits after first diagnosis of CSOM or OME, 2015–2019**

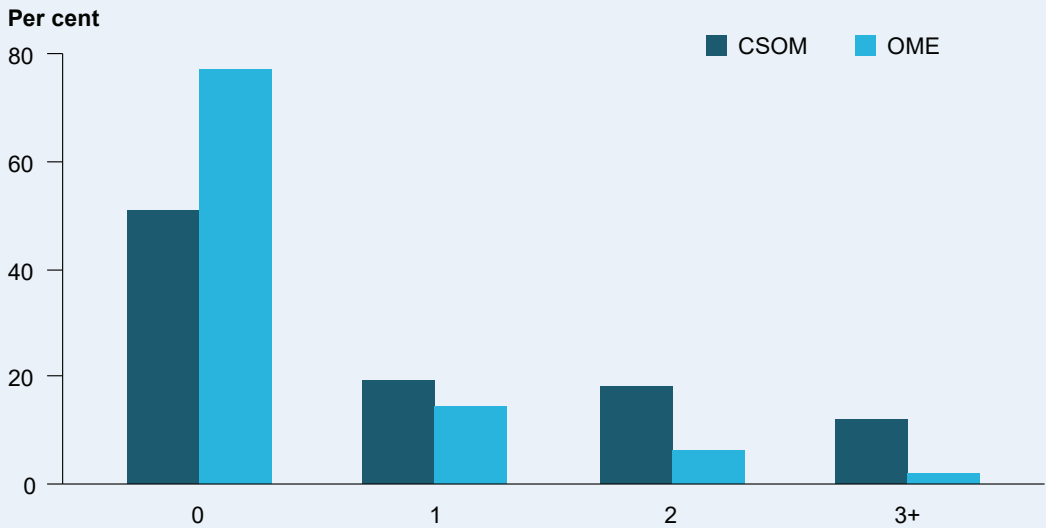


Source: Deadly Ears Program data collection.

### Other diagnoses before CSOM or OME

Around 1 in 4 (23%) children and young people with OME had at least 1 other ear condition before they were first diagnosed with OME. For children and young people with CSOM, half (49%) had at least 1 other ear condition diagnosed before their first CSOM diagnosis. Children and young people with CSOM were also more likely to have a greater number of diagnoses of other ear conditions before the first diagnosis compared with children with OME (Figure 4.9).

**Figure 4.9: Number of other unique ear condition diagnoses before first diagnosis of CSOM or OME, 2015–2019**



Source: Deadly Ears Program data collection.

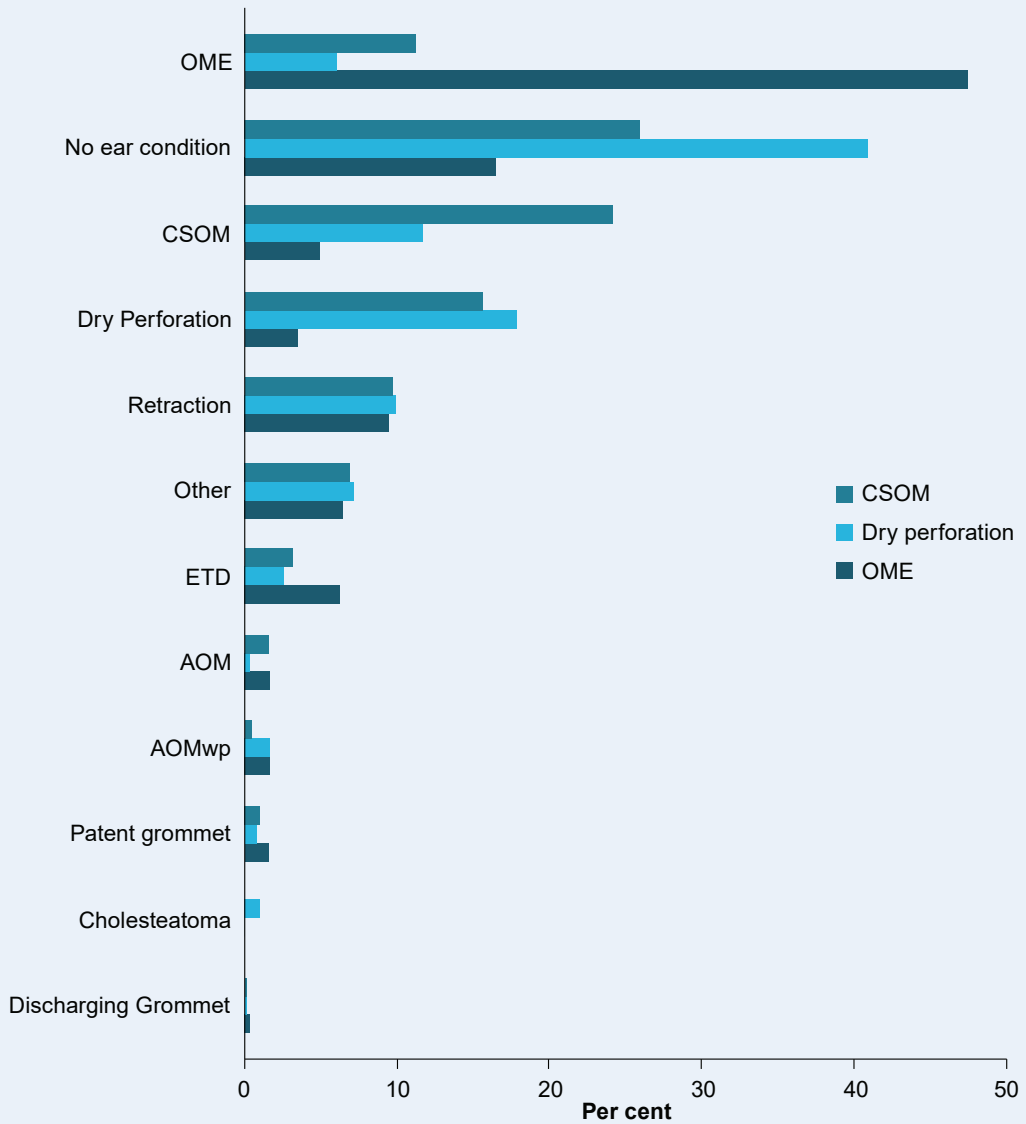
## Other diagnoses with CSOM, OME or dry perforation

This section examines ear conditions experienced in 1 ear at the same time as when CSOM, OME or dry perforation is present in the other ear. Between 2015 to 2019:

- around half (48%) of OME cases had OME at the same time in the other ear
- 24% of CSOM cases had CSOM at the same time in the other ear
- 18% of dry perforation cases had dry perforation at the same time (Figure 4.10).

To fully capture the experience of otitis media, this analysis was based on the total number of service contacts rather than the number of children. Children and young people may be counted more than once in the total.

Figure 4.10: Ear conditions with CSOM, OME or dry perforation in the other ear at the same time, 2015–2019



Source: Deadly Ears Program data collection.

## 5 Hearing loss among Deadly Ears service recipients

### Key findings

- Between 2015 and 2019, around 2 in 5 (39%) children and young people had conductive hearing loss at their first recorded service.
- Among those who attended multiple audiology services over time, the proportion with hearing within normal limits increased from 23% at their first service to 55% at the latest service.
- Around 3 in 5 (left ear: 60%, right ear: 61%) children and young people who had conductive hearing loss at their first service experienced an improvement in their hearing over time.

Hearing loss may affect 1 ear (unilateral) or both ears (bilateral). There are 3 main types of hearing loss: conductive, sensorineural and mixed. Conductive hearing loss is commonly caused by a middle ear condition such as otitis media, whereas sensorineural hearing loss is generally associated with genetic causes, noise exposure, illness or head trauma. Children and young people in the Deadly Ears Program may also receive a hearing diagnosis of 'hearing within normal limits' or 'unable to be determined' (Box 5.1).

### Box 5.1: Types of hearing loss

**Hearing within normal limits:** hearing response that falls within the normal range (refer to Box 5.2 for more information).

**Conductive hearing loss:** hearing loss that results from dysfunction of the outer or middle ear that interferes with the efficient transfer of sound to the inner ear.

**Sensorineural hearing loss:** hearing loss that results from dysfunction in the inner ear (especially the cochlea).

**Mixed hearing loss:** hearing loss that has conductive and sensorineural components.

**Unable to be determined:** when a definitive hearing diagnosis is unable to be made.

*Source:* Darwin Otitis Guidelines Group 2010.

Children and young people who received an audiology service will have information recorded on their hearing status, and as such, only children who have attended an audiology service are included in this chapter. The small number of adults who received an audiology service have also been excluded from this chapter.

It is important to note that:

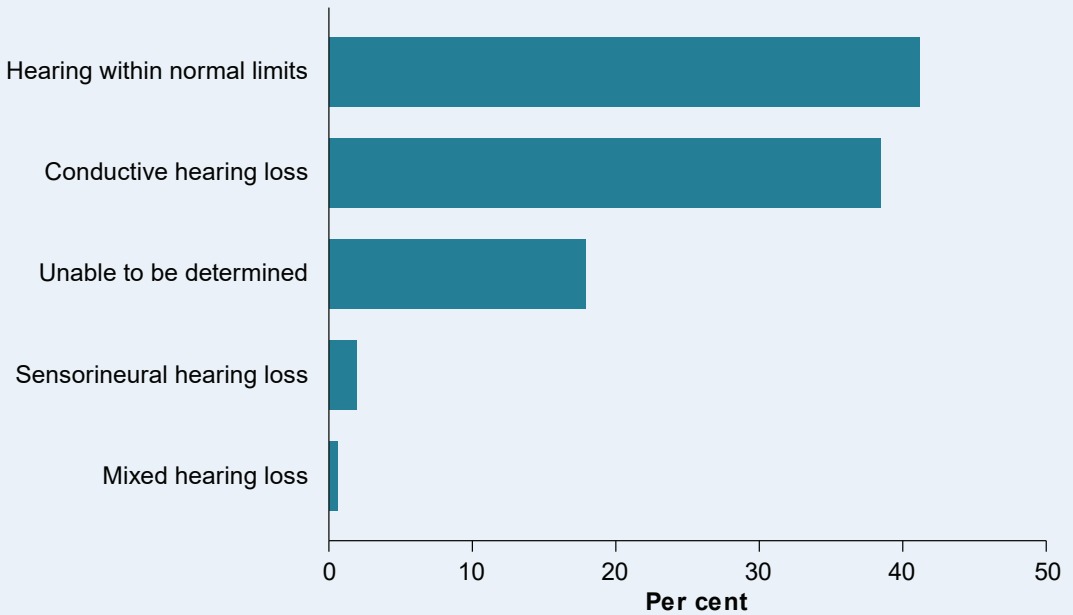
- Changes over time in ear conditions may be due to factors outside the control of the Program including the influence of the social determinants of health in the environment around a child after they are seen by the Program, or the natural decrease in the rates of ear disease as children grow older.
- Ear condition status at the latest recorded service does not necessarily reflect the final outcomes for children and young people, as some of these children and young people may still require further services to see an improvement in ear conditions.
- It can be difficult to obtain a hearing diagnosis in young children due to challenges associated with conditioning to the diagnostic assessment. This is where a hearing diagnosis is listed as 'unable to be determined'.

From 2015 to 2019, 2,355 children and young people received at least 1 audiology service. At their first service in this time period, 41% had hearing within normal limits and 41% had some form of hearing loss:

- 19% had unilateral hearing loss, and 22% had bilateral hearing loss
- 18% of children and young people's hearing loss status was unable to be determined
- 39% had conductive hearing loss, 2.0% had sensorineural hearing loss and 0.6% had mixed hearing loss (Figure 5.1).

It is important to keep in mind that hearing loss can be temporary or permanent. Having a temporary hearing loss as a child may not necessarily reflect long-term hearing outcomes. However, temporary hearing loss in children aged under 4 years old is associated with an increased likelihood of long-term impacts on speech and language development, even if the hearing loss resolves (Burns & Thomson 2013).

**Figure 5.1: Types of hearing loss among children and young people who received at least 1 audiology service, 2015–2019**

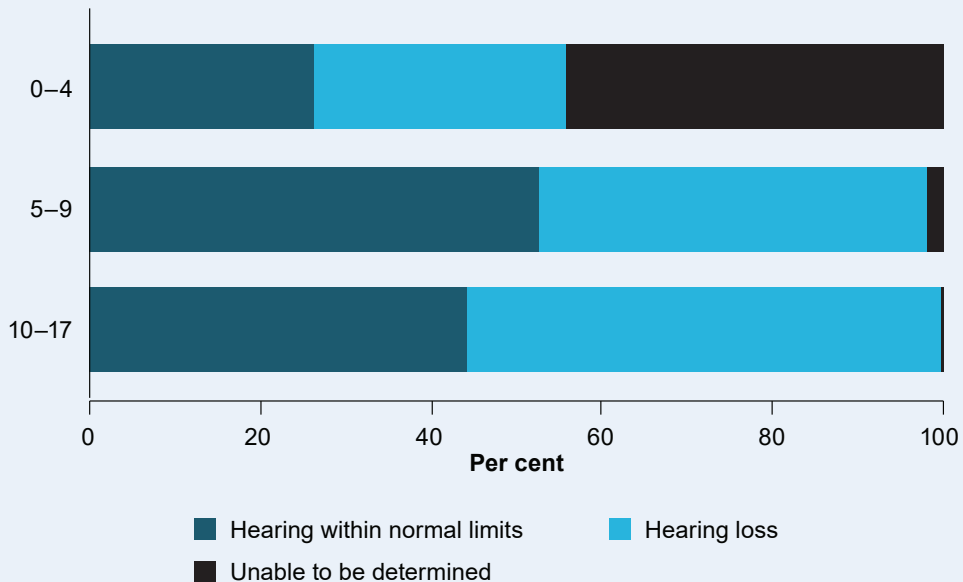


*Note:* Excludes adults.

*Source:* Deadly Ears Program data collection.

Children and young people aged 10–17 had the highest proportion of hearing loss (56%), compared with those aged 5–9 (45%) and 0–4 (30%). However, there was a large proportion of children aged 0–4 whose hearing status was unable to be determined (44%), which may impact these results (Figure 5.2). Excluding those whose hearing status was unable to be determined, just over half (53%) of children aged 0–4 had hearing loss.

**Figure 5.2: Proportion of hearing loss, among children and young people who received at least 1 audiology service, by age, 2015–2019**



Source: Deadly Ears Program data collection.

## Changes over time

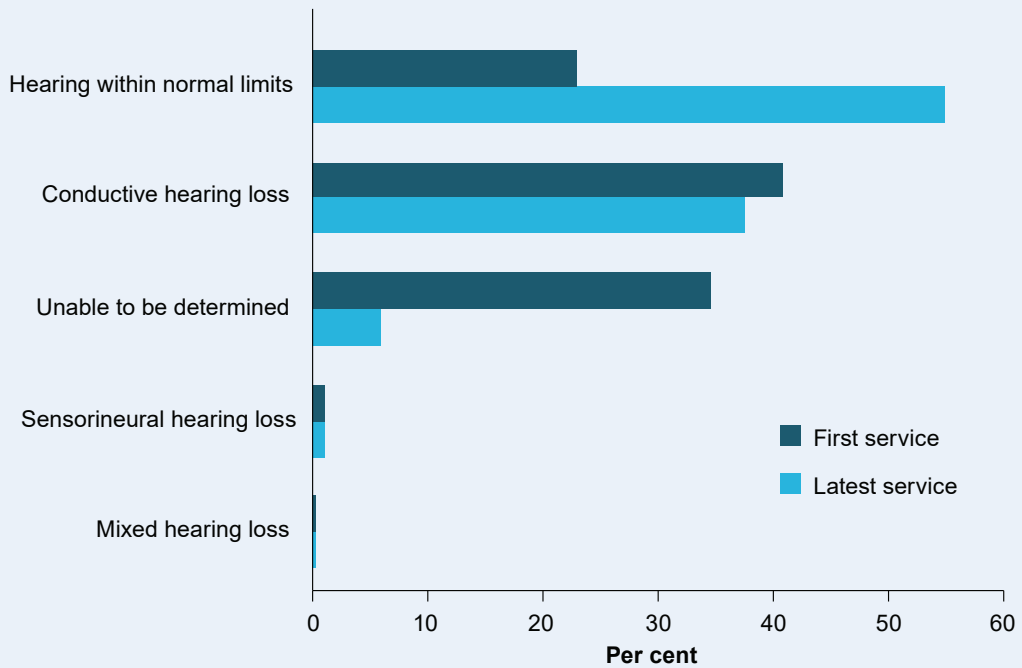
Between 2015 and 2019, 707 children and young people attended at least 2 audiology services. Children were only included in this analysis if they were seen by the Deadly Ears Program for a continuous unbroken period, that is, they were not discharged or removed at any point between their first and latest service. Children and young people who attended their first audiology service prior to 2015 were also excluded.

Among these children and young people:

- The proportion of children and young people who had hearing within normal limits increased from 23% at the first service to 55% at the latest service.
- There was a decrease in the proportion of children whose hearing status was unable to be determined, from 34% at the first service to 6% at the latest service.
- The proportion of children and young people who had conductive hearing loss decreased from 41% at the first service to 38% at the latest service (Figure 5.3).

It is important to keep in mind that, between the first and latest service, the decrease in the proportion of children and young people whose hearing status was unable to be determined contributed to changes in other types of hearing loss.

**Figure 5.3: Change in experience of hearing loss between first and latest service among children and young people who received more than 1 audiology service, by type of hearing loss, 2015–2019**



Note: Excludes adults.

Source: Deadly Ears Program data collection.

## Improvements in hearing over time

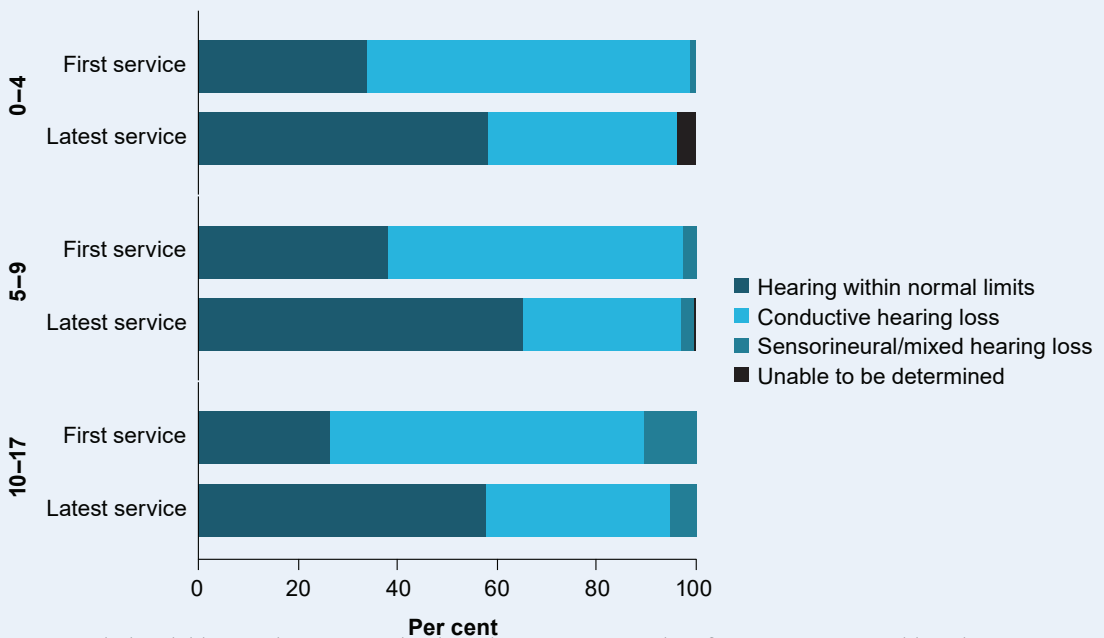
The high proportion of children and young people, particularly in the 0–4 age group, whose hearing status was unable to be determined at their first service makes it difficult to assess the impact of the Program on improvements in conductive hearing loss over time. As such, children and young people whose hearing status at their first service was unable to be determined were excluded to provide further insights into the influence of the Program on hearing loss.

From 2015 to 2019, 463 children and young people had at least 2 audiology services, and did not have a finding of unable to be determined at their first service. Among these children and young people:

- The proportion who had hearing within normal limits increased from 35% (163 children) to 62% (286 children) between the first and latest service.
- The proportion with conductive hearing loss decreased from 62% (288 children) to 35% (161 children) between the first and latest service.

For children aged 0–4 at their first service, the proportion with conductive hearing loss decreased from 65% (128 children) at the first service to 38% (75 children) at their latest service. Improvements were also seen for children and young people aged 5–9 and 10–17 at their first service (Figure 5.4).

**Figure 5.4: Change over time in hearing loss, by age at first service, 2015–2019**



Note: Excludes children and young people whose hearing status at their first service was 'unable to be determined'.

Source: Deadly Ears Program data collection.

## Improvements among children with conductive hearing loss

Among the 288 children and young people who had conductive hearing loss at their first service, between 2015 and 2019:

- 171 (59%) had bilateral conductive hearing loss at the first service
- 117 (41%) had unilateral conductive hearing loss at the first service.

At their latest service:

- half (50%; 145 children) had hearing within normal limits
- 47% still had some form of conductive hearing loss
  - 26% had bilateral conductive hearing loss
  - 21% had unilateral conductive hearing loss.

Hearing loss ranges in degree from 'mild' to 'profound' (Box 5.2). Improvements in hearing over time can be examined by determining if the degree of hearing loss for children and young people has improved, deteriorated or had no change (Box 5.3).

### Box 5.2: Degree of hearing loss

The degree of hearing loss is classified by the decibel (dB) level of the quietest sound a person can hear.

Hearing within normal limits: 20 dB or better

Mild hearing loss: 21–45 dB

Moderate hearing loss: 46–65 dB

Severe hearing loss: 66–90 dB

Profound hearing loss: 91 dB or greater

*Source:* Darwin Otitis Guidelines Group 2010.

### Box 5.3: Change in degree of hearing loss over time

**Improved:** a change in hearing loss from a higher degree to a lower degree (e.g., moderate to mild hearing loss), or from any hearing loss to hearing within normal limits.

**Deteriorated:** a change in hearing loss from a lower degree to a higher degree (e.g., mild to severe), or from hearing within normal limits to any hearing loss.

**No change:** no change in hearing loss status, including those with hearing loss within normal limits at both first and latest service, and those whose degree of hearing loss did not change between services.

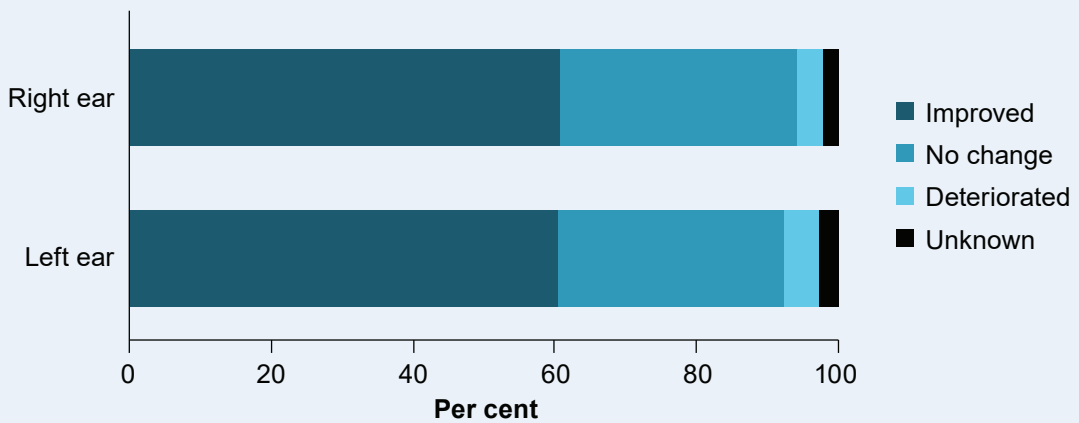
**Unknown:** a change in hearing status to and/or from a finding of 'unable to be determined'.

Among the 707 children and young people who received at least 2 audiology services between 2015 and 2019:

- 225 had conductive hearing loss in their left ear at the first service
- 221 had conductive hearing loss in the right ear at first service.

An improvement in hearing health was seen for around 3 in 5 children who had conductive hearing loss at their first service (left ear: 60%, right ear: 61%). Around 1 in 3 children (left ear: 32%, right ear: 34%) experienced no change in hearing loss status, while less than 5% (left ear: 4.9%, right ear: 3.6%) deteriorated (Figure 5.5).

**Figure 5.5: Change in conductive hearing loss among children and young people who received more than 1 audiology service and who had conductive hearing loss at their first service, by ear, 2015–2019**



Source: Deadly Ears Program data collection.

## Experiences of conductive hearing loss

This section provides information on the prevalence of conductive hearing loss among children and young people who received an audiology service through the Deadly Ears Program and had a 'confirmed hearing status' (Box 5.4)—that is, excluding those who had a hearing finding of 'unable to be determined'. It also examines the association between ear disease and conductive hearing loss.

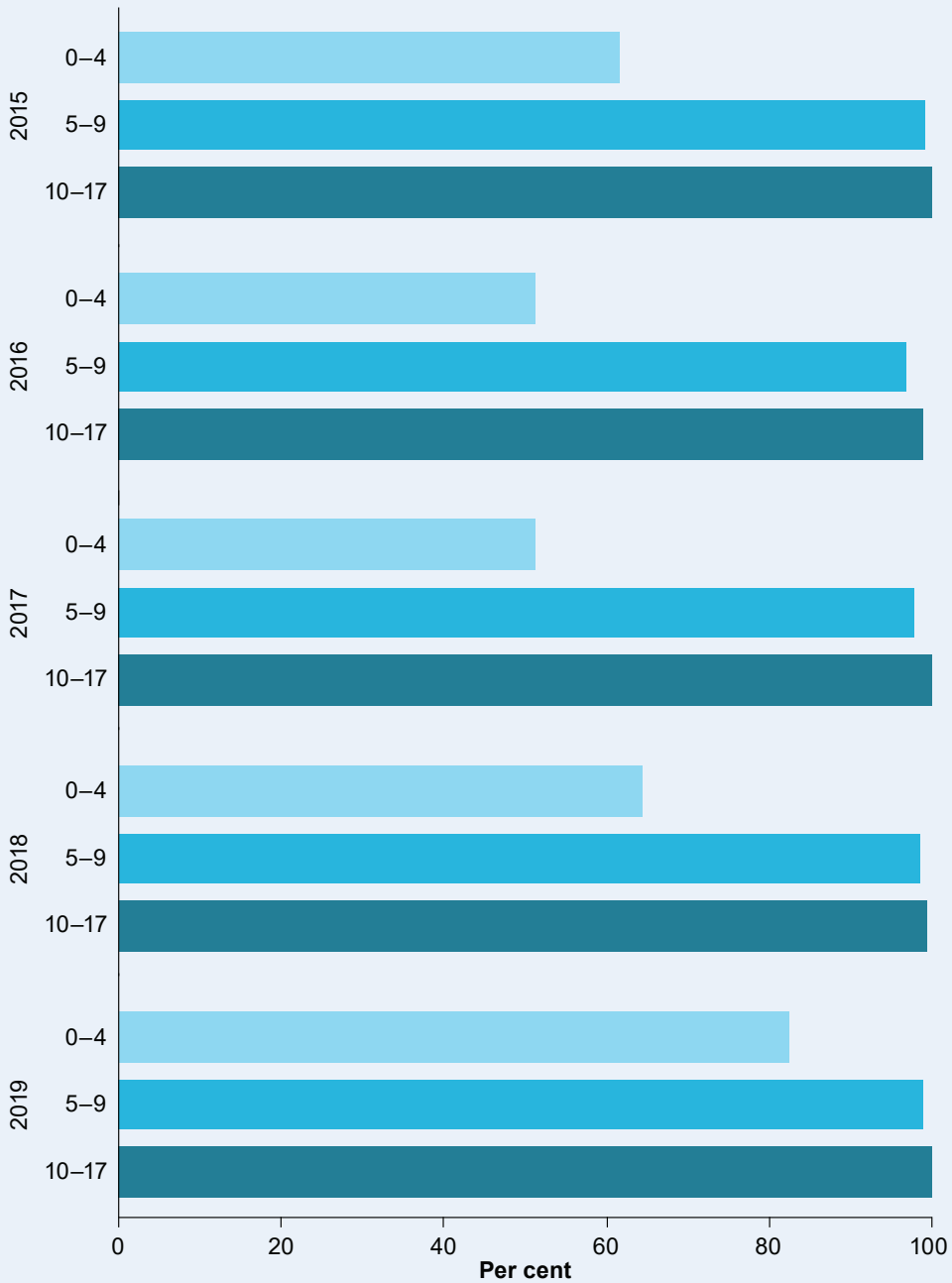
### Box 5.4: Confirmed hearing status

Children and young people are defined as having a confirmed hearing status where a diagnostic hearing assessment was conducted and the overall status of the child's hearing was classified as 1 of: hearing within normal limits, conductive hearing loss, sensorineural hearing loss or mixed hearing loss.

Between 2015 and 2019, a total of 2,355 children and young people received at least 1 audiology service, of which 1,935 (82%) had a confirmed hearing status (based on first service). The proportion of children and young people with confirmed hearing status varied by age, with those aged 0–4 having a lower proportion of confirmed hearing status than older age groups. However, there was an increase overall in the proportion of children aged 0–4 with confirmed hearing status, initially decreasing from 62% in 2015 to a low of 51% in 2017, before increasing to 82% in 2019 (Figure 5.6).

This trend can be linked to the Program’s increasing presentation of younger children aged 0–4, who are more difficult to test, and the Program’s response with the introduction of community visual reinforcement audiology, to enhance the likelihood of a confirmed hearing finding in younger children. This was pilot tested in 2017–18, and rolled out across the Program in 2018.

**Figure 5.6: Proportion of children and young people with confirmed hearing status, by age group and year, 2015–2019**

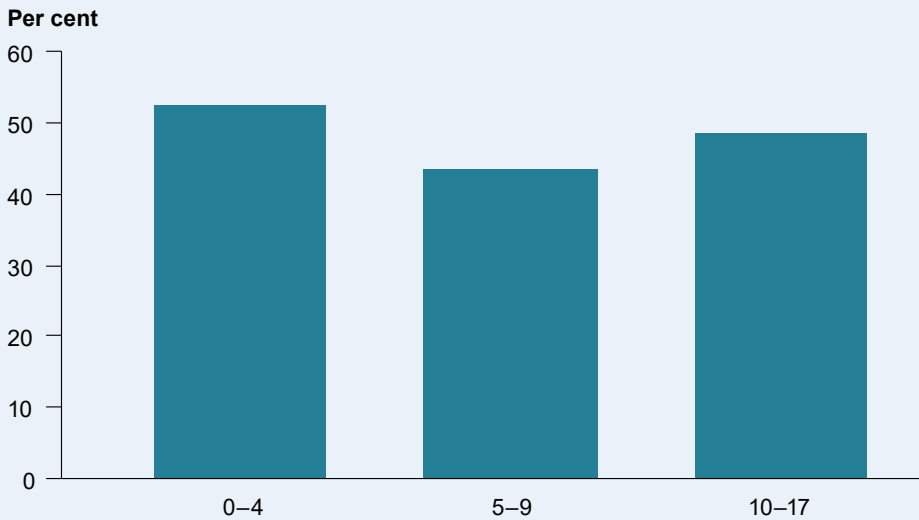


*Note:* For children and young people who received more than 1 audiology service in a year, their age group and hearing status at their first service in that year was used.

*Source:* Deadly Ears Program data collection.

Among the 1,935 children and young people with a confirmed hearing status, 906 (47%) had conductive hearing loss. The proportion of children with conductive hearing loss varied by age, with children aged 0–4 experiencing the highest proportion of conductive hearing loss (52%), followed by those aged 10–17 (49%) (Figure 5.7).

**Figure 5.7: Proportion of children and young people with conductive hearing loss, among those with confirmed hearing status, by age group, 2015–2019**



*Note:* For children and young people who received more than 1 audiology service in a year, their age group and hearing status at their first service in that year was used.

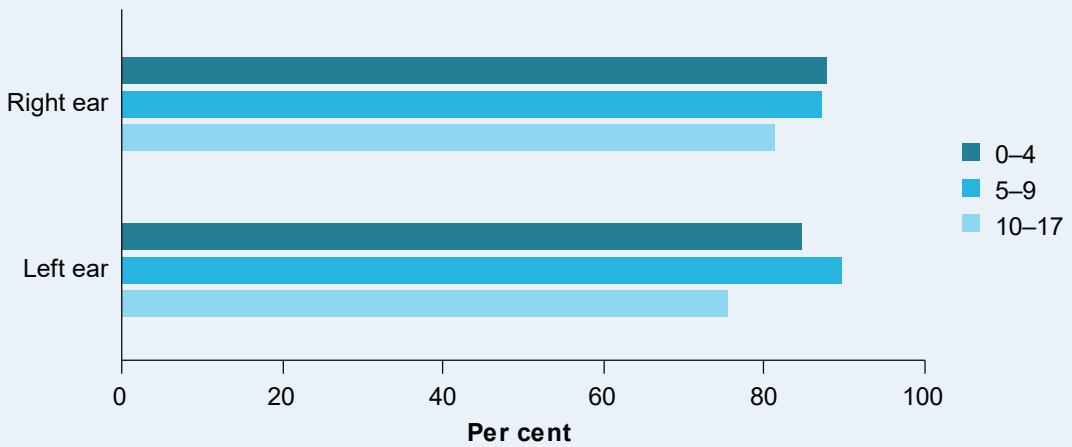
*Source:* Deadly Ears Program data collection.

The majority (left ear: 85%, right ear: 86%) of children and young people experienced a mild degree of conductive hearing loss. However, hearing loss tended to be more severe in older than in younger age groups.

While comparatively fewer older children are seen by the Deadly Ears Program, older children and young people are more likely to remain in the Program due to the severity of their ear disease or degree of hearing loss. As a result, older children and young people have a higher proportion of hearing loss than younger age groups. Additionally, due to the risks associated with hearing loss in the younger age groups, such as developmental impacts, they are managed more conservatively and may remain in the Program to ensure that the resolution of their hearing issues is sustained over time (Figure 5.8):

- A higher proportion of children aged 0–4 and 5–9 had mild hearing loss compared with older children.
- For those aged 10–17, around 1 in 5 (left ear: 25%; right ear: 18%) had a moderate or severe hearing loss.

**Figure 5.8: Proportion of children and young people with a mild hearing loss, among those with conductive hearing loss, by age group, 2015–2019**



Source: Deadly Ears Program data collection.

## Ear conditions and conductive hearing loss

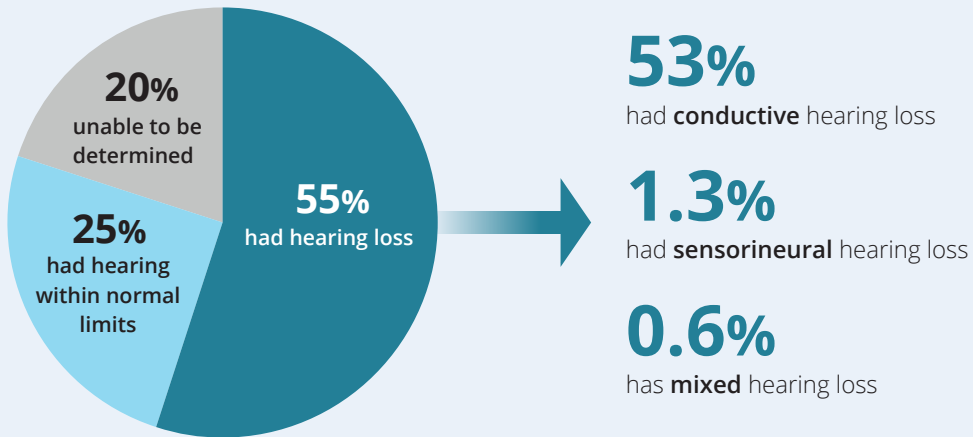
Ear conditions, if left untreated, can cause temporary and sometimes permanent hearing loss which may affect a child or young person's ability to communicate and participate in school.

From 2015 to 2019, 2,147 children and young people received both an ENT clinic service and an audiology service, of which 1,488 (68%) had at least 1 ear condition at their first service in this time period. Among these children and young people, at their first service:

- 819 (55%) experienced some form of hearing loss
  - 790 (53%) had conductive hearing loss
  - 20 (1.3%) had sensorineural hearing loss
  - 9 (0.6%) had mixed hearing loss
- 372 (25%) had hearing within normal limits
- 296 (20%) were unable to be determined (Figure 5.9).

Figure 5.9: Hearing loss among children and young people with at least 1 ear condition, 2015–2019

Among children and young people with an ear condition:



Source: Deadly Ears Program data collection.

### Box 5.5: How does hearing health in the Deadly Ears Program and NTRAI Program compare?

For the past decade the Australian Government has funded the Northern Territory Government to provide hearing health services to Indigenous children and young people aged under 21 in the Northern Territory. Similar to the Deadly Ears Program, the NTRAI Program provides outreach ENT and audiology services, especially in remote areas with high demand and a lack of local services.

- Children and young people in the Deadly Ears Program were more likely to experience conductive hearing loss (39%) compared with the NTRAI Program (27%).
- In the Deadly Ears Program, children and young people aged 10–17 had the highest proportion of hearing loss (56%) while it was highest for children aged 3–5 in the NTRAI Program (47%).
- In both programs, around half of children with an ear condition experienced hearing loss (Deadly Ears: 55%; NTRAI: 48%).

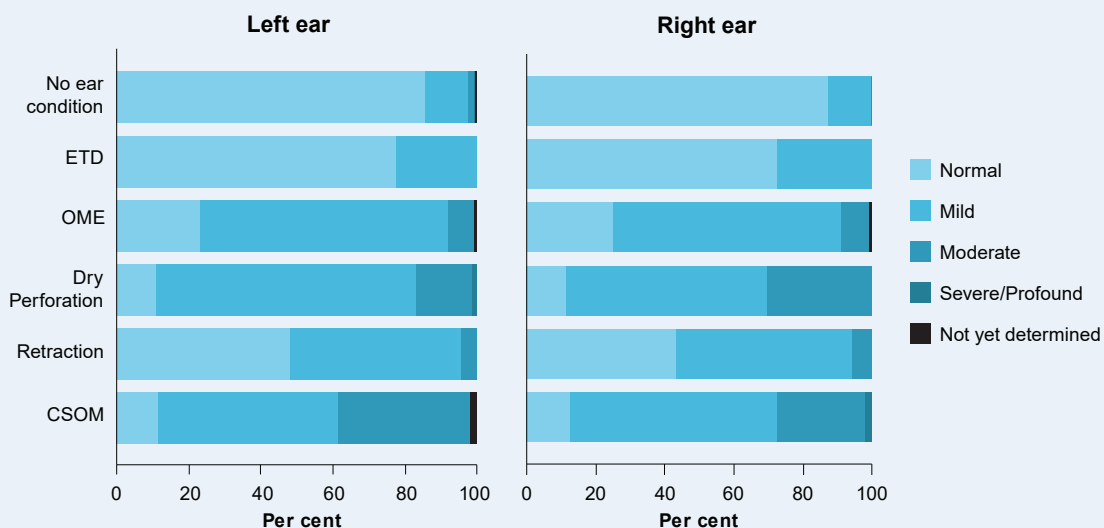
It is important to note that some of the differences seen between the programs are likely to be due to differences in the service delivery models, for example, the eligibility of service recipients. See Box 4.2 for more information.

Source: AIHW 2020; Deadly Ears Program data collection.

For the 1,162 children and young people with hearing within normal limits or conductive hearing loss:

- Most children and young people with no ear conditions at their first service experienced hearing within normal limits (left ear: 86%, right ear: 87%).
- Children and young people with CSOM experienced a high proportion of conductive hearing loss:
  - left ear: 50% mild, 37% moderate and 1.9% severe/profound
  - right ear: 60% mild, 26% moderate and 1.8% severe/profound (Figure 5.10).

**Figure 5.10: Degree of conductive hearing loss for selected ear conditions, left and right ear, 2015–2019**



*Notes*

1. For children and young people who had multiple services over time, ear condition status and hearing loss status at their first service was used.
2. Children and young people with a hearing finding of 'unable to be determined', sensorineural hearing loss or mixed hearing loss were excluded.

Source: Deadly Ears Program data collection.

## 6 Outcomes among Deadly Ears service recipients

### Key findings

- Improvements in ear condition status and hearing were seen among around half of children who had a Deadly Ears ENT surgery service.
- Almost half of children who had an ear condition and conductive hearing loss at their first service had a substantial improvement in their hearing within 2 years.

This chapter focuses on assessing outcomes of children and young people who have received Deadly Ears Program services, including:

- change in severity of ear conditions and degree of hearing loss after surgery
- improvement in hearing among children and young people who had an ear condition and conductive hearing loss at their first service
- children and young people who were lost to follow up
- children and young people who were discharged from the Program.

The outcomes seen in ear and hearing health of children and young people who received Deadly Ears Program services may be attributed to several factors, including:

- the effectiveness of the medical, audiological and surgical interventions delivered through the Program
- the impact of the support the Deadly Ears Program provides to local health services in ensuring these services have the necessary support, equipment and skills required to conduct regular ear and hearing health checks, to treat using best-practice clinical guidelines
- the natural decrease in the rates of ear disease, and hearing health improving, as children and young people grow older
- the influence of the social determinants of health in the environment around a child across the period they are seen by the Program
- the impact of 'unable to be determined' hearing health records, especially for children in the 0–4 age group (AIHW 2020).

Ear condition and hearing status at the latest recorded service does not necessarily reflect the final outcomes for children and young people, as some of these children and young people may still require further services to see an improvement in these conditions.

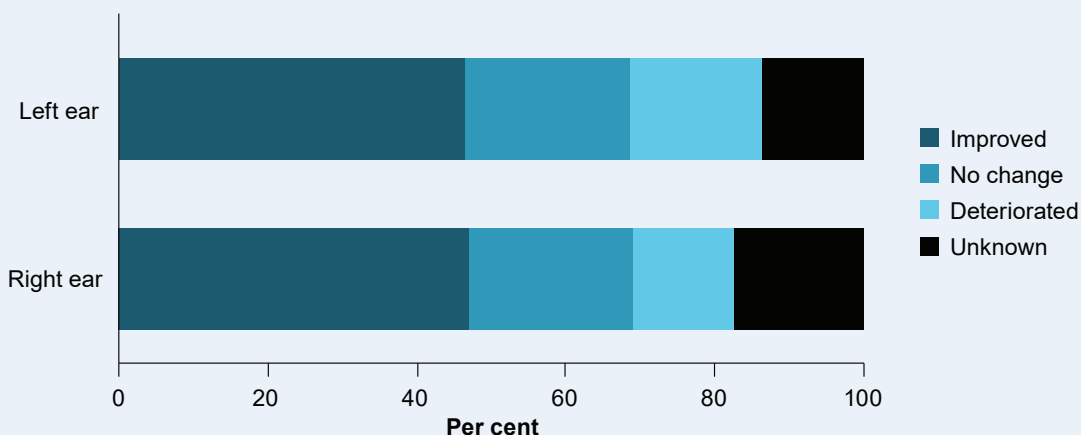
## Outcomes after Deadly Ears surgery services

This section examines the improvements in ear conditions and hearing loss after a child or young person received a Deadly Ears surgery service.

To examine changes in ear conditions, information on ear condition status from a corresponding ENT clinic service is required. Between 2015 and 2019, 225 children and young people had their first ENT surgery and had a corresponding ENT clinic service for this surgery. Of these, 196 (87%) had attended at least 1 ENT clinic follow-up service within 2 years of their surgery.

Figure 6.1 shows the change in severity of ear condition in the ear that had surgery. At their latest ENT clinic service within 2 years after surgery, almost half (left ear: 46%; right ear: 47%) of children and young people had improved in terms of the severity of their ear condition.

**Figure 6.1: Change in severity rank of ear conditions within 2 years after surgery, among children and young people who received an ENT surgery service and a corresponding ENT clinic service, by ear, 2015–2019**



Source: Deadly Ears Program data collection.

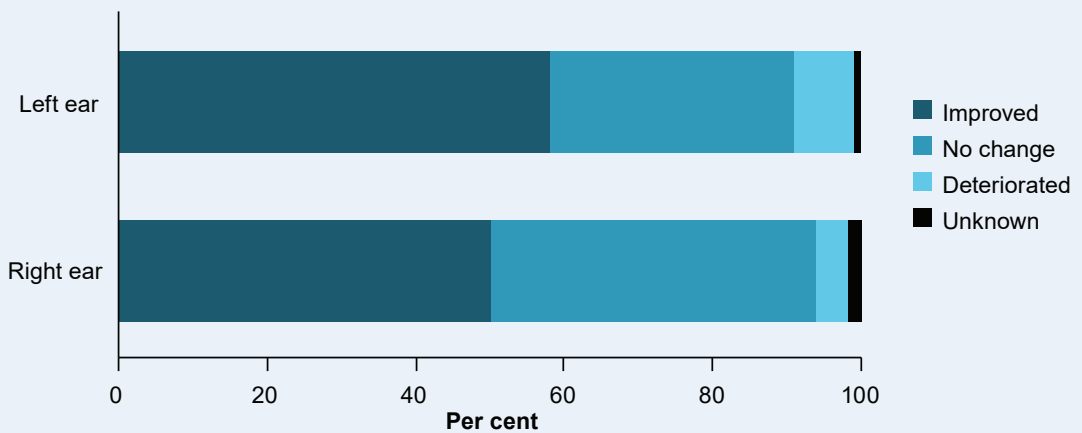
To examine changes in hearing loss, information on hearing loss status from a corresponding audiology service is required. Between 2015 and 2019, 205 children and young people had their first ENT surgery and had a corresponding audiology service for this surgery. Of these, 195 (95%) had attended at least 1 audiology follow-up service within 2 years of their surgery.

Among the 189 children who had surgery in their right ear and had a corresponding audiology service and follow-up service, 100 had conductive hearing loss at the time of surgery. Similarly, 188 children had surgery in the left ear, of which 98 had conductive hearing loss.

Figure 6.2 shows the change in the degree of hearing loss after surgery, among children and young people who had conductive hearing loss at the time of surgery:

- half (50%) of children who had surgery in their right ear had improved hearing
- 58% of children who had surgery in their left ear had improved hearing.

**Figure 6.2: Change in degree of hearing loss within 2 years after surgery, among children and young people who had conductive hearing loss at the time of surgery, by ear, 2015–2019**



Source: Deadly Ears Program data collection.

## Hearing health outcomes

One way to understand children and young people’s experiences with ear conditions and hearing loss is to track their improvements over time as they move through the Program. This section includes children and young people who attended their first ENT clinic service in 2015, 2016 or 2017 and had a corresponding audiology assessment at this service. To assess their hearing outcomes over time, only children who also attended an audiology service within 2 years of their first appointment were included.

Table 6.1 shows the mean change, within 2 years, in the four-frequency average hearing threshold (average quietest sound a child could hear), among those who had both an ear disease and conductive hearing loss at their first service. A negative change indicates an improvement in hearing (they were able to hear quieter sounds than before). Improvements in hearing were seen across all years and age groups (based on age at the first service).

**Table 6.1: Mean change in four-frequency average of the ear at the latest audiology follow-up service within 2 years, among children and young people with at least 1 ear condition and conductive hearing loss at their first ENT clinic and audiology service, by age group and year of first attended service, 2015–2017**

Age Group	2015		2016		2017	
	Mean change	Numbers (ears) <sup>(a)</sup>	Mean change	Numbers (ears) <sup>(a)</sup>	Mean change	Numbers (ears) <sup>(a)</sup>
0–4	-10.9	26	- 4.2	27	- 7.6	27
5–9	- 5.1	37	- 6.0	30	- 3.0	33
10+	- 6.2	23	- 3.5	17	- 6.0	8
<b>Total<sup>(b)</sup></b>	- 7.3	88	- 4.8	74	- 5.1	68

(a) The number of ears with a valid value, used for calculating the associated mean.

(b) Total includes those without an assigned age group.

Source: Deadly Ears Program data collection.

Another way to classify improvements in hearing is by whether or not a child had a ‘clinically significant improvement’—a reduction of at least 5 dB in the four-frequency average hearing threshold. Around half (49%) of children and young people who had both an ear disease and conductive hearing loss at their first attended service in 2015 had a ‘clinically significant improvement’ in their hearing, with similar patterns observed for those first seen in 2016 and 2017 (Table 6.2).

**Table 6.2: Clinically significant changes ( $\pm 5$  dB) in four-frequency average of the ear at the latest follow-up audiology service within 2 years, among children and young people with at least 1 ear condition and conductive hearing loss at their first ENT clinic and audiology service, by age group and year of first attended service, 2015–2017**

	2015		2016		2017	
	Numbers (ears)	%	Numbers (ears)	%	Numbers (ears)	%
Change at least $-5$ dB (clinically significant improvement)	43	48.9	31	41.9	35	51.5
Change between $-5$ and $+5$ dB (no clinically significant change)	38	43.2	32	43.2	21	30.9
Change more than $+5$ dB (clinically significant deterioration)	7	8.0	11	14.9	12	17.6

Source: Deadly Ears Program data collection.

## Children whose care was incomplete

Some children and young people in the Deadly Ears Program may be lost to follow-up—that is, they may be removed from the Program due to repeated failures to attend a scheduled appointment, or they move away from the Deadly Ears target community. Information on children who are lost to follow-up can give important insights into the accessibility of services (including local health services), as well as help pinpoint areas where more or targeted engagement within the community may be required.

Table 6.3 shows the proportion of children with an ear condition at their first attended ENT clinic service who were lost to follow-up:

- Between 14% and 17% of children and young people with an ear condition at their first service were removed from the Program’s booking list within 2 years of this service.
- Around 1 in 5 failed to attend at least 2 times within 2 years of their first service.

**Table 6.3: Children and young people with an ear condition at their first ENT clinic service who were lost to follow-up within 2 years of first attendance, by year of first service, 2015–2017**

	2015	2016	2017
Removed from Deadly Ears Program (%)	17.0	14.7	13.8
Failed to attend 2 or more times (%)	19.0	18.3	23.6

Source: Deadly Ears Program data collection.

## Children discharged from the Deadly Ears Program

Children and young people whose ear and hearing health improved to an extent that they no longer require services from Deadly Ears, can be discharged from the service.

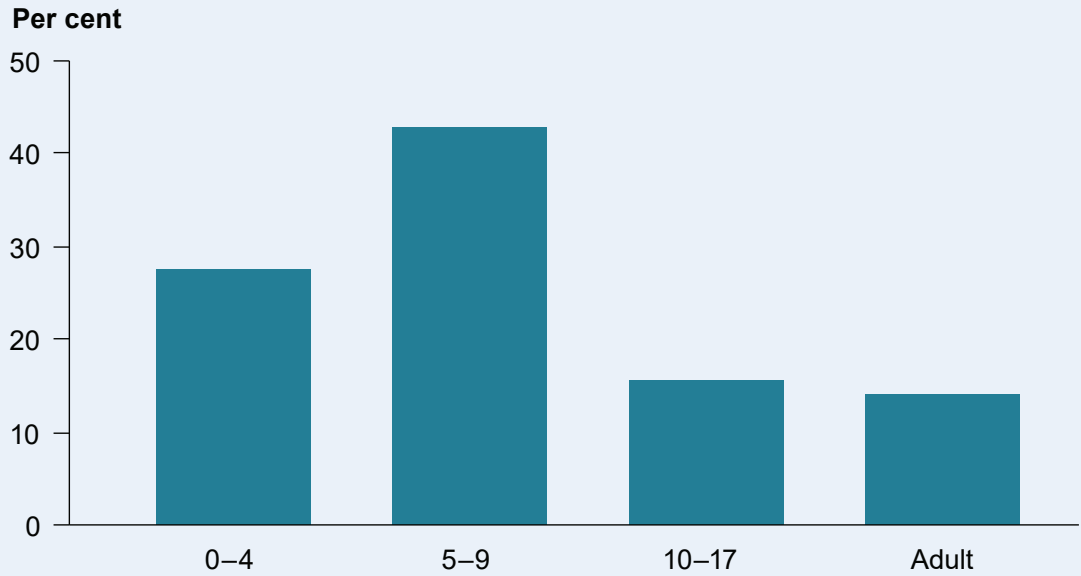
Some children and young people may be discharged and then re-enter the Program later through the usual primary health-care pathways. For this reason, only children and young people who were discharged at their latest service, as at December 2019, were included. Children who were discharged or removed from the Program between their first and latest service, and those who attended their first service prior to 2015 were not included.

From 2015 to 2019, 674 children and young people had been discharged at their latest service. As discharged children and young people could receive multiple types of services during their time in the Program, 555 had received an ENT clinic service, 546 had an audiology service and 36 had an ENT surgery service at least once.

Among those discharged:

- 65% of children and young people had 1 visit, while 35% had 2 or more visits before discharge
- 43% of children and young people discharged from the Program were aged 5–9, while 28% were aged 0–4 (Figure 6.3).

Figure 6.3: Discharged children and young people, by age at discharge, 2015–2019



Source: Deadly Ears Program data collection.

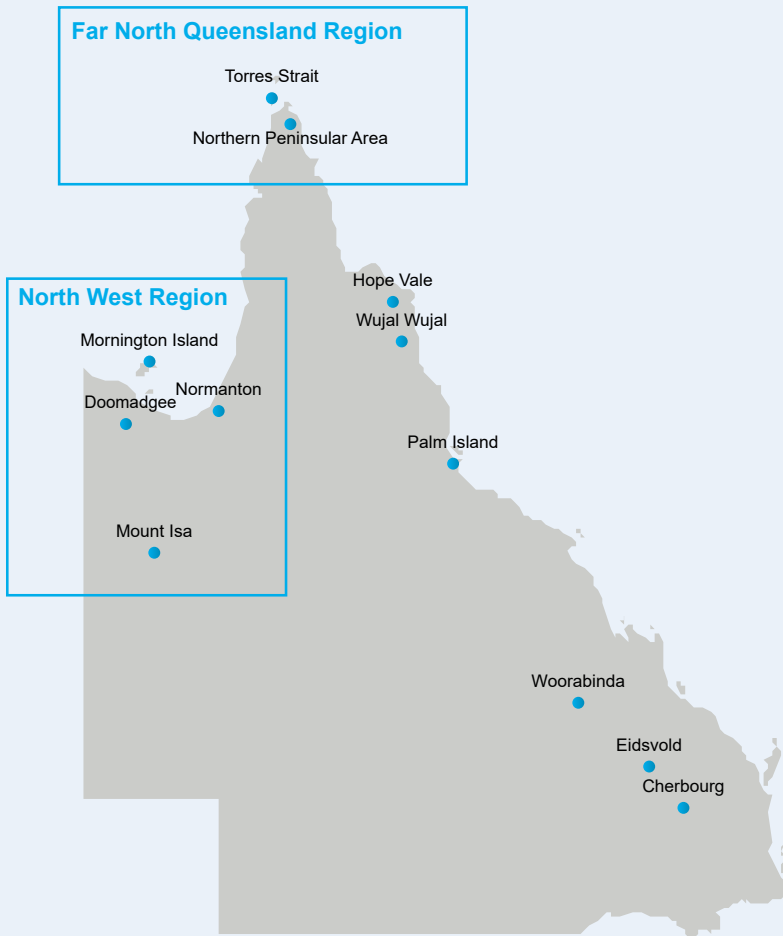
## 7 Regional case study: a closer look at North West and Far North Queensland

### Key findings

- Around 3 in 5 children and young people in the North West and Far North regions had an ear condition at their first service (63% and 60%, respectively).
- Improvements in ear conditions and hearing over time were seen in both regions.

This section provides a comparison of the ear and hearing health of children and young people in 2 regions serviced by the Deadly Ears Program, the North West Region and the Far North Region, between 2015 and 2019. These were selected for comparison as 2 regions that shared significant remoteness, but which appeared to have differing disease profiles and experiences of ear disease and hearing loss amongst children presenting to the Deadly Ears Program. The North West region includes Normanton, Doomadgee, Mornington Island and Mount Isa, while the Far North region consists of the Northern Peninsula Area, Thursday Island and the Torres Strait (Figure 7.1).

Figure 7.1: Map of the North West and Far North Queensland regions



Source: Deadly Ears Program data collection.

Table 7.1 shows the number of ENT clinic, audiology and ENT surgery services delivered in these regions between 2015 and 2019.

**Table 7.1: Number of services delivered in the North West and Far North Regions, by service type, 2015–2019**

	North West Region	Far North Region
ENT clinic services	2,699	1,438
Audiology services	2,386	1,264
ENT surgery services	247	108

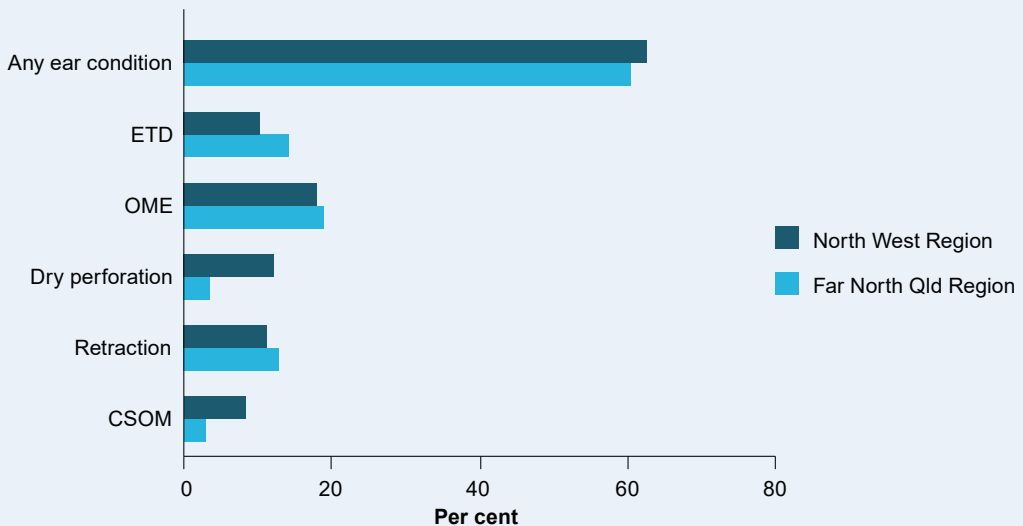
Source: Deadly Ears Program data collection.

# Ear conditions

From 2015 to 2019, 941 children and young people in the North West region and 679 in the Far North Region received at least 1 ENT clinic service. The proportion of ear conditions differed between the 2 regions:

- 63% of the children and young people in the North West region and 60% in the Far North region had at least 1 ear condition at their first service. The rate in the North West region was similar to the rate across all areas within the Program combined (64%).
- The proportion of dry perforation and CSOM was higher in the North West region than the Far North region (Figure 7.2).

**Figure 7.2: Proportion of selected ear conditions among children and young people who received at least 1 ENT clinic service, Far North and North West regions, 2015–2019**



*Note:* For children and young people who received multiple services over time, the region and ear condition is based on the region and ear condition at their first service.

*Source:* Deadly Ears Program data collection.

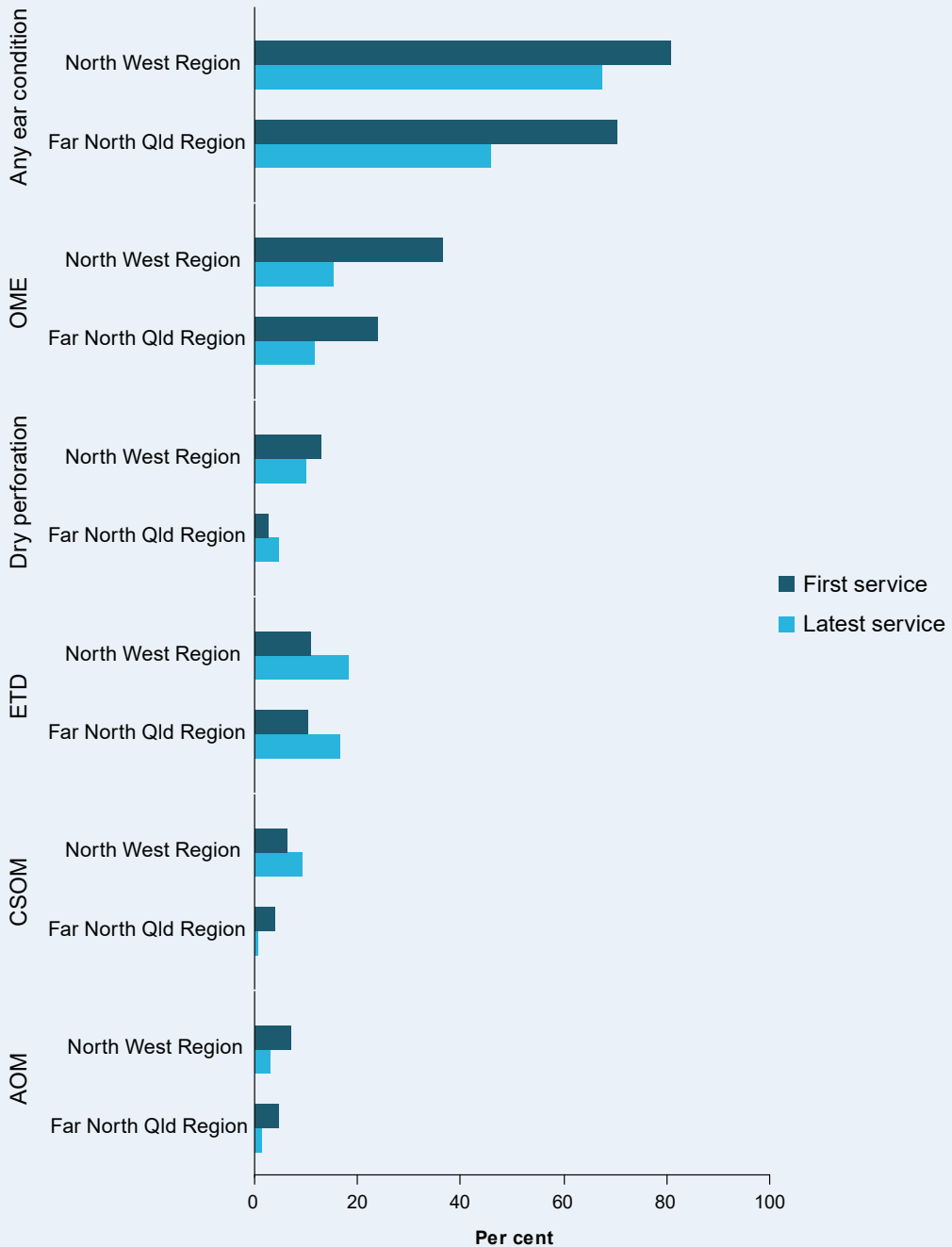
## Changes over time

Between 2015 and 2019, 203 children and young people in the North West region and 155 in the Far North region had at least 2 ENT clinic services (based on region at first service). Children and young people who were removed or discharged between their first and latest service, as well as those who attended their first service before 2015, were excluded.

Children and young people in both regions experienced improvements in ear conditions over time. At the first service, 81% of children and young people in the North West region had at least 1 ear condition, compared with 70% in the Far North region. The proportion of children with any ear condition decreased at the latest service, to 68% for the North West and 46% for the Far North (Figure 7.3).

In all Deadly Ears Program service locations combined, 77% of children and young people had an ear condition at their first service, falling to 59% at the latest service. Children in the North West had higher rates of ear conditions at both the first and latest service, while children in the Far North had lower rates at both the first and latest service.

**Figure 7.3: Changes in specific ear conditions between first and latest service among children and young people who received more than 1 ENT clinic service, Far North and North West regions, 2015–2019**



Note: Based on region at first service.

Source: Deadly Ears Program data collection.

# Hearing loss

## Changes over time

From 2015 to 2019, 222 children and young people in the North West region and 180 in the Far North region received at least 2 audiology services (based on region at first service). Children and young people who were removed or discharged between their first and latest service, as well as those who attended their first service before 2015, were excluded.

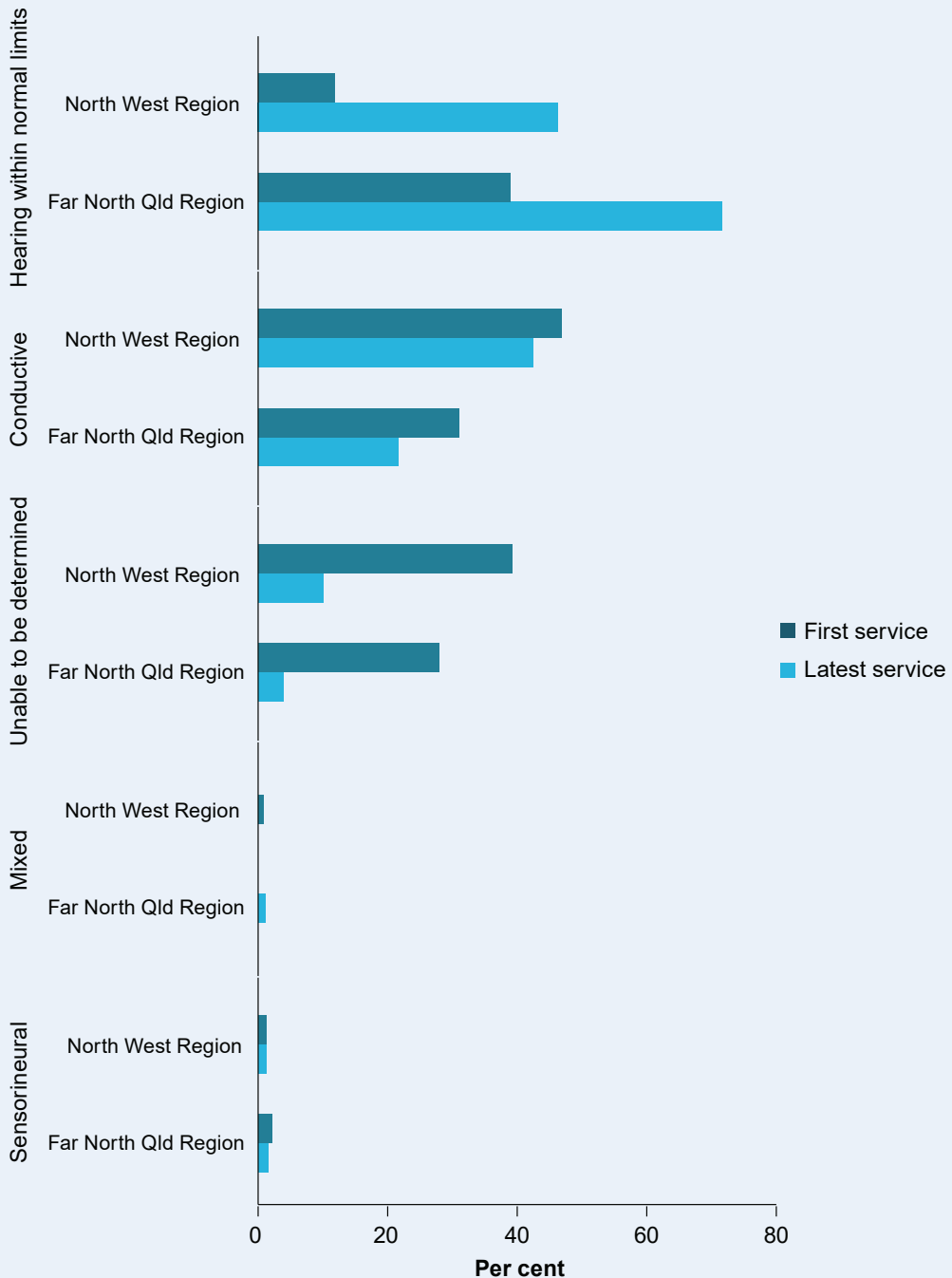
The proportion of children and young people with hearing loss was higher in the North West than in the Far North. However, there were improvements in hearing across both regions.

In the North West, the proportion of children with any hearing loss reduced by 5 percentage points between first and latest service (from 49% to 44%). In the Far North, a larger reduction of 9 percentage points was seen (from 33% to 24%). The reduction in hearing loss in the North West region was similar to that experienced by children and young people in all Deadly Ears Program service areas combined (3 percentage points), however the reduction in the Far North was larger.

For children and young people in both regions, there was an increase in the proportion with hearing within normal limits and a decrease in the proportion with conductive hearing loss over time. The proportion of children and young people who had hearing within normal limits was higher in the Far North than the North West at both the first and latest service:

- The proportion of children with hearing within normal limits in the Far North increased from 39% at the first service to 72% at the latest service.
- In the North West, the proportion increased from 12% at first service to 46% at the latest service (Figure 7.4).

**Figure 7.4: Changes in type of hearing loss among children and young people who received at least 2 audiology services, Far North and North West regions, 2015–2019**



Note: Based on region at first service.

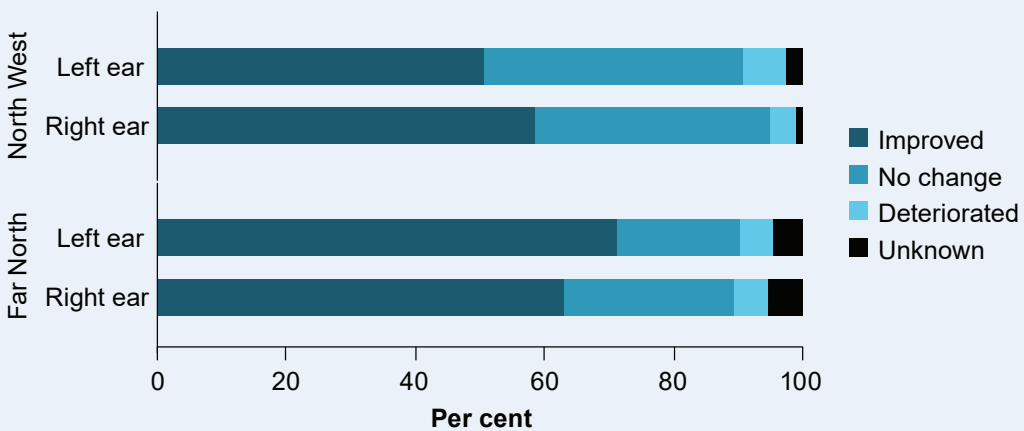
Source: Deadly Ears Program data collection.

Among the 222 children and young people in the North West and 180 in the Far North who received at least 2 audiology services between 2015 and 2019:

- 77 (35%) in the North West and 42 (23%) in the Far North had conductive hearing loss in their left ear at their first service
- 82 (37%) in the North West and 38 (21%) in the Far North had conductive hearing loss in the right ear at their first service.

In the North West, an improvement in hearing health was seen for over half of children who had conductive hearing loss at their first service (left ear: 51%, right ear: 59%). In the Far North, 71% of those with conductive hearing loss in their left ear, and 61% for the right ear, experienced an improvement in hearing health (Figure 7.5). For comparison, in all Deadly Ears Program service areas combined, around 60% (both ears) of children and young people experienced an improvement in their hearing health.

**Figure 7.5: Change in hearing health among children and young people who received more than 1 audiology service and who had conductive hearing loss at their first service, by ear, Far North and North West regions, 2015–2019**



Note: Based on region at first service.

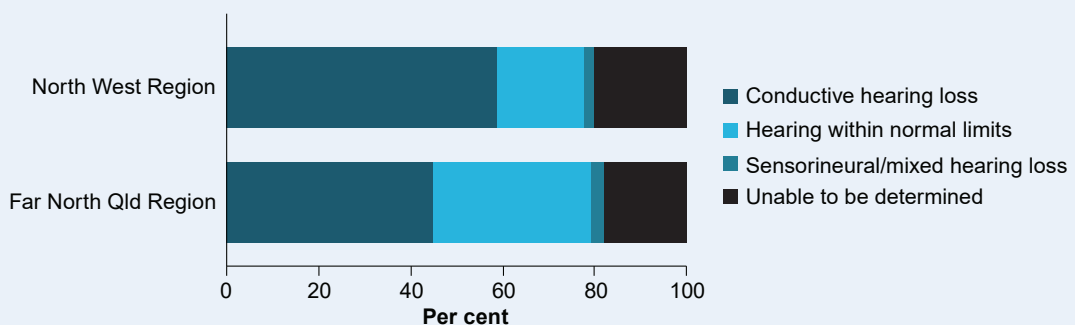
Source: Deadly Ears Program data collection.

## Experiences of ear disease and hearing loss

For children and young people with at least 1 ear condition, the proportion who experienced hearing loss was lower in the Far North compared with the North West region. Between 2015 and 2019, 796 children in the North West and 594 in the Far North Queensland region received both an ENT clinic and audiology service.

In the North West, 68% (541 children) had at least 1 ear condition at their first service, among which 59% (317) had conductive hearing loss. In the Far North, 65% (385) children had an ear condition at their first service, with 45% (173) of these having conductive hearing loss. The proportion of children whose hearing status was unable to be determined was similar between the 2 regions (North West: 20%; Far North: 18%) (Figure 7.6).

**Figure 7.6: Hearing loss among children and young people with at least 1 ear condition, Far North and North West regions, 2015–2019**



*Note:* For children and young people who had multiple services over time, region, ear condition status and hearing loss status at their first service was used.

*Source:* Deadly Ears Program data collection.

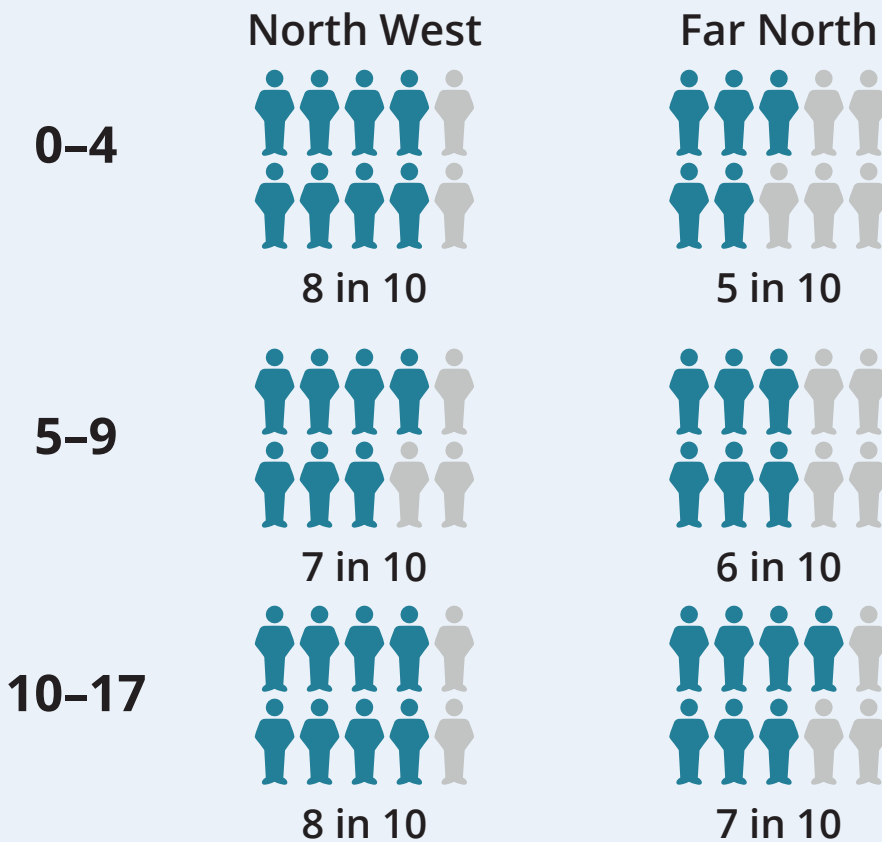
The majority of children and young people whose hearing status was unable to be determined were in the 0–4 age group. In the North West, over half (53%) of children in this age group had a hearing finding of unable to be determined, compared with 38% in the Far North.

The proportion of children and young people with at least 1 ear condition who experienced conductive hearing loss varied by age groups across the regions. Across all age groups, children and young people in the North West were more likely to have conductive hearing loss than those in the Far North Queensland region.

Including only children who had at least 1 ear condition and had a confirmed hearing diagnosis (that is, excluding unable to be determined):

- in the 0–4 age group, 77% in the North West had conductive hearing loss, compared with almost half (47%) in the Far North
- in the 5–9 age group, 69% of children in the North West and 56% in the Far North had conductive hearing loss
- in the oldest age group, 10–17, 80% of those in the North West and 71% in the Far North had conductive hearing loss (Figure 7.7).

**Figure 7.7: Conductive hearing loss among children and young people with at least 1 ear condition, Far North and North West regions, 2015–2019**



*Note:*

1. For children and young people who had multiple services over time, region, ear condition status and hearing loss status at their first service was used.
2. Excludes children and young people with a hearing finding of 'unable to be determined'.

*Source:* Deadly Ears Program data collection.

## Conclusions from the regional case study

The findings presented within this chapter highlight that no 2 regions share the same ear disease and hearing loss profile. The Far North Queensland region and North West region both contain many different communities (and several Deadly Ears service locations), and there may also be differences in ear conditions and hearing loss between the communities within each.

Around 3 in 5 children in both regions experienced at least 1 ear condition (North West: 63%; Far North: 60%). However, the experience of chronic ear disease differed between the 2 regions:

- The North West had higher rates of the more severe forms of disease (CSOM and dry perforation) and associated conductive hearing loss than the Far North Queensland region.
- Children in the Far North region were more likely than those in the North West to experience an improvement in hearing health over time, which may be due to the lower severity of ear disease in the Far North. As such, less time would be required for ear disease status and associated degree of hearing loss to improve.

The differences in ear and hearing health between these 2 regions are likely to be influenced by the way that social determinants of health affect each region.

## 8 Progress against benchmarks

The Deadly Ears Program tracks a range of measures over time to monitor access to the services and outcomes among children and young people. The measures can also provide insight into the effectiveness of the Program's engagement with local primary health management.

This chapter assesses progress against benchmarks in 3 key areas—referrals, attendance and confirmed hearing status—each year from 2015 to 2019.

### Referrals

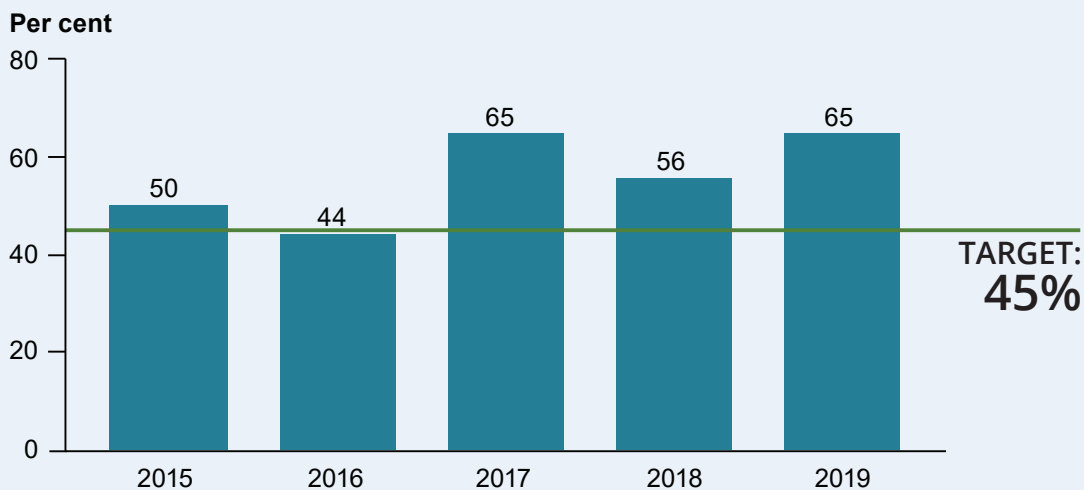
#### Target: 45% of new referrals are for children aged 0–4

'New referrals' are referrals to the Deadly Ears Program for children who have not previously been seen by the Program.

**Purpose:** Provides insight into the extent and effectiveness (against the OM guidelines) of local primary health management, especially within this key age group.

From 2015 to 2019, the proportion of all new and accepted referrals that were for children aged 0–4 exceeded the benchmark of 45% each year except for 2016. The proportion increased from 50% in 2015 to 65% in 2019 (Figure 8.1).

**Figure 8.1: Proportion of new and accepted referrals into the Deadly Ears Program for children aged 0–4, 2015–2019**



Source: Deadly Ears Program data collection.

For the 2 regions analysed in the regional case study in Chapter 7, over the 5-year period 2015 to 2019, the proportion of all new and accepted referrals that were for 0–4 year olds was:

- 56% in the Far North Queensland region
- 55% in the North West region.

These proportions were similar to that observed for all Deadly Ears Program service locations in the same 5-year period (56%).

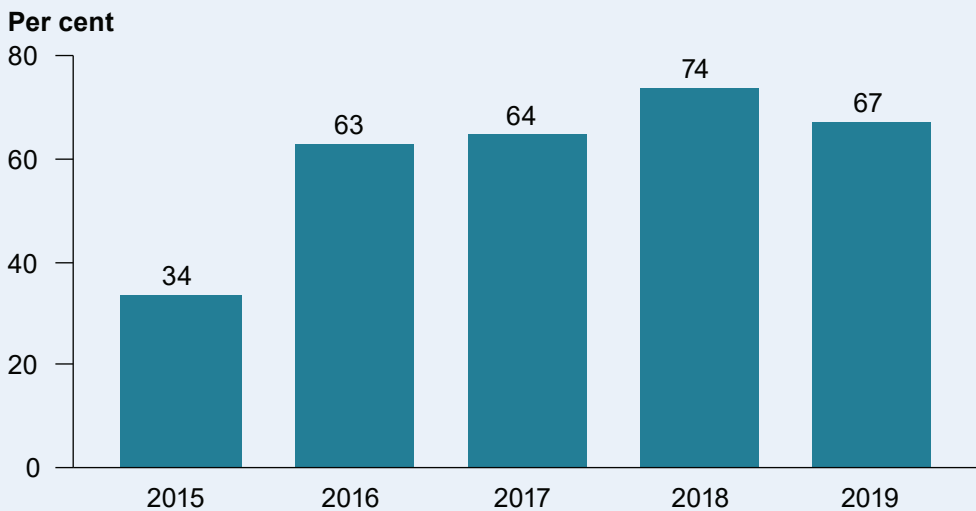
### Target: Increase in the rate of appropriate referrals

Appropriate referrals are referrals to the Deadly Ears Program which are aligned to the OM guidelines and Queensland Health’s Clinical Prioritisation Criteria and were accepted by the Program.

**Purpose:** To track alignment with the Deadly Ears referral guidelines and highlight any need for further training/education support for local primary health services around management of ear disease at the community level.

The rate of appropriate referrals generally increased over time, from 34% in 2015 to 74% in 2018, before decreasing slightly to 67% in 2019 (Figure 8.2).

**Figure 8.2: Proportion of referrals into the Deadly Ears Program which were accepted and were aligned to the Deadly Ears referral guidelines, 2015–2019**



Source: Deadly Ears Program data collection.

Over this time period, the proportion of appropriate referrals was higher in the North West region (70%) than the Far North Queensland region (64%). However, the proportions in both regions were higher than that for all Deadly Ears Program service locations combined (60%).

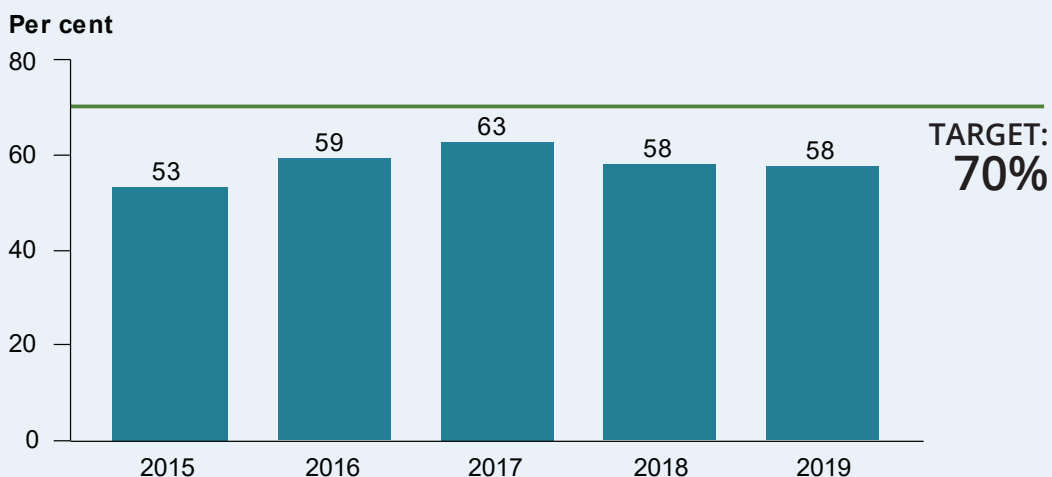
## Attendance

### Target: 70% attendance rate for children who were booked to attend a Deadly Ears service

**Purpose:** Provides insight into the reach and access of the Program, and the Program's effectiveness at local engagement with primary health and families.

The attendance rate at Deadly Ears ENT clinic assessments was below the 70% target for all years between 2015 and 2019. The attendance rate was calculated including only services where children and young people were booked to attend a Deadly Ears ENT clinic service (i.e., children who attended opportunistically or cancelled prior to their appointment were excluded). The attendance rate was similar across this time period, increasing from 53% in 2015 to 63% in 2017, before remaining stable at 58% in 2018 and 2019 (Figure 8.3).

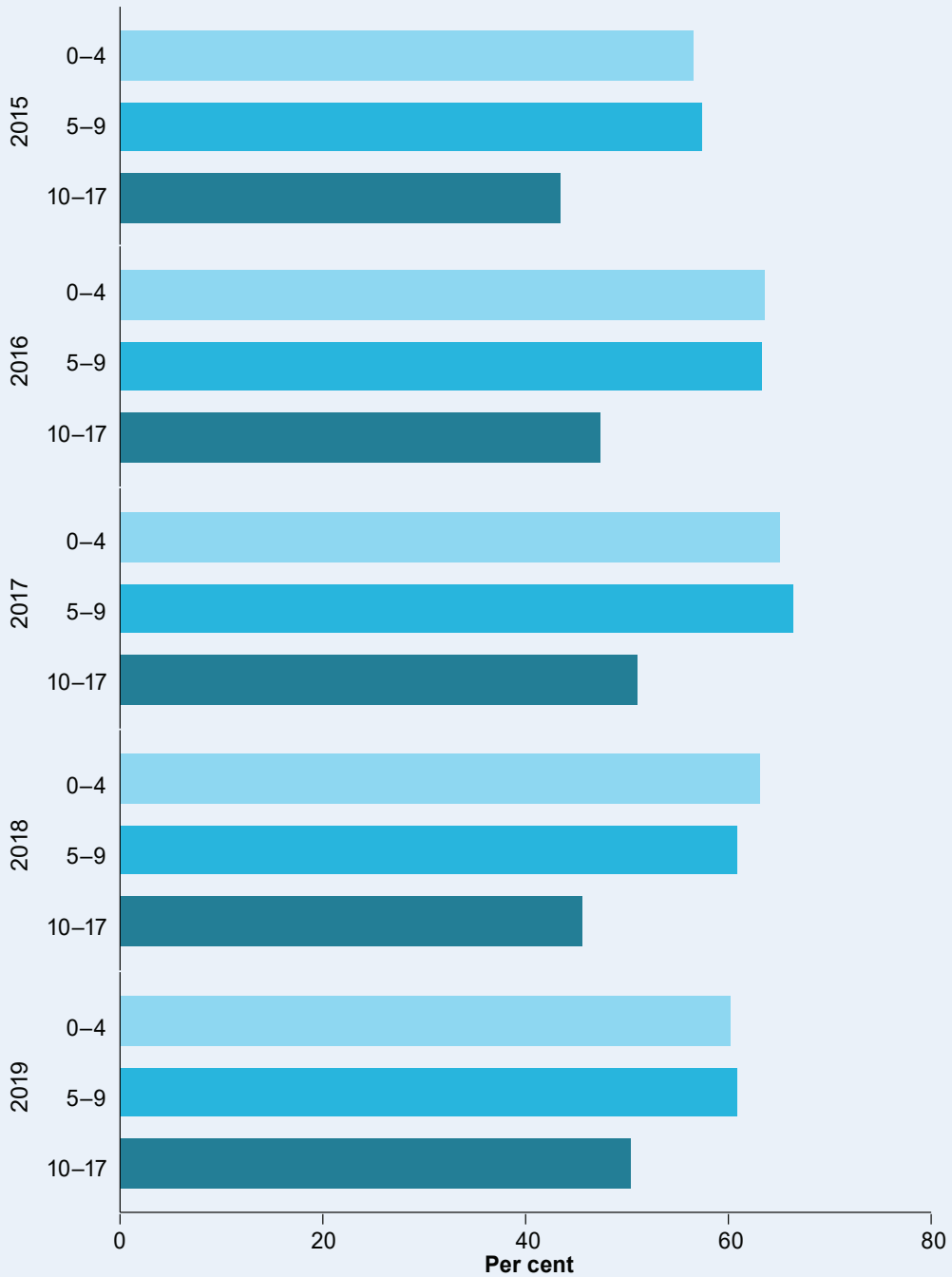
Figure 8.3: Attendance rate at Deadly Ears ENT clinic assessments, 2015–2019



Source: Deadly Ears Program data collection.

The attendance rate varied by age group, with older children less likely to attend their scheduled service (Figure 8.4).

**Figure 8.4: Attendance rate at Deadly Ears ENT clinic assessments, by age group, 2015–2019**



Source: Deadly Ears Program data collection.

Over this time period, attendance rates were higher in the Far North Queensland region (65%) compared with the North West region (58%). For all Deadly Ears Program service locations combined, the total attendance rate was 60%.

## Confirmed hearing status in 0–4 year olds

### **Target: 80% of 0–4 year olds who receive an audiology assessment have a confirmed hearing status**

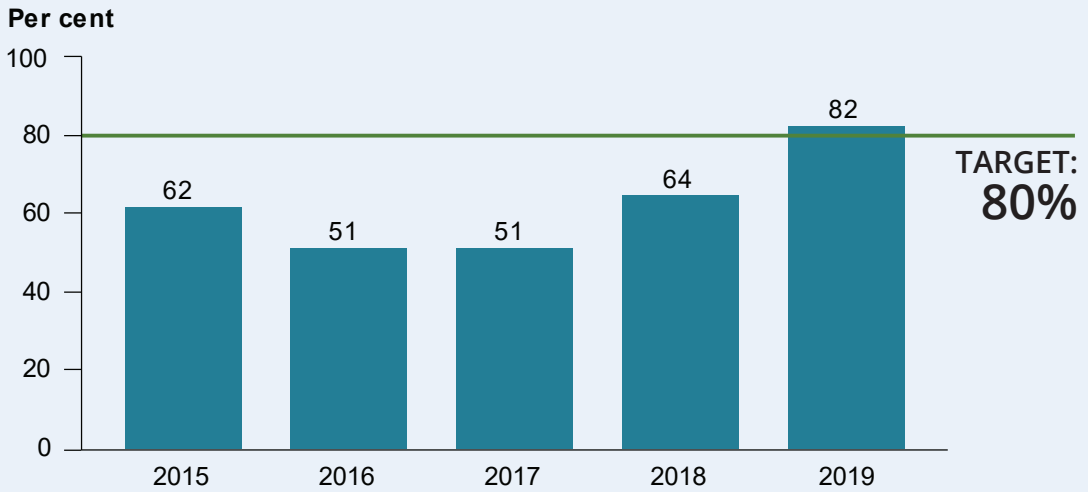
Children and young people are defined as having a confirmed hearing status where a diagnostic hearing assessment was conducted and the overall status of the child's hearing was classified as 1 of: hearing within normal limits, conductive hearing loss, sensorineural hearing loss or mixed hearing loss (i.e., children whose hearing status was unable to be determined were excluded).

**Purpose:** Ensure that the highest risk age group has their hearing status determined as young as possible in order to reduce the potential developmental and other impacts associated with conductive hearing loss. Within this age group, obtaining a hearing finding in the younger cohort can be difficult.

The target of 80% of children aged 0–4 with confirmed hearing status was met in 2019. The proportion increased over time from 62% in 2015 to 82% in 2019 (Figure 8.5).

This trend can be linked to the Program's increasing presentation of younger children aged 0–4, who are more difficult to test, and the Program's response with the introduction of community visual reinforcement audiology, to enhance the likelihood of a confirmed hearing finding in younger children. This was pilot tested in 2017–18, and rolled out across the Program in 2018.

**Figure 8.5: Proportion of children aged 0–4 with confirmed hearing status, 2015–2019**



Source: Deadly Ears Program data collection.

Over this time period, the proportion of 0–4 year olds with confirmed hearing status was higher in the Far North Queensland region (66%) compared with the North West region (58%). In total from 2015 to 2019, 62% of children aged 0–4 had a confirmed hearing status across all Deadly Ears service locations combined.

# Appendix A: About the Deadly Ears Program data collection

The Deadly Ears Program was established by the Queensland Government to address the high rates of chronic middle ear disease and conductive hearing loss among Aboriginal and Torres Strait Islander children in Queensland.

The data used in this report are gathered by staff employed by the Deadly Ears Program. The child's middle ear status is diagnosed by an ENT specialist and the child's hearing status is diagnosed by an audiologist.

The Program does not accept referrals for adults. However, there are small numbers of adults in these data. Sometimes an adult may be seen opportunistically (e.g., a parent asks the ENT specialist for an assessment) or the patient has turned 18 years while in the Program's care before being referred on as an adult.

The Deadly Ears data collection contains information on ENT clinic, audiology assessment and ENT surgery services from 2007 to 2019.

## Changes to the Deadly Ears Program data collection

The Program's regular reviews of its services and data, together with continuous quality improvement activities, have resulted in several changes. These have affected clinical data trends and therefore must be considered when interpreting the findings of this report. These changes include:

- migration of early Deadly Ears Program data from an initial Excel database to a Microsoft Access database: 2009
- commencement of services to Palm Island, Normanton, and Thursday Island / Torres Strait: 2011
- cessation of the delivery of point-in-time ear and hearing screening services to some remote communities in favour of promoting routine surveillance by local primary health: 2013
- support for better local primary health management of these conditions by directly providing or facilitating training in ear and hearing health surveillance: 2013
- establishment of a Reference Group consisting of Program staff and ENT specialists to review clinic and surgical protocols: mid-2014
- migration of Deadly Ears database onto the state-wide *QChild* system: mid-2014
- transition of ENT surgical outreach to Cherbourg from Royal Children's Hospital to the Deadly Ears Program: mid-2014
- discontinuation of ENT Outreach clinics to Eidsvold due to significant reduction in need for a specialist service: end of 2014

- implementation of stricter referral protocols to align with the OM guidelines and targeted capacity building for primary health management: 2014
- commencement of consistent recording of detailed referral information into *QChild* database: 2015
- decision that all children seen in clinic have audiology assessment, with a particular focus on 0–4 year olds: 2016
- introduction of additional targeted ‘mini-clinics’ for high needs children—pilot: 2016, rollout 2017
- introduction of Deadly Ears priority ratings to help target specific children’s attendance at clinic: 2017
- introduction of TeleFIT service delivery in partnership with Hearing Australia to reduce age of first fitting of hearing aids—pilot: 2016–17, rollout 2017
- introduction of community visual reinforcement audiology to enhance the likelihood of audiology diagnoses in young children—pilot: 2017–18, rollout 2018.

## Eligibility for surgery

The scope of practice for General Anaesthetics is limited to children over 2 years of age, unless the health-care facility has a designated paediatric inpatient ward where the minimum corrected age is 18 months. One location serviced by the Program (Mt Isa Hospital) has such a facility, potentially enabling surgery from 18 months. The child must also be over 10 kilograms and the child must be assessed as an ASA 1 or ASA 2, meaning there are no existing comorbidities that would place them at a greater risk when undergoing a general anaesthetic.

# Appendix B: Prevalence of ear disease in Deadly Ears Program locations

In order to understand more about the burden of ear conditions in different locations, the ‘minimum prevalence’ of ear conditions among Deadly Ears service recipients can be calculated. The minimum prevalence is the number of children who attended a Deadly Ears service and were found to have an ear condition expressed as a proportion of the total eligible population. The eligible population was defined as the Aboriginal and Torres Strait Islander population aged 0–14 who resided in any of the Indigenous Areas (IAREs) that encompassed a Deadly Ears service delivery location. See Box B1 for more information on IARE level geographies, and how the eligible populations at this level were estimated.

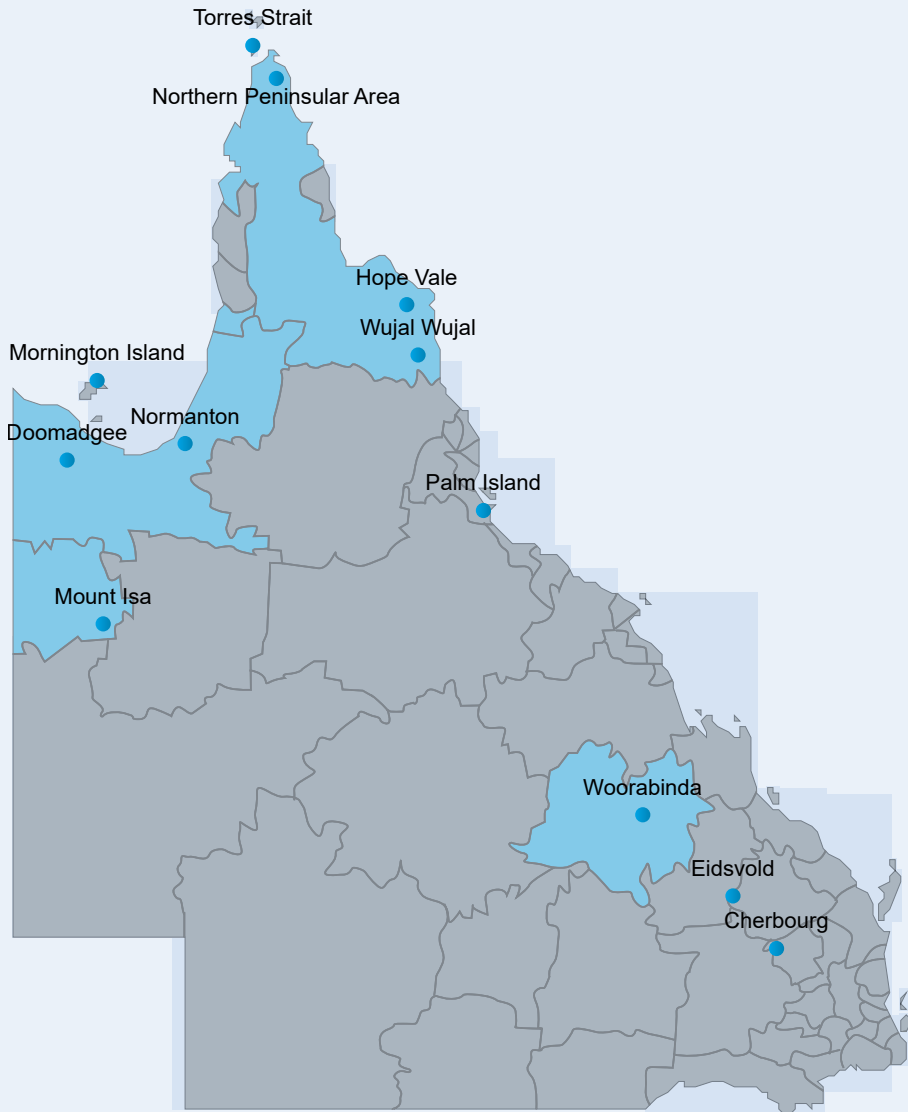
## Box B1: Indigenous Areas (IAREs)

IAREs are medium-sized geographical areas used to report data about Aboriginal and Torres Strait Islander people. IAREs are 1 of 3 levels of geographic units within the Indigenous Structure of the Australian Bureau of Statistics (ABS) Australian Statistical Geography Standard (ASGS). IAREs are aggregates of 1 or more Indigenous Locations (ILOCs). For the 2016 ASGS, 430 IAREs are defined to cover the whole of geographic Australia and 87 IAREs cover the whole of geographic Queensland. For more information, see the [Australian Bureau of Statistics](#) website.

The eligible population by IARE was estimated using a Bayesian smoothing of Census counts, followed by iterative proportional fitting of all relevant public and requested ABS data, together with ABS geographic correspondences where applicable.

Figure B1 shows the locations of the Deadly Ears Program service locations with their corresponding IAREs shaded.

**Figure B1: Map of Deadly Ears Program service locations with corresponding Indigenous Areas**



*Notes*

1. Deadly Ears Program service locations are labelled with the corresponding Indigenous Areas (IAREs) highlighted. See Table B1 for more information on which IAREs included Deadly Ears Program service locations.
2. Services to the Central Queensland community of Eidsvold ended in 2014 due to significant reductions in the need for this type of specialist service, and as such has not been included on this map as this analysis is constrained to the time period 2015 to 2017.
3. The Cherbourg and Palm Island IAREs cover a small geographic region and may be difficult to distinguish on the map.

Source: Deadly Ears Program data collection.

This is a 'minimum' estimate because any children who have an ear condition but do not receive a Deadly Ears service are not included in the numerator. In addition, due to the episodic nature of ear disease, children might not necessarily present with ear disease at the point in time that they attend a Deadly Ears clinic, further reducing the size of the numerator. As such, the minimum prevalence estimates do not provide a complete picture of the prevalence of ear conditions within this population and should be interpreted with caution.

Between 2015 and 2017, 13% of the eligible Indigenous population aged 0–14 accessed a Deadly Ears service and had an ear condition at that service. The estimated minimum prevalence varied by age:

- 11% of eligible children aged 0–4 had an ear condition
- 20% of eligible children aged 5–9 had an ear condition
- 8% of eligible children aged 10–14 had an ear condition.

The minimum prevalence of ear conditions also varied by location. The minimum prevalence was highest in the Wujal Wujal and Carpentaria – Burke – Mornington IAREs and lowest in the Kaiwalagal – Inner Islands and Kalakawal – Top Western Islands (both within the Torres Strait) IAREs (Table B1). Comparisons across areas may be affected by differences in referral rates to Deadly Ears services, rather than differences in prevalence.

**Table B1: Minimum prevalence of ear conditions, by Indigenous Area (IARE) and age group, 2015–2017**

Indigenous Area	Age group (per cent)		
	0–4	5–9	10–14
Deadly Ears Program locations			
<b>Wujal Wujal and outstations</b>			
Wujal Wujal	27	27	27
<b>Hope Vale</b>			
Hope Vale	13	18	5
<b>Northern Peninsula Area</b>			
Bamaga Injinoo	8	14	6
<b>Carpentaria - Burke - Mornington</b>			
Doomadgee, Mornington Island, Normanton	24	37	16
<b>Mount Isa</b>			
Mount Isa	6	14	9
<b>Central Capricorn</b>			
Woorabinda	6	16	5
<b>Cherbourg</b>			
Cherbourg	18	34	11
<b>Kaiwalagal - Inner Islands</b>			
Horn (Ngurupai) Island, Thursday Island	4	8	4
<b>Kalakawal - Top Western Islands</b>			
Boigu Island, Dauan Island, Saibai Island	4	11	4
<b>Kalalagal - Western Islands</b>			
Badu Island, Kubin, Mabuiag Island, St Paul's	16	19	2
<b>Kulkalgal - Central Islands</b>			
Poruma (Coconut) Island, Warraber (Sue) Island, Yam (Iama) Island, Yorke (Masig) Island	12	20	9
<b>Meriam - Eastern Islands</b>			
Darnley (Erub) Island, Murray (Mer) Island, Stephen (Ugar) Island	8	12	4
<b>Palm Island</b>			
Palm Island	18	28	9

Source: Deadly Ears Program data collection; AIHW analysis of ABS data.

# Acknowledgments

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## Abbreviations

ABS	Australian Bureau of Statistics
AIHW	Australian Institute of Health and Welfare
AOM	acute otitis media
ASGS	Australian Statistical Geography Standard
CSCF	Clinical Services Capability Framework
CSOM	chronic suppurative otitis media
dB	decibel
DE	Deadly Ears
ENT	ear, nose and throat
ET	Eustachian tube
ETD	Eustachian tube dysfunction
IARE	Indigenous Area
ILOC	Indigenous Location
NTRAI Program	Northern Territory Remote Aboriginal Investment Hearing Health Program
OM	otitis media
OME	otitis media with effusion
Qld	Queensland
TM	tympanic membrane

# Glossary

**Aboriginal or Torres Strait Islander:** A person of Aboriginal and/or Torres Strait Islander descent who identifies as an Aboriginal and/or Torres Strait Islander. See also **Indigenous**.

**acute otitis media (AOM):** The general term for both acute otitis media without perforation and acute otitis media with perforation. It is the presence of fluid behind the tympanic membrane plus at least 1 of the following: bulging tympanic membrane, fever, ear pain or irritability.

**acute otitis media (AOM) without perforation:** The presence of fluid behind the tympanic membrane, plus at least 1 of the following: bulging tympanic membrane, red tympanic membrane, fever, ear pain or irritability. A bulging eardrum and/or ear pain are the most reliable indicators of AOM without perforation.

**acute otitis media (AOM) with perforation:** AOM presentation with discharge of pus through a perforation in the tympanic membrane for less than 2 weeks. The perforation is usually very small (a pinhole) when the tympanic membrane first ruptures. The perforation can heal and re-perforate after the initial onset of AOM with perforation.

**audiology assessment:** An assessment of a child or young person's hearing health by an audiologist, including diagnosis of hearing loss. If required, the audiologist will refer the child for further treatment and follow-up.

**bilateral hearing loss:** Hearing loss in both ears.

**cholesteatoma:** A cyst formed due to accumulation and abnormal growth of ear skin cells in a retraction pocket or through a perforation of the tympanic membrane, or in the middle ear space. Due to hyperproliferation of the skin cells the cyst grows, becoming space occupying, often with infection. A cholesteatoma caused by middle ear disease most often occurs in the attic region of the tympanic membrane. Cholesteatomas, where untreated, are arguably the most destructive form of middle ear disease.

**chronic suppurative otitis media (CSOM):** Persistent ear discharge through a perforation in the tympanic membrane lasting 2 weeks or more. On otoscopy, the perforation must be viewed and be greater than or equal to 2% of the pars tensa (the tense part of the tympanic membrane).

**clinically significant change in hearing:** A change in the four-frequency average of +/- 5 decibels.

**conductive hearing loss:** Hearing loss that results from dysfunction of the outer or middle ear that interferes with the efficient transfer of sound to the inner ear.

**confirmed hearing status:** Where a diagnostic hearing assessment was conducted and the overall status of the child's hearing was classified as 1 of: hearing within normal limits, conductive hearing loss, sensorineural hearing loss or mixed hearing loss.

**discharging grommet:** A grommet or tympanostomy tube in situ in the tympanic membrane, with discharge passing from the middle ear, through the grommet lumen. Purulent discharge is commonly associated with incomplete water precautions following insertion of grommets. Serous discharge is common during the early postoperative period. This process of discharging is also known as tympanostomy tube otorrhoea.

**dry perforation:** Presence of a perforation (hole) in the tympanic membrane without any signs of discharge, infection or fluid behind the tympanic membrane. In other definitions this can also be referred to as inactive chronic suppurative otitis media (CSOM) or CSOM without discharge.

**Ear, nose and throat (ENT) clinic assessment:** An assessment of a child or young person's ear health by an ENT specialist, including diagnosis and treatment of ear conditions, as well as providing ear and hearing health information for children and their families. The ENT specialist may also refer the child on for further follow-up services, including Deadly Ears Program ENT surgery. The majority of children who attend an ENT clinic assessment will also attend an audiology assessment.

**Ear, nose and throat (ENT) surgery service:** If a child or young person is identified at their ENT clinic assessment as requiring surgery for their ear condition, they will be offered ENT surgery in the same Deadly Ears Program visit (if available and within the Program's scope).

**Eustachian tube dysfunction (ETD):** Failure of 1 or more of the Eustachian tube (ET) functions which include maintaining normal middle ear air pressure, draining fluid from the middle ear, and protecting the middle ear from nasal secretions or sounds. In childhood, inadequate opening of the ETs is the most common form of ETD with resulting negative pressure in the middle ear and retraction of the tympanic membrane.

**first service:** A child or young person's first attended service within the relevant time period.

**four-frequency average:** A measure of hearing threshold (quietest sound heard), averaged over the 4 speech frequencies. An increase (positive change) in the four-frequency average indicates hearing loss, a decrease (negative change) indicates hearing improvement.

**hearing:** The sense for perceiving sounds; includes regions within the brain where the signals are received and interpreted.

**hearing loss:** Any hearing threshold response (using audiometry—the testing of a person's ability to hear various sound frequencies) outside the normal range, to any sound stimuli, in either ear. Hearing loss in a population describes the number of people who have abnormal hearing. Hearing loss may affect 1 ear (unilateral) or both ears (bilateral).

**hearing within normal limits:** Hearing response that falls within the normal range.

**Indigenous:** A person of Aboriginal and/or Torres Strait Islander descent who identifies as an Aboriginal and/or Torres Strait Islander. See also Aboriginal or Torres Strait Islander.

**latest service:** A child or young person's most recent attended service within the relevant time period.

**mixed hearing loss:** Hearing loss that has conductive and sensorineural components.

**no ear condition:** An intact and normal tympanic membrane with an air-filled middle ear. Also referred to as an aerated middle ear.

**otitis media with effusion (OME):** the presence of fluid behind the tympanic membrane without any acute symptoms. Other terms have also been used to describe the type of OME (including 'glue ear', 'serous otitis media' and 'secretory otitis media'). OME may be episodic or persistent.

**patent grommet:** A patent grommet or tympanostomy tube in situ in the tympanic membrane allowing ventilation of the middle ear.

**retraction:** A condition where a part or all of the intact tympanic membrane (ear drum) is pulled inward, initially this can be as a result of persistent negative middle ear pressure, due to Eustachian tube dysfunction.

**sensorineural hearing loss:** Hearing loss that results from dysfunction in the inner ear (especially the cochlea).

**tympanic membrane (TM):** Refers to the ear drum, a membrane which divides the external auditory canal from the middle ear.

**unable to be determined:** When a definitive hearing diagnosis is unable to be made, usually due to challenges associated with conditioning to the diagnostic assessment.

**unilateral hearing loss:** Hearing loss in 1 ear.

**visit:** When a child or young person attends a Deadly Ears service within a single trip. A child or young person may have multiple kinds of services, (for example, ear, nose and throat (ENT) clinic, audiology assessment, and ENT surgery) in a single visit.

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## Related publications

The following AIHW publications relating to the ear and hearing health of Aboriginal and Torres Strait Islander children might also be of interest:

- AIHW 2020. Hearing health outreach services for Aboriginal and Torres Strait Islander children in the Northern Territory. Cat. no. IHW 228. Canberra: AIHW. <https://www.aihw.gov.au/getmedia/cad27a35-7746-4044-b20b-d9b1b24353aa/aihw-ihw-228.pdf.aspx?inline=true>
- AIHW 2020. Indigenous hearing health. Canberra: AIHW. <https://www.aihw.gov.au/reports/australias-health/indigenous-hearing-health>



Queensland's Deadly Ears Program aims to reduce the impact of ear disease and hearing loss on Indigenous children by providing a range of frontline services in remote areas. This report summarises the services provided by the Program between 2007 and 2019. It also presents detailed information on the experiences with ear disease and hearing loss among children receiving services through this Program, including changes over time.

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