Australian Government

Australian Institute of Health and Welfare

AIHW

Northern Territory Outreach Hearing Health Program

July 2012 to December 2016

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Please note that there is the potential for minor revisions of data in this report. Please check the online version at <www.aihw.gov.au/> for any amendments.

Contents

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Abbreviations

ABS	Australian Bureau of Statistics
AIHW	Australian Institute of Health and Welfare
AOM	acute otitis media
CAHS	Central Australia Health Service
CHCI	Child Health Check Initiative
CNS	Clinical Nurse Specialist
CSOM	chronic suppurative otitis media
dB HL	decibels hearing level
ENT	ear, nose and throat
ETD	Eustachian tube dysfunction
HP	hearing health priority
NTER	Northern Territory Emergency Response
OME	otitis media with effusion
TEHS	Top End Health Service
WHO	World Health Organization

Summary

This report presents information on ear and hearing health outreach services for Aboriginal and Torres Strait Islander children and young people aged under 21 in the Northern Territory. These services were funded by the Australian Government and delivered by the Northern Territory Government.

Service delivery

In 2016, 2,452 outreach audiology services, 1,020 ear, nose and throat (ENT) teleotology services and 1,156 Clinical Nurse Specialist (CNS) services were provided to 2,164, 939 and 1,074 children and young people, respectively.

From July 2012 to December 2016, there was a total of 10,576 outreach audiology services, 4,338 ENT teleotology services and 3,663 CNS services provided to 5,878, 2,720 and 3,002 children and young people, respectively.

Improvement in ear and hearing health

The percentage of children and young people with at least 1 ear disease decreased by 15 percentage points from July 2012 to December 2016 (from 76% to 61%).

The percentage of children and young people with hearing loss decreased by 10 percentage points from July 2012 to December 2016 (from 55% to 45%).

Children aged 0–5 who received audiology services were more likely to have improvements in hearing impairment and hearing loss over time, compared with older children. This is consistent with other studies that demonstrated that early intervention is effective in improving hearing health outcomes for children.

Tracking children and young people over time as they move through the Hearing Health Program, 51% had improved hearing loss and 62% had improved hearing impairment (from July 2012 to December 2016).

Demand for hearing health services

While the number of children and young people who use the Hearing Health Program has increased over time, there are still high numbers of outstanding referrals. As at December 2016, there were 2,726 children and young people on the waiting list for outreach audiology services and 2,051 on the waiting list for ENT teleotology services.

Progress against benchmarks

Service delivery targets have mostly been met. These targets focus on the number of services provided by specific Hearing Health Program services.

Targets related to health outcomes for hearing impairment are on track to be met, and are centred on improved hearing and having lower percentages of children with hearing impairment.

Most of the health outcome targets for middle ear conditions are on track to be met. These targets focus on decreasing the percentage of children and young people with certain middle ear conditions.

About this report

This report presents information on hearing health outreach services provided to Aboriginal and Torres Strait Islander children and young people aged under 21 in the Northern Territory from July 2012 to December 2016. The Australian Government funds these services via various programs, and the Northern Territory Government delivers them. These programs aim to provide outreach services for the early detection, treatment and management of ear diseases and hearing health problems among Indigenous children and young people.

This report is an update of the *Northern Territory Remote Aboriginal Investment: Ear and Hearing Health Program July 2012 to June 2016* (AIHW 2017a), which is part of the Australian Institute of Health and Welfare's (AIHW's) publication series that reports on the hearing programs in the Northern Territory. This report also includes some long-term analyses, from August 2007 to December 2016, for children and young people who have received multiple audiology or ear, nose and throat (ENT) services through Australian Government programs. This allows for an examination of the effects that ear and hearing health services and associated programs delivered in the Northern Territory had on children and young people's health over the lifecourse of the programs.

In comparison with previous hearing health reports from the AIHW, this version is more condensed. A set of online tables accompanies this report to maintain the level of reporting found in previous hearing health reports. All tables that have been included in previous hearing health reports are also available online. Throughout this report, you will find links to the online tables related to the figures presented. A list of tables from the last report that are not found in this report, and their updated corresponding online tables, is available in Appendix A.

Online tables are available at <https://www.aihw.gov.au/reports/indigenous-australians/nt-ear-hearing-program-2012-to-2016/data>.

1 Introduction

Why is ear and hearing health important?

Hearing loss is more prevalent among Aboriginal and Torres Strait Islander people compared with non-Indigenous Australians, and continues to be an important health and social issue. Indigenous children are reported to have 2.9 times the rate of ear/hearing problems compared with non-Indigenous children, making hearing health specifically important for these children (AIHW 2017b).

What is ear and hearing health?

Ear and hearing health can refer to a variety of ear-related conditions, hearing impairment, hearing loss and the relationship between these health problems. Hearing loss involves loss of hearing in 1 or both ears, and hearing impairment is a decreased level of hearing in 1 or both ears.

Middle ear disease includes conditions such as otitis media and its various forms, and Eustachian tube dysfunction (ETD). Otitis media is an inflammation of the middle ear, and can be caused by an infection or ETD. The Eustachian tube functions to equalise the pressure in the middle ear to atmospheric pressure, and impairment of this function is known as ETD. Eustachian tube function can be impaired for a number of reasons, most commonly in childhood when it is developing and enlarged adenoids (glands in the roof of the mouth) are often present.

Impact of poor ear and hearing health

Among Indigenous children, otitis media is a large contributor to hearing loss, and often manifests itself at earlier ages, with greater severity, greater persistence and more frequently compared with non-Indigenous children (Jervis-Bardy et al. 2014).

Hearing loss can also have severe negative impacts on language development, cognitive development and socialisation, particularly in infants and young children. Hearing loss in early childhood can lead to social, learning, linguistic and behavioural problems at school. Experiencing these difficulties can translate into a lifetime of disadvantage affecting areas such as wellbeing, social success, income and employment (WHO 1996).

Ear and hearing health in the Northern Territory

Middle ear disease is a common health problem and is a cause for concern among Indigenous children, particularly those who live in remote communities (ABS 2016). This is possibly associated with several factors:

- the nature of otitis media, which makes it a complicated disease to manage
- living conditions in some parts of the Northern Territory; for example, housing and social conditions such as household overcrowding and poor hygiene
- low socioeconomic status
- secondhand smoke exposure

- the inability to find children and their families in communities during health outreach visits because of the high mobility of Indigenous families
- the geographical location and vast spread of Indigenous communities
- the difficulty in recruiting and retaining a specialist workforce.

The last 2 factors are also associated with living in remote areas. Living in remote areas may also affect access to general and ear health services, with fewer medical practitioners per capita, and lower access to general practitioners (AIHW 2014a, 2014b). Decreased access to these services can result in delays in diagnosis, treatment and management of middle ear disease among Indigenous children, prolonging periods of hearing loss and impairment.

Australian Government-funded Hearing Health Program in the Northern Territory

Hearing health specialist services were expanded in the Northern Territory in response to the Child Health Check Initiative (CHCI) in July 2007, which was introduced under the Northern Territory Emergency Response (NTER). The original Child Health Check data of 9,373 Indigenous children who received services in the NTER Prescribed Areas showed that between July 2007 and June 2009, 30% had ear disease. Through the introduction of the CHCI, the children who were found to have ear diseases were able to obtain audiology and ear, nose and throat (ENT) specialist services (AIHW & DoHA 2009).

The program continued under the Closing the Gap initiative in the Northern Territory National Partnership Agreement from mid-2009 to mid-2012. More information can be found in the publication *Northern Territory Emergency Response Child Health Check Initiative—follow-up services for oral and ear health: final report, 2007–2012* (AIHW 2012).

Between July 2012 and June 2015, the ear and hearing health services were replaced and expanded by the National Partnership Agreement on Stronger Futures in the Northern Territory. Since July 2015, these services have been continued through the new National Partnership on Northern Territory Remote Aboriginal Investment.

The Australian Government also funds the Northern Territory Government to deliver services through the Healthy Ears—Better Hearing, Better Listening Program. The Northern Territory Government uses this funding to support audiology services and ENT teleotology services that are part of the Hearing Health Program. The teleotology services are a method of offsite service delivery for children and young people aged under 21, especially in remote areas where there is high demand and lack of local services.The Hearing Health Program mentioned throughout this report refers to all of the Australian Government–funded programs that stemmed from the CHCI in the Northern Territory since July 2007.

There are 4 services included in this Hearing Health Program (detailed information on these services can be found in Chapter 2):

- health education, promotion and prevention
- outreach audiology
- ENT teleotology
- Clinical Nurse Specialists (CNSs).

How do children and young people move through the Northern Territory hearing health system?

The Hearing Health Program is available to all Indigenous children and young people aged under 21 in the Northern Territory. As outlined in Figure 1.1, children and young people generally enter the Northern Territory public hearing health system through the primary health-care sector. From this starting point, referrals can be made to audiologists, ENT specialists or CNS services. CNS services can also provide referrals to audiologists, or other organisations. After children have been seen by audiologists or ENT specialists, they can then be sent for follow-up in primary health-care, or referred to other community-based support organisations or to visiting rehabilitation support services through Australian Hearing or the Department of Education and Training's Hearing Support Services.

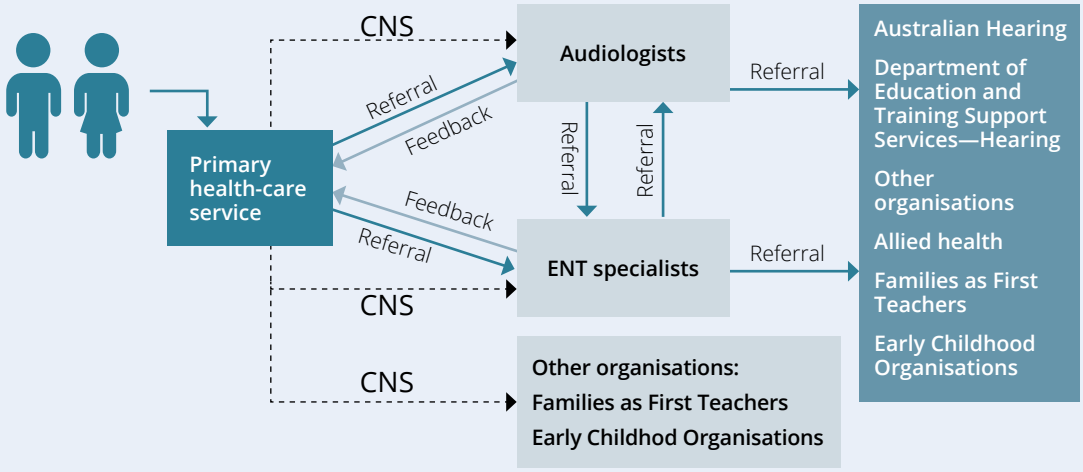


Figure 1.1: Clinical path of children and young people moving through the Northern Territory public hearing health system

About the data in this report

The data used in this report are collected from the hearing health outreach services funded by the Australian Government Department of Health. The data include over 7,000 children and young people aged under 21, which account for approximately 22% of the Northern Territory Indigenous population in this age group. However, children and young people who received these services are not a random sample of the population. In addition, since January 2013, children and young people have been prioritised according to their need for services, which means that those with worse ear and hearing health are more likely to be captured in the data collection.

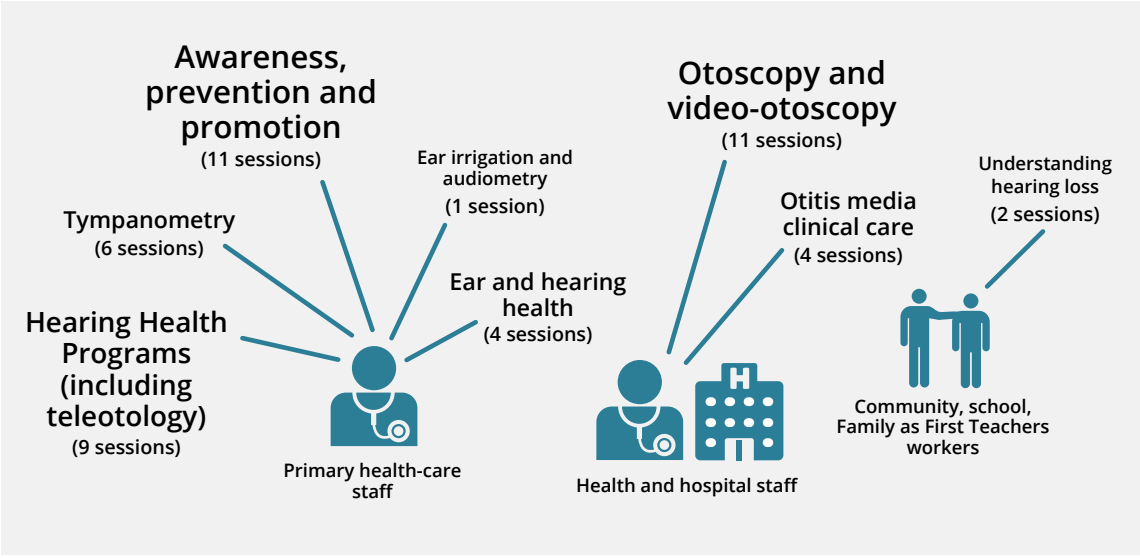
2 Service delivery

Health education, promotion and prevention

There are a variety of hearing health education, promotion and prevention activities delivered through the Northern Territory public hearing health system. Priority areas of hearing health promotion and prevention centre on enhancing hearing health literacy through education and community participation. Health education, promotion and prevention initiatives include:

- training for Aboriginal community hearing workers
- 'Stop the First Infection'—a program aimed at preventing early childhood infections
- ear health promotional material, such as handouts, posters, audiovisual messages
- a hearing health social-marketing campaign with local football organisations
- a health promotion hip-hop music video addressing ear health.

In 2016, 48 training sessions for hearing health education, promotion and prevention activities were provided to heath-care staff. The target audience for these activities is outlined below.

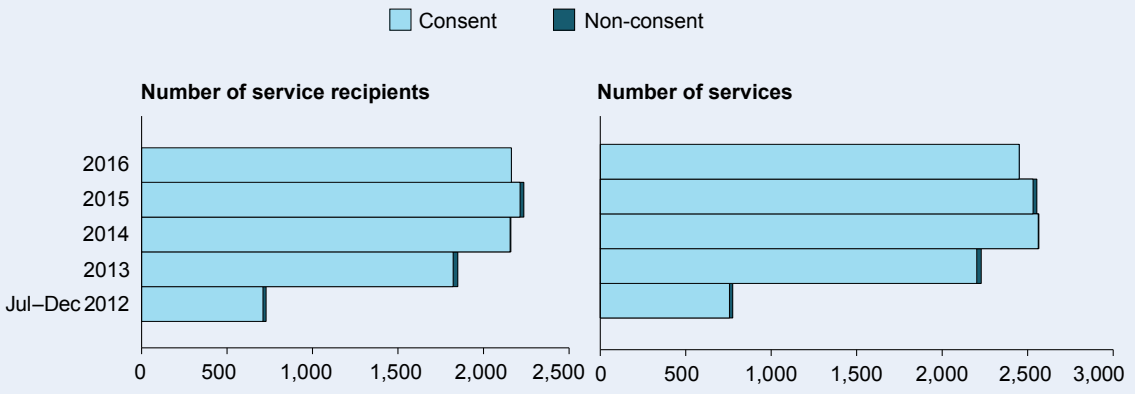


Outreach audiology services

Audiology services include assessing middle ear function, diagnosing hearing loss and middle ear disease, and recommending clinical care or rehabilitation (such as communication strategies, classroom amplification, hearing aids, speech therapy and educational support). These services are delivered by audiology outreach teams, which consist of an audiologist and at least 1 other member of staff, such as a registered nurse, nurse audiometrist, Aboriginal health worker or community health worker.

Figure 2.1 shows:

- In 2016, 2,452 audiology services were provided to 2,164 service recipients.
- From July 2012 to December 2016, a total of 10,576 services were provided to a total of 5,878 unique service recipients.
- The numbers of audiology services and service recipients have been increasing since 2012, but with a slight decrease from 2015 to 2016.



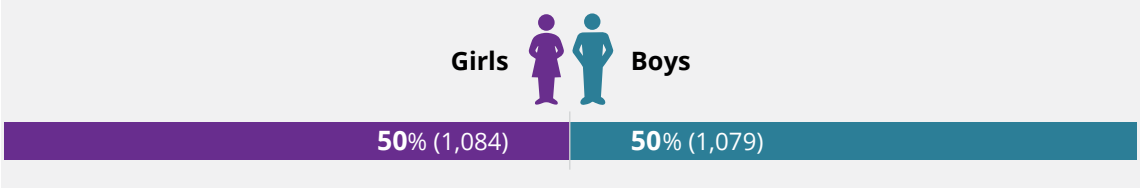
Source: Online Table 2.1.

Figure 2.1: Numbers of outreach audiology services and recipients over time

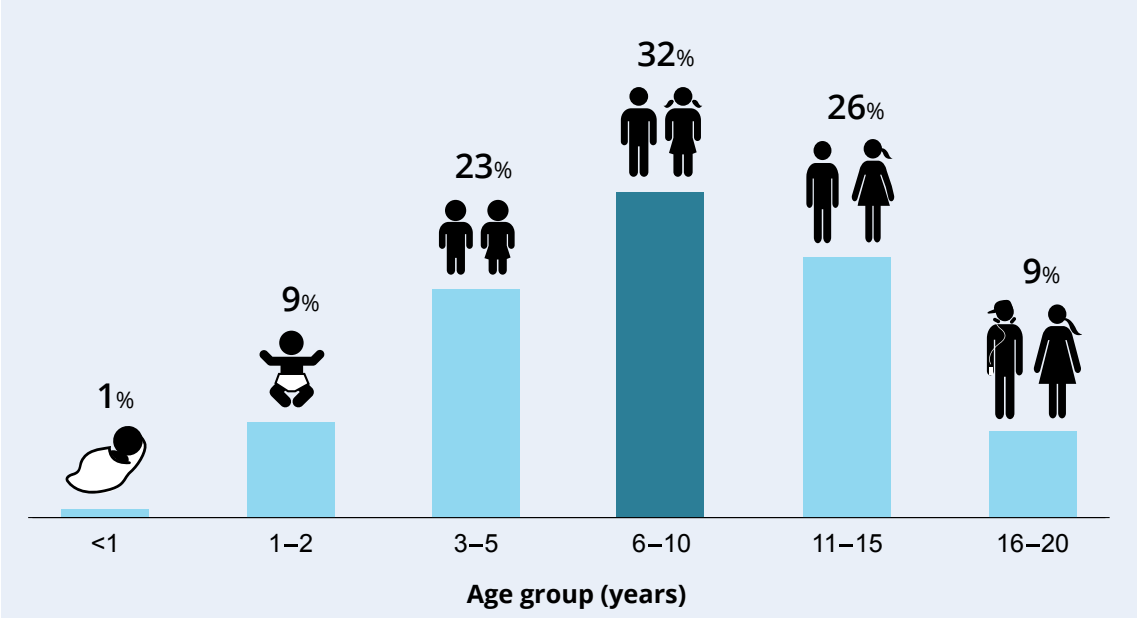
Overall, rates of non-consent to share the information of children and young people who received audiology services are quite small.

Nevertheless, due to the nature of non-consent, the demographic information in this report represents only children who have provided consent. When a child or young person's parent or guardian does *not* provide consent to share information, only a limited amount of aggregate information is provided to the AIHW. Appendix B provides more information.

In 2016, the percentages of audiology service recipients was the same between girls and boys.



The highest proportion of audiology service recipients in 2016 were aged 6–10 (32%) (Figure 2.2).



Source: Online Table 2.2.

Figure 2.2: Age of outreach audiology service recipients in 2016

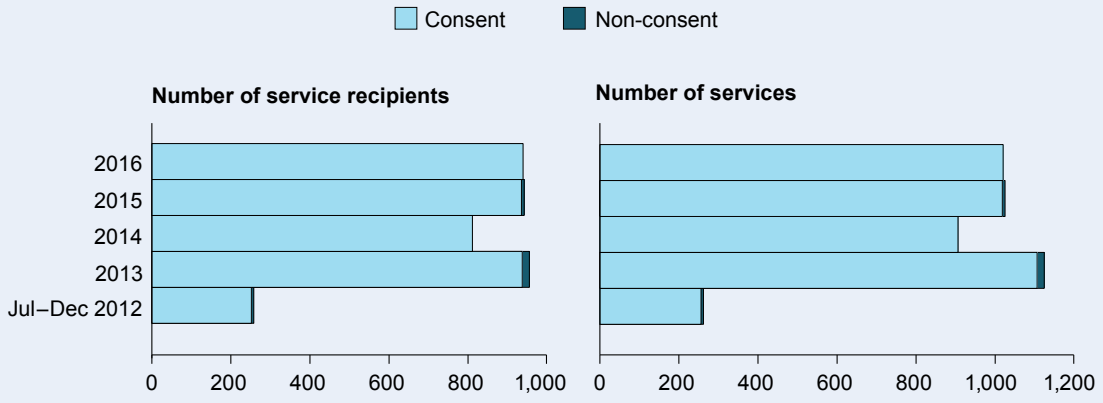
More information on outreach audiology services (or Chapter 3 in the previous report, *Northern Territory Remote Aboriginal Investment: Ear and Hearing Health Program July 2012 to June 2016*), such as services recommended by audiologists, can be found in the online tables.

ENT teleotology services

The ENT teleotology service model was developed to meet the demand for ENT services in remote Northern Territory communities. An outreach visit from an audiologist and ENT nurse provide hearing and full clinical assessments, and uses a video-otoscope to send electronic information to the ENT team at the Royal Darwin hospital. The remotely located ENT specialist provides advice, diagnosis and assessment, treatment recommendations (for example, medications, surgery, hearing aids) and care coordination. The availability of teleotology services reduces travel times for families and increases access to ENT services for children in remote areas.

Figure 2.3 shows:

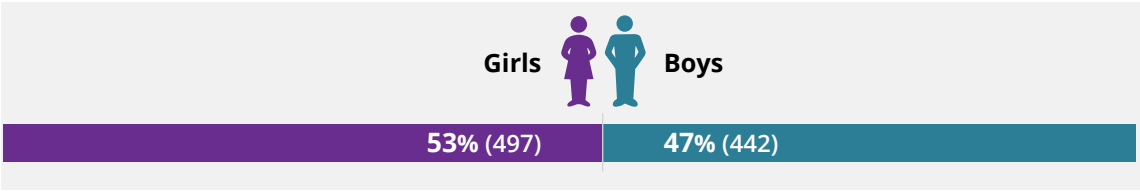
- In 2016, 1,020 ENT teleotology services were provided to 939 service recipients.
- From July 2012 to December 2016, a total of 4,338 services were provided to a total of 2,720 unique service recipients.
- Since 2013, the numbers of ENT teleotology service recipients have been steady over time, with a dip in 2014.
- Consent rates to share the information have been very high, and in 2016, there were no instances of non-consent.



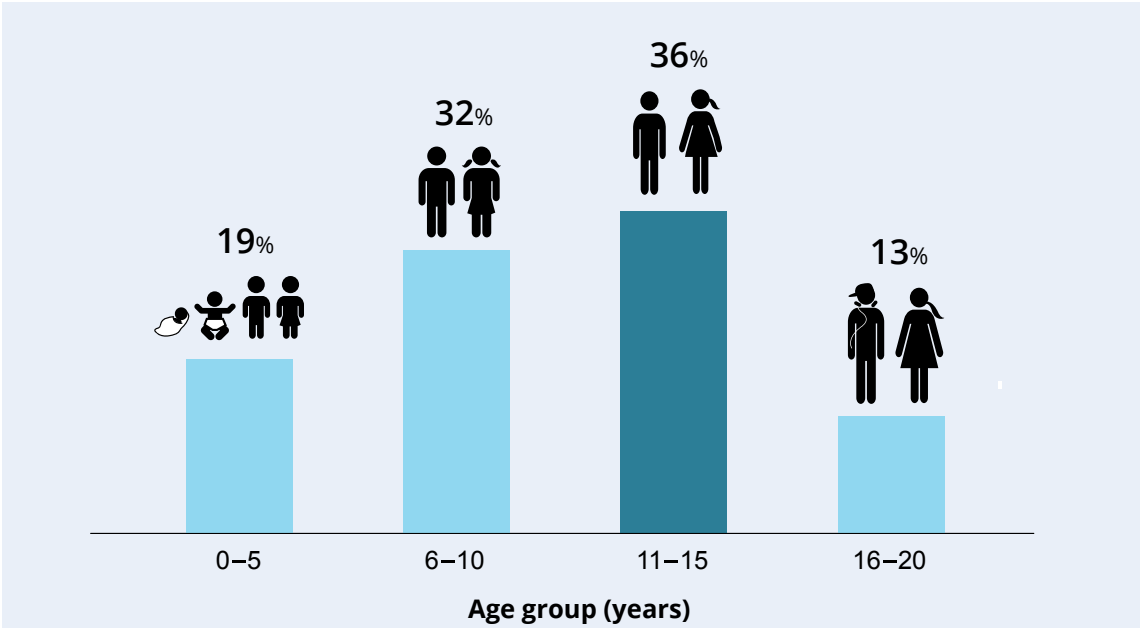
Source: Online Table 2.3.

Figure 2.3: Numbers of ENT teleotology services and recipients over time

In 2016, the percentages of ENT teleotology service recipients were similar between girls and boys.



The highest proportion of ENT teleotology service recipients in 2016 were aged 11–15 (36%).



Source: Online Table 2.4.

Figure 2.4: Age of ENT teleotology service recipients in 2016

The most common age group for ENT teleotology service recipients aged 11–15 is partly attributed to ENT surgery being most suited for children who are over the age of 6. The extended follow-up that is required in the years after the surgery also contributes to the high percentage in this age group.

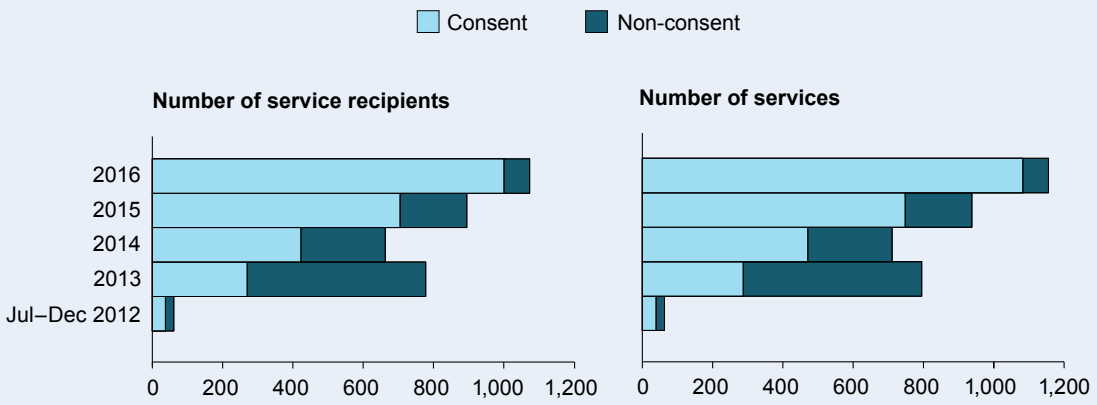
More information on ENT services (or Chapter 4 in the previous report, *Northern Territory Remote Aboriginal Investment: Ear and Hearing Health Program July 2012 to June 2016*), such as services recommended by ENT specialists, can be found in the online tables.

Clinical Nurse Specialist services

The CNS services were developed in response to the challenges encountered in preventing ear disease and implementing clinical care for otitis media in the Northern Territory. The CNS services oversee and coordinate the treatment of children with a prioritised need for care by linking primary health-care services with specialist resources, and acting as a central point of contact between these 2.

Figure 2.5 shows:

- In 2016, 1,156 CNS services were provided to 1,074 service recipients.
- From July 2012 to December 2016, a total of 3,663 services were provided to a total of 3,002 unique service recipients.
- Since 2012, there has been a substantial increase in the number of service recipients and services provided.The most recent increase can largely be explained by the recruitment of more CNSs in 2015.

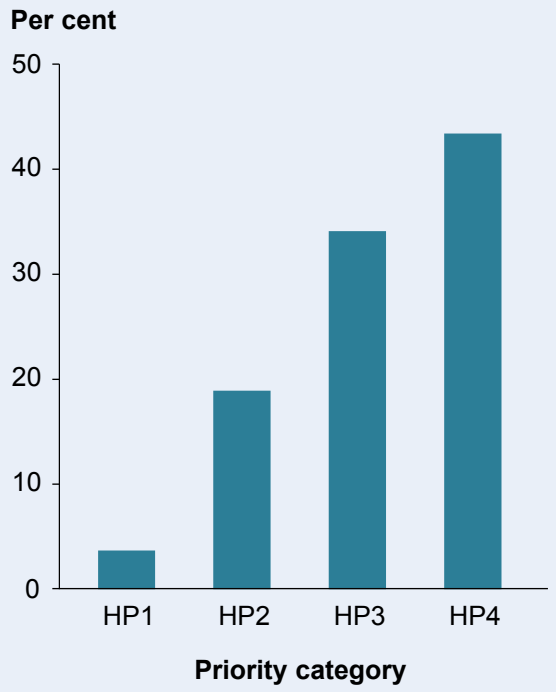


Source: Online Table 2.5.

Figure 2.5: Numbers of CNS services and recipients over time

Caution should be taken when interpreting CNS data in 2013 and 2014 because non-consent rates for sharing information were high. However, non-consent rates have been decreasing over time. The hearing health team in the Northern Territory Department of Health implemented a training program to improve consent rates, and this could explain the decrease in non-consent rates in recent years.

The CNS services are available to Indigenous children who have been identified as a hearing health priority (Figure 2.6), with the priority closely linked to age (Box 2.1).



Source: Online Table 2.6.

Figure 2.6 Hearing health priority (age proxy) among CNS service recipients, 2016

Box 2.1: Hearing health priority categories

HP1: infants aged under 12 months with recurrent acute otitis media (AOM) or chronic suppurative otitis media (CSOM); also infants who have failed newborn hearing screening

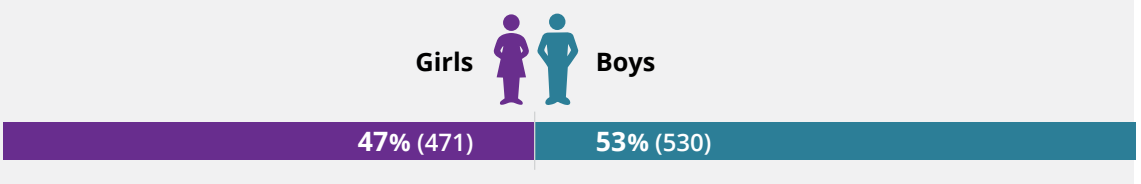
HP2: children aged 1–2 with perforation of the eardrum, recurrent AOM or persistent bilateral otitis media with effusion (OME)

HP3: children aged 3–5 with perforation of the eardrum, recurrent AOM, persistent bilateral OME or moderate to profound hearing impairment

HP4: children aged 6–10 with moderate, severe or profound hearing impairment

Older children represented the majority of service recipients in 2016: nearly half were aged 6–10, a third were aged 3–5, and younger age groups represented a smaller proportion of the children.

In 2016, the percentages of girls and boys who received CNS services were similar.



More information on CNS services (or Chapter 5 in the previous report, *Northern Territory Remote Aboriginal Investment: Ear and Hearing Health Program July 2012 to June 2016*), can be found in the online tables.

3 Ear conditions and hearing health status

Ear conditions

There are 2 main types of ear conditions that are captured in the Hearing Health Program: otitis media and Eustachian tube dysfunction (ETD) (Box 3.1).

Box 3.1: Types of ear conditions

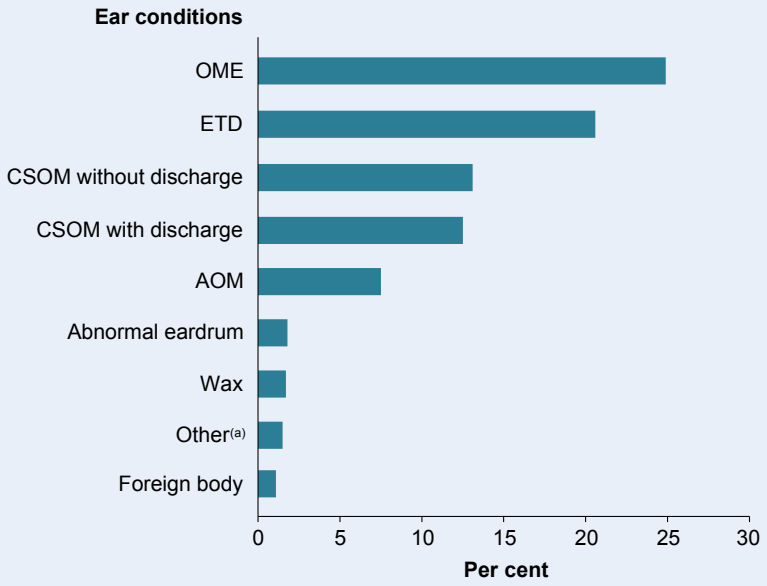
Otitis media: all forms of inflammation and infection of the middle ear. Active inflammation or infection is nearly always associated with a middle ear effusion (fluid in the middle ear space). Types of otitis media include:

- **acute otitis media (AOM)**—the presence of fluid behind the eardrum plus at least 1 of the following: bulging eardrum, red eardrum, recent discharge of pus, fever, ear pain or irritability for less than 6 weeks
- **chronic suppurative otitis media (CSOM) with discharge**—a persistent suppurative (see Glossary) discharge from the middle ear through a tympanic membrane perforation for more than 6 weeks
- **chronic suppurative otitis media (CSOM) without discharge**—the presence of a perforation (hole) in the eardrum without evidence of discharge or fluid behind the eardrum—it is also known as inactive CSOM or dry perforation
- **otitis media with effusion (OME)**—the presence of an intact eardrum and middle ear fluid without symptoms or signs of acute infection. OME may be episodic or persistent.

Eustachian tube dysfunction (ETD): negative middle ear pressure associated with compromised equalisation, impeding middle ear function and sometimes causing middle ear fluid accumulation.

In 2016, 1,425 (63%) children and young people were diagnosed with at least 1 type of ear condition at their latest service, and this proportion has remained quite similar over the years from 2012 to 2016 (63–68%). Proportions of specific ear conditions have also had small fluctuations over the years.

In 2016, the most common type of ear condition was OME (25%, or 563 cases), followed by ETD (21%, or 467 cases), CSOM without discharge (13% or 297 cases) and CSOM with discharge (13%, or 282 cases) (Figure 3.1).



(a) 'Other' includes grommets, myringitis, otitis external, tympanosclerosis and other ear conditions.

Source: Online Table 3.1.

Figure 3.1: Types of ear conditions among children and young people in 2016

2 in 3 children were found to have ≥1 ear condition consistently each year

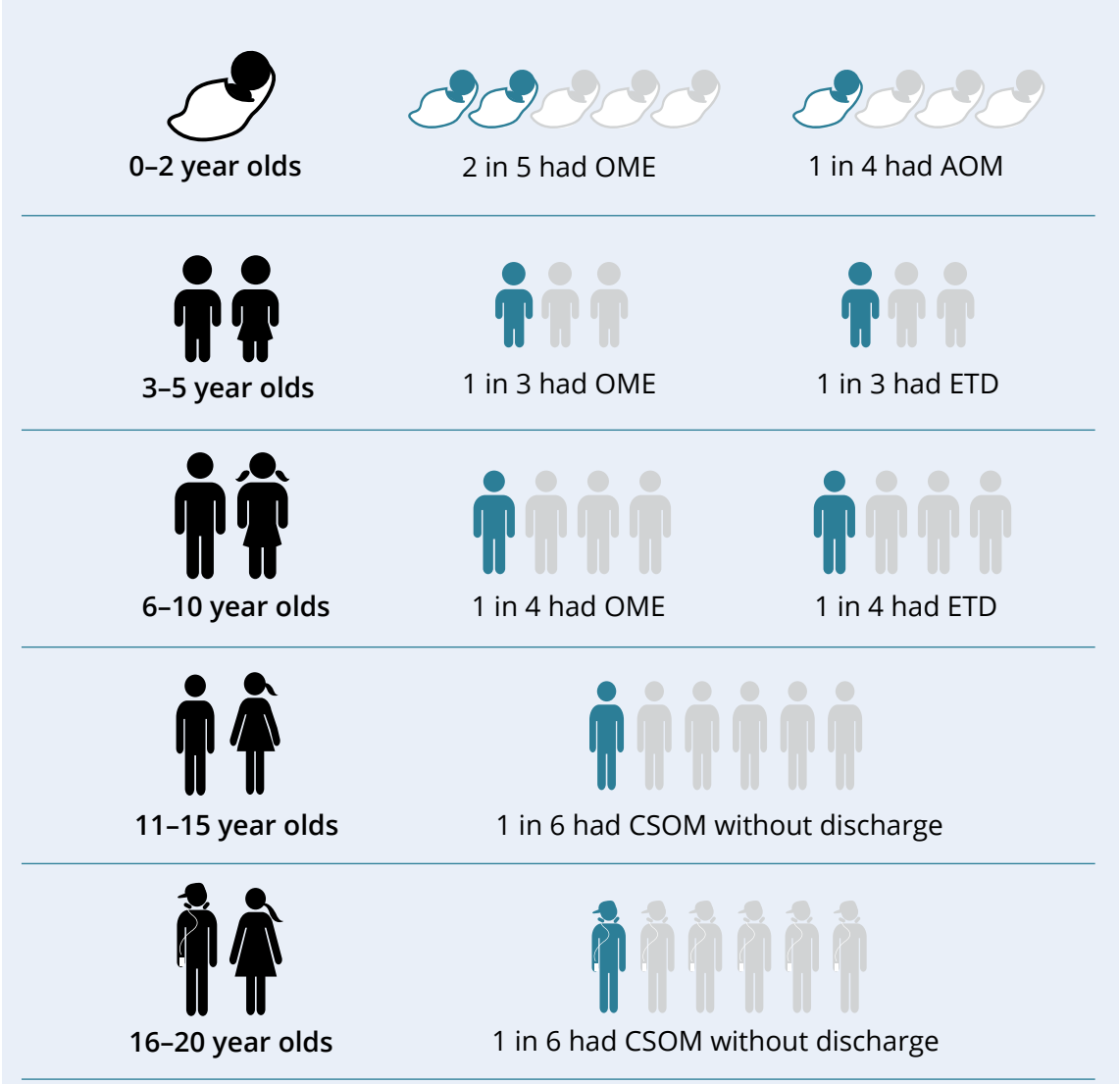
Age and sex differences

The proportions of ear conditions were generally similar by sex, but varied by age group in 2016.

Younger children had the highest proportion of ear conditions. In 2016, 77% of children aged 0–2 and 78% of children aged 3–5 had at least 1 type of ear condition. This pattern reflects the natural profile of ear disease, where children typically grow out of the ear conditions (AIHW 2014c).

Find out more *in Online Table 3.2.*

The most common types of ear conditions differed slightly among age groups in 2016, as shown in Figure 3.2.



Source: Online Table 3.2.

Figure 3.2: Most common ear conditions across age groups of children and young people, 2016

Apart from the trends shown above, the following patterns were also observed:

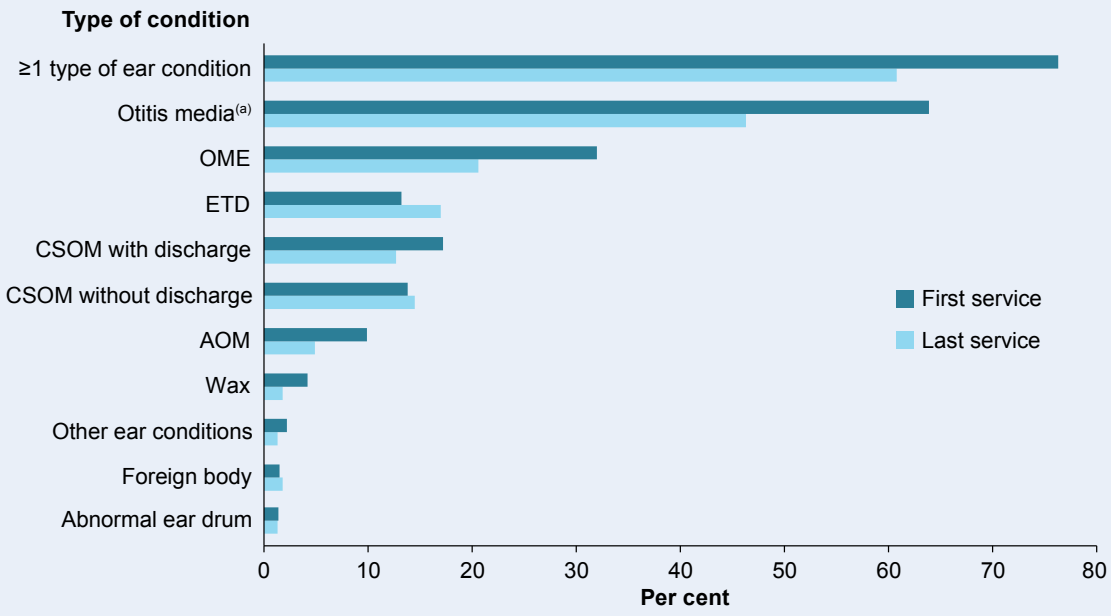
- The proportion of OME, ETD, CSOM with discharge and AOM generally decreased with age.
- The proportion of CSOM without discharge and the presence of a foreign body generally increased with age.
- The proportion of children and young people with no ear conditions increased with age.

Changes over time—short term (2012–2016)

This section presents information about changes in ear conditions, hearing loss and hearing impairment among children and young people along the Hearing Health Program treatment pathway who received more than 1 audiology service. This is 1 way to understand the effectiveness of the hearing health outreach services in terms of improving outcomes. It is important to keep in mind that changes may also be partially attributed to the natural progression of the disease as children and young people grow older. To allow for a more accurate look at how children and young people move through the treatment pathway, those with at least 2 services and at least 3 months between their first and last service were examined.

For almost all conditions, there was an improvement over time. Figure 3.3 shows the change in proportion of ear conditions among first and last services:

- The proportion of children and young people with at least 1 condition decreased by 15 percentage points between the first and the last service.
- While there was a decrease in the proportion of children with an ear condition between first and last services for the majority of middle ear conditions, there were increases in the proportions of ETD, CSOM without discharge and cases with foreign body found in the ear.
- The reasons for these trends are not clear, but they may be associated with the reduction of CSOM with discharge and OME with age.



(a) Otitis media includes OME, CSOM with discharge, CSOM without discharge and AOM.

Source: Online Table 3.3.

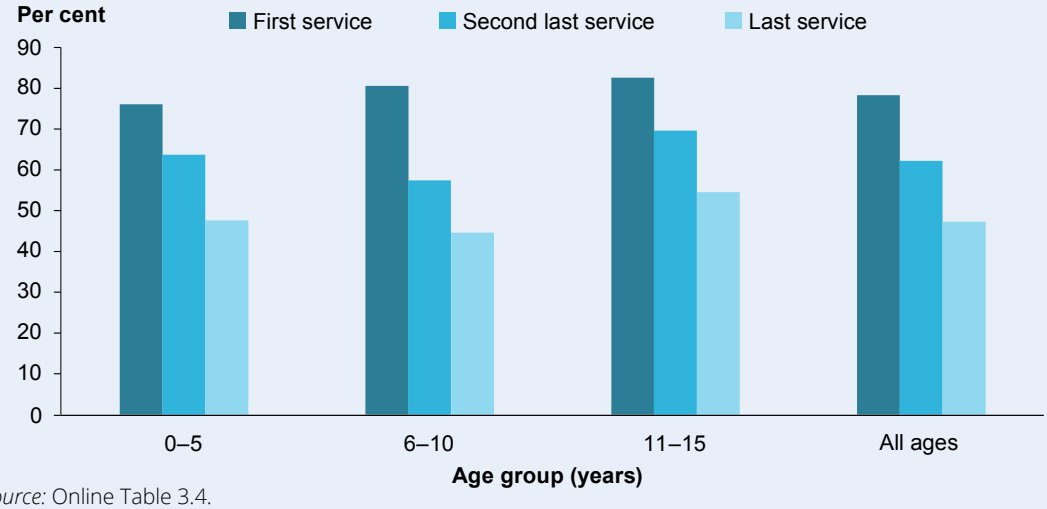
Figure 3.3: Change in proportion of ear conditions between first and last hearing health service, among children who received ≥2 services between July 2012 and December 2016

Changes over time—long term (2007–2016)

The expansion of the Northern Territory public hearing health services started in 2007, so changes over time can be examined across a longer period. This allows for a more in-depth look at any changes in ear conditions.

Among children aged up to 15 who had at least 3 service visits between August 2007 and December 2016, improvement was seen over the long term (Figure 3.4):

- At the last service, 47% of children had at least 1 type of otitis media.
- There was decrease of 31 percentage points among children with otitis media, between first and last service visits.
- There were similar decreases across all age groups.



Source: Online Table 3.4.

Figure 3.4: Change in proportion of otitis media across visits, among children who received ≥3 services between August 2007 and December 2016

Ear conditions among CNS service recipients

Children and young people who receive CNS services have a prioritised need for care. As such, it is important to examine these children and young people separately to track their hearing health as they move through the program.

In 2016, 68% of children and young people were diagnosed with at least 1 ear condition at their first CNS visit, and 27% of children were not diagnosed with an ear condition (information was missing for the remaining 5%). The most commonly diagnosed conditions were:

- OME (31%)
- Eustachian tube dysfunction (ETD) (22%)
- CSOM with discharge (9%).

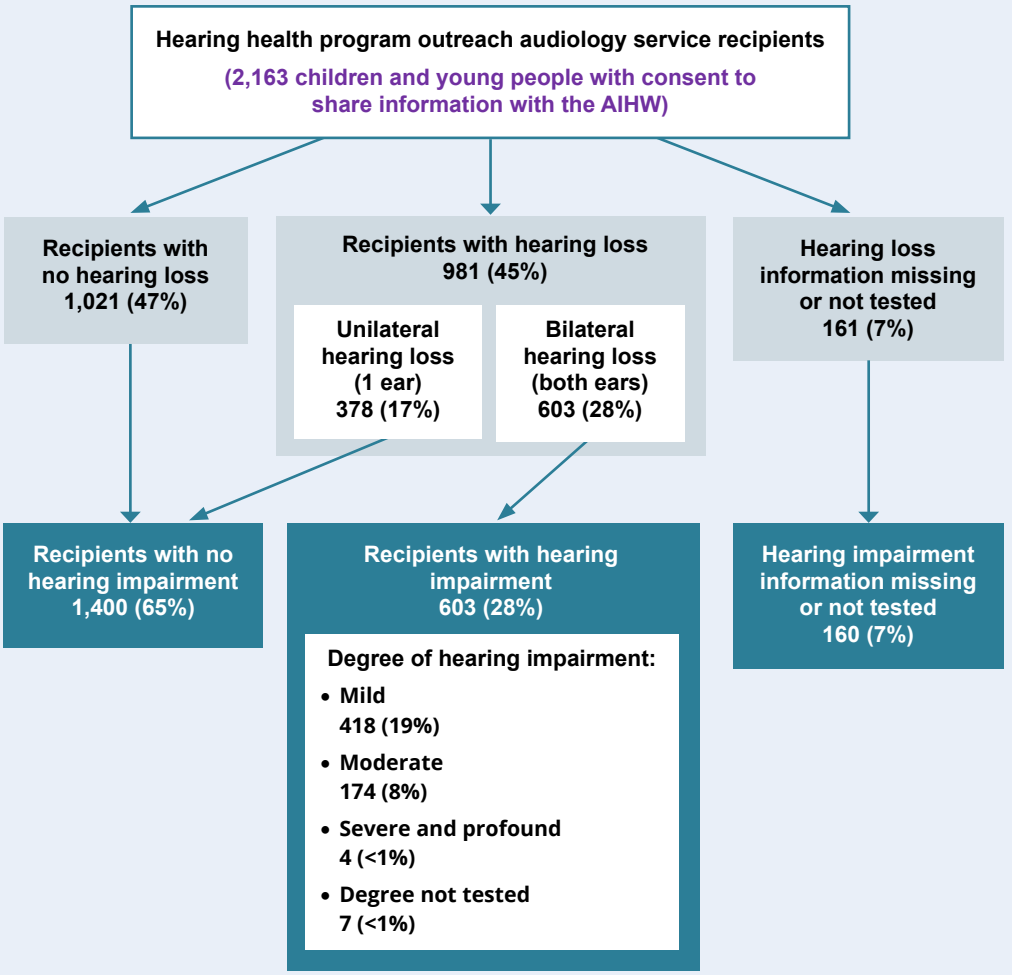
The distribution of ear conditions across CNS visits is similar to the distribution among other Hearing Health Program visits.

Find out more *in Online Table 3.5.*

Hearing status

Hearing loss may affect 1 ear (unilateral) or both ears (bilateral). Hearing impairment is based on the ear with the best hearing, meaning that children and young people with unilateral hearing loss are not defined as having a hearing impairment. Only those with bilateral hearing loss are classified according to the degree of hearing impairment.

Figure 3.5 shows the number and proportion of children and young people with hearing loss and hearing impairment, among service recipients, and the relationship between the 2.



Sources: Online tables 2.1, 3.6, 3.7, 3.8.

Figure 3.5: Hearing loss and impairment among children and young people who received outreach audiology services (includes CNS service recipients), 2016

Hearing loss

In addition to the unilateral and bilateral descriptions of hearing loss, there are 3 types of hearing loss: conductive, sensorineural and mixed. Among the children and young people who received audiology outreach services in 2016:

- 25.8% had conductive hearing loss
- 0.7% had sensorineural hearing loss
- 1.1% had mixed hearing loss.

Although CNS service recipients are a subset of the audiology outreach program, they have a prioritised need for care, so it is important to separately track their hearing health as they move through the program.

Box 3.2: Types of hearing loss

Conductive hearing loss: A deviation of hearing threshold from normal range associated with reduced conduction of sound through the outer ear, tympanic membrane (eardrum) or middle ear, including ossicles (middle ear bones).

Sensorineural hearing loss: A deviation of hearing threshold from the normal range, attributable to problems in the inner ear or vestibulocochlear nerve.

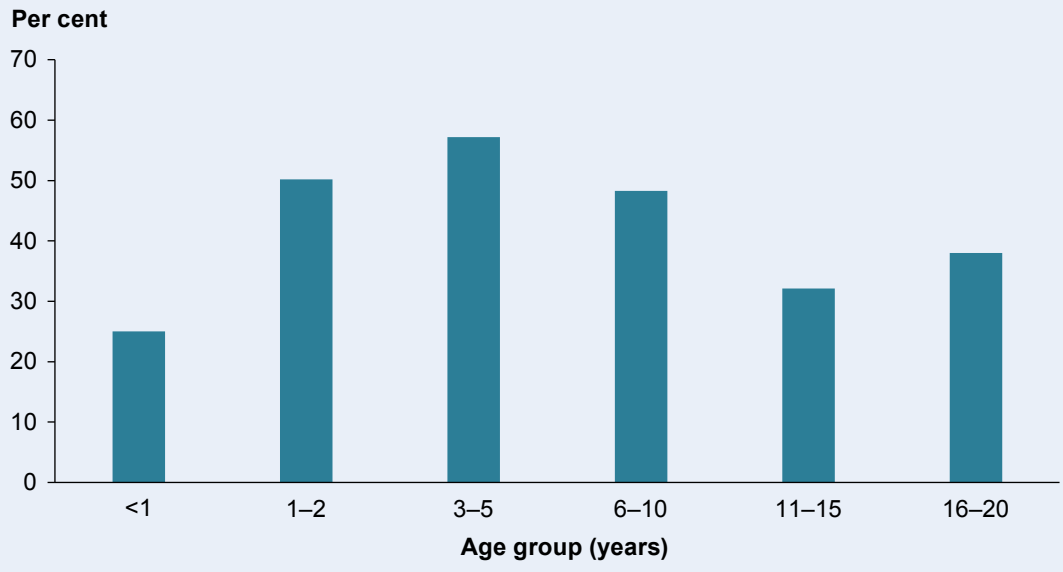
Mixed hearing loss: Hearing loss that has conductive and sensorineural components combined.

Among children and young people who had CNS services in 2016:

- 58% had some form of hearing loss—40% bilateral and 18% unilateral.
- Between July 2012 and December 2016, the proportion of children receiving CNS services who had hearing loss decreased from 77% to 58%.

Find out more *in Online Table 3.9.*

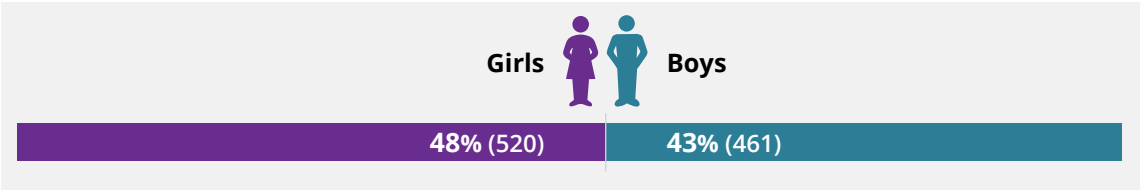
Variation by age and sex



Source: Online Table 3.10.

Figure 3.6: Age range among children and young people with hearing loss, 2016

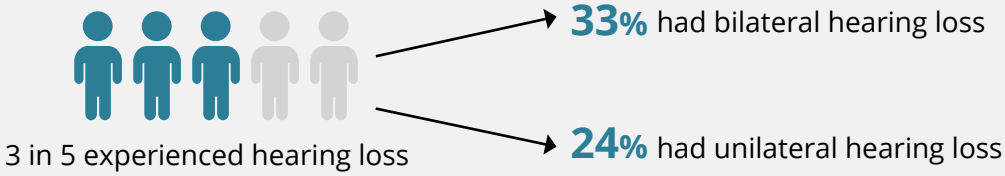
The proportion of hearing loss among girls was slightly higher than the proportion of hearing loss among boys in 2016.



Hearing loss among children and young people with ear conditions

Proportions of hearing loss were much higher among children and young people who had ear conditions than among those with no ear conditions.

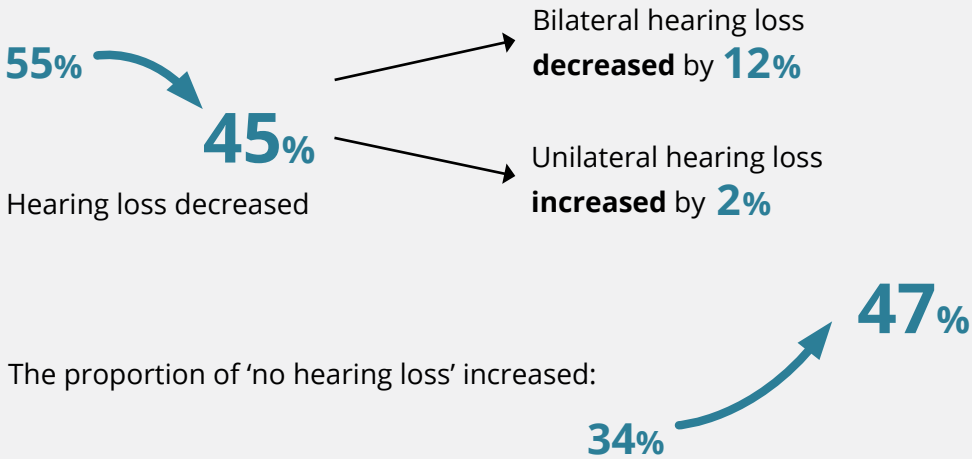
In 2016, among children who were diagnosed with **at least 1** ear condition:



Source: Online Table 3.11.

Trends

When comparing service recipients from July-December 2012 and 2016:



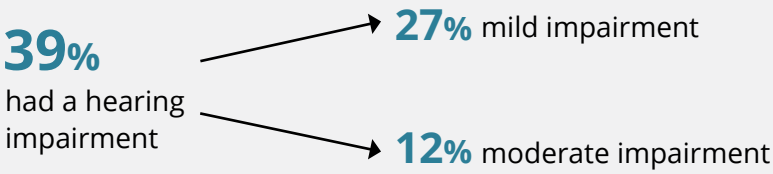
Note: Some of the changes in hearing loss over time would be attributed to changes in the proportion of children who were not tested.

Source: Online Table 3.6.

Hearing impairment

Hearing impairment describes the degree of impairment associated with hearing loss in the 'better hearing ear', using a scale of mild, moderate, severe and profound.

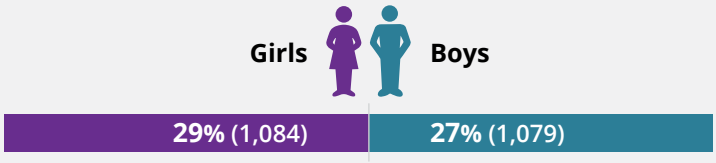
In 2016, among children who were diagnosed with **at least 1** ear condition:



Source: Online Table 3.12.

Variation by age and sex

The proportion of hearing impairment among girls was similar to the proportion of hearing impairment among boys in 2016.



In 2016, the proportion of children and young people with no hearing impairment rose with age, and hearing impairment tended to be more severe in younger age groups versus older age groups.

Ages 1–2: highest proportion of moderate/ severe/profound hearing impairment **(27%)**

Ages 3–5: highest proportion of mild hearing impairment **(31%)**

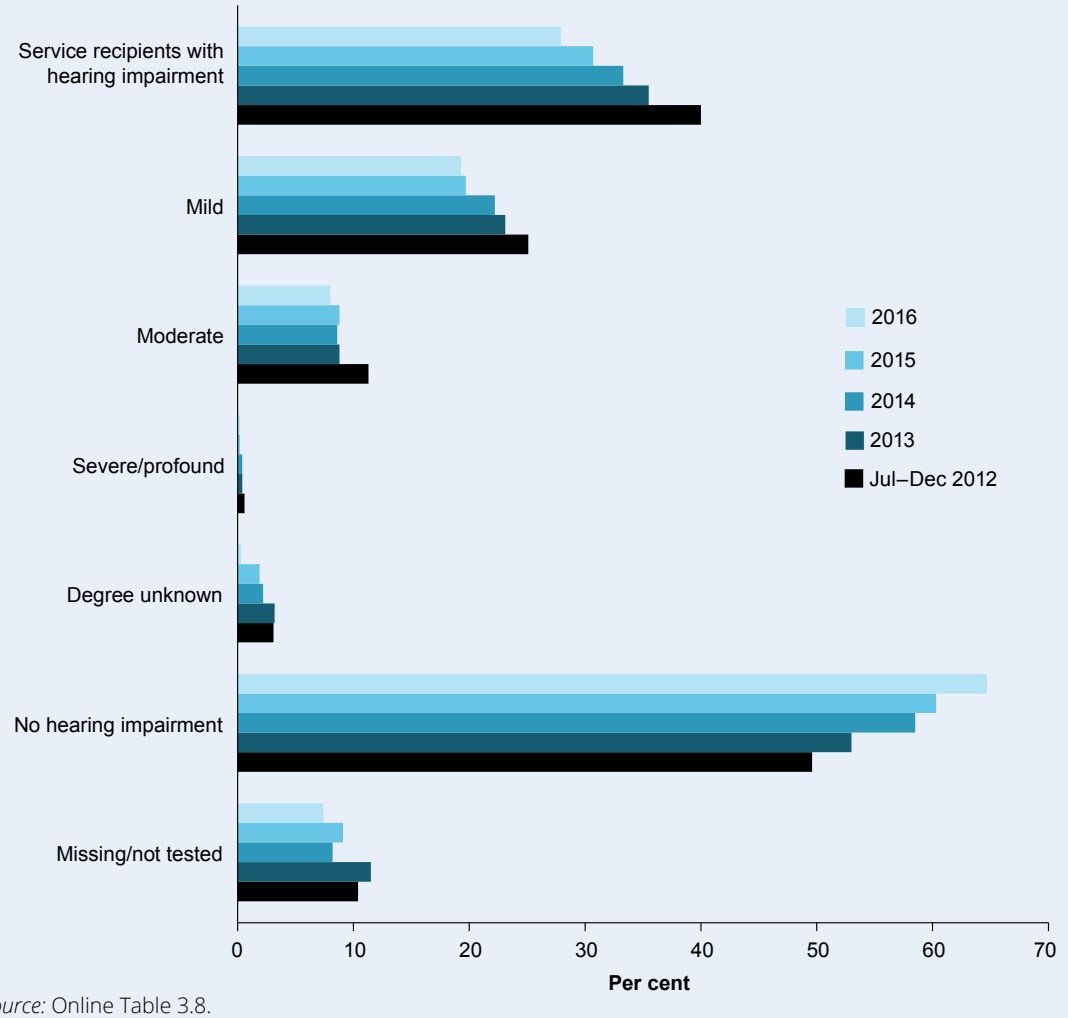
Source: Online Table 3.13

The shifts in the severity of hearing impairment with age can be partly explained by the effects of both medical intervention and natural development (whereby children typically grow out of ear conditions and associated hearing loss with age). At older ages (3–5 onwards), it is likely that medical treatment and interventions for those with ear conditions help reduce the severity of hearing impairment, and therefore reduce the proportion of children and young people with hearing impairment.

Trends

As shown in Figure 3.7, among children and young people who had audiology services between July 2012 and December 2016:

- The proportion with a hearing impairment decreased from 40% to 28%.
- There was an increase in those with no hearing impairment, from 50% to 65%.



Source: Online Table 3.8.

Figure 3.7: Degree of hearing impairment among children and young people, July 2012 to December 2016

Some of the hearing impairment decrease over time could be due to the natural history of ear disease. However, it is more likely that the observed decrease is due to the increasing effectiveness of hearing health services and medical interventions. It is difficult to attribute such a large decrease in hearing impairment over a short period of time solely to the natural progression of the disease. Overall, the effectiveness of these services can only be measured through an evaluation program, which beyond the scope of this report.

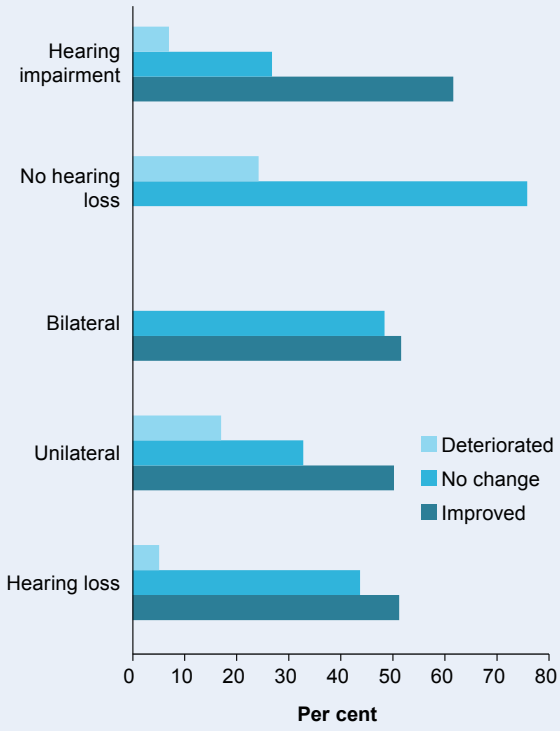
Changes over time in hearing loss and impairment

Changes over the short term (2012–2016)

One way to examine hearing health changes is by matching first and last visits among children as they move through the health system. Individual children who received multiple audiology services were tracked to determine whether their hearing health changed.

As Figure 3.8 demonstrates, overall, as children moved through the Hearing Health Program between July 2012 and December 2016, their hearing health improved:

- 51% of children had their **hearing loss** status improved and only 5% had deteriorated
- among children with **hearing impairment,** 62% had improved and only 7% deteriorated.



Sources: Online tables 3.14, 3.15.

Figure 3.8: Change in hearing loss and impairment among children who received ≥2 audiology services between July 2012 and December 2016

Box 3.3: Change in hearing capability across services

Hearing loss

Improved—is defined as a change in hearing loss status: (1) from bilateral hearing loss to unilateral hearing loss or no hearing loss; and (2) from unilateral hearing loss to no hearing loss.

Deteriorated—is defined as a change in the following scenarios: (1) from no hearing loss to unilateral or bilateral hearing loss; and (2) from unilateral hearing loss to bilateral hearing loss.

Hearing impairment

Improved—is defined as movement to a lower degree of hearing impairment (for example, from profound hearing impairment to severe, moderate or mild hearing impairment).

Deteriorated—is defined as movement to a higher degree of hearing impairment (for example, from mild hearing impairment to moderate, severe or profound).

A number of factors might contribute to the observed improvements in hearing health.

These include:

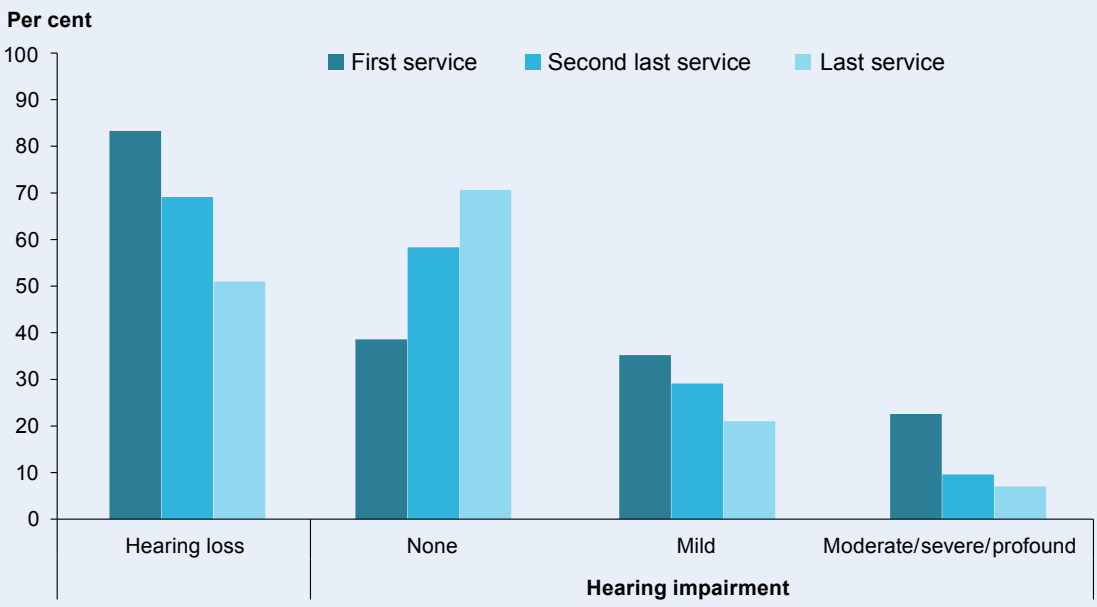
- effectiveness of medical interventions
- effect of health promotion activities in
  - increasing awareness and knowledge of hearing health among families
  - improving the acceptance of and attendance at audiology services provided by outreach teams
- natural improvement in the condition as children and young people get older
- the confounding factor of missing and not tested records, and missing information from children and young people for whom consent was not obtained.

Changes over the long term (2007–2016)

Hearing health outcomes at a child or young person's first, second last and last audiology service visits were obtained among children who had at least 3 service visits between August 2007 and December 2016. To allow for sufficient time for changes between service visits, only services with at least 3 months in between were included in the analysis.

Among children and young people who had at least 3 audiology visits, as seen in Figure 3.9:

- the proportion of **hearing loss** (in 1 or both ears) at the last audiology visit (51%) was much lower than the proportion at the first visit (83%)
- the proportions of **hearing impairment** (among mild and moderate/severe/profound categories) decreased over subsequent audiology services.



Sources: Online tables 3.16, 3.17.

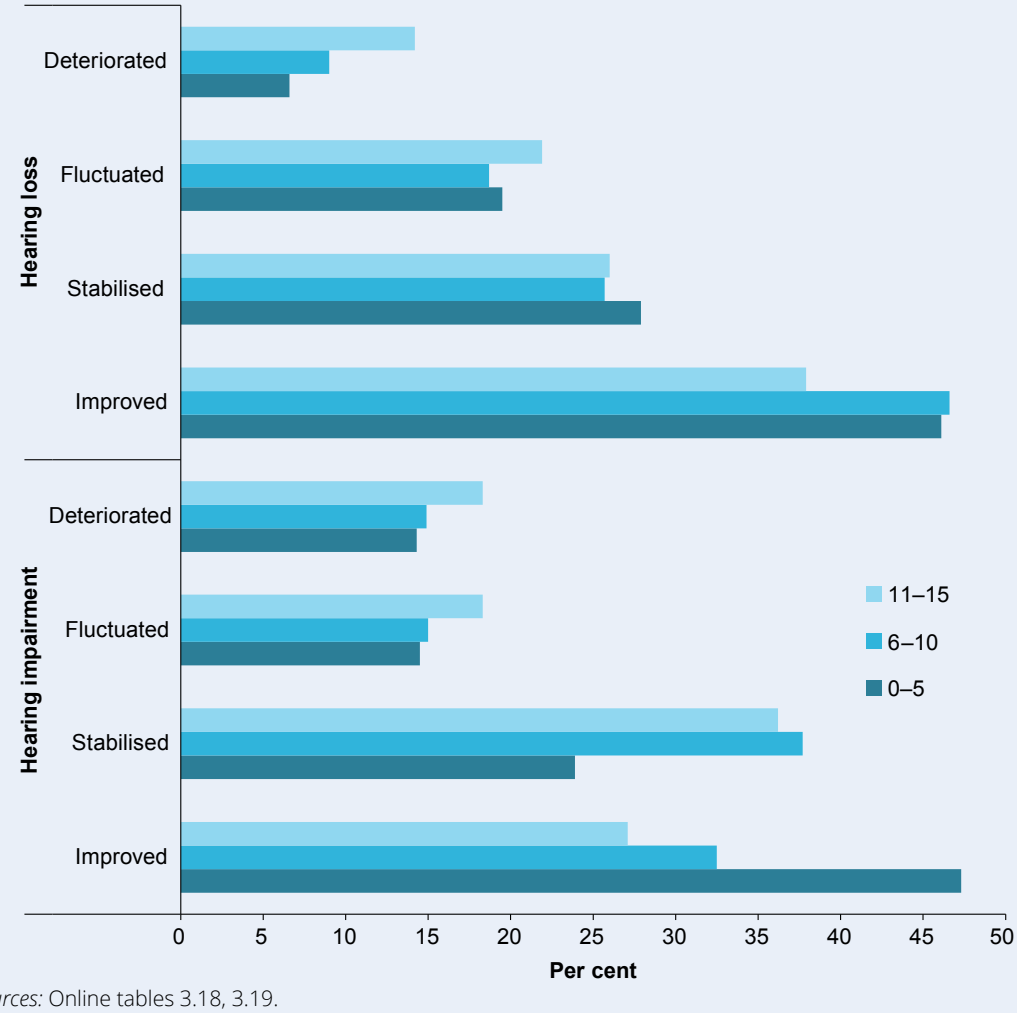
Figure 3.9: Proportion of hearing health at various audiology service visits between August 2007 and December 2016 (among children with ≥3 visits)

Effect of age over time

Children and young people were tracked over time, with their first, second last and last audiology service visits matched, and included in the analysis if they received at least 3 services between August 2007 and December 2016, with a minimum of 3 months between each service.

When comparing a child or young person's first and last visit, for all ages:

- There were somewhat similar patterns in changes in hearing health status for both hearing impairment and hearing loss. There were lower proportions of deterioration, and the majority of the children and young people had hearing loss or impairment that stabilised or improved (see Figure 3.10).
- Those who entered the services at younger ages had slightly better outcomes. Those who received audiology services at a younger age (0–5 years) were more likely to have improvements in hearing impairment and hearing loss status over time.



Sources: Online tables 3.18, 3.19.

Figure 3.10: Changes in hearing health among children and young people with ≥3 audiology services between August 2007 and December 2016, by age

The biggest improvements to hearing health were observed for the youngest children who entered the audiology program (0–5 years). This is consistent with the findings of other studies that demonstrate the effectiveness of early intervention in improving outcomes for children (Moeller 2000). Hearing health improvements at a young age are important because they are associated with large functional gains in learning and language acquisition throughout childhood.

It is not entirely clear why children in younger age groups experienced greater improvement in hearing loss than those in older age groups. These improvements might be attributed to a few factors:

- Younger children may grow out of the conditions naturally as they age.
- Early treatment is effective at younger ages.
- The most common ear conditions in younger age groups are acute, so early interventions may prevent them from developing into chronic conditions or more severe or permanent hearing damage.

Similarly, reasons for differences in reduction of hearing impairment between the first and last services across age groups are not clear. However, a couple of rationales could be implicated:

- Younger children are more likely to have AOM, and less likely to have permanent hearing damage due to the higher effectiveness of treatment.
- Older children are more likely to have chronic otitis media, which is associated with damage to middle ear structures, and is related to an increased risk of residual permanent hearing loss.

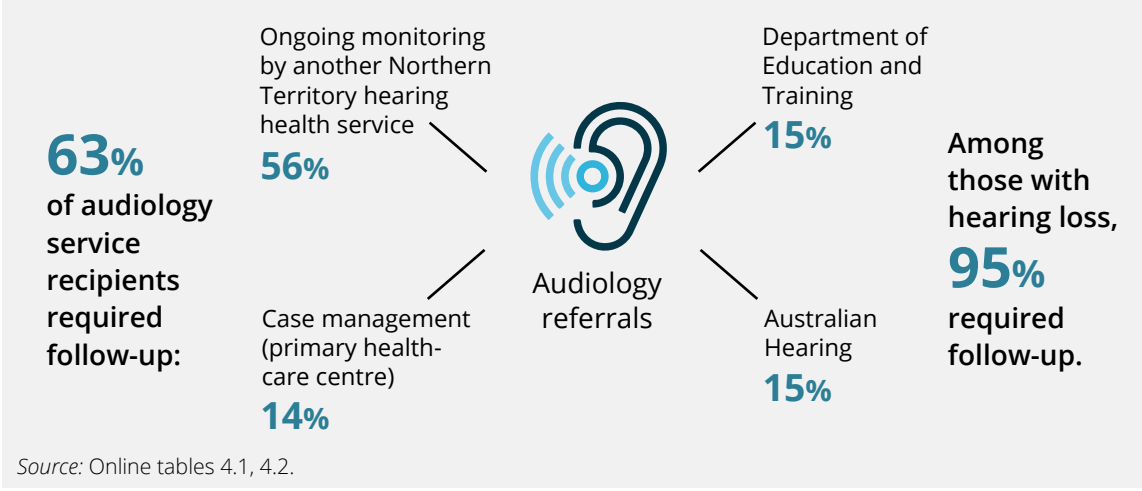
4 Demand for ear and hearing health services and other follow-up services

The Australian Government–funded activities in the Northern Territory public hearing health system are very valuable for children and young people in the Northern Territory. Since 2012, the number of children and young people accessing services has increased, with consent rates increasing as well. Improvements in hearing health status across the years have also been consistently demonstrated. However, there is still a high demand for audiology and ENT services given the high number of outstanding referrals (as seen in figures 4.1 and 4.2).

In addition to these hearing health services, children can be referred to other follow-up services. Follow-up can encompass a wide range of services, from having a hearing aid fitted by Australian Hearing, to medical treatment, such as the provision of ear cleaning or the need for ENT surgery.

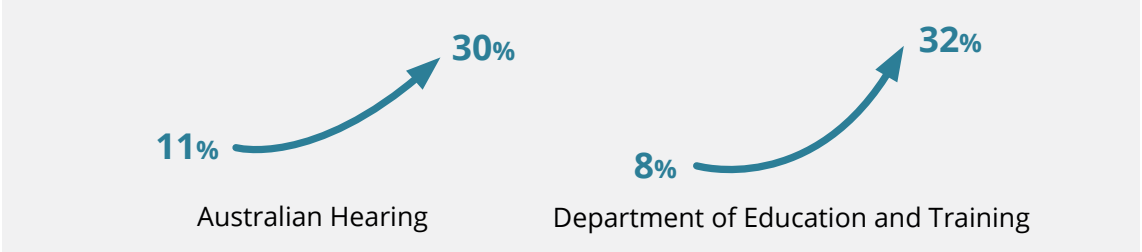
Follow-up services required after audiologist visits

In 2016, 63% of children and young people required at least 1 further action (percentages in the infographic below sum to over 63% because some children required more than 1 referral).



Source: Online tables 4.1, 4.2.

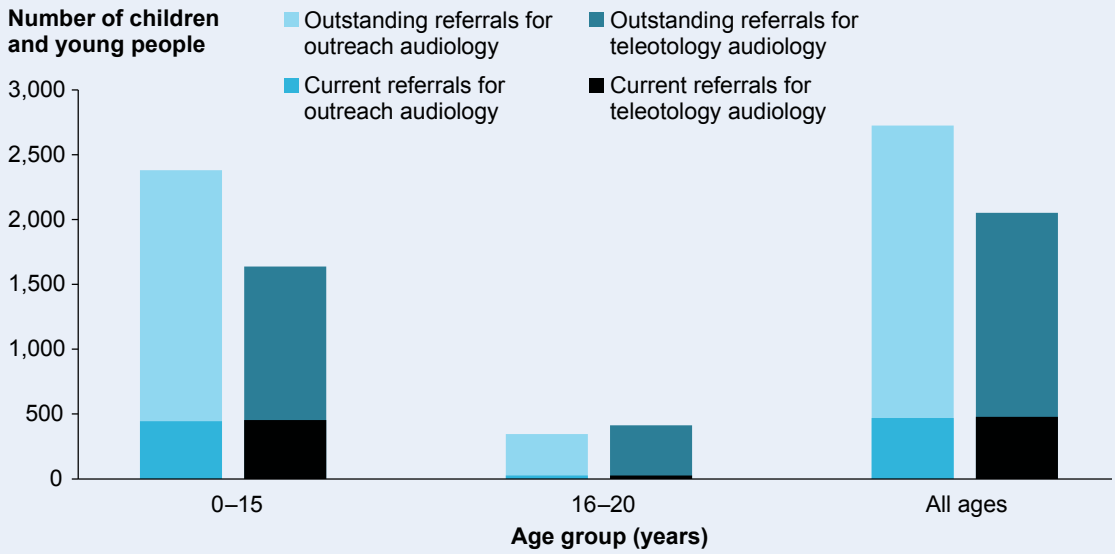
Referrals from audiology services to various other services have increased over time for children and young people with hearing loss (from July 2012 to December 2016).



Source: Online Table 4.2.

Additionally, as shown in Figure 4.1, there were still many children and young people who had current and outstanding referrals to audiology services as at December 2016.

Current referrals are those that *were not* overdue, whereas outstanding referrals are those that *were* overdue as at 31 December 2016.



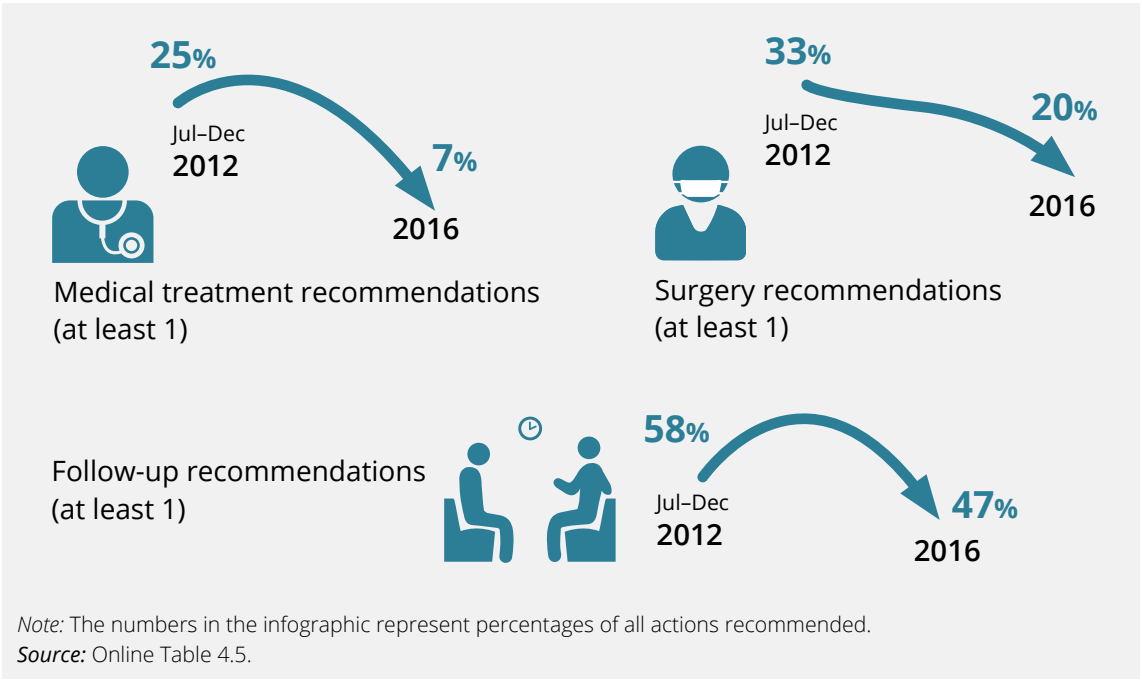
Sources: Online tables 4.3, 4.4.

Figure 4.1: Number of current and outstanding referrals to audiology services as at December 2016

Follow-up services required after ENT teleotology services

In 2016, 63% of children and young people were given a recommendation for at least 1 further action following an ENT teleotology service. There are 3 types of actions that are recommended by ENT specialists:

- Medical treatment—treatment can be recommended to be implemented by the child or young person's primary health-care provider. The most common type of treatment recommendations were medication.
- Surgery—the most common types of surgery recommended were myringoplasty and grommets (see Glossary).
- Further follow-up—this is the main type of ENT action that was recommended through the ENT teleotology service. This was primarily for an ENT review or an audiological assessment.



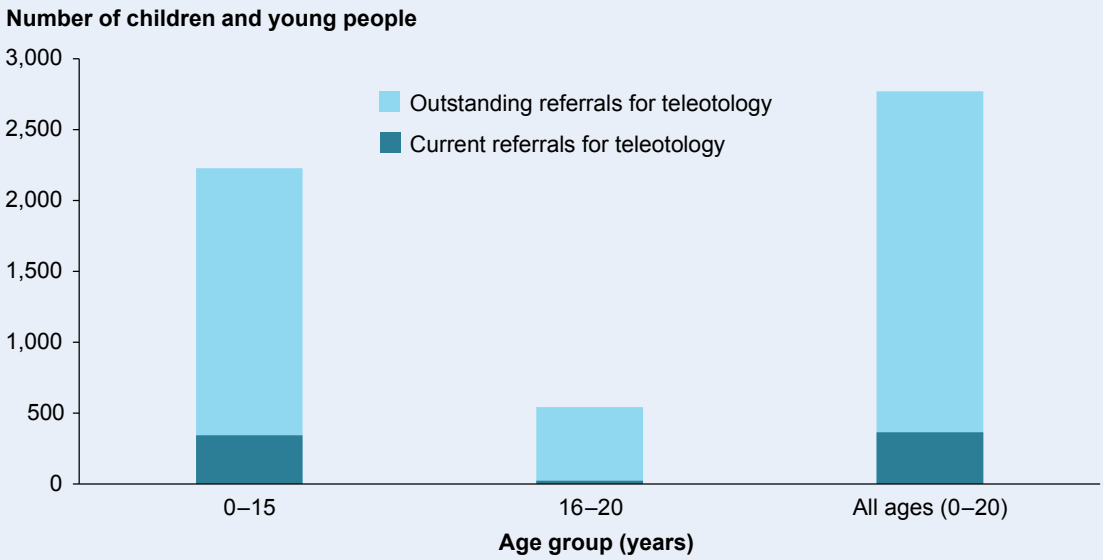
Note: The numbers in the infographic represent percentages of all actions recommended.
Source: Online Table 4.5.

Additionally, between July 2012 and 2016, the proportion of children and young people recommended for an audiological assessment decreased by 30 percentage points (from 51% to 21%).

There are a number of reasons why some of the ENT recommendations have decreased over time; for example:

- changes in treatment guidelines or clinical practice
- changes in the structure of service programs and their funding
- changes in the prevalence of ear conditions across the service years.

Despite the decreases in ENT recommendations, the number of children and young people with current and outstanding ENT referrals as of December 2016 remains high, as demonstrated in Figure 4.2.



Source: Online Table 4.6.

Figure 4.2: Number of current and outstanding referrals to ENT teleotology services as at December 2016

5 Outcomes of young people after exiting the program

The Australian Government–funded Hearing Health Program is for children and young people under 21, and so any participants aged 21 and older would have exited the program. These young people can continue to access services through the Northern Territory public hearing health system; however, these clinical data are not reported through the Hearing Health Program. By analysing this specific set of young people, certain questions can be addressed:

- How long did they participate in the programs?
- Did their ear and hearing health improve?
- Were further actions for continued care and monitoring recommended at their last service?

Time spent in the Hearing Health Program

There were 191 young people who received outreach audiology service and/or ENT teleotology services who had exited the Australian Government–funded Hearing Health Program as at December 2016. Among these young people:

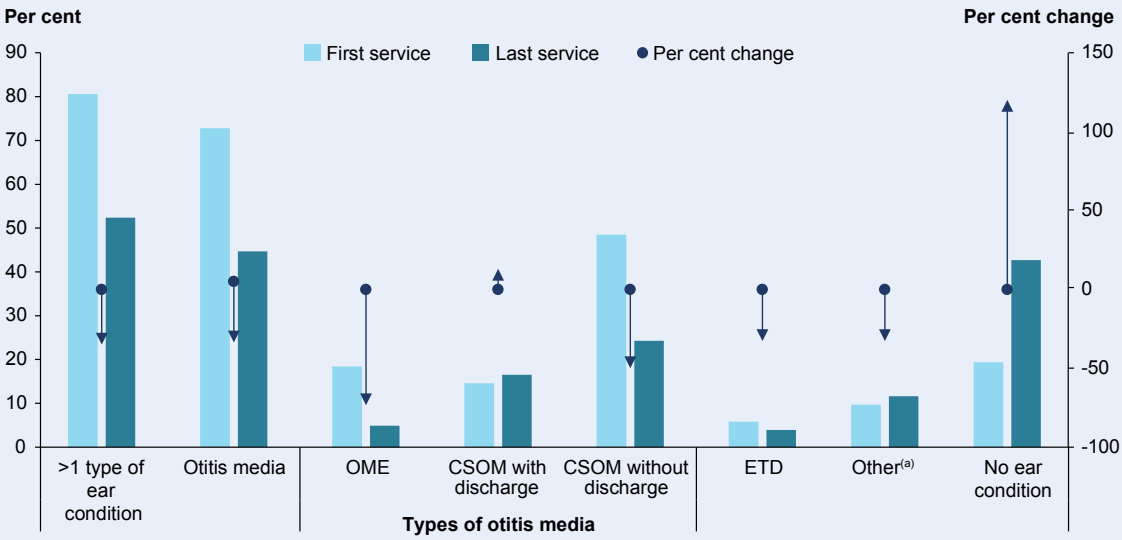
- 103 (54%) received 2 or more services
- the median length of time spent in the Hearing Health Program (length of time between first and last services) was 58 months (4.8 years).

Find out more *in Online Table 5.1.*

Changes over time in hearing health

Among the 103 young people who had exited the Hearing Health Program and received at least 2 audiology or ENT services between August 2007 and December 2016:

- 83 young people (81%) had at least 1 condition at their first service
- at the last service visit, this decreased to 54 young people with at least 1 condition (52%).



(a) 'Other' includes grommets, reduced eardrum movement or retracted eardrum, and other ear conditions.

Source: Online Table 5.2.

Figure 5.1: Change in proportion of ear conditions between first and last ENT or audiology visits between August 2007 and December 2016, among young people who exited the Hearing Health Program

As young people with a hearing impairment who received at least 2 audiology or ENT services moved through the Hearing Health Program:

Among young people who had **at least 2** audiology services:

Source: Online Table 5.3.

When interpreting the above figures, it is important to keep some data limitations in mind:

- Some young people may not have had hearing impairment at their first check, and as such, the figures might under- or overestimate change over time.
- Some changes in hearing improvement might be too small to cross a hearing impairment category threshold, and as such these changes would not be reflected above.

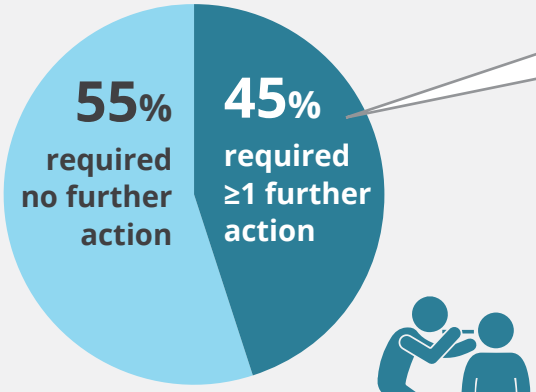
Further actions and recommendations

At least 1 type of follow-up was required for:

- 45% of those who had exited the outreach audiology program
- 63% of those who had exited the ENT teleotology program.

The following infographic outlines the specific types of follow-up that were recommended for young people who had exited the programs.

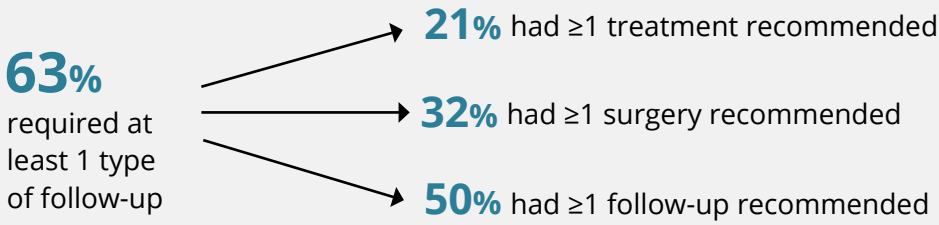
Among young people who left the outreach audiology program:



Further actions include:

- Ongoing monitoring by **NT Hearing Services (34%)**
- Case management by **ENT (20%)**
- Case management by **Primary Health Centre (8%)**
- Referral to **Australian Hearing (5%)**

Among young people who left the ENT teleotology program:



Source: Online tables 5.4 and 5.5.

For these young people who were too old to be included in the Hearing Health Program, it is unknown whether they have received appropriate follow-up care. However, it is possible that they have gone on to receive mainstream medical care to continue their hearing health follow-up.

6 Regional analysis

The Northern Territory has two main health service delivery regions: the Top End Health Service (TEHS) and Central Australia Health Service (CAHS). This section presents the hearing health status of the children and young people in these two regions.

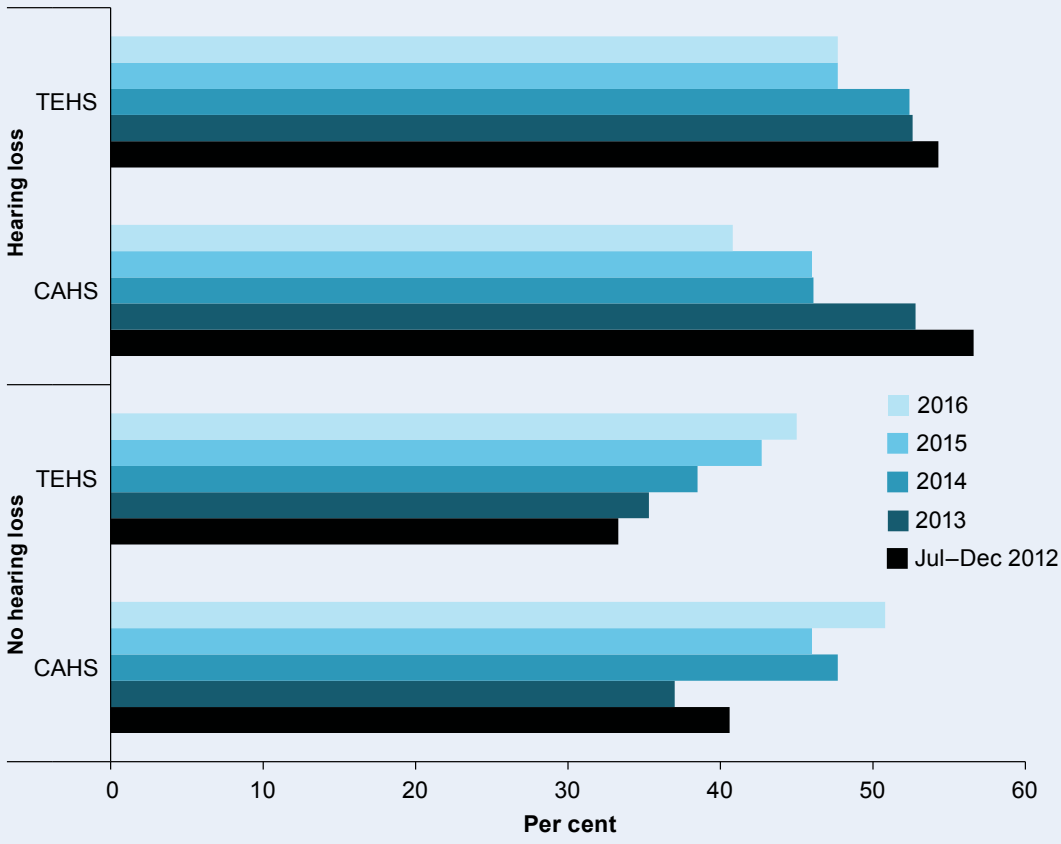
Hearing loss

Patterns over the years, from July 2012 to December 2016, were similar between TEHS and CAHS:

- The proportions of hearing loss (in 1 or both ears) decreased over time.
- The proportions of no hearing loss increased over time.

While overall trends were the same, there were slight differences between the percentages of hearing loss (unilateral and bilateral) between the regions in 2016 (Figure 6.1):

- TEHS had a higher proportion of hearing loss (48%) compared with CAHS (41%).
- The proportion of children and young people with no hearing loss was higher in CAHS (51%) compared with TEHS (45%).

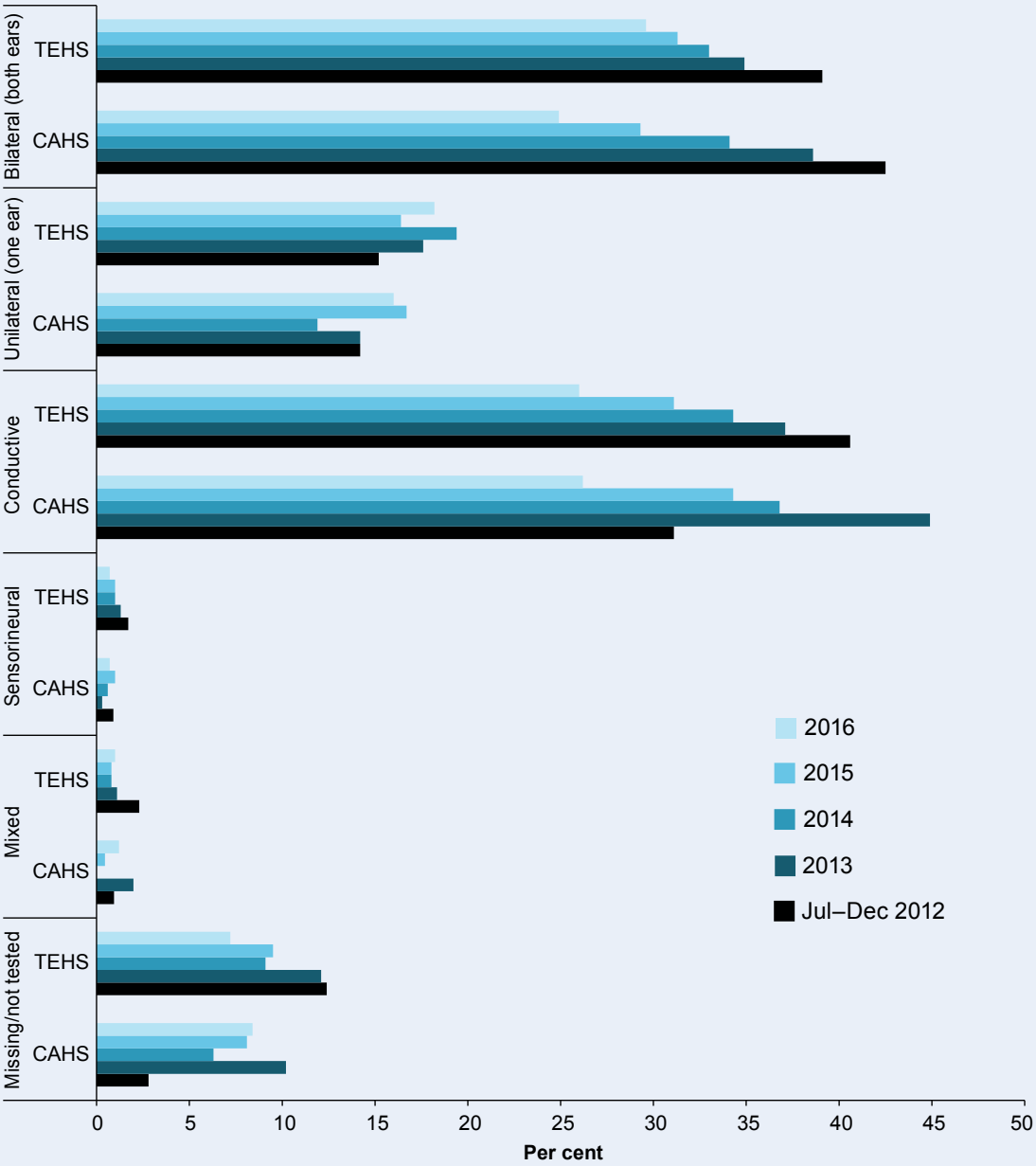


Source: Online Table 6.1.

Figure 6.1: Hearing loss among children and young people in the Top End (TEHS) and Central Australia (CAHS)

When looking at specific types of hearing loss in 2016 (Figure 6.2), the proportions between TEHS and CAHS were all quite similar.

However, in 2016, there was a slightly higher proportion of bilateral hearing loss for TEHS (30%) compared with CAHS (25%).



Sources: Online tables 6.1, 6.2.

Figure 6.2: Specific types of hearing loss among children and young people in the Top End (TEHS) and Central Australia (CAHS)

Hearing impairment

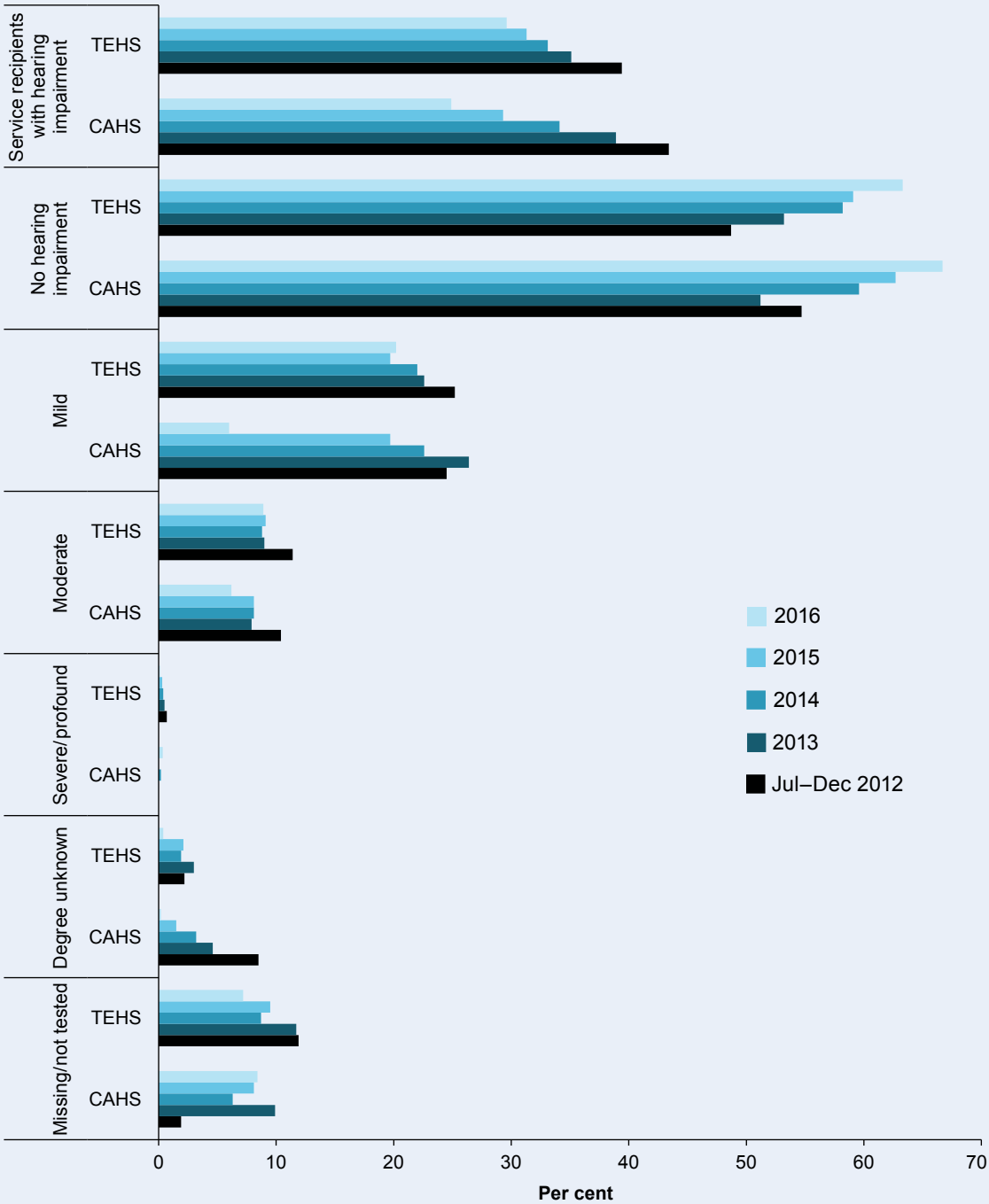
From July 2012 to December 2016, hearing impairment patterns across the years were similar for TEHS and CAHS (Figure 6.3).

Overall for both regions:

- the proportion of children and young people with hearing impairment decreased over time
  - 10 percentage point decrease for TEHS
  - 19 percentage point decrease for CAHS
- the proportion of children and young people with no hearing impairment increased over the years
  - 15 percentage point increase for TEHS
  - 12 percentage point increase for CAHS.

In 2016, TEHS had a slightly higher proportion of hearing impairment among children and young people (30% compared with 25% in CAHS). For specific hearing impairment categories (mild, moderate, severe/profound), the proportions across the 2 regions were quite similar.

See Figure 6.3 below for more detailed comparisons of the regions.

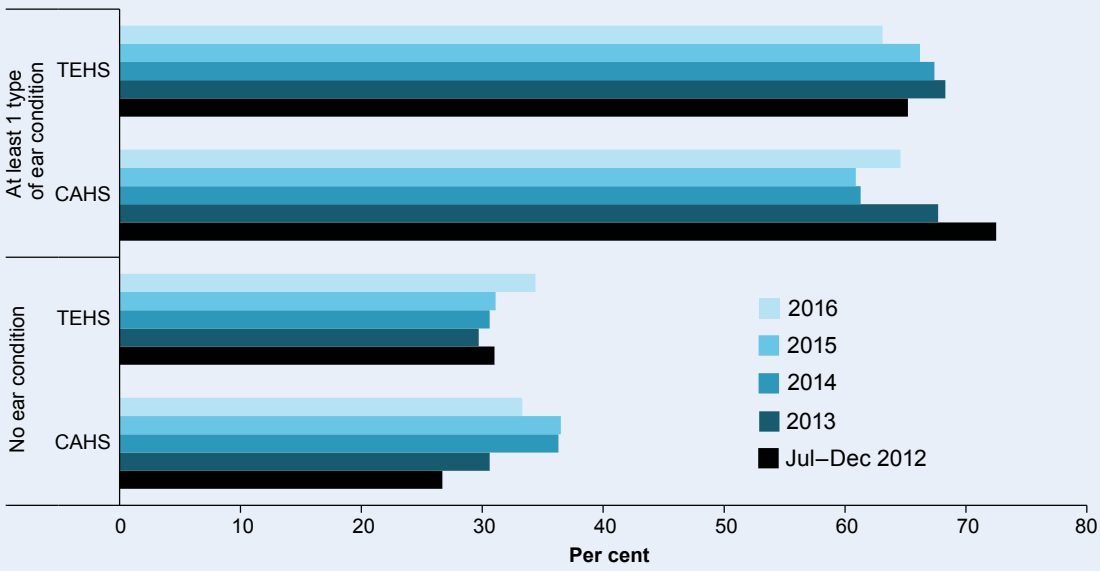


Source: Online Table 6.3.

Figure 6.3: Hearing impairment among children and young people in the Top End (TEHS) and Central Australia (CAHS)

Ear conditions

Between July 2012 and December 2016, the proportion of children and young people with ear conditions decreased overall in both regions—from 65% to 63% in TEHS and from 73% to 65% in CAHS (Figure 6.4).

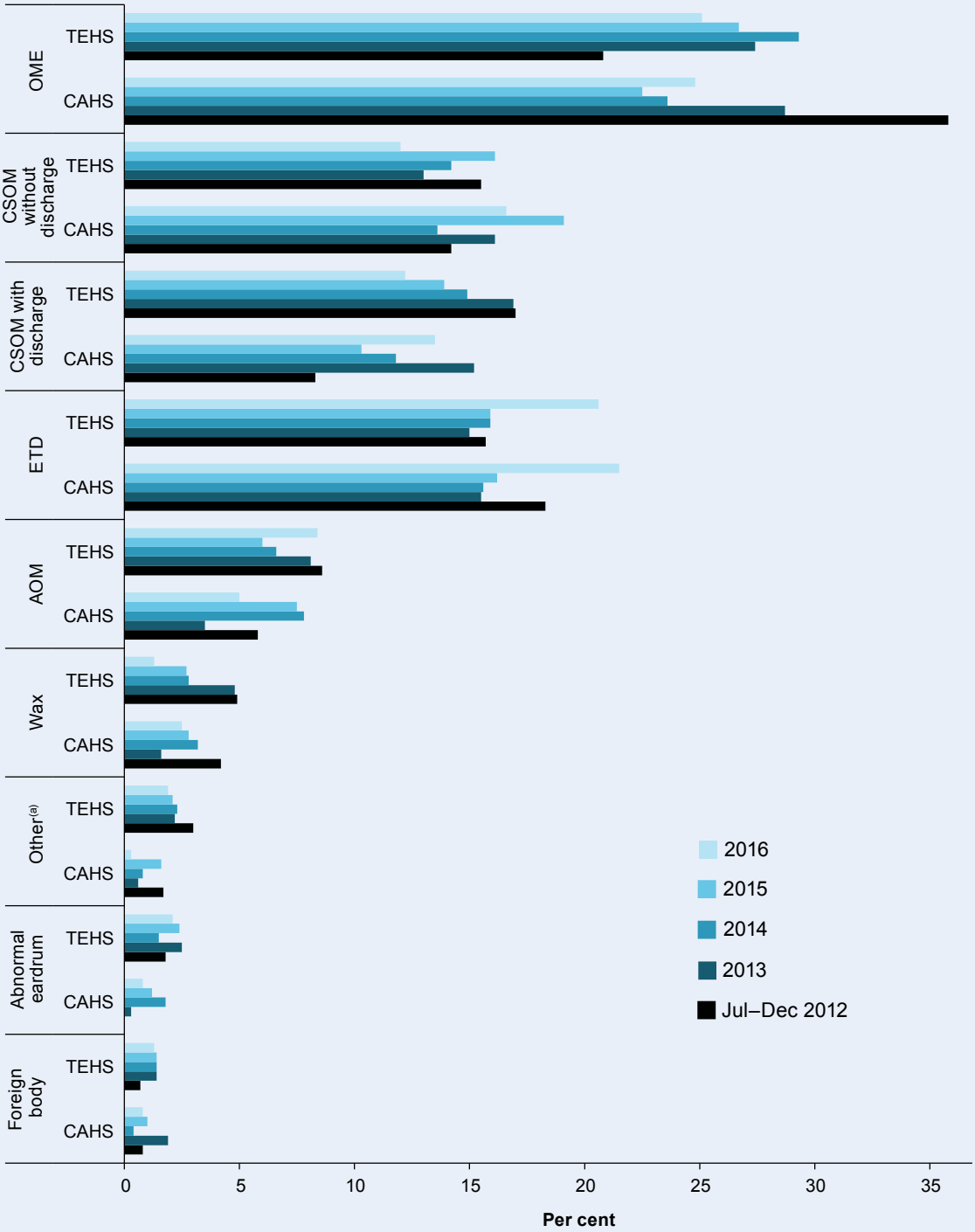


Source: Online Table 6.4.

Figure 6.4: Presence of ear conditions among children and young people in the Top End (TEHS) and Central Australia (CAHS)

In contrast to patterns of hearing impairment and hearing loss across the 2 regions, there was more variation in the distribution of ear conditions (Figure 6.5). Notably, from July 2012 to December 2016:

- The proportion of OME increased in TEHS from 21% to 25%, and decreased in from 36% to 25% in CAHS.
- The proportion of CSOM with discharge decreased in TEHS from 17% to 12%, and increased in CAHS from 8% to 14%.
- The proportion of ETD increased in both regions: from 18% to 22% in CAHS, and from 16% to 21% in TEHS.



(a) 'Other' includes grommets, myringitis, otitis external, tympanosclerosis, or other ear condition.

Source: Online Table 6.4.

Figure 6.5: Distribution of specific ear conditions among children and young people in Top End (TEHS) and Central Australia (CAHS)

7 Progress made against benchmarks

The Hearing Health Program has performance indicators and benchmarks in place to monitor the outcomes achieved through the program. The targets are set jointly by the Australian and Northern Territory Departments of Health through the Northern Territory Health Implementation Plan (Council on Federal Financial Relations 2016).

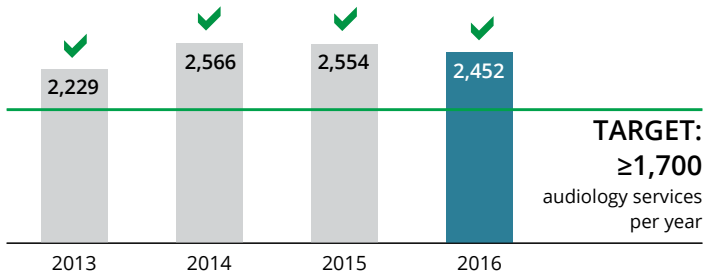
Some targets are set to be met on an annual basis, and others are set for a longer time period. For those set annually, they can be assessed as to whether or not they have been met. For long-term targets, they can only be assessed as to whether or not they are on track to be met at this point in time.

Service delivery

Note that the Northern Territory Health Implementation Plan does not include service delivery targets for ENT services.

Indicator:
Audiology services provided

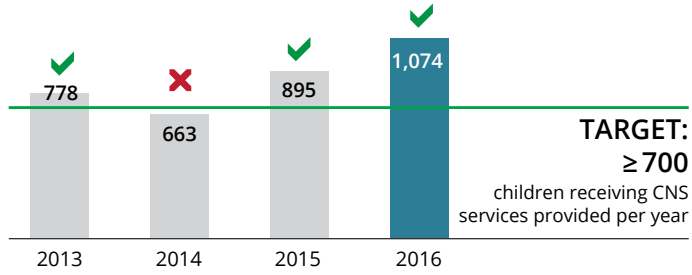
The number of **audiology services** per year



Number of audiology services provided, 2013–2016

Indicator:
CNS services provided

The number of children receiving complex case management services from **CNSs** working with primary health-care services



Number of children receiving CNS services, 2013–2016

Indicator:
Health promotion

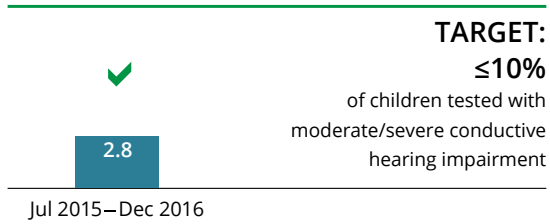
Delivery of hearing health promotion or training services and activities

Number of activities/sessions provided in 2016

Health outcomes—hearing impairment

Indicator:
Hearing impairment

Percentage of children tested who had moderate/severe conductive **hearing impairment**

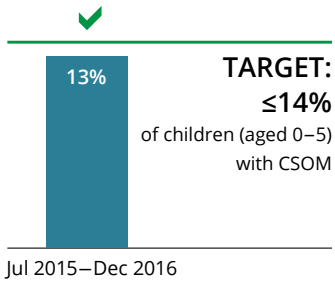


Number of children had moderate or severe conductive hearing impairment from July 2015 to December 2016

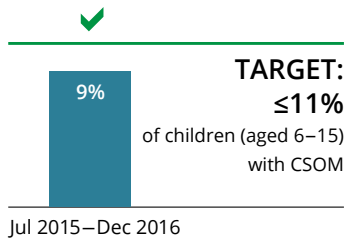
Health outcomes—middle ear conditions

Indicator:
Children with CSOM

Proportion of children who received an audiology check or CNS service who were found to have **CSOM**



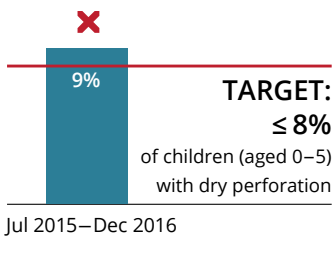
Number of children (aged 0–5) with CSOM, July 2015 to December 2016



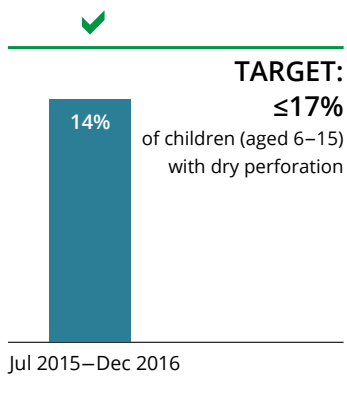
Number of children (aged 6–15) with CSOM, July 2015 to December 2016

Indicator:
Children with dry perforation

Proportion of children who received an audiology check or CNS service who were found to have **dry perforation**



Number of children (aged 0–5) with dry perforation, July 2015 to December 2016



Number of children (aged 6–15) with dry perforation, July 2015 to December 2016

Appendix A: Online tables

The figures presented throughout this report mention accompanying online tables that contain data corresponding to the figures. The online tables also contain updated data from all tables from the previous report—*Northern Territory Remote Aboriginal Investment: Ear and Hearing Health Program July 2012 to June 2016* (AIHW 2017a), including the following tables that were **not** referenced to in this report.

Previous report table number	Table name	Corresponding online table number
Table F3.5	Age group by degree of hearing impairment, children and young people who received outreach audiology services, July 2012 to 2016	Table 3.13
Table 5.2	Average and maximum number of CNS services received, and proportion of children who received 1 service, July 2012 to 2016	Table 2.9
Table F5.2	Type of clinical services provided at CNS visits, July 2012 to 2016	Table 2.10
Table F5.3	Contact made with other service providers at CNS visits, and presence of interpreter at service, July 2012 to 2016	Table 2.11
Table F5.6	Degree of hearing impairment, Indigenous children in the CNS and audiology programs, 2012–13 to 2015–16	Table 3.25
Table F6.5	Hearing loss status among children and young people, with any ear condition, who received an audiology, ENT or CNS service, July 2012 to 2016 (%)	Table 3.23
Table F6.6	Ear condition by degree of hearing impairment, 2016 (%)	Table 3.22
Table F6.10	Progress of children and young people with middle ear conditions between the initial and last service, August 2007 to 2016	Table 3.26
Table 7.2	Change in degree of hearing impairment between first and last audiology services among young people aged 21 and over and who had left hearing health programs at 31 December 2016	Table 5.3

Appendix B: About the Hearing Health Program data collections

Data collection, management and reporting

The Australian Institute of Health and Welfare (AIHW) was commissioned by the Australian Government Department of Health to collect, manage and report on data from ear and hearing health outreach services in the Northern Territory.

These data are collected using paper data collection forms. Health professionals responsible for providing services complete a form with information about the child or young person's demographic characteristics, types of services provided, community where the service was provided, date of service, examination results and medical interventions and recommendations.

How much data the AIHW receives on each child or young person depends on whether the child or young person's parent or guardian provides consent to share the information. There are 2 scenarios for the provision of data under the consent requirements:

- If consent is given, all de-identified data are sent to the AIHW.
- If consent is not given, a limited amount of aggregate information is provided to the AIHW. This includes the number of services provided and the number of children and young people receiving a service by 5-year age group, sex and community where the service was provided.

Throughout this report, the term 'services' refers to occasions of service. A child or young person may receive a number of services and have more than 1 record in each data collection. Each record in the collection corresponds to a single service, not to a single person.

More information on each of the Hearing Health Program data collections can be found in the 'Reference material' online at <https://www.aihw.gov.au/reports/indigenous-australians/nt-ear-hearing-program-2012-to-2016/related-material>.

Appendix C: Data Quality Statement

For all Hearing Health Program data collections, the population included is not a random sample, and is not representative of all Indigenous children and young people in the Northern Territory. The outreach audiology and ear, nose and throat (ENT) teleotology services are available to all Indigenous children and young people, but not all of them access these services. The Clinical Nurse Specialist (CNS) program is available only to Indigenous children who have a referral from a health professional.

As well, some of these services are more commonly accessed by individuals in remote areas. Therefore, results of analyses cannot be generalised to all Indigenous children and young people in the Northern Territory.

Due to differences in the scope of the programs covered in previous Australian Institute of Health and Welfare (AIHW) hearing health reports, analyses from individual reports should not be compared with analyses in subsequent reports.

Outreach audiology data collection summary

- This data collection included over 5,800 children and young people, who were aged under 21 who received Northern Territory outreach audiology services. This accounted for about 18% of the Northern Territory's Indigenous population of this age group (not a random sample).
- Hearing loss status was missing for about 7% of service participants who could complete audiology assessments, and this should be considered when using and interpreting hearing health data.

ENT teleotology data collection summary

- This data collection included over 2,700 children and young people who were aged under 21 and received ENT teleotology services. This accounted for about 8% of the Northern Territory's Indigenous population of this age group (not a random sample).
- The methods of assessment used in ENT teleotology services differ from those used for face-to-face consultations. Therefore, the results of tests and subsequent diagnoses from teleotology services may be affected by the method of service delivery.

Clinical Nurse Specialist data collection summary

- The data collection included over 3,000 children who were aged under 21 and received CNS services. This accounted for about 9% of the Northern Territory's Indigenous population of this age group (not a random sample).
- Rates of non-consent were high over the course of the CNS program prior to 2016 (20% of services and 21% of children in 2015). However, there have been improvements to non-consent rates over time, and non-consent rates were 6% for services and 7% for children in 2016. This should be considered when interpreting CNS program analyses.

Full Data Quality Statements for each data collection in the Hearing Health Program can be found online at <https://www.aihw.gov.au/reports/indigenous-health-welfare-services/nt-ear-hearing-program-2012-to-2016/notes>.

Glossary

audiometry/ pure tone audiometry: The standard technique of testing hearing ability. Pure tone audiometry records a subjective response to threshold (softest) sound stimuli presented through headphone, bone conductor or speaker at discrete frequencies essential to detect and discriminate speech. Any response deviation from the normal range, at any sound stimuli, in either ear, is described as a hearing loss and the type of hearing loss is diagnosed.

acute otitis media (AOM): The general term for both AOM without perforation and AOM with perforation. It is the presence of fluid behind the eardrum plus at least 1 of the following: bulging eardrum, red eardrum, recent discharge of pus, fever, ear pain or irritability. A bulging eardrum, recent discharge of pus and ear pain are the most reliable indicators of AOM.

bilateral hearing loss: Hearing loss in both ears.

chronic suppurative otitis media (CSOM) with discharge: A persistent suppurative (see **suppurative**) discharge from the middle ear through a tympanic membrane (eardrum) perforation for more than 6 weeks. Importantly, the diagnosis of CSOM with discharge is appropriate only if the tympanic membrane perforation is seen and if it is large enough to allow the discharge to flow out of the middle ear space.

chronic suppurative otitis media (CSOM) without discharge: The presence of a perforation (hole) in the eardrum without evidence of discharge or fluid behind the eardrum. It is also known as 'inactive CSOM' and 'dry perforation'.

conductive hearing loss: Describes a deviation of hearing threshold from normal range associated with reduced conduction of sound through the outer ear, tympanic membrane (eardrum) or middle ear, including ossicles (middle ear bones).

Eustachian tube dysfunction: Negative middle ear pressure associated with compromised equalisation impeding middle ear function and sometimes causing middle ear fluid accumulation.

grommet: A small tube surgically placed across the eardrum to re-establish ventilation to the middle ear. It is also called 'ventilation tube', 'pressure equalisation tube' or 'tympanostomy tube'.

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

hearing impairment: Describes the degree of impairment associated with hearing loss in the 'better hearing ear', using a scale of mild, moderate, severe and profound. It is based on the degree of deviation from normal thresholds in the 'better ear', calculated as a 3-frequency average of the threshold of hearing (in decibels Hearing Level; dB HL)—500 hertz (Hz), 1,000 Hz and 2,000 Hz.

hearing loss: Any hearing threshold response (using audiometry) (see **audiometry**) outside the normal range, at 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).

mild hearing impairment: On average, the quietest sounds that people can hear with their better ear are between 16 and 30 dB HL in soundproof conditions and 26–35 dB HL in nonsoundproof conditions. These people are able to hear and repeat words spoken in a normal voice at 1 metre. Counselling and hearing aids may be needed.

mixed hearing loss: Hearing loss that has conductive (see **conductive hearing loss**) and sensorineural (see **sensorineural hearing loss**) components combined.

moderate hearing impairment: On average, the quietest sounds that people can hear with their better ear are between 31 and 60 dB HL in soundproof conditions and 36–60 dB HL in nonsoundproof conditions. These people are able to hear and repeat words spoken in a raised voice at 1 metre and have difficulty keeping up with conversations without using a hearing aid.

myringoplasty: The repair of a perforation of the tympanic membrane (eardrum).

otitis media: All forms of inflammation and infection of the middle ear. Active inflammation or infection is nearly always associated with a middle ear effusion (fluid in the middle ear space).

otitis media with effusion (OME): The presence of an intact eardrum and middle ear fluid without symptoms or signs of acute infection. Other terms used to describe OME include 'glue ear', 'serious otitis media' and 'secretory otitis media'. OME may be episodic or persistent.

otoscopy: visual examination of the auditory canal and the eardrum with an otoscope.

profound hearing impairment: On average, the quietest sounds that people can hear with their better ear are 91+ dB HL either in soundproof conditions or nonsoundproof conditions. These people are unable to hear and understand even a shouted voice. Hearing aids may help in understanding words. Additional rehabilitation is needed, and cochlear implants, lip-reading and sometimes signing are essential.

sensorineural hearing loss: A deviation of hearing threshold from the normal range, attributable to problems in the inner ear or vestibulocochlear nerve.

severe hearing impairment: On average, the quietest sounds that people can hear with their better ear are between 61 and 90 dB HL either in soundproof conditions or non-soundproof conditions. These people are able to hear some words when shouted into the better ear. Hearing aids are needed. If no hearing aids are available, lip-reading and signing may be necessary.

suppurative: Describes pus produced in response to inflammatory bacterial infections.

teleotology: Method of offsite service delivery whereby specialists and audiologists provide full diagnostic hearing assessments, assess middle ear function, diagnose middle ear conditions and recommend further actions and treatment based on information provided to them electronically by an audiologist or an ENT nurse consultant.

tympanometry: An examination to test the condition of the middle ear and mobility of the eardrum and the conduction bones. It is an objective test of middle ear function and provides a measure of energy transmission through the middle ear.

unilateral hearing loss: Hearing loss in 1 ear.

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AIHW 2014c. Stronger Futures in the Northern Territory: hearing health services 2012–2013. Cat. no. IHW 117. Canberra: AIHW.

AIHW 2017a. Northern Territory Remote Aboriginal Investment: Ear and Hearing Health Program July 2012 to June 2016. Cat. no. IHW 176. Canberra: AIHW.

AIHW 2017b. Aboriginal and Torres Strait Islander health performance framework 2017: supplementary online tables. Cat. no. WEB 170. Canberra: AIHW.

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List of figures

Related publications

The following Australian Institute of Health and Welfare (AIHW) publications on Child Health Check Initiative Closing the Gap , National Partnership on Stronger Futures in the Northern Territory and Northern Territory Remote Aboriginal Investment hearing health programs may be of interest:

- AIHW 2010. Health and wellbeing of young Australians: indicator framework and key national indicators. Bulletin no. 77. Cat. no. AUS 123. Canberra: AIHW.
- AIHW 2011. Ear and hearing health of Aboriginal and Torres Strait Islander children in the Northern Territory. Cat. no. IHW 60. Canberra: AIHW.
- AIHW 2012. Northern Territory Emergency Response Child Health Check Initiative—follow-up services for oral and ear health: final report, 2007–2012. Cat. no. DEN 223. Canberra: AIHW.
- AIHW 2014. Stronger Futures in the Northern Territory: hearing health services 2012–2013. Cat. no. IHW 117. Canberra: AIHW.
- AIHW 2015. Hearing health outreach services to Indigenous children and young people in the Northern Territory: 2012–13 and 2013–14. Cat. no. IHW 149. Canberra: AIHW.
- AIHW 2015. Hearing health outreach services to Aboriginal and Torres Strait Islander children and young people in the Northern Territory: 2012–13 to 2014–15. Cat. no. IHW 163. Canberra: AIHW.
- AIHW 2017. Northern Territory Remote Aboriginal Investment: Ear and Hearing Health Program July 2012 to June 2016. Cat. no. IHW 176. Canberra: AIHW.

These reports can be downloaded for free from the AIHW website <www.aihw.gov.au/reports-statistics>. The website also includes information on ordering printed copies.

This report presents information on hearing health outreach services provided to Aboriginal and Torres Strait Islander children and young people in the Northern Territory. It shows that in 2016, 2,452 audiology, 1,020 ear, nose and throat teleotology and 1,156 Clinical Nurse Specialist services were provided. Of those children and young people who received treatment, 51% had improved hearing loss and 62% had improved hearing impairment over subsequent visits.

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