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Stronger Futures in the Northern Territory: Hearing Health Services 2012–2013



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*Authoritative information and statistics
to promote better health and wellbeing*

**Stronger Futures in the Northern Territory:
Hearing Health Services
2012–2013**

Australian Institute of Health and Welfare
Canberra

Cat. no. IHW 117

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Abbreviations

AIHW	Australian Institute of Health and Welfare
AOM	acute otitis media
CHCI(CtG)	Child Health Check Initiative/Closing the Gap
CHHC	Child Hearing Health Coordinator
CSOM	chronic suppurative otitis media
dBHL	decibel hearing level
ENT	ear nose and throat
ETD	eustachian tube dysfunction
HRN	hospital registration number
NT	Northern Territory
NT DoH	Northern Territory Department of Health
OM	otitis media
OME	otitis media with effusion
SFNT	Stronger Futures in the Northern Territory
VROA	Visual Reinforced Orientation Audiometry

Symbols

–	nil or rounded to zero
..	not applicable
n.a.	not available
n.p.	not publishable because of small numbers (<5) or confidentiality

Summary

This report presents data on the hearing health services delivered under the National Partnership Agreement on Stronger Futures in the Northern Territory (SFNT) during 2012–13. Information is provided on the children who participated in this program, the services they received, and their ear and hearing health. Children who accessed SFNT hearing health services are not a random sample of children in the Northern Territory and, as such, the data do not provide a measure of population prevalence.

Key findings

Audiology services

- During 2012–13, 1,807 audiology services were provided to 1,541 Indigenous children.
- Seventy-two per cent of children who received audiology services were diagnosed with at least one type of middle ear condition. The most common condition was otitis media with effusion (OME) (25% of children), followed by eustachian tube dysfunction (ETD) (17%), chronic suppurative otitis media (CSOM) (13%), dry perforation (12%) and acute otitis media (AOM) (8%).
- Fifty-one per cent of children who received audiology services had some form of hearing loss. Thirty-six per cent had bilateral hearing loss and 15% had loss in one ear. Around 10% had moderate, severe or profound hearing impairment.
- When children in the SFNT program were linked with children who received audiology services under the Child Health Check Initiative/Closing the Gap (CHCI[CtG]) program, the proportion with at least one type of middle ear condition decreased from 86% at last CHCI(CtG) service to 73% at last SFNT service; and the proportion with hearing loss decreased from 75% to 60%. Sixty-four per cent of children experienced an improvement in hearing between their last CHCI(CtG) service and last SFNT service, 28% experienced no change and 8% experienced a deterioration.
- Long-term improvements in children’s ear health were also evident. Of children who received 3 or more services over the course of both programs (August 2007 to June 2013), the proportion with at least one type of OM (OME, CSOM, AOM or dry perforation) decreased from 84% at first service to 54% at last service. The proportion with hearing loss declined from 85% to 64% and the proportion with moderate, severe or profound hearing impairment decreased from 23% to 8%.

CHHC program

- The Child Hearing Health Coordinator (CHHC) initiative is a new program under SFNT and is in the early stages of implementation. During 2012–13, a total of 174 Indigenous children presented for 181 visits. Almost all had at least one type of middle ear condition (96%) at the first visit, with the most common conditions being OME (41%), AOM (29%) and CSOM (23%).
- CHHCs provided a range of clinical services including ear health education (provided in 96% of visits), verification of diagnosis (83%), discussion of hearing loss strategies (79%), support for audiological management (78%) and confirmation of regular follow-up and care plan (77%). They also facilitated contact with other service providers including health providers (49% of visits), education providers (39%) and Australian Hearing (10%).

1 Introduction

This report presents information on the hearing health services provided through the National Partnership Agreement on Stronger Futures in the Northern Territory (SFNT). Funded by the Australian Government and implemented by the Northern Territory Government, the SFNT hearing health program aims to reduce the prevalence, incidence, severity and impact of ear disease among Indigenous children in the Northern Territory.

The services examined include a program of audiology services as well as services delivered under the Child Hearing Health Coordinator (CHHC) initiative. The AIHW was commissioned by the Australian Government Department of Health to collect, manage and report on data from these programs. Information is provided on the services delivered as well as the ear and hearing health of the Indigenous children who received services. This report provides a level of accountability for health service delivery in an area of critical need for Indigenous children in the Northern Territory, and helps build the evidence needed for program monitoring and evaluation.

1.1 Background

Ear health of Indigenous children

Research has revealed extensive ear and hearing problems amongst Indigenous children in Australia. Otitis media (OM) is one of the most serious health problems faced by Indigenous children, particularly in remote communities. This is a disease of the middle ear associated with inflammation, accumulation of fluid and bulging of the tympanic membrane or eardrum (Wiertsema & Leach 2009). Indigenous children have substantially higher prevalence of OM than non-Indigenous children. One study, for example, found that Indigenous infants were 3 times more likely than non-Indigenous infants to develop otitis media with effusion (OME) and 4 times more likely to develop acute otitis media (AOM) (Boswell & Nienhuys, cited in Couzos et al. 2003). McGilchrist and Hills reported that between the ages of 2 and 20, Indigenous people can be expected to have 32 months of OM, while non-Indigenous people can be expected to have only 3 months (cited in Couzos et al. 2003). A study undertaken by the World Health Organization (WHO) found that the prevalence of perforation of the eardrum among Indigenous Australians was the highest of all populations surveyed (WHO 2004).

One of the most significant consequences of OM is that it can lead to hearing loss and hearing impairment. Among children who participated in the CHCI(CtG) program, 69% of those who had at least one middle ear condition had hearing loss and 14% had moderate, severe or profound hearing impairment (AIHW 2011). Research has shown that hearing loss associated with OM can have a significant impact on children's development and wellbeing, particularly in relation to speech and language, social development and education (Couzos et al. 2003; Williams et al. 2009; Williams & Jacobs 2009).

SFNT hearing health services

The SFNT began in July 2012 and provides funding over a decade to 2021–22. The hearing health component of this agreement replaced, and expanded upon, services implemented under the CHCI(CtG) program (see Box 1). The two main service elements covered in this

report include the delivery of audiology services and services provided through the CHHC program.

Audiology services

Audiology services are available to all Indigenous children in the Northern Territory under the age of 16. They are delivered by outreach teams consisting of an audiologist and at least one other member of staff such as a registered nurse, nurse audiometrist, Aboriginal health worker, or a community hearing worker. The outreach teams work with local families, primary health organisations, community personnel, schools and early childhood organisations. The Aboriginal Interpreting Service is used routinely for all outreach visits to remote communities as English is generally a second or third language.

Audiology services include an assessment of middle ear function, diagnosis of hearing loss and middle ear disease, and recommendations for clinical care and rehabilitation, such as communication strategies, classroom amplification, hearing aids, speech therapy and education support.

Audiological services play an important role in assisting health practitioners to make case management decisions through the provision of diagnostic hearing acuity information. While this in itself may not lead to an outcome, the information provided allows health practitioners to determine the need for Ear Nose and Throat (ENT) surgical intervention and other forms of primary clinical care. While in many cases, primary health care services can improve ear health, specialist ENT intervention is sometimes required. Audiological assessment is essential for ENT case management and family decision making, and children requiring ENT services receive a full diagnostic assessment as part of the care pathway.

It is important to note that the audiology services established under the CHCI(CtG) program and continued through SFNT were introduced in the context of increased investment in Aboriginal and Torres Strait Islander primary health care in the Northern Territory. Primary health care services play a critical part in the management and treatment of ear disease.

CHHC program

The CHHC program is based on a case management approach where an expert co-ordinator manages the treatment of children through the linking of primary health services with specialist resources. CHHCs administer clinical services and facilitate contact with a range of service providers, such as education or health services, community-based workers and Australian Hearing. Indigenous children are referred to a CHHC if they have a priority listing; that is, a diagnosed middle ear condition or documented hearing impairment (see Chapter 3 for information on priority categories).

Box 1: The CHCI(CtG) program

This program refers to the Northern Territory Emergency Child Health Check Initiative (NTER CHCI) and the Closing the Gap in the Northern Territory National Partnership Agreement (CtG NT). The NTER CHCI was initiated in August 2007 and involved the roll-out of voluntary child health checks targeting Indigenous children living in prescribed communities in the Northern Territory. The program of checks finished in June 2009 and reached more than 10,000 children. The most common conditions identified included ear disease, which affected 30% of children, and oral health problems, which affected 40% of children (AIHW 2012).

In response to this high level of need, the Australian Government initiated a program of follow-up services, including ear and oral health services, initially as part of the NTER CHCI and later through the CtG NT. Audiology services have been funded continuously over this time. The follow-up services targeted children who received a referral from their initial health check but other Indigenous children in need in the prescribed areas were also able to access these services. The audiology services are now funded as part of the SFNT and are available to all Indigenous children under 16 in the Northern Territory.

The CHHC program began as a component of the CtG NT and was funded under the 2009–12 Expanded Health Service Delivery Initiative. It was implemented through the SFNT at the end of 2012.

The final report from the CHCI(CtG) program was published by the AIHW in 2012: *Northern Territory Emergency Response Child Health Check Initiative – Follow-up services for oral and ear health: final report 2007–2012*. This report included information on ENT services as well as audiology services.

1.2 Information collected

The information presented in this report is derived from two sources: the SFNT audiology and CHHC data collections. These collections were established to monitor the progress of hearing health services delivered through the SFNT program. The relevant health professionals responsible for providing the services complete a form with information about the service provided and the child's demographic characteristics. The paper forms are then sent to the AIHW for processing. The detailed data items collected are described in the relevant chapters of this report. Data collection forms are included in Appendix 1.

The amount of data received by the AIHW depends on the child's family consenting to share this information. There are two 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, only a limited amount of aggregate information is provided to AIHW: the number of services provided and the number of children receiving a service by 5-year age group, sex and community where service was provided.

Limitations of the data

The SFNT audiology and CHHC data collections have some limitations that should be considered when interpreting the findings.

- The scope of this report is limited to the SFNT program. Audiology services provided through other funding sources (for example, services funded by the NT Government or private sector) are not included.
- There is only very limited information on the CHHC program in this report because this program is currently in the process of being established, including recruiting and training of staff.
- As the AIHW does not receive detailed information on audiology and CHHC services if children's parents or guardians do not consent to share the data, the data for which consent has not been obtained are not included in most of the analysis of this report. The extent of non-consent data is reported in sections 2.2 and 3.1.
- The extent of missing and not tested responses should be taken into account when using and interpreting data. Where possible, published tables show the percentage of missing and not tested responses.
- As personal information, such as the child's name, is not provided to the AIHW, children can only be tracked using their Hospital Registration Number (HRN). A very small number of children cannot be tracked due to missing or incorrect HRNs. These are noted in relevant tables.
- Due to the nature of the collection process, there is a lag between the date when the service was provided and the date of data receipt. This means that there may be services provided in the reference period (2012–2013) that have not yet been captured in the data reported here.
- Children who receive audiology or CHHC services are not a random sample of Indigenous children in the Northern Territory and, as such, the findings in this report are not representative of the Indigenous child population. Although all Indigenous children under 16 in the Northern Territory are eligible for services under the audiology program, not all children access these services. To be eligible for the CHHC program, children must have a referral from a health service provider and be assigned a priority listing (see Chapter 3).

1.3 About this report

The information in this report relates to audiology and CHHC services provided as part of the SFNT program from July 2012 to June 2013.

This report contains the following chapters:

- **Chapter 2, SFNT audiology services**, includes information on the number of services provided and number of children who received services, their health condition (hearing loss status, degree of hearing impairment and prevalence of middle ear conditions) and changes in health status over time.
- **Chapter 3, Child Hearing Health Coordinator program**, outlines the number of children who participated in the program and number of visits, the ear health of children, clinical service activities provided and contacts made with other service providers.

The data collection forms for the SFNT audiology and CHHC data collections are provided in Appendix 1, and a data quality statement can be found in Appendix 2.

2. SFNT audiology services

This chapter focuses on the provision of audiology services funded by the SFNT program.

As mentioned in the introduction of this report, apart from aggregated information on number of services, data are not provided to the AIHW if parents or guardians do not give consent for sharing detailed information. As such, for most of this chapter, the analyses are based only on data where consent was provided. Throughout this report, the term ‘services’ refers to service occasions rather than service providers.

2.1 Audiology data collection

Audiology data are received by the AIHW in paper form from the Northern Territory Department of Health (NT DoH) audiology team.

The audiology data include:

1. details about the child (that is, HRN, date of birth and sex)
2. community where service was provided and date of service
3. outcomes from the audiology check
4. whether further action was recommended.

A child may receive a number of audiological assessments and have more than one record in the audiology data collection. Each record in the collection corresponds to a single assessment of middle ear function and peripheral hearing (audiological assessment). A course of care for OM may consist of one or a series of audiological assessments to monitor hearing loss and assess middle ear function as part of primary clinical care or ENT specialist care pathways.

2.2 Audiology services provided

In the first year of the SFNT program, a total of 1,807 audiology services were provided to 1,541 children in the Northern Territory (Table 2.1). Consent for sharing information with the AIHW was obtained for almost all children and services. Analyses for the remainder of this chapter are based on data where consent was obtained (1,527 children and 1,793 services). As only a very small minority of children did not provide consent (less than 1%), the impact on the analyses is likely to be minimal.

Table 2.1: Number of audiology services provided and number of Indigenous children who received services, July 2012 to June 2013

	Services			Children		
	Consent	Non-consent	Total	Consent	Non-consent	Total
Number	1,793	14	1,807	1,527	14	1,541
Per cent	99.2	0.8	100.0	99.1	0.9	100.0

Note: Services include only those that were provided through the SFNT program.

Source: AIHW analysis of SFNT audiology database on services provided on or before 30 June 2013.

Of children who received audiology services, the majority were aged between 3 and 10 (27% 3–5 years and 39% 6–10 years). Smaller proportions of children were aged 11–15 (19%) and less than 2 years (2% aged less than 1 year and 13% aged 1–2). Compared with children who received audiology services through CHCI(CtG) (AIHW 2012), the SFNT program contained a higher proportion of children aged between 0 and 5 (31% and 42% respectively).

A similar proportion of boys and girls received SFNT audiology services (51% and 49% respectively) (Table 2.2).

Table 2.2: Indigenous children who received audiology services, by age and sex, July 2012 to June 2013

Age and sex	Number	Per cent
Age group		
<12 months	29	1.9
12 months–2 years	203	13.3
3–5 years	416	27.2
6–10 years	592	38.8
11–15 years	287	18.8
Total	1,527	100.0
Sex		
Male	777	50.9
Female	750	49.1
Total	1,527	100.0

Notes

1. Data are only reported for children where consent was obtained.
2. Services include only those that were provided through the SFNT program.

Source: AIHW analysis of SFNT audiology database on services provided on or before 30 June 2013.

2.3 Actions required

During audiology consultations, the audiologists recommend appropriate action for the continuing care of the child. These actions include care from an ENT specialist, primary health care or other hearing services, rehabilitation and educational services. Of children who received audiology services, 73% were identified as requiring further action (Table 2.3). The most common actions required were ongoing monitoring by NT hearing services (64%), followed by case management by an ENT specialist (30%) and case management by primary

health care services (25%). About 4% of children were referred to the Department of Education, Employment and Training for hearing advisory support, and 7% were referred to Australian Hearing for rehabilitation.

Almost all children with hearing loss (97%) required further services, with most (86%) being recommended for ongoing monitoring by NT hearing services. Some children who did not have hearing loss (at the time when their hearing assessment was conducted) also required further services (29%). This is because treatment or monitoring may be required to prevent hearing loss, particularly for children with OM.

Table 2.3: Type of actions required, Indigenous children who received audiology service, July 2012 to June 2013

Type of further action required	No hearing loss		Hearing loss		Missing ^(a)		Total	
	No.	%	No.	%	No.	%	No.	%
At least one further action required ^(b)	156	28.9	759	97.2	193	93.7	1,108	72.6
Ongoing monitoring by NT hearing services	128	23.7	670	85.8	175	85.0	973	63.7
Case management by Ear, Nose and Throat specialist	39	7.2	371	47.5	42	42.0	452	29.6
Case management by primary health care services	36	6.7	265	33.9	81	39.3	382	25.0
Referral to Australian Hearing (rehabilitation)	—	—	97	12.4	6	2.9	103	6.7
Referral to Department of Education, Employment and Training hearing advisory support	n.p.	n.p.	65	8.3	n.p.	n.p.	67	4.4
Other	n.p.	n.p.	28	3.6	n.p.	n.p.	38	2.5
No further action required	384	71.1	18	2.3	12	5.8	414	27.1
Missing	—	—	4	0.5	1	0.5	5	—
Total children	540	100.0	781	100.0	206	100.0	1,527	100.0

n.p. not publishable because of small numbers (<5) or confidentiality.

(a) Missing includes not tested, not stated, unsure and invalid responses.

(b) Children can have multiple further actions required, and as such, sum of these categories totals more than 100%.

Notes

1. Data are only reported for children where consent was obtained.
2. Services include only those that were provided through the SFNT program.

Source: AIHW analysis of SFNT audiology database on services provided on or before 30 June 2013.

2.4 Results of hearing assessment

During the audiology services, children's middle ear and hearing status are investigated and examined by an audiologist. This includes:

- detailed clinical history of ear health, family history, general health, noise exposure, speech development and language development
- visual examination of the ear canal and tympanic membrane
- examination of mobility of ear membrane
- examination of functional hearing acuity.

Visual Response Orientation Audiometry (VROA) is used to assess hearing in children aged between 9 months and 3 years and results are obtained in a sound field where both ears are presented to test stimulus simultaneously through a calibrated speaker.

This section describes the outcomes of hearing assessments. When interpreting the data, the extent of missing data (not stated, unsure or invalid responses) should be taken into consideration. There are also occasions where children cannot be tested due to difficulties in complying with the testing procedure. Where possible, the percentage of missing responses and not tested cases are presented in the tables.

It must also be noted that where children have received multiple services, hearing health status is reported from information provided at their most recent service.

2.4.1 Hearing status and type of hearing loss

A diagnosis of hearing loss defines a functional limitation that may affect social activity or participation. It is diagnosed when any pure tone audiometry hearing threshold response falls outside the normal range in either ear at any sound frequency. Hearing loss may be present in one ear (unilateral) or both ears (bilateral).

Hearing thresholds obtained through sound field measurements do not provide information on separate ears and are indicative of hearing acuity in the better hearing ear.

Among the 1,527 children who received audiology services, 781 (51%) had some form of hearing loss, 35% had no hearing loss, 12% could not be tested and there were missing data for 2%. Around one-third had bilateral hearing loss and 15% had hearing loss in one ear (Table 2.4).

The results of the hearing assessments from the CHCI(CtG) program show similar patterns. Of children who received audiology services through this program, 51% had hearing loss (35% bilateral and 17% unilateral), and 40% had no hearing loss (AIHW 2012).

Table 2.4: Hearing status^(a), Indigenous children who received audiology services, July 2012 to July 2013

Hearing status	Number	Per cent
No hearing loss	540	35.4
Hearing loss ^(b)	781	51.1
<i>Unilateral (one ear)</i>	232	15.2
<i>Bilateral (both ears)</i>	549	36.0
Not tested ^(c)	182	11.9
Missing ^(d)	24	1.6
Total number of children who received an audiology service	1,527	100.0

(a) Where child received multiple audiology services, information is from latest service.

(b) Total children with unilateral and bilateral hearing loss.

(c) Some children may not be tested because they may find it difficult to cooperate with the procedure.

(d) Missing includes not stated, unsure and invalid.

Notes

1. Data are only reported for children where consent was obtained.

2. Services include only those that were provided through the SFNT program.

Source: AIHW analysis of SFNT audiology database for services provided on or before 30 June 2013.

Hearing loss status varied with age. The 3–5 year age group had the highest proportion of children with hearing loss (55%), followed by children aged 6–10 and 11–15 (52% and 50% respectively), under 12 months (45%) and 1–2 years (43%)(Table 2.5).

Table 2.5: Hearing status^{(a)(b)} by age, Indigenous children who received audiology services, July 2012 to July 2013

Age group	Total number of children who received an audiology service	Number of children with hearing loss	Per cent of children with Hearing loss
<12 months	29	13	44.8
12 months–2 years	203	87	42.9
3–5 years	416	230	55.3
6–10 years	592	307	51.9
11–15 years	287	144	50.2
Total	1,527	781	51.1

(a) Where child received multiple audiology services, information is from latest service.

(b) Hearing status is based on the child's better ear. Therefore, degree of hearing loss is only reported for those children who may have bilateral hearing loss.

Notes

1. Data are only reported for children where consent was obtained.
2. Services include only those that were provided through the SFNT program.

Source: AIHW analysis of SFNT audiology database for services provided on or before 30 June 2013.

Forty per cent of children who received audiology services had conductive hearing loss, while only a small proportion had sensorineural or mixed hearing loss (2%) (Table 2.6, Box 2). Fifteen per cent of children could not be tested and there were missing responses for 7% (Table 2.6). This is similar to children who received audiology services through the CHCI(CtG) program, where 45% of children had conductive hearing loss and 3% had sensorineural or mixed hearing loss (AIHW 2012).

Box 2: Type of hearing loss

- *Sensorineural hearing loss* is a deviation of hearing threshold from the normal range attributable to problems in the inner ear or the cochlear nerve.
- *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). Some children may have clinical symptoms of conductive hearing deficit, but the degree of hearing loss is not enough to be diagnosed as clinical hearing loss.
- *Mixed hearing loss* refers to a deviation of hearing threshold from the normal range that has conductive and sensorineural components combined.

Table 2.6: Type of hearing loss^(a), Indigenous children who received audiology services, July 2012 to June 2013

Type of hearing loss	Number	Per cent
Conductive	608	39.8
Sensorineural	14	0.9
Mixed (both conductive and sensorineural)	19	1.2
Not tested ^(b)	235	15.4
Missing ^(c)	111	7.3
No hearing loss	540	35.4
Total number of children who had an audiology service	1,527	100.0

(a) Where child received multiple audiology services, information is from latest service.

(b) Some children may not be tested because they may find it difficult to cooperate with the procedure.

(c) Missing include not stated, unsure and invalid responses.

Notes

1. Data are only reported for children where consent was obtained.
2. Services include only those which were provided through the SFNT program.

Source: AIHW analysis of SFNT audiology database for services provided on or before 30 June 2013.

2.4.2 Hearing impairment

Hearing impairment is a measured health problem that can impact language development, cognition, socialisation, education and employment. Hearing impairment categorisation 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 degree of deviation from normal thresholds in the ‘better ear’ calculated as a 3 frequency average of the threshold of hearing (in dBHL) - 500Hz, 1000Hz and 2000Hz.

In this report, the number of children with hearing impairment and the severity of the impairment are classified based on the categorical variable on the data collection form provided by the NT DoH (Box 3). The NT DoH applies a conservative categorisation of hearing impairment for children under 15 years (Australian Hearing, cited in Access Economics 2006).

Box 3: Degree of hearing impairment defined by NT DoH

- *Mild*: On average, the quietest sounds that people can hear with their better ear are 16–30 dB HL in soundproof conditions and 26–35 dB HL in non-soundproof conditions. They are able to hear and repeat words spoken in normal voice at 1 meter. Counselling and hearing aids may be needed.
- *Moderate*: On average, the quietest sounds that people can hear with their better ear are 31–60 dB HL in soundproof conditions and 36–60 dB HL in non-soundproof conditions. They are able to hear and repeat words spoken in raised voice at 1 meter and have difficulty keeping up with conversations without using a hearing aid.
- *Severe*: On average, the quietest sounds that people can hear with their better ear are between 61–90 dB HL either in soundproof conditions or non-soundproof conditions. They 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.
- *Profound*: On average, the quietest sounds that people can hear with their better ear are 91+ dB HL either in soundproof conditions or non-soundproof conditions. They are unable to hear and understand a voice shouting. Hearing aids may help with understanding words. Additional rehabilitation is needed. Lip-reading and sometimes signing is essential.

In total, 500 children (33% of children who had an audiology check) had some form of hearing impairment (Table 2.7). About 23% of children who had an audiology check had mild hearing impairment, 10% had moderate and less than 1% had severe or profound hearing impairment. About 54% had no hearing impairment, 12% could not be tested and there were missing responses for less than 2%. This is similar to children who received services through the CHCI(CtG) program where 23% had mild hearing impairment, 9% had moderate and less than 1% had severe or profound hearing impairment (AIHW 2012).

Table 2.7: Degree of hearing impairment^(a), Indigenous children who received audiology services, June 2012 to July 2013

Degree of hearing impairment	Number	Per cent
Mild	344	22.5
Moderate	151	9.9
Severe/profound	5	0.3
<i>Sub-total children with hearing impairment</i>	<i>500</i>	<i>32.7</i>
No hearing impairment	818	53.6
Not tested ^(b)	188	12.3
Missing ^(c)	21	1.4
Total number of children who had an audiology service	1,527	100.0

(a) Hearing impairment is based on the child's better ear. Therefore, degree of hearing impairment is reported only for those children who may have bilateral hearing loss. Where child received multiple audiology services, information is from latest service.

(b) Children may not be tested if they find it difficult to co-operate with the procedure.

(c) Missing includes not stated, unsure and invalid responses.

Notes

1. Data are only reported for children where consent was obtained.
2. Services include only those that were provided through the SFNT program.

Source: AIHW analysis of SFNT audiology database on services provided on or before 30 June 2013.

The prevalence of hearing impairment among children who received audiology services varied with age. Children in the older age groups (3–5, 6–10 and 11–15) were most likely to have mild hearing impairment (27%, 24% and 18% respectively), while children aged 0–2 were most likely to have moderate, severe or profound hearing impairment (21%)(Table 2.8). There was a high proportion of missing and not tested responses for children in the younger age groups (47% for 0–2 years and 17% for 3–5 years).

Table 2.8 Degree of hearing impairment^{(a)(b)}, by age, Indigenous children who received audiology services, July 2012 to June 2013

Age group	Number children received audiology service	Hearing impairment							
		No hearing impairment		Mild		Moderate/Severe/Profound		Missing ^(c) /not tested	
		No.	%	No.	%	No.	%	No.	%
0–2 years ^(d)	232	37	15.9	38	16.4	48	20.7	109	47.0
3–5 years	416	176	42.3	113	27.2	55	13.2	72	17.3
6–10 years	592	400	67.6	141	23.8	34	5.7	17	2.9
11–15 years	287	205	71.4	52	18.1	19	6.6	11	3.8
Total	1,527	818	53.6	344	22.5	156	10.2	209	13.7

(a) Where child received multiple audiology services, information is from latest service.

(b) Hearing impairment is based on the child's better ear. Therefore, degree of hearing impairment is only reported or those children who may have bilateral hearing loss.

(c) Missing includes not stated, unsure and invalid responses.

(d) Age groups (>12months and 1–2 years) have been combined due to small numbers.

Notes

1. Data are only reported for children where consent was obtained.

2. Services include only those that were provided through the SFNT program.

Source: AIHW analysis of SFNT audiology database for services provided on or before 30 June 2013.

2.5 Changes in hearing loss and hearing impairment over time

The following tables present information on changes in hearing loss and hearing impairment for children in the SFNT and CHCI(CtG) audiology programs.

As noted earlier, the SFNT audiology program came into effect on 1 July 2012 and replaced audiology services delivered under the CHCI(CtG) program (August 2007 to June 2012). A few changes were made to the CHCI(CtG) model in order to improve the effectiveness of the program. The SFNT program provides services to all Indigenous children in the Northern Territory (rather than children in prescribed areas only). As well as audiology assessment, several hearing health co-ordinators were employed to enhance continuing services for children with ear health problems. A preventive program is also being developed as part of the SFNT audiology program. As such, it is very important to assess the effectiveness of SFNT audiology services through examining changes in hearing health status of children who participated in the program.

As 2012–13 is the first year of the SFNT program, there is not enough data to meaningfully ascertain change in hearing health status, particularly as two or more services are required in order to assess change. To allow outcomes of children in the SFNT program to be examined, records of children who participated in the SFNT and CHCI(CtG) programs are linked, and their hearing status at their last service in each program is compared (Table 2.9). Change in

hearing status is measured in relation to differences in the proportions of children in each hearing loss category between first and last service. These are expressed as percentage change and percentage point difference over the 2 time periods. Percentage change is the change in a variable from one period to another expressed as a percentage of its value in the first period, while percentage point difference is the difference between the percentage at two time periods.

In the second half of this section, a broader analysis is undertaken, investigating changes in hearing health status for all children who had 3 or more services over the 6-year period of both programs (Figures 2.1 and 2.2). This captures more children, as it includes children who participated in either program (that is, the SFNT and/or CHCI(CtG) programs), and allows for an examination of changes in hearing health over a longer time period.

It is important to note that the analyses presented in this section (and in Section 2.7 on middle ear conditions) do not reflect changes in the prevalence of ear health problems among Indigenous children in the Northern Territory or children who participated in the SFNT/CHCI(CtG) programs. Rather, these analyses track changes in the hearing health status of a group of children who participated in these programs (that is, those who presented for more than one service), allowing for an examination of the outcomes of children who received hearing health services.

It must also be noted that some children may be lost to follow-up (that is, they may present for an initial service but not return for subsequent services). It is not possible to determine the health outcomes of such children.

2.5.1 Change in hearing loss

Table 2.9 shows outcomes for children in the SFNT program who also participated in the CHCI(CtG) program. It measures hearing status at last service in each program with a minimum time interval of 3 months. Out of a total of 631 children (with available data on hearing loss status), 60% had hearing loss at their last SFNT service, compared with 75% at last CHCI(CtG) service (Table 2.9). This represents a decrease of 20% (or 15 percentage points). Conversely, the proportion of children with no hearing loss increased by 61% (15 percentage points) when their hearing results at their last CHCI(CtG) service are compared with the results at their last SFNT service.

Table 2.9: Change in hearing status, Indigenous children in the SFNT and CHCI(CtG) programs who received at least two audiology services^{(a)(b)}

Hearing loss status	Last service CHCI(CtG)		Last service SFNT		Per cent change (y-x)÷x	Percentage point difference (y-x)
	Number	Per cent (x)	Number	Per cent (y)		
Hearing loss ^(c)	474	75.1	379	60.1	-20.0	-15.1
<i>Unilateral</i>	130	20.6	142	22.5	9.2	1.9
<i>Bilateral</i>	344	54.5	237	37.6	-31.1	-17.0
No hearing loss	157	24.9	252	39.9	60.5	15.1
Total children^(d)	631	100.0	631	100.0

(a) Excludes 11 children with an unknown or invalid HRN in CHCI(CtG) audiology dataset.

(b) Median time between first and second service: 20 months. Minimum time interval: 3 months.

(c) Total children with unilateral and bilateral hearing loss.

(d) Indigenous children in the SFNT and CHCI(CtG) programs who received two or more audiology services. Excludes children with missing or not tested responses for hearing status.

Notes

1. Data are only reported for children where consent was obtained.

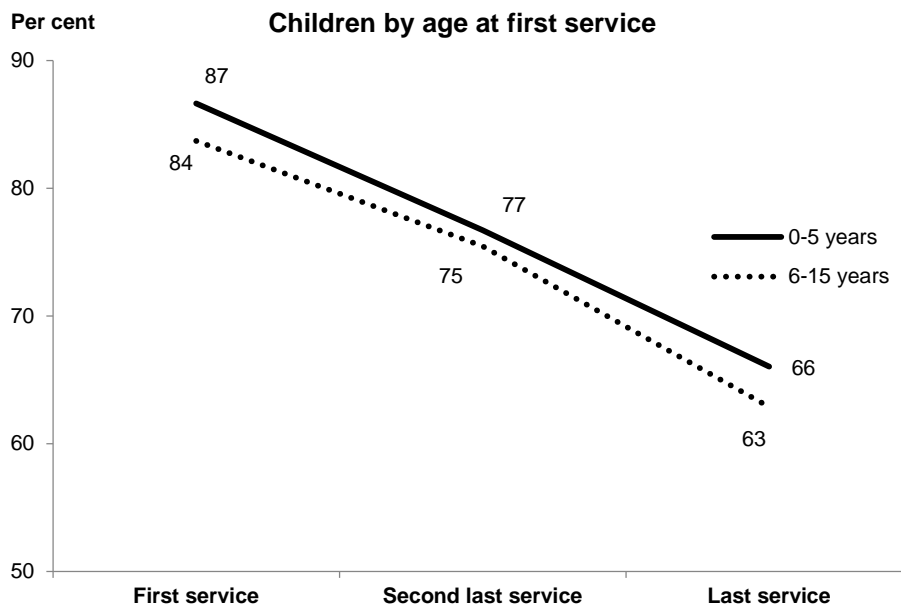
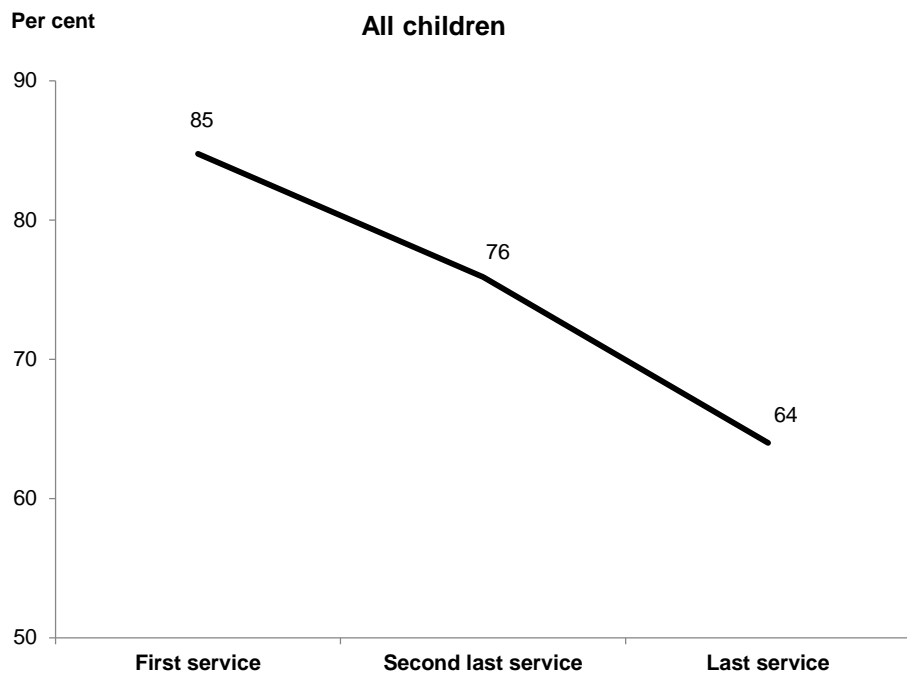
2. Services include only those that were provided through the CHCI(CtG) and SFNT programs.

Source: AIHW analysis of SFNT and CHCI(CtG) audiology databases for services provided on or before 30 June 2013.

Figure 2.1 shows changes in hearing status for children in the SFNT and/or CHCI(CtG) programs who had 3 or more audiology services from August 2007 to June 2013. It measures hearing status at first service, second last service and last service. The minimum time interval between services is 3 months. The figure also presents an analysis using 2 age groups (0–5 and 6–15), where age is determined by age at first service.

As can be observed, there has been a continual improvement in children’s hearing health. Out of a total of 747 children, the proportion with hearing loss changed from 85% at first service, to 76% at second last service, and 64% at last service (Figure 2.1).

Similar trends are observed for children of different age groups. For children who were aged 0–5 at their first check (227), the proportion with hearing loss changed from 87% at first service to 77% at second last service, and 66% at last service. For children aged 6–15 at their first check (406), the proportions were 84%, 75% and 63% respectively.



Notes

1. The CHCI(CtG) program ran from August 2007 to June 2012 and the SFNT program began in July 2012. Median time between first and second measurement: 16 months; second and third measurement: 11 months. Minimum time between services: 3 months.
2. Excludes 11 children with an unknown or invalid HRN in the CHCI(CtG) audiology dataset.
3. Indigenous children in the CHCI(CtG) and/or SFNT program who received 3 or more audiology services. Excludes children with missing or not tested responses for hearing status.
4. Data are only reported for children where consent was obtained.
5. Services include only those that were provided through the CHCI(CtG) and SFNT programs.

Source: AIHW analysis of SFNT and CHCI(CtG) audiology databases for services provided on or before 30 June 2013.

Figure 2.1: Indigenous children with hearing loss who participated in the CHCI(CtG) and/or SFNT program

2.5.2 Change in hearing impairment

Among children who received 2 or more services in the CHCI(CtG) and SFNT audiology programs, 315 had some degree of hearing impairment at their first check (Table 2.10). Most of these children (64%) had improved hearing at their last SFNT check. Twenty-eight per cent experienced no change while 8% experienced deterioration.

Table 2.10: Change in degree of hearing impairment between last CHCI(CtG) and last SFNT service, Indigenous children who participated in both programs^{(a)(b)(c)}

Hearing impairment	Number	Per cent
Improved ^(d)	202	64.1
No change	89	28.3
Deteriorated ^(e)	24	7.6
Total children	315	100.0

(a) Excludes 11 children with an unknown or invalid HRN in the CHCI(CtG) dataset.

(b) Median time between first and second measurement: 20 months. Minimum time interval: 3 months.

(c) Indigenous children who had 2 or more audiology services and had some degree of hearing impairment at their first service. Excludes children with missing or not tested responses for hearing impairment.

(d) Defined as a movement to a less severe hearing impairment category, for example, from moderate to mild.

(e) Defined as a movement to a more severe hearing impairment category, for example, from mild to moderate.

Notes

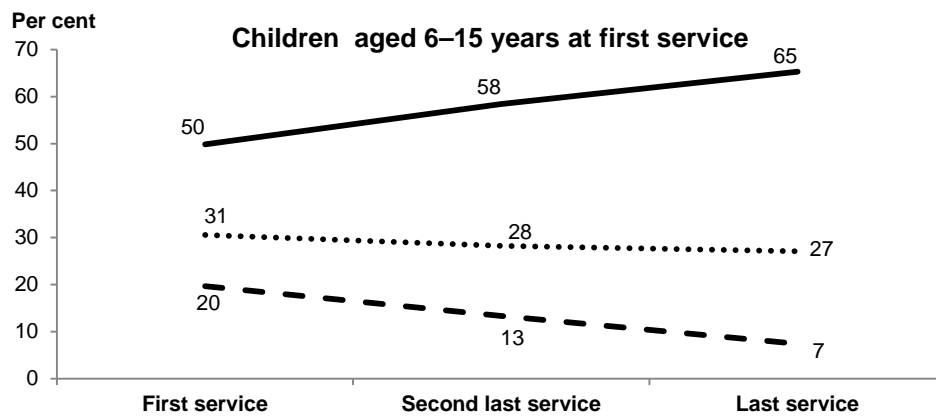
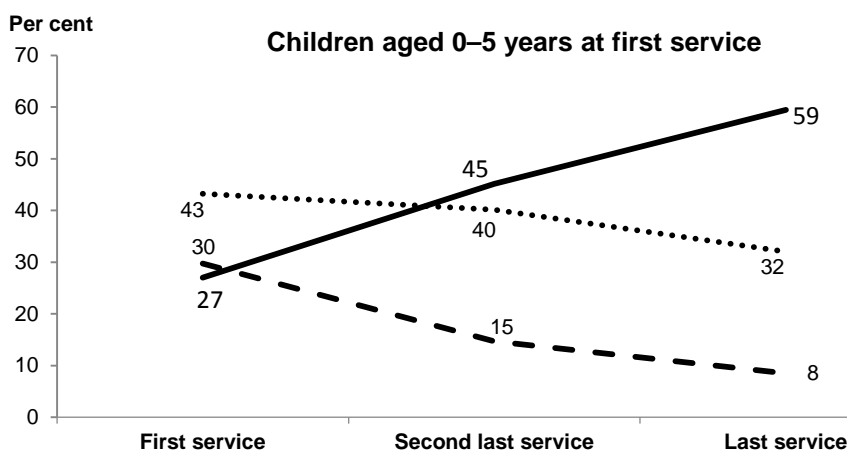
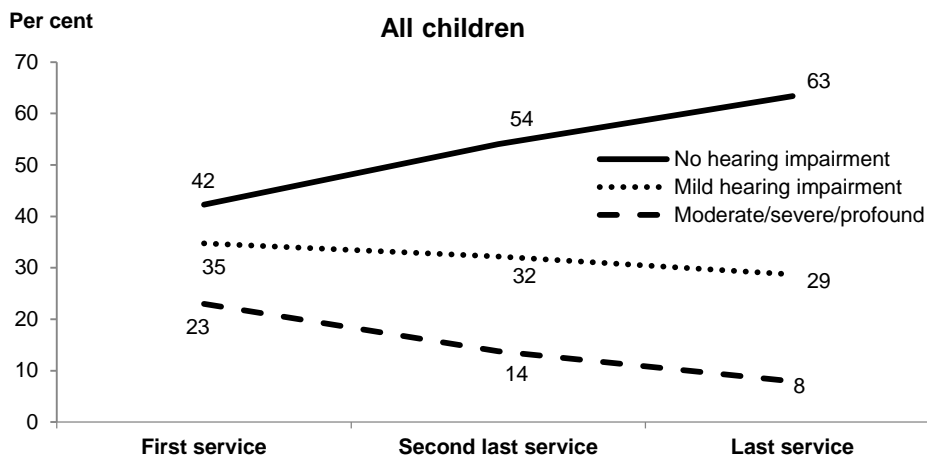
1. Data are only reported for children where consent was obtained.

2. Services include only those which were provided through the CHCI(CtG) and SFNT program.

Source: AIHW analysis of SFNT and CHCI(CtG) audiology databases for services provided on or before 30 June 2013.

Figure 2.2 shows changes in hearing impairment for children in the SFNT and/or CHCI(CtG) programs who had 3 or more services. Out of a total of 783 children (with available data on hearing impairment), the proportion with no impairment increased from 42% at first service to 54% at second last service, and to 63% at last service. The proportion with mild hearing impairment decreased slightly (from 35% to 29% between first and last service); and the proportion with moderate, severe or profound hearing impairment decreased from 23% to 14%, and then to 8%.

Patterns in relation to age were similar, although children in the younger age group (0–5 years) were more likely than older children (6–15 years) to have hearing impairment at their first check and also experienced a greater degree of improvement in their health condition. Of children aged 0–5 at first service (259), the proportion with mild hearing impairment changed from 43% to 32% between first and last service (a decrease of 11 percentage points); and the proportion with moderate, severe or profound impairment decreased from 30% to 8% (22 percentage points). This compares with children aged 6–15 (524) where the proportion with mild hearing impairment decreased from 31% to 27% (4 percentage points) and the proportion with moderate, severe or profound impairment decreased from 20% to 7% (13 percentage points).



Notes

1. The CHCI(CtG) program ran from August 2007 to June 2012 and the SFNT program began in July 2012. Median time between first and second measurement: 16 months; second and third measurement: 11 months. Minimum time interval between services: 3 months.
2. Excludes 11 children with an unknown or invalid HRN in the CHCI(CtG) dataset.
3. Indigenous children in the CHCI(CtG) and/or SFNT program who received 3 or more audiology services. Excludes children with missing or not tested responses for hearing impairment.
4. Data are only reported for children where consent was obtained.
5. Services include only those which were provided through the CHCI(CtG) and SFNT programs.

Source: AIHW analysis of SFNT audiology database for services provided on or before 30 June 2013.

Figure 2.2: Degree of hearing impairment, Indigenous children who participated in the CHCI(CtG) and/or SFNT program

2.6 Middle ear conditions

At least one type of middle ear condition was diagnosed in 72% of children who received an audiology service through the SFNT program, 25% had no middle ear condition, and there were missing responses for 3% (Table 2.11). The most common condition was OME (25% of children), followed by ETD (17%), CSOM (13%) and dry perforation (12%). Eight per cent of children were diagnosed with AOM and 18% were diagnosed with a foreign body or other middle ear condition (see Box 4 for a description of middle ear conditions).

Similar patterns can be noted in regard to children who participated in the CHCI(CtG) program. Sixty-seven per cent of these children had at least one type of middle ear condition, 26% had OME, 11% had ETD, 12% CSOM and 15% dry perforation (AIHW 2012).

Table 2.11: Type of middle ear condition^(a), Indigenous children who received audiology services, July 2012 to June 2013

Type of middle ear condition	Number ^(b)	Per cent
At least one type of middle ear condition	1,098	71.9
<i>OME</i>	374	24.5
<i>ETD</i>	255	16.7
<i>CSOM</i>	205	13.4
<i>Dry perforation</i>	181	11.9
<i>AOM</i>	126	8.3
<i>Foreign body</i>	17	1.1
<i>Other^(c)</i>	253	16.6
No middle ear condition ^(d)	387	25.3
Missing ^(e)	42	2.8
Total children receiving audiology services	1,527	100.0

(a) Middle ear condition at most recent audiology service.

(b) Because one child can have more than one middle ear condition, the sum of the column does not equal the total.

(c) Other includes: grommets, reduced ear drum movement or retracted ear drum, or other ear condition.

(d) Where no middle ear condition reported for both ears.

(e) Includes cases where there is a missing value for one ear, and no middle ear condition reported in the other ear. Missing includes not stated and invalid responses.

Notes

1. Data are only reported for children where consent was obtained.

2. Services include only those that were provided through the SFNT program.

Source: AIHW analysis of SFNT audiology database for services provided on or before 30 June 2013.

Patterns in the prevalence of middle ear conditions were varied by age (Table 2.12). Children aged 1–2 and 3–5 were most likely to have at least one middle ear condition (80% each), followed by children under 1 year (72%), children 6–10 years (68%) and children 11–15 years (62%).

Box 4: Description of middle ear conditions

- *Otitis media* (OM) is a condition with any inflammation, fluid or suppurative infection in the middle ear.
- *Otitis media with effusion* (OME) is the presence of intact eardrum and middle ear fluid without symptoms or signs of infection.
- *Acute otitis media* (AOM) is the presence of suppurative (infected) middle ear fluid with or without eardrum perforation.
- *Chronic suppurative otitis media* (CSOM) is a persistent suppurative discharge from the middle ear through a tympanic membrane perforation for more than 6 weeks.
- *Dry perforation* refers to a CSOM condition that presents as a hole in the eardrum without any evidence of suppurative otitis media (either acute or chronic).
- *Eustachian tube dysfunction* (ETD) is negative middle ear pressure associated with compromised equalisation impeding middle ear function and sometimes causing middle ear fluid accumulation.

Children aged under 3 were most likely to have AOM (28% less than 1 year and 23% 1–2 years). Those aged 1–10 were most likely to have CSOM (16% 1–2 years, 14% 3–5 years and 15% 6–10 years). The prevalence of OME was highest among children under 1 (41%), ETD was most common in children aged 3–5 (21%), and the prevalence of dry perforation was highest among children aged 6–15 (14% 6–10 years and 16% 11–15 years).

Table 2.12: Type of middle ear condition^(a), by age, Indigenous children who received audiology services (per cent), July 2012 to June 2013

Type of middle ear condition	Age group (years)					Total
	< 1 year	1–2	3–5	6–10	11–15	
At least one middle ear condition	72.4	80.3	80.0	68.1	62.0	71.9
<i>OME</i>	41.4	32.5	32.5	22.0	10.8	24.5
<i>ETD</i>	—	9.9	20.9	17.6	15.3	16.7
<i>CSOM</i>	<i>n.p.</i>	15.8	13.7	14.9	<i>n.p.</i>	13.4
<i>Dry perforation</i>	<i>n.p.</i>	<i>n.p.</i>	10.1	13.9	16.4	11.9
<i>AOM</i>	27.6	22.7	10.1	3.4	3.5	8.3
<i>Foreign body/other^(b)</i>	<i>n.p.</i>	<i>n.p.</i>	15.6	16.2	<i>n.p.</i>	17.6
No middle ear condition ^(c)	20.7	14.8	16.6	29.9	36.6	25.3
Missing ^(d)	6.9	4.9	3.4	2.0	1.4	2.8
Total children^(e)	100.0	100.0	100.0	100.0	100.0	100.0

n.p. not publishable because of small numbers (<5) or confidentiality.

(a) Middle ear condition at most recent audiology service.

(b) Other includes: grommets, reduced ear drum movement or retracted ear drum, or other ear condition.

(c) Where no middle ear condition reported for both ears.

(d) Includes cases where there is a missing value for one ear, and no middle ear condition reported in the other ear. Missing includes not stated and invalid responses.

(e) Because one child can have more than one middle ear condition, the sum of the columns does not equal the total.

Notes

1. Data are only reported for children where consent was obtained.

2. Services include only those that were provided through the SFNT program.

Source: AIHW analysis of SFNT audiology database for services provided on or before 30 June 2013.

The presence of middle ear disease is strongly associated with hearing loss and hearing impairment. Sixty-six per cent of children who had at least one type of middle ear condition had hearing loss (Table 2.13). The conditions most commonly associated with hearing loss were CSOM (82% of children experienced hearing loss), dry perforation (79%) and OME (76%).

Forty-three per cent of children who had at least one middle ear condition had some form of hearing impairment (Table 2.14). Most had mild impairment (29%) and 14% had moderate, severe or profound hearing impairment. The conditions most likely resulting in moderate, severe or profound impairment were AOM (23%), CSOM (22%) and OME (17%).

It must be noted that for tables 2.13 and 2.14 there was a high proportion of missing or not tested responses for many of the variables. It is not possible to determine the level of hearing loss or hearing impairment for these children.

Table 2.13: Hearing status, by middle ear condition^(a), Indigenous children who received audiology services (per cent), July 2012 to June 2013

Type of middle ear condition	No hearing loss	Type of hearing loss		Sub-total of hearing loss	Missing ^(b) /not tested	Total
		Unilateral	Bilateral			
At least one middle ear condition	18.6	19.3	47.0	66.3	15.1	100.0
<i>OME</i>	9.1	15.0	61.2	76.2	14.7	100.0
<i>ETD</i>	41.2	20.4	27.8	48.2	10.6	100.0
<i>CSOM</i>	<i>n.p.</i>	<i>n.p.</i>	59.5	81.5	16.6	100.0
<i>Dry perforation</i>	11.0	29.8	49.2	79.0	9.9	100.0
<i>AOM</i>	6.3	10.3	57.1	67.5	26.2	100.0
<i>Foreign body/other^(c)</i>	<i>n.p.</i>	<i>n.p.</i>	34.9	56.1	20.4	100.0
No middle ear condition ^(d)	85.5	3.9	4.9	8.8	5.7	100.0

n.p. not publishable because of small numbers (<5) or confidentiality.

(a) Health status of children at most recent service.

(b) Missing includes not stated, unsure and invalid responses.

(c) Other includes: grommets, reduced ear drum movement or retracted ear drum, or other ear condition.

(d) Where no middle ear condition reported for both ears.

Notes

1. Data are only reported for children where consent was obtained.
2. Services include only those that were provided through the SFNT program.

Source: AIHW analysis of SFNT audiology database for services provided on or before 30 June 2013.

Table 2.14: Hearing impairment by type of middle ear condition^(a), Indigenous children who received audiology services (per cent), July 2012 to June 2013

Type of middle ear condition	Children with hearing impairment			Sub-total hearing impairment	Missing ^(b) /not tested	Total
	None	Mild	Moderate severe/profound			
At least one middle ear condition	42.0	29.2	13.8	43.0	15.0	100.0
<i>OME</i>	30.2	37.7	17.1	54.8	15.0	100.0
<i>ETD</i>	64.7	<i>n.p.</i>	<i>n.p.</i>	25.5	9.8	100.0
<i>CSOM</i>	28.3	34.6	21.5	56.1	15.6	100.0
<i>Dry perforation</i>	44.8	33.1	13.8	47.0	8.3	100.0
<i>AOM</i>	20.6	29.4	23.0	52.4	27.0	100.0
<i>Foreign body/other^(c)</i>	48.7	23.0	8.9	32.0	19.3	100.0
No middle ear condition ^(d)	89.4	<i>n.p.</i>	<i>n.p.</i>	4.4	6.2	100.0

n.p. not publishable because of small numbers (<5) or confidentiality.

(a) Health status of children at most recent audiology service.

(b) Missing includes not stated, unsure and invalid responses.

(c) Other includes: grommets, reduced ear drum movement or retracted ear drum, or other ear condition.

(d) Where no middle ear condition reported for both ears.

Notes

1. Data are only reported for children where consent was obtained.

2. Services include only those that were provided through SFNT program.

Source: AIHW analysis of SFNT audiology database for services provided on or before 30 June 2013.

2.7 Changes in middle ear conditions over time

Table 2.15 shows changes in the proportion of children with middle ear conditions among children who participated in the SFNT and CHCI(CtG) program and received two or more audiology services. Although some of these changes may be partly attributed to the fluctuating nature of OM, the information in this section provides valuable information on the outcomes of medical intervention.

Most children experienced an improvement in their health condition. Seventy-three per cent had at least one middle ear condition at their last SFNT service, which compares with 86% of children at their last CHCI(CtG) service (Table 2.15). This represents a decrease of 15% (or 13 percentage points). The proportion of children with no middle ear condition increased by 93% (a percentage point difference of 13%).

Children with AOM experienced the greatest improvement in their condition, with the proportion decreasing by 55%. There were also substantial decreases in the proportion of children with OME (31%) and CSOM (14%). On the other hand, the proportion of children with foreign bodies or other middle ear conditions increased by 26%.

Table 2.15: Change in the prevalence of middle ear conditions, Indigenous children in the SFNT and CHCI(CtG) programs who received at least two audiology services^{(a)(b)}

Type of middle ear condition	Last CHCI(CtG)		Last SFNT service		Per cent change (y-x)÷x	Percentage point difference (y-x)
	service		Per cent			
	Number	Per cent (x)	Number	Per cent (y)		
At least one type of middle ear condition	635	86.0	539	73.0	-15.1	-13.0
<i>OME</i>	239	32.4	165	22.4	-31.0	-10.0
<i>ETD</i>	135	18.3	129	17.5	-4.4	-0.8
<i>CSOM</i>	130	17.6	112	15.2	-13.8	-2.4
<i>Dry perforation</i>	126	17.1	115	15.6	-8.7	-1.5
<i>AOM</i>	80	10.8	36	4.9	-55.0	-6.0
<i>Foreign body/other^(c)</i>	113	15.3	142	19.2	25.7	3.9
No middle ear condition ^(d)	103	14.0	199	27.0	93.2	13.0
Total children^{(e)(f)}	738	100.0	738	100.0

(a) Excludes 11 children with unknown or invalid HRN in the CHCI(CtG) dataset.

(b) Median time interval between first and second service: 20 months. Minimum time interval: 3 months.

(c) Other includes: grommets, reduced ear drum movement or retracted ear drum, or other ear condition.

(d) Where no middle ear condition reported for both ears.

(e) Indigenous children in the SFNT and CHCI(CtG) programs who received 2 or more audiology services. Excludes children with missing response for middle ear condition.

(f) The sum of the columns may be greater than 100% as children may have more than one middle ear condition.

Notes

1. Data are only reported for children where consent was obtained.

2. Services include only those that were provided through the SFNT program.

Source: AIHW analysis of SFNT and CHCI(CtG) audiology databases for services provided on or before 30 June 2013.

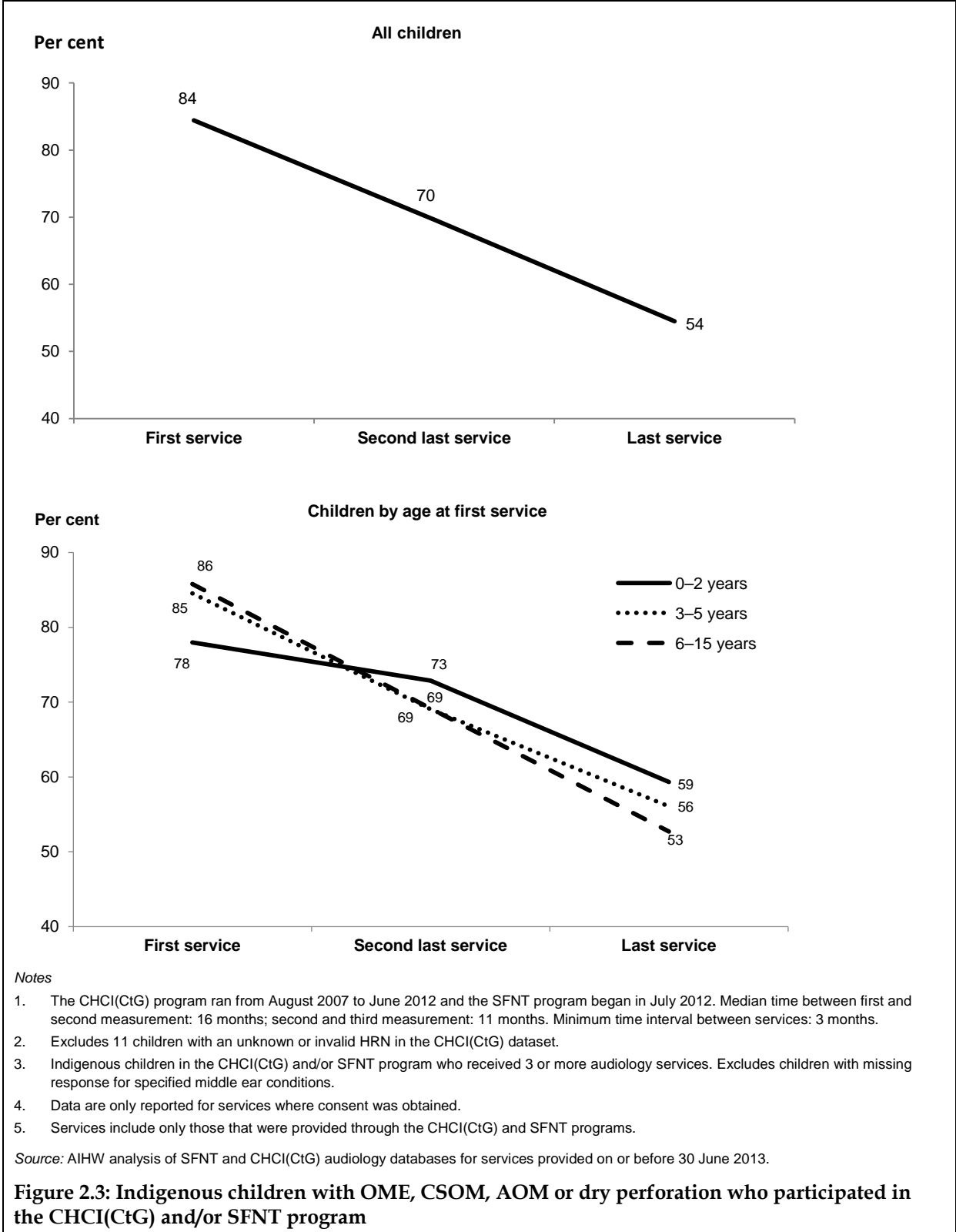
Figure 2.3 shows changes in the proportion of children with OM (AOM, CSOM, OME or dry perforation) for children who had 3 or more services in the SFNT and/or CHCI(CtG) program. Out of a total of 892 children, the proportion who had at least one type of OM decreased from 84% at first service to 70% at second last service, and to 54% at last service.

Patterns for age were similar, although children in the older age groups (3–5 years and 6–15 years) were more likely than younger children (0–2 years) to experience health improvements. Of children aged 0–2 at their first service (118), the proportion with at least one type of OM changed from 78% to 59% between first and last service (a decrease of 19 percentage points). This compares with children aged 3–5 (239) and 6–15 (535), where the proportions changed from 85% to 56% (a decrease of 29 percentage points), and 86% to 53% (a decrease of 33 percentage points), respectively.

While the medical and public health interventions received through the SFNT and CHCI(CtG) programs are likely to have played an important role in improving children’s ear health, it must be noted that audiology assessments alone (which are essentially diagnostic) may not necessarily lead to immediate health improvements. Audiological assessments, however, play a critical role in the care pathway by enabling health practitioners to determine appropriate forms of primary clinical care or specialist ENT intervention. As discussed earlier, audiologists provide recommendations for further action which may include case management by primary health care services or ENT specialists (Section 2.3). In this regard, audiology outreach teams work closely with local health services and provide a bridge between patients and essential treatments which may lead to improvements in ear

health. The outreach teams also play a valuable role in providing ear health education and raising awareness of ear health issues.

It is also important to note that it is possible that the natural history of the disease has contributed to the observed improvements in children's health. As discussed in Section 2.6, the prevalence of OM is highest among younger children (aged 0–5), particularly with regard to AOM and OME (Table 2.12). Other research has shown that the proportion of children with middle ear disease decreases with increasing age (Williams et al. 2009), and that the incidence of AOM declines after 6 to 7 years of age (Australian Hearing 2013). As the children examined in this analysis have been tracked over the course of the CHCI(CtG) and SFNT programs, it is possible that the changes observed may, in part, reflect the ageing of the cohort. This factor alone, however, cannot explain the degree of improvement in outcomes which were of a greater magnitude for children in the older age groups. If maturation was the main issue, then greater improvement in the younger age groups would be expected. It is therefore likely that medical and public health interventions, as well as the natural process of maturation, have contributed to improved ear health outcomes.



3. Child Hearing Health Coordinator program

The CHHC program provides services to Indigenous children who have a diagnosed ear condition or hearing impairment. Co-ordinators operate from 7 regionally based Health Development Teams in the Northern Territory. The program is based on a case management model of service delivery where the co-ordinators administer clinical care and link children with specialist and community health services. This approach was developed in response to the difficulties encountered in treating ear disease in the Northern Territory, where the persistent and recurrent nature of the disease, combined with the challenges involved in delivering services in remote areas, made it a very complicated disease to manage (AIHW 2011). The treatment, for example, often involves frequent monitoring and assessment, the co-ordination of multiple health services (such as GPs, paediatricians, child health nurses and ENT specialists), adjustment in non-medical settings (such as school, child care or the home environment), and the provision of treatment at critical times in the disease process. Co-ordinators monitor the health status of children, co-ordinate treatment strategies, and facilitate contact with a range of service providers while ensuring continuity of care.

The CHHC program is available to Indigenous children who have been assigned a priority listing. The hearing health priority categories are:

- HP1: Infants under 12 months with recurrent AOM or CSOM. Infants who have failed Newborn Hearing Screening.
- HP2: Children aged 1–2 with perforation of the eardrum (with or without discharge), recurrent AOM or persistent bilateral OME.
- HP3: Children aged 3–5 with perforation of the ear drum (with or without discharge), recurrent AOM, persistent bilateral OME or moderate to profound hearing impairment.
- HP4: Children aged 6–10 with moderate, severe or profound hearing impairment.

At the completion of each visit, a service form is completed by the treating clinician. The form captures information on:

- demographic characteristics of children including age, sex, date of birth and community where service was provided
- HRN and priority listing
- ear health of children including diagnosis of middle ear condition
- clinical service activities provided
- contacts made with other service providers.

This chapter provides information on the children who participated in the CHHC program, the services they received and their health condition. Where children attended multiple visits, demographic characteristics, priority listing and hearing health status are based on information at first visit. As admission into the program, and the care pathway, are based on priority categorisation (that is, age and health condition), it is important to know the status of children upon entry into the program.

It must be noted that this is the first year of data collection for the CHHC program, and this program is currently in the process of being established, including recruiting and training staff. Therefore, only a limited amount of information can be reported. In particular, due to

the relatively small numbers of children captured in the data, it is not possible to provide information on changes in health status. Such information, however, may be presented in future reports.

3.1 Children and visits

From July 2012 to June 2013, 174 Indigenous children participated in the CHHC program and attended a total of 181 visits (Table 3.1). Consent for sharing information with the AIHW was obtained for most children and visits (around 94%). Analyses for the remainder of this chapter are based on data where consent was obtained (163 children and 170 visits). It is not possible to evaluate the impact of non-consented data on the analyses.

Table 3.1: Number of Indigenous children in the CHHC program and number of visits, by consent status, July 2012 to June 2013

	Visits			Children		
	Consent	Non-consent	Total	Consent	Non-consent	Total
Number	170	11	181	163	11	174
Per cent	93.9	6.1	100.0	93.7	6.3	100.0

Note: Services include only those that were provided through the SFNT program.

Source: AIHW analysis of SFNT CHHC database for services provided on or before 30 June 2013.

Slightly more girls (55%) than boys participated in the program. About two-thirds of children were assigned a priority category of 2 or 3, almost one-quarter category 4, and 9% category 1 (Table 3.2).

Table 3.2: Number of Indigenous children in the CHHC program, by sex and priority listing, July 2012 to June 2013

	Number	Per cent
Sex^(a)		
Male	74	45.4
Female	89	54.6
Total	163	100.0
Priority listing^(a)		
HP1	15	9.2
HP2	52	31.9
HP3	60	36.8
HP4	36	22.1
Total	163	100.0

(a) Status at first visit.

Notes

1. Data are only reported for children where consent was obtained.
2. Services include only those that were provided through the SFNT program.

Source: AIHW analysis of SFNT CHHC database for services provided on or before 30 June 2013.

3.2 Types of services provided

CHHCs provided a variety of services to children in the program, including a range of clinical services as well as facilitating contact with other clinicians.

The most common types of clinical services provided were ear health education (provided in 96% of visits), verification of diagnosis (83% of visits), discussion of hearing loss strategies (79%), support for audiological management (78%), and confirmation of regular follow-up and care plan (77%)(Table 3.3).

Table 3.3: Type of clinical services provided at CHHC visits, July 2012 to June 2013

Clinical services	Number	Per cent
Discussed ear health education	163	95.9
Verified diagnosis	141	82.9
Discussed hearing loss strategies	134	78.8
Supported audiological management	132	77.6
Confirmed regular follow-up & care plan	131	77.1
Discussed treatment adherence strategies	92	54.1
Verified or amended treatment	80	47.1
Support ENT management	61	35.9
Total visits^(a)	170	100.0

(a) Children can be provided with multiple clinical services, and as such, the sum of the columns may total more than 100%.

Notes

1. Data are only reported for children where consent was obtained.
2. Services include only those that were provided through the SFNT program.

Source: AIHW analysis of SFNT CHHC database for services provided on or before 30 June 2013.

In addition, a range of health service providers were contacted by CHHCs for further services. The most common contacts were with health providers (49%) and education providers (39%) (Table 3.4).

Table 3.4: Contact made with other service providers at CHHC visits, July 2012 to June 2013

Service providers	Number	Per cent
Health providers	84	49.4
Education providers	67	39.4
Australian Hearing	17	10.0
Community-based workers	11	6.5
Total visits^(a)	170	100.0

(a) Children can be provided with multiple service provider contacts, and as such, the sum of the columns may total more than 100%.

Notes

1. Data are only reported for children where consent was obtained.
2. Services include only those that were provided through the SFNT program.

Source: AIHW analysis of SFNT CHHC database for services provided on or before 30 June 2013.

3.3 Ear health of children

3.3.1 Middle ear conditions

Ninety-six per cent of children who participated in the CHHC program were diagnosed with at least one type of middle ear condition (Table 3.5). It is important to note that children must have an ear condition or hearing impairment to be referred to the program.

The most common condition was OME (present in 41% of children), followed by AOM (29%), CSOM (23%), foreign bodies or other conditions (18%), dry perforation (15%), and ETD (9%).

Table 3.5: Type of middle ear condition, Indigenous children in the CHHC program, July 2012 to June 2013

Type of middle ear condition ^(a)	Number	Per cent
At least one type of middle ear condition	157	96.3
<i>OME</i>	67	41.1
<i>ETD</i>	14	8.6
<i>CSOM</i>	38	23.3
<i>Dry perforation</i>	24	14.7
<i>AOM</i>	47	28.8
<i>Foreign body or other</i>	29	17.8
No middle ear condition ^(b)	6	3.7
Total children^(c)	163	100.0

(a) Middle ear condition at first visit.

(b) No middle ear condition reported for both ears.

(c) Children can be provided with multiple services, and as such, the sum of the columns may total more than 100%.

Notes

1. Data are only reported for children where consent was obtained.
2. Services include only those that were provided through the SFNT program.

Source: AIHW analysis of SFNT CHHC database for services provided on or before 30 June 2013.

3.3.2 Hearing loss and hearing impairment

The CHHC program does not collect information on hearing loss and hearing impairment, however, if children in the CHHC program also participated in the audiology program it is possible to link them to ascertain hearing health status.

Of the 163 children in the CHHC program, 156 (96%) had an audiology service (Table 3.6). Of these, 74% had some form of hearing loss, 3% had no hearing loss, 19% could not be tested and there were missing responses for 3%. Children were more likely to have bilateral hearing loss (65%) than unilateral (9%).

Thirty-seven per cent of children who participated in both programs had mild hearing loss and 22% had moderate, severe or profound loss (Table 3.7). Twenty per cent of children could not be tested and there were missing responses for 6%.

Table 3.6: Hearing loss status^(a), Indigenous children in the CHHC and audiology programs^(b)

Hearing status	Number	Per cent
No hearing loss	5	3.2
Hearing loss ^(c)	116	74.4
<i>Unilateral (one ear)</i>	14	9.0
<i>Bilateral (both ears)</i>	102	65.4
Not tested ^(d)	30	19.2
Missing ^(e)	5	3.2
Total children	156	100.0

(a) Based on hearing status at last audiology service.

(b) Children in the CHHC program who also had an audiology service provided through the SFNT or CHCI(CtG) program.

(c) Total children with unilateral and bilateral hearing loss.

(d) Some children may not be tested because they may find it difficult to cooperate with the procedure.

(e) Missing includes not stated, unsure, invalid and not tested responses.

Notes

1. Data are only reported for children where consent was obtained.

2. Services include only those that were provided through the SFNT or CHCI(CtG) programs.

Source: AIHW analysis of the SFNT CHHC database and the SFNT/CHCI(CtG) audiology databases for services provided on or before 30 June 2013.

Table 3.7: Degree of hearing impairment^(a), Indigenous children in the CHHC and audiology programs^(b)

Degree of hearing impairment	Number	Per cent
None	24	15.4
Mild	58	37.2
Moderate/severe ^(c)	34	21.8
Not tested ^(d)	31	19.9
Missing ^(e)	9	5.8
Total children	156	100.0

(a) Based on hearing status at last audiology service.

(b) Children in the CHHC program who also received an audiology service provided through the SFNT or CHCI(CtG) program.

(c) There were no children with profound hearing impairment.

(d) Some children may not be tested because they may find it difficult to cooperate with the procedure.

(e) Missing includes not stated, unsure, invalid and not tested responses.

Notes

1. Data are only reported for children where consent was obtained.

2. Services include only those that were provided through the SFNT or CHCI(CtG) programs.

Source: AIHW analysis of the SFNT CHHC database and the SFNT/CHCI(CtG) audiology databases for services provided on or before 30 June 2013.





HEARING HEALTH PROGRAM
CHHC SERVICE FORM

DEPARTMENT OF HEALTH

COMMUNITY:	CHHC:	VISIT DATE: / /
FIRST NAME:	OTHER NAME:	
FAMILY NAME:	HRN:	
DOB: / /	<input type="checkbox"/> MALE <input type="checkbox"/> FEMALE	CARER:

EAR HEALTH

OTOSCOPY						PRIORITY	
 <p><i>Right Tympanic Membrane</i></p>		 <p><i>Left Tympanic Membrane</i></p>		<input type="checkbox"/> HP1 <input type="checkbox"/> HP2 <input type="checkbox"/> HP3 <input type="checkbox"/> HP4 See Table 2: Priority Activities			
Pneumatic Otoscopy Mobility: <input type="checkbox"/> None <input type="checkbox"/> Slight <input type="checkbox"/> Normal <input type="checkbox"/> DNT COMMENTS:		Pneumatic Otoscopy Mobility: <input type="checkbox"/> None <input type="checkbox"/> Slight <input type="checkbox"/> Normal <input type="checkbox"/> DNT COMMENTS:		CLINICAL SERVICE ACTIVITIES		Comments	
				Verified Diagnosis		<input type="checkbox"/>	
				Verified or Amended Treatment		<input type="checkbox"/>	
				Confirmed Regular Follow Up & Care			
				Plan		<input type="checkbox"/>	
				Discussed Treatment Adherence			
				Strategies		<input type="checkbox"/>	
				Discussed Hearing Loss Strategies		<input type="checkbox"/>	
TYMPANOMETRY							
EAR	TYPE	MEP	MEC	ECV	DNT	Discussed Ear Health Education	
RIGHT						Supported Audiological M'tment	
LEFT						Supported ENT Management	
DIAGNOSIS AS PER CARPA				Right	Left	CONTACT WITH OTHER PROVIDERS	
NAD / None				<input type="checkbox"/>	<input type="checkbox"/>	Education Providers	
Eustachian Tube Dysfunction				<input type="checkbox"/>	<input type="checkbox"/>	Health Provider	
Otitis Media with effusion				<input type="checkbox"/>	<input type="checkbox"/>	Community-based Worker	
Acute Otitis Media without perforation				<input type="checkbox"/>	<input type="checkbox"/>	Australian Hearing	
Acute Otitis Media with perforation				<input type="checkbox"/>	<input type="checkbox"/>	Other	
Chronic Suppurative Otitis Media				<input type="checkbox"/>	<input type="checkbox"/>		
Dry Perforation				<input type="checkbox"/>	<input type="checkbox"/>		
Other.....				<input type="checkbox"/>	<input type="checkbox"/>		
COMMENTS							
<input type="checkbox"/> Results entered into PCIS / Communicare Clinician Name:..... Signature:.....							

Appendix 2: Data quality statement

Data quality statement: Stronger Futures in the Northern Territory (SFNT) hearing health data collections

Summary of key data quality issues

- Children who receive SFNT audiology or CHHC services are not a random sample of Indigenous children in the Northern Territory. Although audiology services are available to all Indigenous children under 16 years of age, not all eligible children access these services. The CHHC program is only available to Indigenous children who have a referral from a health professional.
- The data that have been collected as part of the SFNT hearing health program are a by-product of a clinical process. That is, health professionals providing services document the results on standard data collection forms which are then forwarded to the AIHW.
- The extent of missing data should be taken into account when using and interpreting SFNT data. Where possible, published tables show the percentage of missing data.

Description

The National Partnership Agreement on Stronger Futures in the Northern Territory (SFNT) was implemented mid-2012 outlining a 10-year commitment to 2021–22. It is funded by the Australian Government and delivered by the Northern Territory Government. The AIHW collects data on 2 of the programs of the hearing health component of the SFNT: the delivery of audiology services and the Child Hearing Health Coordinator (CHHC) program.

Audiology services are available to all Indigenous children under 16 in the Northern Territory, while the CHHC program is available to Indigenous children with an identified middle ear condition or hearing impairment who have been referred to the program.

Institutional environment

The Australian Institute of Health and Welfare (AIHW) is a major national agency set up by the Australian Government under the *Australian Institute of Health and Welfare Act 1987* to provide reliable, regular and relevant information and statistics on Australia's health and welfare. It is an independent statutory authority established in 1987, governed by a Management Board, and accountable to the Australian Parliament through the Health portfolio.

The AIHW aims to improve the health and wellbeing of Australians through better health and welfare information and statistics. It collects and reports information on a wide range of topics and issues, ranging from health and welfare expenditure, hospitals, disease and injury, and mental health, to ageing, homelessness, disability and child protection.

The Institute also plays a role in developing and maintaining national metadata standards. This work contributes to improving the quality and consistency of national health and welfare statistics. The Institute works closely with governments and non-government organisations to achieve greater adherence to these standards in administrative data collections to promote national consistency and comparability of data and reporting.

One of the main functions of the AIHW is to work with the states and territories to improve the quality of administrative data and, where possible, to compile national datasets based on

data from each jurisdiction, to analyse these datasets and disseminate information and statistics.

The Australian Institute of Health and Welfare Act 1987, in compliance with the *Privacy Act* 1988, ensures that the data collections managed by the AIHW are kept securely and under the strictest conditions with respect to privacy and confidentiality.

For further information see the AIHW website <www.aihw.gov.au>

The AIHW is responsible for undertaking the data management, analysis and reporting of information collected as part of the hearing health component of the SFNT.

Data collection forms are completed by clinical service providers and forwarded to the AIHW via the Northern Territory Department of Health (NT DoH). The Department is responsible for providing a wide range of health and family services, and delivers services related to the Ministerial responsibilities of Health and Senior Territorians. For further information see the NT DoH website: <www.health.nt.gov.au>

Timeliness

The first report from the SFNT Audiology and CHHC data collections will be published in January 2014, with a reference period of July 2012 to June 2013. It is expected that future reports will be published on an annual basis.

Due to the nature of the collection process, there is a lag between the date when the service was provided and the date of data receipt. This means that at any point in time, there may be services provided that have not yet been captured in the data collection.

Accessibility

SFNT reports can be downloaded free of charge from the website of the AIHW: AIHW Publications.

Permission to obtain unpublished data must be sought from NT DoH and the Australian Government Department of Health. In addition, approvals from relevant ethics committees of the Northern Territory may be required.

Interpretability

SFNT reports contain basic information about the programs and the data contained in the report to enable interpretation of this information. The first report from the SFNT hearing health program will be published by the AIHW in January 2014.

A copy of the *National Partnership Agreement on Stronger Futures in the Northern Territory* is available on the website of the Standing Council on Federal Financial Relations.

Relevance

Children who receive SFNT audiology or CHHC services are not a random sample of Indigenous children in the Northern Territory. Although audiology services are available to all Indigenous children under 16, not all eligible children access these services. The CHHC program is only available to Indigenous children who have a referral from a health professional. As such, it is important to note that SFNT data cannot be used to determine the prevalence of health conditions among all Indigenous children in the Northern Territory.

The data that have been collected from services delivered under the SFNT are a by-product of a clinical process. That is, health professionals providing audiology and CHHC services

document the results on standard data collection forms which are then forwarded to the AIHW.

The AIHW SFNT hearing health collections consists of two separate databases:

Audiology data collection

Captures data on children who receive audiology services funded through the SFNT. All Indigenous children in the Northern Territory under 16 are eligible for services. Includes information on type and degree of hearing loss (if any), hearing impairment (if any), middle ear conditions (if any), and the requirement for further action.

CHHC data collection

Captures data on children who participated in the CHHC program. Indigenous children are referred to this program if they have an identified middle ear condition or hearing impairment. Includes information on ear health (results of otoscopy and tympanometry), middle ear conditions (if any), clinical services provided, and contact with other service providers.

Accuracy

Health providers use standard forms to record information from the audiology and CHHC services. The forms were developed by NT DoH in consultation with the Australian Government Department of Health and the AIHW.

The extent of missing data should be taken into account when using and interpreting SFNT data. Where possible, published tables show the percentage of missing data.

Not all audiology services provided in the Northern Territory are captured in the SFNT audiology or CHHC databases. These data collections only capture hearing health services funded through the SFNT.

To obtain unit record data for the AIHW SFNT audiology and CHHC collections, consent for sharing information must be obtained from children and families. If children or families do not give consent for their information to be used in unit record form, their information cannot be presented by demographic characteristics or referral type, but only in aggregated form. The proportion of non-consented data varies over time, however, in general it is around 1% for children who received audiology services, and 6% for children in the CHHC program.

In order to protect privacy, personal information, such as the child's name, is not provided to the AIHW. As such, children can only be tracked using a Hospital Registration Number (HRN).

Coherence

The SFNT audiology services were originally funded through the Child Health Check Initiative/Closing the Gap (CHCI[CtG]) program that ran from August 2007 to June 2012. Direct comparisons with data from this program cannot be made due to differences in the programs. The CHCI(CtG) services were provided to Indigenous children in prescribed areas of the Northern Territory and targeted towards children who had a referral from their initial Child Health Check. The audiology services provided through the SFNT are available to all Indigenous children in the Northern Territory under the age of 16. The final report from the CHCI(CtG) program, *Northern Territory Emergency Response Child Health Check Initiative – follow-up services for oral and ear health: final report 2007–2012*, was published in 2012 and is available from the AIHW website.

Glossary

Acute otitis media (AOM)	Describes presence of suppurative (infected) middle ear fluid with or without eardrum perforation.
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 for detecting and discriminating 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.
Chronic suppurative otitis media (CSOM)	A persistent suppurative discharge from the middle ear through a tympanic membrane perforation for more than six weeks.
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).
Dry perforation	A CSOM condition that appears as a hole in the eardrum without any evidence of suppurative otitis media (either acute or chronic).
Eustachian tube dysfunction	Negative middle ear pressure associated with compromised equalisation impeding middle ear function and sometimes causing middle ear fluid accumulation.
Hearing	Hearing is the sense for perceiving sounds and includes regions within the brain where the signals are received and interpreted.
Hearing loss	Describes any hearing threshold response (using audiometry) outside the normal range, at any sound stimuli, in either ear. Hearing loss in a population describes the number of children who have abnormal hearing. Hearing loss may affect one ear (unilateral) or both ears (bilateral).
Mixed hearing loss	Hearing loss that has conductive and sensorineural components combined.
Otitis media (OM)	A condition with any inflammation, fluid or suppurative infection in the middle ear.
Otitis media with effusion (OME)	The presence of intact eardrum and middle ear fluid without symptoms or signs of infection.
Persistent	A hearing loss or otitis media condition that is demonstrated to have been present for 3 months or longer.
Sensorineural hearing loss	A deviation of hearing threshold from the normal range attributable to problems in the inner ear or vestibulocochlear nerve.
Suppurative	Describes pus produced in response to inflammatory bacterial infections.

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.
Visual reinforce observation audiometry (VROA)	A hearing assessment technique using specialised sound field facilities that is appropriate for smaller children and babies 9–36 months). When able to sit and turn their heads independently, children can be conditioned to repeatedly and reliably respond to frequency specific warble tones, presented via speaker, headphone or bone conductor. This conditioned response is reinforced through provision of a visual reward (puppet) to obtain threshold (softest) measures. Results obtained via speaker (standard test) do not provide separate ear information but determine adequacy of hearing for speech and language development and reflect the better ear.

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Related publications

AIHW 2011. Ear and hearing health of Indigenous 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.

This report presents data on the Indigenous children who participated in the audiology and Child Hearing Health Coordinator (CHHC) programs delivered under the National Partnership Agreement on Stronger Futures in the Northern Territory.

During 2012–13, 1,807 audiology services were provided to 1,541 children. A total of 174 children participated in the CHHC program and presented for 181 visits. Of children who received audiology services, 72% were diagnosed with at least one type of middle ear condition and about 10% had moderate, severe or profound hearing impairment.