



## **Summary: Hearing Screening**

### **Ireland**

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## 1. Glossary of Terms: Hearing Screening

<b>Abnormal test result</b>	A test result where a normal “pass” response could not be detected under good conditions. The result on screening equipment may indicate “no response,” “fail,” or “refer.”
<b>Attendance rate</b>	<p>The proportion of all those <u>invited for screening</u> that are <u>tested and receive a result</u>,</p> <ul style="list-style-type: none"> <li>• <u>Invited for screening</u> includes all those that are offered the screening test.</li> <li>• <u>Tested and receive a result</u> could be a “pass” or “fail”.</li> </ul> <p>Attendance rate provides information on the willingness of families to participate in screening.</p>
<b>Attendance rate in first year of life</b>	<p>See definition of <b>Attendance rate</b>.</p> <p>The calculation cut-off is after <u>one year of life</u>.</p>
<b>Compliance with referral (percentage)</b>	<p>The percentage of those who are <u>referred from screening</u> to a diagnostic assessment that actually <u>attend</u> the first diagnostic assessment.</p> <p>Percentage of compliance provides information on the willingness of families to attend the diagnostic assessment after referral from screening.</p>
<b>Coverage</b>	<p>The proportion of those <u>eligible for screening</u> that are <u>tested and receive a result</u> within a <u>specific time</u>.</p> <ul style="list-style-type: none"> <li>• <u>Eligible for screening</u> includes those within the population that are covered under the screening or health care program.</li> <li>• <u>Tested and receive a result</u> could be a “pass” or “refer to diagnostic assessment”.</li> <li>• <u>Specific time</u> can be defined, such as 1 month after birth, 3 months after birth, etc.</li> </ul> <p>Coverage provides information on the overall effectiveness and timeliness of a complete screening programme.</p> <p>Factors such as being offered screening, willingness to participate, missed screening, ability to complete the screen, and ability to document the screening results will influence the coverage.</p>
<b>Coverage in first year of life</b>	<p>See definition of <b>Coverage</b>.</p> <p>The <u>specific time</u> is pre-defined as within the first year of life.</p> <p>In other words, the coverage is the proportion of those eligible for screening that complete the screening sequence to a final result within the first year of life.</p>
<b>False negatives</b>	The percentage of <u>infants/children with a hearing loss</u> (defined by the target condition) that <u>receive a result of “pass”</u> during screening.



	<p>Example: If 100 infants with hearing loss are screened, and 1 infant passes the screening, the percentage of false negatives is 1%.</p>
<b>False positives</b>	<p>The percentage of <u>infants/children with normal hearing</u> that <u>receive a result of “fail”</u> from the final screening test.</p> <p>Example: If 100 infants with normal hearing are screened, and 3 infants fail the screening and are referred for diagnostic assessment, the percentage of false positives is 3%.</p>
<b>Guidelines</b>	<p>Recommendations or instructions provided by an authoritative body on the practice of screening in the country or region.</p>
<b>Hearing screening professional</b>	<p>A person qualified to perform hearing screening, according to the practice in your country or region.</p>
<b>Inconclusive test result</b>	<p>A test result where a normal “pass” response could not be detected due to poor test conditions.</p>
<b>Invited for screening</b>	<p>Offered screening.</p>
<b>Outcome of hearing screening</b>	<p>An indication of the effectiveness or performance of screening, such as a measurement of coverage rate, referral rate, number of infants detected, etc.</p>
<b>Permanent hearing loss</b>	<p>A hearing impairment that is <i>not</i> due to a temporary or transient condition such as middle ear fluid.</p> <p>Permanent hearing loss can be either sensorineural or permanent conductive.</p>
<b>Positive predictive value</b>	<p>The percentage of infants/children referred from screening who have a confirmed <u>hearing loss</u>, as described by your protocol or guideline and indicated in the <b>Target Condition</b> (see definition).</p> <p>For example, if 100 babies are referred from screening for diagnostic assessment and 90 have normal hearing while 10 have a confirmed hearing loss, the positive predictive value would be 10%.</p>
<b>Preschool or (pre)school children</b>	<p>All children between 3-6 years of age.</p>
<b>Preschool or (pre)school screening</b>	<p>Screening that takes place during the time children are between 3-6 years of age.</p> <p>This refers to <i>any</i> hearing screening during this age. The location of the screening is irrelevant to the definition.</p>



<b>Prevalence</b>	The number or percentage of individuals with a specific disease or condition. Prevalence can either be expressed as a percentage, proportion, or as the value per 1000 individuals within the same demographic.
<b>Programme</b>	An organized system for screening, which could be based nationally, regionally or locally.
<b>Protocol</b>	Documented procedure or sequence for screening, which could include which tests are performed, when tests are performed, procedures for passing and referring, and so forth.
<b>Quality assurance</b>	A method for checking and ensuring that screening is functioning adequately and meeting set goals and benchmarks.
<b>Referral criteria</b>	A pre-determined cut-off boundary for when an infant/child should be re-tested or seen for a diagnostic assessment.  For example, referral criteria may be “no response” at 35 dB nHL.
<b>Risk babies / Babies at-risk</b>	All infants that are considered to be at-risk or have risk-factors for hearing loss according to the screening programme.  Two common risk factors are admission to the neonatal-intensive care unit (NICU) or born prematurely. However, other risk factors for hearing loss may also be indicated in the screening programme.
<b>Sensitivity</b>	The percentage of infants/children with hearing loss that are identified via the screening program.  For example, if 100 babies with hearing loss are tested, and 98 of these babies are referred for diagnostic assessment while 2 pass the screening, the sensitivity is 98%.
<b>Specificity</b>	The percentage of infants/children with normal hearing that pass the screening.  For example, if 100 babies with normal hearing are tested, and 10 of these babies are referred for diagnostic assessment and 90 pass the screening, the specificity is 90%.
<b>Target condition</b>	The hearing loss condition you are aiming to detect via your screening programme. This includes: <ul style="list-style-type: none"> <li>• The <u>laterality of the condition</u>, whether the program aims to detect both unilateral and bilateral hearing loss or just bilateral hearing loss.</li> <li>• The <u>severity of the condition</u>, whether the program aims to detect hearing loss <math>\geq 30</math> dB HL, <math>\geq 35</math> dB HL, <math>\geq 40</math> dB HL or <math>\geq 45</math> dB HL</li> </ul>
<b>Well, healthy babies</b>	Infants who are <i>not</i> admitted into the NICU or born prematurely.  Well, healthy babies may or may not have additional risk factors for hearing loss, according to the procedures indicated in the specific screening programme.



## **2. Abbreviations**

ABR – auditory brainstem response

aABR – automatic auditory brainstem response

ANSD – auditory neuropathy spectrum disorder

ASSR – auditory steady-state response

CHO – community health organization

CI – cochlear implant

CMV – cytomegalovirus

dB HL – decibel hearing level

dB nHL – decibel normalized hearing level

dB SNR – decibel signal-to-noise ratio

DPOAE – distortion product otoacoustic emissions

HA – hearing aid

HSE – health service executive

NICU – neonatal intensive care unit

OAE – otoacoustic emissions

TEOAE – transient-evoked otoacoustic emissions

UNHS – universal newborn hearing screening



### 3. Background

In Ireland, hearing screening is performed nationally and organized nationally across the nine community health organizations (CHOs) of the Health Service Executive (HSE).

The Health Service Executive (HSE) is a public sector organization implemented after the publication of the Health Act of 2004, and is the universal organization providing health and personal social services to residents of Ireland. The HSE is funded by the government with a budget of around 15 billion euros, employing over 65 000 individuals and funding an additional 35 000 workers.

Information about the HSE is available through their website ([www.hse.ie](http://www.hse.ie)).

The nine CHOs are organized geographically, where each CHO area has about 350 000 to 670 000 population.

The following report contains information with regards to childhood hearing screening across the entire country of Ireland.

#### 3.1. General

The total island of Ireland has an area of 84 421 km<sup>2</sup> and the republic of Ireland has an area of 70 282 km<sup>2</sup> with a population of 4 749 153 as of 2017 (Central Statistics Office, 2018).

In Ireland, all births are registered. The number of live births in Ireland in 2015 was 65 607 (Central Statistics Office, 2018).

The World Bank income classification categorizes Ireland as a high-income country (The World Bank, 2018). The gross domestic product (GDP) in 2015 was €61 928 per capita (Central Statistics Office, 2018).

From the World Health Organization (WHO) Global Health Expenditure Database, health expenditure for Ireland in 2015 was 4626 USD or €4027 per capita (World Health Organization (WHO), 2018).

An infant mortality rate of 3.4 per 1000 and 3.3 per 1000 is reported for Ireland for 2015 and 2017, respectfully (United Nations Statistics Division, 2016; Central Statistics Office, 2018).

#### 3.2. Neonatal hearing screening

In Ireland, neonatal hearing screening is conducted universally, with all babies in the country having access to hearing screening, though participation is not obligatory for parents. Hearing screening is offered to all eligible infants<sup>1</sup> covered by the Irish health system without contraindications for hearing screening.

Hearing screening for well and at-risk babies started in April 2011 through a phased roll out and was fully implemented as a national programme across all of Ireland by November 2013. Neonatal hearing screening is funded by the state and embedded in the Preventive Child Health Care screening system.

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<sup>1</sup> Babies who are not eligible for UNHS include: a) Those born with congenital atresia. b) Those where meningitis is contracted, or where suspected, prior to screening being offered. c) Those who have suspected / Zika virus. d) Babies who have a prolonged period in Special Care Baby Unit, greater than 6 months. e) Babies receiving palliative care (in these cases the decision to screen or not is for the parents in discussion with the neonatologist). Infants will be referred to the local audiology service for diagnostic hearing assessment as and when appropriate by the hearing screening team or the child's paediatrician or neonatologist.

An information-communication technology (ICT) system is nationally implemented in Ireland for national control of data. Neonatal hearing screening is provided by Northgate Public Services (NPS) across all of Ireland under contract with the HSE.

### **3.3. Preschool hearing screening**

School-entry screening currently exists in Ireland, though contrary to neonatal hearing screening, there is no national programme. It is unknown when school-entry screening began in Ireland or since when it became available across the entire country. Screening is funded by the state and also embedded in the Preventive Child Health Care screening system.



## 4. Guidelines & Quality Control

There are national guidelines for hearing screening in Ireland. Specifically, for neonatal hearing screening, policies, procedures, protocols and guidelines (PPPG) are in effect, and all screening is managed through a central ITC system (Health Service Executive (HSE), 2014). For school-entry hearing screening, there is a school hearing screening policy; however, there is no central management or data collection (Health Service Executive (HSE), 2017).

The content of the hearing screening programme is decided on by the HSE national technical group for hearing screening (NTGCHS). The NTGCHS specifies the requirements for newborn hearing screening. It is based upon the English NHSP programme. The HSE tenders for the screening service nationally, in line with HSE procurement requirement. This is typically on a 3 +2 +2-year contract, pending successful metrics by the provider.

The current Universal Newborn Hearing Screening (UNHS) Governance document provides details related to the service provision for UNHS, including care pathways and guidelines. The service reviews the need for new or amended PPPGs and these are developed on an as needs basis (e.g. change in CMV pathway, where suspected or confirmed referral for diagnostic services are expedited). The governance guidelines are reviewed by the NTGCHS every 3 years.

Since the establishment of the programme, there have been some revisions. First, the age for hearing screening was increased from 3 to 6 months for infants with complex medical needs who have been hospitalized from birth. Second, a protocol for managing cases of infants undergoing palliative care was established. And within most recent UNHS tender, an ABR peer review ICT system (SONAR: system for online ABR peer review) was initiated to provide a quality assurance mechanism for diagnostic ABRs.

The protocol for school screening has been changed once since implementation, specifically with the removal of 500 Hz as a test frequency. In theory, school-entry screening protocols should be reviewed every two years. The revision process takes place by formulating a consensus document within the NTGCHS using external feedback, such as those from school screeners.

Quality assurance of the HSE national neonatal hearing screening programme is imposed and provided at different levels. Within each of the CHO structures, there is an oversight group who reviews local KPIs / metrics and communicates risks and issues with the national technical group for children's hearing screening. This governance group now reports to the National Group for Child Health Screening and Surveillance.

The universal newborn hearing screening governance document describes the process of quality assurance, though this document is currently under revision. First, the programme should adhere to quality standards outlined in the governance document. Second, quality assurance is performed via the central collection of universal newborn hearing screening metrics, which are reviewed by the National Technical Group for Childhood Hearing Screening. Third, clinical audits are performed. Fourth, programme staff are qualified and monitored. Finally, internal quality assurance procedures are expected by screening providers (e.g., monitoring of day-to-day operations, risk management, data downloading practice, etc).

While key performance indicators are regularly monitored, only one annual report has been published to date (Health Service Executive (HSE), 2012).



The UNHS programme is relatively new and research to date has been limited though is a priority for 2019. There have not been studies published on the effectiveness of hearing screening in Ireland.



## 5. Process: Screening, Diagnosis, Intervention

### 5.1. Neonatal hearing screening

Well and at-risk babies are screened in the hospital, in a quiet room if possible. At-risk infants may also be screened in the NICU. In Ireland, 99.72% of infants are born in a hospital, and 0.28% are born at home. For single normal births, 54% of infants/mothers stayed up to 2 days in the maternity hospital after delivery, and 44% stayed for 3-5 days. The average length of stay was 3.2 days (Healthcare Pricing Office (HPO), Health Service Executive (HSE), 2014). A list of the 19 maternity unit sites and two paediatric hospitals (for complex needs babies) that perform neonatal hearing screening is available in Appendix A.

Parents/caregivers of eligible well and at-risk babies are invited to participate in neonatal hearing screening directly in person in the hospital by dedicated screeners.

Hearing screening should be completed within 4 weeks after birth; however, some NICU babies, particularly if premature, have screening completed within 3 months as screening would not be age-appropriate by 4 weeks.

The same hearing screening protocol is carried out across all of Ireland. Protocol states that hearing screening is contraindicated among children with bacterial meningitis, atresia, suspected or confirmed CMV, suspected or confirmed zika virus and those under palliative care.

Infants admitted to the NICU for more than 48 hours are tested with a different protocol than well-babies due to the higher incidence of hearing loss and greater likelihood of auditory neuropathy spectrum disorder among these infants. Approximately 1% of neonates are admitted to the NICU.

Data are not available regarding the prevalence of CMV or meningitis among infants or children in Ireland.

The target condition for screening for well and at-risk babies is a bilateral hearing loss of 40 dB HL or worse.

### 5.2. Neonatal diagnostic assessment

Diagnostic audiological assessments are regionalized into nine central services to ensure that each diagnostic clinician performs a sufficient number of electrophysiological assessments.

The diagnostic assessment after neonatal hearing screening referral should be completed after 40 weeks gestational age and before 12 weeks after birth.

### 5.3. Preschool hearing screening

Screening takes place in schools in Ireland by a school or public health nurse. The target condition for school hearing screening is a hearing loss greater than 25 dB HL at 1, 2 and 4 kHz in one or both ears.

### 5.4. Intervention approach

In Ireland, treatment options available include grommets, hearing aids, bone conductive devices, cochlear implants, and Irish sign language. Parents / caregivers are offered amplification where clinically appropriate and depending upon parental consent are fitted with hearing aids within 2 weeks of diagnosis, significantly less than the 6 months of age target. Where parents have deferred the



decision to aid or there has been progression of hearing loss some children may be older than 6 months of age when they receive amplification. Children with a severe / profound bilateral loss at diagnostic assessment are referred immediately to the national cochlear implant programme for consideration of implantation, whilst hearing aid fitting and initial management occurs in the community audiology services. Children are implanted typically at around 6-12 months of age or older, depending upon clinical / medical requirements

Hearing aid fitting recommendations depend on the degree of hearing loss. Guidelines are available in a document from the HSE (Integrated Audiology Programme, 2017). Specifically, amplification is recommended for infants with bilateral sensorineural hearing loss  $>40$  dB eHL and fixed conductive hearing loss  $> 40$  dB eHL. Immediate amplification is not recommended for mild or unilateral hearing loss or for cases of ANSD. Recommendation for amplification of bilateral high- or low-frequency sloping hearing losses depend on the threshold of individual frequencies (Integrated Audiology Programme, 2017a; Integrated Audiology Programme, 2017b)



## 6. Protocols

Hearing screening protocols are described for neonatal hearing screening (well and at-risk) as well as for preschool hearing screening when applicable.

- The Test performed is the screening technique used
- The Age of the child is indicated in hours, days, months or years
- Referral criteria may be the lack of an OAE response at specified frequencies, a response-waveform repeatability constant, the absence of an aABR response at a specified intensity, or an absent behavioural response at a specified intensity. Referral criteria may be defined within a protocol or limited based on the device used.
- The Device is the screening device used.
- Unilateral Referrals indicates whether children are referred if only one ear fails screening.
- The Location is where the screening takes place

### 6.1. Neonatal hearing screening (well)

The process for neonatal hearing screening for well babies is summarized in Table 1, whereby a 3-step OAE - OAE - aABR protocol is in effect. The first OAE is performed in the maternity hospital after birth. If the infant does not pass the first OAE test, rescreening occurs at least 5 hours after the first test and before discharge from the maternity hospital. If the infant does not pass the second OAE attempt, an aABR is performed. If the infant does not pass the aABR, a referral to the ENT department for a diagnostic assessment is made (Health Service Executive (HSE), 2014).

**Table 1:** Process for neonatal hearing screening for well, healthy infants in Ireland (Health Service Executive (HSE), 2014).

Test	Age	Referral criteria	Device	Unilateral Referrals?	Location
OAE1	<24-72 hours		Accuscreen	Yes	Maternity hospital
OAE2	24-72 hours (at least 5 hours after OAE1)		Accuscreen	Yes	Maternity hospital / Outpatient clinic
aABR	< 4-5 weeks	45 dB nHL	Accuscreen	Yes	Maternity hospital / Outpatient clinic

### 6.2. Neonatal hearing screening (at-risk)

The screening process for at-risk (NICU) infants is described in Table 2. A combined OAE+aABR protocol is in effect whereby both OAE and aABR are performed (Health Service Executive (HSE), 2014).

If the infant does not pass the OAE but passes the aABR, they are listed for targeted follow-up at 9 months of age. If the infant does not pass both the OAE and aABR, a referral is made to diagnostic audiology.

**Table 2:** Process for neonatal hearing screening for at-risk (NICU) infants in Ireland (Health Service Executive (HSE), 2014).

<b>Test</b>	<b>Age</b>	<b>Referral criteria</b>	<b>Unilateral Referrals?</b>	<b>Location</b>
OAE + aABR	>37 weeks gestation (depending on health of child)	45 dB nHL	Yes	Maternity hospital / NICU

### 6.3. Preschool hearing screening

Hearing screening is performed in schools at 5 years of age. Children are conditioned to the task at 50 dB HL first as a group and individually. Pure-tone audiometry screening is performed at 25 dB HL at 1-4 kHz in both ears. If thresholds are greater than screening levels, the child does not pass initial screening. Repeat screening is performed 6-8 weeks later. If the child does not pass repeat screening, a referral is made to diagnostic audiology (Health Service Executive (HSE), 2017).

**Table 3:** Process for school hearing screening in Ireland (Health Service Executive (HSE), 2017).

<b>Test</b>	<b>Age</b>	<b>Referral criteria</b>	<b>Unilateral Referrals?</b>	<b>Location</b>
Pure-tone screening 1	4-5 years	Threshold >25 dB HL(1-4 kHz)	Yes	Schools (quiet room)
Pure-tone screening 2	6-8 weeks after initial screen			



## **7. Professionals**

### **7.1. Neonatal hearing screening (well)**

Neonatal hearing screening is performed by dedicated newborn screeners. Newborn screeners do not require specific background education. Instead, training is performed internally and includes an e-learning program and training provided by Northgate Public Services.

Training is generally carried out over a 6-week period and includes eLearning, on-the-ward training and shadowing existing screeners. An objective structured clinical examination is then undertaken and any advisory notes on screener performance are then addressed by the screener and their manager. Ongoing ward observations/support and screener stats produced through the central IT system ensure that all screeners are monitored closely on a regular basis.

### **7.2. Neonatal hearing screening (at-risk)**

Screening for at-risk (NICU) infants is also performed by dedicated trained newborn screeners. See 7.1 for details on newborn hearing screeners and training requirements.

### **7.3. Preschool hearing screening**

Screening for school-age children is performed by public health nurses. Training is provided locally by HSE audiologists for 2 days, plus additional mentoring. Training is updated every two years, though performance is not monitored by HSE audiology.



## 8. Results: Neonatal Hearing Screening

### 8.1. Coverage and attendance rates

The information provided corresponds to data available in the HSE database (Norman, 2018).

From April 2011 to November 2018, 99.83% of well infants and 99.01% of at-risk infants were offered screening (Norman, 2018).

A total of 362 869 well infants were screened before 4 weeks of age, resulting in a coverage rate of 99.2% and an attendance rate of 99.74% before 4 weeks of age (Norman, 2018).

### 8.2. Referral rates

The pass rates for neonatal hearing screening of well, healthy infants are presented below in Table 4. Rates are presented for data in the HSE database 2011-2018 (Norman, 2018).

**Table 4:** Pass rates for neonatal hearing screening (well babies) in Ireland (Norman, 2018).

Test	Referral Rate
OAE1	6.25%
OAE2	49.8%

Referral rates assume 100% attendance. Rates reflect the number of infants referred out of the number of infants screened at each step.

The final referral rate to a diagnostic assessment was 1.30% for well, healthy babies and 6.80% for at-risk (NICU) infants (Norman, 2018).

### 8.3. Diagnostic assessment attendance

All infants referred from neonatal hearing screening are offered a diagnostic assessment. Data are not currently available on the compliance or attendance rate to the diagnostic assessment; however, this is roughly estimated to be high.

### 8.4. Prevalence / Diagnosis

Data on prevalence rates are provided from the HSE database, calculated from infants screened between April 2011 and November 2018 (Norman, 2018).

**Table 5:** Prevalence rate (per 1000) of permanent hearing loss among neonates in Ireland (Norman, 2018).

	Bilateral		Unilateral	
	≥ 40 dB HL	≥ 80 dB HL	≥ 40 dB HL	≥ 80 dB HL
Prevalence per 1000 (Apr 2011-Nov 2018)	1.03	0.29	0.42	0.15

Given the fact that prevalence data are calculated from infants diagnosed after neonatal hearing screening, the percentages of neonates diagnosed after screening match these values.

Due to the fact that there is no school-age hearing screening ICT system, data are not available regarding the prevalence of preschool or school-age children or the percentage of children diagnosed with hearing loss after hearing screening.



There are 17 cases of ANSD reported in Ireland from April 2011 to November 2018, including both well and at-risk (NICU) infants. The total prevalence rate for all infants is therefore calculated to be 0.02 per 1000 live births (Norman, 2018), or 1 case diagnosed per years birth cohort. The data set currently does not differentiate NICU or well-babies, though this work is in progress.

Data are not available regarding the prevalence of children who were diagnosed with permanent hearing loss without being screened. Infants that are not screened after birth due to health conditions are tested when well enough. Children that migrate to Ireland prior to 3 months are referred to the newborn hearing screening programme by the public health nurse, and older children are referred to local paediatric audiology.

### **8.5. Treatment success**

Data are not available regarding the number of children fitted with hearing aids per year in Ireland, though all children with permanent bilateral hearing loss are offered hearing aids according to the recommendations in section 5.4.

Between 50 and 60 children are fitted with cochlear implants per year (National Cochlear Implant Programme, 2019). Bilateral simultaneous cochlear implants are often provided for children, but planned sequential implantation is an option when medically / clinically appropriate.

### **8.6. Screening evaluation**

Actual data on the sensitivity or false negatives are difficult to assess. When an infant is diagnosed with hearing loss and passed screening, an audit of the screen is carried out. In these cases, the hearing loss is likely acquired or progressive.

The specificity and percentage of false positives can be calculated for well and at-risk infants combined. As indicated previously, data are not currently separated between infant groups. From the data collected from April 2011 to November 2018, specificity is calculated to be 98.4% and the percentage of false positives is calculated to be 1.6% (Norman, 2018).

The positive predictive value (PPV) of a refer result for all *referred* infants is 10.5% for all cases of permanent hearing loss and 8% for cases of permanent bilateral hearing loss >40 dB HL (Norman, 2018). Note that these figures are calculated from the number of infants diagnosed out of the number *referred* from neonatal hearing screening. In other words, the PPV may be slightly higher as not all infants referred may have attended their diagnostic appointment.



## **9. Results: Preschool Hearing Screening**

### **9.1. Coverage and attendance rates**

Data not available (no national ICT system).

### **9.2. Referral rates**

Data not available (no national ICT system).

### **9.3. Diagnostic assessment attendance**

Data not available (no national ICT system).

### **9.4. Screening evaluation**

Data not available (no national ICT system).

## 10. Costs: Neonatal Hearing Screening

In Ireland, screening is free of charge for parents. There is no financial reward when parents attend hearing screening, nor is there a penalty for those who do not attend hearing screening.

There has not been a cost-effectiveness analysis performed on neonatal hearing screening in Ireland.

### 10.1. Screening costs

The total screening costs for the neonatal hearing screening program is 3.5 million euros, which includes screening for both well and NICU babies. This screening cost is the total national budget and includes all aspects of neonatal hearing screening.

### 10.2. Equipment costs

*(Information extracted to protect commercially sensitive data)*

The annual cost for calibration of equipment is €200. Devices are replaced every 6 years. The annual cost for disposables (TEOAE eartips, aABR couplers, electrode tabs, cables, batteries, etc.) for screening a population of 63 000 infants is estimated at €100 000 per year.

### 10.3. Staff costs

There are 51 full-time equivalent dedicated hearing screeners in the newborn hearing screening programme. The annual salary for a newborn hearing screener is €22 000 to €25 000. The costs associated with training neonatal hearing screeners is an internal cost for the provider.

### 10.4. Diagnostic costs

The total cost of diagnostic confirmation is not indicated.

### 10.5. Amplification costs

In Ireland, all children with hearing loss meeting requirements are offered invention; however parental consent is required prior to provision.

Data are unavailable regarding the yearly costs for hearing aid or cochlear implant treatment. These costs are business critical as devices are procured through an HSE tender.

### 10.6. Social costs

It is roughly estimated that there are 4 schools in Ireland for children who are deaf or hard of hearing. It is unknown how many children attend one of these special schools

Special needs assistants are available for deaf children who attend mainstream schools.

All costs associated with schooling or special support are unknown.



## **11. Costs: Preschool Hearing Screening**

### **11.1. Screening costs**

Total costs are not available.

### **11.2. Equipment costs**

A school screening audiometer costs approximately €2000. Annual calibration costs approximately €200, and disposable costs would include ear pads for supra-aural earphones.

### **11.3. Staff costs**

It is unknown how many public health nurses perform school hearing screening in Ireland. The annual salary for a public health nurse is €47 000 to €56 000.



## 12. References

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## Appendix A

Community Health Organisation		Newborn Hearing Screening Location	No
CHO 1	Donegal, Sligo/ Leitrim/ West Cavan, Cavan/ Monaghan	Cavan General Hospital, Co. Cavan	1
		Letterkenny General Hospital, Co. Donegal	2
		Sligo General Hospital, Co. Sligo	3
CHO 2	Galway, Roscommon, Mayo	Galway University Hospital, University Road, Co. Galway	4
		Portiuncula Hospital, Ballinasloe, Co. Galway	5
		Mayo General Hospital, Castlebar, Co. Mayo	6
CHO 3	Clare, Limerick, North Tipperary / East Limerick	University Maternity Hospital, Ennis Road, Co. Limerick	7
CHO 4	Kerry, North Cork, North Lee, South Lee, West Cork	Wilton Cork University Maternity Hospital, Co. Cork	8
		University Hospital Kerry, Co. Kerry	9
CHO 5	South Tipperary, Carlow / Kilkenny, Waterford, Wexford	St Luke's General Hospital, Co. Kilkenny	10
		South Tipperary General Hospital, Clonmel, Co. Tipperary	11
		University Hospital Waterford, Co. Waterford	12
		Wexford General, Newtown Road, Co. Wexford	13
CHO 6	Wicklow, Dun Laoghaire, Dublin South East		
CHO 7	Kildare, West Wicklow, Dublin West, Dublin South City, Dublin South West	Coombe University Hospital, Dublin 8	14
		National Maternity Hospital, Dublin 2	15
CHO 8	CHO 8: Laois / Offaly, Longford / West Meath, Louth / Meath	Midlands Regional Hospital, Portlaoise, Co. Laois	16
		Midland Regional Hospital, Mullingar, Co. Westmeath	17
		Our Lady of Lourdes Hospital, Drogheda, Co. Louth	18
CHO 9	Dublin North, Dublin North Central, Dublin North West	Rotunda Hospital, Dublin 1.	19
	Paediatric Hospitals	Temple Street Children's University Hospital, Dublin 1.	20
		Our Lady's Hospital for Sick Children, Crumlin, Dublin 12	21