



## **Summary: Hearing Screening**

**Lithuania**

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**Disclaimer:** This is a summary report representing the responses from a screening expert working within hearing care services of the country or region reported. This report is the product of professional research conducted for the EUSCREEN study and does not represent conclusions made by the authors. It is not meant to represent the position or opinions of the EUSCREEN study or its Partners. Efforts were made to cross-check the information supplied; however, not all information supplied is fully verified by the authors.

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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.



	Example: If 100 infants with hearing loss are screened, and 1 infant passes the screening, the percentage of false negatives is 1%.
<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>	Recommendations or instructions provided by an authoritative body on the practice of screening in the country or region.
<b>Hearing screening professional</b>	A person qualified to perform hearing screening, according to the practice in your country or region.
<b>Inconclusive test result</b>	A test result where a normal “pass” response could not be detected due to poor test conditions.
<b>Invited for screening</b>	Offered screening.
<b>Outcome of hearing screening</b>	An indication of the effectiveness or performance of screening, such as a measurement of coverage rate, referral rate, number of infants detected, etc.
<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>	All children between 3-6 years of age.
<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

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

NICU – neonatal intensive care unit

OAE – otoacoustic emissions

TEOAE – transient-evoked otoacoustic emissions



### 3. Background

In Lithuania, hearing screening is organized nationally.

The following report contains information with regards to hearing screening in the entire country of Lithuania.

#### 3.1. General

Lithuania has a total area of 65 300 km<sup>2</sup> and a population of 2 819 753 as of 2016. The birthrate in Lithuania was 30 623 in 2016 (Lithuanian Department of Statistics, 2018).

The World Bank income classification categorizes Lithuania as a high-income country (The World Bank, 2018). The gross domestic product (GDP) is €3653.2 per capita (Lithuanian Department of Statistics, 2018).

From the World Health Organization (WHO) Global Health Expenditure Database, health expenditure in Lithuania in 2015 was 923 USD or €795 per capita (World Health Organization, 2018).

In Lithuania, each birth is registered with the Information Society Development Committee according to law. Data acquired from the 2016 United Nations Demographic Yearbook and from the Lithuanian Department of Statistics (2018) indicate an infant mortality rate of 4.2 per 1000 for the country of Lithuania in 2015, a rate of 4.3 per 1000 in urban areas and 4.0 per 1000 in rural areas (United Nations Statistics Division, 2016). Infant mortality rate was 4.5 in 2016 (Lithuanian Department of Statistics, 2018).

#### 3.2. Neonatal hearing screening

In Lithuania, neonatal hearing screening is conducted universally, with all babies in the country having access to hearing screening, though screening is not obligatory for parents. The universal programme for well and at-risk babies was first implemented in 1998 through an initiative led by neonatologists and hearing specialists in the country, and by 2014, neonatal hearing screening was available across the country. Neonatal hearing screening is embedded in the Preventive Child Health Care screening system. Today, screening is funded through the Health Insurance and organized by the Ministry of Health.

There are no regional differences in Lithuania with regards to the protocol used for screening either well babies and at-risk babies.

#### 3.3. Preschool hearing screening

In Lithuania, preschool hearing screening is not performed.



#### **4. Guidelines & Quality Control**

National guidelines for hearing screening exists in Lithuania together with a national protocol (Ministry of Health, Republic of Lithuania, 2013).

The content of hearing screening programme was decided on by the Ministry of Health, a professional body of ENT specialists, specialists for children's health care, and the public health organization. The content of the programme has not been changed since its start and there is no revision process in place.

Quality assurance of hearing screening programmes is not imposed by the government; however, information is collected about hearing screening outcomes through auditing. Through the Health Information Centre in the Institute of Hygiene of the Ministry of Health, data are aggregated across maternity hospitals in Lithuania on hearing screening results. These data include all groups of infants, including well, healthy babies, premature infants, infants with risk factors, and infants admitted to the NICU. However, these data contain only screening results; follow-up results are not collected in this centralized database, and therefore, these data cannot be used for monitoring the effectiveness of the hearing screening protocol.

Annual reports are not published; however, as indicated, screening data from maternity hospitals are reviewed by the Ministry of Health and the Perinatology Integrated Healthcare Management Committee. Findings from each review are discussed among neonatal hearing screening professionals and shared with the maternity hospitals.

Data are unavailable on whether research has been performed on hearing screening in Lithuania apart from auditing.



## 5. Process: Screening, Diagnosis, Intervention

### 5.1. Neonatal hearing screening

In Lithuania, well babies and at-risk babies are screened in the hospital, where the average length of stay is estimated to be 2-3 days. If the infant was not born in a hospital, the family physician is responsible for referring the infant to a health care centre or private clinic where screening can be performed. It is estimated that up to 0.7% of infants are born at home. Well-baby and at-risk families are invited to participate in neonatal screening by pediatricians. Parents are informed of the importance of screening and provided written information in the form of a leaflet.

Neonatal hearing screening for both well- and at-risk babies should be completed before 3 months of age. If for any reason an infant is not screened directly in the maternity ward, this initial screen should take place within 28 days.

The target condition for screening for well- and at-risk babies is a unilateral or bilateral hearing loss of  $\geq 25$  dB HL.

In Lithuania, there are no differences in screening protocol between well and at-risk babies. However, for approximately 5% of infants, their health condition, risk factors and gestational age are considered when performing newborn hearing screening.

At-risk infants are defined as those with a family history of permanent childhood hearing impairment, maternal infections during pregnancy or delivery (e.g., toxoplasmosis, syphilis, HIV, hepatitis B, rubella, CMV, herpes simplex), physical problems of the head, face, ears or neck (e.g. cleft lip/palate, ear pits/tags, atresia), ototoxic medications given in the neonatal period, syndromes associated with hearing loss (Pendred, Usher, Waardenburg, neurofibromatosis), admission to the neonatal intensive care unit for  $> 5$  days, prematurity  $< 37$  weeks, or hyperbilirubinemia.

Approximately 5.8% of infants are born prematurely and approximately 1.8% of neonates are admitted to NICUs or hospitals other than maternity hospitals. The prevalence of CMV infections among neonates or meningitis is unknown.

### 5.2. Neonatal diagnostic assessment

The diagnostic assessment tests performed after neonatal hearing screening referral are an ABR and ASSR test, which should be completed by 6 months of age.

### 5.3. Preschool hearing screening

Not applicable.

### 5.4. Intervention approach

In Lithuania, treatment options available include grommets, hearing aids, bone conductive devices and cochlear implants. Infants are fitted with hearing aids from less than 6 months of age to 12 months of age. They are fitted with cochlear implants from 6 months of age to 2 years of age.

The hearing aid fitting criteria in Lithuania is a bilateral hearing loss of  $>30$  dB HL.



## 6. Hearing Screening 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 neonatal hearing screening programme in Lithuania for well babies without risk factors is a two-step OAE protocol. The first step typically occurs before discharge from the maternity ward and a re-screening test occurs at the hearing centre no more than 3 months after birth.

The first step is typically performed before discharge from the maternity ward; however, if screening was not performed before discharge or the infant was born outside of the maternity centre, then OAE1 can be performed in another institution (usually the hearing centre) no later than 28 days after discharge. Re-screening (step 2) is performed at the hearing centre in cases of a “no pass” result for OAE, no later than 3 months after birth.

**Table 1:** Screening process for well babies in Lithuania.

Test	Age	Referral criteria	Device	Unilateral Referrals?	Location
OAE1*	24-72 hours <sup>†</sup>	4 dB SNR for 3/6 freq (Interacoustics, 2017)	Otoread	Yes	Maternity hospital
OAE2	< 3 months			Yes	Hearing centre

\* A second OAE may be performed in the maternity hospital before discharge if the results indicate a noisy recording or if the baby is not settled. Otherwise, only one OAE is performed before discharge.

<sup>†</sup> Infants are routinely screened in the maternity hospital at 24-72 hours; however, screening can also occur at outpatient clinics around the age of 3-5 days (and no later than 28 days) if screening was not performed before discharge or if the infant was born outside of the hospital.

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

The screening process for infants considered at risk is identical to the process for well, healthy babies, with the exception that infants with risk factors that pass the OAE will be referred for a diagnostic assessment using behavioural measures at the age of 6-12 months.

### 6.3. Preschool hearing screening

Not applicable.

## **7. Professionals**

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

Screening for well babies is performed by nurses, midwives, neonatologists and/or pediatricians. Newborns not screened in the hospital will be referred by their family physician to an ENT clinic where ENT physicians or hearing specialists will screen hearing. Training is provided across 2 to 5 days in two parts, theoretical and practical, with the practical component taking place in the workplace.

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

Screening for at-risk infants is typically performed by nurses, though neonatologists and pediatricians are responsible for screening supervision. Practical training occurs in the workplace for these professionals.

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

Not applicable



## 8. Results: Neonatal Hearing Screening

### 8.1. Coverage and attendance rates

Calculated from 2016 data, coverage rates are only available for combined well-baby and at-risk groups. These groups are not separated in the database.

Coverage rates for the initial screening test are determined by information aggregated by maternity hospitals in Lithuania. In 2016, the coverage rate for recorded births in maternity hospitals was 98.1%. In other words, out of the total number of births recorded by maternity hospitals, 98.1% had an initial screening test performed (Health information Center, 2016). This figure includes 13 parents (0.05%) who refused hearing screening for their neonate (Health information Center, 2016).

Because data are only accumulated from maternity hospitals, home-birth infants would not be included in these percentages. As indicated, it is roughly estimated that up to 0.7% of infants are born at home. Furthermore, according to the national statistics tables, the number of total births documented in Lithuania in 2016 was 30 361 while the number of births reported by maternity wards was 28 788 (Health information Center, 2016; Lithuanian Department of Statistics, 2018). This difference is reportedly due to babies that are born abroad but are registered in Lithuania. Screening results are documented only for births within the maternity ward. Therefore, this coverage rate figure did not account for about 5% of the births registered in Lithuania in 2016.

Data are not available on the coverage rate for infants referred to the second-step rescreening (OAE2) at the hearing centre.

Attendance rate for neonatal hearing screening is defined as the percentage of babies who completed the screening out of all babies offered screening. The number of infants that missed being *offered* the first step of screening is not specified, and therefore, attendance rate of screening cannot be determined.

### 8.2. Referral rates

Referral rates for each step of the neonatal screening programme in all babies are presented in Table 2. However, the number of infants that were referred from step 2 to a diagnostic assessment is unknown.

**Table 2:** Referral rates for each step of the neonatal hearing screening programme (among all infants) in Lithuania (Health information Center, 2016).

Test	Referral Rate
OAE1 (maternity hospital)	2.8
OAE2 (hearing centre)	Unknown

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 from the OAE2 performed in the hearing centre is unknown.

### 8.3. Diagnostic assessment attendance

The compliance rate for a diagnostic assessment after neonatal hearing screening is unknown as follow-up data after neonatal hearing screening are not collected.

### 8.4. Prevalence / Diagnosis



The prevalence values of permanent hearing loss among neonates in Lithuania are presented in Table 3.

**Table 3:** Prevalence of neonatal permanent hearing loss (per 1000 neonates) in Lithuania (Vilnius University Hospital, Santaros Clinics, 2016; Lithuanian University of Health Sciences, Kaunas Clinics, 2016).

	Bilateral		Unilateral	
	≥ 40 dB HL	≥ 80 dB HL	≥ 40 dB HL	≥ 80 dB HL
Prevalence per 1000 (Clinical Data, 2016)	2.19	0.62	0.28	0.17

While there is no preschool hearing screening in Lithuania, national statistics are available indicating the number of preschool-aged children with hearing loss. For children ages 4 through 6, 366 children are registered at a hearing care institution in 2016 (Lithuanian Department of Statistics, 2016). Calculated from the total population statistics for this age group (4, 5 and 6 year olds), a prevalence value can be estimated at 4.13 per 1000 children (Lithuanian Department of Statistics, 2016; Lithuanian Department of Statistics, 2016; Lithuanian Department of Statistics, 2018). More information about hearing loss among this age group is not available. For example, data are not available for type or severity of hearing loss for this population.

The prevalence of bilateral auditory neuropathy in Lithuania is not indicated, but the incidence of auditory neuropathy in all children (not exclusively infants) is approximately 4 new cases identified per year among healthy children and 6-8 new cases identified per year among NICU/at-risk children (Vilnius University Hospital, Santaros Clinics, 2016; Lithuanian University of Health Sciences, Kaunas Clinics, 2016).

### 8.5. Treatment success

Approximately 88-89 infants are fitted with hearing aids per year in Lithuania, and approximately 16-18 children are fitted with cochlear implants per year (Lithuanian University of Health Sciences, Kaunas Clinics, 2016; Vilnius University Hospital, Santaros Clinics, 2016).

### 8.6. Screening evaluation

The percentage of false negatives is unknown, but considered to be very rare with 1-2 infants per year missed from neonatal hearing screening (<1%). The percentage of false positives after neonatal hearing screening is unknown as there is no database tracking follow-up after neonatal hearing screening.

Data are unavailable regarding the positive predictive value of a refer result.



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

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

Not applicable

### **9.2. Referral rates**

Not applicable

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

Not applicable.

### **9.4. Diagnosis**

Not applicable.

### **9.5. Treatment success**

Not applicable.

### **9.6. Screening evaluation**

Not applicable.



## 10. Costs: Neonatal Hearing Screening

Neonatal hearing screening in Lithuania is free of charge for parents. There is no financial reward when parents attend hearing screening, and there is no penalty for those who do not attend.

There has not been a cost effectiveness analysis completed in Lithuania.

### 10.1. Screening costs

Neonatal hearing screening costs are not allocated separately from complete delivery costs, including postnatal care. The total costs for each newborn for delivery and postnatal care is €400 per infant.

### 10.2. Equipment costs

*(Information extracted to protect commercially sensitive data)*

For 100 soft disposable OAE probe tips, the cost is €40 (Vilnius University Hospital, Santaros Clinics, Financial Dept, 2018).

### 10.3. Staff costs

The 2017 yearly salary for physicians was €11 468 and the yearly salary for a nurse was €7 885. Education costs for a physician is approximately €16 000 to 18 000 for state-funded medical studies. The education costs for a nurse or midwife who performs the primary OAE screening is €4 158, The education costs for specialist training is €21 076 for a pediatrician or GP, €26 345 for a neonatologist, and €15 807 for an ENT physician.

### 10.4. Diagnostic costs

The cost for a consultation with an ENT physician is €13.39.

### 10.5. Amplification costs

In Lithuania, children are treated for hearing loss, except for children whose deaf parents may refuse cochlear implant treatment.

The costs for the hearing aid treatment per patient for the first year was roughly estimated to be around €200. The cost for cochlear implant treatment for the first year is estimated to be approximately €25 000 (Ministry of Health). Follow-up costs after the first year are not available.

### 10.6. Social costs

There is a total of 5 schools for deaf children in Lithuania; however, data on the number of children attending these schools, and the costs for attending special education schooling, and the availability of special support in mainstream schools are unavailable.



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

### **11.1. Screening costs**

Not applicable.

### **11.2. Equipment costs**

Not applicable.

### **11.3. Staff costs**

Not applicable.

### **11.4. Diagnostic costs**

Not applicable.



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