



Summary: Hearing Screening

Latvia

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1. Glossary of Terms: Hearing Screening

Abnormal test result	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.”
Attendance rate	<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"> • <u>Invited for screening</u> includes all those that are offered the screening test. • <u>Tested and receive a result</u> could be a “pass” or “fail”. <p>Attendance rate provides information on the willingness of families to participate in screening.</p>
Attendance rate in first year of life	<p>See definition of Attendance rate.</p> <p>The calculation cut-off is after <u>one year of life</u>.</p>
Compliance with referral (percentage)	<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>
Coverage	<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"> • <u>Eligible for screening</u> includes those within the population that are covered under the screening or health care program. • <u>Tested and receive a result</u> could be a “pass” or “refer to diagnostic assessment”. • <u>Specific time</u> can be defined, such as 1 month after birth, 3 months after birth, etc. <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>
Coverage in first year of life	<p>See definition of Coverage.</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>
False negatives	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%.
False positives	<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>
Guidelines	Recommendations or instructions provided by an authoritative body on the practice of screening in the country or region.
Hearing screening professional	A person qualified to perform hearing screening, according to the practice in your country or region.
Inconclusive test result	A test result where a normal “pass” response could not be detected due to poor test conditions.
Invited for screening	Offered screening.
Outcome of hearing screening	An indication of the effectiveness or performance of screening, such as a measurement of coverage rate, referral rate, number of infants detected, etc.
Permanent hearing loss	<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>
Positive predictive value	<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 Target Condition (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>
Preschool or (pre)school children	All children between 3-6 years of age.
Preschool or (pre)school screening	<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>



Prevalence	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.
Programme	An organized system for screening, which could be based nationally, regionally or locally.
Protocol	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.
Quality assurance	A method for checking and ensuring that screening is functioning adequately and meeting set goals and benchmarks.
Referral criteria	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.
Risk babies / Babies at-risk	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.
Sensitivity	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%.
Specificity	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%.
Target condition	The hearing loss condition you are aiming to detect via your screening programme. This includes: <ul style="list-style-type: none"> • The <u>laterality of the condition</u>, whether the program aims to detect both unilateral and bilateral hearing loss or just bilateral hearing loss. • The <u>severity of the condition</u>, whether the program aims to detect hearing loss ≥ 30 dB HL, ≥ 35 dB HL, ≥ 40 dB HL or ≥ 45 dB HL
Well, healthy babies	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 Latvia, hearing screening is performed and organized nationally. The following report contains information with regards to childhood hearing screening in the entire country of Latvia.

3.1. General

Latvia has a total area of 64,589 km² with a population of 1.95 million in 2017 (Central Statistical Bureau, 2018).

In Latvia, all births are registered in two locations, the Medical Birth Register (a perinatal database) and the Population Register through the Office of Citizenship and Migration Affairs (an administrative database). The number of live births in Latvia in 2016 was 21646 (Centre for Disease Prevention and Control (CDPC) of Latvia, 2017).

The World Bank income classification categorizes Latvia as a high-income country (The World Bank, 2018). The gross domestic product (GDP) in 2016 was € 12691 per capita in Latvia (Central Statistical Bureau, 2018).

From the World Health Organization (WHO) Global Health Expenditure Database, health expenditure for Latvia in 2015 was 784 USD or €689 per capita (World Health Organization (WHO), 2018).

An infant mortality rate of 3.7 per 1000 is reported for Latvia by Centre for Disease Prevention and Control (CDPC) of Latvia for 2016 (2017) , and data from the World Health Organization cites an infant mortality rate of 4.1 per 1000 for 2015, with a higher mortality rate in rural areas (4.5 per 1000) compared to urban areas (3.9 per 1000; World Health Organization (WHO), 2018).

3.2. Neonatal hearing screening

In Latvia, 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 program for well and at-risk babies was first implemented in 2007 and implemented across the entire country from the onset.

Neonatal hearing screening is embedded in the Preventive Child Health Care screening system (The National Health Service, 2018). Screening for well and at-risk infants is funded by the state.

National guidelines are available in the legal document, The Provision of Childbirth Assistance which stipulates that hearing screening is to be performed during early neonatal care (Cabinet of Ministers, 2006). This law also stipulates a protocol that is followed across the entire country.

3.3. Preschool hearing screening

Preschool hearing screening is conducted universally in Latvia as part of the routine check-up prior to school entry. It is embedded in the Preventive Child Health Care screening system and is funded by the state. The exact date of when preschool hearing screening began is not known; however routine examination of hearing during childhood has been performed since the implementation of the preventative care programme.



4. Guidelines & Quality Control

National guidelines for hearing screening exist in Latvia by law in a document outlining the standard of maternal and neonatal care. These guidelines describe a short protocol for neonatal hearing screening, which is followed across Latvia.

Quality assurance of hearing screening programs is not imposed by the government; however, data are collected by the National Health Service. A united information database is available where all information about outpatient and inpatient services is collected. The Ministry of Health does not collect data about neonatal hearing screening nor produce annual reports; however, the Centre for Disease Prevention and Control (CDPC) provides annual reports on general information regarding newborns and deliveries. These annual reports do not, however, include hearing screening data.



5. Process: Screening, Diagnosis, Intervention

5.1. Neonatal hearing screening

Well-babies and at-risk babies are screened in the hospital or child health centre. In 2016, 98.4% of births take place in the maternity hospital, where the average length of stay after delivery is 3.7 days (Centre for Disease Prevention and Control (CDPC) of Latvia, 2016; 2017). Planned home deliveries accounted for 1.2 % of births in 2016 (Centre for Disease Prevention and Control (CDPC) of Latvia, 2017). Parents/caregivers of well and at-risk babies are invited to participate in neonatal hearing screening directly in person at the hospital.

Neonatal hearing screening for well and at-risk babies should be completed before 3 months of age.

At-risk infants are defined as those with a birth weight less than 1.5 kg or prematurity less than 37 weeks; however, in Latvia all infants (well or at-risk) are screened using the same protocol. There is no specific “at-risk” protocol.

Data on the prevalence of CMV is not available in Latvia. The prevalence of meningitis on children (0-17 years) is 0.3 per 100 000.

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

5.2. Neonatal diagnostic assessment

The diagnostic assessment after neonatal hearing screening referral includes an OAE test to confirm screening results, and if confirmed, an objective audiometry test (Cabinet of Ministers, 2006), such as ABR or ASSR. The diagnostic assessment should be completed by 3 months of age. All diagnostics follow-up assessments are performed at the Latvian Children’s Hearing Center in Riga.

5.3. Preschool hearing screening

Preschool hearing screening is performed at the child health clinic /physician as part of routine examination or at the Latvian Children’s Hearing Center in Riga. Children and parents are invited to participate via a discussion at the family physician’s office. Testing is performed by the family doctor, or by an otolaryngologist when indicated.

The target condition for preschool hearing screening is a bilateral hearing loss of 25 dB or worse.

5.4. Intervention approach

In Latvia, treatment options available include grommets, hearing aids, bone conductive devices, cochlear implants, as well as various assistive devices and FM systems. Infants are fitted with hearing aids from <6 months of age or older or as soon a hearing loss is identified. Infants are fitted with cochlear implants from 6 months of age or older.

The fitting criteria in Latvia for a hearing aid is bilateral hearing loss of at least 25 dB in the better ear (Latvian Association of the Deaf (LAD), 2018).

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 described in Table 1. A 2-step OAE protocol is in effect, whereby the first OAE is performed in the maternity hospital before discharge. If the infant fails the first test, rescreening occurs at 1 month of age at the Latvian Children's Hearing Center in Riga. A subsequent fail at age 1-month would warrant a follow-up diagnostic assessment at 3-months of age, also at the Latvian Children's Hearing Center in Riga.

Table 1: Process for neonatal hearing screening in Latvia.

Test	Age	Referral criteria	Device	Unilateral Referrals?	Location
OAE1	3-5 days	Locked: 4 dB SNR for 3 of 6 freqs (1.5 – 4 kHz)	GSI 70, GSI Corti	Yes	Maternity hospital
OAE2	1 month		GSI 70, GSI Corti	Yes	Latvian Children's Hearing Center

6.2. Neonatal hearing screening (at-risk)

The screening process for at-risk infants is identical to screening well infants. See 4.1 for the protocol.

6.3. Preschool hearing screening

Preschool hearing screening is performed during a routine childhood check-up at 5-6 years of age. Pure-tone audiometry and speech audiometry is performed in the physician's office, or in special cases at the otolaryngologist or Latvian Children's Hearing Centre.

Table 2: Process for preschool hearing screening in Latvia.

Test	Age	Referral criteria	Unilateral Referrals?	Location
Pure-tone audiometry + Speech audiometry	5-6 yrs	Threshold >20 dB	Yes	Physician / [Otolaryngologist, Latvian Children's Hearing Centre]



7. Professionals

7.1. Neonatal hearing screening (well)

Screening is performed by trained nurses or otolaryngologists.

Training involves a full day (approximately 8 hours) of education. This training is certified and regularly updated. The training is provided by the OAE device company and is updated when a new device is introduced. All medical personnel, including nurses, are certified through this training and must renew their certificate after a certain period.

7.2. Neonatal hearing screening (at-risk)

Screening for at-risk infants is also performed by pediatric nurses or doctors (see 7.1 for training requirements).

7.3. Preschool hearing screening

Screening for preschool-age children is performed by a general physician or otolaryngologist.

8. Results: Neonatal Hearing Screening

8.1. Coverage and attendance rates

Data on coverage and attendance rates are provided by the National Health Service, which holds a database with all information about inpatient and outpatient services, including OAEs, which are entered into the database with a unique code. In 2016, the coverage rate was 93.9%. Specifically, out of 21 968 live births, OAEs were performed on 20 640 infants including 1160 outpatient and 19 480 inpatient neonates (The National Health Service, 2018).

8.2. Referral rates

Data are unavailable regarding the pass or referral rates of neonatal hearing screening in Latvia.

Rough estimates were made that 95% of infants pass the first OAE and 97% of infants pass the second OAE. In total 5% are referred for diagnostic assessment.

8.3. Diagnostic assessment attendance

Data are unavailable regarding the compliance rate to a diagnostic assessment.

A rough estimate was made that 95% of infants referred attend their diagnostic assessment.

8.4. Prevalence / Diagnosis

Data are unavailable regarding the prevalence of neonatal hearing loss in Latvia.

Rough estimates were made that 0.5% and 0.25% of infants have a bilateral hearing loss of ≥ 40 and ≥ 80 dB HL, respectively, and that 0.2% and 0.01% of infants have a unilateral hearing loss of ≥ 40 and ≥ 80 dB HL, respectively.

Data are unavailable regarding the prevalence of auditory neuropathy in Latvia.

8.5. Treatment success

In Latvia, 80 children were fit with hearing aids in 2017 and an estimated 15-20 children were fit with cochlear implants.

8.6. Screening evaluation

Data on the sensitivity or specificity of neonatal hearing screening are not available, and neither are data on false positives, false negatives, or the positive predictive value.

Rough estimates were made that the sensitivity and specificity for both well and NICU babies is 80% and 97%, respectively. Rough estimates were also made that the positive predictive value of a refer result is 20-30%.



9. Results: Preschool Hearing Screening

9.1. Coverage and attendance rates

Data are unavailable. A rough estimate was made that 99% of children receive preschool hearing screening.

9.2. Referral rates

Data are unavailable. A rough estimate was made that 20% of children are referred for diagnostic assessment from preschool hearing screening.

9.3. Diagnostic assessment attendance

Data are unavailable. It was roughly estimated that 100% of children referred for diagnostic assessment attend their appointment.

9.4. Screening evaluation

Data are unavailable. Rough estimations were made that the sensitivity is 80%, specificity is 97% and positive predictive value is 20%.

10. Costs: Neonatal Hearing Screening

Neonatal hearing screening in Latvia is financed by the state and 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 hearing screening.

A cost analysis of neonatal hearing screening in Latvia has not been performed.

10.1. Screening costs

The total screening costs per year was €171 078.12 in 2016 or €8.46 per child, according to the National Health Service.

10.2. Equipment costs

(Information extracted to protect commercially sensitive data)

Maintenance costs are approximately €200 per year. It is estimated that devices are replaced around every 5-10 years for OAE devices and every 10-15 years for ABR/ASSR devices.

The cost for disposables is approximately €100 per year.

10.3. Staff costs

The number of screening staff across all of Latvia is one otolaryngologist and 20 nurses for one million population.

The average annual salary for a screening professional is €7 200. The hourly salary is €3.00 for a nurse and €3.50 for an otolaryngologist. University education is approximately €1,400 per year.

10.4. Diagnostic costs

The total cost of diagnostic confirmation is not indicated.

10.5. Amplification costs

In the Latvia, all children with hearing loss are treated, except for children of deaf parents who refuse cochlear implant for their children.

The costs for hearing aid fitting for the first year (including the device) is approximately €800-900 and the cost for intervention in the second year is approximately €100. For cochlear implant surgery, costs are roughly €21 500 for the first year. After the first year, costs are approximately €500.

All amplification costs are covered by the state.

10.6. Social costs

In Latvia, there are a total of 7 primary and secondary schools with special programs for hearing impaired students (Ministry of Education and Science of the Republic of Latvia, 2018). It is unknown how many children attend one of these special schools. A rough estimate was made that there are 150 students in Latvia in special schools.

In mainstream schools, extra support is provided to children with hearing impairment.



All costs for mainstream or special education schools are unknown, as are costs for extra support. All costs for education and support are covered by the government.



11. Costs: Preschool Hearing Screening

11.1. Screening costs

Data on screening costs are unknown. It is roughly estimated that preschool screening costs €820 000 annually, or around €20 per child.



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