



Summary: Hearing Screening Russian Federation

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Allison Mackey & Inger Uhlén
Karolinska Institutet, Stockholm Sweden

Hearing screening representative for the Russian Federation: George Tavartkiladze, National Research Centre for Audiology and Hearing Rehabilitation, Department of Physiology and Pathology of Hearing

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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	<p>A pre-determined cut-off boundary for when an infant/child should be re-tested or seen for a diagnostic assessment.</p> <p>For example, referral criteria may be “no response” at 35 dB nHL.</p>
Risk babies / Babies at-risk	<p>All infants that are considered to be at-risk or have risk-factors for hearing loss according to the screening programme.</p> <p>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.</p>
Sensitivity	<p>The percentage of infants/children with hearing loss that are identified via the screening program.</p> <p>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%.</p>
Specificity	<p>The percentage of infants/children with normal hearing that pass the screening.</p> <p>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%.</p>
Target condition	<p>The hearing loss condition you are aiming to detect via your screening programme. This includes:</p> <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	<p>Infants who are <i>not</i> admitted into the NICU or born prematurely.</p> <p>Well, healthy babies may or may not have additional risk factors for hearing loss, according to the procedures indicated in the specific screening programme.</p>



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 Russia, neonatal hearing screening is organized nationally.

The following report contains information corresponding to hearing screening in the entire country of Russia.

3.1. General

The country of Russia has a total area of around 17 100 000 km² and a population of around 146 800 000 as of January 2017 (Federal State Statistics Service, 2018). In Russia, each birth is registered. The number of live births in Russia was 1 888 729 in 2016 (Federal State Statistics Service, 2018).

The World Bank income classification categorizes Russia as an upper-middle-income country (The World Bank, 2018). The gross domestic product (GDP) was € 9 470 per capita in 2017 (The World Bank Group, 2019).

From the World Health Organization (WHO) Global Health Expenditure Database, health expenditure in Russia in 2015 was 502 USD or €442 per capita (World Health Organization, 2018).

Infant mortality rate in the country of Russia was 8.6 per 1000 births in 2012 (United Nations Statistics Division, 2016). From the Federal State Statistics Service (2018), infant mortality rate was calculated to be 6.5 per 1000 in 2015.

3.2. Neonatal hearing screening

In Russia, neonatal hearing screening is conducted universally, with all babies in the country having access to hearing screening. Screening is government-funded, and participation is obligatory for parents. There is no penalty for non-attendance nor is there a reward for attendance.

Neonatal hearing screening started in Russia in 1996 and universal screening started in 2008. It was fully implemented across the country in 2011. Neonatal hearing screening is not embedded in the Preventive Child Health Care screening system.

There are no differences in neonatal hearing screening procedures across regions, though coverage rates of well-babies differ across regions. Regional coverage rates are monitored to ensure staff training.

3.3. Preschool hearing screening

There is no preschool hearing screening in Russia.

4. Guidelines & Quality Control

National guidelines for child health care exist in Russia, including the national hearing screening guidelines (Moscow Health Department, 2011).

The content of general hearing screening programme was decided on by audiologists and the Ministry of Public Health. The content of the programme was revised in 2010 when the network of maternity hospitals was expanded, personnel were trained and hospitals were additionally equipped. The guidelines are revised by leading audiological centres once per 5 years, which are decided on by the ministry.

Data are unavailable on how these revisions are funded.

Quality assurance of hearing screening programs is not imposed by the government though information is collected about hearing screening by the Ministry of Health and the National Research Centre for Audiology and Rehabilitation. Therefore, these institutions have the possibility to monitor the screening programme.

Annual reports are not available for Russia.

Studies have been performed on hearing screening in Russia, though not on the programme effectiveness.

5. Process: Screening, Diagnosis, Intervention

5.1. Neonatal hearing screening

In Russia, well-babies and at-risk babies are screened in the maternity hospital. Approximately 99% of infants are born in maternity hospitals, where the average length of stay after delivery is 3-4 days.

For well-babies, screening should be performed by 72-96 hours of life and before discharge from the hospital though 2% of infants are screened later in the pediatric outpatient clinics. For infants at-risk, screening should be completed by 1 month after birth.

The target condition for screening for well and at-risk babies is a bilateral hearing loss greater than 25 dB HL.

In Russia, at-risk infants are defined as those with a family history of permanent childhood hearing loss, syndromes associated with hearing loss, cranio-facial anomalies, intrauterine infections (CMV, rubella, toxoplasmosis, syphilis), severe hypoxia/ asphyxia requiring mechanical ventilation for more than 5 days, prematurity less than 32 weeks gestation or birthweight less than 1500 g, ototoxic medications during the perinatal period, hyperbilirubinaemia above exchange transfusion levels, neurodegenerative disorders, and meningitis. In Russia, all babies are screened with the same protocol. Infants with one or more of the listed risk factors are automatically referred for diagnostic assessment, regardless of the result of the initial screening test.

In Russia, the percentage of children admitted to the NICU is around 1% (Research Centre for Organization and Information of Public Health, 2017). The prevalence of CMV infections is roughly estimated to be about 1.5% at birth (National guideline, 2014). The prevalence of meningitis is roughly estimated to be 7.3 per 100 000 at the age of 2 to 4 (National guideline, 2014)

5.2. Neonatal diagnostic assessment

In Russia, the national neonatal hearing screening programme for well babies includes both screening and diagnostics. The second stage of the screening programme is the diagnostic assessment. When referral to diagnostic assessment is warranted, families are provided a written referral after discharge from the maternity hospital.

The diagnostic assessment tests performed after referral from the first stage of neonatal hearing screening are ABR, TEOAE, DPOAE, tympanometry, and acoustic reflex testing.

As described, a specified target age for screening is not indicated by guidelines for well-infants; however, regulations indicate that the entire screening / diagnostic process should be completed before 3 months of age. For at-risk infants, the diagnostic test should also be performed by 3 months corrected age.

Those that do not attend the second stage of screening are contacted by phone.

5.3. Preschool hearing screening

Not applicable. Russia does not have a preschool hearing screening programme.

5.4. Intervention approach

In Russia, treatment options available include grommets, hearing aids, bone conductive devices, and cochlear implants. It is estimated that infants are fitted with hearing aids from less than 6 months of age and infants are fitted with cochlear implants from 6-12 months of age or older.

The estimated hearing aid fitting criteria in Russia is a bilateral hearing loss of >35 dB HL. Unilateral hearing loss is not currently within the criteria for fitting hearing aids.

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 neonatal hearing screening protocol in Russia for well babies is described in Table 1. In Russia, the OAE may be performed multiple times under Step 1 before discharge from the maternity ward. The screening protocol in Russia also includes the diagnostic audiological assessment. The diagnostic assessment is the second phase of the protocol.

Table 1: Screening process for well babies in Russia.

Test	Age	Referral Criteria	Device	Unilateral Referrals?	Location
OAE	72-96 hours	4 dB SNR for 3/6 freq (Interacoustics, 2017)	OtoRead TEOAE screening	Yes	Maternity ward

6.2. Neonatal hearing screening (at-risk)

The at-risk screening protocol is indicated in Table 2. Note that the process for screening is similar to the process for well babies. However, all babies at-risk are automatically referred to the second phase of the screening programme (i.e., the diagnostic assessment), regardless of the OAE result at the initial screen.

Table 2: Screening process for at-risk babies in Russia.

Test	Age	Referral Criteria	Settings / Device	Unilateral Referrals?	Location
OAE	Before discharge	All infants are referred	OtoRead TEOAE screening	Yes	Maternity ward /NICU

6.3. Preschool hearing screening

Not applicable. There is no preschool hearing screening.

7. Professionals

7.1. Neonatal hearing screening (well)

Screening for well babies is performed by nurses, neonatologists and pediatricians. There is a 2-week accredited/certified course in newborn hearing screening. Updating or re-validating training occurs once every 5 years.

7.2. Neonatal hearing screening (at-risk)

Screening for at-risk infants is also performed by nurses and pediatricians, but also audiologists.

7.3. Preschool hearing screening

Not applicable.

8. Results: Neonatal Hearing Screening

8.1. Coverage and attendance rates

In Russia, 97.8% of infants born in Russia have completed the first stage of screening within the first year of life (Russian Ministry of Health, 2016).

Attendance rate is the number of infants that attend out of all infants that are offered screening. The number of infants that missed being *offered* the first stage of screening is not specified, and attendance rate for the first stage of screening is not indicated.

As described, in Russia the second stage of screening is the diagnostic assessment. See details of the second stage of screening under the heading *Diagnostic assessment attendance*.

8.2. Referral rates

The referral rates for first stage of screening (i.e., OAE testing in the maternity ward) were 1.62 and 1.8% for 2016 and 2017, respectively (Russian Ministry of Health, 2016; Russian Ministry of Health, 2017).

8.3. Diagnostic assessment attendance

The compliance rate for attendance at the diagnostic assessment (second stage of screening) after referral from the first stage of screening is 76% for well-babies and 89.3% for at-risk babies (Russian Ministry of Health, 2016).

Out of the referred well-babies that attend a diagnostic assessment, 11-12% were found to have an abnormal result and are referred for follow-up. For at-risk babies, around 10% (roughly estimated) are confirmed and referred for follow-up from the diagnostic examination.

8.4. Prevalence / Diagnosis

The known prevalence values of permanent hearing loss among neonates in Russia is presented in Table 3 based on calculated estimates (Russian Ministry of Health, 2016).

Table 3: Prevalence of permanent hearing loss among neonates in Russia.

	Bilateral		Unilateral	
	≥ 25 dB HL	≥ 80 dB HL	≥ 40 dB HL	≥ 80 dB HL
Prevalence per 1000 (Russian Ministry of Health, 2016)	2.5	0.6		

The percentage of infants diagnosed with permanent hearing loss in Russia after neonatal hearing screening are the same data as those used for prevalence in Table 3.

The prevalence of bilateral auditory neuropathy in Russia is unknown.

8.5. Treatment success

The number of children with neonatal hearing impairment fitted with hearing aids per year in Russia is unknown. It is estimated that around 890 infants with neonatal hearing impairment are fitted with cochlear implants per year in Russia (Russian Ministry of Health, Annually).

8.6. Screening evaluation

Data on false negative or false positive rates were not provided. It was roughly estimated that 17% of babies who pass screening have a hearing loss and 85% of babies who fail the screening have normal hearing. It was roughly estimated that the positive predictive value of a refer result is 11%. Sensitivity was estimated to be 80%. Specificity was roughly estimated at around 97%.

For at-risk infants, positive predictive value, sensitive, and specificity rates are not available.



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. Prevalence / Diagnosis

Not applicable.

9.5. Treatment success

Not applicable.

9.6. Screening evaluation

Not applicable.

10. Costs: Neonatal Hearing Screening

Data on neonatal hearing screening costs are unavailable.

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

10.1. Screening costs

Data on neonatal hearing screening costs are unavailable.

10.2. Equipment costs

Data on neonatal hearing screening costs are unavailable.

10.3. Staff costs

There are 28.57 screening professionals per one million people in Russia, though the salary and training costs per year for hearing screening professionals is unknown.

10.4. Diagnostic costs

The cost for a diagnostic assessment is not provided.

10.5. Amplification costs

In Russia, not all children are treated due to capacity problems, payment problems or if deaf parents refuse cochlear implants for their children.

The total cost for hearing aids, including the device and associated services for the first year is estimated to be around €100-300. The costs associated with hearing aid treatment after the first year is estimated to be around €150 (Russian Ministry of Health, Annually).

For cochlear implants, the cost of the first year of treatment is €20 600 including the device and associated services (surgery, programming, rehabilitation, etc.). The cost of cochlear implant treatment after the first year is estimated to be €200, which includes 3 consults (Russian Ministry of Health, Annually).

10.6. Social costs

There are 83 specialized schools in Russia for the deaf and 84 schools for the hard-of hearing. There are 5 high-schools. The number of children that attend these schools is unknown.

The costs for these specialized schools are also unknown.

11. Costs: Preschool Hearing Screening

11.1. Screening costs

Not applicable.

11.2. Equipment costs

Not applicable.

11.3. Staff costs

Not applicable.

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