



Summary: Hearing Screening Montenegro

Produced as part of Work Package 4

Date: 2018-09-03

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 733352

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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 Montenegro, hearing screening is not implemented. Any testing performed is locally organized. The following report contains information with regards to status of hearing screening in the entire country of Montenegro.

3.1. General

Montenegro has a total area of 13 812 km² and a population of 620 029 as of 2011 (Statistical Office of Montenegro, 2011). In Montenegro, each birth is registered. The number of births in Montenegro was 7569 in 2016 (Statistical Office of Montenegro, 2015)

The World Bank income classification categorizes Montenegro as an upper-middle income country (The World Bank, 2018). The gross domestic product (GDP) is €6 354 per capita as of 2015 (Statistical Office of Montenegro, 2016).

From the World Health Organization (WHO) Global Health Expenditure Database, health expenditure in Montenegro in 2015 was 381 USD or €331 per capita (World Health Organization, 2018).

Data acquired from the 2016 United Nations Demographic Yearbook indicate an infant mortality rate of 4.9 per 1000 for the country of Montenegro in 2014 (United Nations Statistics Division, 2016).

3.2. Neonatal hearing screening

In Montenegro, there is no universal neonatal hearing screening. Only the Clinical Centre of Montenegro has equipment for screening children; however, testing or screening is not performed on a regular basis. There is no protocol or procedure used to screen infants. Any tests performed are funded by the state, but it is not embedded into the general Preventive Child Health Care screening system. Screening is not obligatory for parents.

3.3. Preschool hearing screening

There is no preschool hearing screening in Montenegro.



4. Guidelines & Quality Control

There are no guidelines or protocols for hearing screening in Montenegro.

Quality assurance or data collection on hearing screening is not performed and there have been no annual reports or studies performed on hearing screening in Montenegro.



5. Process: Screening, Diagnosis, Intervention

5.1. Neonatal hearing screening

For hospitals that have neonatal hearing screening, infants are screened in the hospitals. At-risk babies are screened in the hospital. Families are invited to participate in screening directly in person in the hospital.

The average length of stay in the maternity ward after delivery is estimated to be 3 days. According to the Ministry of Health (2016), 99.5% of births in Montenegro take place in the hospital, while 0.5% of births take place at home.

There is no neonatal hearing screening protocol that indicates the targeted maximum age of screening or target condition for screening.

5.2. Neonatal diagnostic assessment

There is no protocol that indicates details of the diagnostic assessment or by when the diagnostic audiological evaluation should be completed.

5.3. Preschool hearing screening

Not applicable.

5.4. Intervention approach

In Montenegro, treatment options available include grommets, hearing aids, bone conductive devices and cochlear implants. Infants are fitted with hearing aids from 1-2 years of age, and infants are fitted with cochlear implants from 1-2 years of age or older.

The hearing aid fitting criteria for children in Montenegro is a bilateral hearing loss of at least 25 dB HL, according to the Policy on Hearing Aids (The Health Insurance Fund of Montenegro, 2017).



6. Protocols

6.1. Neonatal hearing screening (well)

There is no set protocol in place for screening well, healthy infants. For hospitals that have neonatal hearing screening, infants are screened with OAE during the first week of life in either one or both ears. Infants that do not pass the initial screening are rescreened after one month.

6.2. Neonatal hearing screening (at-risk)

There is no set protocol in place for screening at-risk infants. For hospitals that perform screening, infants at risk are screened with OAEs during the first 3 months of life in either one or both ears.

6.3. Preschool hearing screening

Not applicable.



7. Professionals

7.1. Neonatal hearing screening (well)

ENT specialists and nurses perform neonatal hearing screening, when applicable. There is no specific training for hearing screening.

7.2. Neonatal hearing screening (at-risk)

ENT specialists and nurses perform neonatal hearing screening, when applicable.

7.3. Preschool hearing screening

Not applicable.



8. Results: Neonatal Hearing Screening

8.1. Coverage and attendance rates

Data are unavailable regarding the coverage and attendance rates of neonatal hearing screening in Montenegro. It is roughly estimated that 30% of infants at-risk are invited for neonatal hearing screening across Montenegro.

8.2. Referral rates

Data are unavailable on passing or referral rates.

8.3. Diagnostic assessment attendance

Data are unavailable on the diagnostic assessment attendance rate.

8.4. Prevalence / Diagnosis

Data are unavailable on the prevalence rate or percentage of infants diagnosed with hearing impairment in Montenegro.

8.5. Treatment success

In Montenegro, infants may not be treated for hearing impairment if deaf parents refuse cochlear implants for their children. It is estimated that 10 children per year are fitted with cochlear implants. Data are unavailable regarding the number of children fitted with hearing aids per year.

8.6. Screening evaluation

Data are unavailable regarding the outcome measures for neonatal hearing screening.



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

There has not been a cost effectiveness analysis completed in Montenegro. Screening is free of charge for parents and no reward or penalty is offered for those attending or refusing hearing screening.

10.1. Screening costs

Data are unavailable regarding the costs for hearing screening

10.2. Equipment costs

Data are unavailable regarding the costs for hearing screening equipment, maintenance, or disposables.

10.3. Staff costs

The annual salary for nurses and ENT specialists that perform hearing screening are €4500 and €8000, respectively. Data are unavailable regarding the number of hearing screening professionals; however, there are approximately 30 ENT specialists and 2 audiologists in Montenegro.

10.4. Diagnostic costs

The cost for a diagnostic assessment is not provided.

10.5. Amplification costs

According to the price lists for hearing aids (Health Insurance Fund of Montenegro, 2017), one hearing aid plus a pair of batteries costs €295,29. Children under 7 years of age are covered for a replacement hearing aid every 24 months. There are no data available on the costs for follow-up or consultations.

For cochlear implants, the implant itself costs €7800, the external processor costs €7800, the magnet costs €34,06, the battery pack costs €285 and the cable costs €65. The external processor is covered for replacement every 84 months, a new magnet is covered every 36 months, a new battery pack is covered every 60 months and a new cable is covered every 6-12 months, batteries are replaced every 3 months. There are no data available on the costs for follow-up or consultation.

10.6. Social costs

In Montenegro, there is one specialized school for the education of children with hearing and speech impairment. The Strategy for Education (2008) has indicated that, 162 children in total, attend this school, with a count of 7, 59 and 106 children in preschool, primary school, and high school, respectively. The costs associated with school or specialized school in Montenegro are unknown.



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.



12. References

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