

EUSCREEN - HEARING SCREENING BULGARIA

Petar Rouev¹, Lidia Georgieva², Mario Milkov³

¹ENT Department, Trakia Hospital, Stara Zagora, Bulgaria

²Department of Social Medicine, Medical University, Sofia, Bulgaria

³Faculty of Dental Medicine, Medical University of Varna, Bulgaria

1. BACKGROUND

In Bulgaria, hearing screening is performed nationally and organized nationally. The following report contains information with regards to childhood hearing screening in the entire country of Bulgaria.

1.1. General

Bulgaria has a total area of 110 994 km² with a population of 7 101 859 at the end of 2016 (1). In Bulgaria, all births are registered as public information. Birth information is regulated by a medical standard in obstetrics and gynecology. There were 63 955 births registered in 2017 (1). The World Bank income classification categorizes Bulgaria as an upper-middle-income country (2). The gross domestic product (GDP) in 2017 was €7099 per capita in Bulgaria (1). From the World Health Organization (WHO) Global Health Expenditure Database, health expenditure for Bulgaria in 2015 was 572 USD or €502 per capita (3). An infant mortality rate of 6.4 per 1000 was reported for Bulgaria in 2017 (1). The United Nations Statistics Division also showed a higher mortality rate in Bulgaria in rural areas compared to urban areas. Infant mortality rates in 2015 were 10.9 and 5.2 for rural and urban areas, respectively (4).

1.2. Neonatal Hearing Screening

In Bulgaria, neonatal hearing screening is conducted universally. All babies in the country should have access to hearing screening, though participation is not obligatory for parents.

Hearing screening for both healthy and at-risk babies started and was fully implemented in Bulgaria in 2015. Screening for healthy babies is funded through the council (5) and it is roughly estimated that funding for at-risk infants is funded through the province/region. Screening is not part of the Preventive Child Health Care screening system. Neonatal hearing screening is organized by the Ministry of Health in Bulgaria.

National guidelines are available as is a screening protocol used across the country. Although a national universal programme is in place in Bulgaria, and all hospitals should follow the same protocol, there

are some inconsistencies regarding how accurately the hearing screening protocol is followed in some hospitals.

1.3. Preschool Hearing Screening

Preschool hearing screening is conducted universally in Bulgaria. Before starting school, children's hearing should be tested. Screening is not part of the Preventive Child Health Care screening system and is funded by parents or health insurance. It is unknown when preschool hearing screening started or was implemented across the country. It is typically organized by the child's physician and is performed in the clinic. Referrals are made to the ENT clinic when necessary.

2. GUIDELINES & QUALITY CONTROL

There are national guidelines for hearing screening in Bulgaria. The content of the general hearing screening programme was decided on by the Ministry of Health and has not been changed since implementation in 2015.

Quality assurance of hearing screening programmes is not imposed by the government; however, information is collected directly by the Ministry of Health. Each hospital provides screening information to the regional office of the Ministry. Data are unavailable on whether annual reports are produced.

It is unknown whether research has been done on hearing screening programmes in Bulgaria, but there has not been research performed on the effectiveness of screening in Bulgaria.

3. SCREENING – DIAGNOSIS – INTERVENTION PROCESS

3.1. Neonatal Hearing Screening

Healthy babies and at-risk babies are screened in the hospital, NICU or private clinic. The percentage of infants born in a maternity hospital in Bulgaria is unknown though roughly estimated to be close to 100%, while home births are roughly estimated to be below 2-3%. The average length of stay in the maternity hospital after delivery is roughly estimated to

be 3-5 days. Parents/caregivers of healthy and at-risk babies are invited to participate in neonatal hearing screening directly in person in the hospital.

Neonatal hearing screening for healthy babies should be completed before 3 months of age. For at-risk babies, screening should be completed before 3 months of gestational (corrected) age. The definition of at-risk infants is listed according to the Joint Committee on Infant Hearing (6). Data on the prevalence of CMV and meningitis is not available in Bulgaria, but is roughly estimated to be very low (less than 0.5% and 1%, respectively). The target condition for screening for both healthy and at-risk babies is a bilateral hearing loss of 40 dB or worse.

3.2. Neonatal Diagnostic Assessment

The diagnostic assessment after neonatal hearing screening referral should include an ABR assessment and be completed by 3 months of age for well infants, and 3 months corrected age for at-risk infants.

3.3. Preschool Hearing Screening

Hearing screening is performed on children before they start school. They are invited to participate by their general practitioner, and screening is performed there in the health care clinic by the GP. Follow-up may be made at the ENT clinic if necessary. The target condition for preschool hearing screening is a unilateral or bilateral hearing loss of 40 dB or worse.

3.4. Intervention Approach

In Bulgaria, the treatment options available include grommets, hearing aids, bone conduction devices, and cochlear implants; however, not all children in Bulgaria are treated due to capacity problems and payment problems. Furthermore, children with deaf parents who refused cochlear implants for their children are not fitted with cochlear implants.

Infants are fitted with hearing aids from 6-12 months of age or older and with cochlear implants from 1-2 years of age or older. The fitting criteria in Bulgaria for a hearing aid is roughly estimated to be bilateral hearing loss of at least 40 dB HL.

4. HEARING SCREENING PROTOCOLS

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

- The Test performed is the screening technique used (OAE or aABR).
- The Age of the infant is indicated in hours or days for neonatal hearing screening or in years for preschool hearing screening.

- The Settings or Device is the protocol specifications of the screening device or name of device used.
- Pass criteria may either be an OAE present at specified frequencies, a specified response-waveform repeatability constant, an aABR detected at specified intensity, or a behavioural response present at a specified intensity. Pass criteria may be defined within a protocol or limited based on the device used.
- Protocols may indicate if an infant is referred with a “no pass” result in either One or Both ears.
- The Location is where the screen takes place (hospital, clinic, school, etc.)

4.1. Neonatal Hearing Screening (Healthy Baby)

The process for neonatal hearing screening for healthy babies is described in Table 1. A 2-step OAE protocol is in effect, whereby the first OAE is performed in the maternity hospital. If the infant fails the first test, rescreening occurs at 1 month of age. A subsequent fail at rescreening would warrant a referral to the ENT department for clinical/diagnostic ABR.

4.2. Neonatal Hearing Screening (At-Risk Baby)

The screening process for at-risk infants is described in Table 2. A combined TEOAE+aABR screening is in effect whereby both OAE and aABR is performed before the infant is discharged from the NICU. Both aABR and TEOAE are required for all at-risk infants. Additionally, follow-up is performed on all at-risk infants at 6 months of age.

4.3. Preschool Hearing Screening

Hearing screening is performed in health care clinics at 7 years of age. The screening test is pure-tone audiometry, described in Table 3.

5. SCREENING PROFESSIONALS

5.1. Neonatal Hearing Screening (Healthy Baby)

Neonatal hearing screening is performed by a nurse, audiologist, midwife or pediatrician. There is currently no specific training for hearing screening staff. The training currently provided is practical (on the job).

5.2. Neonatal Hearing Screening (At-Risk Baby)

Screening for at-risk infants is performed by pediatricians.

5.3. Preschool Hearing Screening

Screening for preschool-age children may be performed by general practitioners, ENT physicians or audiologists. This is not clearly defined in Bulgaria.

6. RESULTS: NEONATAL HEARING SCREENING

6.1. Coverage and Attendance Rates

In Bulgaria, the coverage and attendance rates of neonatal hearing screening is unknown.

6.2. Referral Rates

The pass rates for neonatal hearing screening of healthy infants are roughly estimated. The pass rate for OAE1 is roughly estimated to be greater than 80% and the pass rate for OAE2 is roughly estimated to be greater than 50%.

The final referral rate to a diagnostic assessment for healthy babies is roughly estimated to be 0.5%, and the final referral rate for at-risk infants is roughly estimated to be 1-2%.

6.3. Diagnostic Assessment Attendance

The compliance rate of a referral to diagnostic assessment from neonatal hearing screening for healthy infants and for at-risk infants is roughly estimated that more than 80% and more than 95%, respectively.

6.4. Prevalence / Diagnosis

Data are generally unavailable regarding the prevalence of neonatal hearing loss in Bulgaria. However, data from 2001 showed a prevalence rate of 1.63 per 1000 for neonatal permanent bilateral hearing loss ≥ 40 dB. Data are unavailable regarding the prevalence of auditory neuropathy in Bulgaria.

6.5. Treatment Success

As indicated, not all children in Bulgaria are treated due to capacity problems and payment prob-

lems. Furthermore, children with deaf parents who refused cochlear implants for their children are not fitted with cochlear implants. It is roughly estimated that 50-60 children are fitted with hearing aids and 30-40 children are fitted with cochlear implants each year in Bulgaria.

6.6. Screening Evaluation

Actual 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. However, estimations were provided. For healthy infants, sensitivity was estimated to be 100% and specificity was estimated to be 98%. For at-risk infants, sensitivity was estimated to be 99% and specificity was estimated to be 97%.

7. RESULTS: PRESCHOOL HEARING SCREENING

7.1. Coverage and Attendance Rates

Data are unavailable regarding the coverage and attendance rates of preschool hearing screening in Bulgaria.

7.2. Referral Rates

Data are unavailable regarding the referral rate for preschool hearing screening.

7.3. Diagnostic Assessment Attendance

Data are unavailable.

7.4. Screening Evaluation

Data are unavailable.

Table 1. Process for neonatal hearing screening for healthy infants in Bulgaria

Test	Age	Pass criteria	Settings / Device	One / Both Ear Referral	Location
OAE1*	24-72 hours	4 of 6 freq: >5 dB SNR (TE); 3 of 4 freq: >6 dB SNR (DP).	Various	One or both	Maternity hospital
OAE2	1 month	4 of 6 freq: >5 dB SNR (TE); 3 of 4 freq: >6 dB SNR (DP).	Various	One or both	Maternity hospital

* OAE1 may be performed 1-3 times before discharge.

Table 2. Process for neonatal hearing screening for at-risk infants in Bulgaria

Test	Age	Pass criteria	One / Both Ear Referral	Location
OAE+ aABR	24-72 hours	40 dB nHL	One or both	Maternity hospital / NICU

Table 3. Process for preschool hearing screening in Bulgaria

Test	Age	Pass criteria	One / Both Ear Referrals	Location
Pure-tone audiometry	7 years	40 dB HL	One or both	Clinic

8. COSTS: NEONATAL HEARING SCREENING

Financing of neonatal hearing screening in Bulgaria is organized by the Ministry of Health. Screening is free of charge for parents. There is no financial reward when parents attend hearing screening, nor a penalty for those who do not attend hearing screening.

A cost analysis of neonatal hearing screening in Bulgaria has not been completed.

8.1. Screening Costs

The total screening costs for healthy babies per year is unknown; however, the cost of neonatal hearing screening provided by the Ministry of Health per child (all infants) is 10 BGN or €5.12 (Ministry of Health, 2016).

8.2. Equipment Costs

The cost of an OAE screening device is 10 000 BGN or €5111, the cost of an aABR screening device is 20 000 BGN or €10 221, and the cost for ASSR equipment is 40 000 BGN or €20 448. Maintenance costs are unknown. Devices are replaced every 10-20 years. The cost for disposables are unknown.

8.3. Staff Costs

Data are unavailable regarding the number of professionals performing hearing screening in Bulgaria. The annual salary for a screening professional (nurse) is roughly estimated to be 13 200 BGN or €6746. The educational fee per student is 1000-1500 BGN or €511-€767 per year.

8.4. Diagnostic Costs

The total cost of diagnostic confirmation is not indicated.

8.5. Amplification Costs

In Bulgaria, not all children with hearing loss are treated due to capacity and payment problems. Chil-

dren of deaf parents who refuse cochlear implant for their children would also not be treated. The cost for a hearing aid is 1200 BGN or €613 and the cost for a cochlear implant is 33 600 BGN or €17 174. There are no treatment costs specifically for habilitation. The hearing aids and cochlear implant are covered by social and health system.

8.6. Social Costs

There are 3 schools in Bulgaria for deaf and hard-of-hearing students that runs from preschool to primary school. It is unknown how many children attend this school. It is unknown whether extra support is provided to children with hearing impairment in mainstream schools. All costs for mainstream or special education schools are unknown.

9. COSTS: PRESCHOOL HEARING SCREENING

9.1. Screening Costs

The total costs for preschool hearing screening are unknown. It is estimated that preschool hearing screening costs 20 BGN or €10.22 per child.

9.2. Equipment Costs

The cost of a pure-tone screening audiometer is not specified.

Conflict of Interest

The authors have no conflict of interest to declare. This article does not contain patient data. This study is part of the EUSCREEN Vision & Hearing - Erasmus MC programme and validation of this data by the Karolinska Institutet in Stockholm (hearing) and University of Sheffield (vision).

REFERENCES

1. National Statistical Institute. (2018). Statistical data. Retrieved from Republic of Bulgaria National statistical institute : <http://www.nsi.bg/en/content/11223/statistical-data>
2. The World Bank. (2018). World Bank GNI per capita Operational Guidelines & Analytical Classifications. The World Bank.
3. World Health Organization (WHO). (2018). Global Health Expenditure Database. Retrieved from NHA Indicators: <http://apps.who.int/nha/database/DataExplorerRegime.aspx>
4. United Nations Statistics Division. (2016). Demographic Yearbook – 2016. Department of Economic and Social Affairs. New York: United Nations.
5. Ministry of Health. (2016, 09 02). Response of the Minister of Health Dr. Petar Moskov to a question by the Minister of Health. Mr. Yavor Haytov. Retrieved from Ministry of Health: <http://www.mh.government.bg/bg/novini/parlamentaren-kontrol/otgovor-na-ministra-na-zdraveopazvaneto-02-09-16-7/>
6. Joint Committee on Infant Hearing. (2007). Year 2007 position statement: principles and guidelines for early hearing detection and intervention programs. *Pediatrics*, 120(4), 898-921.