



Summary Vision Screening Data: Bulgaria

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1. Glossary of Terms: Vision 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 invited for screening that are tested and receive a result:</p> <ul style="list-style-type: none"> • Invited for screening includes all those that are offered the screening test. • Tested and receive a result could be a “pass” or “referral to diagnostic assessment”. <p>Attendance rate provides information on the willingness of families to participate in screening.</p>
Compliance with referral (percentage)	<p>The percentage of those who are referred from screening to a diagnostic assessment that actually attend the 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 eligible for screening that are tested and receive a result:</p> <ul style="list-style-type: none"> • Eligible for screening includes those within the population that are covered under the screening or health care programme. • Tested and receive a result could be a “pass” or “refer to diagnostic assessment”. <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>
False negatives	<p>The percentage of children with a visual deficit (defined by the target condition) that receive a result of “pass” during screening.</p> <p>Example: If 100 children with visual deficit are screened, and 1 child passes the screening, the percentage of false negatives is 1%.</p>



False positives	The percentage of children with normal vision that are referred from screening to a diagnostic assessment.
Guidelines	Recommendations or instructions provided by an authoritative body on the practice of screening in the country or region.
Vision screening professional	A person qualified to perform vision screening, according to the practice in the country or region.
Inconclusive test result	A test result where a normal “pass” response could not be detected due to poor test conditions or poor cooperation of the child.
Invited for screening	Infants/children and their families who are offered screening.
Outcome of vision screening	An indication of the effectiveness or performance of screening, such as a measurement of coverage rate, referral rate, number of children detected, etc.
Untreated amblyopia	Those children who have not received treatment for amblyopia due to missed screening or missed follow-up appointment.
Persistent amblyopia	Amblyopia that is missed by screening, or present after the child has received treatment.
Positive predictive value	<p>The percentage of children referred from screening who have a confirmed vision loss.</p> <p>For example, if 100 babies are referred from screening for diagnostic assessment and 10 have normal vision and 90 have a confirmed visual defect, the positive predictive value would be 90%.</p>
Prevalence	The percentage or number of individuals with a specific disease or condition. Prevalence can either be expressed as a percentage or as a number out of 1000 individuals within the same demographic.
Programme	An organised 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 a child should be re-tested or seen for a diagnostic assessment.
Risk babies / Babies at-risk	All infants that are considered to be at-risk or have risk-factors for vision defects/ophthalmic pathology according to the



	<p>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 visual defects may also be indicated in the screening programme.</p>
Sensitivity	<p>The percentage of children with visual defects that are identified via the screening programme.</p> <p>For example, if 100 babies with visual defects are tested, and 98 of these babies are referred for diagnostic assessment and 2 pass the screening, the sensitivity is 98%.</p>
Specificity	<p>The percentage of children with normal vision that pass the screening.</p> <p>For example, if 100 babies with normal vision 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 visual defect you are aiming to detect via the screening programme.</p>
Well, healthy babies	<p>Infants who are <i>not</i> admitted into the NICU or born prematurely (born after a gestation period of less than 37 weeks).</p>



2. Abbreviations

ACT	Alternating Cover Test
AR	Autorefraction
AS	Automated Screening
CT	Cover Test
CV	Colour Vision
EI	Eye Inspection
EM	Eye Motility
Fix	Fixation
GDP	Gross Domestic Product
GP	General Practitioner
Hir	Hirschberg test
NICU	Neonatal-intensive care unit
PM	Pursuit Movements
PPP	Purchasing Power Parity
PR	Pupillary Reflexes
RE	Retinal Examination
ROP	Retinopathy of Prematurity
RR	Red Reflex Testing
SV	Stereopsis
VA	Visual Acuity
WHO	World Health Organisation



3. Population and Healthcare Overview

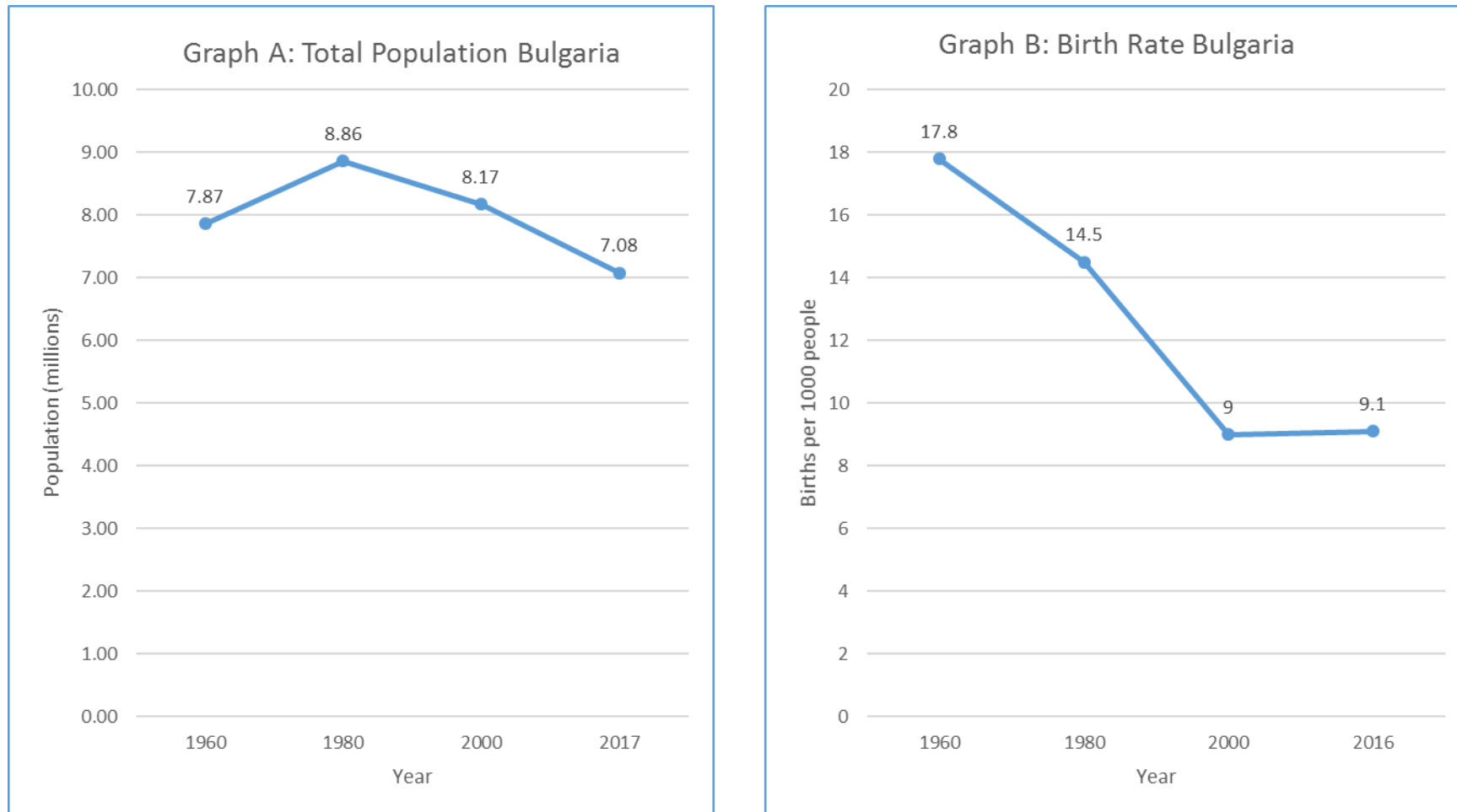
The population of Bulgaria is estimated at 7,075,991 (World Bank, 2018a) and a birth rate estimated at 9.1 births/1,000 population in 2016 (World Bank, 2018b). The change in population and birth rate from 1960 to 2017 is shown in Figure 1, graphs A and B respectively.

In 2017 Bulgaria has a reported population density of 65.18 people per square kilometre and this has fallen from 71.79 people per square kilometre in 1961 (World Bank, 2018c). Infant mortality in 2017 is estimated at 6.3 deaths/1,000 live births in total (World Bank, 2018d).

The average life expectancy in Bulgaria is estimated at 74.6 (World Bank, 2018e), with a death rate of 15.1 deaths/1,000 population in 2016 (World Bank, 2018f). Bulgaria has a gross national income per capita (PPP int. \$, 2013) of \$15,000 (WHO, 2016). The estimated total expenditure on health per capita in 2014 was \$1,399 (Intl \$) and the total expenditure on health in 2014 as percentage of GDP was 8.4% (WHO, 2016).



Figure 1: Change in the Total Population and Birth Rate in Bulgaria between 1960 and 2017



Source: Information sourced from World Bank (2018)



4. Vision Screening Commissioning and Guidance

Vision screening is not set-up as a national programme in Bulgaria and is organised regionally. Dates that these regional services started and changes to services are not known. Vision screening is conducted as part of charity programmes in different cities and villages, among different age groups and usually in schools. There are no regions in Bulgaria that have a standardised vision screening programme, every charity campaigns are funded by different sources. There are no guidelines for vision screening available in Bulgaria. However, the Ministry of Health in Bulgaria have stated that GPs should perform a visual acuity assessment after the age of 3 years with vision screening embedded into a general preventative child healthcare screening programme.

In Bulgaria, vision screening is performed by ophthalmologists, neonatologists and general practitioners (GP). It is not known how many vision screening professionals there are in Bulgaria, per million population. Not all GPs perform vision screening, and as such, there are some that could do so with additional training. Paediatricians and nurses are also healthcare professionals within the country who could deliver vision screening with additional training. Currently there is no specific training to perform vision screening.

Coverage can differ between cities, schools and kindergartens and the tests used vary; some are using only automated screening, others test visual acuity and more. There are no methods for quality monitoring imposed by the government. There is only one reported paper published on the outcomes of vision screening (Dikova, Dragoev & Chernodrinska, 2015); this does not include cost-effectiveness analysis.



5. Screening programme

Target conditions for vision screening have not been identified as there is no protocol for vision screening in Bulgaria. The health care professionals delivering vision screening, venue for screening and tests used vary depending on the age of the child as shown in Tables 1, 2 and 3 respectively. Specific details of the screening offered within each age group and within different regions are described more fully in sections 5.1 to 5.4 below.

5.1 *Vision screening - Preterm babies*

There is no national policy for preterm babies. In the capital cities of Sofia and Plovdiv, a few hospitals screen for retinopathy of prematurity (ROP) by a paediatric ophthalmologist in a hospital. There are RetCams in Sofia, Varne and Ruse. Parents can travel to Sofia or Plovdiv, if they live in other areas, otherwise no vision screening is conducted. The vision screening tests utilised at this age include red reflex testing and retinal examination, although this should be conducted everywhere, the retinal examination is not performed in all areas.

5.2 *Vision screening - Birth to 3 months*

Well, healthy babies, up to the age of 3 months, are screened once by a neonatologist in a hospital in every region of Bulgaria. The only test utilised at this age is red reflex testing. It is not known how many abnormal or how many inconclusive tests necessitate referral to an ophthalmologist for further examination.

5.3 *Vision screening - 3 months to 36 months*

Children aged 3 to 36 months do not receive any vision screening.

5.4 *Vision screening - 36 months to 7 years*

Children aged from 36 months to 7 years are screened by a GP in the GPs office. The only test utilised at this age is a visual acuity measurement. Referral for further diagnostic examination occurs after one abnormal test result. There is no defined policy for the number of inconclusive results, for example, due to poor cooperation, before referral for further diagnostic examination. There are no specific referral criteria, referral is at the discretion of the GP. The optotype charts used include numbers and Tumbling E, most of which are linear, crowded tests (it is not known if this is logMAR or Snellen format). It is not known at what age visual acuity is measured for the first time, or if it is measured again at any other age.



Table 1: Healthcare professionals who conduct vision screening in each age group

Table 1	Neonatologist	Ophthalmologist	GP
Preterm babies	×	✓ Only in available in Sofia and Plovdiv	×
0 to 3 months	✓	×	×
3 to 36 months	×	×	×
3 to 7 years	×	×	✓



Table 2: Vision screening tests used in vision screening for each age group

Table 2	Hospital	GP clinic	Public place	Other
Preterm babies	✓	×	×	×
0 to 3 months	✓	×	×	×
3 to 36 months	×	×	×	×
3 to 7 years	×	✓	×	×



Table 3: Location of vision screening for each age group

Table 3	Red reflex testing	Retinal examination	VA measurement
Preterm babies	✓	✓ Not conducted in all areas	×
0 to 3 months	✓	×	×
3 to 36 months	×	×	×
3 to 7 years	×	×	✓



6. Automated Screening

Automated vision screening is achieved using handheld, portable devices designed to detect presence of refractive error from 6 months of age. It provides objective results and is used to detect amblyopic risk factors. This differs from other methods used to screen children for amblyopia which focus on detection of the actual condition and the resulting visual loss. No automated vision screening is used in Bulgaria.



7. Provision for Visually Impaired

The Association of the Blind in Bulgaria report that there are two schools for blind or severely visually impaired children in Bulgaria; it is not known how many children attend these schools. There is no special support provided for visually impaired children who attend regular primary school.



8 Knowledge of existing screening programme

8.1 Prevalence/Diagnosis

A cross-sectional study (Dikova, Dragoev and Chernodrinska, 2018) of 1675 children in western Bulgaria, aged between 4 and 10 years showed that the prevalence of treated or untreated amblyopia in Bulgaria by the age of 7 years is estimated to be 2.5%. However, due to there being no standardised screening in Bulgaria, it is not possible to determine the prevalence of persistent amblyopia. There is no data available concerning the prevalence of strabismus in Bulgaria. The cross-sectional study also showed that the incidence of the four types of amblyopia were: 7% strabismic; 59% anisometric, 31% isoametropic and 3% deprivation. Unilateral amblyopia was diagnosed in 73% of the cases and bilateral amblyopia was diagnosed in 27% of the cases. For 45% of the children, it was their first visit to an ophthalmologist.

8.2 Coverage

The percentage of children invited for vision screening is not available. Invitations for general preventative child healthcare screening are made by the GP and is carried out during routine visits. It is estimated that approximately 45% of children receive vision screening before the age of 7 years (Dikova, Dragoev and Chernodrinska, 2015). The assessment of visual acuity as part of vision screening, before the age of 7 years, is estimated to be offered to 20% of children with just 40% of these actually attend (Dikova, Dragoev and Chernodrinska, 2015).

8.3 Screening evaluation

There is not data available concerning the percentage of false negative referrals, false positive referrals, the positive predictive value of a refer result, the sensitivity of vision screening, or the specificity of vision screening in Bulgaria.

8.4 Treatment success

Children who fail vision screening are referred to an ophthalmologist, who are the only professionals that prescribe glasses for children under the age of 7 years in Bulgaria. Other treatment options include patching, atropine and cataract surgery where required. Not all children identified are treated due to the cost, as vision screening is funded through charities and parents. There are also compliance problems. There is no information concerning the percentage of compliance with referral after an abnormal screening test result as there is no registration or documentation of noncompliance.

Approximately 1% of infants are treated for congenital eye disorders in the total population. There is no available data concerning the percentage of children treated for strabismus, or amblyopia before the age of 7 years.



9 Costs of vision screening in children

9.1 Cost of vision screening

There is no data available concerning the salary costs per year, or per hour, for vision screening professionals. It is not known how much it costs to train general preventative child healthcare screening professional, between leaving secondary education and qualification. The total screening costs per year, or per child per year, for vision screening in Bulgaria are not known.

9.2 Cost of treatment for amblyopia

The estimated costs for treatment of typical patients, with refractive amblyopia and strabismic amblyopia including follow up are estimated at:

- 250 Leva (127.82 Euros*) for glasses
- 20 Leva (10.23 Euros*) per visit, with between 6 and 12 visits required
- 200 Leva (102.27 Euros*) for patching.

9.3 Cost of Treatment for strabismus

The estimated costs for strabismus surgery including follow up are estimated at:

- 20 Leva (10.23 Euros*) for each visit – of which 12 are needed
- 1000 Leva (511.35 Euros*) for surgery.

9.4 Cost of treatment for cataract

The estimated costs for congenital cataract surgery, including follow up of deprivation amblyopia, is estimated at:

- Surgery: 1500 Leva (766.96 Euros*) if an intraocular lens is implanted; 500 Leva (255.68 Euros*) if only surgery is needed
- 300 Leva (153.41 Euros*) for glasses/soft contact lenses
- 20 Leva (10.23 Euros*) for each visit by an ophthalmologist (at least 10 needed)
- 300 Leva (153.41 Euros*) for patching.

There is not financial reward for parents when children attend vision screening, no penalty when they do not attend and vision screening is not obligatory for parents and children.

*Currency conversions are as of 04/10/2018.



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