



Summary Vision Screening Data: Serbia

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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 screening programme.



	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.
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	The visual defect you are aiming to detect via the screening programme.
Well, healthy babies	Infants who are <i>not</i> admitted into the NICU or born prematurely (born after a gestation period of less than 37 weeks).



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
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

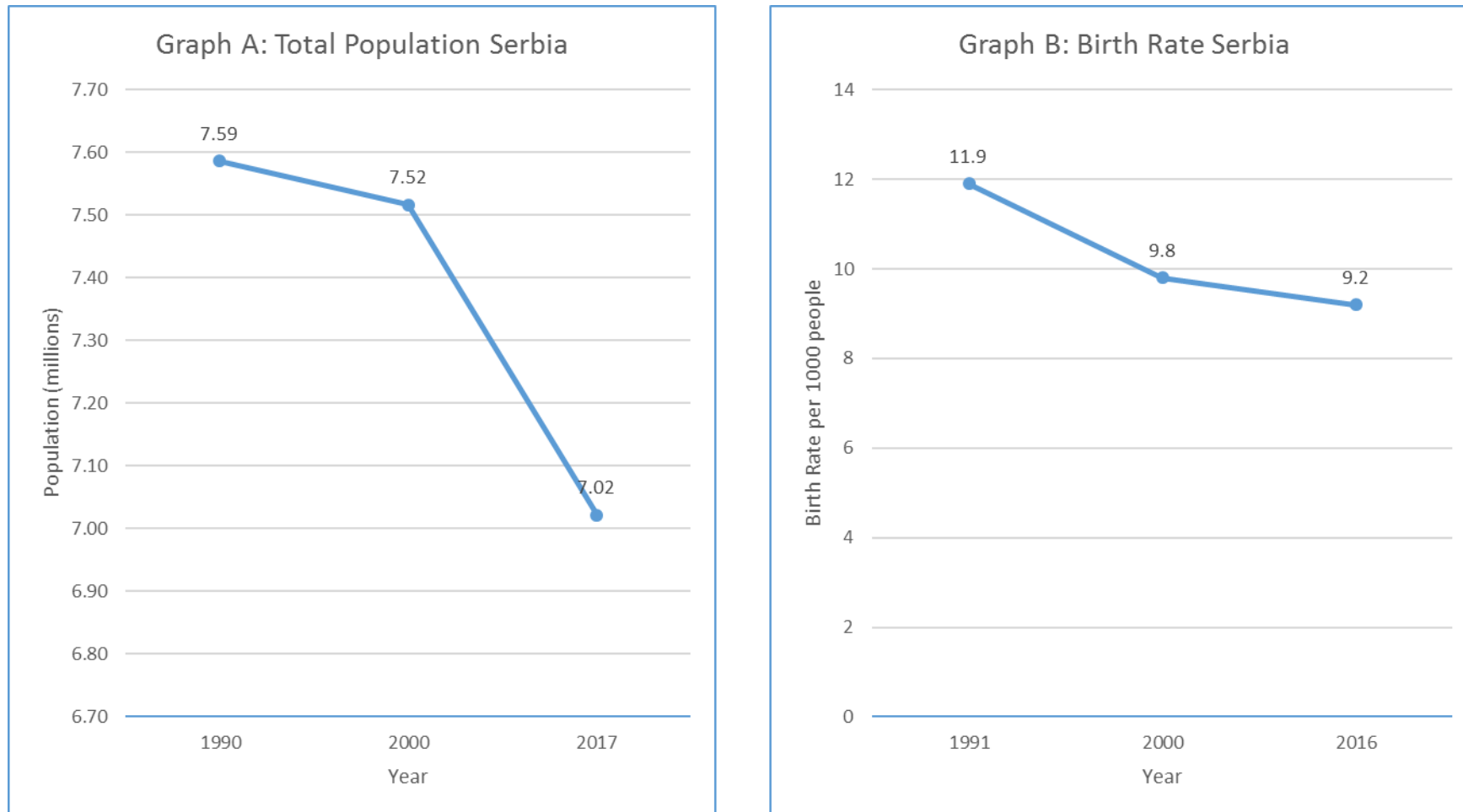
The population of Serbia is 7,022,268 (World Bank, 2018a) and birth rate is estimated at 9.2 births/1,000 population in 2016 (World Bank, 2018b). The change in population and birth rate from 1990 to 2017 is shown in Figure 1, graphs A and B respectively.

Serbia had a reported population density of 80 people per square kilometre in 2017 and this has risen from 87 people per square kilometre in 1990 (World Bank, 2018c). In terms of healthcare facilities, the total density of hospitals in 2013 was 1.09 per 100,000 population (WHO, 2016a). Infant mortality in 2017 was estimated at 5 deaths/1,000 live births in total (World Bank, 2018d).

The average life expectancy in Serbia is estimated at 75 years (World Bank, 2018e), with a death rate 14.3 deaths/1,000 population in 2016 (World Bank, 2018f). Serbia has a gross national income per capita (PPP int. \$, 2013) of \$12,000 (WHO, 2016b). The estimated total expenditure on health per capita in 2014 was \$1,312 (Intl \$) and the total expenditure on health in 2014 as percentage of GDP was 10.4% (WHO, 2016b).



Figure 1: Change in the Total Population and Birth Rate in Serbia between 1990 and 2017



Source: Information sourced from World Bank (2018)

4 Vision Screening Commissioning and Guidance

Vision screening is organised nationally, with no regional variations. It is estimated to have been set-up in 1950 and changed in 2010 to remove vision screening in children aged 2 to 3 years. The programme is funded through health insurance and is embedded within a general preventative child healthcare screening system. The content of vision screening is decided upon by the National Advisory Board for Health Protection for Women, Children and Youth. The national guidelines for vision screening are reviewed every 10 years with the revisions decided upon by the National Advisory Board for Health Protection for Women, Children and Youth. There are no methods for quality monitoring for vision screening imposed by the government.

In Serbia, the professionals who perform vision screening include paediatricians, ophthalmologists, orthoptists and nurses, depending on the age of the child. There are approximately 85 ophthalmologists per million population. No other general professionals have been identified who could deliver vision screening with additional training. There is no specific training to perform vision screening for professionals, instead, paediatricians and ophthalmologists are trained during residency and orthoptists are trained during their academic studies. Training is regularly updated, monitored and revalidated, but only training for paediatricians, ophthalmologists and orthoptists is certified. Nurses are trained by ophthalmologists. At present, the majority of registered nurses do not have any formal ophthalmological education, or any specific training; they are trained by individual ophthalmologists to examine visual acuity accurately.

There has been one piece of research concerning the vision screening programme in Serbia,, an oral presentation at 14th Congress of Ophthalmologists of Serbia, 2013, titled: Importance of preventive ophthalmological examination in 5th year before obligatory entry in preschool institution (Rogošić. et al., 2013). This was published as abstract in Serbian language. This does not include a cost-effectiveness analysis.

5 Screening programme

In Serbia, the target conditions screened for by vision screening are retinopathy of prematurity, congenital eye defects, amblyopia and strabismus. 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 are described more fully in sections 5.1 to 5.4 below.

5.1 Vision screening - Preterm babies

Preterm babies aged up to 3 months are screened by a paediatrician and ophthalmologist in a hospital, at birth before discharge, a child healthcare centre, or a private clinic; dependent upon parental preference of private or public setting. The sequence of testing is as follows: a paediatrician will perform an eye inspection, fixation, eye motility, pursuit movements, Hirschberg test and pupillary reflexes. If there is a suspicion or detection of any problem(s), the child is referred to a child healthcare centre or private practice to see an ophthalmologist. Preterm babies of a birth weight less than 2000 grams, or less than 37 gestational weeks are examined by an ophthalmologist in maternity hospitals in regional centres with a complete ophthalmological examination, including fundus examination. These babies are referred by a paediatrician for follow up in public or a private setting if the parents prefer.

5.2 Vision screening - Birth to 3 months

Well, healthy babies aged up to 3 months are screened by either an ophthalmologist or paediatrician in either a child healthcare centre or a private clinic; this is based on parental preference whether they attend public or private setting. Screening tests include eye inspection, fixation, ocular motility including pursuit eye movements, Hirschberg test, and pupillary reflexes. These tests are conducted by the paediatrician and if the child has a white pupil they are referred to an ophthalmologist to perform a fundus examination. A child is referred to an ophthalmologist after one abnormal or inconclusive test result.

5.3 Vision screening - 3 months to 36 months

Children aged 3 to 36 months are screened by a paediatrician in either a child healthcare centre or a private clinic. Screening tests include eye inspection, fixation, eye motility, Hirschberg test, pursuit movements, pupillary reflexes, cover test, alternating cover test and stereopsis using Lang I test. Children are screened at every general screening visit. Children are referred to an ophthalmologist if there is any suspected or detected eye problem.

5.4 Vision screening - 36 months to 7 years

Children aged between 36 months and 7 years are screened by an ophthalmologist at child healthcare centres and in some cases at kindergartens between the ages of 3 to 4 years. Not all children attend kindergarten. Screening tests include eye inspection, red reflex testing, eye

motility including pursuit movements, Hirschberg test, pupillary reflexes, cover test, alternating cover test, stereopsis using Lang I or Randot test, and visual acuity measurement. Visual acuity is measured using the Snellen chart (range: 0.1 to 1.0 or 1.25 decimal). It is measured for the first time at 3 to 4 years of age, then again at 6 to 7 years of age, and once more at 13 to 14 years of age. Visual acuity is measured by nurses and orthoptists, with two inconclusive or abnormal test results determining referral to an ophthalmologist for further diagnostic examination. Referral criteria necessitating further diagnostic examination is suggested as a low VA for the age of the child, which includes:

- VA of less than 0.5 decimal (0.3 logMAR, 6/12 Snellen) at 5 years or less
- VA of less than 0.8 decimal (0.1 logMAR, 6/7.5 Snellen) at 6-7 years
- VA of less than 1.0 decimal (0.0 logMAR, 6/6 Snellen) at 13 to 14 years

Other referral criteria include manifest strabismus, or any other significant pathological condition.

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

Table 1	Ophthalmologist	Paediatrician
Preterm babies	✓	✓
0 to 3 months	✓	✓
3 to 36 months	x	✓
3 to 7 years	✓	x

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

Table 2	EI	Fix	RR	EM	Hir	PM	PR	CT	ACT	VA	SV
Preterm babies	✓	✓	✗	✓	✓	✓	✓	✗	✗	✗	✗
0 to 3 months	✓	✓	✗	✓	✓	✓	✓	✗	✗	✗	✗
3 to 36 months	✓	✓	✗	✓	✓	✓	✓	✓	✓	✗	✓
3 to 7 years	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓

Key: EI: Eye Inspection; Fix: Fixation; RR: Red Reflex Testing; EM: Eye Motility; Hir: Hirschberg; PM: Pursuit Movements; PR: Pupillary Reflexes; CT: Cover Test; ACT: Alternating Cover Tests; VA: Visual Acuity; SV: Stereoacuity test.

Table 3: Location of vision screening for each age group

Table 3	Hospital	Kindergarten	Child Healthcare Centre	Private Clinic
Preterm babies	✓	✗	✓	✓
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 in infants 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. There is no automated vision screening conducted in Serbia.

7 Provision for Visually Impaired

There are two schools in Serbia for blind or severely visually impaired children. One school caters for 5 preschool children and 138 primary school children; the other caters for 135 children. The costs per child for these schools are not known. There is special support for visually impaired children who attend regular primary school, for example magnifying glasses. Where possible, Serbia try to incorporate visually impaired children into regular mainstream primary schools. Public health insurance pays up to 36000 RSD (approximately 300 Euros) for magnifying glasses.

8 Knowledge of existing screening programme

8.1 Prevalence/Diagnosis

The prevalence of treated amblyopia, by the age of 7 years, is estimated to be 2%. The prevalence of persistent amblyopia (missed by screening or failed treatment), by the age of 7 years, is estimated to be 0.5%. The prevalence of strabismus is estimated as 2.5% by the age of 5 years. There is no data available concerning the incidence of the four types of amblyopia (strabismic, refractive, combined mechanism and deprivation) per age per year.

8.2 Coverage

All children are invited for vision screening by the paediatrician during a health visit, or by letter. The coverage of vision screening is estimated as 35% for children aged 3-4 years and this rises to 100% for children by the age of 7 years, which is obligatory for primary school entrance at this age (Rogošić et al., 2013). There is no data available relating to the percentage of compliance with referral after an abnormal screening test result, this is due to there being no registration or documentation of non-compliance with referral.

8.3 Screening evaluation

The percentage of false negative referrals is not available, however this is stated as being "rare". The percentage of false positive referrals is estimated as 20% and the positive predictive value of a refer result after vision screening is estimated as 80%. The sensitivity and specificity of vision screening is not known.

8.4 Treatment success

The percentage of infants treated for congenital eye disorders is not known, however, the percentage of children treated for strabismus before the age of 7 years is estimated at 2.5%. The percentage of children treated for amblyopia, after being screened, is estimated at 0.5% and this rises to 3.5% of all children, irrespective of screening.

Ophthalmologists are the only professionals who prescribe glasses to children up to the age of 7 years. Other treatment options include patching, penalisation with glasses, atropine and cataract surgery as required. All eligible children are offered treatment.

9 Costs of vision screening in children

9.1 Cost of vision screening

There is no data concerning the costs of vision screening.

9.2 Cost of treatment for amblyopia

There is no data pertaining to the costs of treatment for amblyopia.

9.3 Cost of Treatment for strabismus

There is no data regarding the costs of treatment for strabismus.

9.4 Cost of treatment for cataract

There is no data about the costs of cataract treatment.

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