Summary Vision Screening Data: Slovakia

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Paolo Mazzone[1], Dr Jill Carlton[2], Dr Helen Griffiths[3]

1. Research Assistant, School of Health and Related Research, University of Sheffield, United Kingdom (UK)
2. Senior Research Fellow, School of Health and Related Research, University of Sheffield, United Kingdom (UK)
3. Senior Lecturer, Academic Unit of Ophthalmology and Orthoptics, University of Sheffield, United Kingdom (UK)

Information provided by Dr Alena Furdova, Ophthalmologist, Comenius University in Bratislava) & Dr Dana Tomcikova, Ophthalmologist, Comenius University in Bratislava

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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	The proportion of all those invited for screening that are tested and receive a result: • 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". Attendance rate provides information on the willingness of families to participate in screening.
Compliance with referral (percentage)	The percentage of those who are referred from screening to a diagnostic assessment that actually attend the diagnostic assessment. Percentage of compliance provides information on the willingness of families to attend the diagnostic assessment after referral from screening.
Coverage	The proportion of those eligible for screening that are tested and receive a result: • 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". 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.
False negatives	The percentage of children with a visual deficit (defined by the target condition) that receive a result of "pass" during screening. Example: If 100 children with visual deficit are screened, and 1 child passes the screening, the percentage of false negatives is 1%.

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	The percentage of children referred from screening who have a confirmed vision loss. 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%.
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	The percentage of children with visual defects that are identified via the screening programme. 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%.
Specificity	The percentage of children with normal vision that pass the screening. 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%.
Target condition	The visual defect you are aiming to detect via the screening programme.
Well, healthy babies	Infants who are *not* admitted into the NICU or born prematurely (born after a gestation period of less than 37 weeks).

2 Abbreviations

GDP Gross Domestic Product

NICU Neonatal-intensive care unit

PPP Purchasing Power Parity

ROP Retinopathy of Prematurity

VA Visual Acuity

WHO World Health Organisation

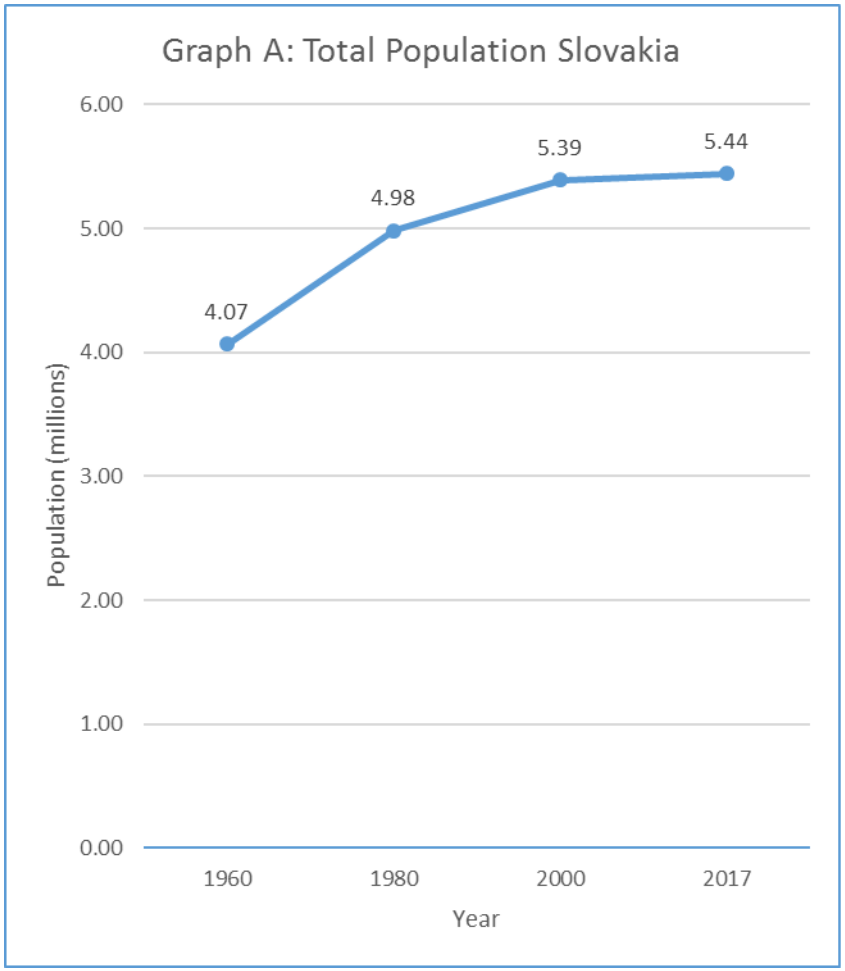
3 Population and Healthcare Overview

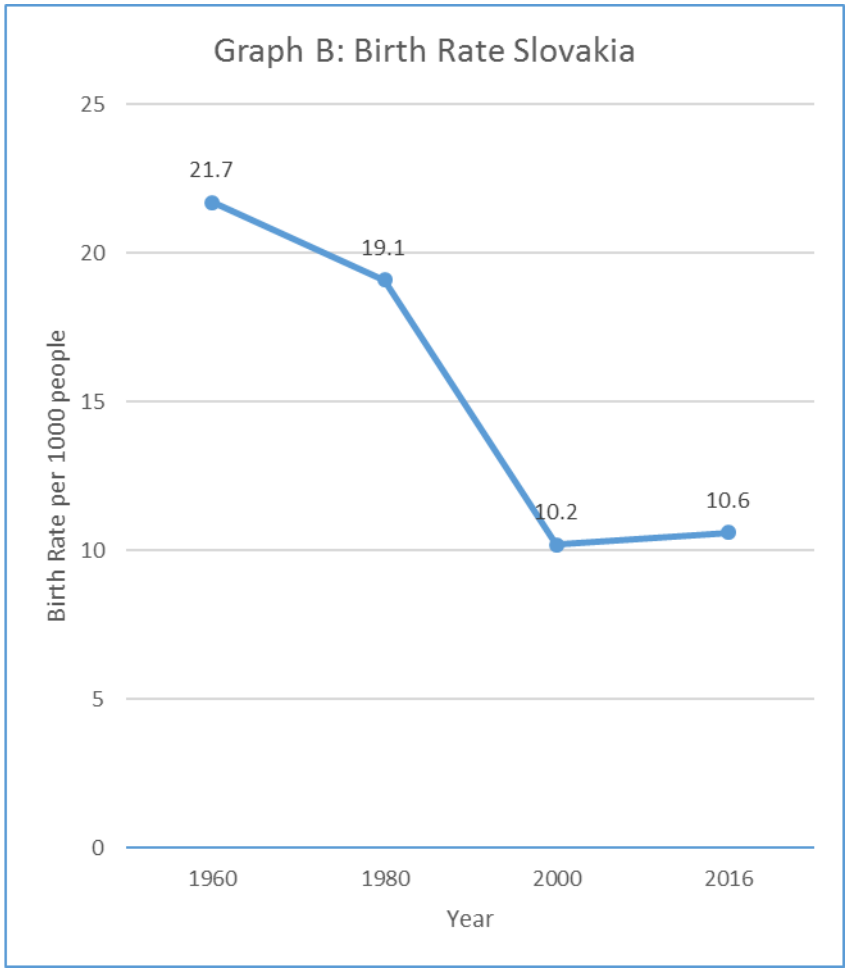
The population of Slovakia is 5,439,892 (World Bank, 2018a) and birth rate estimated at 10.6 births/1,000 population in 2016 (World Bank, 2018b). The change in population and birth rate from 1960 to 2017 is shown in Figure 1, graphs A and B respectively.

Slovakia has a reported population density of 113 people per square kilometre in 2017 and this has risen from 87 people per square kilometre in 1961 (World Bank, 2018c). In terms of healthcare facilities, the total density of hospitals in 2013 was 1.54 per 100,000 population (WHO, 2016a). Infant mortality in 2017 is estimated at 4.6 deaths/1,000 live births in total (World Bank, 2018d).

The average life expectancy in Slovakia is estimated at 76.6 years (World Bank, 2018e), with a death rate of 9.6 deaths/1,000 population in 2016 (World Bank, 2018f). Slovakia has a gross national income per capita (PPP int. $, 2013) of $25,000 (WHO, 2016b). The estimated total expenditure on health per capita in 2014 was $2,179 (Intl $) and the total expenditure on health in 2014 as percentage of GDP was 8.1% (WHO, 2016b).

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





Source: Information sourced from World Bank (2018)

4 Vision Screening Commissioning and Guidance

In Slovakia, vision screening is funded through health insurance. The vision screening programme is organised nationally, with no regional variations in protocols. Vision screening is embedded in a general preventative child health care screening system and is performed by paediatricians, ophthalmologists and healthcare support workers within child healthcare centres and hospitals. In Slovakia, there are 1,642 paediatricians and approximately 500 registered ophthalmologists, however it is not known exactly how many of them perform vision screening. No other healthcare professionals have been identified that could screen with additional training. There is no specific training to perform vision screening, instead, this is part of postgraduate education in paediatrics.

The content of the vision screening programme is decided upon by the government and there have been changes made. Currently the vision screening programme for refractive errors and amblyopia is completed between the ages of 3 years and 5 years. The method used by paediatricians, is reading and pictures. The new proposal is to conduct the screening in all children at the age of 3 years using Cardiff or Lea Symbols, combined with cover/uncover test and PlusOptix screening, which should be done in the kindergarten by a qualified nurse. The proposal is not accepted yet, and the tests are currently only completed by paediatric physician.

There are no guidelines for vision screening and there is no protocol for timing of programme revision. Changes are not made on regular basis, they are made when a group of experts make an appeal and it is approved by the Healthcare Ministry. Such revisions are conducted by the Ministry of Health, who also provide funding for such endeavours.

There are no methods for quality monitoring imposed by the government and there has been no research concerning the vision screening programme in Slovakia. There has been no cost-effectiveness analysis and no other studies on the effectiveness of vision screening in Slovakia.

5 Screening programme

In Slovakia, retinopathy of prematurity (ROP), congenital eye disorders and amblyopia are the target conditions of vision screening. 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 up to the age of 3 months are screened in hospitals using eye inspection, fixation, red reflex testing, retinal examination, eye motility, pursuit movements and pupillary reflexes. These tests are performed in part by a paediatrician and also by an ophthalmologist who screens for ROP in all children born before 32 weeks and those who weigh less than 1200 grams. Other babies are evaluated if there are risk factors for ROP. The ophthalmologist will conduct a cataract screening in premature babies at the same time ROP screening is conducted. Preterm babies with or without ROP undergo ophthalmological evaluation until the vascularisation is completed. The parents are then informed about the timing of any subsequent examinations, dependent upon the findings.

5.2 Vision screening - Birth to 3 months

Well, healthy babies up to the age of 3 months are screened in either a hospital or a child health centre using eye inspection and red reflex testing (5 days to 4 weeks postnatal), fixation and eye motility (at 3 months). The vision screening, including red reflex testing to diagnose a white pupil, is conducted by either a paediatrician or an ophthalmologist. Babies are referred to the ophthalmologist when the paediatrician notices strabismus, an abnormality in anatomical appearance of the eye, and/or when there is an abnormal reaction to a visual stimulus. Babies are referred for further examination after one or two abnormal or inconclusive tests at the doctor's discretion.

5.3 Vision screening - 3 months to 36 months

At 12 months of age, children are screened using eye inspection, fixation and eye motility. This is conducted by a paediatrician at a child health centre and repeated at 36 months of age. Children are referred to the ophthalmologist when the paediatrician notices strabismus, an abnormality in anatomical appearance of the eye, and/or when there is an abnormal reaction to a visual stimulus. Babies are referred for further examination after one or two abnormal or inconclusive tests, at the doctor's discretion. .

5.4 Vision screening - 36 months to 7 years

Between the ages of 36 months to 7 years, children are screened at the age of 5 years and again at 6 to 7 years of age. At the age of 5, vision screening is conducted at child health

centres by paediatricians, using eye inspection, fixation, eye motility and a visual acuity (VA) measurement.

VA is measured for the first time at 5 years of age and it is assessed using E-pfluger (Pfluger hooks are similar to the letter E in a standardised form and size in all directions) and linear picture charts, with a range of 1.0 to 0.1 (decimal). Visual acuity is measured for a second time at either 6 or 7 years of age (dependent on the child availability) by a paediatrician.

If there is one-line difference in visual acuity at the age of 5 years, then children are referred to an ophthalmologist for further diagnostic examination. Children are referred to the ophthalmologist when the paediatrician notices strabismus, an abnormality in anatomical appearance of the eye, and/or when there is an abnormal reaction to a visual stimulus. Children are referred for further examination after one or two abnormal or inconclusive tests at the doctor's discretion.

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

Table 1	Paediatrician	Ophthalmologist
Preterm babies	✓	✓
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	Retinal Exam	Eye inspection	Red reflex	Eye motility	Fixation	Retinal examination	Pursuit movements	Visual acuity	Pupillary reflexes
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	**Hospital**	**Child healthcare centre**
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 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.

In Slovakia, PlusOptix automated screening devices are used, however, screening using PlusOptix is not yet a standarlised screening test. There are some foundations who conduct the screening tests for free and individual private optic shops who conduct it for business purposes. There are approximately ten of these devices in Slovakia, but there is no exact information.

There is no specific age at which these tests are performed, however, it is usually conducted in kindergarten (4-5 years of age). There are no defined referral criteria, the optic specialists (not doctors) send everyone that they think needs to be referred. These devices cost approximately 6000 Euros, with unknown maintenance costs. The devices should be replaced every 5 years.

7 Provision for Visually Impaired

In Slovakia, there are approximately 3 schools for blind or severely visually impaired children. Two schools are elementary, the third school is a high school in which there are also physically and mentally disabled children. Placing the child in the special school is also dependant on the mental capacity of the student. The two elementary schools are located in Levoca and Bratislava. Special school in Levoca has 43 day students and 13 external students. Bratislava is about the same. The special high school in Levoca has about 40 students and out of that 14 children are studying to become cooks.

The costs per child for these schools is unknown and whilst there is support for visually impaired children who attend mainstream primary school, it is unknown what this support is.

8 Knowledge of existing screening programme

8.1 Prevalence/Diagnosis

The prevalence of treated or untreated and persistent amblyopia, by the age of 7 years, is estimated at 20%. This figure is estimated from the statistics of medical information based on the statistics of children aged 7-8 years. This is true for all other estimations in section 8. The prevalence of persistent amblyopia, by age 7 years is not known. The prevalence of strabismus is estimated at 15% at age 7 years. There is no data provided on the incidence of the four types of amblyopia (strabismic, refractive, combined-mechanism and deprivation) in Slovakia.

8.2 Coverage

All children are invited for vision screening at the age of 5 years and this invitation is carried out by a paediatrician by way of a letter. The coverage and subsequent attendance of any kind of vision screening, before the age of 7 years, is estimated at 99-100%. All children (100%) are invited and attend a VA measurement as part of vision screening, before the age of 7 years.

8.3 Screening evaluation

The percentage of false positives is estimated at 10%. The percentage of false negatives is estimated at 10%. The positive predictive value of a refer result, after vision screening, is estimated at 60%. The sensitivity and the specificity of vision screening is not reported.

8.4 Treatment success

It is estimated that 100 infants are treated for congenital eye disorders, per year, in the total population. Twenty percent of children are treated for strabismus and amblyopia, after being screened before 7 years of age. Eighty percent of these children are treated for strabismus by 7 years of age. Ninety percent of these children are treated for amblyopia by 7 years of age.

There is no registration or documentation of noncompliance with referral after an abnormal screening test result, however, it is estimated that 80% of children comply with a referral after an abnormal screening test result. It is estimated that 2500 patients are treated, per year, for congenital cataract, amblyopia and strabismus by ophthalmologists. Ophthalmologists are the professionals that prescribe glasses for children under the age of 7 years, after referral from screening. Other treatment options include patching, penalisation with glasses, atropine and cataract surgery. All eligible children with vision disorders are offered treatment.

9 Costs of vision screening in children

9.1 Cost of vision screening

The salary costs per year and per hour for vision screening professionals are not available. The cost of training general preventative child healthcare screening professionals, between leaving secondary education to qualification, is not available. The total vision screening costs, per year and per child are not known.

9.2 Cost of treatment for amblyopia

The estimated costs for treatment of typical patients with refractive amblyopia and strabismic amblyopia are not known.

9.3 Cost of Treatment for strabismus

The estimated cost of strabismus surgery is 1000 Euros; the cost of follow-up is not known.

9.4 Cost of treatment for cataract

The estimated costs for congenital cataract surgery is 1500 Euros. The cost of follow-up including deprivation amblyopia is not known.

Vision screening is free of charge to parents. Vision screening is obligatory, but it is not strictly enforced; instead, the responsibility lies with the parent and those who do not bring their children to screening can lose their governmental child support. There is no financial reward for those who do attend vision screening.

10 References

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