



Summary Vision Screening Data: Slovenia

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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



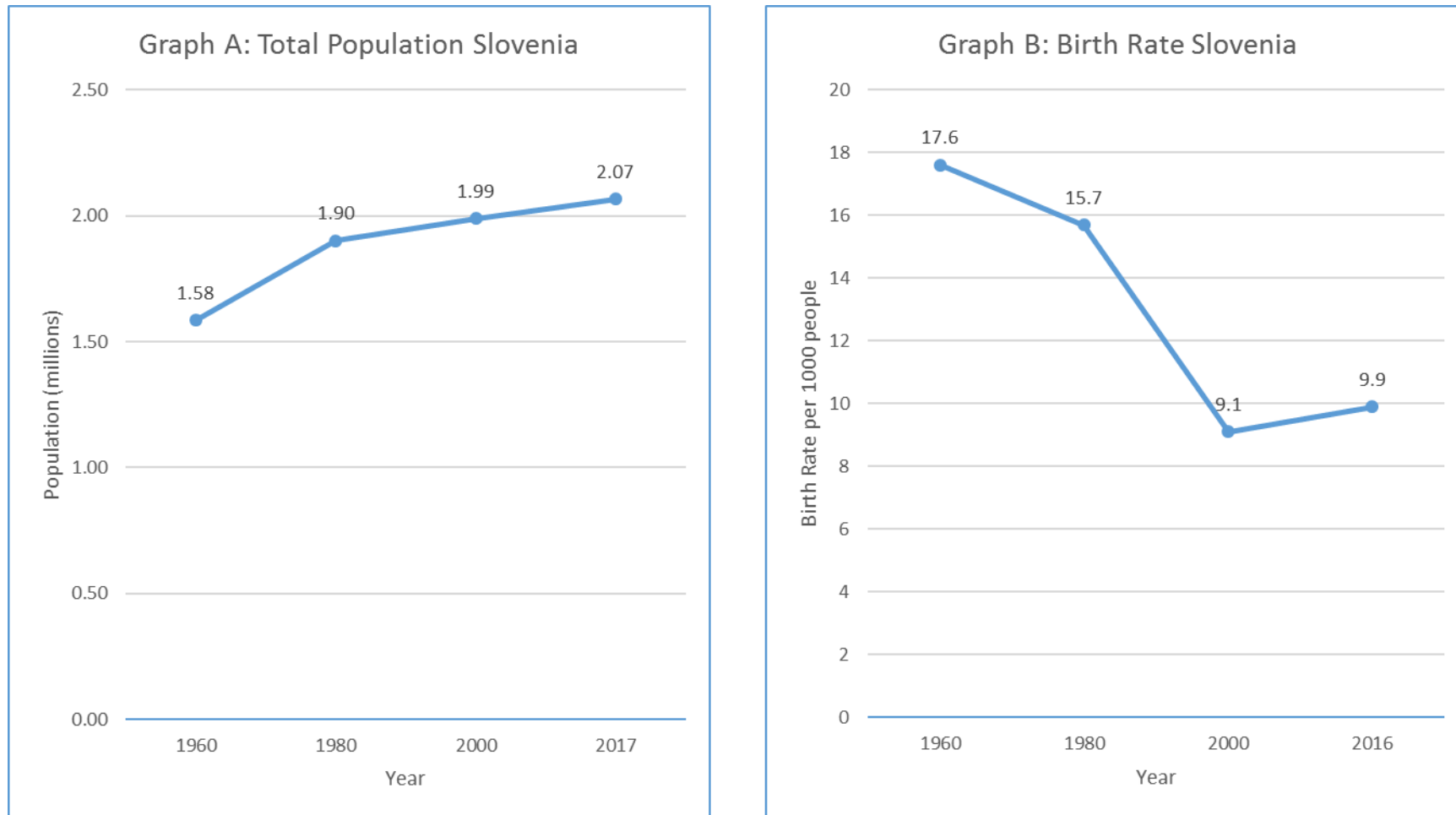
3 Population and Healthcare Overview

The population of Slovenia is 2,066,748 (World Bank, 2018a) and birth rate is estimated at 9.9 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.

Slovenia has a reported population density of 103 people per square kilometre in 2017 and this has risen from 79 people per square kilometre in 1961 (World Bank, 2018c). In terms of healthcare facilities, the total density of hospitals in 2013 was 1.25 per 100,000 population (WHO, 2016a). Infant mortality in 2017 is estimated at 1.7 deaths/1,000 live births in total (World Bank, 2018d).

The average life expectancy in Slovenia is estimated at 80.78 years (World Bank, 2018e), with a death rate 9.5 deaths/1,000 population in 2016 (World Bank, 2018f). Slovenia has a gross national income per capita (PPP int. \$, 2013) of \$28,000 (WHO, 2016b). The estimated total expenditure on health per capita in 2014 was \$2,698 (Intl \$) and the total expenditure on health in 2014 as percentage of GDP was 9.2% (WHO, 2016b).

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



Source: Information sourced from World Bank (2018)



4 Vision Screening Commissioning and Guidance

In Slovenia, vision screening is organised nationally, all regions provide the same screening with no differences between programmes. Vision screening is funded by the state through compulsory healthcare insurance, and is embedded in a general preventative child healthcare screening system. The content of the vision screening programme is decided upon by the National Institute of Public Health, in collaboration with the government and the professional body of ophthalmologists. Vision screening began in the 1950's and was implemented nationally in the 1960's; it has been changed since its start date, however, it is not clear exactly what changes have been made. There are national general health screening guidelines for vision screening, which are reviewed approximately every 5 years. Revisions are decided upon by the National Institute of Public Health and the professional committees of ophthalmologists and paediatricians.

Vision screening is conducted in child healthcare centres or a public place. There are approximately 400 paediatric nurses and assistant nurses per million population. There are some nurses that do not screen, but could do so with additional training. Specialist nurses and assistant nurses receive 75 hours of ophthalmology training, with repeated training instruction for screening. The training is regularly reviewed as part of the education programme.

There are methods for quality monitoring imposed by the government; this is conducted through the professional committees reporting to the health authorities. There is no systematic collection of information using a national register; instead, this is done through paediatricians referring children who have failed vision screening to the ophthalmic service. There is no research concerning the vision screening programme carried out in Slovenia.



5 Screening programme

In Slovenia, the target conditions screened for are retinopathy of prematurity (ROP), congenital eye disorders, amblyopia, reduced visual acuity, refractive error, strabismus, any other ocular anomalies. 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 by an ophthalmologist in a hospital. These are identified as babies who weigh less than 1500 grams at birth, or <30-32 weeks gestational age. The vision screening tests utilised at this age include eye inspection, fixation, retinal examination, red reflex testing, pupillary reflexes, eye motility and pursuit movements.

5.2 Vision screening - Birth to 3 months

Well, healthy babies up to the age of 3 months are screened by a paediatrician, in either a hospital or a primary healthcare centre. The vision screening tests utilised at this age include eye inspection, assessment of fixation, red reflex testing, pupillary reflexes, eye motility and pursuit movements. Babies are referred after one abnormal test result or two inconclusive results. Children are referred to an ophthalmologist for further diagnostic examination in the presence of no fixation, pursuit movements, strabismus), nystagmus, optic media opacities, asymmetries, anomalies, neurological reasons, general health problems, or no cooperation for the second time. The criteria used to determine the need for repeat screening before referral for diagnostic assessment is not defined.

5.3 Vision screening - 3 months to 36 months

Babies aged between 3 and 36 months are screened by a specialist nurse or assistant nurse in a primary healthcare centre. The vision screening tests administered at this age include eye inspection, assessment of fixation, red reflex testing, pupillary reflexes, eye motility, pursuit movements and Hirschberg test. Referral criteria include congenital structural malformations or anomalies, atypical development for age, misalignment, anisocoria, or opaque optic media. Children are referred after one abnormal test result or two inconclusive results.

5.4 Vision screening - 36 months to 7 years

Children aged between 36 months to 7 years are screened by either a specialist nurse or an assistant nurse in a primary healthcare centre. The vision screening tests conducted at this age include eye inspection, assessment of fixation, red reflex testing, pupillary reflexes, eye motility, pursuit movements, Hirschberg test and visual acuity measurement. Visual acuity is tested for the first time at 3 years of age. Professional preferences determine which optotype



chart is used. This can include Lea Symbols, Sheridan Gardiner, Snellen, HOTV, and Cambridge acuity cards. Visual acuity is measured for the second time at 3.5 years, and then again at ages 4, 5 and 7 years. Further visual acuity tests are performed every second year of education. Children are referred for further diagnostic examination after one abnormal or inconclusive result. Referral criteria include congenital structural malformations or anomalies, atypical development for age, misalignment, anisocoria, or opaque optic media, 2 lines of visual acuity difference at 3 years of age, a visual acuity of less than 0.4 decimal (0.4 logMAR, 6/15 Snellen).

Stereopsis is not commonly used in screening, but if included may involve the Titmus fly and Lang stereo tests. In primary health care centres, Ishihara colour vision test is used for screening in 7th grade (12-13 years).



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

Table 1	Ophthalmologist	Paediatrician	Specialist Nurse	Assistant Nurse
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	EI	Fix	RE	RR	PR	EM	PM	Hir	VA
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; RE: Retinal Examination; PM: Pursuit Movements; PR: Pupillary Reflexes; VA: Visual Acuity Measurement*



Table 3: Location of vision screening for each age group

Table 3	Hospital	Primary Healthcare Centre
Preterm babies	✓	x
0 to 3 months	✓	✓
3 to 36 months	x	✓
3 to 7 years	x	✓



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 Slovenia, autorefraction and automated screening are not used for screening in primary healthcare centres, they are used only in the diagnostic assessment following referral at ophthalmic centres. Each device costs approximately 7,500 Euros and the maintenance costs per year are estimated at 500 Euros. The devices are scheduled for replacement after 7-8 years.



7 Provision for Visually Impaired

In Slovenia, there is one school for blind or severely visually impaired children; this has mobile units. The costs per child for these schools is unavailable. There is additional special support for visually impaired children who attend regular mainstream primary school, in the form of specially trained personnel.

The school for the blind and visually impaired is located in Ljubljana, there are annually around 70 children enrolled in primary school and 20-30 in early intervention and kindergarten. Mobile units should have 1 or 2 teams regionally, comprising of special diploma or master degree trained teachers for the blind and visually impaired and other disabilities. These professionals also offer home and school help (integrated education). They collaborate with the social workers, psychologists, and teachers for special education. The exact number of specialist teachers is not known, but it is acknowledged that there is a general lack of personnel. Every child is provided with glasses, or magnifying glasses, and other low vision support through ophthalmic service and national healthcare insurance. Expensive electronic devices are not free, and patients are required to pay for these (it is not known how much). This excludes some children from families with low income.

8 Knowledge of existing screening programme

8.1 Prevalence/Diagnosis

The prevalence of treated or untreated amblyopia by the age of 7 years is estimated at 3-5% (using the criteria of more than 1-line difference in corrected vision testing, a visual acuity of less than 0.8 decimal (0.1 logMAR, 6/7.5 Snellen binocular and monocular). The prevalence of persistent amblyopia (missed by screening or failed treatment) by 7 years of age, is estimated at less than 1%. The prevalence of strabismus at 5 years of age is estimated at 2-3%.

8.2 Coverage

Administrative personnel are responsible for inviting children by mail, for general preventative child healthcare screening through scheduled periodic systematic examinations. The evidence of performing vision screening is registered in the child's paediatric file and in case of a non-compliant child, vision screening failure, or non-certainty, vision screening is repeated as soon as possible. The parents get a new appointment immediately; in case of non-compliance they get a written invitation or are re-examined at another visit. It is estimated that 90 to 100% of children aged 3 years are invited for vision screening in Slovenia. The total percentage of children invited for vision screening, combining screening at all age groups, before the age of 7 years, is estimated as 90-100%. The invitation for visual acuity measurements as part of vision screening, before the age of 7 years, is not known, neither is the coverage of visual acuity measurements. The percentage of non-compliance with referral after an abnormal screening test result is estimated at less than 10% as there is no official registration or documentation of noncompliance with referral after an abnormal screening test result. The only available information is based on referral to ophthalmologists from paediatric services.

8.3 Screening evaluation

The percentage of false negatives (patients who pass screening but who have amblyopia) is estimated at less than 10%. This is also true for false positives (patients who fail screening, even though they are healthy). The positive predictive value of a 'refer' result is not known; neither is the sensitivity or specificity of vision screening in Slovenia.

8.4 Treatment success

There are approximately 35-40 new cases of congenital cataract per year. It is approximated that there are a total of 3,500 strabismic cases up to school age. There are only 3-5 cases of congenital glaucoma, plus 3-5 other congenital anterior segment problems, up to 10 with posterior segment surgery, 40-50 oculoplastic reconstructive, orbital or lacrimal surgery plus up to 20 strabismus cases needing early surgery. The percentage of infants treated for



congenital eye disorders in the total population is not clear. The percentage of children with strabismus who receive treatment for strabismus before the age of 7 years, is estimated at greater than 98%. The percentage of children with amblyopia who receive treatment before the age of 7 years is estimated at greater than 98%. The distribution of the four types of amblyopia is not known, however, it is stated that the majority of cases are refractive amblyopia, followed by combined mechanism, strabismic and then deprivation. Only ophthalmologists or optometrists/opticians prescribe glasses for children under the age of 7 years. Other treatment options include patching, penalisation with glasses, atropine, strabismus surgery and cataract surgery, where appropriate. All eligible children 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 is not available. The cost to train general preventative child healthcare screening professionals, between leaving secondary education to qualification is approximately 10,000 Euros. This relates to professionals with a faculty diploma after 3 years of tertiary education. The total screening costs per year for vision screening in Slovenia is estimated at between 1.5 to 2 million Euros.. The total costs per child per year for vision screening nationally is estimated at between 20 to 25 Euros.

9.2 Cost of treatment for amblyopia

The estimated costs for treatment of a typical patient with refractive and strabismic amblyopia, including follow up are 200 to 350 Euros, with surgery between 1,500 to 2,000 Euros. These numbers are based on an estimated 4 to 5 visits per year to an orthoptist and ophthalmologist, including patches and glasses. Glasses are paid for only up to a certain amount, it is not known what the payment cut-off is.

9.3 Cost of Treatment for strabismus

The costs of strabismus surgery are estimated at between 1,500 to 2,000 Euros.

9.4 Cost of treatment for cataract

The cost of cataract surgery, including follow up of deprivation amblyopia is estimated at between 1,500 and 2,000 Euros.



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