Summary Vision Screening Data: Estonia

Produced as part of Work Package 3

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21st December 2018

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 733352

Contents

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

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

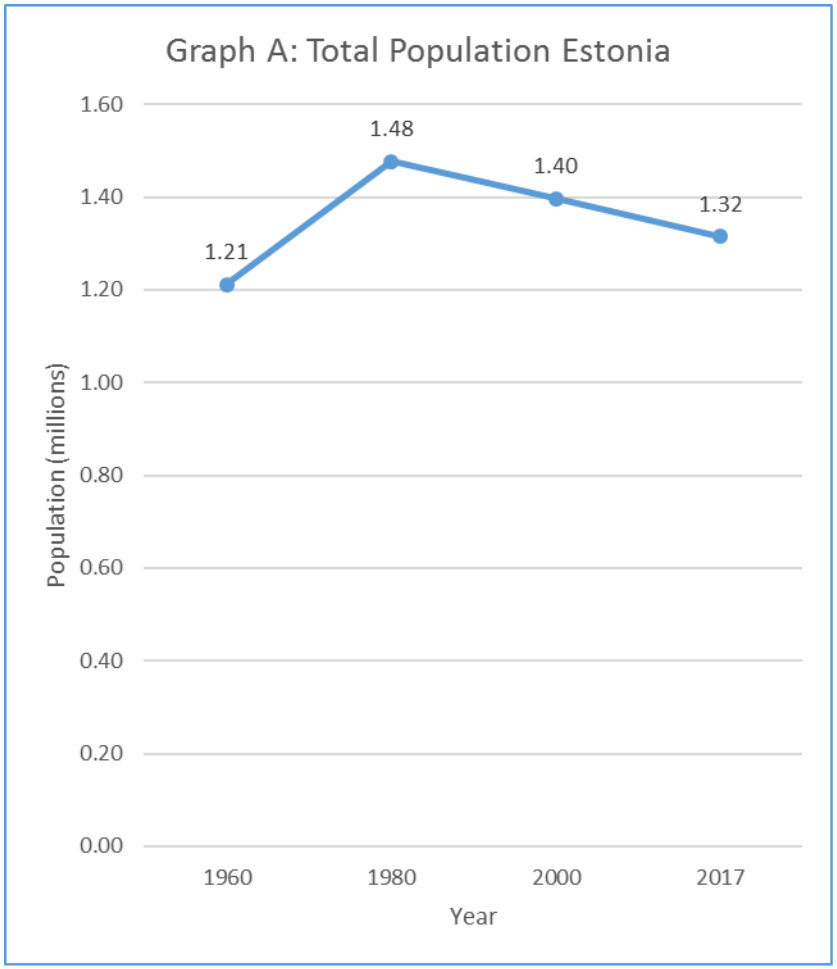
3. Population and Healthcare Overview

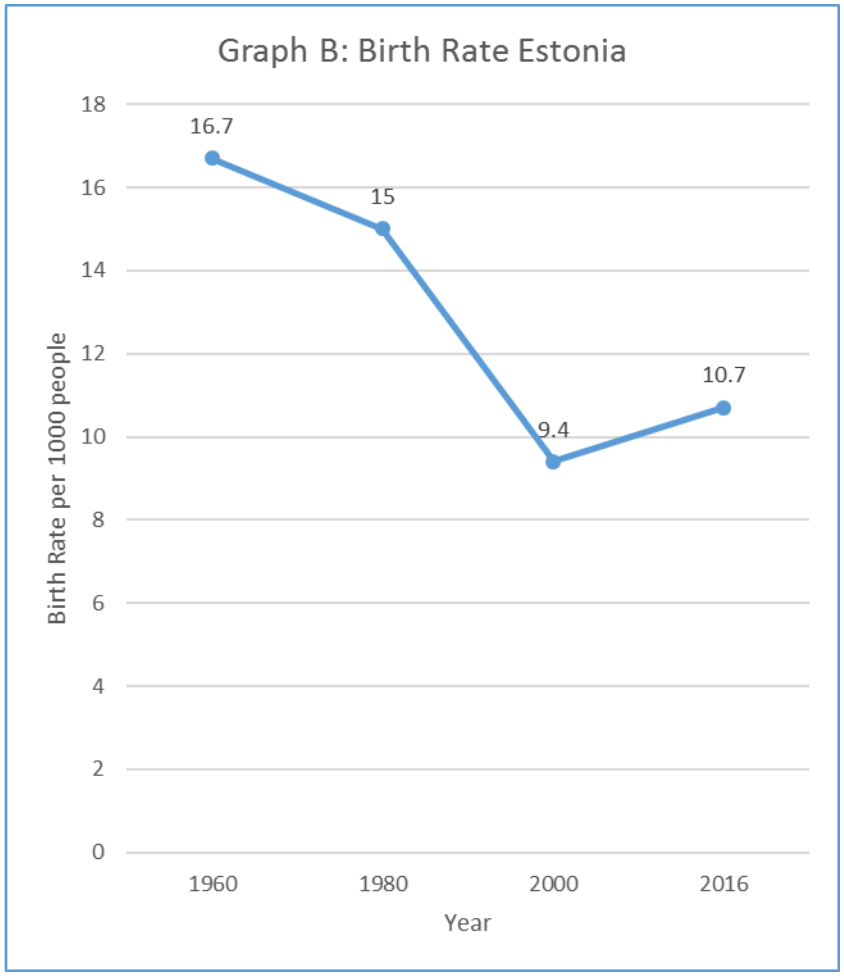
The population of Estonia is estimated at 1,320,000 (World Bank, 2018a) and birth rate is estimated at 10.7 births/1,000 population in 2016 (World Bank, 2018b). The change in population and birth rate from 1960 to 2017 is shown in Figure 1, graphs A and B respectively.

Estonia has a reported population density of 31 people per square kilometre in 2017 and this has risen from 29 people per square kilometre in 1961 (World Bank, 2018c). In terms of healthcare facilities, the total density of hospitals in 2013 was 1.94 per 100,000 population (WHO, 2016a). Infant mortality in 2017 is estimated at 2.1 deaths/1,000 live births in total (World Bank, 2018d).

The average life expectancy in Estonia is estimated at 77.7 (World Bank, 2018e), with a death rate 11.7 deaths/1,000 population in 2016 (World Bank, 2018f). Estonia has a gross national income per capita (PPP int. $, 2013) of $24,000 (WHO, 2016b). The estimated total expenditure on health per capita in 2014 was $1,668 (Intl $) and the total expenditure on health in 2014 as percentage of GDP was 6.4% (WHO, 2016b).

Figure 1: Total Population and Birth Rate in Estonia





Source: Information sourced from World Bank (2018)

4. Vision Screening Commissioning and Guidance

Vision screening in Estonia is organised nationally, with no regional variation between protocols. Vision screening is performed by family doctors and family nurses. In some cases, vision screening is performed by ophthalmologists, orthoptists and optometrists in hospitals or private clinics. There are approximately 1700 family doctors and family nurses, per million people. There are family doctors and family nurses that do not screen, but could do so with additional training. Changes to the national vision screening programme are still in progress, the aim is that healthy children will be screened by family doctors and nurses, whereas ophthalmologists, orthoptists and optometrists will not screen healthy children. At present, as the new regulation by the Ministry of Social Affairs is not in force, some family doctors follow old guidelines and do not screen healthy children. Due to the period of transition, there is no exact statistical data. Training for family doctors and nurses is provided by ophthalmologists and orthoptists, this last for around 4 hours. The training is regularly updated, monitored and revalidated, however, this is not yet accredited or certified.

Vision screening is funded through health insurance and it is embedded into a general preventative child healthcare screening programme. The content of the vision screening programme is decided upon by ophthalmologists and was implemented nationally in 1995. Since its application, the vision screening programme has been changed; this change is being fulfilled at present, with the addition of family doctors and family nurses as vision screeners.

The national general health screening guideline provides recommendations for vision screening to each professional. The vision screening programme is reviewed once every 5 years, and any revisions are decided upon by the Ministry of Social Affairs through guideline revisions set out by the Estonian Ophthalmological Society. There are no methods for quality monitoring of vision screening imposed by the government.

There is no research carried out in Estonia regarding the vision screening programme, or the cost-effectiveness and overall effectiveness of the vision screening programme.

5. Screening programme

In Estonia, the target conditions for vision screening are retinopathy of prematurity and reduced visual acuity measured at 3 years and again at 6 years of age. 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

All babies less than 32-weeks gestational age or less than 1500g birthweight are screened for retinopathy of prematurity (ROP). The first ROP screening examination is performed between 4 to 5-weeks postnatal age. The baby is screened until full retinal vascularisation, at least until 40-weeks gestational age. Frequency of follow-up examinations is determined by the examining ophthalmologist on the basis of retinal findings. Babies are screened by binocular indirect ophthalmoscopy and digital retinal images (Retcam). These tests are conducted by a paediatric ophthalmologist at either a children's hospital or an eye clinic and referral for further diagnostic examination is determined by absence of red reflex, or suspicion of eye pathology during eye inspection.

5.2 Vision screening - Birth to 3 months

A neonatologist will screen newborns at the maternity hospital, this includes external inspection of the eyes and lids and red reflex examination. Family doctors (GP) will then screen again during 1-2 weeks of life at an outpatient clinic including external inspection of the eyes, lids and red reflex examination. These tests are conducted by either a paediatrician, ophthalmologist or a GP at a hospital. Referral for further diagnostic examination is determined by absence of red reflex, or suspicion of eye pathology during eye inspection. Babies are referred after one abnormal or one inconclusive test and if there is any suspicion of pathology.

5.3 Vision screening - 3 months to 36 months

Children aged 3 to 36 months are screened by a GP in an outpatient clinic. The GP will perform the eye inspection and red reflex test at 3 months of age and again at 6 months of age, with the addition of fixation, eye motility and Hirschberg. Referral for further diagnostic examination at 6 months of age is determined by abnormal tearing, abnormal fixation and eye motility abnormalities such as nystagmus and strabismus. At 12 months, the GP will conduct assessments using eye inspection, red reflex testing, fixation, eye motility and Hirschberg. Any visible eye pathology, abnormal red reflex, strabismus or tearing results in the child being referred to ophthalmologist.

5.4 Vision screening - 36 months to 7 years

Children aged 36 months to 7 years are screened using eye inspection, fixation, red reflex testing, eye motility, Hirschberg and a visual acuity measurement. At the age of 3 years, children are screened using a visual acuity assessment for the first time, this is conducted by family nurses using linear crowded Lea Symbols. Visual acuity measurement is repeated at age 6 years, by a family nurse. Vision screening is repeated twice after abnormal or inconclusive test results, or if there is any suspicion of pathology. Children are referred from screening if they fail the visual acuity measurement and this is determined by a visual acuity of 2 lines difference between the eyes (both at ages 3 and 6 years old).

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

Table 1.	Neonatologist	Nurse	Ophthalmologist	Orthoptist	GP	Paediatrician
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.	Eye inspection	Fixation	Red reflex	Eye motility	Hirschberg test	Retinal examination	Visual acuity
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.	Eye Clinic	Hospital	Outpatient 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. Automed vision screening is not used as part of vision screening in Estonia.

7 Provision for Visually Impaired

In Estonia, there are two schools for the blind or severely visually impaired; Tartu Emajõe School, accommodates 43 children and Tallinn Helen's School (severe hearing and/or visual impairment) accommodates 156 children. The costs per child for these schools is not known. There is special support for visually impaired children who attend regular mainstream primary schools via the Social Insurance Agency who purchase magnifying glasses and low vision aids once a year.

8 Knowledge of existing screening programme

8.1 Prevalence/Diagnosis

The prevalence of treated or untreated amblyopia in Estonia, by age 7 years is estimated at 2 to 4%. The prevalence of persistent amblyopia by age 7 years is not known. The prevalence of strabismus before the age of 7 years is not known. The incidence of the four types of amblyopia (strabismic, refractive, combined mechanism and deprivation) are not known.

8.2 Coverage

In Estonia, it is estimated that 14,500 children are screened each year, by the age of 3 years. Family nurses invite children for their general preventative health screening and that this is done via the telephone but there is no data available regarding the number of children invited for vision screening. The coverage and attendance rates of vision screening is not known. The percentage of compliance with referral after an abnormal screening test result is not known and there is no registration or documentation of noncompliance with referral after an abnormal screening test result.

8.3 Screening evaluation

The percentage of false negative and false positive referrals from vision screening is not known. The positive predictive value, sensitivity and specificity of vision screening is not known.

8.4 Treatment success

The percentage of children treated for strabismus or amblyopia before the age of 7 years is not known. The percentage of children treated for congenital eye disorders is not known. The number of patients treated for congenital cataract, amblyopia and strabismus each year by either an orthoptist or ophthalmologist is not known.

Paediatric ophthalmologists are the professionals that are employed to prescribe glasses for children, under the age of 7 years, after referral from screening. Further treatment options include patching and cataract surgery. The aim is to treat all eligible children with vision disorders, however, this is not possible, due to capacity problems. There are insufficient numbers of ophthalmologists to screen all healthy children, the preferred model is screening by family doctors or nurses where there is no capacity problem. A new national vision screening programme is in process that will be delivered by family doctors and family nurses.

9 Costs of vision screening in children

9.1 Cost of vision screening

The salary costs per hour for vision screening professionals is not known. It is not known how much it costs to train the general preventative child health care screening professionals between leaving secondary education to qualification. The total screening costs per year for vision screening in Estonia is not known. Vision screening is free of charge, with no reward for attending vision screening or penalty for non-attendance. However, vision screening is deemed obligatory, although it is unclear how this is enforced.

9.2 Cost of treatment for amblyopia

The estimated costs for treatment of typical patients, with refractive amblyopia and strabismic amblyopia, including follow up, is not known.

9.3 Cost of Treatment for strabismus

The Estonian Health Insurance Fund estimates the costs for strabismus surgery including follow up to be as follows:

- strabismus surgery 300-400 Euros
- 1-day hospital stay 100 Euros
- general anaesthesia 98 Euros
- recovery room stay 24 Euros
- Total of 522-622 Euros

9.4 Cost of treatment for cataract

The Estonian Health Insurance Fund estimates the costs for cataract surgery including follow up –to be 530 Euros.

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