



Summary Vision Screening Data: Finland

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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</p>

	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	<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	<p>All infants that are considered to be at-risk or have risk-factors for vision defects/ophthalmic pathology according to the 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	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

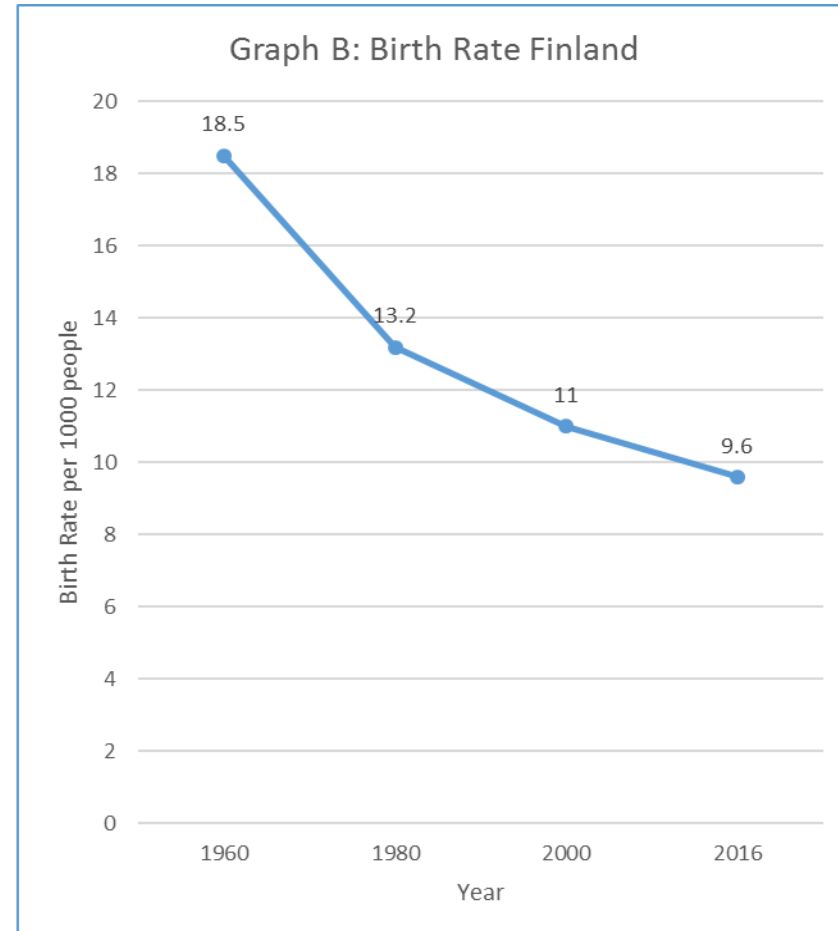
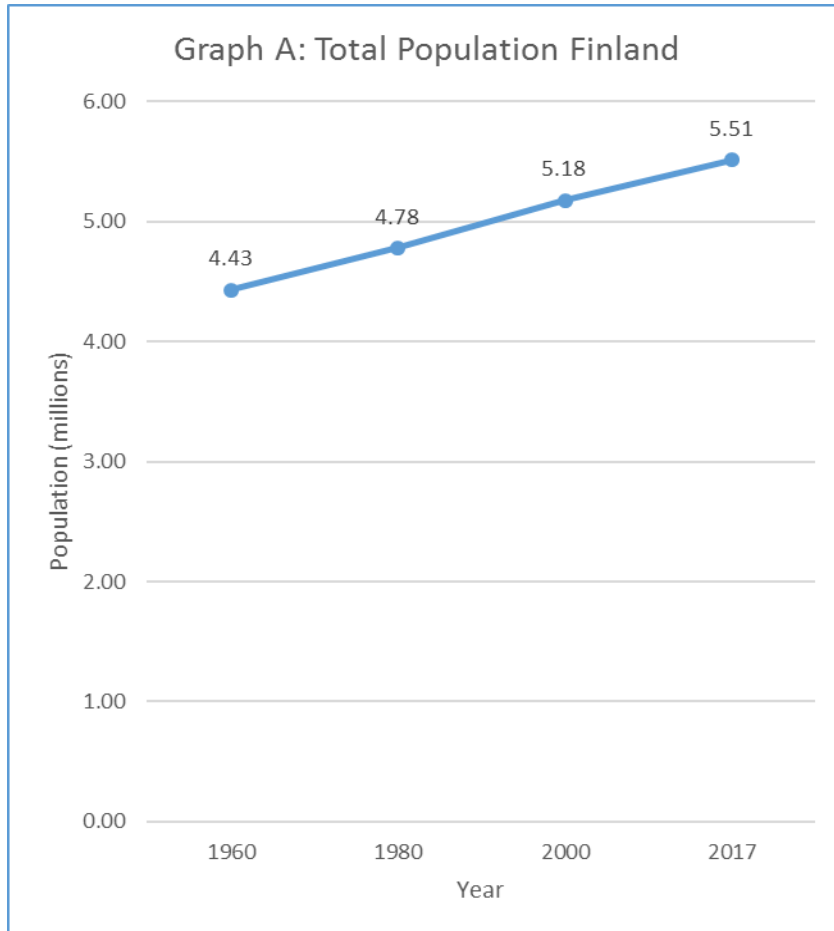
The population of Finland is 5,511,303 (World Bank, 2018a) and a birth rate estimated at 9.6 births/1,000 population in 2016 (World Bank, 2018b). The change in population and birth rate from 1960 to 2017 is shown in Figure 1, graphs A and B respectively.

Finland had a reported population density of 18.1 people per square kilometre in 2017 and this has risen from 14.7 people per square kilometre in 1961 (World Bank, 2018c). In terms of healthcare facilities, the total density of hospitals in 2013 was 1.38 per 100,000 population (WHO, 2016a). Infant mortality in 2017 is estimated at 1.9 deaths/1,000 live births in total (World Bank, 2018d).

The average life expectancy in Finland is estimated at 82 years (World Bank, 2018e), with a death rate 9.8 deaths/1,000 population in 2016 (World Bank, 2018f). Finland has a gross national income per capita (PPP int. \$, 2013) of \$38,000 (WHO, 2016b). The estimated total expenditure on health per capita in 2014 was \$3,701 (Intl \$) and the total expenditure on health in 2014 as percentage of GDP was 9.7% (WHO, 2016b).



Figure 1: Total Population and Birth Rate in Finland



Source: Information sourced from World Bank (2018)



4 Vision Screening Commissioning and Guidance

In Finland, there are national guidelines for conducting vision screening, however, it is organised regionally with differences between protocols. Vision screening is embedded into a general preventative child healthcare screening system and funded by each municipality. The National Institute of Health and Welfare develops and recommends the content of vision screening programme. Any revisions to the programme would be made by the National Institute of Health and Welfare in collaboration with a network of specialists, and funded by the government. It is not known when the programme started, or if there have been any changes since its implementation.

There are no methods for quality monitoring imposed by the government and no research of concerning the vision screening programme.

Vision screening is conducted by either an ophthalmologist, general practitioner (GP), youth doctor, or specialist nurse. The number of these professionals employed in vision screening per million population is unknown. There are no other general healthcare professionals that have been identified who could undertake the screening with additional training. There is no specific training provided in order to conduct vision screening. Ophthalmologists are the only professionals that prescribe glasses to children under the age of 8 years. Other treatment options for amblyopia include patching. All eligible children are offered treatment.



5 Screening programme

The target conditions screened for by vision screening are retinopathy of prematurity (ROP) and amblyopia. The health care professionals delivering vision screening, venue for screening and tests used, vary depending on the age of the child. 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, if born under 32 weeks, are screened by an ophthalmologist at a hospital. The tests conducted at this age include eye inspection and retinal examination.

5.2 Vision screening - Birth to 3 months

Well, healthy babies up to the age of 3 months are screened by a paediatrician before discharge, and then by a youth doctor or GP in a child welfare clinic. The tests conducted at this age include eye inspection, red reflex testing, pursuit movements and pupillary reflexes and presence or absence of eye contact. These tests are all conducted at birth. It is not known how many abnormal or inconclusive test results necessitate referral for further diagnostic examination. Criteria that necessitate referral include presence of abnormal eye structures, dark red reflex, or no eye contact.

5.3 Vision screening - 3 months to 36 months

Children aged 3 to 36 months are screened twelve times by a specialist nurse and four times by a GP in a child welfare clinic. The tests conducted at this age include eye inspection, fixation, red reflex testing, eye motility, cover test, Hirschberg test and pursuit movements. These tests are conducted at 4, 8 and 18 months. Criteria that necessitate referral include presence of abnormal eye structures, dark red reflex, or no eye contact. Infants are referred for further diagnostic examination after one abnormal or two inconclusive test results.

5.4 Vision screening - 36 months to 7 years

Children aged 36 months up to 7 years of age are screened by a specialist nurse or a GP in a child welfare clinic. This is part of routine visual screening conducted as a part of child welfare clinic visit. The tests conducted at this age include eye inspection, fixation, red reflex testing, eye motility, Hirschberg test, pursuit movement, pupillary reflexes, cover test, alternating cover test and visual acuity measurement. The age of screening and tests at each age are as follows:

- 3 years: Eye inspection, fixation, red reflex testing, eye motility, Hirschberg test,



pursuit movements, pupillary reflexes, near visual acuity measurement.

- 4 years: near and distance visual acuity, Hirschberg test, cover test, alternating cover test. This is repeated at the age of 5 years and 6 years.
- 7 years: near and distance visual acuity. This is repeated at 11 years and 14 years of age.

The optotype charts used for children aged 3 to 6 years include linear Lea Symbols based on the Snellen format (Snellen 6/126 to 6/3, logMAR 1.3 to -0.3, decimal 0.05 to 2.0) and a Snellen number chart at age 7 years and older. Children are referred for further diagnostic examination after one abnormal or two inconclusive test results

The referral criteria are as follows:

- 3 to 4 years: strabismus, visual acuity under 0.5 decimal (6/12 Snellen, 0.3 logMAR) or 2 lines difference in visual acuity, absent red reflex, abnormal head posture.
- 5 to 6 years: strabismus, visual acuity under 0.63 decimal (6/9.5 Snellen, 0.2 logMAR) or 2 lines difference in visual acuity, absent red reflex, abnormal head posture.
- 7 years or older: distance visual acuity under 0.8 decimal (6/7.5 Snellen, 0.1 logMAR), near visual acuity under 0.63 decimal (6/9.5 Snellen, 0.2 logMAR), or any symptomatic eye disorder

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

Table 1	Paediatrician	Ophthalmologist	Specialist Nurse	Youth Doctor	GP
Preterm babies	x	✓	x	x	x
0 to 3 months	✓	x	x	✓	✓
3 to 36 months	x	x	✓	x	✓
3 to 7 years	x	x	✓	x	✓

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

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

Key: EI: Eye Inspection; Fix: Fixation; RR: Red Reflex Testing; EM: Eye Motility; Hir: Hirschberg; RE: Retinal Exam; PM: Pursuit Movements; PR: Pupillary Reflexes; VA: Visual Acuity; CT: Cover Test; ACT: Alternating cover test

Table 3: Location of vision screening for each age group

Table 3	Hospital	Child Welfare Clinic
Preterm babies	✓	x
0 to 3 months	x	✓
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. No automated screening is routinely conducted in Finland.



7 Provision for Visually Impaired

All children with visual impairments and their families have the right to get appropriate rehabilitation. There is one specialised school for blind and visually impaired children, this is owned and run by the government. It delivers teaching consultation, supportive materials and methods to the whole country. There is also boarding school, the number of pupils that attend this is not known. The costs per child for these schools is not known.

Visually impaired children who attend regular mainstream primary schools are provided with special support which includes visual aids, glasses, magnifiers, reading devices and audio books.



8 Knowledge of existing screening programme

The following data is provided by the National Institute of Health and Welfare Registries. The figures provided constitute the average number of patients treated in specialised care per year (between 2010 and 2017) who are under 18 years of age and another population under 12 years old.

8.1 Prevalence/Diagnosis

The prevalence of amblyopia and types of amblyopia in Finland is unknown. It is estimated that the prevalence of anophthalmia is 1.9/10,000 people, congenital cataract is 2.7/10,000 people and congenital glaucoma is 0.6/10,000 people.

8.2 Coverage

Routine visual screening is conducted as part of the child welfare clinic visit. All children are invited for these visits and they are free of charge. Prior to this, the parents can make an appointment if they have any parental concerns about their child's vision.

8.3 Treatment success

Estimated figures concerning the number of patients treated for congenital cataract, strabismus and amblyopia per year are:

- Figures from Population under 18-years old (average per year from 8 years of data 2010-2017):
 - Congenital cataract 627
 - Strabismus 12,722
 - Amblyopia 4,978

- Figures from Population under 12-years old (average per year from 8 years of data 2010-2017)
 - Congenital cataract 578
 - Strabismus 11,726
 - Amblyopia 4,848

No further data available.

8.4 Screening evaluation

There is no data available concerning attendance, false negative referrals, false positive referrals, the positive predictive value, sensitivity or specificity of a 'refer' result from screening.



9 Costs of vision screening in children

9.1 Cost of vision screening

Routine visual screening is conducted as a part of child welfare clinic visit. Reference costs of the service provider from year 2011 is 50 Euros per visit to a specialized nurse, 104 Euros for a GP. Routine visual screening is conducted as a part of child welfare clinic visit, which is free of charge for the child and family (Kapiainen, Väisänen & Haula, 2014).

9.2 Cost of treatment for amblyopia

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

- Per visit to an ophthalmologist (3 to 10 visits needed) - 212 Euros per visit = 636 Euros – 2,120 Euros total (Kapiainen, Väisänen & Haula, 2014).
- User charges applies for visit to specialized health care, maximum of 41.20 Euros per visit (Kapiainen, Väisänen & Haula, 2014).
- Patching: not known
- Glasses 70 to 100 Euros per year for 2 to 5 years

9.3 Cost of Treatment for strabismus

Conservative treatment costs are the same as treatment for amblyopia. Reference cost for strabismus surgery 2,215.70 Euros ((Kapiainen, Väisänen & Haula, 2014).

9.4 Cost of treatment for cataract

Reference cost for cataract surgery 3,105.20 Euros in 2011 (Kapiainen, Väisänen & Haula, 2014). User charges applies for visit to specialized health care, maximum of 41.20 Euros per visit (Kapiainen, Väisänen & Haula, 2014). The maximum charge for day surgery is 135.10 Euros and charge for inpatient care is a maximum of 48.90 Euros per day (maximum 7 days per year for children less than 18 years of age). For children, 40% of costs of medication is reimbursed - excluding glaucoma for which 100% is reimbursed and only a user charge of 4.50 Euros per purchase (Kapiainen, Väisänen & Haula, 2014).



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