



Summary Vision Screening Data: Montenegro

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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



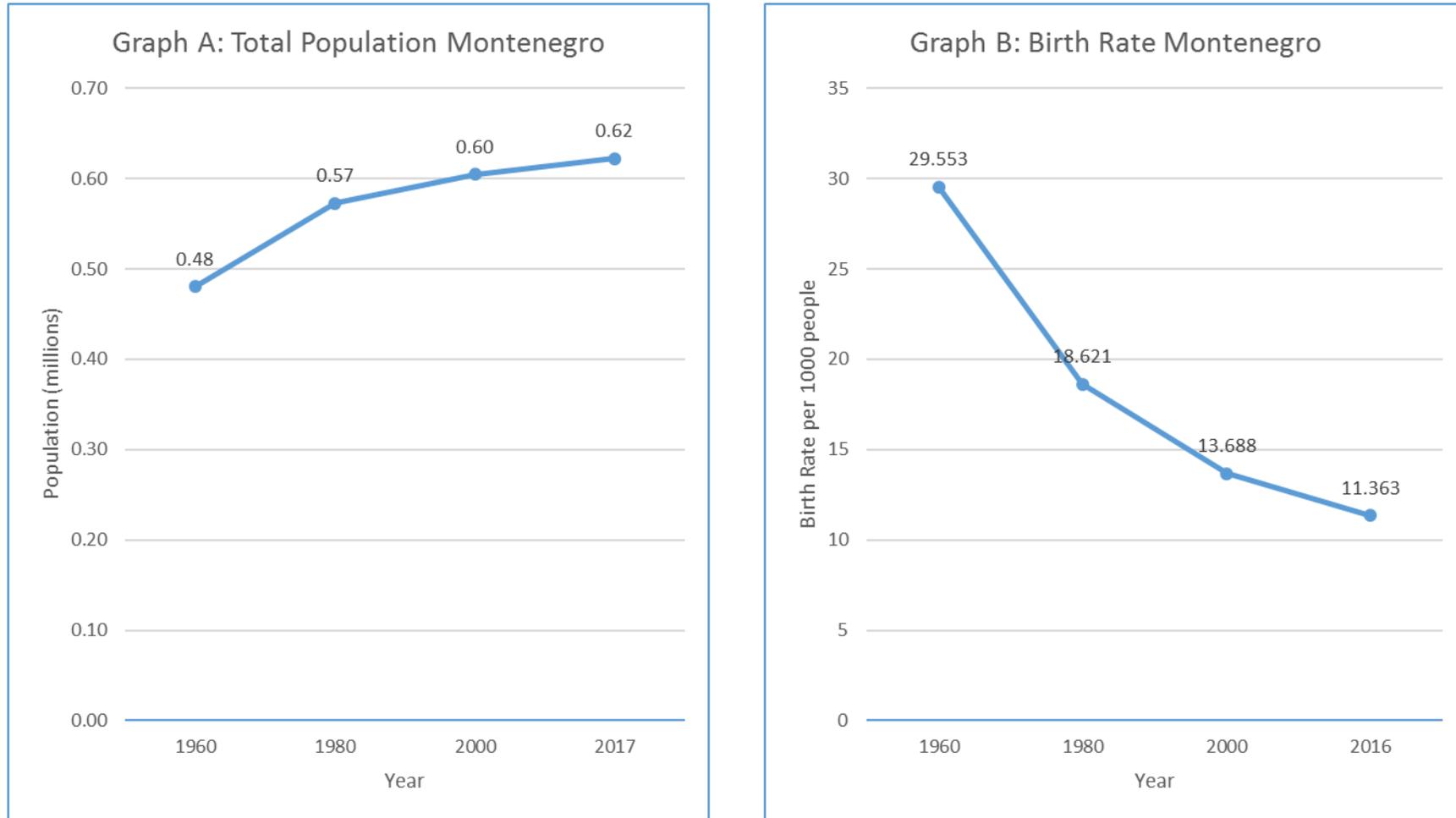
3 Population and Healthcare Overview

The population of Montenegro is 622,471 (World Bank, 2018a) and the birth rate was estimated at 11.4 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.

Montenegro has a reported population density of 46 people per square kilometre in 2017 and this has risen from 37 people per square kilometre in 1961 (World Bank, 2018c). In terms of healthcare facilities, the total density of hospitals in 2013 was 2.09 per 100,000 population (WHO, 2016a). Infant mortality in 2017 is estimated at 3.2 deaths/1,000 live births (World Bank, 2018d).

The average life expectancy in Montenegro is estimated at 77 years (World Bank, 2018e), with a death rate of 9.9 deaths/1,000 population in 2016 (World Bank, 2018f). Montenegro has a gross national income per capita (PPP int. \$, 2013) of \$14,000 (WHO, 2016b). The estimated total expenditure on health per capita in 2014) was \$888 (Intl \$) and the total expenditure on health in 2014 as percentage of GDP was 6.4% (WHO, 2016b).

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



Source: Information sourced from World Bank (2018)



4 Vision Screening Commissioning and Guidance

In Montenegro, vision screening is organised nationally with no differences in protocols between regions. All children are screened in both cities and rural areas. Vision screening is funded by the state and is embedded into a general preventative child healthcare screening programme, the content of which is decided upon and regulated by The Law on Health Care of Population.

There is no data to identify when the vision screening programme began, however, it is known that it has not been changed since its implementation and that it has not been reviewed. There are no methods for quality monitoring of the vision screening imposed by the government. There has been no research into the clinical or cost-effectiveness of the vision screening programme in Montenegro.

Vision screening is conducted by paediatricians in child healthcare centres and hospitals; this is part of general screening programme. Nurses have been identified as general professionals who do not screen but could do with additional training. There is a nurse in every screening team. There is no specific training provided for paediatricians.



5 Screening programme

In Montenegro, retinopathy of prematurity, congenital eye conditions and reduced visual acuity are the main target conditions screened for through vision screening. This is shown in Tables 1, 2 and 3 respectively. 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 a paediatrician in a hospital. The tests conducted at this age include eye inspection, fixation, red reflex testing and eye motility. There are no defined or regulated referral criteria at this age; babies are referred if there is any sign of abnormality. It is not known how many abnormal or inconclusive test results necessitate referral for further diagnostic examination.

5.2 Vision screening - Birth to 3 months

Well, healthy babies up to the age of 3 months are screened using eye inspection, fixation, red reflex testing and eye motility. These tests are carried out by a paediatrician at either a hospital or a child healthcare centre. There are no defined or regulated referral criteria at this age; babies are referred if there is any sign of abnormality. It is not known how many abnormal or inconclusive test results necessitate referral for further diagnostic examination.

5.3 Vision screening - 3 months to 36 months

Children aged 3 to 36 months are screened using eye inspection, fixation, red reflex testing and eye motility. These tests are conducted by a paediatrician at a child healthcare centre. There are no defined or regulated referral criteria at this age; children are referred if there is any sign of abnormality. It is not known how many abnormal or inconclusive test results necessitate referral for further diagnostic examination

5.4 Vision screening - 36 months to 7 years

Children aged 36 months to 7 years are screened using eye inspection and visual acuity measurement. These tests are conducted by a paediatrician at a child healthcare centre. The visual acuity measurement is conducted for the first time at 6 years of age using the Amsterdam Picture Chart or Snellen charts. These are linear, crowded charts with a testing range of 0.0-1.0 decimal. Children are referred for further diagnostic examination after one abnormal or one inconclusive test result or in the case of visual acuity of less than 1.0 decimal (0.00 logMAR, 6/6 Snellen).

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

Table 1	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 testing	Eye motility	Visual acuity measurement
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	Child Health Care Centre	Hospital
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 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. No automated vision screening takes place in Montenegro.



7 Provision for Visually Impaired

In Montenegro, there is one school for blind or visually impaired children; this is the JU Resource Center in Podgoric. Children are sent to this resource centre if they have severe and highly challenging combined disabilities. There are 26 children who attend from primary education and 10 from secondary education. The cost per child for this school is not known. Special support comes in the form of specially trained staff in braille letters and textbooks printed in Digital Accessible Information System (DAISY), format.



8 Knowledge of existing screening programme

8.1 Prevalence/Diagnosis

There is no information provided relating to the prevalence and diagnosis of vision disorders in children aged up to 7 years.

8.2 Coverage

There is no available protocol for vision screening and there is no available data regarding the percentage of children invited for vision screening. However, it is known that children are invited by nurses from primary child healthcare centres and that this invitation is conducted via telephone. Nurses also conduct standard screening procedures, not including vision, such as measuring the length or weight, giving advice regarding feeding and evaluate the development of the baby. There is no information provided relating to the coverage and treatment success of vision disorders in children aged up to 7 years.

8.3 Screening evaluation

There is no information provided relating to the screening outcomes of vision disorders in children aged up to 7 years.

8.4 Treatment success

In the event that a child fails screening, a referral is made to an ophthalmologist who will then perform further diagnostic examinations and prescribe relevant treatment. Ophthalmologists are the only professionals who prescribe glasses for children under the age of 7 years and other treatment options include patching, cataract surgery, enucleation for retinoblastoma, or glaucoma surgery as appropriate. All eligible children are offered treatment. If a procedure is not available in Montenegro, the National Health Insurance refer the children to the centres or Europe.



9 Costs of vision screening in children

9.1 Cost of vision screening

In Montenegro, screening is conducted as part of the job of the relevant healthcare professionals. There is no additional money to professionals for performing screening. The professionals include only paediatricians, who earn a yearly salary of 10,000 Euros. The salary costs per hour are not known exactly, but this is based on a 40-hour work week. It is not clear how much it costs to train paediatricians, from leaving secondary education to qualification and it is also not clear how much it costs the state to perform vision screening per year or per child. Medical school is free to the student; however paediatrician residency costs 22,500 Euros plus the salary for 48 months of residency.

9.2 Cost of treatment for amblyopia

The costs of treating typical patients with refractive amblyopia and strabismic amblyopia, including follow-up:

- First examination costs - 8.34 Euros
- Any follow up - 2.78 Euros
- Refraction examination in cycloplegia - 13.90 Euros
- Spectacles prescription - 2.78 Euros
- Anterior segment biomicroscopy - 8.34 Euros
- Fundus examination - 13.90 Euros
- Examination of convergence and divergence - 4.17 Euros
- Worth test - 2.78 Euros
- Occlusion application - 1.39 Euros
- Additional prismatic correction - 5.56 Euros
- Motility examination - 4.17 Euros
- Fusion exercises - 5.56 Euros

9.3 Cost of Treatment for strabismus

The costs of strabismus surgery, including follow-up:

- Oblique muscles surgery - 52 Euros
- Reposition and myectomy - 52 Euros
- Faden procedure - 52 Euros (prices per eye)
- General anaesthesia - 9.10 Euros

9.4 Cost of treatment for cataract

There is no information provided regarding the costs of cataract surgery, including follow-up of deprivation amblyopia.



10 References

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