Summary Vision Screening Data: Belgium (Brussels)

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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

AR	Autorefraction
AS	Automated Screening
BG	Biprism of gracis
CT	Cover Test
CV	Colour vision
EI	Eye Inspection
EM	Eye Motility
FA/PA	Facial asymmetry/palpebral asymmetry
Fix	Fixation
GDP	Gross Domestic Product
Hir	Hirschberg
Kaleidoscope	organisation subsidised by the government
K&G	Kind en Gezin - an organisation subsidized by the government
NICU	Neonatal-intensive care unit
ONE	Office de la naissance et de l'enfance (The Office of birth and childhood)
PPP	Purchasing Power Parity
PR	Pupillary Reflexes
SV	Stereopsis
VA	Visual Acuity
WHO	Word Health Organisation

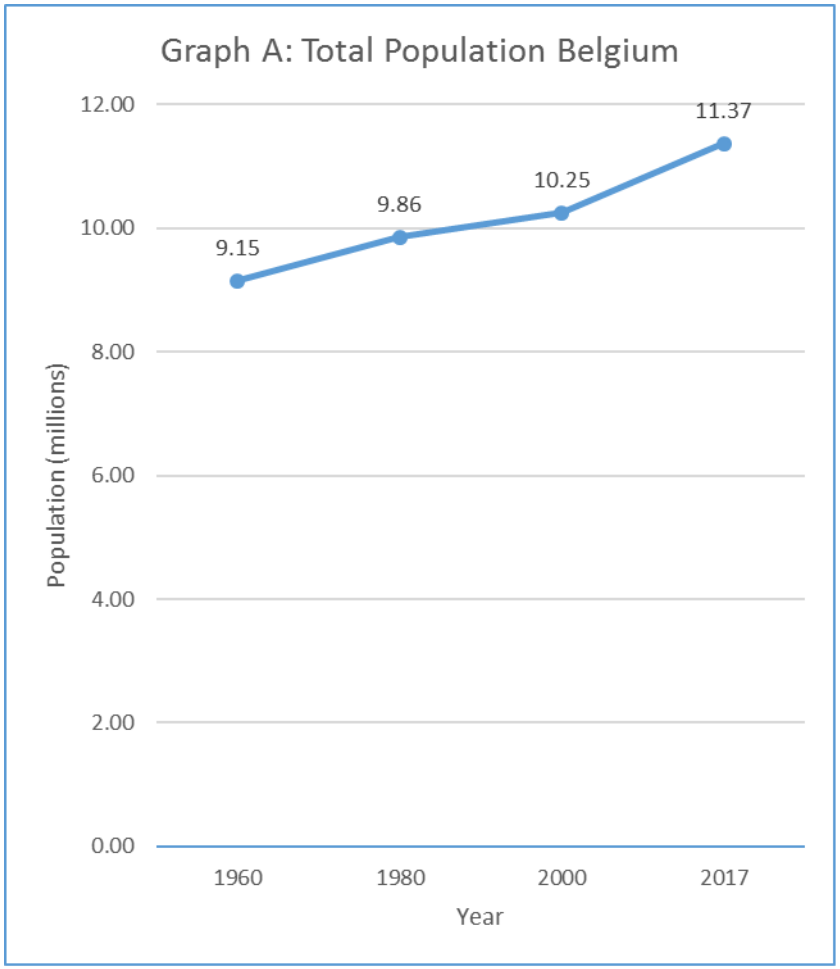
3 Population and Healthcare Overview

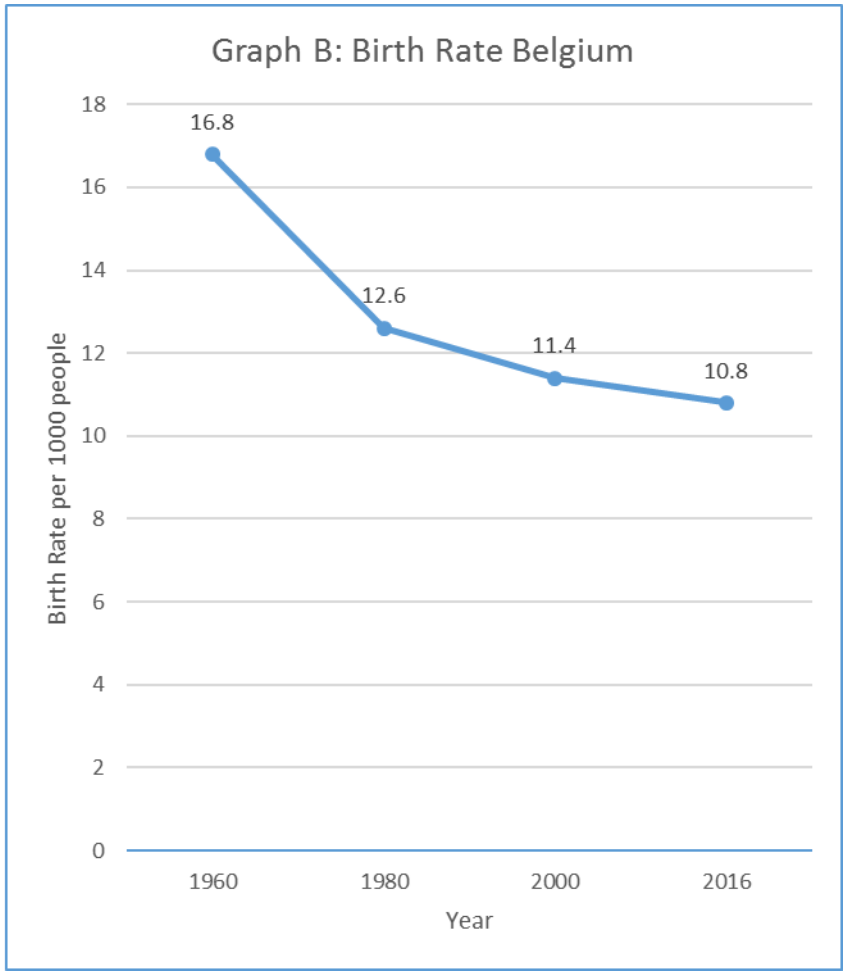
The population of Belgium is 11,372,068 (World Bank, 2018a) and the birth rate is estimated at 10.8 births/1,000 population in 2016 (World Bank, 2018b). The change in population and birth rate from 1960 to 2017 is shown in Figure 1, graphs A and B respectively.

Belgium has a reported population density of 376 people per square kilometre in 2017 and this has risen from 339 people per square kilometre in 2000 (World Bank, 2018c). Infant mortality in 2017 is estimated at 3.1 deaths/1,000 live births (World Bank, 2018d).

The average life expectancy in Belgium is estimated at 81 years (World Bank, 2018e), with a death rate of 9.5 deaths/1,000 population in 2016 (World Bank, 2018f). Belgium has a gross national income per capita (PPP int. $, 2013) of $40,000 (WHO, 2016). The estimated total expenditure on health per capita in 2014) was $4,392 (Intl $) and the total expenditure on health in 2014 as percentage of GDP was 10.6% (WHO, 2016).

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





Source: Information sourced from World Bank (2018)

4 Vision Screening Commissioning and Guidance

Vision screening is organised regionally; the three regions of Wallonia, Flanders and the German speaking region, all provide vision screening. They each have different protocols; such as the age at which tests are conducted, the tests used and the professionals administering the tests. In Wallonia (South Belgium), vision screening began in 2004; in Flanders, vision screening began in 2013. It is not known when vision screening began in the German speaking community (on the Eastern border). The guidelines for vision screening are included within each of the regional general health screening guidelines. None of the vision screening programmes have changed since implementation, however discussions on their content are scheduled for 2019.

Vision screening is offered free of charge for parents. Each region must have at least 80 births in the latest year; if that is not achieved, children are invited to attend centres in another region.

There were no orthoptic training schools and therefore nurses and GPs were trained to undertake vision screening. A total of forty GPs and paediatricians have been trained by ONE, between 2004 and 2016, it is not known how many more are needed. Training for general professionals occurs annually, organised by ONE and taught by an ophthalmologist. The training is not accredited or certified. In 2016, an Orthoptic training programme opened in Liege and there are another two courses in preparation in Brussels and Gent. The training for orthoptists is a Bachelor's degree which takes 3 years, therefore additional orthoptists will graduate to enter the workforce in 2019. These new graduate Orthoptists have been identified as professionals that do not screen, but could do so ;.

Vision screening is funded independently by each region and therefore there are differences in the provision. Vision screening is embedded into a general preventative child healthcare screening system, the content of which is decided upon by ONE (for Wallonia) and the local government advised by a committee directed by paediatricians in collaboration with ophthalmologists and orthoptists.

Data is collected monthly about the activity of the vision screeners. This includes where screening has taken place, the type of vision screening, the number of children screened, the number of normal results, the number of abnormal results, the number of doubtful results and the number of unfeasible results. Annual charts are created, the results of which are sent back to the vision screeners to be analysed. There are methods for quality monitoring imposed by the government; specifically, the collection of data is done on an anonymous basis. The outcome from the ophthalmologist visit (diagnostic testing of those referred) are documented and collected from the ophthalmologists, the parents, or the director of the kindergarten, school or health centre and sent back to ONE. There has been no research concerning the cost- or clinical-effectiveness of the vision screening programme in Belgium.

5 Screening programme

Retinopathy of prematurity, congenital eye disorders and amblyopia are the target condition screened for by vision screening. The criteria for referral for further diagnostic examination for preschool children (before the age of 2.5 years) is detailed relating to each region (different methods of screening and also different choices made by each committee). 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 a hospital by an ophthalmologist. The vision screening tests used include eye inspection, fixation and pupillary reflexes. Babies are referred immediately if there are signs of abnormality. There are no specific guidelines.

5.2 Vision screening - Birth to 3 months

Well, healthy babies up to the age of 3 months are screened in either a hospital, child healthcare centre, private clinic or private medical practice. The tests are carried out by either a GP or paediatrician. The vision screening tests used include eye inspection, fixation and pupillary reflexes, observation for facial asymmetry or palpebral asymmetry. An ophthalmologist will conduct fundus red reflex examination, only if there are signs of amblyopia. In all regions babies are referred immediately if there are signs of abnormality.

5.3 Vision screening - 3 months to 36 months

<u>Flanders</u>

Babies aged 3 to 36 months are screened in medical consultations organised by Kind en Gezin (K&G). An eye test completed by specialist nurses is carried out at 12 to 15 months of age and then again at 24 to 30 months of age.

<u>Flanders referral criteria</u>

- Hypermetropia: HM≥ +4 Dioptres
- Myopia: ≥ -4 Dioptres
- Astigmatism: 12 Months >3 Dioptres; 24 Months: >2.5 Dioptres
- Anisometropia: sph/cyl >1.5 Dioptres
- or no detection of a pupil

Wallonia

Babies aged 3 months to 36 months are screened in medical consultations organised by Office de la naissance et de l'enfance (ONE, The Office of birth and childhood). One test is carried out between 18 to 47 months of age by orthoptists, general practitioners, paediatricians or specially trained nurses.

Wallonia referral criteria

- Hypermetropia: HM≥ +1.5 Dioptres
- Myopia: > -3 Dioptres
- Astigmatism: >2 Dioptres
- Anisometropia: sph/cyl >2 Dioptres
- or anomaly on one of the following items: inspection, corneal reflexes, biprism Gracis (specific test with 6DP base out and base in in one compact device), cover test, ocular motility

German-speaking community

Between 3 to 36 months children are screened in medical consultations organised by Kaleidoscope. At around 30 months of age, children are screened by orthoptists or ophthalmologists. The vision screening tests utilised include eye inspection, fixation, eye motility, Hirschberg, pupillary reflexes, cover test, visual acuity measurement, stereopsis (Lang I or II), colour vision, autorefraction (Retinomax Autorefractor), or automated screening (PlusOptix).

German-speaking community referral criteria

- Hypermetropia: HM≥ +1.5 Dioptres
- Myopia: ≥ -3 Dioptres
- Astigmatism: >2 Dioptres
- Anisometropia: sph/cyl >2 Dioptres
- or anomaly on 1 of the following items: inspection, corneal reflexes, pupil reflexes, Lang stereotest, biprism Gracis, cover test, ocular motility

5.4 Vision screening - 36 months to 7 years

Children aged 36 months to 7 years are screened at a Médecine Scolaire (Medical School). Vision screening is conducted by either a paediatrician, specialist nurse, orthoptist, or technical assistant in ophthalmology. The vision screening tests utilised at this age include eye inspection, eye motility, Hirschberg, pupillary reflexes, cover test, visual acuity measurement, stereopsis, autorefraction (Retinomax Autorefractor), or automated screening (PlusOptix), biprism of Gracis (Wallonia only). The optotype charts used to

measure visual acuity include Lea Symbols, Crowded Kay pictures , Keeler logMAR crowded test performed at 3m, Snellen optotypes, E-test, Stycar and Paris near vision test. Visual acuity is measured for the first time at 3 years of age, and for a second time between the ages of 5 and 6 years. Visual acuity is measured in Flanders by specialist nurses, paediatricians, or a GP with master of youth health; in Wallonia by specialist nurses, paediatricians, or GPs with "certificat d'université-médecine soclaire-PSE" (certificate from a university/school of medicine-PSE); in German-speaking community by specialist nurses, paediatricians, or GP some with education in school medicine. Children are referred to an ophthalmologist after one abnormal or one inconclusive test result.

For all regions, the children are not tested at a specific age but in a certain class:

- 1st year of kindergarten approx. 3 years
- 2nd year of kindergarten approx. 4 years
- 1st year of primary school approx. 6 years
- 3rd year of primary school approx. 9 years
- 4th year of primary school approx. 10 years
- 5th year of primary school approx. 11 years
- 6th year of primary school approx. 12 years

Flanders referral criteria:

- 1st year of Kindergarten: <0.63 (decimal) Kay test or <0.5 (decimal) logMAR test
- 2nd year of Kindergarten: <0.63 logMAR test (Keeler Crowded) or Kay test (Picture crowded book)
- 1st year of primary school: <0.8 (decimal) logMAR test
- 3rd year of primary school: <0.8 logMAR test (or Snellen test)
- 5th year of primary school: 1 line interocular difference, anomaly of ocular alignment, repeated failed measurement in cooperative child

Wallonia referral criteria:

- 1st year of Kindergarten: <0.6 (decimal) or smallest line not correctly performed (Paris near vision test)
- 3rd year of Kindergarten: <0.8 (decimal)
- 2nd year of Primary school: <0.8 (decimal)
- 4th year of Primary school: <0.8 (decimal)
- 6th year of Primary school: 1 line interocular difference or anomaly of ocular alignment or repeated failed measurement in cooperative child

German-speaking community referral criteria:

- 1st year of Kindergarten: <1.0 (decimal)

- 2nd year of Kindergarten:<1.0 (decimal)
- 1st year of Primary school: <1.0 (decimal)
- 3rd year of Primary school: <1.0 (decimal)
- 5th year of Primary school: <1.0 (decimal)
- or at any age: anomaly of ocular alignment or stereopsis or repeated failed measurement

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

Table 1	Ophthalmologist	Paediatrician	GP	Orthoptist	Specialist Nurse	Technical assistant in ophthalmology
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	PR	EM	Hir	CT	VA	SV	AR	AS	BG	CV
Preterm babies	✓	✓	✓	×	×	×	×	×	×	×	×	×
0 to 3 months	✓	✓	✓	×	×	×	×	×	×	×	×	×
3 to 36 months	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓ Wallonia	✓
3 to 7 years	✓	×	✓	✓	×	✓	✓	✓	✓	✓	✓ Wallonia	✓

Key - *EI: Eye Inspection; Fix: Fixation; EM: Eye Motility; Hir: Hirschberg; PR: Pupillary Reflexes; CT: Cover Test; VA: Visual Acuity Measurement; SV: Stereopsis; CV: Colour Vision; AR: Autorefraction; AS: Automated Screening; BG: Biprism of gracis; CV: Colour vision*

Table 3: Location of vision screening for each age group

Table 3	Hospital	Child healthcare centre	Private clinic	Private practice	Medical School	ONE	K&G	Kaleidoscope
Preterm babies	✓	×	×	×	×	×	×	×
0 to 3 months	✓	✓	✓	✓	×	×	×	×
3 to 36 months	×	×	×	×	×	✓ Wallonia	✓ Flanders	✓ German community
3 to 7 years	×	×	×	×	✓	×	×	×

Key:

- *ONE: Office de la naissance et de l'enfance (The Office of birth and childhood)*
- *K&G: Kind en Gezin - an organisation subsidized by the government*

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 Belgium, PlusOptix or Retinomax Autorefractor devices are used. The use of devices differs between regions. These devices are used with other tests included in the vision screening battery. There is no comparative data between regions. All children are screened using automated screening. If a child passes the visual acuity test, but fails the photoscreening/autorefractor, they still get referred for diagnostic examination.

It is not known how much the PlusOptix or Retinomax Autorefractor devices cost to buy, nor how much the maintenance costs are per year. It is unknown after how many years either device is scheduled to be replaced. In Flanders, since September 2018 testing has been conducted using Go Check Kids compared to PlusOptix.

7 Provision for Visually Impaired

Wallonia

There are 4 schools for blind or severely visually impaired children. The equipment is financed by the regional government and prescribed according to the needs of the children.

Flanders

There are 10 schools but only 4 of these are specifically for visual and sensorial deficits. Magnifying screens are provided in schools where required and financed by the Flemish government, but these are not updated due to a lack of resources to fund new devices.

German-speaking community

There is no data on this region.

The costs per child for these schools in each region is unknown.

8 Knowledge of existing screening programme

8.1 Prevalence/Diagnosis

There is no data available for Belgium concerning: the prevalence of treated or untreated amblyopia at age 7 years; the prevalence of persistent amblyopia (missed by screening or failed treatment) at age 7 years; the prevalence of strabismus at any age; or the incidence (observed cases) of the four types of amblyopia (strabismic, refractive, combined mechanism and deprivation) per age per year. This is partly due to a lack of consensus of amblyopia definition.

8.2 Coverage

All children are invited to attend screening however some parents may choose not to attend. Instead, they may go directly to an ophthalmologist, or go to another region. Invitations for vision screening are sent by the governmental departments in that area (i.e. ONE, K&G, Kaleidoscope) and organised, free of charge, by paediatric consultations, during which the vision screening is performed. All children are invited for vision screening. The attendance of vision screening in Wallonia is 58% for preschool children; for Flanders it is 85%; for the German speaking community it is 70 %. When it comes to school age children, attendance is estimated at 99% to 100% for all 3 regions.

8.3 Screening evaluation

It is estimated that in Wallonia, 75% to 80% of the children referred from screening have an anomaly confirmed and treatment and follow-up is planned by an ophthalmologist. The exact percentage of compliance with referral after an abnormal screening test result is unknown, as there is no registration or documentation of noncompliance with referral after an abnormal screening test result.

The percentage of false negatives (children who pass screening but who have amblyopia) for vision screening is estimated at less than 5%. The percentage of false positives (patients who fail screening even though they are healthy) is also estimated at less than 5%. The positive predictive value of a ‘refer’ result after vision screening is estimated at around 90%. The sensitivity and specificity of vision screening in school age children are not known. However, preschool screening evaluation has been provided and is outlined in Figure 3 below.

Figure 3: Preschool Screening Evaluation (excluding children with already known anomalies). Data collected by each region.

Figure 3.	Flanders	Wallonia	German-speaking community
Response rate to eye test*[1]	17%	33%	60%
Anomaly with risk of amblyopia confirmed*[2]	44%	83%	36%
Anomaly not confirmed*[3]	36%	17%	24%
No answer from the ophthalmologist concerning anomaly*[4]	19%	?	40%
Treatment started in confirmed anomaly	13%	74%	?
Follow-up planned	52.5% with ophthalmologist; 17.6% at K&G/ CLB (school aged children)	81%	?

- *[1]: Attendance to the ophthalmologist after referral
- *[2]: This is not true positives. Some children were not tested adequately due to a lack of cooperation and/or the definition of amblyopia was not strict enough
- *[3]: These are the false positives plus the children not adequately testable (lack of cooperation
- *[4]: The ophthalmologists did not send the results from the referral visit

8.4 Treatment success

All eligible children are offered treatment. Ophthalmologists are the only professionals who prescribe glasses for children under the age of 7 years. Other treatment options, in select cases, include patching, penalisation with glasses, atropine and cataract surgery.

Congenital eye disorders

There is no data available concerning the percentage of children treated for congenital eye disorders in the total population.

Strabismus

There is no data pertaining to the percentage of children treated for strabismus alone after being screened before age 7 years, or of all children treated for strabismus alone before age 7.

Amblyopia

The percentage of all children treated for amblyopia before age 7 is unknown. The distribution of strabismic amblyopia, refractive amblyopia, combined-mechanism amblyopia and deprivation amblyopia is not known.

The percentage of children treated for amblyopia after being screened before age 7 years are listed in Figure 4.

Figure 4: - Referral rates for Flanders, Wallonia, German community (excluding children with already known anomalies) – the number of children this refers to is not available.

Flanders		Wallonia		German-speaking community	
Percentage	Year/age	Percentage	Year/age	Percentage	Year/age
6.8%	1st year kindergarten	11.5%	1st year of kindergarten	9.4%	1st year kindergarten
7.9%	2nd year kindergarten	13.6%	3rd year kindergarten	18.3%	2nd year kindergarten
7.2%	1st year primary school	11.4%	2nd year primary school	11.1%	1st year primary school
5.8%	3rd year primary school	No results	4th year primary school	10.0%	3rd year primary school
7.3%	5th year primary school	13.5%	6th year primary school	9.1%	5th year primary school

9 Costs of vision screening in children

9.1 Cost of vision screening

The salary costs, per year for vision screening professionals is only available for Wallonia:

- 5 medical staff: 65,404 Euros per year each, plus fees for transport between places.
- Orthoptists and technical assistants number unknown): 32,666 Euros each per year.
- For 2017 it was estimated there were 74 full time vision screeners: Total cost 241,733Euros per year, plus transport fees.

There is no data available concerning the cost 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 Belgium, per region, is not available.

9.2 Cost of treatment for amblyopia

No data available.

9.3 Cost of Treatment for strabismus

No data available.

9.4 Cost of treatment for cataract

No data available.

10 References

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