



Gender and anatomical influences on the prevalence of low vision and blindness in Owerri, Nigeria

C G Emerole¹, C O Emerole^{2*}, G U Emerole³

¹ Optometry Unit, Eye Clinic, Federal Medical Centre, Owerri, Imo State, Nigeria

² Department of Public Health, Federal University of Technology, Owerri, Imo State, Nigeria

³ King's College Hospital, Denmark Hill, London, UK

Abstract

Background: The aim of the study is to identify Gender and Anatomical Influences on the prevalence of Low vision and Blindness in Owerri, Nigeria.

Methods: A total of 12,160 subjects comprising 4230 males and 7930 females who met the inclusion criteria were seen between January 2005 and December 2019 from Eye clinic attendees in Owerri, Imo State, Nigeria. Visual impairment was defined as Visual Acuity <6/18. All the subjects underwent a complete ophthalmic examination. Standard procedures were used to determine visual parameters of subjects

Results: Subjects with low vision in both eyes were in the majority (70.8%). Subjects with low vision in the left eye only (15.7%) were more than those with low vision in the right eye only (13.5%). There were more females (54.7%) with low vision than males (45.3%). Those aged ≥ 50 years (66.3%) were in the majority among subjects with low vision. Subjects blind in both eyes were 4.1%. Those with blindness in the left eye only (56.2%) were more than those with blindness in the right eye only (39.7%). There were more males (58.3%) than females (41.7%) among those who were blind. Those aged 50 years and above (73.1%) were in the majority among subjects who were blind.

Conclusions: Our findings has provided evidence that low vision and blindness are more prevalent in the left eye than in the right eye. In addition, there were gender differences in the prevalence of low vision and blindness, with more females with low vision; and more males with blindness. There is a need to take these observations into consideration in the management of visual health.

Keywords: visual-impairment, blindness, low-vision, gender, ocular-dominance

Introduction

The human eyes are the two important special sensory organs for seeing located externally on the face. In addition, the eyes serve as mirrors of the human body: environmental factors and disease conditions have visual manifestations. (Seidu *et al.*, 2021) [31] William Blake described the eyes as the "windows of the soul". The eyes are the windows through which we view the world around us. (Borish, 1975; Emerole, C.G *et al.*, 2013; Lin *et al.*, 1999) [7, 12, 13]

Vision (the power of seeing; sight; ability to see) is a physiologic function (Borish, 1975) [7]. There are various parameters used in describing or assessing visual function that are of relevance in health and disease conditions of the body. (Borish, 1975; Emerole, C.G, 1992; Ferris *et al.*, 1982; Goode *et al.*, 1998) [7, 12, 13, 16] In order for our eyes to be able to see, light rays must be refracted by the cornea and the crystalline lens so that incident light rays are focused on the retina. Ocular refraction is a measure of ocular function and visual health. The retina receives the picture formed by these light rays and sends the image to the brain through the optic nerve. (Borish, 1975; Lin *et al.*, 1999) [7, 22] An object is seen by slightly different angles by each eye so the information the brain receives from each eye is different although it overlaps. The brain interprets the information to produce a complete picture. (Kay *et al.*, 2017) [19]

The importance of good vision to life activities cannot be overlooked. (Asogwa, 1999; Seidu *et al.*, 2021) [5, 31] In spite of the important function the eyes perform, the simple things that can be done to keep the eyes healthy are often

ignored, resulting in damage to the eyes and vision. The consequences of low vision and blindness are enormous and do not spare any age, eye, gender, person or race. (Canadian Council of Motor Transport Administration, 2013; Emerole & Nneli, 2013) [10, 12, 13] From the beginning of time blindness and other related issues have left the people affected shunned and stigmatised by the community. In the past the most sightless people could hope for as employment would be to become a successful beggar. (Emerole, C.G *et al.*, 2013) [12, 13] Advances in technology with time are modifying the attitude of the visually impaired. The statistics of low vision and blindness are ever increasing by the day. According to the World Health Organisation, presently, at least 2.2 billion people around the world have a visual impairment that could have been prevented or is yet to be addressed. (World Health Organization, 2019) [35] Uncorrected refractive errors and cataracts are reported as leading causes of visual impairment posing enormous global financial burden and productivity losses. (World Health Organisation, 2021) [34]

The aim of this study therefore is to identify the Gender and Anatomical influences on the Prevalence of Low vision and Blindness in Owerri, Imo State, Nigeria in order to further establish a framework for the management of eye disorders.

Methods

Study settings and study population

A total of 12,160 subjects comprising 4230 males and 7930 females who met the inclusion criteria (Visual Acuity <6/6)

were seen between January 2005 and December 2019 from Eye Clinic attendees in Owerri, Nigeria. Two thousand one hundred and six were visually impaired (Visual Acuity <6/18).

Data collection

In the course of consultation, history was obtained from subjects as to existence of possible risk factors to visual impairment. Blood pressure was measured routinely in adult subjects. All the subjects underwent a complete ophthalmic examination which included measurement of distant, near and pin-hole vision in subjects with visual acuity less than 6/6 (with snellen’s chart and near reading charts); ophthalmoscopy; retinoscopy; subjective refraction and perimetry to investigate other possible causes of impairment or reduction in vision.

Case Definition

Refractive errors (ametropia) in an eye were defined. Emmetropia was defined as a spherical dioptric power between -0.50DS and +0.50DS. Refraction data are based on subjective refraction. Low vision in an eye was defined as visual acuity <6/18 and equal to or greater than 3/60 in the better eye with the best correction. Blindness in an eye was defined as visual acuity of less than 3/60 or a corresponding visual field loss less than 10° in the better eye with the best possible correction. Those whose history suggests the presence of diabetes mellitus had their fasting or random blood sugar checked as the case may be.

Data analysis

The data obtained were reported as percentages and statistical analysis (Chi square) was done using statistical package for social sciences (SPSS) version 23.

Results

Prevalence of Low Vision among the Subjects

The prevalence of low vision was 70.8% in both eyes [O.U], 13.5% in the right eye [O.D] only and 15.7% in the left eye [O.S] only see tables 1-3.

The gender characteristics of the subjects with low vision show that 45.3% were males and 54.7% females. The differences were statistically significant. See tables 1-3.

Majority of the low vision were seen in subjects aged ≥50 years (66.3%). In subjects aged 20-49 years (20.8%); and in those aged ≤19 years, 12.9% see tables 1-3.

Table 1: Low Vision in Both Eyes by Age and Gender

Age Group	Males		Females	
	N=576	%	N=744	%
0-9yrs	30	5.2	26	3.4
10-19yrs	70	12.2	82	11.0
20-29yrs	59	10.2	85	11.4
30-39yrs	27	4.7	45	6.0
40-49yrs	30	5.2	40	5.3
50-59yrs	45	7.8	79	10.6
60-69yrs	100	17.4	166	22.3
70 and above yrs	215	37.3	221	30.0

X² = 16.523 df = 7 p – value = 0.021* (significant) [bivariate]

Table 2: Low Vision in Right Eye Only by Age and Gender

Age Group	Males		Females	
	N= 129	%	N= 122	%
0-9yrs	5	3.9	1	0.8
10-19yrs	6	4.7	4	3.3
20-29yrs	4	3.1	7	5.7
30-39yrs	6	4.7	5	4.1
40-49yrs	9	6.9	9	7.4
50-59yrs	20	15.5	29	23.8
60-69yrs	28	21.7	43	35.2
70 and above yrs	51	39.5	24	19.7

X² = 18.3369 df = 7 p – value = 0.011* (Significant) [Bivariate]

Table 3: Low Vision in Left Eye Only by Age and Gender

Age Group	Males		Females	
	N= 140	%	N= 153	%
0-9yrs	1	0.7	N/A	0.0
10-19yrs	6	4.3	10	6.5
20-29yrs	7	5.0	7	4.6
30-39yrs	10	7.1	8	5.2
40-49yrs	12	8.6	18	11.8
50-59yrs	23	16.4	32	20.9
60-69yrs	33	23.6	46	30.1
70 and above yrs	48	34.3	32	20.9

X² = 9.676 df = 7 p – value = 0.208 (NotSignificant) [Bivariate]

Prevalence of Blindness among the Subjects

Analysis of the results show that 4.1% of the subjects were blind in both eyes (O.U), while 39.7% and 56.2% were blind in the right eye (O.D) only and left eye (O.S) only respectively see tables 4-6.

The prevalence of blindness among the males was 58.3% while that in the females was 41.7%. The differences were statistically significant. See tables 5 (p-value = <0.001).

The prevalence of blindness with age shows that 6.6% of the subjects who were blind were in the paediatric and adolescent age group. In subjects aged 20-49 years (20.3%). Those aged ≥50 years constituted 73.1%. The differences were statistically significant. See tables 4-6.

Table 4: Blindness in Both Eyes by Age and Gender

Age Group	Males		Females	
	N= 7	%	N= 3	%
0-9yrs	1	14.3	N/A	0.0
10-19yrs	1	14.3	N/A	0.0
20-29yrs	N/A	0.0	N/A	0.0
30-39yrs	N/A	0.0	N/A	0.0
40-49yrs	N/A	0.0	N/A	0.0
50-59yrs	N/A	0.0	1	33.3
60-69yrs	N/A	0.0	N/A	0.0
70yrs and above	5	71.4	2	66.7

X² = 3.1973 df = 3 p – value = 0.362 (Not Significant) [Bivariate]

Table 5: Blindness in Right Eye Only by Age and Gender

Age Group	Males		Females	
	N= 66	%	N= 30	%
0-9yrs	N/A	0.0	N/A	0.0
10-19yrs	3	4.5	4	13.3
20-29yrs	2	3.0	N/A	0.0
30-39yrs	5	7.6	N/A	0.0
40-49yrs	6	9.1	N/A	0.0
50-59yrs	14	21.2	4	13.3
60-69yrs	5	7.6	14	46.7
70yrs and above	31	47.0	8	26.7

X² = 36.459 df = 7 p – value = < 0.001* (Significant) [Bivariate]

Table 6: Blindness in Left Eye Only by Age and Gender

Age Group	Males		Females	
	N= 68	%	N= 68	%
0-9yrs	2	2.9	N/A	0.0
10-19yrs	3	4.4	2	3.0
20-29yrs	3	4.4	4	5.9
30-39yrs	3	4.4	4	5.9
40-49yrs	10	14.7	12	17.6
50-59yrs	10	14.7	12	17.6
60-69yrs	18	26.5	15	22.1
70yrs and above	19	28.0	19	27.9

$\chi^2=2.906$ df = 6 p – value = 0.821 (Not Significant) [Bivariate]

Discussion

Low vision and blindness can be in the right eye or left eye, and at times it is present in both eyes. In the present study, the prevalence of low vision in both eyes was 70.8%; in the right eye only 13.5%; and 15.7% in the left eye only. Among the subjects, 4.1% were blind in both eyes while 39.7% and 56.2% were blind in the right eye only and left eye only respectively. The differences in vision in the right and left eyes of subjects were statistically significant (p – value = 0.021).

The observed differences in the prevalence of low vision in the right and left eyes of subjects that sought visual intervention in the present study supports the influence of anatomical location of the eyes and ocular dominance on vision as noted earlier. (Borish, 1975; Kay *et al.*, 2017; Rezaee *et al.*, 2010) [7, 30] The right side of the brain receives information through both optic nerves for the left field of vision, and the left side of the brain receives information through both optic nerves for the right field of vision. The middle of the fields of vision overlaps. It is seen by both eyes- binocular vision. (Kay *et al.*, 2017) [19] An object is seen from slightly different angles by each eye. So the information the brain receives from each eye is different although it overlaps. The brain interprets the information to produce a complete picture. (Borish, 1975; Kay *et al.*, 2017) [7] It is reported that the right side of the brain (right cortical/subcortical structures) play a significant role in processing pain and emotion. This may explain the lower pain threshold found in many left-sided anatomic structures. The study on ocular sensitivity between the right and left eyes undergoing glaucoma laser surgery showed a higher mean sensitivity in left eyes. (Kay *et al.*, 2017) [19] Majority of the subjects in the present study had visual impairment in the left eye.

Multi-ethnic studies in healthy eyes have shown ethnic differences in corneal parameters; racial influences in lens opacity incidence and progression; and racial differences in retinal vessel geometrics and retinal thickness. (Alsaqr *et al.*, 2021; Kashani *et al.*, 2010; Li *et al.*, 2013; Storey *et al.*, 2013; Wong *et al.*, 2004) The existence of a positive correlation between visual acuity, ocular dominance and handedness has been noted. This correlation could explain the higher prevalence of low vision and blindness in the left eyes of the subjects in this study. (Borish, 1975; Bourassa *et al.*, 1996; Rezaee *et al.*, 2010) [7, 30] Eye dominance refers to the phenomenon that input from one eye is dominant (that is processed in a privileged manner) over simultaneous input from the other eye in binocular tasks. Majority of persons are right handed and right eye dominant. (Borish, 1975; Bourassa *et al.*, 2010) [7] Dominant eye refers to the eye which does purposeful task. Ocular dominance is a constant

tendency for receiving input information from one eye which is more accurate and pictures seem clearer, larger and more constant and this eye can limit information from the less dominant eye. (Bamikole & Aunde, 2012; Rengstorff, 1968; Rezaee *et al.*, 2010) [6, 29, 30]

In the present study, the gender characteristics of the subjects with low vision show that 45.3% were males and 54.7% were females while the prevalence of blindness among the males was 58.3% while that in the females was 41.7%. The gender differences between the subjects with low vision and blindness was significant. There were more female subjects with low vision and more male subjects with blindness. Women as a result of pregnancy, child birth, motherhood and menopause appear more aware and health conscious than men. (Borish, 1975; Emerole, C.G *et al.*, 2014; Ezepue, 1997) [7, 14, 15] There is also demand on women of their vision from domestic chores and peasant farming. Their higher attendance to visual health care facility may explain the higher prevalence of low vision among the female subjects. (Emerole, C.G, 1992; Emerole, C.G *et al.*, 2014; Ezepue, 1997) [11, 15, 14, 15] The higher prevalence of blindness among the male subjects is probably due to the fact that men engage in more hazardous occupation and activities like welding, aggressive sports (boxing), armed forces, combat professions and carpentry. Culturally also it is not “manly” to seek medical attention at the least health challenge.

Majority of the low vision were seen in subjects aged 50 years and above (66.3%); subjects aged 20-49 years, 20.8%; and those aged ≤ 19 years, 12.9%. The prevalence of blindness with age shows that subjects aged ≥ 50 years constituted 73.1%; subjects aged 20-49 years, 20.3%; the paediatric and adolescent age group ≤ 19 years were 6.6%. The differences were statistically significant. Subjects aged 50 years and above were in the majority among subjects who were low vision or blind. This agrees with previous studies. (Abdu, 2002; Abdull *et al.*, 2009; Adeoye, 1996; Ezepue, 1997; Kingo & Ndawi, 2009; Ngondi *et al.*, 2006; Nwosu, 1994; Onakpoya *et al.*, 2007; I. Patel *et al.*, 2006; N. Patel *et al.*, 2008) [1, 2, 24, 25, 26, 27, 28] There is a gradual decline in accommodation after the age of 35. After the age of 40, the crystalline lens becomes more rigid. As the crystalline lens cannot change shape as easily as it once did, it becomes more difficult to read at close. (Borish, 1975; Emerole, C.G *et al.*, 2014; I. Patel *et al.*, 2006) [7, 14] Low vision is more common in older adults because many of the diseases that can cause it are more common in older adults. Ageing does not cause low vision on its own, but modifies a pre-existing error making it more symptomatic. In addition most domestic and office duties are near point activities and demand good near vision. The decline in vision at near from presbyopia, and at far from ametropia and other associated conditions and morbidities with the subjects ≥ 50 years may explain the higher prevalence of low vision and blindness in this age interval. (Emerole, C.G *et al.*, 2014; Ezepue, 1997; Milton *et al.*, 2005) [14, 15, 23]

Conclusion

In conclusion, our findings have provided evidence that low vision and blindness are more prevalent in the left eye than the right eye. In addition, there were gender differences in the prevalence of low vision and blindness with more females with low vision and more males with blindness.

There is therefore the need to take these observations into consideration in the management of visual health.

References

1. Abdu L. Prevalence and causes of blindness and low vision in Dambatta local government area, Kano State, Nigeria - PubMed. Niger Journal of Medicine,2002;11(3), 108–112. <https://pubmed.ncbi.nlm.nih.gov/12221951/>
2. Abdull MM, Sivasubramaniam S, Murthy GVS, Gilbert C, Abubakar T, Ezelum C *et al.* Causes of Blindness and Visual Impairment in Nigeria: The Nigeria National Blindness and Visual Impairment Survey. Investigative Ophthalmology & Visual Science,2009;50(9):4114–4120. <https://doi.org/10.1167/IOVS.09-3507>
3. Adeoye A. Survey of blindness in rural communities of south-western Nigeria. Tropical Medicine & International Health: TM & IH,1996;1(5):672-676. <https://doi.org/10.1111/J.1365-3156.1996.TB00093.X>
4. Alsaqr A, Fagehi R, Abu Sharha A, Alkhudair M, Alshabrami A, Muammar A *et al.* Ethnic Differences of Corneal Parameters: A Cross-Sectional Study. The Open Ophthalmology Journal,2021;15(1):13-20. <https://doi.org/10.2174/1874364102115010013>
5. Asogwa SE. Road traffic accident in Nigeria. A handbook for all road users (first). SNAPP Press Ltd, 1999. <https://frsc.gov.ng/NATROADTRAFFICREGS2012.pdf>
6. Bamikole O, Aunde G. Task Difficulties, Eye Conditions and Visual Acuity Tasks Among Selected Students of The University of Lagos, Nigeria. Undefined, 2012.
7. Borish IM. Clinical Refraction (3rd ed.). The Professional Press Inc, 1975. <https://www.amazon.com/Clinical-Refraction-Irvin-Borish-Hardcover/dp/B011MEFVQA>
8. Bourassa DC, McManus IC, Bryden MP. Handedness and eye-dominance: a meta-analysis of their relationship. Laterality,1996;1(1):5-34. <https://doi.org/10.1080/713754206>
9. Bourassa DC, McManus IC, Bryden MP. Handedness and Eye-dominance: A Meta-analysis of Their Relationship,2010;1(1):5-34. <https://doi.org/10.1080/713754206>
10. Canadian Council of Motor Transport Administration. = CCMTA-CCATM Medical Standard for Drivers (13th ed, 2013, 146. <https://www.transportation.alberta.ca/content/docType45/Production/CCMTADriverMedicalStandardsAugust2013.pdf>
11. Emerole CG. The Influence of Environmental Factors on the Occurrence of Allergic Conjunctivitis amongst Primary School Pupils in Owerri Urban. Abia State University, Uturu, 1992.
12. Emerole CG, Emerole CO, Nneli RO. Blindness and Low Vision in Nigeria: A Review of Etiological Factors And Impact. Journal of Health and Visual Sciences, 2013;15(1). <https://doi.org/10.4314/u.v15i1.%c>
13. Emerole CG, Nneli RO. Visual indices of motor vehicle drivers in relation to road safety in Nigeria. Nigerian Journal of Physiological Sciences,2013;28(1):57-62.
14. Emerole CG, Nneli RO, Osim EE. Gender and environmental influences on visual acuity in Owerri, Nigeria. Nigerian Journal of Physiological Sciences,2014;29(1):017–022–017–022. <https://doi.org/10.171/5KGHRJM8S142>
15. Ezepeue U. Magnitude and causes of blindness and low vision in Anambra State of Nigeria (Results of 1992 point prevalence survey). Public Health,1997;111(5):305-309. <https://doi.org/10.1038/SJ.PH.1900365>
16. Ferris FL, Kassoff A, Bresnick GH, Bailey I. New visual acuity charts for clinical research. American Journal of Ophthalmology,1982;94(1):91-96. [https://doi.org/10.1016/0002-9394\(82\)90197-0](https://doi.org/10.1016/0002-9394(82)90197-0)
17. Goode KT, Ball KK, Sloane M, Roenker DL, Roth D, L *et al.* Useful Field of View and Other Neurocognitive Indicators of Crash Risk in Older Adults. Journal of Clinical Psychology in Medical Settings,1998;5:4:5(4), 425–440. <https://doi.org/10.1023/A:1026206927686>
18. Kashani AH, Zimmer-Galler IE, Shah SM, Dustin L, Do DV, Elliott D *et al.* Retinal thickness analysis by race, gender, and age using Stratus OCT. American Journal of Ophthalmology,2010;149(3). <https://doi.org/10.1016/J.AJO.2009.09.025>
19. Kay DB, Kay R, Kay J. Comparison of Ocular Sensation in Right vs. Left Eyes Undergoing Glaucoma Laser Surgery. Investigative Ophthalmology & Visual Science,2017;58(8):4980-4980.
20. Kingo A, Ndawi B. Prevalence and causes of low vision among schoolchildren in Kibaha District, Tanzania. Tanzania Journal of Health Research,2009;11(3):111-115. <http://www.sciepub.com/reference/275351>
21. Li X, Wong WL, Cheung CYL, Cheng CY, Ikram MK, Li J *et al.* Racial Differences in Retinal Vessel Geometric Characteristics: A Multiethnic Study in Healthy Asians. Investigative Ophthalmology & Visual Science,2013;54(5):3650-3656. <https://doi.org/10.1167/IOVS.12-11126>
22. Lin LLK, Shih YF, Tsai C, Bin Chen CJ, Lee LA, Hung PT *et al.* Epidemiologic study of ocular refraction among schoolchildren in Taiwan in 1995. Undefined,1999;76(5):275-281. <https://doi.org/10.1097/00006324-199905000-00013>
23. Milton RC, Clemons TE, Klien R, Seddon JM, Ferris FL. Risk factors for the incidence of Advanced Age-Related Macular Degeneration in the Age-Related Eye Disease Study (AREDS) AREDS report no. 19. Ophthalmology,2005;112(4):533-539.e1. <https://doi.org/10.1016/J.OPHTHA.2004.10.047>
24. Ngondi J, Ole-Sempele F, Onsarigo A, Matende I, Baba S. Reacher M *et al.* Prevalence and Causes of Blindness and Low Vision in Southern Sudan. PLoS Medicine,2006;3(12):2416-2423. <https://doi.org/10.1371/JOURNAL.PMED.0030477>
25. Nwosu SN. Blindness and visual impairment in Anambra State, Nigeria. Trop Geogr Med.,1994;46(6):346-349. <https://pubmed.ncbi.nlm.nih.gov/7892700/>
26. Onakpoya OH, Adeoye AO, Akinsola FB, & Adegbehingbe BO. Prevalence of blindness and visual impairment in Atakunmosa west local government area of southwestern Nigeria. Tanzania Journal of Health Research, 2007;9(2):126-131. <https://doi.org/10.4314/thrb.v9i2.14315>

27. Patel I, Munoz B, Burke AG, Kayongoya A, Mchiwa W, Schwarzwald AW *et al.* Impact of Presbyopia on Quality of Life in a Rural African Setting. *Ophthalmology*,2006;113(5):728-734.
<https://doi.org/10.1016/J.OPHTHA.2006.01.028>
28. Patel N, Adewoyin T, Chong NV. Age-related macular degeneration: a perspective on genetic studies. *Eye (London, England)*,2008;22(6):768-776.
<https://doi.org/10.1038/SJ.EYE.6702844>
29. Rengstorff RH. Contact lenses and after-effects: some temporal factors which influence myopia and astigmatism variations. *Am J Optom Arch Am Acad Optom.*,1968;45(6):364-373.
<https://pubmed.ncbi.nlm.nih.gov/5245570/>
30. Rezaee M, Shojaee M, Ghasemi A, Moghaddam A, Momeni M. Which Factors Affect Hand Selection in Adults? Combined Effects of Ocular Dominance, Task Demand and Object Location. *Journal of Human Kinetics*,2010;26:39-44.
<https://doi.org/10.2478/V10078-010-0046-X>
31. Seidu AA, Agbadi P, Duodu PA, Dey NEY, Duah HO, Ahinkorah BO. Prevalence and sociodemographic factors associated with vision difficulties in Ghana, Gambia, and Togo: a multi-country analysis of recent multiple Indicator cluster surveys. *BMC Public Health*,2021;21(1). <https://doi.org/10.1186/S12889-021-12193-7>
32. Storey P, Munoz B, Friedman D, West S. Racial differences in lens opacity incidence and progression: the Salisbury Eye Evaluation (SEE) study. *Investigative Ophthalmology & Visual Science*,2013;54(4):3010-3018. <https://doi.org/10.1167/IOVS.12-11412>
33. Wong ACM, Chan CWN, Hui SP. Relationship of Gender, Body Mass Index, and Axial Length with Central Retinal Thickness Using Optical Coherence Tomography. *Eye*,2004-2005;19:3:19(3):292-297.
<https://doi.org/10.1038/sj.eye.6701466>
34. World Health Organisation. *Blindness and vision impairment*, 2021. <https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment>
35. World Health Organization. World report on vision. In *World health Organization*,2019;214(14).