

Prevalence and associated factors of visual impairment among adults at Debre Berhan Town, North Shewa, Ethiopia.

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Research article

Keywords: Visual impairment, Associated factors, Adults, Debre Berhan, Ethiopia

Posted Date: September 26th, 2019

DOI: <https://doi.org/10.21203/rs.2.15192/v1>

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Version of Record: A version of this preprint was published on August 3rd, 2020. See the published version at <https://doi.org/10.1186/s12886-020-01586-8>.

Abstract

Introduction Visual impairment refers to presenting distance visual acuity worse than 6/18 in either or both eyes. Globally 285 million (4.25%) people had visual impairment and among those 266.4 million were adults. It has become a global challenge that greatly affects the mobility, social participation and the quality of life of the people.

Purpose The purpose of this study was to determine the prevalence and associated factors of visual impairment among adults at Debre Berhan town.

Methods and materials A community-based cross sectional study was conducted at Debre Berhan town. Data was collected by interview with pre-tested semi structured questionnaire and ocular examinations. The collected data were analyzed by SPSS version 20. Multivariate logistic regression was used to identify the determinant factors and p value less than 0.05 was considered as statistically significant.

Result A total of 416 participants were involved in the study with a 98.6% response rate. The prevalence of visual impairment among adults was 16.8% (95% CI: 13.5%-20.2%). Age 40-60years (AOR: 3.04, 95% CI: 1.22-7.58), age>64 years (AOR=12.18, 95%CI: 4.47-33.20), illiterate (AOR=3.02, 95% CI: 1.36-6.72), previous eye trauma (AOR=4.44, 95% CI: 1.64-12.04), family size >5 (AOR: 4.44, 95% CI: 1.43-13.75) and family history of eye problem (AOR=7.02, 95% CI: 1.95-25.22) had statistically significant association with visual impairment.

Conclusion Prevalence of visual impairment among adults was found to be a significant public health problem. Older age, illiterate, previous eye trauma, large family size and family history eye problem were positively associated with visual impairment.

Background

Visual impairment (VI) refers to a functional limitation of the eye or visual system due to a disorder or disease that results in poor vision in either or both eyes. According to World Health Organization(WHO) revised definition, it is defined as presenting distance visual acuity worse than 6/18 in either or both eyes(1). In reference to 2010 WHO report, there were 285 million (4.23%) visually impaired people among those 266.4 million were adults in the world. The principal causes of visual impairment were uncorrected refractive errors (43%) and cataract (33%). Other causes were glaucoma 2%, age-related macular degeneration, diabetic retinopathy, trachoma and corneal opacities all approximately 1% (2). Based on 2007/2008 survey, prevalence of visual impairment were 5.3% in United States adult populations (3). Based on 2006 national survey blindness and low vision were major public health problems in Ethiopia. The national prevalence of blindness was 1.6% and that of low vision was 3.7% based on presenting vision in the better eye. The major causes of low vision were cataract (42.3%), refractive error (33.4%), trachomatous corneal opacity (7.7%), other corneal opacity (5.9%) and macular degeneration (4.6%) (4). Visual impairment has become a global challenge, especially for developing countries. It had significant influence not only on the individual's quality of life, but also on the society due to its economic and social

impact. Those people with visual impairment have poor vision-related quality of life. It is a major health problem that greatly affects the mobility, social participation, productivity and other activities of the people. People who had moderate, severe, or extreme visual difficulty had a higher odd of not working due to an inability to find a job and not working due to ill health. This visual limitation impacts the ability of working to conduct a productive life. Hence, their ability to find an employment and support themselves and provide for their families is diminished (5–10). There is limited access of eye care service for large number of populations at the study area. So this study had estimated the total magnitude of vision impairment at the town and it may be helpful for health authorities to improve the access of eye care services in the area.

Methods And Materials

A community-based cross-sectional study was conducted at Debre Berhan town from April 30, 2018 to May 15, 2018. Debre Berhan town is located in North Shewa, Amhara Regional State, 120km away from Addis Ababa (the capital city of Ethiopia) in the north direction and 688km from Bahir Dar (capital city of Amhara National Regional State). It has 88,375 total populations (39,961 males and 48, 414 females), of which 56,884 are adults aged ≥ 18 years (unpublished data obtained from Debre Berhan town woreda health office).

All adults age ≥ 18 years who lived at Debre Berhan town for at least 6 months were the source population of the study.

Sample size was determined with single population proportion formula.

$$n = \frac{(Z_{\alpha/2})^2 P(1-P)}{d^2}$$

(n = Sample size, Z = The Value of z statistic at 95% confidence level = 1.96, P —Proportion of visual impairment = 50% = 0.5 (since no community based study conducted on the presenting visual acuity, 50% proportion was used), d —Maximum tolerable error (marginal error) 5% = 0.05, $n = 384$.. By adding 10% nonresponse rate, the final sample size were 422. Systematic random sampling method was employed to select the households by using an interval of constant ($k = 49$). If more than one eligible adults age ≥ 18 years were found in the selected household, lottery method was used to recruit the sample.

Operational definition

Visual impairment: Visual impairment was defined as presenting distance visual acuity worse than 6/18 to no light perception (NLP) in either or both eyes. It was further classified into moderate visual impairment (*PVA < 6/18 - $\leq 6/60$), sever visual impairment (PVA < 6/60 - $\leq 3/60$), blindness (PVA < 3/60 - NLP), monocular moderate visual impairment (PVA of <6/18 - $\leq 6/60$ in one eye and 6/6 - $\leq 6/18$ in the other eye), monocular severe visual impairment (PVA< 6/60 - $\leq 3/60$ in one eye and 6/6 - 6/60 in the

other eye) and monocular blindness (PVA <3/60 to NLP in one eye and PVA of 6/6 - 3/60 in the other eye) (1).

Smoking: Smokers were those who smoked one stick of cigarette at least once per day and nonsmokers those who never smoke cigarette(11).

Eye trauma: Self-reported previous history of any trauma to the eye.

Family history of eye problem: Were those participants who had positive history of vision problems in their family members/ near relatives (parents & grandparents).

Pre-tested semi-structured questionnaire and ocular examinations with checklist were used to collect the data. Ocular examinations were done by using Snellen's "E" optotype chart, pinhole disc, pen torch, direct ophthalmoscope and 2.5× magnifying loupe in the house survey. All the collected data were entered, coded and cleaned to EPI INFO 7. After checked the accuracy data were exported to SPSS (Statistical Package for Social Science) version 20 and analyzed. Descriptive result was presented by using frequency, percentages, chart, tables, graph and summary statistics. Binary logistic regression model was used to find out the association between visual impairment and independent variables. The variables with p-value of < 0.2 in bi-variable binary logistic regression were entered to multivariable binary logistic regression model through Enter method to determine the factors adjusted for potential confounders. Adjusted Odds Ratio and 95% confidence interval were used to show the strength of association. Model fitness was checked by Hosmer and Lemeshow goodness of fit test. Multi co-linearity was checked by variable inflation factor (VIF) and tolerance. Finally, those factors with p-value of less than 0.05 were considered as statistically significant.

Results

Socio-demographic characteristics of study participants

A total of 416 participants were included in the study with a 98.6% response rate. The median age of participants was 36 years with interquartile range (IQR: 27–52 years). Among the study participants 247(59.4%) were females and 345(82.9%) were orthodox Christian. (*Table 1*)

Table 1: Socio-demographic characteristics of adults at Debre Berhan town, North Shewa, Ethiopia, 2018 (n=416, n= number of study participants).

Variable	Frequency	Percentage (%)
Age (years)		
18-39	235	56.5
40-64	123	29.6
>64	58	13.9
Gender		
Male	169	40.6
Female	247	59.4
Religion		
Orthodox	345	82.9
Muslim	27	6.5
Protestant	32	7.7
Catholic	12	2.9
Ethnicity		
Amhara	359	86.3
Oromo	27	6.5
Tigrie	13	3.1
Guragie	17	4.1
Marital status		
Single	178	42.8
Married	238	57.2
Family history of eye problem		
Yes	16	3.8
No	400	96.2

Socio-economic characteristics of study participants

The median family monthly income was 3,000 Ethiopian Birr with inter quartile range of [IQR: 1,700–4,500ETB]. Most of the study participants 354 (85.1%) had no health insurance. (*Table 2*).

Table 2: Socio-economic characteristics of adults at Debre Berhan town, North Shewa, Ethiopia, 2018 (n=416, n= number of study participants).

Variables	Categories	Frequency	Percentage (%)
Health insurance	Yes	62	14.9
	No	354	85.1
Occupations	Employed	155	37.3
	Not employed	261	62.7
Educational status	Illiterate	55	13.2
	Literate	361	86.8
Family monthly income	<1701	106	25.5
	1701-3000	127	30.5
	3001-4500	84	20.2
	>4500	99	23.8

Systemic co-morbidities and behavioral characteristics of study participants

Among the study participants 405(97.8%) were non-smokers. History of systemic hypertension and diabetic mellitus were found in 21(5.0%) and 9(2.2%). (*Table 3*).

Table 3: Systemic co-morbidity and behavioral characteristics of adults at Debre Berhan town, North Shewa, Ethiopia, 2018 (n=416, n= number of study participants)

Variables	Category	Frequency	Percentage (%)
Known history of hypertension	Yes	21	5.0
	No	395	95.0
Known history of diabetes	Yes	9	2.2
	No	407	97.8
Cigarette smoking	Yes	11	2.6
	No	405	97.4
History of eye trauma	Yes	28	6.7
	No	388	93.3
History of eye check up	Yes	133	32.0
	No	283	68.0
Eye glass wear	Yes	101	24.3
	No	315	75.7

Prevalence of visual impairment among adults

The prevalence of visual impairment among adults was 16.8% [95% CI: 13.5%, 20.2%]. (Figure 1)

Figure 1: Prevalence of visual impairment among adults at Debre Berhan town, Ethiopia, 2018, North Shewa, Ethiopia, 2018 (n = 416, n = number of study participants)

Nearly a third 22(31.4%) of the participants with visual impairments were in the moderate visual impairment category. Among the overall prevalence of visual impaired adults 27(6.49%) had bilateral vision impairment and 43(10.34%) had monocular vision impairment. (Table 4).

Table 4: Frequencies of visual impairment categories among adults with visual impairment at Debre Berhan town, North Shewa, Ethiopia, 2018 (n=70, n= number of adults with visual impairment)

Visual impairment category		Frequency	Percentage (%)
<6/18-6/60	Bilateral moderate VI	22	31.4
<6/60-3/60	Bilateral sever VI	2	2.9
<3/60-NLP	Bilateral blindness	3	4.3
<6/18-6/60, other eye 6/6-6/18	Monocular moderate VI	21	30.0
<6/60-3/60, other eye 6/6-6/60	Monocular sever VI	4	5.7
<3/60-NLP, other eye 6/6- 3/60	Monocular blindness	18	25.7
Total		70	100.0

The most common ocular abnormalities found in adults with visual impairment were cataract, refractive error (RE), age related macular degeneration (AMD), glaucoma and corneal opacity. (Figure 2)

Figure 2: Common ocular abnormalities found in adults with visual impairment at Debre Berhan town, North Shewa, Ethiopia, 2018, (n = 70, n = number of adults with visual impairment)

Factors associated with visual impairment in adults

In multivariable analysis age, history of eye trauma, family history of eye problem, family size and educational status had statistically significant positive association with visual impairment.

The odds of visual impairment in adults age 40–60 years were 3 times (AOR: 3.04, 95 CI: 1.22, 7.59) more likely to had visual impairment, whereas in older adults age >64 years were 12 times (AOR = 12.18, 95% CI: 4.47, 33.20) more likely to had visual impairment compared to younger adults aged 18–39 years. Those who had family history of eye problem were 7 times (AOR = 7.02, 95% CI: 1.95–25.22) more likely to had visual impairment than adults with no history of family eye problems. The odds of visual impairment in adults who had history of eye trauma were 4 times (AOR = 4.44, 95% CI: 1.64, 12.04) more likely than those who had no previous eye trauma. (Table 5).

Table 5: Factors associated with visual impairment among adults at Debre Berhan town, Ethiopia, 2018 (n=416, n= number of study participants)

Factors	Visual Impairment		COR(95% CI)	AOR(95% CI)	p-value
	No	Yes			
Age (year)					0.000
18-39	222	13	1.0	1.0	
40-64	100	23	3.93(1.91-2.8.07)	3.04(1.22-7.58)	0.017
>64	24	34	24.19(11.25-52.01)	12.18(4.47-33.20)	0.000
Marital status					0.058
Single	141	37	1.63(0.97-2.73)	2.06(0.98-4.37)	
Married	205	33	1.0	1.0	
Education level					0.007
Illiterate	26	29	8.71(4.68-16.20)	3.02(1.36-6.72)	
Literate	320	41	1.0	1.0	
Family income					0.491
<1701	74	32	3.85(1.78-8.35)	2.20(0.78-6.20)	0.137
1701-3000	108	19	1.57(0.69-3.54)	1.40(0.52-3.76)	0.506
3001-4500	75	9	1.07(0.41-2.77)	1.67(0.54-5.17)	0.373
>4500	89	10	1.0	1.0	
Hypertension					0.840
Yes	15	6	2.07(0.77-5.53)	1.14(0.33-3.87)	
No	331	64	1.0	1.0	
Diabetes					0.278
Yes	5	4	4.13(1.08-15.80)	2.47(0.48-12.63)	
No	341	66	1.0	1.0	
Family history of eye problem					0.003
Yes	9	7	4.16(1.50-11.58)	7.02(1.95-25.22)	
No	337	63	1.0	1.0	
History of trauma					0.003
Yes	18	10	3.61(1.61-8.09)	4.44(1.64-12.04)	
No	328	60	1.0	1.0	
Occupation					0.595

Employed	141	14	1.0	1.0	
Unemployed	205	56	2.75(1.48-5.13)	1.24(0.56-2.72)	
Cigarette smoke					0.287
Yes	7	4	2.93(0.83-10.31)	2.42(0.42-12.29)	
No	339	66	1.0		
Family size					0.077
<2	104	12	1.0	1.0	
2-4	159	30	1.64(0.80-3.34)	2.25(0.83-6.14)	0.113
4-5	39	9	2.00(0.78-5.12)	2.25(0.63-8.03)	0.210
>5	44	19	3.74(1.68-8.36)	4.44(1.43-13.75)	0.010

Discussion

Prevalence of visual impairment among adults was 16.8% (95% CI: 13.5%, 20.2%). The result of visual impairment in this study is higher than other studies done in South Sudan (11.8%) (12), Cape Town South Africa(7.2%) (13), Sokoto state of Nigeria(11%) (14), Atakunmosa, South Western Nigeria (7.4%) (15), Bangladesh(9.3%) (16), Malaysia (9.2%) (17), South Korea(4.3%) (18), East Delhi district of India (11.4%) (19), Mahabubanagar district of India (8.4%) (20), Iran (1.39%) (21) and Botucato, Brazil (7.4%)(22).

The studies in South Sudan, Sokoto and Atakunmosa, Nigerian state and Cape Town, South Africa were done by better eye presenting visual acuity which means they considered bilateral visual impairment only. If one eye was visually impaired and the other was not impaired, they considered as no vision impairment which under estimate the magnitude of visual impairment compared to the present study which is done by considering either eye's visual acuity. The reason for magnitude of visual impairment in Cape Town, South Africa was lower than the present study might be due to socio-economic and the access of eye care service difference.

The possible difference between this study and other studies done in Brazil, Bangladesh, Mahabubanagar district of Indian and Malaysian might be due to the definition of visual impairment and population difference. These studies had used the better eye presenting visual acuity to define visual impairment unlike the present study which uses the presenting visual acuity of either eyes (1). Use of better eye visual acuity underestimate the magnitude of visual impairment because of missing monocular visual impairment. The Iran and Korean studies were based on best corrected better eye visual acuity. This might under estimate the burden of visual impairment, since measuring visual acuity after correction didn't include the reduced vision due to different cases.

The prevalence of visual impairment in this study is lower than studies done in upper Egypt (38.8%) (23), Cocoa farmers of Ghana(22.7%) (24), Saudi(23.5%) (25) and rural areas of Coastal Karantaka, India

(25.7%) (9).

The possible discrepancy between the studies in Upper Egypt and Cocoa farmers of Ghana compared to this study, might be due to study population difference. They studied on rural and more aged (≥ 40 years) group of the populations. This might overestimate the result because of including the more affected population groups but the present study is done on urban adult's aged ≥ 18 years.

The study in Saudi had used 6/9 as a lowest cut of point of visual acuity to define visual impairment (25) but in this study the lowest cut of point of visual acuity for visual impairment is 6/18 (1). This might be the possible reason that visual impairment was higher in Saudi compared to this study. The majority (>40%) of the participants in rural areas of Coastal Karnataka, Indian study were above 50 years who were in the more risk age groups compared to this study in which most of the study participants (56.5%) were young adult age groups. Hence, this population difference might overestimate the burden compared to the present study.

The prevalence of visual impairment in this study is in line with the studies done in China (17.17%) (6), Andhra Pradesh state of India (14.3%) (26) and Southern Mexico (14.1%) (27). This might be due to studying the same ages of the populations (≥ 18 years), use of presenting visual acuity and similar cut of point (VA < 6/18) for defining visual impairment.

In this study, illiteracy is positively associates with visual impairment which was supported by other studies done in china (6), rural area of Karnataka India (8), Cape Town, South Africa (13), Southern Mexico (27). The possible reason for increasing visual impairment in illiterates might be due to their poor health related behaviors (28).

Age from 40–64 years and greater than 64 years are positively associated with visual impairment which was supported by studies done in Singapore (29), South Africa (13), China ((6)), South Korea (18) Western Cameroon (30), Southern Mexico (27), and Nigeria (15). The possible reason for increased visual impairment in old age might be due to increasing age related eye diseases and degenerations (31).

History of trauma to the eye had the odds of 4 times more likely to have visual impairment compared to those adults who have no history of eye trauma in this study. The possible reason might be due to deterioration of the eye structure, functional loss and exposure to ocular infections.

The odds of visual impairment in adults with family history of eye problems is nearly 7 times higher in reference to adults with no family history of eye problems in this study. This might be due to inheritance of genetic factors.

The odds of visual impairment in adults within >5 family size is nearly 4 times more likely to have visual impairment compared to those adults within <2 family size. This might be due to difficulty to cater for the provision of food, health service use, education and low standard of living for the siblings in such large families (32).

Conclusions

Prevalence of visual impairment was significant public health problem among adults at Debre Berhan town. Advanced age, history of eye trauma, illiteracy, large family size and family history of eye problems were positively associates with visual impairment.

Abbreviations

AOR Adjusted Odds Ratio

CI Confidence Interval

COR Crude Odds Ratio

EPI INFO Epidemiological Information

ETB Ethiopian Birr

NLP No Light Perception

PVA Presenting Visual Acuity

SPSS Statistical Package for Social Science

VI Visual Impairment

WHO World Health Organization

Declarations

Ethics Approval and consent to participate

Ethical clearance was obtained from University of Gondar College of Medicine and Health Science School of Medicine ethical review committee and written letter of permission was obtained from Debre Berhan town woreda health office. Written informed consent was obtained from each study participants after explaining the purpose of the study. They had full right to participate and to refuse or with draw at any time they want from the study.

Consent to publish

Not applicable

Availability of data and materials

All the necessary data were available with the principal investigator (Natnael Lakachew Assefa) when required with email: natiuog@gmail.com / natnael.lakachew.uog.edu.et

Competing interests

All the authors declared no any potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no any financial support for the research, authorship, and/or publication of this article.

Authors' Contributions

NL: Wrote proposal, conducted data collection and analysis, wrote thesis and prepared manuscript, *AW*: Revised proposal & thesis, conducted data collection and analysis, *NF*: Reviewed the literature, revised proposal, thesis manuscript and participated in data collection. All authors have read and approved the final version of the manuscript.

Acknowledgements

We are deeply indebted University of Gondar for gave ethical clearance to conduct this research. We would also like to acknowledge study participants for their cooperation and willingness in the whole data collection offer.

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Figures

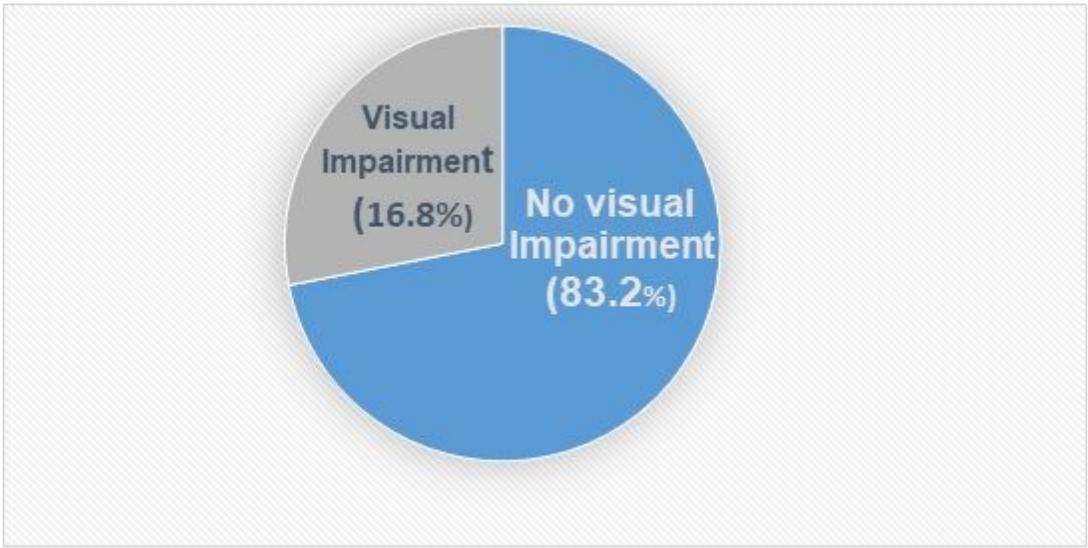


Figure 1

Prevalence of visual impairment among adults at Debre Berhan town, Ethiopia, 2018, North Shewa, Ethiopia, 2018 (n=416, n= number of study participants)

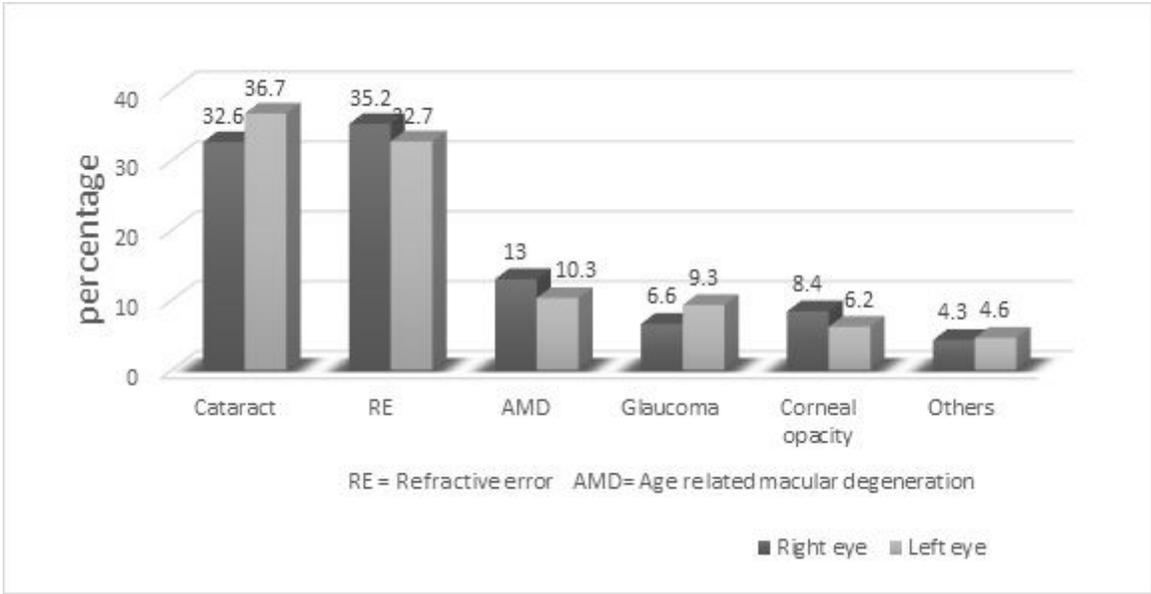


Figure 2

Common ocular abnormalities found in adults with visual impairment at Debre Berhan town, North Shewa, Ethiopia, 2018, (n=70, n= number of adults with visual impairment)