Prevalence and Causes of Blindness and Vision Impairment: Magnitude, Temporal Trends, and Projections in South and Central Asia

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Background: To assess prevalence and causes of vision loss in Central and South Asia.

Methods: A systematic review of medical literature assessed the prevalence of blindness (presenting visual acuity<3/60 in the better eye), moderate and severe vision impairment (MSVI; presenting visual acuity <6/18 but ≥3/60) and mild vision impairment (MVI; presenting visual acuity <6/12 and ≥6/18) in Central and South Asia for 1990, 2010, 2015, and 2020.

Results: In Central and South Asia combined, age-standardized prevalences of blindness, MSVI and MVI in 2015 were for men and women 2.80% (80%uncertainty interval (UI):1.14-4.91) and 3.47% (80%UI:1.45-5.99), 16.75% (80%UI:5.60-30.84) and 20.06% (80%UI:7.15-36.12), 11.49% (80%UI:3.43-21.44) and 12.77% (80%UI:4.04-23.48), respectively, with a significant decrease in the study period for both gender. In South Asia in 2015, 11.76 million individuals (32.65% of the global blindness figure) were blind and 61.19 million individuals (28.3% of the global total) had MSVI. From 1990 to 2015, cataract (accounting for 36.58% of all cases with blindness in 2015) was the most common reason for blindness, followed by undercorrected refractive error (36.43%), glaucoma (5.81%), age-related macular degeneration (2.44%), corneal diseases (2.43%), diabetic retinopathy (0.16%) and trachoma (0.04%). For MSVI in South Asia 2015, most common causes were under-corrected refractive error (accounting for 66.39% of all cases with MSVI), followed by cataract (23.62%), age-related macular degeneration (1.31%) and glaucoma (1.09%).

Conclusions: One third of the global blind resided in South Asia in 2015, although the age-standardized prevalence of blindness and MSVI decreased significantly between 1990 and 2015.

Précis

Age-standardized prevalence of blindness in South Asia was more than twice the global prevalence with one third of the global blind residing in South Asia and undercorrected refractive error and cataract as most common causes.

Introduction

The Global Burden of Disease Study (GBD) 2016 revealed that vision impairment and hearing impairment together with other sense organ deficits were worldwide one of the most common causes for YLDs (Years Lived with Disability) in the population aged 65+ years.[1] Particularly in South Asia, the prevalence of blindness (defined as presenting visual acuity <3/60 in the better eye) and of moderate to severe visual impairment (MSVI; defined as presenting visual acuity <6/18 but ≥3/60 in the better eye) was among the highest as compared to other world regions.[2, 3] Since South Asia has become one of the economically fastest growing regions worldwide and in view of the heavy weight South Asia has on the prevalence of worldwide blindness and MSVI, the Vision Loss Expert Group of the Global Burden of Disease study conducted this study to re-assess the prevalence of vision impairment in the world regions of South Asia and Central Asia and to compare the data with findings obtained in other world regions as well as previously in the same regions.

Methods

The methodology used for the preparation of prevalence estimates for vision impairment and blindness including a PRISMA checklist and a flowsheet has been published in full elsewhere.[2, 4-7] Based on the Global Vision Database, the trends in the prevalence of blindness and vision impairment and their uncertainties were estimated for 188 countries in the 21 GBD regions for the period from 1990-2015, after stratification by age and gender.[2, 4-6] The Central Asia and South Asia super-region consisted of 9 countries in Central Asia and 6 countries in South Asia (Table 1). Mild vision impairment was defined as presenting visual acuity <6/12 but ≥6/18. In total, 10 new studies were added to the Global Vision Database for the Central and South Asia region (Table 1). For forecasting the prevalence of blindness and vision impairment to 2020 and 2050, we relied on the United Nations Population Division's (UNPOP) forecasts to 2050 to derive crude numbers affected and age-standardized prevalence figures.[8] For estimating the causal attribution to the blindness and vision impairment burden, we estimated the proportions of overall vision impairment attributable to cataract, glaucoma, age-related macular degeneration, diabetic retinopathy, corneal opacity, trachoma, uncorrected refractive error, and non-cause specific in 1990–2015 by geographical region and year.[3, 5, 6, 9]

Results

Our investigation included 49 studies performed in South Asia and 3 studies carried out in Central Asia (Table 1). Within the South Asian studies, 22 investigations were performed in urban areas and in rural areas, 25 studies were carried out only in rural communities, and 2 studies were performed only in urban communities; 32 studies from South Asia included communities aged 40+ years, while the remaining 17 South Asian studies also included younger individuals. All three studies carried out in Central Asia were conducted in rural and urban regions for populations aged 40+ years. The visual acuity data were ascertained through clinical examination.

In the study region of Central Asia in 2015, the crude prevalence of blindness for all ages was 0.29% (80% uncertainty interval [UI]: 0.09 -0.53), with a prevalence of 1.83% (80%UI:0.67-3.33%) for MSVI and 1.69% (80%UI:0.48-3.33) for mild vision impairment. In the study region of South Asia in 2015, the crude prevalence of blindness for all ages was 0.70% (80%UI:0.24-1.29), with a prevalence of 3.62% (80%UI:1.75-5.83%) for MSVI and 2.98% (80%UI:1.05-5.46) for mild vision impairment.

The age-standardized prevalence of blindness in 2015 in the super region of Central Asia and South Asia combined was higher for women (3.47%; 80%UI:1.45-5.99) than for men (2.80%; 80%UI:1.14-4.91) (Table 2) (Fig. 1). The corresponding figures for MSVI were 20.06% (80%UI:7.15-36.12) for women and 16.75% (80%UI:5.60-30.84) for men, and for mild vision impairment it was 12.77% (80%UI:4.04-23.48) for women and 11.49% (80%UI:3.43-21.44) for men (Table 2a, 2b) (Fig. 2).

There was a significant reduction in the age-standardized prevalences of blindness, MSVI and mild vision impairment in the period from 1990 to 2015 for men and women (Table 2, 3). For females the age-standardized values for blindness in 1990 and 2015 were 1.81% (0.76-3.09) and 0.85% (0.33 -1.53), for MSVI they were 8.43% (2.87-15.34) and 5.62% (1.80-10.50), and for mild vision impairment the rates were 5.36% (1.45-10.58) and 4.08% (1.09-7.94), respectively, demonstrating that females, as also did men, benefitted from a significant reduction in the rates of blindness and vision impairment.

In South Asia, 11.76 million individuals were blind in 2015, slightly less than 1/3 (32.65%) of the global blindness figures of 36.02 million (Table 4). A similar ratio has been estimated in the projection to 2020 with an increase in the number of people blind both in South Asia (12.94 million (UI: 4.37-24.20) and in the world (38.50 million (UI: 13.18-70.95)). In a similar manner, 61.19 million individuals in South Asia had MSVI in 2015, representing 28.25 of the global total of 216.60 million individuals affected with MSVI. This proportion remains largely unchanged in 2020 with 68.27 million with MSVI in South Asia and 237.08 million individuals affected globally. Figures for mild VI also show similar trends. For Central Asia, the prevalence figures of blindness, MSVI and mild VI in 2015 (in millions) were 0.25, 1.60 and 1.47, respectively, and for 2020 the figures were 0.25, 1.69 and 1.56, respectively (Table 4). The number of individuals affected by of blindness, MSVI and mild VI increased from 2015 to 2020 (as projected) for both regions, except for the number of individuals with blindness in Central Asia where number were projected to remain constant in the period from 2015 to 2020 (Table 4).

In 1990 cataract was in South Asia as well as worldwide the most common cause of blindness, followed by undercorrected refractive error, glaucoma, age-related macular degeneration, corneal disease, trachoma and diabetic retinopathy (Table 5a). This pattern was mostly maintained in 2015 and also in the projection up to 2020, with the only difference of diabetic retinopathy taking the second-last position from trachoma in exchange for the last position (Tables 5b, 5c, 5d). In Central Asia in 2015, undercorrected refractive error (12.85%) ranked only fourth after cataract, glaucoma and age-related-macular degeneration as more frequent causes of blindness (Table 5).

For global MSVI in 1990, undercorrected refractive error was the most common cause accounting for 50.80% of all cases with MSVI, followed by cataract (26.62%), age-related macular degeneration (5.97%), glau-

coma (2.14%), corneal disease (1.99%), trachoma (1.75%) and finally diabetic retinopathy (1.03%) (Table 6a). This ranking order remained mostly unchanged till 2015, with the change in the ranking of diabetic retinopathy getting more common, while corneal diseases and trachoma showed a reduced relative prevalence as cause for MSVI in 2015 (Table 6a-d). A similar ranking was prevalent in South Asia in 2015, with the difference that corneal disorders as compared to diabetic retinopathy were more the reason for MSVI (Table 6). Central Asia showed the same ranking order as the global ranking, with major change in the projection to 2020. For both Central Asia and South Asia there is a minor decline in the proportion of MSVI due to cataract and a small increase in the proportion of blindness and MSVI due to undercorrected refractive error from 1990 to 2015 (Tables 6a, 6c).

Discussion

Applying an updated statistical model, refreshing the database by including findings obtained in recent investigations and projecting the number of people with impaired vision to the year 2020, our study revealed that South Asia included 32.65%, 28.25% and 26.73% of the worldwide blind individuals, subjects with MSVI, and individuals with mild vision impairment, respectively (Table 4). Forecasted for the year 2020, these figures are estimated to change only slightly to 33.61%, 28.80% and 27.15%, respectively. From 1990 to 2015, the age-standardized prevalence of blindness and MSVI in both Central and South Asia decreased significantly although the absolute numbers of individuals who had MSVI or who were blind increased. In 2015, approximately 123.35 million people in South Asia had a presenting visual acuity of <6/12 in their better eyes. For the year 2020, this number is estimated to increase to 137.06 million. In 2015, Central Asia was home to 0.69%, 0.74% and 0.78% of worldwide blind individuals, subjects with MSVI, and individuals with mild vision impairment, respectively (Table 4). As globally, cataract was the most frequent reason for of blindness in 2015 in this super-region of Central and South Asia. South Asia and Central Asia differed in the ranking of undercorrected refractive error which was ranked second in South Asia and fourth in Central Asia. In both regions, glaucoma followed by age-related macular degeneration and as compared to cataract showed a considerably lower prevalence as cause for blindness. During the study period from 1990 to 2015 and projected further on to 2020, the percentage of cataract, undercorrected refractive error and glaucoma as causes for blindness did not change markedly in South Asia, while the percentages of age-related macular degeneration, corneal diseases and trachoma decreased slightly (Table 5). In Central Asia, the percentage of glaucoma remained unchanged during the study period, while the percentages of cataract, age-related macular degeneration, and corneal diseases decreased and the percentage of diabetic retinopathy as reason of blindness increased.

The decrease in the percentage of age-related macular degeneration as reason for blindness in Central Asia may be due to the relatively new therapy of intravitreal application of anti-vascular endothelial growth factor (VEGF) drugs.[10, 11] The finding of an elevated prevalence of diabetic retinopathy as a cause for vision loss in Central Asia is probably due to the increase in the prevalence of diabetes mellitus and due to the ageing of the

population: diabetic patients reach an age at which diabetic complications in the eye occur more frequently are experienced.[12-14] Interestingly, that tendency has not been detected yet in South Asia, where, in particular in the countryside, diabetic subjects as compared to diabetic individuals in Western countries have a markedly lower prevalence of diabetic retinopathy. It may probably due to a considerably reduced life expectancy of diabetic patients in rural India.[14, 15]

The decrease in the prevalence of blindness in South Asia might have been caused by an improved cataract surgery coverage and by better outcomes of cataract surgery, as has been found in Nepal, Bangladesh, India and Pakistan.[16-18] The improvement in South Asia should however not make one overlook that the region still has an age-standardized prevalence of blindness and MSVI of double as high as it is globally so that further efforts ate necessary to decrease the burden of low vision in South Asia (Table 4). In contrast, Central Asia had a prevalence of blindness slightly lower than the average global figures.

In the study regions as also globally, the age-standardized prevalence of blindness and MSVI was lower for men than for women.[4] The reasons for this general gender disparity may be gender-related differences in the access to medical services and to higher longevity of women. Differences between men and women in having access to the medical infrastructure should be a primary focus of public health measures.

In the study regions, cataract has remained to be ranked as the most common cause for blindness. It is in contrast to high-income regions. The importance of further propagating cataract surgery in particular in South Asia is shown by the finding that 4.74 million people were cataract-related blind in that region in 2015. Based on previous experiences, one must be cautious that an increase in the number of cataract surgeries is not combined with a drop in the surgical quality.[19]

Undercorrected refractive error was the most common reason for MSVI in Central Asia and South Asia, and it was the second most frequent reason for blindness in South Asia. Providing adequate glasses for correction of refractive errors, including reading glasses for addressing near vision impairment, is thus the most effective, most economical and safest measure to increase vision.

There are limitations of our study. First, parts of the survey were based on rapid assessment studies which performed only measurements of presenting visual acuity or which assessed the best corrected visual acuity using a pinhole. The findings obtained in these investigations were used only for the statistical analysis of the frequency of cataract and uncorrected refractive error as reasons of vision impairment. Second, the causal proportions for 1990 and 2010 in our current study as compared to the estimates performed in our previous investigation did not markedly differ.[3] Reasons for differences were an improvement of the statistical model, an increase in the number of studies assessed and a better design of the most recent studies included. Third, for many countries and years data were not available, or the studies were not representative on a national level or they applied incomparable vision impairment definitions. Fourth, a considerable fraction of the reasons of MSVI and blindness could not be determined and they have has categorized as “other causes”. In the present study, “other causes” accounted for about 20.44% in Central Asia and for 12.42% in South Asia of the causes of blindness, while in the previously published estimate the percentage was 33.0% for Central Asia and 10.9% for South

Asia.[3] Fifth, almost all population-based studies as basis for the present meta-analysis did not examine inhabitants of nursing homes. Sixth, the definitions of diseases including the one for glaucoma differed between the basic studies. Seventh, for eyes with several reasons of vision loss it might have been difficult to decide which of the reasons the major cause for the loss of vision was. Eighth, near vision impairment was only scarcely examined in the preceding investigations, so that it could not fully be evaluated in the present investigation. Ninth, for many prevalence estimates, the uncertainty intervals (UI) overlap indicating a borderline significance of differences between the prevalence estimates. Tenth, the present study is an update of the previous survey on the same study region performed for the period from 1990 to 2010.[3] The difference between the previous survey and the present study was that we applied an updated statistical model, that we refreshed and extended the database by including findings obtained in recent investigations, and that we projected the number of people with impaired vision to the year 2020.

In conclusion the age-standardized prevalence of MSVI and blindness has diminished significantly in the study regions in the period from 1990 and 2015. The age-standardized prevalence of blindness and visual impairment continues to be higher in females, indicating greater efforts be directed towards delivery of eye health to them. The age-standardized prevalence of blindness in males and females in South Asia is more than twice the global age-standardized prevalence and for Central Asia it is less than the global age-standardized prevalence. One third of the global blind resided in South Asia in 2015 and the figures do not change when projected to 2020. The projected numbers of people blind, with MSVI and mild visual impairment show an increasing trend from 2015 to 2020. Undercorrected refractive error and cataract continue to be the two most common reasons of blindness and visual impairment from 1990 and projected to 2020.

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Table 1

Countries included in the category of Central Asia and South Asia.

Central Asia (n=3, 0)	Armenia, Azerbaijan, Georgia, Kazakhstan , Kyrgyzstan, Mongolia(n=2, 0), Tajikistan, Turkmenistan (n=1, 0), Uzbekistan
South Asia (n=49, 10)	Afghanistan (n=1, 1), Bangladesh (n=2, 0), Bhutan (n=1, 1), India (n=21, 5), Nepal (n=19, 3), Pakistan (n=5, 0)

The “n” numbers indicate the number of studies from that country and following the comma, the number of new studies for that country included since the most recent Global Vision Database meta-analysis. A list of all references used for this analysis can be found in a web appendix at http://bit.ly/2u3RVzm (Please scroll down to 'Reference list of sources used for the GBD Study database' and click on 'Global Burden of Diseases Vision Loss Group - Web Appendix (330 Kb)'

Table 2a

Age-standardized prevalence (mean [80% uncertainty interval]) of blindness and vision impairment stratified by sex and age in Central Asia and South Asia combined in 2015 and projected to 2020

2015	Age: 50+ years	All Ages	2020	Age: 50+ Years	All Ages
Blindness					
Male	3.72 (1.39 - 6.75)	0.92 (0.34 - 1.67)	Male	3.49 (1.24 - 6.46)	0.86 (0.30 - 1.59)
Female	4.00 (1.41 - 7.39)	0.99 (0.34 - 1.83)	Female	3.78 (1.29 - 7.05)	0.93 (0.31 - 1.74)
Both	3.86 (1.40 - 7.08)	0.95 (0.34 - 1.75)	Both	3.64 (1.26 - 6.77)	0.90 (0.31 - 1.67)
Moderate and Severe Vision Impairment					
Male	16.33 (8.55 - 25.47)	4.42 (2.23 - 7.03)	Male	15.73 (7.84 - 24.99)	4.26 (2.03 - 6.87)
Female	17.65 (9.00 - 27.62)	4.81 (2.35 - 7.69)	Female	17.13 (8.22 - 27.09)	4.67 (2.13 - 7.52)
Both	17.00 (8.78 - 26.56)	4.62 (2.29 - 7.36)	Both	16.45 (8.03 - 26.06)	4.46 (2.08 - 7.19)
Mild Vision Impairment					
Male	11.70 (4.70 - 20.32)	3.48 (1.28 - 6.28)	Male	11.38 (4.37 - 19.94)	3.38 (1.18 - 6.12)
Female	12.25 (4.86 - 21.30)	3.71 (1.33 - 6.73)	Female	11.97 (4.58 - 21.06)	3.61 (1.25 - 6.60)
Both	11.97 (4.78 - 20.80)	3.60 (1.30 - 6.50)	Both	11.67 (4.47 - 20.50)	3.49 (1.21 - 6.35)

Table 2b

Crude and age-standardized prevalence (%) of blindness and moderate to severe vision impairment (MSVI) and mild vision impairment (mild VI) in 2015 in Central Asia and South Asia (all ages); 80% uncertainty intervals are given in brackets

	Blind	MSVI	Mild VI
Crude prevalence, Central Asia			
Males	0.23 (0.08 – 0.43)	1.58 (0.57 – 2.89)	1.50 (0.42 – 2.97)
Females	0.34 (0.11 – 0.63)	2.08 (0.76 – 3.75)	1.87 (0.54 – 3.68)
All	0.29 (0.09 – 0.53)	1.83 (0.67 – 3.33)	1.69 (0.48 – 3.33)
Crude prevalence, South Asia			
Males	0.63 (0.23 – 1.15)	3.31 (1.62 – 5.33)	2.79 (0.98 – 5.11)
Females	0.77 (0.26 – 1.43)	3.95 (1.89 – 6.36)	3.19 (1.12 – 5.83)
All	0.70 (0.24 – 1.29)	3.62 (1.75 – 5.83)	2.98 (1.05 – 5.46)
Age-standardized prevalence Central Asia			
Males	0.36 (0.12 - 0.66)	2.20 (0.82 - 3.99)	2.00 (0.59 - 3.90)
Females	0.36 (0.12 - 0.68)	2.25 (0.82 - 4.05)	2.02 (0.59 - 3.97)
Age-standardized prevalence South Asia			
Males	0.94 (0.35 - 1.72)	4.53 (2.29 - 7.18)	3.56 (1.31 - 6.40)
Females	1.03 (0.36 - 1.91)	4.98 (2.45 - 7.92)	3.81 (1.38 - 6.89)
Age-standardized prevalence Central Asia and South Asia Combined			
Males	0.92 (0.34 - 1.67)	4.42 (2.23 - 7.03)	3.48 (1.28 - 6.28)
Females	0.99 (0.34 - 1.83)	4.81 (2.35 - 7.69)	3.71 (1.33 - 6.73)
All	0.95 (0.34 - 1.75)	4.62 (2.29 - 7.36)	3.60 (1.30 - 6.50)

Table 3

Age-standardized prevalence of blindness and moderate to severe vision impairment (MSVI), and mild vision impairment (VI) by sex and region comparing adults 50 years and older with all ages, for 2015 in Central Asia and South Asia

Age (Years)	50+						All Ages					
Sex	Men			Women			Men			Women		
Region	Blind	MSVI	Mild VI	Blind	MSVI	Mild VI	Blind	MSVI	Mild VI	Blind	MSVI	Mild VI
Central Asia	1.45 (0.48 - 2.69)	8.27 (3.19 - 14.87)	7.18 (2.28 - 13.81)	1.48 (0.48 - 2.78)	8.47 (3.19 - 15.17)	7.29 (2.27 - 14.07)	0.36 (0.12 - 0.66)	2.20 (0.82- 3.99)	2.00 (0.59 - 3.90)	0.36 (0.12 - 0.68)	2.25 (0.82 - 4.05)	2.02 (0.59 - 3.97)
South Asia	3.83 (1.43 - 6.95)	16.72 (8.82 - 25.99)	11.92 (4.81- 20.64)	4.18 (1.48 - 7.71)	18.26 (9.40 - 28.43)	12.56 (5.01 - 21.75)	0.94 (0.35 - 1.72)	4.53 (2.29 - 7.18)	3.56 (1.31 - 6.40)	1.03 (0.36 - 1.91)	4.98 (2.45 - 7.92)	3.81 (1.38 - 6.89)
World	1.82 (0.67 - 3.28)	10.12 (4.85 - 16.45)	8.33 (3.10 - 15.02)	1.91 (0.68 - 3.49)	10.79 (5.00 - 17.74)	8.77 (3.23 - 15.84)	0.46 (0.17 - 0.84)	2.79 (1.29 - 4.61)	2.46 (0.84 - 4.55)	0.49 (0.17 - 0.90)	2.99 (1.33 - 4.99)	2.60 (0.88 - 4.85)

Table 4

Estimated number of people (millions) affected by blindness and moderate and severe vision impairment (MSVI) and mild vision impairment (VI) in Central Asia and South Asia by region in 2015 and projections to 2020.

	Blind		MSVI		Mild VI	
Region	2015	2020	2015	2020	2015	2020
Central Asia	0.25 (0.08 - 0.47)	0.25 (0.08 - 0.48)	1.60 (0.58 - 2.90)	1.69 (0.56 - 3.11)	1.47 (0.42 - 2.90)	1.56 (0.41 - 3.13)
South Asia	11.76 (4.14 - 21.72)	12.94 (4.37 - 24.20)	61.19 (29.65 - 98.57)	68.27 (31.30 - 110.79)	50.40 (17.73 - 92.25)	55.85 (18.90 - 102.48)
World	36.02 (12.86 - 65.44)	38.50 (13.18 - 70.95)	216.60 (98.51 - 359.1)	237.08 (101.5 - 399.0)	188.54 (64.46 - 350.19)	205.73 (67.30 - 385.11)

Table 5

Table 5a: Proportion of blindness by cause for all ages in 1990

Region, Year: 1990	Under-corrected Refractive Error	Cataract	Glaucoma	Age-related Macular Degeneration	Diabetic Retinopathy	Corneal Disease	Trachoma	Other
Central Asia	12.52 (10.62 - 14.37)	29.77 (22.36 - 37.73)	13.40 (4.00 - 26.55)	16.44 (4.21 - 32.89)	2.23 (0.26 - 5.04)	5.21 (0.47 - 12.28)	0.00 (0.00 - 0.00)	20.44 (4.83 - 40.56)
South Asia	35.54 (32.29 - 38.41)	38.79 (32.99 - 44.43)	5.93 (2.20 - 10.85)	3.10 (0.83 - 6.32)	0.10 (0.02 - 0.21)	3.91 (0.73 - 8.47)	0.20 (0.18 - 0.23)	12.42 (4.42 - 22.80)
World	19.58 (17.29 - 21.72)	36.67 (30.11 - 43.22)	8.66 (3.25 - 15.72)	7.93 (2.32 - 15.54)	0.85 (0.15 - 1.83)	4.75 (0.80 - 10.47)	2.78 (2.66 - 2.90)	18.78 (7.12 - 32.87)

Table 5b: Proportion of blindness by cause for all ages in 2010

Region, Year: 2010	Under-cor-rected Refrac-tive Error	Cataract	Glau-coma	Macular Degene-ration	Diabet-ic Reti-no-pathy	Corneal Disease	Tra-choma	Other
Central Asia	12.82 (11.03 - 14.57)	27.06 (18.96 - 35.75)	14.10 (3.73 - 29.18)	14.68 (3.08 - 31.18)	3.59 (0.39 - 8.38)	3.73 (0.29 - 8.31)	0.00 (0.00 - 0.00)	24.01 (5.57 - 48.05)
South Asia	36.29 (33.63 - 38.73)	37.39 (30.16 - 44.61)	5.77 (2.27 - 10.26)	2.51 (0.76 - 4.88)	0.14 (0.03 - 0.29)	2.58 (0.53 - 5.54)	0.09 (0.06 - 0.12)	15.24 (5.41 - 28.01)
World	20.23 (18.16 - 22.20)	35.67 (27.74 - 43.66)	8.48 (3.17 - 15.38)	6.28 (1.68 - 12.64)	0.99 (0.16 - 2.19)	3.37 (0.58 - 7.39)	1.54 (1.38 - 1.71)	23.43 (8.98 - 40.83)

370 Table 5c: Proportion of blindness by cause for all ages in 2015

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Region, Year: 2015	Under-cor-rected Refrac-tive Error	Cataract	Glau-coma	Age-related Macular Degene-ration	Diabet-ic Reti-no-pathy	Corneal Dis-eases	Tra-choma	Other
Central Asia	12.85 (11.07 - 14.60)	25.94 (17.43 - 35.02)	14.17 (3.50 - 29.80)	14.01 (2.64 - 30.57)	3.60 (0.34 - 8.59)	3.58 (0.25 - 8.02)	0.00 (0.00 - 0.00)	25.86 (6.09 - 51.43)
South Asia	36.43 (33.81 - 38.83)	36.58 (28.55 - 44.67)	5.81 (2.18 - 10.51)	2.44 (0.71 - 4.83)	0.16 (0.03 - 0.35)	2.43 (0.45 - 5.34)	0.04 (0.01 - 0.07)	16.10 (5.71 - 29.58)
World	20.28 (18.23 - 22.24)	35.15 (26.40 - 44.03)	8.49 (2.99 - 15.66)	5.93 (1.46 - 12.18)	1.06 (0.15 - 2.38)	3.21 (0.50 - 7.19)	0.97 (0.80 - 1.15)	24.92 (9.58 - 43.36)

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376 Table 5d: Proportion of blindness by cause for all ages in 2020

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Region, Year: 2020	Under-corrected Refractive Error	Cataract	Glaucoma	Age-related Macular Degeneration	Diabetic Retinopathy	Corneal Disease	Trachoma	Other
Central Asia	12.88 (11.10 - 14.63)	25.59 (16.52 - 35.34)	13.86 (3.09 - 29.95)	13.31 (2.22 - 29.72)	4.44 (0.39 - 10.80)	3.50 (0.21 - 7.96)	0.00 (0.00 - 0.00)	26.41 (6.10 - 52.86)
South Asia	36.50 (33.89 - 38.90)	36.17 (27.11 - 45.30)	5.76 (2.02 - 10.64)	2.21 (0.58 - 4.41)	0.16 (0.02 - 0.36)	2.32 (0.38 - 5.25)	0.00 (0.00 - 0.00)	16.88 (5.97 - 31.02)
World	20.58 (18.52 - 22.54)	34.73 (25.04 - 44.63)	8.43 (2.75 - 15.96)	5.57 (1.23 - 11.72)	1.20 (0.16 - 2.75)	3.09 (0.42 - 7.09)	0.40 (0.30 - 0.58)	25.99 (9.96 - 45.27)

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Table 6: Proportion of moderate to severe vision impairment by cause for all ages in 1990 (Table 6a), 2010 (Table 6b), 2015 (Table 6) and 2020 (Table 6d)

Table 6a:

Region, Year: 1990	Under-corrected Refractive Error	Cataract	Glaucoma	Age-related Macular Degeneration	Diabetic Retinopathy	Corneal Disease	Trachoma	Other
Central Asia	46.51 (41.54 - 50.29)	22.02 (16.11 - 28.52)	3.94 (0.87 - 8.43)	11.63 (2.58 - 24.12)	2.44 (0.35 - 5.67)	2.20 (0.16 - 4.79)	0.00 (0.00 - 0.00)	11.26 (1.87 - 25.14)
South Asia	64.59 (58.92 - 69.42)	25.80 (21.67 - 29.77)	1.12 (0.37 - 2.09)	1.76 (0.41 - 3.70)	0.10 (0.02 - 0.20)	1.28 (0.21 - 2.75)	0.14 (0.12 - 0.16)	5.21 (1.57 - 10.32)
World	50.80 (46.12 - 54.74)	26.62 (21.53 - 31.78)	2.14 (0.69 - 4.11)	5.97 (1.63 - 11.87)	1.03 (0.20 - 2.22)	1.99 (1.88 - 2.09)	1.75 (0.25 - 3.81)	9.71 (3.03 - 18.50)

Table 6b: Proportion of moderate to severe vision impairment by cause for all ages in 2010

GBD Region 2010	Under-cor-rected Refrac-tive Error	Cataract	Glau-coma	Age-related Macular Degene-ration	Diabet-ic Reti-no-pathy	Corneal Disease	Tra-choma	Other
Central Asia	47.92 (44.30 - 50.76)	18.96 (12.80 - 25.90)	3.99 (0.78 - 8.97)	10.65 (2.04 - 23.38)	4.01 (0.52 - 9.44)	1.49 (0.10 - 3.10)	0.00 (0.00 - 0.00)	12.99 (2.14 - 29.08)
South Asia	66.08 (61.82 - 69.66)	24.22 (19.54 - 28.83)	1.07 (0.38 - 1.97)	1.35 (0.39 - 2.67)	0.13 (0.03 - 0.26)	0.79 (0.16 - 1.63)	0.06 (0.04 - 0.08)	6.30 (1.89 - 12.50)
World	52.12 (48.44 - 55.23)	25.55 (19.80 - 31.54)	2.04 (0.66 - 3.93)	4.65 (1.21 - 9.53)	1.21 (0.21 - 2.68)	1.19 (0.19 - 2.55)	1.07 (0.93 - 1.21)	12.17 (3.87 - 23.03)

Table 6c: Proportion of moderate to severe vision impairment by cause for all ages in 2015

Region, Year: 2015	Under-cor-rected Refrac-tive Error	Cataract	Glau-coma	Age-related Macular Degene-ration	Diabet-ic Reti-no-pathy	Corneal Disease	Tra-choma	Other
Central Asia	48.26 (44.85 - 50.98)	18.11 (11.70 - 25.35)	4.05 (0.73 - 9.28)	10.05 (1.74 - 22.69)	4.06 (0.45 - 9.75)	1.41 (0.09 - 2.98)	0.00 (0.00 - 0.00)	14.06 (2.34 - 31.39)
South Asia	66.39 (62.16 - 69.95)	23.62 (18.43 - 28.79)	1.09 (0.37 - 2.03)	1.31 (0.37 - 2.62)	0.15 (0.03 - 0.32)	0.74 (0.14 - 1.56)	0.03 (0.00 - 0.05)	6.67 (2.00 - 13.24)
World	52.34 (48.66 - 55.45)	25.15 (18.83 - 31.76)	2.05 (0.62 - 4.03)	4.38 (1.05 - 9.15)	1.30 (0.20 - 2.93)	1.14 (0.17 - 2.48)	0.64 (0.50 - 0.79)	13.00 (4.14 - 24.57)

Table 6d: Proportion of moderate to severe vision impairment by cause for all ages in 2020

GBD Region 2020	Under-cor-rected Refrac-tive Error	Cataract	Glau-coma	Age-related Macular Degene-ration	Diabet-ic Reti-no-pathy	Corneal Disease	Tra-choma	Other
Central Asia	48.58 (45.32 - 51.20)	17.46 (10.76 - 25.04)	3.94 (0.64 - 9.27)	9.58 (1.46 - 22.26)	5.01 (0.51 - 12.20)	1.34 (0.08 - 2.85)	0.00 (0.00 - 0.00)	14.11 (2.31 - 31.61)
South Asia	66.50 (62.19 - 70.14)	23.37 (17.50 - 29.26)	1.09 (0.34 - 2.09)	1.18 (0.30 - 2.40)	0.15 (0.03 - 0.33)	0.71 (0.11 - 1.53)	0.00 (0.00 - 0.00)	7.00 (2.09 - 13.90)
World	52.61 (48.86 - 55.76)	24.75 (17.77 - 32.12)	2.05 (0.57 - 4.15)	4.16 (0.89 - 8.94)	1.49 (0.20 - 3.43)	1.10 (0.14 - 2.45)	0.22 (0.16 - 0.37)	13.61 (4.34 - 25.73)

Fig. 1

Ladder plot showing the age-standardized prevalence of blindness in women (A) and men (B) aged 50+ years for 2015. These are modelled estimates using prevalence figures applied to the individual populations of countries.

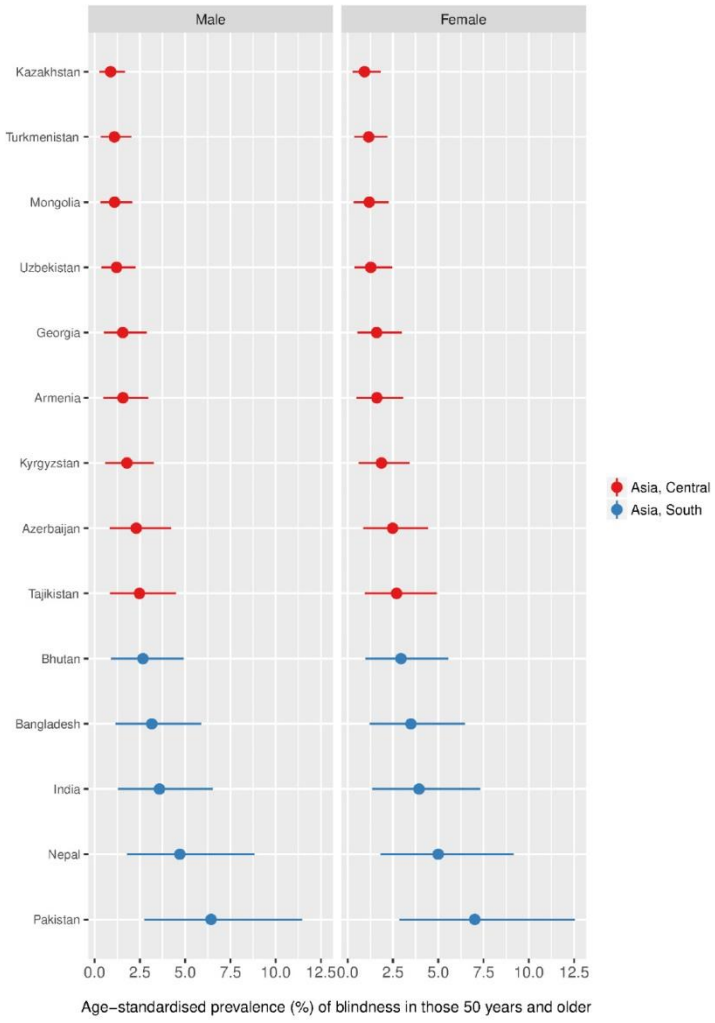

Fig. 2

Ladder plot showing the age-standardized prevalence of moderate/severe vision impairment (MSVI) in women (A) and men (B) aged 50+ years for 2015. These are modelled estimates using prevalence figures applied to the individual populations of countries.