

Rapid Assessment of Avoidable Blindness

Report of findings from Ethiopia, Amhara, West Gojam (2022)

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Report generated 01 August 2022

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Sample representation

Table 1

Table 1: Eligible persons, coverage, absentees and refusals

Exam status	Female		Male		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Examined*	2 239	96.1	1 839	93.4	4 078	94.8
Refused	12	0.5	8	0.4	20	0.5
Incapable	28	1.2	19	1.0	47	1.1
Unavailable	52	2.2	103	5.2	155	3.6
Total	2 331	100.0	1 969	100.0	4 300	100.0

* The response rate is the percent examined

The response rate indicates the proportion of eligible, enumerated people who were examined. The RAAB sample size calculator includes the expected non-response rate in the sample and increases the sample size accordingly. This ensures that the sample size is powerful enough to estimate the prevalence of blindness with the desired precision.

If the response rate is lower than 80-90%, there is a concern that the conditions under review in the 10-20% who were not examined may be different to those that were examined (non-response bias). For example, non-responders in a RAAB may be younger than responders (e.g., working age vs retired) and may, on average, be less likely to be vision impaired.

If the response rate is over 95%, this might be an indication that eligible participants who were absent or refused to participate were not enumerated but rather replaced by eligible participants in the next household, which would introduce selection bias and mean that results are not representative of the population. For example, people with impaired vision may be more likely to be at home and people with good vision may be more likely to be away and unavailable. In certain settings (e.g., rural or remote) a response rate over 95% is not uncommon – participants may be more compliant with requests to stay home on the day of data collection, or more likely to work in the environment close to their home.

It is important to review this information in relation to the tables on representativeness of the sample below to identify whether a high response rate is valid.

Table 2, table 3

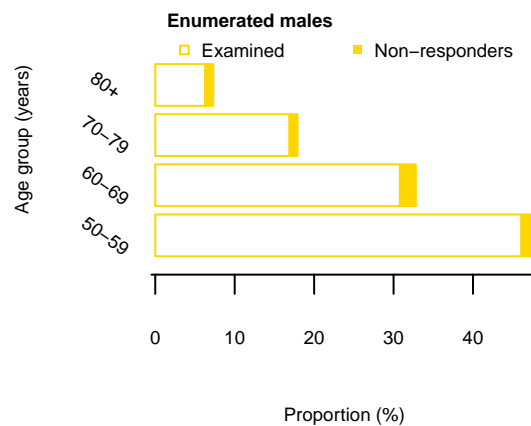
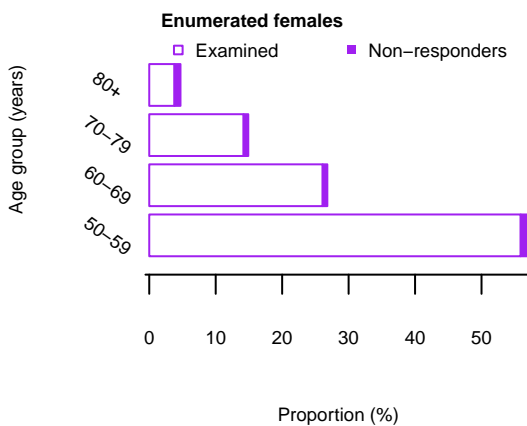
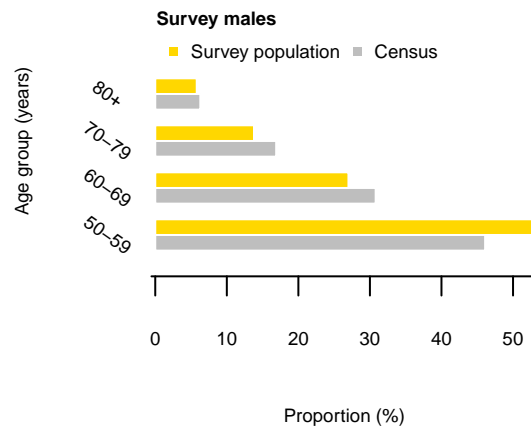
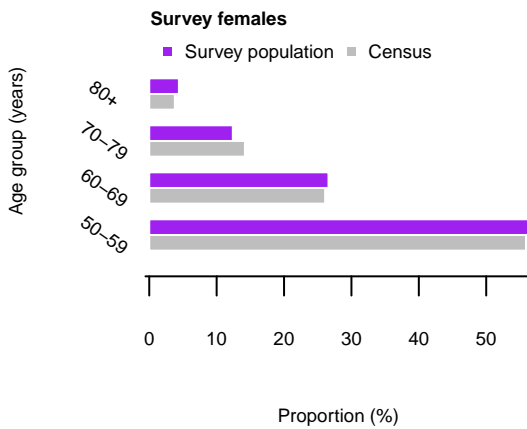
Table 2: Age and sex distribution of people examined in the sample

Age group (years)	Female		Male		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
50-59	1 251	55.9	848	46.1	2 099	51.5
60-69	585	26.1	566	30.8	1 151	28.2
70-79	318	14.2	310	16.9	628	15.4
80+	85	3.8	115	6.3	200	4.9
Total	2 239	100.0	1 839	100.0	4 078	100.0

Table 3: Total number of people aged 50+ in survey area

Exam status	Female		Male		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
50-59	82 716	56.7	80 326	53.4	163 042	55.0
60-69	38 756	26.6	40 549	27.0	79 305	26.8
70-79	18 071	12.4	20 819	13.8	38 890	13.1
80+	6 384	4.4	8 746	5.8	15 130	5.1
Total	145 927	100.0	150 440	100.0	296 367	100.0

Plot 1, plot 2



For your results to be useful for planning, your sample needs to be representative of the population 50

years and older. After completing the survey, we can assess representativeness by comparing the age-sex composition of the sample to the age-sex composition of the population 50 years and older.

We can also use the age-sex composition of the population 50 years and older to weight (post-stratify) crude estimates and provide age-sex adjusted (ASA) estimates for the population. We apply an ‘inflation factor’ – derived from sample vs population comparisons – to the counts of our conditions of interest in each sample age-sex group to generate extrapolated values in the population.

Often, there are more older females than younger males in the sample, and less younger males in the sample than in the population, because men are more likely to be away at work when the survey teams visit. If this is the case, use the age-sex adjusted estimates.

Important: if your sample differs from the population because one group was more likely to be unavailable (e.g., younger men, or other seasonal labourers) then you would expect to see this reflected in the response rate (i.e., more people enumerated but unavailable). If the difference between the sample and the population is high, but the proportion of people unavailable is low (e.g., response rate is still above 95%) this might be an indication that eligible participants who were absent or refused were replaced by others, which introduces bias and may mean that results are not accurate.

Prevalence and causes of distance vision impairment

We report the prevalence of distance vision impairment (VI) in the population 50 years and older using presenting visual acuity (PVA) in the better eye. PVA is visual acuity measured with correction, if available.

Distance vision impairment categories are defined according to the VA thresholds used in the World Health Organization's International Classification of Diseases (ICD-11).

Blindness: PVA less than 3/60 in the better eye

Severe VI: PVA less than 6/60 to 3/60 in the better eye

Moderate VI: PVA less than 6/18 to 6/60 in the better eye

Mild VI: PVA less than 6/12 to 6/18 in the better eye

Table 4, table 5

Table 4: Crude prevalence of blindness, severe, moderate and mild vision impairment

VI level	Female			Male			Total		
	<i>n</i>	%	95% <i>CI</i>	<i>n</i>	%	95% <i>CI</i>	<i>n</i>	%	95% <i>CI</i>
Blind	76	3.4	2.6 - 4.2	46	2.5	1.8 - 3.2	122	3.0	2.4 - 3.5
Severe	40	1.8	1.2 - 2.4	16	0.9	0.4 - 1.3	56	1.4	1.0 - 1.7
Moderate	79	3.5	2.8 - 4.3	56	3.0	2.1 - 3.9	135	3.3	2.7 - 3.9
Mild	136	6.1	5.0 - 7.2	130	7.1	5.9 - 8.2	266	6.5	5.7 - 7.3

Table 5: Adjusted prevalence and extrapolated magnitude of blindness, severe, moderate and mild vision impairment

VI level	Female			Male			Total		
	%	95% <i>CI</i>	<i>Extrapolated magnitude</i>	%	95% <i>CI</i>	<i>Extrapolated magnitude</i>	%	95% <i>CI</i>	<i>Extrapolated magnitude</i>
Blind	3.4	2.6 - 4.2	4 991	2.3	1.6 - 3.0	3 419	2.8	2.3 - 3.4	8 411
Severe	1.8	1.2 - 2.5	2 681	0.8	0.4 - 1.3	1 221	1.3	0.9 - 1.7	3 901
Moderate	3.5	2.7 - 4.2	5 056	2.8	1.9 - 3.7	4 215	3.1	2.5 - 3.7	9 271
Mild	5.9	4.8 - 7.0	8 548	6.5	5.3 - 7.6	9 705	6.2	5.3 - 7.0	18 254

These tables show the crude and adjusted prevalence of vision impairment by impairment level and gender. The sample size for RAAB is calculated to provide an acceptable level of precision for the total prevalence of blindness. The accuracy of prevalence estimates for population subgroups is lower and caution should be taken in the interpretation of these data. Table 5 shows the estimated magnitude of vision impairment in the study area by gender, calculated by multiplying the crude prevalence by the population count (e.g., census data). Throughout, the 95% confidence intervals are calculated to account for RAAB's cluster sampling design.

Table 6, table 7

Table 6: Crude cumulative prevalence of blindness (any PVA <3/60), severe (any PVA <6/60), moderate (any PVA <6/18) and mild (any PVA <6/12) vision impairment

VI level	Female			Male			Total		
	<i>n</i>	%	95% <i>CI</i>	<i>n</i>	%	95% <i>CI</i>	<i>n</i>	%	95% <i>CI</i>
Blind	76	3.4	2.6 - 4.2	46	2.5	1.8 - 3.2	122	3.0	2.4 - 3.5
Severe or worse	116	5.2	4.1 - 6.3	62	3.4	2.6 - 4.2	178	4.4	3.7 - 5.1
Moderate or worse	195	8.7	7.3 - 10.1	118	6.4	5.2 - 7.6	313	7.7	6.7 - 8.7
Mild or worse	331	14.8	13.1 - 16.5	248	13.5	11.9 - 15.1	579	14.2	13.0 - 15.4

Table 7: Adjusted cumulative prevalence of blindness (any PVA <3/60), severe (any PVA <6/60), moderate (any PVA <6/18) and mild (any PVA <6/12) vision impairment

VI level	Female			Male			Total		
	%	95% <i>CI</i>	<i>Extrapolated magnitude</i>	%	95% <i>CI</i>	<i>Extrapolated magnitude</i>	%	95% <i>CI</i>	<i>Extrapolated magnitude</i>
Blind	3.4	2.6 - 4.2	4 991	2.3	1.6 - 3.0	3 419	2.8	2.3 - 3.4	8 411
Severe or worse	5.3	4.2 - 6.3	7 672	3.1	2.3 - 3.9	4 640	4.2	3.5 - 4.9	12 312
Moderate or worse	8.7	7.3 - 10.1	12 728	5.9	4.7 - 7.1	8 855	7.3	6.3 - 8.3	21 583
Mild or worse	14.6	12.9 - 16.3	21 276	12.3	10.7 - 14.0	18 560	13.4	12.2 - 14.6	39 836

Table 8, table 9

Table 8: Principal cause of blindness, severe, moderate and mild vision impairment

Principal cause	Blind		Severe		Moderate		Mild	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
1. Uncorrected refractive error	0	0.0	0	0.0	5	3.7	59	22.2
2. Uncorrected aphakia	0	0.0	0	0.0	0	0.0	0	0.0
3. Untreated cataract	53	43.4	34	60.7	78	57.8	124	46.6
4. Cataract surgical complications	5	4.1	4	7.1	5	3.7	5	1.9
5. Trachomatous corneal opacity	14	11.5	4	7.1	14	10.4	26	9.8
6. Other corneal opacity	7	5.7	2	3.6	0	0.0	8	3.0
7. Phthisis	3	2.5	0	0.0	0	0.0	0	0.0
8. Onchocerciasis	0	0.0	0	0.0	0	0.0	0	0.0
9. Glaucoma	18	14.8	2	3.6	8	5.9	9	3.4
10. Diabetic retinopathy	0	0.0	0	0.0	1	0.7	0	0.0
11. Age-related macular degeneration	17	13.9	4	7.1	8	5.9	14	5.3
12. Other posterior segment disease	4	3.3	5	8.9	11	8.1	13	4.9
13. Other globe or CNS abnormalities	1	0.8	1	1.8	5	3.7	8	3.0
Total	122	100.0	56	100.0	135	100.0	266	100.0

Table 9: Principal cause of blindness, severe, moderate and mild vision impairment, by intervention category

Category	Blind		Severe		Moderate		Mild	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
A. Treatable (1, 2, 3)	53	43.4	34	60.7	83	61.5	183	68.8
B. Preventable (PHC/PEC services) (5, 6, 7, 8)	24	19.7	6	10.7	14	10.4	34	12.8
C. Preventable (Ophthalmic services) (4, 9, 10)	23	18.9	6	10.7	14	10.3	14	5.3
D. Avoidable (A + B + C)	100	82.0	46	82.1	111	82.2	231	86.9
E. Posterior segment disease (8, 9, 10, 11, 12)	39	32.0	11	19.6	28	20.6	36	13.6

* PHC: Primary Health Care; PEC: Primary Eye Care

Table 8 compares the main cause of blindness, severe vision impairment, moderate vision impairment and mild visual impairment in the person. Table 9 shows what proportion of vision impairment is attributable to treatable, preventable and posterior segment disease. From these tables the priorities for intervention can be determined. The distribution of cases of blindness in the sample are visualised below.

Plot 3

Principal causes of bilateral blindness

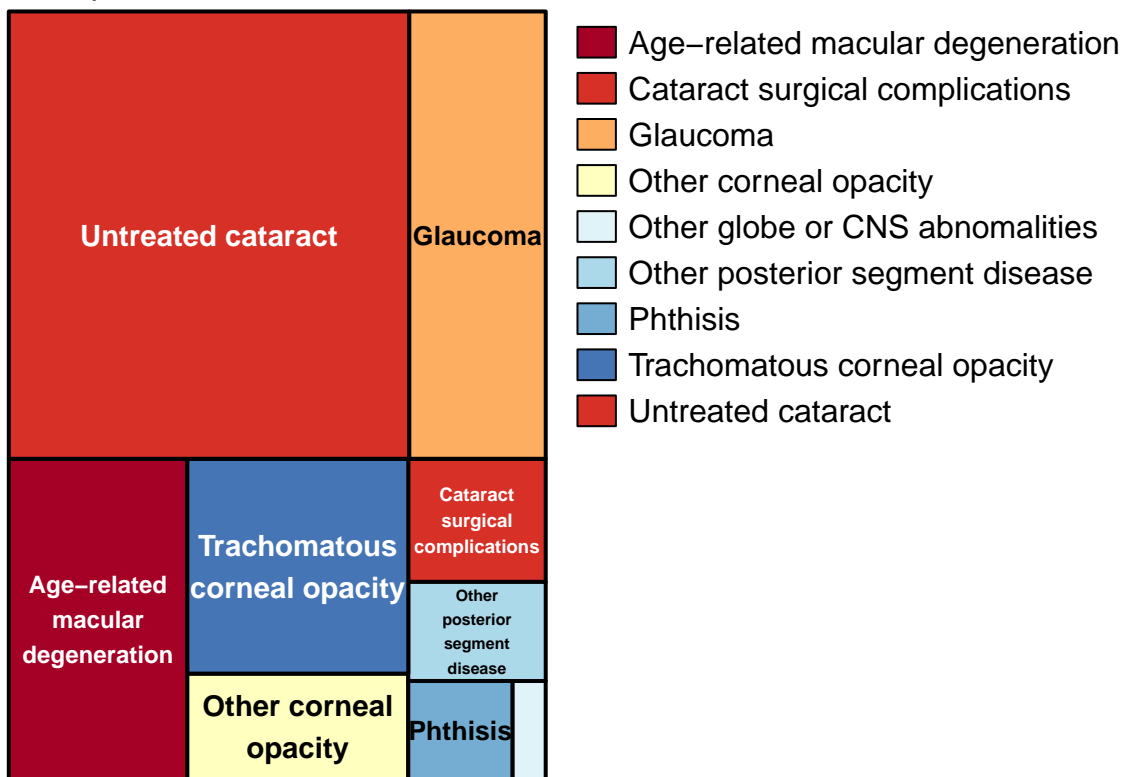


Table 10, table 11

Table 10: Principal cause of blindness in males and females

Principal cause	Female		Male		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
1. Uncorrected refractive error	0	0.0	0	0.0	0	0.0
2. Uncorrected aphakia	0	0.0	0	0.0	0	0.0
3. Untreated cataract	35	46.1	18	39.1	53	43.4
4. Cataract surgical complications	2	2.6	3	6.5	5	4.1
5. Trachomatous corneal opacity	10	13.2	4	8.7	14	11.5
6. Other corneal opacity	2	2.6	5	10.9	7	5.7
7. Phthisis	2	2.6	1	2.2	3	2.5
8. Onchocerciasis	0	0.0	0	0.0	0	0.0
9. Glaucoma	10	13.2	8	17.4	18	14.8
10. Diabetic retinopathy	0	0.0	0	0.0	0	0.0
11. Age-related macular degeneration	13	17.1	4	8.7	17	13.9
12. Other posterior segment disease	2	2.6	2	4.3	4	3.3
13. Other globe or CNS abnormalities	0	0.0	1	2.2	1	0.8
Total	76	100.0	46	100.0	122	100.0

This table shows the principal cause of blindness disaggregated by gender.

Table 11: Principal cause of blindness (PVA <3/60), by gender and intervention category

Category	Male		Female		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
A. Treatable (1, 2, 3)	35	46.1	18	39.1	53	43.4
B. Preventable (PHC/PEC services) (5, 6, 7, 8)	14	18.4	10	21.8	24	19.7
C. Preventable (Ophthalmic services) (4, 9, 10)	12	15.8	11	23.9	23	18.9
D. Avoidable (A + B + C)	61	80.3	39	84.8	100	82.0
E. Posterior segment disease (8, 9, 10, 11, 12)	25	32.9	14	30.4	39	32.0

Table 12, table 13

Table 12: Crude prevalence of blind, severe, moderate and mild unilateral vision impairment

VI level	Male			Female			Total		
	<i>n</i>	%	95% CI	<i>n</i>	%	95% CI	<i>n</i>	%	95% CI
Blind in one eye only	98	4.4	3.4 - 5.3	129	7.0	6.0 - 8.0	227	5.6	4.8 - 6.3
Severe in one eye only	39	1.7	1.2 - 2.3	29	1.6	1.0 - 2.1	68	1.7	1.3 - 2.1
Moderate in one eye only	61	2.7	2.1 - 3.3	50	2.7	2.0 - 3.5	111	2.7	2.2 - 3.2
Mild in one eye only	135	6.0	5.0 - 7.0	88	4.8	3.7 - 5.9	223	5.5	4.7 - 6.3

* Unilateral refers to cases where the other eye has PVA of 6/12

Table 13: Adjusted prevalence and extrapolated magnitude of blind, severe, moderate and mild unilateral vision impairment

VI level	Female				Male				Total			
	%	95% CI	<i>Extrapolated magnitude</i>		%	95% CI	<i>Extrapolated magnitude</i>		%	95% CI	<i>Extrapolated magnitude</i>	
Blind in one eye only	4.3	3.4 - 5.3	6 315		6.7	5.8 - 7.7	10 148		5.6	4.8 - 6.3	16 463	
Severe in one eye only	1.7	1.1 - 2.3	2 506		1.5	0.9 - 2.1	2 240		1.6	1.2 - 2.0	4 746	
Moderate in one eye only	2.7	2.1 - 3.3	3 970		2.6	1.9 - 3.4	3 921		2.7	2.2 - 3.2	7 891	
Mild in one eye only	6.0	5.0 - 7.0	8 744		4.6	3.5 - 5.7	6 874		5.3	4.5 - 6.1	15 618	

* Unilateral refers to cases where the other eye has PVA of 6/12

Cases of unilateral vision impairment acknowledge an additional sight loss burden in the population, not captured in the standard definition of bilateral vision impairment, but with the potential to impact on visual functioning.

Cataract

Table 14, table 15

Table 14: Crude prevalence of cataract at surgical thresholds <3/60, <6/60, <6/18 and <6/12

Cataract surgical threshold	Female			Male			Total		
	<i>n</i>	%	95% <i>CI</i>	<i>n</i>	%	95% <i>CI</i>	<i>n</i>	%	95% <i>CI</i>
Bilateral									
PinVA <3/60	21	0.9	0.5 - 1.4	9	0.5	0.2 - 0.8	30	0.7	0.4 - 1.0
PinVA <6/60	40	1.8	1.2 - 2.4	15	0.8	0.4 - 1.3	55	1.3	1.0 - 1.7
PinVA <6/18	78	3.5	2.6 - 4.4	40	2.2	1.4 - 2.9	118	2.9	2.2 - 3.6
PinVA <6/12	125	5.6	4.5 - 6.6	90	4.9	3.7 - 6.1	215	5.3	4.5 - 6.1
Unilateral									
PinVA <3/60	92	4.1	3.3 - 5.0	79	4.3	3.3 - 5.3	171	4.2	3.5 - 4.9
PinVA <6/60	112	5.0	4.1 - 5.9	95	5.2	4.1 - 6.2	207	5.1	4.4 - 5.8
PinVA <6/18	144	6.4	5.4 - 7.5	121	6.6	5.5 - 7.7	265	6.5	5.7 - 7.3
PinVA <6/12	176	7.9	6.6 - 9.1	141	7.7	6.4 - 8.9	317	7.8	6.9 - 8.6

* Unilateral refers to cases where the other eye has PVA of 6/12

Table 15: Adjusted prevalence and extrapolated magnitude of cataract at surgical thresholds <3/60, <6/60, <6/18 and <6/12

Cataract surgical threshold	Female			Male			Total		
	<i>Adj. %</i>	<i>95% CI</i>	<i>Extrapolated magnitude</i>	<i>Adj. %</i>	<i>95% CI</i>	<i>Extrapolated magnitude</i>	<i>Adj. %</i>	<i>95% CI</i>	<i>Extrapolated magnitude</i>
Bilateral									
PinVA <3/60	1.0	0.5 - 1.4	1 405	0.5	0.1 - 0.8	695	0.7	0.4 - 1.0	2 100
PinVA <6/60	1.8	1.2 - 2.5	2 670	0.8	0.3 - 1.2	1 135	1.3	0.9 - 1.7	3 805
PinVA <6/18	3.5	2.6 - 4.4	5 125	2.0	1.3 - 2.8	3 023	2.7	2.1 - 3.4	8 148
PinVA <6/12	5.5	4.5 - 6.6	8 056	4.4	3.2 - 5.6	6 646	5.0	4.2 - 5.8	14 702
Unilateral									
PinVA <3/60	4.0	3.2 - 4.9	5 877	3.9	3.0 - 4.9	5 940	4.0	3.3 - 4.7	11 817
PinVA <6/60	4.9	4.0 - 5.8	7 180	4.7	3.7 - 5.8	7 091	4.8	4.1 - 5.5	14 271
PinVA <6/18	6.3	5.2 - 7.3	9 178	6.0	4.9 - 7.1	9 033	6.1	5.4 - 6.9	18 211
PinVA <6/12	7.7	6.5 - 8.9	11 222	7.0	5.8 - 8.2	10 547	7.3	6.5 - 8.2	21 769

* Unilateral refers to cases where the other eye has PVA of 6/12

The cataract surgical thresholds (based on PinVA) used in Tables 14 & 15 describe the prevalence and magnitude of operable cataract at WHO vision impairment thresholds. They are used in the definitions of cataract surgical coverage and effective cataract surgical coverage (Table 16).

Table 16

Table 16: Adjusted cataract surgical coverage and effective cataract surgical coverage at the person level

	Female		Male		Total	
	<i>Adj. %</i>	<i>95% CI</i>	<i>Adj. %</i>	<i>95% CI</i>	<i>Adj. %</i>	<i>95% CI</i>
Cataract surgical threshold <6/12						
CSC	31.2	24.0 - 38.4	34.8	26.4 - 43.2	32.9	27.2 - 38.5
eCSC	14.7	9.6 - 19.8	15.6	9.3 - 21.9	15.1	11.2 - 19.0
Cataract surgical threshold <6/18						
CSC	40.0	31.2 - 48.8	52.9	42.1 - 63.7	45.6	38.3 - 52.8
eCSC	19.4	13.1 - 25.6	24.8	15.8 - 33.8	21.7	16.6 - 26.8
Cataract surgical threshold <6/60						
CSC	54.2	42.1 - 66.2	74.6	62.5 - 86.6	63.0	54.3 - 71.7
eCSC	24.8	16.5 - 33.1	35.7	23.0 - 48.4	29.5	22.6 - 36.5
Cataract surgical threshold <3/60						
CSC	68.7	54.8 - 82.6	82.7	72.3 - 93.1	75.3	66.1 - 84.5
eCSC	30.7	20.0 - 41.4	39.6	26.6 - 52.6	34.9	27.3 - 42.5

* CSC: Cataract Surgical Coverage; eCSC: Effective Cataract Surgical Coverage

CSC measures the accessibility of cataract surgical services. It describes the number of people in a population with operated cataract as a proportion of those having operated cataract plus people with cataract and pinhole visual acuity worse than a specified surgical threshold (sometimes referred to as operable cataract). Effective CSC (eCSC) is a quality-corrected version of the same metric. It describes the number of people with operated cataract and a good (6/12 or better PVA) post-operative visual acuity outcome as a proportion of those having operated plus operable cataract. This indicator therefore incorporates a measure of service quality concurrently with access. eCSC and CSC are reported at four cataract surgical thresholds.

Table 17

Table 17: Barriers to cataract surgery among participants with bilateral cataract and PinVA <6/60

Barrier	Female		Male		Total	
	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>
Unaware	45	13.4	32	12.7	77	13.1
Other	47	13.9	40	15.9	87	14.8
Denied	16	4.7	15	6.0	31	5.3
Access	64	19.0	39	15.5	103	17.5
Cost	18	5.3	17	6.8	35	6.0
Felt not needed	146	43.3	106	42.2	252	42.9
Fear	1	0.3	2	0.8	3	0.5
Total	337	100.0	251	100.0	588	100.0

* Participants can report 1 or 2 barriers each

The standard RAAB survey protocol does not allow for in-depth interviews to determine why people with cataract have not yet been operated. This preliminary data on barriers to surgery should be regarded as an

indication whether more detailed qualitative studies are required.

Surgical outcomes

Surgical outcomes are reported for all operated eyes in the sample, not at the person level. RAAB gives population based data on post-operative visual outcomes, not specific to one surgeon or one hospital and with follow-up periods ranging from months to decades.

Table 18

Table 18: Type of cataract surgery performed, count by eyes

Surgery type	Female		Male		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
IOL	94	97.9	91	100.0	185	98.9
Non-IOL	1	1.0	0	0.0	1	0.5
Couching	0	0.0	0	0.0	0	0.0
Total	95	98.9	91	100.0	186	99.4

Table 19, table 20

Table 19: Post-operative visual outcome (PVA), count by eyes

Outcome (PVA)	Female		Male		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Good (6/12)	42	43.8	37	40.7	79	42.2
Borderline (<6/12 to 6/60)	33	34.4	26	28.6	59	31.6
Poor (<6/60)	21	21.9	28	30.8	49	26.2
Total	96	100.1	91	100.1	187	100.0

Table 20: Post-operative visual outcome (PinVA), count by eyes

Outcome (PinVA)	Female		Male		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Good (6/12)	44	45.8	43	47.3	87	46.5
Borderline (<6/12 to 6/60)	33	34.4	22	24.2	55	29.4
Poor (<6/60)	19	19.8	26	28.6	45	24.1
Total	96	100.0	91	100.1	187	100.0

Table 21, table 22

Table 21: Post-operative visual outcomes (PVA) in eyes by place of surgery (male)

Post-surgical VA	Gov. Hosp.		Vol. Hosp.		Priv. Hosp.		Camp Improv.		Trad.	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Good (6/12)	18	40.0	0	0.0	18	41.9	1	20.0	0	0.0
Borderline (<6/12 to 6/60)	12	26.7	0	0.0	13	30.2	1	20.0	0	0.0
Poor (<6/60)	15	33.3	0	0.0	12	27.9	3	60.0	0	0.0
Total	45	100.0	0	0.0	43	100.0	5	100.0	0	0.0

Table 22: Post-operative visual outcomes (PVA) in eyes by place of surgery (female)

Post-surgical VA	Gov. Hosp.		Vol. Hosp.		Priv. Hosp.		Camp Improv.		Trad.	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Good (6/12)	23	47.9	0	0.0	16	36.4	3	60.0	0	0.0
Borderline (<6/12 to 6/60)	15	31.2	0	0.0	18	40.9	0	0.0	0	0.0
Poor (<6/60)	10	20.8	0	0.0	10	22.7	2	40.0	0	0.0
Total	48	99.9	0	0.0	44	100.0	5	100.0	0	0.0

Variation in outcome by place of surgery allows for monitoring of quality across providers. Where providers are outliers, in terms of poor quality, steps to address this should be incorporated in service planning.

Gov. Hosp. = Government hospital

Vol. Hosp. = NGO hospital

Priv. Hosp. = Private hospital

Camp Improv. = Improvised surgical camp

Trad. = Traditional setting

Refractive error

Refractive error as a cause of vision impairment is defined as better eye PVA worse than 6/12 improving to 6/12 with pinhole. Note: As these estimates are based on presenting VA, i.e., with correction if available, participants with corrected refractive error are not included, only those with under- or uncorrected refractive error.

Table 23, table 24

Table 23: Crude prevalence of blindness (PVA <3/60), severe (PVA <6/60), moderate (PVA <6/18) and mild (PVA <6/12) vision impairment due to refractive error

VI level	Female			Male			Total		
	<i>n</i>	%	95% CI	<i>n</i>	%	95% CI	<i>n</i>	%	95% CI
Blind	0	0.0	0.0 - 0.0	0	0.0	0.0 - 0.0	0	0.0	0.0 - 0.0
Severe	0	0.0	0.0 - 0.0	0	0.0	0.0 - 0.0	0	0.0	0.0 - 0.0
Moderate	2	0.1	0.0 - 0.2	3	0.2	0.0 - 0.3	5	0.1	0.0 - 0.2
Mild	36	1.6	1.0 - 2.2	23	1.3	0.7 - 1.8	59	1.4	1.0 - 1.9

Table 24: Adjusted prevalence and extrapolated magnitude of blindness (PVA <3/60), severe (PVA <6/60), moderate (PVA <6/18) and mild (PVA <6/12) vision impairment due to refractive error

VI level	Female			Male			Total		
	%	95% CI	Extrapolated magnitude	%	95% CI	Extrapolated magnitude	%	95% CI	Extrapolated magnitude
Blind	0.0	0.0 - 0.0	0	0.0	0.0 - 0.0	0	0.0	0.0 - 0.0	0
Severe	0.0	0.0 - 0.0	0	0.0	0.0 - 0.0	0	0.0	0.0 - 0.0	0
Moderate	0.1	0.0 - 0.2	123	0.2	0.0 - 0.3	234	0.1	0.0 - 0.2	357
Mild	1.5	0.9 - 2.1	2 252	1.2	0.6 - 1.7	1 768	1.4	0.9 - 1.8	4 020

Table 25

Refractive error coverage (REC) is defined as $(A + B) / (A + B + C)$

Effective refractive error coverage (eREC) is defined as $(A) / (A + B + C)$

where:

A = Individuals who present with spectacles or contact lenses for distance and whose UCVA is <6/12 in the better eye and CVA is 6/12 in the better eye (Met Need)

B = Individuals who present with spectacles or contact lenses for distance and whose UCVA is <6/12 in the better eye and whose CVA is <6/12 in the better eye, but who improve to 6/12 on PinVA (Undermet Need)

C = Individuals who present without spectacles and whose UCVA is <6/12 in the better eye and whose PinVA is 6/12 in the better eye (Unmet Need)

Note: Both indicators refer to distance refractive error

Table 25: Adjusted distance refractive error coverage and effective refractive error coverage

	Female		Male		Total	
	<i>Adj. %</i>	<i>95% CI</i>	<i>Adj. %</i>	<i>95% CI</i>	<i>Adj. %</i>	<i>95% CI</i>
eREC	9.4	1.3 - 17.4	0.0	0.0 - 0.0	5.2	0.3 - 10.0
REC	9.4	1.3 - 17.4	0.0	0.0 - 0.0	5.2	0.3 - 10.0

* eREC: Effective Refractive Error Coverage; REC: Refractive Error Coverage

Table 26

Table 26: Distance and near vision spectacle use among study participants

	Female		Male		Total	
	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>
Distance vision spectacles	8	0.4	9	0.5	17	0.4
Near vision spectacles	24	1.1	61	3.3	85	2.1

This table reports the sample (crude) prevalence of distance and near spectacle use by gender. The categories of distance and near use are not mutually exclusive, i.e., some participants will use both. Near visual acuity is not currently measured in RAAB7; however, near vision spectacle use (for presbyopia) can be used as a proxy for refractive error coverage at near if it is assumed that 100% of the population 50 years and older will require near vision (presbyopic) correction.

Notes

Abbreviations

CI = Confidence interval

CNS = Central nervous system

CSC = Cataract surgical coverage

eCSC = Effective cataract surgical coverage

eREC = Effective refractive error coverage

NGO = Nongovernmental organisation

PinVA = Pinhole visual acuity

PVA = Presenting visual acuity

REC = Refractive error coverage

VI = Vision impairment

Snellen to logMAR conversion

Historic RAAB survey data variables have been updated to align with RAAB7 variable names and levels. RAAB7 records visual acuity in logMAR notation (or a code number representing light perception)

0.3 = Can see 6/12 [1]

0.47 = Cannot see 6/12 but can see 6/18 [2]

1.0 = Cannot see 6/18 but can see 6/60 [3]

1.3 = Cannot see 6/60 but can see 3/60 [4]

1.8 = Cannot see 3/60 but can see 1/60 [5]

3 = Light perception [6]

4 = No light perception [7]

Bilateral VI

Blindness: PVA less than 3/60 in the better eye

Severe VI: PVA less than 6/60 to 3/60 in the better eye

Moderate VI: PVA less than 6/18 to 6/60 in the better eye

Mild VI: PVA less than 6/12 to 6/18 in the better eye

Unilateral VI

Blindness: PVA less than 3/60 in one eye, PVA 6/18 in the other eye

Severe VI: PVA less than 6/60 to 3/60 in one eye, PVA 6/18 in the other eye

Moderate VI: PVA less than 6/18 to 6/60 in one eye, PVA 6/18 in the other eye

Mild VI: PVA less than 6/12 to 6/18 in one eye, PVA 6/12 in the other eye

Cataract-related VI and surgical outcomes

Cataract surgical threshold (operable cataract): PinVA at <3/60, <6/60 and <6/18 thresholds plus lens opacity plus untreated cataract as principal cause

Operated cataract: Aphakia or pseudoaphakia (with or without posterior capsule opacification [PCO])

Cataract surgical coverage (CSC) and effective cataract surgical coverage (eCSC)

eCSC and CSC are calculated at the person level, not by eyes, and calculated at various cataract surgical thresholds.

CSC is defined as $(X + Y) / (X + Y + Z)$

eCSC is defined as $(A + B) / (X + Y + Z)$

where:

A = individuals with unilateral operated cataract attaining 6/12 or better post-operative presenting VA in the operated eye, who have vision impairment from any cause in the other eye

B = individuals with bilateral operated cataract attaining 6/12 or better post-operative presenting VA in at least one eye

X = individuals with unilateral pseudo/aphakia (i.e. operated cataract, excluding couched eyes) and vision impairment in the other eye

Y = individuals with bilateral pseudo/aphakia (i.e. operated cataract, excluding couched eyes), regardless of post-operative presenting visual acuity

Z = individuals with bilateral operable cataract

For further information see: Ramke J, Gilbert CE, Lee AC, Ackland P, Limburg H, Foster A (2017) Effective cataract surgical coverage: An indicator for measuring quality-of-care in the context of Universal Health Coverage. PLoS ONE 12(3): e0172342. doi:10.1371/journal.pone.0172342

Refractive error coverage (REC) and effective refractive error coverage (eREC)

REC is defined as $(A + B) / (A + B + C)$

eREC is defined as $(A) / (A + B + C)$

where:

A = Individuals who present with spectacles or contact lenses for distance and whose UCVA is <6/12 in the better eye and CVA is 6/12 in the better eye (Met Need)

B = Individuals who present with spectacles or contact lenses for distance and whose UCVA is <6/12 in the better eye and whose CVA is <6/12 in the better eye, but who improve to 6/12 on PinVA (Undermet Need)

C = Individuals who present without spectacles and whose UCVA is <6/12 in the better eye and whose PinVA is 6/12 in the better eye (Unmet Need)

Note: This is the ‘gold-standard’ eREC calculation described here: McCormick I, Mactaggart I, Bastawrous A, Burton MJ, Ramke J. Effective refractive error coverage: an eye health indicator to measure progress towards universal health coverage. Ophthalmic Physiol Opt. 2020;40(1):1-5. doi:10.1111/opo.12662

95% Confidence Interval

The 95% confidence intervals are based on standard errors calculated for the clustering of the sample and the variability between clusters, specifically using the formula provided by:

Bennett S, Woods T, Liyanage WM, Smith DL. A simplified general method for cluster-sample surveys of health in developing countries. *World Health Stat Q.* 1991;44(3):98-106.