Rapid Assessment of Avoidable Blindness

Report of findings from India, Uttar Pradesh (2021)

Principal Investigator Armani Tremblay

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Contents

Sample representation

Table 1

Table 1: Eligible persons, coverage, absentees and refusals

Exam status	Female		Male		Total	
	n	%	*n*	%	*n*	%
Examined*	2 067	95.4	1 800	93.4	3 867	94.4
Refused	18	0.8	7	0.4	25	0.6
Incapable	28	1.3	21	1.1	49	1.2
Unavailable	54	2.5	100	5.2	154	3.8
Total	2 167	100.0	1 928	100.0	4 095	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

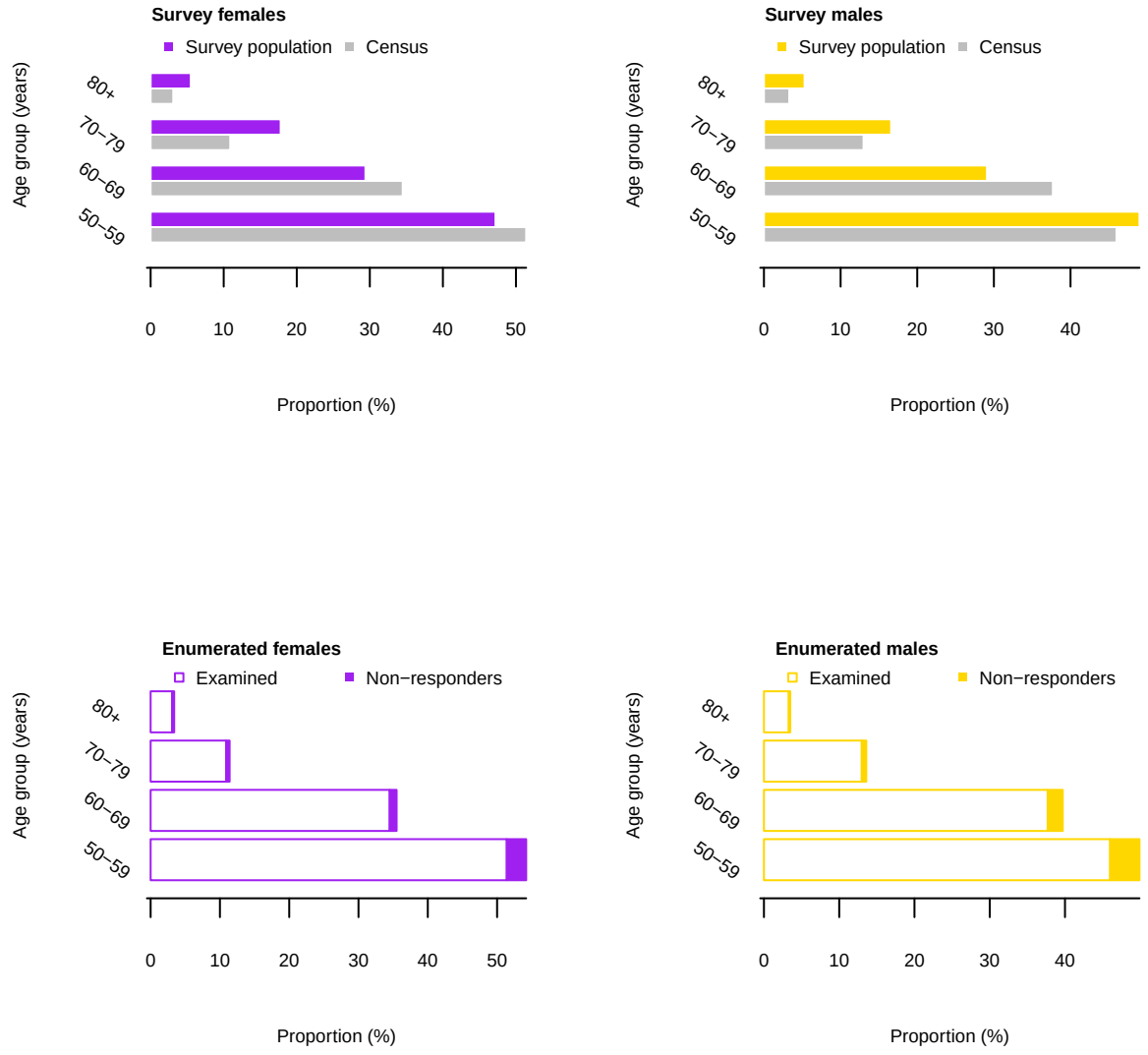
Table 2: Age and sex distribution of people examined in the sample

Age group	Female		Male		Total	
Years	*n*	%	*n*	%	*n*	%
50-59	1 063	51.4	828	46.0	1 891	48.9
60-69	714	34.5	678	37.7	1 392	36.0
70-79	225	10.9	234	13.0	459	11.9
80+	65	3.1	60	3.3	125	3.2
Total	2 067	100.0	1 800	100.0	3 867	100.0

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

Age group	Female		Male		Total	
Years	*n*	*%*	*n*	*%*	*n*	*%*
50-59	162 100	47.2	155 784	49.0	317 884	48.1
60-69	101 049	29.4	92 629	29.1	193 678	29.3
70-79	61 050	17.8	52 630	16.6	113 680	17.2
80+	18 947	5.5	16 842	5.3	35 789	5.4
Total	343 146	100.0	317 885	100.0	661 031	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**		
	n	*%*	*95% CI*	*n*	*%*	*95% CI*	*n*	*%*	*95% CI*
Blind	43	2.1	1.4 - 2.7	25	1.4	0.8 - 2.0	68	1.8	1.3 - 2.2
Severe	67	3.2	2.5 - 4.0	60	3.3	2.5 - 4.2	127	3.3	2.7 - 3.9
Moderate	325	15.7	14.1 - 17.4	287	15.9	14.2 - 17.7	612	15.8	14.5 - 17.1
Mild	204	9.9	8.4 - 11.3	137	7.6	6.3 - 8.9	341	8.8	7.8 - 9.8

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

VI level	**Female**			**Male**			**Total**		
	%	*95% CI*	*Extraplotated magnitude*	*%*	*95% CI*	*Extrapolated magnitude*	*%*	*95% CI*	*Extrapolated magnitude*
Blind	2.8	2.1 - 3.4	9 456	1.6	1.0 - 2.1	4 993	2.2	1.7 - 2.7	14 448
Severe	3.6	2.9 - 4.4	12 473	3.5	2.6 - 4.4	11 158	3.6	3.0 - 4.2	23 631
Moderate	17.3	15.6 - 19.0	59 418	16.4	14.6 - 18.1	52 057	16.9	15.5 - 18.2	111 475
Mild	10.2	8.8 - 11.7	35 166	7.6	6.3 - 8.9	24 209	9.0	8.0 - 10.0	59 375

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		
	n	*%*	*95% CI*	*n*	*%*	*95% CI*	*n*	*%*	*95% CI*
Blind	43	2.1	1.4 - 2.7	25	1.4	0.8 - 2.0	68	1.8	1.3 - 2.2
Severe or worse	110	5.3	4.4 - 6.3	85	4.7	3.7 - 5.8	195	5.0	4.3 - 5.8
Moderate or worse	435	21.0	19.2 - 22.9	372	20.7	18.7 - 22.6	807	20.9	19.4 - 22.3
Mild or worse	639	30.9	28.8 - 33.0	509	28.3	26.1 - 30.5	1148	29.7	28.0 - 31.4

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% CI*	*Extrapolated magnitude*	*%*	*95% CI*	*Extrapolated magnitude*	*%*	*95% CI*	*Extrapolated magnitude*
Blind	2.8	2.1 - 3.4	9 456	1.6	1.0 - 2.1	4 993	2.2	1.7 - 2.7	14 448
Severe or worse	6.4	5.4 - 7.4	21 929	5.1	4.0 - 6.1	16 150	5.8	5.0 - 6.5	38 079
Moderate or worse	23.7	21.8 - 25.6	81 347	21.5	19.5 - 23.4	68 207	22.6	21.1 - 24.1	149 554
Mild or worse	34.0	31.8 - 36.1	116 513	29.1	26.9 - 31.3	92 416	31.6	29.9 - 33.3	208 930

Table 8, table 9

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

Principal cause	Blind		Severe		Moderate		Mild	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*
1. Uncorrected refractive error	0	0.0	6	4.7	214	35.0	270	79.2
2. Uncorrected aphakia	1	1.5	1	0.8	1	0.2	0	0.0
3. Untreated cataract	52	76.5	107	84.3	335	54.7	59	17.3
4. Cataract surgical complications	1	1.5	4	3.1	25	4.1	8	2.3
5. Trachomatous corneal opacity	0	0.0	0	0.0	0	0.0	0	0.0
6. Other corneal opacity	8	11.8	4	3.1	4	0.7	0	0.0
7. Phthisis	1	1.5	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	1	1.5	1	0.8	4	0.7	1	0.3
10. Diabetic retinopathy	0	0.0	0	0.0	2	0.3	3	0.9
11. Age-related macular degeneration	0	0.0	0	0.0	2	0.3	0	0.0
12. Other posterior segment disease	3	4.4	2	1.6	14	2.3	0	0.0
13. Myopic degeneration	0	0.0	2	1.6	9	1.5	0	0.0
14. Other globe or CNS abnomalities	1	1.5	0	0.0	2	0.3	0	0.0
Total	68	100.0	127	100.0	612	100.0	341	100.0

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

Category	Blind		Severe		Moderate		Mild	
	n	%	*n*	%	*n*	%	*n*	%
A. Treatable (1, 2, 3)	53	78.0	114	89.8	550	89.9	329	96.5
B. Preventable (PHC/PEC services) (5, 6, 7, 8)	9	13.3	4	3.1	4	0.7	0	0.0
C. Preventable (Ophthalmic services) (4, 9, 10)	2	3.0	5	3.9	31	5.1	12	3.5
D. Avoidable (A + B + C)	64	94.3	123	96.8	585	95.7	341	100.0
E. Posterior segment disease (8, 9, 10, 11, 12, 13)	4	5.9	5	4.0	31	5.1	4	1.2

* 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

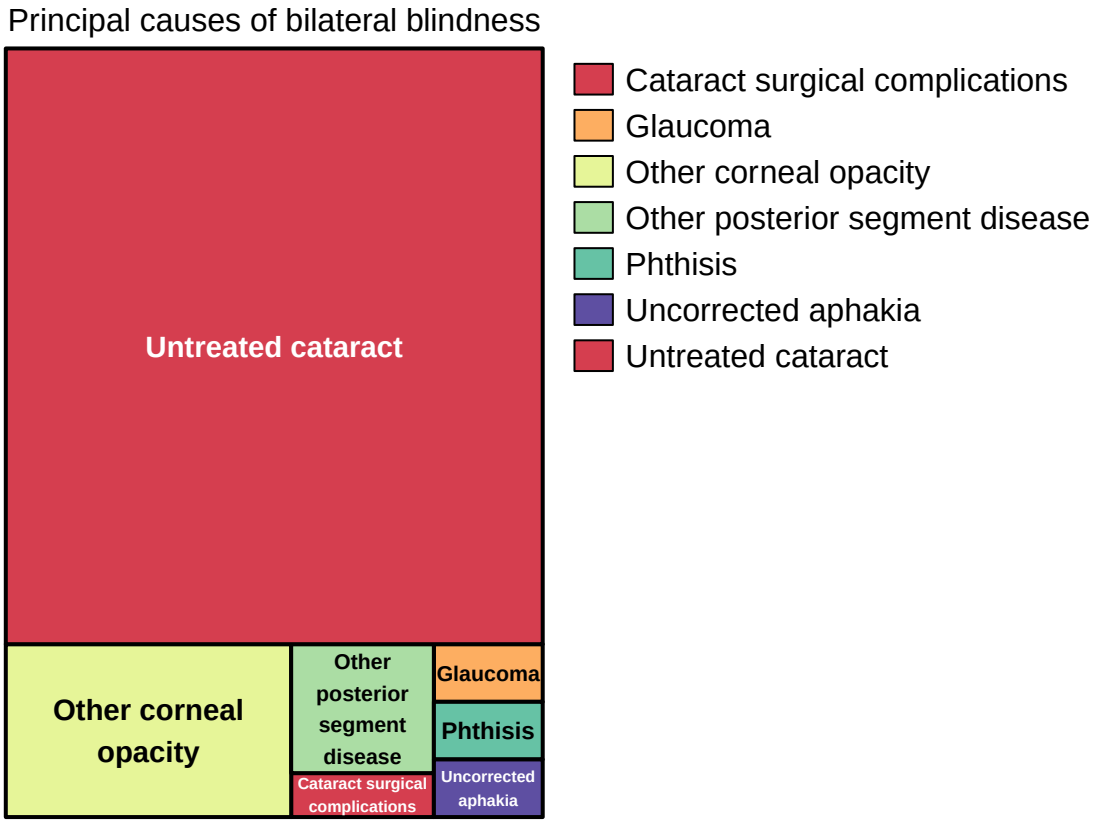


Table 10, table 11

Table 10: Principal cause of blindness in males and females

Principal cause	Female		Male		Total	
	n	%	*n*	%	*n*	%
1. Uncorrected refractive error	0	0.0	0	0	0	0.0
2. Uncorrected aphakia	1	2.3	0	0	1	1.5
3. Untreated cataract	31	72.1	21	84	52	76.5
4. Cataract surgical complications	1	2.3	0	0	1	1.5
5. Trachomatous corneal opacity	0	0.0	0	0	0	0.0
6. Other corneal opacity	6	14.0	2	8	8	11.8
7. Phthisis	0	0.0	1	4	1	1.5
8. Onchocerciasis	0	0.0	0	0	0	0.0
9. Glaucoma	1	2.3	0	0	1	1.5
10. Diabetic retinopathy	0	0.0	0	0	0	0.0
11. Age-related macular degeneration	0	0.0	0	0	0	0.0
12. Other posterior segment disease	3	7.0	0	0	3	4.4
13. Myopic degeneration	0	0.0	0	0	0	0.0
14. Other globe or CNS abnomalities	0	0.0	1	4	1	1.5
Total	43	100.0	25	100	68	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	
	n	%	*n*	%	*n*	%
A. Treatable (1, 2, 3)	32	74.4	21	84	53	78.0
B. Preventable (PHC/PEC services) (5, 6, 7, 8)	6	14.0	3	12	9	13.3
C. Preventable (Ophthalmic services) (4, 9, 10)	2	4.6	0	0	2	3.0
D. Avoidable (A + B + C)	40	93.0	24	96	64	94.3
E. Posterior segment disease (8, 9, 10, 11, 12, 13)	4	9.3	0	0	4	5.9

Table 12, table 13

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

VI level	Male			Female			Total		
	n	*%*	*95% CI*	*n*	*%*	*95% CI*	*n*	*%*	*95% CI*
Blind in one eye only	94	4.5	3.7 - 5.4	78	4.3	3.4 - 5.3	172	4.4	3.8 - 5.1
Severe in one eye only	59	2.9	2.1 - 3.6	50	2.8	2.0 - 3.5	109	2.8	2.3 - 3.4
Moderate in one eye only	137	6.6	5.7 - 7.6	120	6.7	5.4 - 7.9	257	6.6	5.9 - 7.4
Mild in one eye only	180	8.7	7.3 - 10.2	115	6.4	5.2 - 7.5	295	7.6	6.7 - 8.5

* 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*	*Extrapolated magnitude*	*%*	*95% CI*	*Extrapolated magnitude*	*%*	*95% CI*	*Extrapolated magnitude*
Blind in one eye only	5.0	4.2 - 5.9	17 251	4.6	3.7 - 5.5	14 542	4.8	4.1 - 5.5	31 793
Severe in one eye only	2.9	2.2 - 3.7	10 047	2.7	2.0 - 3.5	8 701	2.8	2.3 - 3.4	18 748
Moderate in one eye only	6.6	5.7 - 7.6	22 755	6.5	5.3 - 7.7	20 676	6.6	5.9 - 7.3	43 431
Mild in one eye only	8.3	6.9 - 9.8	28 592	6.3	5.2 - 7.4	20 044	7.4	6.4 - 8.3	48 636

* 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 14: Crude prevalence of people bilaterally and unilaterally cataract operated

Oerated cataract	Female		Male		Total	
	n	*%*	*n*	*%*	*n*	*%*
Bilateral operated	196	9.5	144	8.0	340	8.8
Unilateral operated	260	12.6	179	9.9	439	11.4
Total operated	456	22.1	323	17.9	779	20.1

This table reports the prevalence of people in the sample with one or both eyes operated, irrespective of post-operative visual acuity or pinhole acuity in the unoperated eye.

Table 15, table 16

Table 15: Crude unmet need for cataract surgery at pinhole VA thresholds <3/60, <6/60, <6/18 and <6/12

Unmet need threshold	Female			Male			Total		
	n	*%*	*95% CI*	*n*	*%*	*95% CI*	*n*	*%*	*95% CI*
PinVA <3/60	21	1.0	0.5 - 1.5	13	0.7	0.4 - 1.1	34	0.9	0.6 - 1.2
PinVA <6/60	49	2.4	1.7 - 3.0	28	1.6	1.0 - 2.1	77	2.0	1.5 - 2.5
PinVA <6/18	151	7.3	6.1 - 8.5	130	7.2	6.0 - 8.4	281	7.3	6.3 - 8.2
PinVA <6/12	265	12.8	11.3 - 14.4	237	13.2	11.6 - 14.7	502	13.0	11.7 - 14.2

Table 16: Extrapolated magnitude of unmet need for cataract surgery at pinhole VA thresholds <3/60, <6/60, <6/18 and <6/12

Unmet need threshold	Female			Male			Total		
	Adj. %	*95% CI*	*Extrapolated magnitude*	*Adj. %*	*95% CI*	*Extrapolated magnitude*	*Adj. %*	*95% CI*	*Extrapolated magnitude*
PinVA <3/60	1.4	1.0 - 1.9	4 941	0.9	0.5 - 1.3	2 790	1.2	0.9 - 1.5	7 731
PinVA <6/60	3.0	2.3 - 3.7	10 416	1.8	1.2 - 2.4	5 667	2.4	1.9 - 2.9	16 084
PinVA <6/18	8.4	7.2 - 9.7	28 869	7.7	6.5 - 8.9	24 387	8.1	7.1 - 9.0	53 256
PinVA <6/12	14.2	12.6 - 15.7	48 579	13.4	11.9 - 15.0	42 694	13.8	12.5 - 15.1	91 273

The number of people at each PinVA threshold in these tables correspond to the unmet need for cataract surgery in the calculation for effective cataract surgical coverage (see notes). People with unmet need for surgery may have cataract in one or both eyes. Those with cataract in one eye and different cause of VI in the other eye would potentially benefit from cataract surgery. Note, this group with unilateral cataract excludes people with previous cataract surgery, refractive error or uncorrected aphakia in the non-cataract eye.

Table 17, table 18

In tables 17 & 18, the unmet need for cataract surgery is broken down by bilateral and unilateral cataract cases at each of the cataract surgical thresholds. Here, cataract cases are defined by the presence of an

obvious lens opacity and assignment of cataract as the main cause of vision impairment in both eyes (bilateral) or only one eye (unilateral).

Table 17: Crude prevalence of cataract at surgical thresholds <3/60, <6/60, <6/18 and <6/12

Cataract surgical threshold	**Female**			**Male**			**Total**		
	n	*%*	*95% CI*	*n*	*%*	*95% CI*	*n*	*%*	*95% CI*
Bilateral									
PinVA <3/60	15	0.7	0.3 - 1.1	11	0.6	0.3 - 1.0	26	0.7	0.4 - 0.9
PinVA <6/60	43	2.1	1.5 - 2.7	26	1.4	0.9 - 2.0	69	1.8	1.3 - 2.2
PinVA <6/18	138	6.7	5.5 - 7.8	124	6.9	5.7 - 8.1	262	6.8	5.9 - 7.7
PinVA <6/12	248	12.0	10.5 - 13.5	225	12.5	11.0 - 14.0	473	12.2	11.0 - 13.5
Unilateral									
PinVA <3/60	121	5.9	4.8 - 6.9	72	4.0	3.0 - 5.0	193	5.0	4.2 - 5.8
PinVA <6/60	157	7.6	6.2 - 8.9	108	6.0	4.9 - 7.1	265	6.9	5.9 - 7.8
PinVA <6/18	279	13.5	11.9 - 15.1	208	11.6	10.0 - 13.1	487	12.6	11.4 - 13.7
PinVA <6/12	316	15.3	13.8 - 16.8	244	13.6	11.9 - 15.2	560	14.5	13.3 - 15.7

* Unilateral cases can have any level of VA in the eye without operable cataract

Table 18: 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**		
	Adj. %	*95% CI*	*Extrapolated magnitude*	*Adj. %*	*95% CI*	*Extrapolated magnitude*	*Adj. %*	*95% CI*	*Extrapolated magnitude*
Bilateral									
PinVA <3/60	1.1	0.7 - 1.5	3 812	0.9	0.5 - 1.2	2 790	0.9	0.7 - 1.2	6 096
PinVA <6/60	2.7	2.1 - 3.3	9 287	1.8	1.2 - 2.3	5 667	2.2	1.7 - 2.6	14 449
PinVA <6/18	7.7	6.5 - 8.8	26 349	7.7	6.5 - 8.9	24 387	7.5	6.6 - 8.4	49 452
PinVA <6/12	13.1	11.6 - 14.6	45 104	13.4	11.9 - 15.0	42 694	12.9	11.7 - 14.2	85 394
Unilateral									
PinVA <3/60	6.7	5.7 - 7.8	23 160	4.3	3.3 - 5.3	13 771	5.6	4.8 - 6.4	36 931
PinVA <6/60	8.5	7.2 - 9.9	29 295	6.2	5.1 - 7.3	19 668	7.4	6.5 - 8.3	48 963
PinVA <6/18	14.6	13.0 - 16.2	49 966	11.8	10.2 - 13.3	37 456	13.2	12.1 - 14.4	87 422
PinVA <6/12	16.2	14.7 - 17.8	55 719	13.8	12.2 - 15.4	43 795	15.1	13.9 - 16.3	99 515

* Unilateral cases can have any level of VA in the eye without operable cataract

These tables enable planning the number of surgeries required to eliminate vision impairment from cataract at a particular PinVA threshold. Assuming services will aim to operate on all eyes of people with vision impairing cataract, two surgeries are required for 'bilateral cases' and one surgery is required for 'unilateral cases'.

Table 19

Table 19: Adjusted cataract surgical coverage and effective cataract surgical coverage at the person level

	Female		Male		Total		Relative Quality Gap
	Adj. %	*95% CI*	*Adj. %*	*95% CI*	*Adj. %*	*95% CI*	*%*
Cataract surgical threshold <6/12							
CSC	62.1	58.4 - 65.9	56.3	52.2 - 60.5	59.6	56.5 - 62.7	
eCSC	38.0	34.6 - 41.4	37.6	33.4 - 41.8	37.8	35.0 - 40.6	36.5
Cataract surgical threshold <6/18							
CSC	72.1	68.2 - 76.1	67.8	63.2 - 72.4	70.3	67.1 - 73.5	
eCSC	44.1	40.2 - 48.1	45.3	40.2 - 50.4	44.6	41.2 - 48.0	36.5
Cataract surgical threshold <6/60							
CSC	86.4	82.8 - 90.0	88.7	84.9 - 92.4	87.3	84.4 - 90.1	
eCSC	52.4	47.7 - 57.2	61.4	55.5 - 67.2	56.0	51.9 - 60.1	35.9
Cataract surgical threshold <3/60							
CSC	92.6	89.6 - 95.5	93.6	90.7 - 96.5	93.0	90.9 - 95.0	
eCSC	55.0	49.8 - 60.3	64.9	58.7 - 71.0	58.9	54.5 - 63.4	36.6

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

Effective cataract surgical coverage (eCSC) measures the number of people in a population who have been operated on for cataract, and had a good outcome (at least 6/12 post-operative presenting VA), as a proportion of all people operated on or still requiring surgery. Therefore, eCSC describes service access (ie, cataract surgical coverage, [CSC]) adjusted for quality. eCSC and CSC are reported at four cataract surgical thresholds. The gap between CSC and eCSC values can be considered a quality gap; the relative quality gap is calculated as (total CSC–total eCSC)/ total CSC, with lower values reflecting better quality of cataract surgical services. See notes section for more details.

Table 20

Table 20: Barriers to cataract surgery among participants with bilateral cataract and PinVA <6/60

Barrier	Female		Male		Total	
	n	*%*	*n*	*%*	*n*	*%*
Unaware treatment possible	1	2.3	0	0.0	1	1.4
Surgery denied by provider	3	6.8	1	3.7	4	5.6
Cannot access surgery	11	25.0	5	18.5	16	22.5
Cost	5	11.4	2	7.4	7	9.9
Felt not needed	19	43.2	15	55.6	34	47.9
Fear	5	11.4	2	7.4	7	9.9
Other	0	0.0	2	7.4	2	2.8
Total	44	100.0	27	100.0	71	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 21

Table 21: Type of cataract surgery performed, count by eyes

Surgery type	**Female**		**Male**		**Total**	
	n	%	*n*	%	*n*	%
IOL	639	98.5	445	95.7	1084	97.3
Non-IOL	10	1.5	20	4.3	30	2.7
Couching	0	0.0	0	0.0	0	0.0
Total	649	100.0	465	100.0	1114	100.0

Table 22, table 23

Table 22: Post-operative visual outcome (PVA), count by eyes

Outcome (PVA)	**Female**		**Male**		**Total**	
	n	%	*n*	%	*n*	%
Good (6/12)	377	58.1	292	62.8	669	60.1
Borderline (<6/12 to 6/60)	217	33.4	127	27.3	344	30.9
Poor (<6/60)	55	8.5	46	9.9	101	9.1
Total	649	100.0	465	100.0	1114	100.1

Table 23: Post-operative visual outcome (PinVA), count by eyes

Outcome (PinVA)	**Female**		**Male**		**Total**	
	n	%	*n*	%	*n*	%
Good (6/12)	505	77.8	360	77.4	865	77.6
Borderline (<6/12 to 6/60)	109	16.8	71	15.3	180	16.2
Poor (<6/60)	35	5.4	34	7.3	69	6.2
Total	649	100.0	465	100.0	1114	100.0

Table 24, table 25

Table 24: Post-operative visual outcomes (PVA) in eyes by place of surgery (male)

Post-surgical VA	Gov. Hosp.		Vol. Hosp.		Priv. Hosp.		Camp Improv.		Trad.	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Good (6/12)	13	48.1	205	60.8	61	75.3	13	61.9	0	0.0
Borderline (<6/12 to 6/60)	11	40.7	93	27.6	18	22.2	5	23.8	0	0.0
Poor (<6/60)	3	11.1	39	11.6	2	2.5	3	14.3	1	100.0
Total	27	99.9	337	100.0	81	100.0	21	100.0	1	100.0

Table 25: Post-operative visual outcomes (PVA) in eyes by place of surgery (female)

Post-surgical VA	Gov. Hosp.		Vol. Hosp.		Priv. Hosp.		Camp Improv.		Trad.	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Good (6/12)	33	55.9	256	54.7	75	68.8	13	81.2	0	0.0
Borderline (<6/12 to 6/60)	16	27.1	171	36.5	29	26.6	1	6.2	0	0.0
Poor (<6/60)	10	16.9	41	8.8	5	4.6	2	12.5	0	0.0
Total	59	99.9	468	100.0	109	100.0	16	99.9	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 26, table 27

Table 26: 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		
	n	*%*	*95% CI*	*n*	*%*	*95% CI*	*n*	*%*	*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	3	0.1	0.0 - 0.3	3	0.2	0.0 - 0.4	6	0.2	0.0 - 0.3
Moderate	119	5.8	4.7 - 6.8	95	5.3	4.2 - 6.3	214	5.5	4.7 - 6.4
Mild	166	8.0	6.7 - 9.4	104	5.8	4.6 - 7.0	270	7.0	6.0 - 8.0

Table 27: 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*	*Extraplotated magnitude*	*%*	*95% CI*	*Extrapolated magnitude*	*%*	*95% CI*	*Extrapolated magintude*
Blind	0.0	0.0 - 0.0	0	0.0	0.0 - 0.0	0	0.0	0.0 - 0.0	0
Severe	0.2	0.0 - 0.3	565	0.2	0.0 - 0.3	513	0.2	0.0 - 0.3	1 078
Moderate	5.9	4.8 - 6.9	20 098	5.3	4.2 - 6.3	16 807	5.6	4.8 - 6.4	36 905
Mild	8.1	6.8 - 9.5	27 962	5.6	4.4 - 6.8	17 901	6.9	6.0 - 7.9	45 863

Table 28

Effective refractive error coverage (eREC) measures the number of people in a population in need of optical correction who have received correction and had a good outcome (ie, can see at least 6/12 corrected) as a proportion of all people in need of optical correction who have accessed correction or still require it. Therefore, eREC describes service access (ie, refractive error coverage, [REC]) adjusted for quality. See notes section for more details.

Note: Both indicators refer to distance refractive error

Table 28: Adjusted distance refractive error coverage and effective refractive error coverage

	Female		Male		Total	
	Adj. %	*95% CI*	*Adj. %*	*95% CI*	*Adj. %*	*95% CI*
eREC	7.1	4.0 - 10.3	16.2	11.7 - 20.6	11.2	8.5 - 13.9
REC	9.5	5.8 - 13.3	19.5	14.6 - 24.4	14.0	10.9 - 17.1

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

Table 29

Table 29: Distance and near vision spectacle use among study participants

	Female		Male		Total	
	n	*%*	*n*	*%*	*n*	*%*
Distance vision spectacles	97	4.7	120	6.7	217	5.6
Near vision spectacles	194	9.4	254	14.1	448	11.6

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.

Diabetic retinopathy

Table 30

The response rate for the diabetic retinopathy (DR) module can be lower than the standard RAAB survey if participants do not consent to a random blood sugar test (see Table 31) or to a dilated eye examination (see Table 32). Those who do not consent to dilated examination may differ from those who do. For example, they may be younger (e.g., working age rather than retired) or drivers, with the appropriate level of vision required to hold a driving licence.

Table 30: RAAB survey and DR module response rate

Exam status	Female		Male		Total	
	n	*%*	*n*	*%*	*n*	*%*
Enrolled	2167	100.0	1928	100.0	4095	100.0
Examined	2067	95.4	1800	93.4	3867	94.4
Diabetes status assessed*	2026	93.5	1777	92.2	3803	92.9

* Self-reported diabetes or consented to random blood sugar test

Table 31

Table 31: Known or suspected diabetes among participants assessed for diabetes status

Exam status	Female		Male		Total	
	n	*%*	*n*	*%*	*n*	*%*
Known or suspected diabetes	159	7.8	106	6.0	265	7.0
Known	82	51.6	50	47.2	132	49.8
Suspected*	77	48.4	56	52.8	133	50.2
Consented dilated examination	131	82.4	93	87.7	224	84.5

* No known history of diabetes but random blood glucose 200mg/dl or higher

The proportions of diabetes that is diagnosed and undiagnosed in a population varies by region. The 2021 International Diabetes Federation Atlas (https://diabetesatlas.org/) estimates that more than half of people with diabetes are undiagnosed in Africa (53.6%), Western Pacific (52.8%) and South-East Asia (51.3%).

Note: The use of random blood glucose testing without fasting may result in over-estimates of suspected diabetes in RAAB surveys.

Table 32

Table 32: The prevalence of known or suspected diabetes among participants assessed for diabetes status, by age group and gender

Age group	Female			Male			Total		
Years	*n*	*%*	*95% CI*	*n*	*%*	*95% CI*	*n*	*%*	*95% CI*
50-59	69	6.6	4.9 - 8.3	44	5.4	3.7 - 7.0	113	6.1	4.7 - 7.5
60-69	66	9.4	7.3 - 11.5	40	6.0	4.1 - 7.8	106	7.7	6.3 - 9.2
70-79	20	9.2	4.8 - 13.7	19	8.2	4.0 - 12.5	39	8.7	5.6 - 11.8
80+	4	6.5	0.4 - 12.5	3	5.1	0.0 - 10.6	7	5.8	1.8 - 9.8
Total	159	7.8	6.5 - 9.2	106	6.0	4.7 - 7.2	265	7.0	5.9 - 8.0

The crude prevalence of diabetes among DR module participants by 10-year age group and gender is shown in Table 31. A diagnosis of diabetes is based on either a self-reported history of diabetes (“known diabetes”), or, where diabetes is not self-reported, on a random blood sugar of 200 mg/dl or higher (“suspected diabetes”).

Table 33

Table 33: Self-reported time since last eye examination for diabetic retinopathy among known diabetics

Last exam	Female		Male		Total	
	n	%	*n*	%	*n*	%
Never	74	90.2	38	76.0	112	84.8
Within 1 year	6	7.3	5	10.0	11	8.3
1-2 years	1	1.2	0	0.0	1	0.8
More than 2 years	0	0.0	7	14.0	7	5.3
Total	81	98.8	50	100.0	131	99.2

Self-reported time since last eye examination for DR among known diabetics can be considered as a proxy for the coverage of DR (screening) services. Recall bias may affect the reliability of the findings and results should be reviewed alongside facility-based DR screening records where available.

Table 34

Table 34: The prevalence of retinopathy and maculopathy among (known and suspect) diabetics in the sample

	Female			Male			Total		
	n	%	*95% CI*	*n*	%	*95% CI*	*n*	%	*95% CI*
Any retinopathy	26	19.8	13.5 - 26.2	17	18.3	10.3 - 26.3	43	19.2	14.6 - 23.8
Any maculopathy	11	8.4	3.7 - 13.1	15	16.1	8.1 - 24.1	26	11.6	7.4 - 15.8
Any retinopathy and/or maculopathy	29	22.1	15.7 - 28.6	22	23.7	15.3 - 32.0	51	22.8	18.2 - 27.3
Sight-threatening DR (R4 and/or M2)	4	3.1	0.2 - 5.9	9	9.7	2.8 - 16.6	13	5.8	2.6 - 9.0
Any laser scars	1	0.8	0.0 - 2.3	1	1.1	0.0 - 3.1	2	0.9	0.0 - 2.1

Table 35

Table 35: Grade of retinopathy and maculopathy among (known and suspect) diabetics in the sample

	Female		Male		Total	
	n	%	*n*	%	*n*	%
Retinopathy						
None (R0)	101	77.1	75	80.6	176	78.6
Mild (R1)	15	11.5	5	5.4	20	8.9
Observable (R2)	4	3.1	1	1.1	5	2.2
Referable (R3)	6	4.6	10	10.8	16	7.1
Proliferative (R4)	1	0.8	1	1.1	2	0.9
Not visualised (R6)	4	3.1	1	1.1	5	2.2
Maculopathy						
None (M0)	116	88.5	77	82.8	193	86.2
Observable (M1)	7	5.3	6	6.5	13	5.8
Referable (M2)	4	3.1	9	9.7	13	5.8
Not visualised (M6)	4	3.1	1	1.1	5	2.2

```
## [1] "Graded using the Scottish Diabetic Retinopathy Grading Scheme"
```

Crude prevalence is reported among known or suspect diabetics who consented to dilated fundus examination (see Table 34). At the person level, the grade of retinopathy and maculopathy is calculated as the higher of right and left eye grades (R0-4 and M0-2; see Table 35).

A 'rule of thirds' has previously been applied to planning for diabetic retinopathy services. This estimates that approximately one third of people with diabetes have some level of retinopathy and, of those with retinopathy, approximately one third will have sight-threatening retinopathy (STDR) requiring laser or anti-VEGF treatment. A 2021 paper by To et al. emphasises there are regional differences in DR and STDR prevalence (https://doi.org/10.1016/j.ophtha.2021.04.027).

Table 36

Table 36: The prevalence of vision impairment among known and suspected diabetics and non-diabetics

VI level	**Diabetics**			**Non-diabetics**		
	n	*%*	*95% CI*	*n*	*%*	*95% CI*
Blind	4	1.5	0.1 - 2.9	63	1.8	1.3 - 2.3
Severe VI	5	1.9	0.3 - 3.5	118	3.3	2.7 - 3.9
Moderate VI	46	17.4	12.9 - 21.8	554	15.7	14.3 - 17
Mild VI	26	9.8	6.3 - 13.3	308	8.7	7.6 - 9.8

The crude prevalence of vision impairment (due to any cause) by WHO categories among DR module participants with and without diabetes.

Notes

Abbreviations

CI = Confidence interval

CNS = Central nervous system

CSC = Cataract surgical coverage

DR = Diabetic retinopathy

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

0.47 = Cannot see 6/12 but can see 6/18

1.0 = Cannot see 6/18 but can see 6/60

1.3 = Cannot see 6/60 but can see 3/60

1.8 = Cannot see 3/60 but can see 1/60

3 = Light perception

4 = No light perception

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 6/12 in the other eye

Severe VI: PVA less than 6/60 to 3/60 in one eye, PVA 6/12 in the other eye

Moderate VI: PVA less than 6/18 to 6/60 in one eye, PVA 6/12 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 (excluding couched eyes) or pseudoaphakia (with or without posterior capsule opacification [PCO]) or no view of lens but cataract surgical complications as cause of vision impairment

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, e.g., at the <6/12 cataract surgical threshold:

A = individuals with unilateral operated cataract attaining 6/12 or better post-operative presenting VA in the operated eye, who have BCVA <6/12 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 operated cataract (regardless of visual acuity in the operated eye) and BCVA <6/12 in the other eye

Y = individuals with bilateral operated cataract (regardless of visual acuity in the operated eyes)

Z = individuals with BCVA <6/12 in both eyes with cataract as the main cause of vision impairment in one or both eyes

For more information see: McCormick, I, Butcher, R, Evans, JR et al. Effective cataract surgical coverage in adults aged 50 years and older: estimates from population-based surveys in 55 countries. Lancet Global Health. 2022. https://doi.org/10.1016/S2214-109X(22)00419-3

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. https://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.