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Population-based rapid assessment of avoidable blindness survey in Sohag governorate in Egypt

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ABSTRACT

Objectives To determine the prevalence and causes of blindness and vision impairment, and the coverage and quality of cataract surgical services, among population aged 50 years and older in Sohag governorate in Egypt.

Design A population-based cross-sectional survey using two-stage cluster random sampling following the rapid assessment of avoidable blindness methodology.

Setting A community-based survey conducted by six teams of ophthalmologists, assistants and local guides. Enrolment and examination were door-to-door in selected clusters.

Participants Using 2016 census data, 68 population units were randomly selected as clusters (of 60 people) with probability proportionate to population size. Anyone aged 50 years and older, residing in a non-institutional setting in a cluster for at least 6 months, was eligible to participate.

Primary and secondary outcome measures The prevalence and causes of blindness and vision impairment. Secondary outcomes were CSC and effectiveness and participant-reported barriers to cataract surgery.

Results Of 4078 participants enrolled, 4033 (98.9%) were examined. The age-adjusted and sex-adjusted prevalence of blindness, severe vision impairment and moderate vision impairment were 5.9% (95% CI 4.8% to 6.9%), 4.7% (95% CI 3.8% to 5.7%) and 18.9% (95% CI 16.8% to 21.0%), respectively. Cataract caused most of blindness (41.6%), followed by non-trachomatous corneal opacity (15.7%) and posterior segment diseases (14.5%). Cataract surgical coverage (CSC) for persons for visual acuity <3/60 was 86.8%, the proportion of cataract surgeries with poor visual outcome was 29.5% and effective CSC (eCSC) was 44.9%. eCSC was lower in women than men. The most frequently reported barrier to surgery was cost (51.5%).

Conclusions The prevalence of blindness in Sohag governorate is higher than districts in other middle-income countries in the region. CSC was high; however, women suffer worse quality-corrected CSC than men. The quality of cataract surgery needs to be addressed, while health system strengthening across government and private settings could alleviate financial barriers.

Strengths and limitations of this study

- Addresses an overlooked area of research about the epidemiology of blindness in Egypt.
- Standardised cluster random sampling methodology and high response rate provides a representative sample of the population of interest.
- Analysis includes population-reported barriers to cataract surgery and insight on the coverage and quality of cataract services provided in the district.
- The rapid survey methodology may have underestimated the contribution of posterior segment conditions to the burden of vision impairment in the governorate.
- The estimate of uncorrected presbyopia in the sample was based on an assumption that all participants were presbyopic and as such may overestimate the burden of this condition.

INTRODUCTION

In 2018, over 23 million people had vision impaired in the Eastern Mediterranean Region (EMR), of whom 5 million were blind.[1] Egypt is the most populous country in the Middle East with more than 98 million residents.[2] It is classified as a low-middle income country (LMIC), with a gross domestic product per capita of $2549 in 2018. The government allocated 4.2% of its total expenditure to health in 2016, while out of pocket payments constituted 62% of all health expenditure.[3] Sohag governorate lies in the centre of Upper Egypt, the region with the highest levels of poverty in the country.[4]

There are four government hospitals (including one teaching hospital) and many private centres that provide eye care services to approximately five million citizens.[5] Across these facilities, 81 ophthalmologists carried out 5344 cataract operations—mainly phacoemulsification—in 2014, corresponding to a cataract surgical rate of 1161 per million population compared with 3674 per million population nationally.[6] Phacoemulsification is a standard practice in private settings, while government hospitals use extracapsular cataract extraction (ECCE) with intraocular lens implantation, due to cost considerations. Small incision cataract surgery is not known to be performed in either setting.[6]

Since the 1960s, there have been very few population-based, representative surveys of vision impairment in Egypt.[7] A survey of the population 50 years and older in Menofiya governorate found a prevalence of blindness of 7.9%.[8 9] In 2010, the Ministry of Health and Population (MOHP) carried out surveys of the population 50 years and older in five governorates; however, data were not published. There are discrepancies between national and international vision impairment (VI) data. In 2017, the Central Agency for Public Mobilization and Statistics estimated the all-age prevalence of blindness to be 0.57%,[5] while the International Agency for Blindness Prevention estimated it to be 0.96% for 2015.[10] The reason for this inconsistency is unclear.

Over the years, gender inequality has been a key finding of blindness and eye health studies in Egypt,[7 11 12] all found approximately twice as many blind women as blind men in their samples. Egypt lacks a national plan for eye care. In the era of universal health coverage, it is important that eye health planners develop plans to achieve universal eye health—delivering equitable, high-quality services and improve quality of life for everyone affected by vision loss.

The objectives of this study were to determine the prevalence and causes of blindness and vision impairment in the population 50 years and older in Sohag governorate, and to report the coverage and quality of cataract surgical services, barriers to cataract surgery, as well as the prevalence of diabetes and diabetic retinopathy. The MOHP will use the data to develop a community-based eye care plan.

METHODS

A population-based, cross-sectional survey was conducted following the standardised rapid assessment of avoidable blindness (RAAB) methodology, with the addition of the diabetic retinopathy module.[13] Results of the diabetic retinopathy component will be prepared for publication separately.

Sampling

The 2016 national census for Sohag governorate showed the population 50 years and older was 627 510.[5] The sample size, calculated using RAAB6 software, was 4080 individuals, based on an expected prevalence of diabetic retinopathy of 4.25% (25% of the prevalence of diabetes in adults in Egypt,[14] with a precision of 20% of the expected prevalence, at 95% confidence level, non-compliance rate of 15% and a design effect of 1.6 to compensate for clustering. The prevalence of diabetic retinopathy was used instead of blindness as it was expected to be the lower of the two values.

The sampling frame consisted of 288 urban and rural population units, corresponding to 12 Marakez (districts), based on 2016 census enumeration areas. From this, 68 clusters were selected with probability proportionate to population size. Cluster selection was carried out using the RAAB6 software. Individuals within a population unit were selected through compact segment sampling. Each population unit was divided into equal segments estimated to contain at least 60 people 50 years and older. For large population units, this was done with a grid square overlaid on a Google Maps map of the area. Local community leaders contributed to ensure all segments represented inhabited areas only and one segment was randomly selected for the survey. There was little variation in the arrangement of households between areas defined as urban or rural and most housing was single story. Households in a randomly selected segment were included in the survey until 60 people aged 50 years and older were enrolled. The study used a cluster size of 60 instead of 50 as this was a 'RAAB + Diabetic Retinopathy' survey. In each selected segment, people 50 years and older, residing in non-institutional households for 6 months or more over the past year, were eligible to participate.

Survey teams

There were six survey teams, each consisting of an ophthalmologist, ophthalmology assistant and local community worker. The six ophthalmologists were masters degree qualified, government employees from Cairo (four), Hurghada and Sohag (one each); all were part of the Magrabi Foundation outreach team. Teams were trained by a certified RAAB trainer and passed an interobserver variation test with a kappa score of at least 0.6 prior to the fieldwork.

Examination protocol

Presenting visual acuity (PVA) for right and left eyes was measured in ambient illumination, with a 6/60 tumbling E optotype at 6 m, 3 m or 1 m, and 6/18 and 6/12 tumbling E optotypes at 6 m. Pinhole VA was measured where presenting VA was <6/12 in any eye. All participants had a lens examination by an ophthalmologist using direct ophthalmoscope. Fundus examination using a direct and indirect ophthalmoscope was undertaken by an ophthalmologist to determine the cause of presenting VA <6/12 as required. Dilated fundus examination, using two drops of tropicamide 0.5%, was carried out where the cause of vision impairment was not uncorrected refractive error, or an obvious corneal or lens opacity (or in line with the RAAB diabetic retinopathy module protocol). Glaucoma was considered the cause of vision impairment or blindness based on only obvious pathological signs (digital palpation, an afferent pupil defect, corneal oedema, a vertical cup–disc ratio of 0.8 or greater) in the absence of intraocular pressure or visual field examination, or where an existing diagnosis of glaucoma was known. Details of the diabetic retinopathy examination protocol undertaken will be reported in detail elsewhere.

WHO definitions of vision impairment and blindness, based on presenting VA in the better eye, were used. Blindness is VA less than 3/60, severe vision impairment (SVI) is VA 3/60 or better and less than 6/60, moderate

vision impairment (MVI) is VA 6/60 or better and less than 6/18 and early vision impairment (EVI) is VA 6/18 or better and less than 6/12.

Cataract surgical coverage (CSC) is an indicator of to what extent a population's need for cataract surgery has been met. It is the number of people with operated cataract as a proportion of those with operated and operable cataract, for a given level of cataract vision impairment. Effective CSC (eCSC) reports the same proportion; however, it only includes the number of people with operated cataract that have achieved a good visual outcome (ie, can see 6/18 or better) in the numerator. As such, it is a measure of cataract surgical quality in addition to CSC.[15]

Refractive error includes people who presented with distance spectacles plus those whose VA improved from less than 6/12 presenting VA to 6/12 with pinhole. Uncorrected refractive error is the latter group only. Uncorrected presbyopia is defined as all examined people (aged 50 years and older) reporting not having near vision correction. Near VA is not measured in RAAB surveys.

Data collection and statistical analysis

Field work was completed over 23 days in February 2019. Two teams attended one cluster per day, examining 30 participants each.

Data were collected door-to-door following the standardised RAAB6 two-page survey form and cross-checked daily to identify missing data and correct errors. Survey teams revisited enrolled participants who were not available at the first visit. Two data entry clerks used the RAAB6 software for consistency checks during data entry. Standardised survey reports were generated by RAAB6 software, which accounts for the clustered survey design. Adjusted prevalence estimates were weighted to age and sex disaggregated population data from the 2016 census. A two-sample test of proportions was used in STATA V.16 software to compare the age-adjusted and sex-adjusted prevalences of blindness and vision impairment in men and women. This was a post hoc analysis, using data modified from RAAB's standardised reporting output.

Participants and public involvement in the research

We did not directly include participants in the design of the research; however, policy makers in the MOHP and local community leaders were consulted about the survey design, questionnaire and approaches to facilitate the implementation of the study. In partnership with the MOHP, we will disseminate a plain language summary of the findings to the public.

RESULTS

Age and gender distribution

Among the 4078 people aged 50 years and older enrolled, 13 were unavailable for examination (0.3%), 18 refused to be examined (0.4%) and 14 were not able to communicate (0.4%). Accordingly, a total of 4033 participants aged 50+ were examined, a response rate of 98.9%. The proportion of men in the sample was higher than the population (59.2% and 52.1%, respectively); there was a statistically significant difference in the proportions of the male and female population included in the sample (0.73% vs 0.55% [p<0.001; two-sample test of proportions]). The youngest age group (50–59) was underrepresented in the sample in contrast to the three older age groups. The difference between the sample population and the study area is presented in table 1.

Blindness and vision impairment by gender

The age-adjusted and sex-adjusted prevalence of blindness, SVI and MVI were 5.9% (95% CI 4.8% to 6.9%), 4.7% (95% CI 3.8% to 5.7%) and 18.9% (95% CI 16.8% to 21.0%), respectively. There was only weak evidence of a statistically significant difference between women and men for blindness (p=0.046), but strong evidence for the differences between women and men for SVI and MVI (p<0.001 for both). The prevalence of early VI was 17.8% (95% CI 16.0% to 19.5%) with no evidence of a difference between sexes (p=0.151). (table 2).

Causes of blindness and VI

Cataract was the main cause of blindness (41.2%) followed by non-trachomatous corneal opacity (15.7%), and posterior segment diseases (14.5%). Glaucoma was responsible for 8.2% of blindness, while cataract surgical complications were responsible for 7.8% of blindness

Table 1 Age and sex distribution of survey participants compared with the 2016 census data for Sohag governorate

	Men				Women				Total			
	Sample		Governorate		Sample		Governorate		Sample		Governorate	
	n	%	n	%	n	%	n	%	n	%	n	%
50–59	995	41.6	168208	51.4	731	44.5	157701	52.5	1726	42.8	325909	51.9
60–69	846	35.4	103632	31.7	568	34.5	90387	30.1	1414	35.1	194019	30.9
70–79	411	17.2	39858	12.2	261	15.9	37423	12.5	672	16.7	77281	12.3
80+	137	5.7	15268	4.7	84	5.1	15033	5.0	221	5.5	30301	4.8
Total	2389	100.0	326966	100.0	1644	100.0	300544	100.0	4033	100.0	627510	100.0

Table 2 Age-adjusted and sex-adjusted prevalence of bilateral blindness, SVI, MVI and EVI, and the projected number of people aged 50 years and older affected in Sohag governorate

	Men		Women			Total	
	Projected number of people aged 50 years and older	% (95% CI)	Projected number of people aged 50 years and older	% (95% CI)	P value*	Projected number of people aged 50 years and older	% (95% CI)
Blindness	16115	4.9 (3.9 to 6.0)	20598	6.9 (5.1 to 8.6)	0.046	36715	5.9 (4.8 to 6.9)
SVI	10459	3.2 (2.4 to 4.0)	19173	6.4 (4.7 to 8.0)	<0.001	29639	4.7 (3.8 to 5.7)
MVI	52089	15.9 (13.5 to 18.3)	66348	22.1 (19.7 to 24.5)	<0.001	118446	18.9 (16.8 to 21.0)
EVI	54664	16.7 (14.6 to 18.8)	56792	18.9 (16.8 to 21.0)	0.151	111452	17.8 (16.0 to 19.5)

*Two-sample test of proportions using the adjusted prevalence estimates for male and female subgroups.
EVI, early vision impairment; MVI, moderate vision impairment; SVI, severe vision impairment.

in the sample (table 3). Accordingly, 74.9% of causes of blindness were avoidable through either treatment or prevention. Non-trachomatous corneal opacity is not classified further by specific corneal disorders in the RAAB methodology. Onchocerciasis is not endemic in Egypt; however, a single case of onchocerciasis blindness was recorded in a man previously resident in Sudan, now living in the Sohag governorate.

84.5% of SVI was avoidable; 62.0% was treatable (60.5% due to cataract and 1.5% due to refractive error), while preventable causes (cataract surgical complications, glaucoma, diabetic retinopathy, trachomatous and non-trachomatous corneal opacities) together constituted 22.5%.

Uncorrected refractive error contributed little to the prevalence of blindness, SVI or MVI but was the main cause of EVI (53.6%). 17.1% of the sample had refractive error, the majority of which was uncorrected (73.7%). The estimated proportion of the sample with uncorrected presbyopia was 95.5%.

Cataract blindness and vision impairment

The age-adjusted and sex-adjusted prevalence of bilateral blindness with correction due to cataract (defined as pinhole VA less than 3/60 in both eyes with obvious lens opacity in both eyes) was 1.5% (95% CI 1.1% to 2.0%), with no difference between men and women (1.5% (95%

Table 3 Causes of blindness, SVI, MVI and EVI based on participants' presenting VA

	Blindness		Severe VI		Moderate VI		Early VI	
	n	%	n	%	n	%	n	%
Refractive error	1	0.4	3	1.5	109	13.6	394	53.6
Aphakia, uncorrected	0	0	0	0	0	0	0	0
Cataract, untreated	105	41.2	121	60.5	366	45.8	151	20.5
Cataract surgical complications	20	7.8	20	10	53	6.6	23	3.1
Trachomatous corneal opacity	2	0.8	3	1.5	11	1.4	6	0.8
Non-trachomatous corneal opacity	40	15.7	14	7	34	4.3	11	1.5
Phthisis	0	0	0	0	0	0	0	0
Onchocerciasis	1	0.4	0	0	0	0	0	0
Glaucoma	21	8.2	4	2	12	1.5	7	1
Diabetic retinopathy	1	0.4	4	2	14	1.8	5	0.7
Age Related Macular Degeneration (ARMD)	5	2	3	1.5	9	1.1	4	0.5
Other posterior segment disease	37	14.5	25	12.5	183	22.9	121	16.5
All other globe/Central Nervous System (CNS) abnormalities	22	8.6	3	1.5	9	1.1	13	1.8
Total	255	100	200	100	800	100	735	100

EVI, early vision impairment; MVI, moderate vision impairment; SVI, severe vision impairment; VA, visual acuity.

Table 4 Age-adjusted and sex-adjusted prevalence of bilateral cataract blindness, SVI, MVI and EVI (with best corrected VA) and the projected number of people aged 50 years and older affected in Sohag governorate

	Men		Women		Total	
	Projected number of people aged 50 years and older	% (95% CI)	Projected number of people aged 50 years and older	% (95% CI)	Projected number of people aged 50 years and older	% (95% CI)
Blindness	4808	1.5 (0.9 to 2.0)	4750	1.6 (0.8 to 2.4)	9558	1.5 (1.0 to 2.0)
SVI	3043	0.9 (0.5 to 1.4)	5332	1.8 (1.0 to 2.5)	8375	1.3 (0.9 to 1.8)
MVI	15636	4.8 (3.6 to 5.9)	17761	5.9 (4.6 to 7.2)	33397	5.3 (4.3 to 6.3)
EVI	11745	1.8 (0.7 to 2.9)	10992	1.8 (0.7 to 2.9)	22737	1.8 (1.0 to 2.7)

EVI, early vision impairment; MVI, moderate vision impairment; SVI, severe vision impairment; VA, visual acuity.

CI 0.9% to 2.0%) and 1.6% (95% CI 0.8% to 2.4%), respectively (table 4).

The age-adjusted and sex-adjusted prevalence of unilateral cataract blindness was 6.8% (95% CI 6.1% to 7.6%), with more women (8.4% (95% CI 7.1% to 9.7%)) affected than men (5.4% (95% CI 4.5% to 6.3%)).

Effective CSC

The CSC (in persons) for operable cataract causing VA<3/60 was 86.8%. The figure was similar in women (89.2%) and men (84.3%). CSC for VA<6/60 and <6/18 were 79.3% and 61.2%, respectively, with slightly higher coverage in women than men for both (80.6% vs 77.9% and 63.0% vs 59.5%, respectively). eCSC was approximately half that of the CSC for the sample and, in contrast to CSC, effective coverage was higher in men than women at all three levels of vision (table 5).

Cataract surgical outcome

99.2% of all operated eyes were pseudophakic, with most surgeries done in private (66.0%) or government (24.3%) hospitals.

Considering presenting VA, visual outcome was good (≥6/18) in 46.1%, borderline (<6/18 to 6/60) in 25.6% and poor (<6/60) in 28.3% of operated eyes. Poor outcomes occurred in 25.1% of eyes in men and 31.8% of eyes in women.

Table 5 CSC and effective CSC (in persons) by level of vision impairment due to operable cataract

	Men (%)	Women (%)	Total (%)
CSC			
VA <3/60	83.4	89.2	86.6
VA <6/60	77.9	80.6	79.3
VA <6/18	59.5	63	61.2
Effective CSC			
VA <3/60	51	39	44.9
VA <6/60	45.9	34.9	40.4
VA <6/18	33.9	26.1	30.2

CSC, cataract surgical coverage; VA, visual acuity.

Poor patient selection (eg, presence of comorbidities) and surgical complications were the most common causes of poor (58.0% and 32.1%, respectively) and borderline (44.9% and 30.2%) visual outcomes. With pinhole correction, the proportions of eyes with good, borderline and poor surgical outcomes were 55.4%, 20.9% and 23.8%, respectively; 48.8% of eyes with a presenting VA of 6/18 but not 6/12 would benefit from distance spectacles, based on an observed improvement with pinhole.

Visual outcome was more favourable for eyes operated in private hospitals than charitable or faith-based organisations and government sites; good outcomes were achieved in 52.5% of eyes compared with 43.8% and 30.4%, respectively. Almost half of eyes operated at government hospitals (44.1%) had poor postoperative VA (<6/60). The proportion of eyes operated at government hospitals was similar in men and women (26.0% and 22.3%, respectively).

For all operated eyes, visual outcomes were slightly better with more recent surgery. Good outcomes were achieved in 50.1% of operations in the past 3 years, dropping to 42.7% in 4–6 years previously and 43.9% in 7 or more years ago. Poor outcomes had reduced over the same time periods.

Barriers to cataract surgery

Among people with bilateral cataract and best-corrected VA <6/60, the most frequently reported barrier to surgery was cost (51.5%), followed by 'need not felt' (28.7%). A slightly lower proportion of women than men reported cost as a barrier (47.7% and 54.9%, respectively).

DISCUSSION

The survey had a high response rate (98.9%). This was achieved as the survey teams revisited participants who were eligible but unavailable at first visit. Women and younger ages (50–59) were under-represented relative to the proportions available from the census data. Consequently, we reported age-adjusted and sex-adjusted estimates where available from the standardised survey analysis. The rapid survey methodology may have underestimated the contribution of posterior segment conditions to the burden of vision impairment in the governorate.[16]

Uncorrected presbyopia may be overestimated in this study as the methodology assumes all participants require presbyopic correction. A previous study from Tanzania has suggested not all people aged 50 years and older are in fact presbyopic.[17] Near spectacle use was self-reported and, as such, may be under-reported or over-reported.

The age-adjusted and sex-adjusted prevalence of blindness in the population 50 years and older in Sohag governorate was 5.9% (95% CI 4.8% to 6.9%). This area shares many demographic and cultural characteristics with the wider Upper Egypt region; however, we cannot generalise our findings too broadly. The most recent population-based estimate of blindness (PVA <3/60) for the same age group in Egypt was 7.9% in 2000 in Menofiya governorate in Nile delta. Compared with this finding, the point prevalence estimate of blindness in Egypt has decreased, but is higher than estimates from recent RAAB surveys in the region. Districts in upper-middle income countries, such as Libya, Iran and Jordan, have reported blindness estimates of 2.7%,[18] 1.9%[19] and 1.2%,[20] respectively. Our estimate was also higher than results from districts in other lower-middle income countries in the EMR region, for example, Sudan (4.9%) and Pakistan (4.2%).[20] Only surveys in Sennar state, Sudan (2010) and Lahij and Amran governorates in Yemen (2009) found higher prevalence of blindness of 7.4%, 10.8% and 9.3%, respectively.[20 21]

Cataract was the most common cause of blindness (41.2%), SVI (60.7%) and MVI (45.8%) overall, and in both men and women separately. This is in keeping with the survey in Menofiya in 2000 which also reported cataract as the main cause of 'blindness' (defined as VA <6/60, equivalent to SVI here) at 64%. CSC at that time was reported to be only 13%, although, at which level of vision impairment was not reported.

In Sohag, there are approximately 16 ophthalmologists per million people[5] slightly lower than the WHO target for EMR of 20.[22] At the national level, ophthalmologist density was estimated to be 65.6 per million in 2015; however, only one third (24.6 per million) of these perform cataract surgery.[22]

The density of ophthalmologists in Egypt is higher than the neighbouring countries with lower prevalence of blindness. For example, Libya, Jordan and Iran had 41.4, 44.8 and 21.5 ophthalmologists per million populations, respectively.[23] Although ophthalmologist density may not necessarily be a strong predictor of blindness in a region,[23] advancing the surgical capacity of the ophthalmic human resources available in Egypt should be a priority in efforts to reduce avoidable blindness. The distribution of cataract surgeons relative to population need should be reviewed and strategies to redress imbalances may need to be considered.

The poor quality of cataract surgeries performed was an important contributor to the relatively high prevalence of blindness. Despite CSC for VA<3/60 reaching 90%, when eCSC (a measure of coverage and surgical quality) was considered, this dropped to 45%, and almost a quarter of cataract surgeries resulted in poor visual outcome, much higher than the WHO target of less than 5%.[24] A review of cataract surgical training programmes and skills of trainees may be indicated to identify gaps in training contributing to poor surgical outcomes.

The higher prevalence of SVI and MVI among women compared with men was found to be statistically significant. There was only borderline statistical significance for the difference between the higher female blindness estimate compared with the male blindness estimate; however, this trend is consistent with previous studies in other governorates in Egypt.[11 12] Gender inequity in vision impairment has often been reported to be a consequence of lower utilisation of eye care services by women than men.[25] Gender-specific barriers in this governorate may include the financial burden of seeking eye care, as Sohag has the highest rate of women who are the only source of income for their families (23.5%).[26] Moreover, 53% of women in Sohag were not subscribed to, or beneficiaries of, health insurance compared with 47% for men in 2017.[5]

In this survey, cost and 'need not felt' were the most frequently reported barriers to surgery, similar to previous findings from LMIC.[27] CSC was similar in women and men, suggesting that access to cataract surgical services was not affected by sex. However, when eCSC was considered, the coverage of quality cataract services was higher in men than women. Good outcomes were more likely at private hospitals than government facilities; however, the proportion of eyes operated at each were similar in men and women. Women appears to suffer a cataract surgical quality deficit, but the reason for that is not clear from these data.

Although cataract surgery is provided at no or low cost at teaching and government hospitals, users tend to make out of pocket payments for private sector surgeries, even those who have insurance.[28] Anecdotally, surgery at government hospitals may cost up to $50, while the cost of private surgery ranges from $250 to $500. The type of surgery and associated outcomes are an important influence on service utilisation. Phacoemulsification is typically offered at private facilities, unlike at government hospitals where ECCE is normally performed.[6] A 2014 study reported that, within the public sector, ophthalmologists felt there were a lack of training, supervision and incentives, while managers were concerned with a lack of government financial and technical support.[6]

While more cataract surgeries are needed to address the high prevalence of blindness, improving the proportion of good visual outcomes should occur in parallel. This may require investment in facilities and well-structured training programmes for government ophthalmologists. At the same time, as the private sector is a major service provider, partnerships and innovations in health financing can mitigate out of pocket expenditure on cataract surgery. Both government and private clinics will require ongoing monitoring of cataract surgical outcomes.[29]

Non-trachomatous corneal opacity was the second most common cause of blindness, followed by the other posterior segment diseases and other globe or central nervous system diseases categories. Further information on the

causes of non-trachomatous corneal opacity are not available from this survey but merit further investigation as public health interventions for avoidable causes may be feasible. We found no other relevant literature on the causes of non-trachomatous corneal opacity in the population in Egypt.

Only 17% of participants in the survey sample had refractive errors; however, 75% were uncorrected. As the main cause of mild VI, and considering the likely high burden of near vision impairment, further understanding of barriers to spectacle wear is warranted.

CONCLUSION

The prevalence of blindness in Sohag governorate in Egypt is higher than districts in other middle-income countries in the region. Most of the causes of blindness and vision impairment are avoidable. The gender gap in eye health remains a key issue to be considered by policy makers. Improvements in the quality of cataract surgery are required. Alongside further population-based studies of the prevalence and causes of blindness in Egypt, eye health system assessments should precede planning to better align services with the population need. Building on the capacities of government facilities is critical to increase the utilisation of services and provide quality, equitable eye care. Partnerships with private sector and civil society organisations can be an efficient tool to improve the affordability of the services.

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Contributors HA, MS and GE conceived and planned the presented study. CDM (a certified rapid assessment of avoidable blindness trainer) oversaw delivery of the survey methodology and training of fieldwork teams. HA was responsible for data acquisition and handling. IM and HA reviewed the survey findings and wrote the manuscript with input from all authors.

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Competing interests None declared.

Patient consent for publication Not required.

Ethics approval Ethical approval for the study was obtained from the Egyptian Ministry of Health and Population. The field teams explained the purpose of the study and gained consent prior to data collection (see online supplemental file 1). Participants identified with eye conditions were counselled and referred for further care.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available in a public, open access repository. The data of the study will be available through the RAAB repository at http://raabdata.info/repository/. Unless otherwise stated, content on this website is licensed for re-distribution under the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.

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