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Prevalence and risk factors for visual impairment among elderly residents in 'homes for the aged' in India: the Hyderabad Ocular Morbidity in Elderly Study (HOMES)

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ABSTRACT

Background/Aim To investigate the prevalence, causes and risk factors of visual impairment (VI) among the elderly in 'home for the aged' in Hyderabad, India.

Methods Individuals aged ≥60 years were recruited from 41 'homes for the aged'. All participants had complete eye examinations including presenting visual acuity, refraction, slit-lamp examination, intraocular pressure measurement and fundus imaging by trained clinicians. VI was defined as presenting visual acuity worse than 6/18 in the better eye. Multivariate logistic regression was used to determine the risk factors associated with VI.

Results 1512 elderly residents from 41 homes for the aged were enumerated, of whom 1182 (78.1%) were examined. The mean age of examined participants was 75.0 years (SD 8.8 years; range: 60–108 years); 35.4% of those examined were men. The prevalence of VI was 30.1% (95% CI 27.5 to 32.8). The leading cause of VI was cataract (46.3%, n=165), followed by uncorrected refractive error (27.0%, n=96), posterior capsular opacification (14.9%, n=53) and posterior segment disease (6.5%, n=23). Overall, 88.2% of the VI was either treatable or correctable. In multiple logistic regression, those aged 80 years and older (OR: 1.7, p<0.01), living in 'free' homes (OR: 1.5, p<0.01) and who were immobile/bedridden (OR: 3.02, p<0.01) had significantly higher odds of VI. Gender was not associated with VI.

Conclusions VI was common and largely avoidable in residents of 'homes for the aged' in Hyderabad, India. Screening for vision loss in 'homes for aged' and the provision of appropriate services should become routine practice to achieve the goal of healthy ageing in India.

Ageing is associated with declines in health status, physical function, cognition, frailty, and other physical and physiological functions.[1] Ageing also makes one vulnerable to other health problems, including vision loss. Over 250 million people are visually impaired globally,[2] and 80% of them are 50 years of age or older. A large proportion of this vision loss is avoidable (preventable, treatable or correctable) with relatively simple interventions such as use of spectacles and cataract surgery.[3–7] Vision loss adversely impacts the quality of life of the elderly population[8–10] and is associated with mortality.[11–13] Previous studies have found that vision loss is more common in institutionalised populations and among the elderly in residential care.[14–18]

According to the 2011 Indian census, 8% of the population is aged ≥60 years or 'elderly', and this proportion will increase to 20% by year 2050. This translates to 195 million elderly individuals by year 2030 and 324 million by year 2050.[19] The population of India will grow by 55% by 2050, and the percentage of elderly people will increase by 326%, with those aged ≥80 years increasing by 700%, making them the fastest-growing age group.[19]

The longitudinal Hyderabad Ocular Morbidity in Elderly Study (HOMES)[20] is designed to (1) investigate the prevalence, causes, risk factors and impact of visual impairment (VI) among the elderly individuals living in residential care facilities in Hyderabad (pre-intervention), and (2) assess the impact of interventions such as spectacles and cataract surgery on visual functions, falls, fear of falls and depression (post-intervention). In this paper, we report on the prevalence, causes and risk factors of VI in this study population.

MATERIALS AND METHODS

Participants provided written informed consent. HOMES was carried out in the 'home for the aged' centres in Hyderabad and adjoining regions of the Greater Hyderabad Municipal Corporation in the south Indian state of Telangana.[20] In total, 46 of 76 (60.5%) 'homes for the aged' in this region were selected and invited to participate in the study (including 5 for pilot study). The residents who were aged ≥60 years at the time of enumeration and had been residing in these homes for at least 1 month and agreed to participate were included in the study.

Eye examinations

The details of the design and the study methodology of HOMES were described in our previous report.[20] In brief, the field investigators visited the selected homes and enumerated all residents. Informed consent was obtained, and detailed interviews were conducted. Personal and demographic information such as age, gender, level of education

(years of education) and years of residence in the home and other details were collected using precoded questionnaires. Data were also collected on risk factors such as smoking (never smokers and ever smokers, including current and past smoker) and alcohol consumption (no alcohol and ever alcohol, including current and past alcohol consumption), and a self-report of systemic conditions (diabetes, hypertension and heart disease) and current medication for these conditions. Based on the interviewer's observations and self-report, the mobility status of the participants was classified as 'independently mobile', 'mobile with assistance' and 'immobile/bedridden'. Homes for the aged were classified as (1) private homes, where the individual or their kin pay a monthly or annual user fee; (2) aided/partially subsidised homes, where the individuals or their kin pay a part of the user fee and the rest of the amount is met by philanthropic support or other funding sources; and (3) free homes, where individuals need not pay any user fee as homes are supported by external funding sources.

A 'makeshift' clinic was set up in each of the homes and eye examinations were carried out by trained clinicians that included optometrist and vision technicians. Interviews and the clinical examination were conducted on different days to ensure that elderly participants were adequately rested. Interviews were done prior to the clinical examinations. At least two attempts were made within a period of 2 weeks to enrol participants who were not available at the time of the first visit.

The eye examination included assessment of visual acuity (VA) for distance and near using logMAR (logarithm of the minimum angle of resolution) charts.[20] Distance VA was assessed at a distance of 3 m in a well-illuminated room (at least 180 lux), and near vision was assessed at a fixed distance of 40 cm. The charts with tumbling E optotypes and English letter alphabets were used. Presenting VA and pinhole VA were assessed. Both manual and autorefraction were done. Subjective refraction was performed on all participants and best corrected VA was obtained. The anterior segment of the eye was examined using a handheld portable slit-lamp biomicroscope (BA 904, Haag-Streit Clement Clarke International, UK). Intraocular pressure was measured using a Perkins applanation tonometer (Mk3, Haag-Streit Clement Clarke International, UK). Fundus images were taken through undilated pupils using a non-mydriatic fundus camera (Visuscout 100 Handheld Fundus Camera, Carl Zeiss Meditec, USA). Both disc-centred and macula-centred images were attempted for each eye, which was graded by trained graders. Among those with aphakia or pseudophakia, distance direct ophthalmoscopy was done in a semi-dark room to grade density, area and extent of posterior capsular opacification (PCO) in the pupillary area. This was graded as (1) no posterior capsule, (2) clear posterior capsule (clear fundus glow visible), (3) hazy posterior capsule (dull fundus glow visible or few dark spots visible), (4) opaque posterior capsule (no fundus glow visible), and (5) cannot examine posterior capsule (for reasons such as opaque cornea, absent globe, phthisis bulbi).

The main cause of VI was assigned by the clinician for each eye and then for the person.[20] Where there were multiple causes, based on the clinical examination and the retinal images, the cause that was more likely to explain the vision loss was considered as the main cause in that eye. At the person level, in cases where there were different causes of VI in both the eyes, the cause that was more easily correctable or treatable was assigned. For example, if the cataract was the cause of VI in the right eye and undercorrected/uncorrected refractive error (URE) in the left eye, URE was marked as the main cause of VI and used for analysis. Similarly, if one eye had mature cataract and the other had PCO, then the main cause of VI for the individual was considered PCO as it is easier to address compared with cataract surgery.

VI was defined as presenting VA worse than 6/18 in the better eye. VI was subdivided into blindness (worse than 3/60), severe VI (worse than 6/60–3/60) and moderate VI (worse than 6/18–6/60). VI caused by cataract, URE or PCO was considered as avoidable, which included treatable and correctable causes. All participants who had VI due to URE were provided with spectacles. Those with VI due to other causes such as cataract and/or those who needed further care were referred to the L V Prasad Eye Institute for services. All services and spectacles were provided at 'no cost' to the participants.

Data management

Data were collected using precoded questionnaires and entered in a database developed in Microsoft Access, with validation checks for minimising data entry errors using double data entry. Data analysis was conducted using Stata Statistical Software for Windows V.14.[21] Prevalence estimates were calculated and presented with 95% CI. Multiple logistic regression models were used to examine the strength of association between VI and all the potential risk factors. Hosmer-Lemeshow goodness-of-fit test was used to assess the goodness of the model fit. Variance inflation factors were used to test for collinearity between the covariates after fitting a multiple regression model. Adjusted ORs with 95% CIs were presented. Statistical significance was assessed at the conventional level of p value less than 0.05 (two-tailed).

RESULTS

Study participants

In total, 1513 elderly participants were enumerated from 41 homes for the aged, of whom 1182 (78.1%) were examined, 179 (11.8%) were not available for examination after two attempts and 152 (10.1%) refused to undergo eye examinations. Those examined and non-examined were similar in terms of age (p=0.05) and gender (p=0.31). Participation rates ranged from 80.2% among the free homes, 80.8% in aided/partially subsidised homes and 75.0% in private homes (p=0.03) (table 1). The mean age of examined participants was 75.0 years (SD 8.8 years; range: 60–108 years), and 35.4% (n=418) were men.

Table 1 Characteristics of the participants examined and not examined (n=1513) in the HOMES

	Total enumerated (n)	Examined (n)	Response rate (%)	P value comparing examined and not examined
Age group (years)				0.05
60–69	415	329	79.3	
70–79	604	453	75.0	
80 and above	494	400	81.0	
Gender				0.31
Male	525	418	79.6	
Female	988	764	77.3	
Type of home				0.03
Private home	668	501	75.0	
Aided/partially subsidised	608	491	80.8	
Free	237	190	80.2	
Total	1513	1182	78.1	

HOMES, Hyderabad Ocular Morbidity in Elderly Study.

Table 2 Categories of visual impairment (n=356) among the elderly in residential care

Level of visual impairment	n (%)	95% CI
Moderate visual impairment (worse than 6/18–6/60)	279 (23.6)	21.1 to 26.1
Severe visual impairment (worse than 6/60–3/60)	38 (3.2)	2.3 to 4.4
Blind (worse than 3/60—no perception of light)	39 (3.3)	2.4 to 4.5
Total visual impairment	356 (30.1)	27.5 to 32.8

Of the participants, 20.3% (n=240) had no formal education, 60.7% (n=717) had school education and 19% (n=225) had higher education. Among those examined, 9.2% (n=108) were bedridden or immobile, 32.0% (n=378) were mobile with assistance and 58.8% (n=695) were independently mobile. In total, 42.4% (n=190) of the participants were from private homes, 41.5% (n=491) were from aided/partially subsidised homes and the remaining 16.1% (n=190) were from free homes. More than two-thirds of the participants reported living in homes for less than 5 years (68.2%, n=806), 17.3% (n=205) reported living in homes for 5–9 years, and 14.5% (n=171) reported living in homes for 10 years or more.

Prevalence and causes of VI

Based on presenting VA, the prevalence of VI was 30.1% (95% CI 27.5 to 32.8), which included moderate VI in 279 (23.6%) participants (95% CI 21.1 to 26.1), severe VI in 38 (3.2%) participants (95% CI 2.3 to 4.4), and blindness in 39 (3.3%) participants (95% CI 2.4 to 4.5) (table 2). Using a better level of cut-off and defining VI as presenting VA worse than 6/12 in the better eye, the prevalence of VI was 52.7% (95% CI 49.8 to 55.6) (table 2). The leading cause of VI was cataract (46.4%, n=165), followed by URE (27.0%, n=96) and PCO (14.9%, n=53). Posterior segment disease was a cause of VI in 6.5% (n=23) of the cases and included age-related macular degeneration (n=9), optic atrophy (n=7), diabetic retinopathy (n=1) and other retinal conditions (n=7). Overall, 88.2% of the VIs were either treatable or correctable (table 3). The causes of VI stratified by categories of VI are shown in figure 1.

Table 3 Distribution and prevalence of causes of visual impairment (n=356) among the elderly

Cause	n	Cause-specific prevalence (95% CI)	% of the total visual impairment
Cataract	165	14.0 (12.0 to 16.1)	46.3
Uncorrected refractive errors	96	8.1 (6.6 to 9.8)	27.0
Posterior capsular opacification	53	4.5 (3.4 to 5.8)	14.9
Glaucoma	9	0.8 (0.3 to 1.4)	2.5
Age-related macular degeneration	9	0.8 (0.3 to 1.4)	2.5
Optic atrophy	7	0.6 (0.2 to 1.2)	2.0
Other posterior segment disease*	7	0.6 (0.2 to 1.2)	2.0
Corneal scar	5	0.4 (0.1 to 10)	1.4
Other causes†	5	0.4 (0.1 to 10)	1.4
All causes	356	30.1 (27.5 to 32.8)	100.0

*Includes diabetic retinopathy (n=1), healed chorioretinitis (n=1), myopic retinal degeneration (n=1) and other retinal conditions (n=2).
†Includes glaucoma, phthisis bulbi (n=3) and unexplained vision loss (n=2).

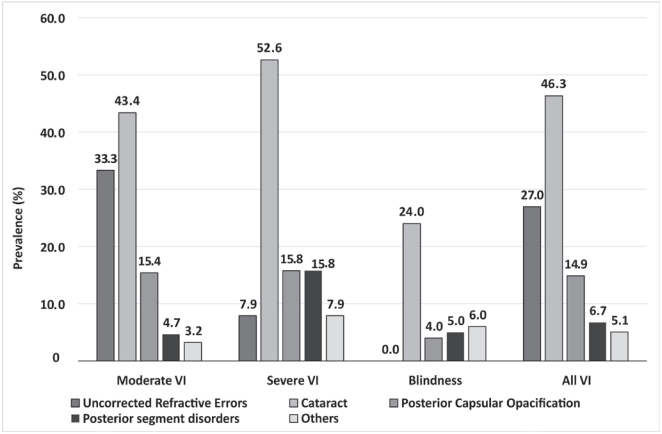

Figure 1 Distribution of causes stratified by categories of visual impairment (VI) (n=356).

VI and associations

In multivariate logistic regression analysis, those aged 80 years and older had higher odds of VI (OR: 1.70; 95% CI 1.6 to 2.47) compared with their younger counterparts. Compared with those with no formal education, those with school education (OR: 0.35; 95% CI 0.25 to 0.49) or higher education (OR: 0.21; 95% CI 0.13 to 0.35) had lower odds of VI. When compared with those residing in private homes, those living in free homes (OR: 1.51; 95% CI 1.00 to 2.30) had higher odds of VI. VI was more common in those with shorter length of stay in the homes. Compared with those living in residential care for less than 5 years, those who resided for 5–9 years had similar odds of VI (OR: 0.82; 95% CI 0.56 to 1.20), while those residing for 10 years or more had lower odds of VI (OR: 0.46; 95% CI 0.30 to 0.72). Compared with the elderly who were independently mobile, those with mobility with assistance (OR: 1.44; 95% CI 1.06 to 2.16) and those who were immobile/bedridden (OR: 3.02; 95% CI 1.91 to 4.80) had significantly higher odds of VI. Smoking status, alcohol consumption, gender and heart disease were not associated with VI. Those reported to have diabetes had lower odds of VI (OR: 0.68; 95% CI 0.49 to 0.96). The odds were also lower for those who self-reported hypertension (OR: 0.67; 95% CI 0.50 to 0.88) (table 4).

DISCUSSION

Nearly one-third of the elderly individuals living in homes for the aged centres in Hyderabad had bilateral presenting vision worse than 6/18 and 52% had bilateral presenting VA of 6/12 or worse. Furthermore, over 3% were blind. A large proportion of this VI (88%) was avoidable with either cataract surgery, glasses or laser treatment (for posterior capsule opacification). We previously reported a higher prevalence of VI (56.7% vs 30% in the present study) in residential care homes in Prakasam district in India in 2012.[18] This difference could be due to a few factors. First, Prakasam is a rural district and access to eye care services may be even more limited compared with the urban location of the present study. Second, there has been an expansion of eye care services in the region since the previous research was conducted and more residents are likely to have received care, leading to a lower prevalence. However, the burden of vision loss remains high and needs to be addressed.

Studies done among the elderly institutionalised populations from other parts of the world report large variability in the prevalence and causes of VI. The prevalence of VI is higher in studies reported from developing countries when compared

Table 4 Association of visual impairmentwith sociodemographic characteristics and systemic conditions (multiple logistic regression analysis) (n=1182)

	Total in the sample (n)	Visual impairment, n (%)	OR (95% CI)*†‡	P value
Age group (years)				
60–69	329	85 (25.8)	Reference	
70–79	453	123 (27.1)	1.09 (0.76 to 1.56)	0.63
80 and above	400	148 (37.0)	1.70 (1.16 to 2.47)	<0.01
Gender				
Male	418	117 (28.0)	Reference	
Female	764	239 (31.3)	0.98 (0.66 to 1.45)	0.91
Education level				
No education	240	129 (53.7)	Reference	
School education	717	188 (26.2)	0.35 (0.25 to 0.49)	<0.01
Higher education	225	39 (17.3)	0.21 (0.13 to 0.35)	<0.01
Marital status				
Married	254	55 (21.7)	Reference	
Widowed/separated/single	928	301 (32.4)	1.64 (1.14 to 2.36)	0.01
Home type				
Private	501	136 (27.1)	Reference	
Aided/partially subsidised	491	142 (28.9)	1.21 (0.87 to 1.66)	0.25
Free	190	78 (41.0)	1.51 (1.00 to 2.3)	0.05
Years of residence at the home				
<5	806	264 (32.7)	Reference	
5–9	205	57 (27.8)	0.82 (0.56 to 1.20)	0.31
≥10	171	35 (20.5)	0.46 (0.30 to 0.72)	<0.01
Diabetes				
No	851	286 (33.6)	Reference	
Yes	331	70 (21.1)	0.68 (0.49 to 0.96)	0.02
Hypertension				
No	503	177 (35.2)	Reference	
Yes	679	179 (26.4)	0.67 (0.50 to 0.88)	0.01
Heart disease				
No	1065	332 (31.1)	Reference	
Yes	117	24 (20.5)	0.77 (0.47 to 1.27)	0.31
Smoking status				
Never	976	293 (30.0)	Reference	
Current/past	206	63 (30.6)	1.10 (0.69 to 1.78)	0.68
Alcohol consumption				
Never	971	282 (29.0)	Reference	
Current/past	211	74 (35.1)	1.42 (0.94 to 2.16)	0.09
Mobility score				
Fully independent	696	166 (23.9)	Reference	
Mobile with support	378	135 (35.7)	1.44 (1.06 to 2.0)	0.02
Immobile/bedridden	108	55 (50.9)	3.02 (1.91 to 4.80)	<0.01
Total	1182	356 (30.1)		

*Based on multiple logistic regression with visual impairment as the outcome and all the predictors entered at the same time.
†Hosmer-Lemeshow test for goodness of fit for the regression model, p=0.64.
‡Mean variance inflation factor for the multiple logistic regression model=1.28.

with those in developed countries. For example, using a similar definition for VI, a study among the elderly in residential care in Nepal reported an overall prevalence of 31.9%, which was higher than what we found in this study.[22] Using the <6/12 definition, the prevalence of VI among the elderly in residential care in Singapore and Australia was 46.4% and 41.5%, respectively, compared with 51.5% in the present study. This difference in the prevalence can be attributed to the mean age of the participants in these studies and due to other factors.[8 14] Few studies in the USA have reported the prevalence of VI among those in residential care. Tielsch *et al*[23] in 1995 reported a very low prevalence of VI (15.2%), and Owsley *et al*[15] reported that over 57% of those examined had VI. However, Tielsch *et al* included all individuals in residential care, including those aged 40 years and older, whereas Owsley *et al* included participants aged 55 and older. Using the same definition <6/12 definition for VI, West *et al* in 2003 reported a 38% prevalence of VI among nursing home residents in the USA, and this prevalence declined to 29% after refractive correction.[24]

The two most common causes of VI were cataract and URE, a finding that is common to almost all population-based prevalence surveys in adults.[18] Of note, PCO was the third leading cause of VI and this was a novel finding in our study. One explanation is the high rate of cataract surgery in Hyderabad, resulting in large numbers of elderly who are pseudophakic. Access to a Nd:YAG (Yttrium Aluminum Garnet) laser may not be simple, and many in the home for the aged do not receive routine eye care, and thus easy-to-manage cases of PCO remain unattended. One possible solution is the development and wider use of portable YAG laser for treating PCO in elderly homes. This may be necessary as poor mobility, poor systemic health and access to care remain major barriers to the uptake of services in the elderly. The elderly with poor mobility were at a higher risk for VI, as has been reported in other studies done in nursing homes.[18 25 26] This could either be a risk factor or it could be a cause of VI as those with poor vision are less mobile.

The elderly with poor mobility cannot independently attend eye examinations, and hence a higher prevalence of VI was an expected finding. Access to care is likely an important factor in determining who has VI in these facilities. Residents in private homes had better visual status compared with those living in aided/partially subsidised care, and even better vision than those in free homes. This suggests that those with more resources are more likely to access eye care. 'Homes for the aged' in India lack regulatory oversight, leading to considerable variation in services provided. There are often no standard operating procedures in these homes, and no state-wide regulations requiring regular eye examinations.

As expected, age was a major risk factor of VI. However, gender was not associated with the prevalence of VI, which is in contrast to what is reported in the recent Global Burden of Disease studies and other studies from India.[2 27] Our earlier study in elderly people in Prakasam district also did not find a significant association between VI and gender.[18] It may be that the overall effect of being institutionalised levels the playing field in terms of access to care, and therefore men are equally as likely as women to have VI. Those with diabetes and hypertension were less likely to have VI, and there was no significant association between smoking, alcohol consumption and VI. The most likely explanation is 'survival bias', where those elderly individuals with more serious morbidity from these conditions either never entered the homes or were more likely to die after entry, leaving the more healthy ones in the homes. It is also possible that those with diabetes and hypertension are more likely to attend health checks and also eye check-up. Also, home authorities may be biased about admitting individuals with significant morbidity, which may impact the resources available to them. Nursing homes and rehabilitation centres would be more likely to have a higher burden of severe disease than the homes for the aged centres.

Our study is one of the most comprehensive eye health studies done among the elderly in India. The inclusion of a large number of 'homes for the aged' as well as a large number of individuals examined combined with the high response rate are important strengths of our study. Of the total number of homes

in Hyderabad, 60% participated in our study. Our inability to carry out dilated fundus examination may have led to an underestimation of the prevalence of posterior segment disease especially in cases of dense cataract. While we took fundus images to help in making an accurate diagnosis of the posterior segment disorders, some of these images were not gradable due to cataract and other media opacities.

In conclusion, we found that the elderly individuals living in 'homes for the aged' in Hyderabad have a high burden of treatable or correctable vision loss. The results likely can be extrapolated to other urban locations in India. Strategies are needed to reach out to this elderly and vulnerable population, to implement vision screening, and to provide eye care. As the Indian population ages, there will be an increasing burden of vision loss in these homes. Screening for vision loss in 'homes for the aged' should become standard practice similar to that of school screening programmes to ensure that this vulnerable population does not suffer due to needless vision loss in their 'sunset' years of life.

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Contributors SM conceived the idea, designed and conducted the study, analysed the data, and wrote the manuscript. NRB, RC, TRK, SBM and MB are involved in data collection. RY assisted in data management. RCK and DF reviewed the earlier version of the manuscript and provided intellectual input.

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Competing interests None declared.

Patient consent for publication Not required.

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Visual outcomes after cataract surgery among the elderly residents in the 'homes for the aged' in South India: the Hyderabad Ocular Morbidity in Elderly Study

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ABSTRACT

Background/Aim To report visual outcomes and factors associated with good visual outcomes after cataract surgery among the elderly residents in 'homes for the aged' in Hyderabad, India.

Methods Individuals aged ≥60 years were recruited from 41 'homes for the aged'. All participants had a detailed eye examinations including visual acuity (VA) assessment , refraction, slit-lamp examination and fundus imaging by trained professionals. A detailed history of cataract surgery was recorded. Multivariate logistic regression was used to determine the factors associated with good visual outcomes after cataract surgery which was defined as presenting VA of 6/18 or better in the operated eye. Visual impairment (VI) is defined as presenting VA worse than 6/18 in the operated eye.

Results 1215 eyes of 703 individuals had cataract surgery. The mean age of these participants was 77.5 years (SD: 8.2 years; range: 60–108 years), 66.8% were women, 29.9% reported diabetes and 61% reported hypertension. 406/1215 (33.4%; 95% CI 30.8 to 36.1) eyes had VI after cataract surgery. Posterior capsular opacification (31.8%; n=129) was the leading cause of VI followed by uncorrected refractive error (24.1%; n=98). The prevalence of good outcomes was 66.6% (95% CI 63.8 to 69.2). On applying multivariable analysis, younger age, self-reported hypertension, independent mobility, surgery in a non-government (as opposed to private) hospital and undergoing paid surgery were associated with good outcomes.

Conclusions One-third of the eyes of elderly individuals living in homes for the aged that had previously undergone cataract surgery had VI. Regular eye examinations with the provision of laser capsulotomy and appropriate refractive correction can substantially improve their vision.

Cataract is the leading cause of visual impairment (VI) worldwide, affecting 65.2 million people.[1] Cataract surgery is a cost-effective, safe and predictable procedure,[2] which improves quality of life and visual function.[3–5] Yet, millions suffer from vision loss due to cataract, and some who are operated have poor vision due to issues with the quality of eye surgery or pre-existing eye conditions.[6–10] In India, nearly 30% of operated eyes remain vision impaired due to uncorrected refractive errors (UREs), posterior segment diseases and surgical complications.[6–9] The Andhra Pradesh Eye Disease Study (APEDS) found that 50% of the operated eyes had VI in Hyderabad, India, in the year 1999.[11] However, studies conducted later in the states of Telangana and Andhra Pradesh reported better outcomes, with less than 30% having VI after cataract surgery.[7 8] These and many other studies of cataract outcomes were population-based[6 8 11]; no studies have been on visual outcomes in individuals living in residential care in India.

One important effect of urbanisation and societal change in India is the increasing number of 'homes for the aged', especially in urban and semiurban locations. The Hyderabad Ocular Morbidity in Elderly Study (HOMES) was undertaken to understand the eye health situation of the elderly in residential care in Hyderabad, India.[12] We previously reported a large burden of avoidable vision loss and UREs in this population.[13 14] In this paper, we report on the visual outcomes of cataract surgery in a large cohort of residents living in these homes in South India.

MATERIALS AND METHODS

The study protocol was approved by the Institutional Review Board of the Hyderabad Eye Research Foundation, L V Prasad Eye Institute, Hyderabad, India, and was carried out following the Declaration of Helsinki. All participants provided written informed consent. The HOMES protocol has been published.[12]

The participating homes for the aged facilities have been described in our previous publications.[12–14] Briefly, homes for the aged are a recent phenomenon in India and hence not a well-organised sector. The homes are diverse both in terms of scope, amenities provided and the number of elderly living in them and are typically run by non-governmental (NGO), religious or voluntary organisations with support from the government and philanthropists (free and subsidised homes). In private homes, either the elderly person or their kin pay the user fee. Some private homes have nursing staff to attend to medical needs and other support staff to assist elderly residents in their routine tasks.[12–14]

In HOMES, a total of 46/76 (60.5%) homes for the aged who agreed to participate in the study (including 5 for pilot study) were included.[13 14] A total of 16/76 (21.1%) homes were not interested in participation in the study. The residents who were aged ≥60 years at the time of enumeration and residing in these homes for at least 1 month and agreed to participate were included in the study. All the residents in the selected homes were enumerated, and all those who were available and provided consent were examined. A total of 1512 elderly residents were enumerated, of which 1182 participants (78.1%) were examined. Those examined and not examined were similar in terms of gender (p=0.31); however, the mean age of these examined was slightly higher (75.0 years vs 74.2 years; p=0.05).[13 14]

Detailed personal and demographic information, systemic and ocular history were collected. The ocular history included information on previous eye examinations, current and past use of spectacles as well as medical and surgical history. If a participant reported having undergone cataract surgery, details of the cataract surgery were recorded such as the place of surgery (government hospital which typically provides free surgeries), private hospital (provides paying surgeries only) or NGO-run hospital (provides both paying and non-paying surgeries, as is done in L V Prasad Eye Institute), cost of surgery (free or paid) and time since surgery. If any surgical reports were available for the participants, they were reviewed, and details were documented. Systemic history included self-report of hypertension or diabetes. Apart from this, mobility status based on the interviewer's observations and self-report was classified as 'independently mobile', 'mobile with assistance' or 'immobile/bedridden'.

All participants underwent a comprehensive eye examination as described previously.[12] In brief, monocular distance visual acuity (VA) was assessed using a logMAR (minimum angle of resolution) chart at a distance of 3 m under ambient lighting conditions. Refraction was done and the best-corrected VA was recorded. Slit-lamp examination was conducted using a portable slit lamp, and intraocular pressure was measured using a Perkins handheld tonometer. Fundus images of the disc and macula were captured using a non-mydriatic fundus camera (Visuscout 100 Handheld Fundus Camera, Carl Zeiss Meditec, Dublin, CA, USA). Among those with aphakia or pseudophakia, a slit-lamp examination and distance direct ophthalmoscopy were done in a semidark room to grade density, area and the extent of posterior capsular opacification (PCO) in the pupillary area. This was graded as (a) no posterior capsule, (b) clear posterior capsule (clear red glow), (c) hazy posterior capsule (dull red glow), (d) opaque posterior capsule (no red glow visible) and (e) cannot examine the posterior capsule (for reasons such as the opaque cornea, absent globe, phthisis bulbi).[12 13]

Definitions

Good visual outcome was defined as presenting VA of 6/18 or better in the operated eye (definition 1). We also analysed visual outcomes using presenting VA of 6/12 or better in the operated eye to define a good visual outcome (definition 2). Among those who had bilateral cataract surgery, VA in the better-seeing eye was used to define VI and good outcome. The revised Indian categories of VI, which now include a definition for severe VI, were used, and these included moderate VI (VA worse than 6/18–6/60), severe VI (VA worse than 6/60– 3/60), and blindness (VA worse than 3/60 to no perception of light).[15]

URE was deemed to be present if the presenting VA improved to at least 6/18 with refraction (best correction).[7 8] Whenever there were multiple causes, based on the clinical examination and the retinal images, the cause which most likely explained the vision loss in the eye was considered the primary cause. In cases of bilateral surgery where there were different causes of VI in each eye of a participant, the cause that was more easily correctable or treatable to regain vision was considered the primary cause for that participant. For example, if URE was the main cause of VI in one eye and PCO in the other eye, then URE was considered as the main cause and used for analysis.[12 13] VI due to URE or PCO was considered as avoidable. Effective cataract surgical coverage (eCSC) was defined as the number of people with a good outcome after cataract surgery divided by the number with vision-impairing cataract plus those operated for cataract.[16] To enable comparison with recent studies, the mild VI category (presenting VA worse than 6/12–6/18) as proposed by WHO was also used.[17]

Data management

Data analysis was conducted using Stata statistical software version 14 (StataCorp LP, TX).[18] The prevalence of postoperative good visual outcomes was calculated and presented with 95% CIs. Univariable and multivariable analyses were conducted to explore the factors associated with good outcomes. Multiple logistic regression was done using generalised estimating equation along with robust variance estimation to account for correlation between the two eyes of an individual. In the regression models, 'good outcome' was considered a dependent variable, with covariates being age group, gender, education (no formal education/any education), type of home (free, aided or private), place of surgery (private hospital, government hospital or non-government hospital), cost of surgery (free/paid), time from eye surgery (0–5 years, 6–10 years or >10 years), diabetes (yes/no), hypertension (yes/no) and mobility score. Eyes offering no visualisation of the lens (n=3) and those with aphakia (n=39) were excluded from this analysis.

RESULTS

Overall, 1182 participants were examined from 41 homes for the aged in Hyderabad with 703 (59.5%) having had cataract surgery in at least one eye. The mean age of those who had cataract surgery was 77.5 years (SD: 8.2 years; range: 60–108 years), 470 (66.8%) were women, 389 (55.3%) had independent mobility, 245 (34.9%) needed assistance for mobility and 69 (9.8%) were bedridden; 210 (29.9%) reported diabetes and 429 (61%) reported hypertension, 113 (16.1%) reported current/past smoking and 105 (14.9%) reported current/past alcohol consumption. The prevalence of unilateral cataract surgery was 16.2% (95% CI 14.1 to 18.4; n=191) and bilateral surgery was 43.3% (95% CI 40.5 to 46.2; n=512). While unilateral cataract surgery was highest among those aged 70–79 years, bilateral cataract surgery was highest among those aged ≥80 years (table 1). The eCSC for persons with VA threshold of 6/18 and 6/12 was 69.0% and 40.9%, respectively.

Operated eyes

A total of 1215 eyes of 703 individuals were operated for cataract; 1173 (96.8%) had intraocular lens (IOLs) implantation, 39 (3.2%) were aphakic. There was no view of the lens in 3 cases. Of the operated eyes, 527 (45.2%) eyes were operated within the last 5 years, 404 (34.6%) operated 6–10 years ago and 236 (20.2%) eyes operated more than 10 years ago. A total of 750 (64.3%) surgeries were done in private hospitals compared to 280 (24.0%) in non-government hospitals and 137 (11.7%) in government hospitals; 776 (66.5%) were free surgeries while 319 (33.5%) were paid surgeries. In all, 30 participants (n=48 eyes) could not

Table 1 Characteristics of the participants who had undergone cataract surgery in either eye (n=703)

	Unilateral surgery		Bilateral surgery		Total	
	n	%	n	%	n	%
Age group (in years)						
60–69	52	27.2	58	11.3	110	15.6
70–79	78	40.8	202	39.5	280	39.8
≥80	61	31.9	252	49.2	313	44.5
Gender						
Male	63	33.0	170	33.2	233	33.1
Female	128	67.0	342	66.8	470	66.9
Hypertension						
Yes	109	57.1	320	62.5	429	61.0
No	82	42.9	192	37.5	274	39.0
Diabetes						
Yes	60	31.4	150	29.3	210	29.9
No	131	68.6	362	70.7	493	70.1
Mobility score						
Immobile/bedridden	19	9.9	50	9.8	69	9.8
Mobile with support	60	31.4	185	36.1	245	34.9
Independent	112	58.6	277	54.1	389	55.3
Smoking						
Never	156	81.7	434	84.8	590	83.9
Past/current	35	18.3	78	15.2	113	16.1
Alcohol						
Never	152	79.6	446	87.1	598	85.1
Past/current	39	20.4	66	12.9	105	14.9
Total	**191**	100.0	**512**	100.0	703	100.0

Table 2 Characteristics of the eyes operated for cataract among the elderly residents in homes for the aged (n=1215)

	Total operated eyes (n=1215)	Good outcomes Definition 1 (presenting visual acuity 6/18 or better) (n=809)		Good outcomes Definition 2 (presenting visual acuity 6/12 or better) (n=508)	
	n (%)	n (%)	P value		P value
Lens status*			<0.001		<0.01
Aphakia	39 (3.2)	14 (1.7)		6 (1.2)	
Pseudophakia	1173 (96.8)	795 (98.3)		502 (98.8)	
Years lapsed after surgery†					
<5	527 (45.2)	372 (47.1)	0.089	238 (47.8)	0.01
6–10	404 (34.6)	270 (34.2)		179 (35.9)	
>10	236 (20.2)	148 (18.7)		81 (16.3)	
Place of surgery†,‡					
Government hospital	137 (11.7)	65 (8.2)	<0.001	27 (5.5)	<0.001
Non-governmental organisation hospital	280 (24.0)	188 (23.8)		117 (23.9)	
Private clinic	750 (64.3)	537 (68.0)		345 (70.6)	
Cost of surgery†,‡			<0.001		<0.001
Free surgery	391 (33.5)	227 (28.7)		120 (24.1)	
Paid surgery	776 (66.5)	563 (71.3)		378 (75.9)	

*No view of the lens in three eyes.
†Data not available in 48 eyes.
‡Data not available in 28 eyes.

Table 3 Prevalence of visual impairment (VI) following cataract surgery among the elderly in residential care

	Eyes (n=1215)		Persons (n=512)	
	n	Prevalence (95% CI)	n	Prevalence (95% CI)
Moderate VI (presenting visual acuity worse than 6/18–6/60)	287	23.6 (21.3 to 26.1)	78	15.2 (12.2 to 18.6)
Severe VI (presenting visual acuity worse than 6/60–3/60)	46	3.8 (2.8 to 5.0)	11	2.1 (1.1 to 3.8)
Blindness (presenting visual acuity worse than 3/60 to no light perception)	73	6.0 (4.7 to 7.5)	6	1.2 (0.4–2.5)
All VI	**406**	**33.4 (30.8 to 36.1)**	**95**	**18.5 (15.3 to 22.2)**

recall the details of the surgery such as where surgery was performed or who paid for surgery or it is free. On applying univariable analysis, good visual outcome (defined by presenting VA better than 6/18) after cataract surgery was associated with pseudophakia, place of surgery and cost of surgery (table 2). The outcomes were better among those with an IOLs (98.3%) and those operated less than 5 years ago (47.1%). Those in private clinics (68%) had better outcomes compared to NGO hospitals (23.8%) and government hospitals (8.2%). Paid surgeries had a better outcome than free surgeries (71.3% vs 28.7%; p<0.001). The results were similar when definition 2 (presenting VA 6/12 or better) was used except that a shorter time since surgery was associated with good VA after cataract surgery (p<0.01).

Of the 406/1215 (33.4%; 95% CI 30.8 to 36.1) eyes that had VI after cataract surgery, 287 (23.6%; 95% CI 21.3 to 26.1) eyes had moderate VI, 46 (3.8%; 95% CI 2.8 to 5.0) eyes had severe VI and 73 (6%; 95% CI 4.7 to 7.5) eyes were blind (table 3). PCO (31.8%; n=129) was the leading cause of VI, followed by URE (24.1%; n=98), posterior segment disease/unexplained vision loss (10.1%; n=41) and age-related macular degeneration (8.6%; n=35). In total, 55.9% of the VI was due to avoidable causes. In addition, mild VI (presenting VA 6/12–6/18) was present in 301/1215 (24.8%; 95% CI 22.3 to 27.3) operated eyes of which about 66% was due to avoidable causes (URE—41.5% (n=125) and PCO—24.6% (n=74).

VI after cataract surgery (persons)

In total, 95/512 (18.5%, 95% CI 15.3 to 22.2) people who had VI after bilateral cataract surgery included 78 (15.2%; 95% CI 12.2 to 18.6) participants with moderate VI, 11 with severe VI (2.1%; 95% CI 1.1 to 3.8) and 6 (1.2%; 95% CI 0.4 to 2.5) with blindness. PCO (33.7%; n=32) and URE (33.7%; n=32) were the leading causes of VI, followed by glaucoma (7.4%; n=7), age-related macular degeneration (6.3%; n=6) and optic atrophy (6.3%; n=6) (table 4). In total, 67.4% of the VI was due to avoidable causes. A large proportion of blindness was due to unavoidable causes, whereas a large portion of moderate and severe VI was due to avoidable causes. In addition, mild VI (presenting VA 6/12–6/18) was present in 130/512 (25.4%; 95% CI 21.7 to 29.4) participants who had bilateral cataract surgery of which 65.3% were due to avoidable causes (URE—46.1% (n=60) and PCO—19.2% (n=25)).

Table 4 The cause of vision impairment following cataract surgery in the elderly in residential care

	Moderate vision impairment (presenting visual acuity worse than 6/18–6/60 in the better-seeing eye) (%)	Severe vision impairment (presenting visual acuity worse than 6/60–3/60 in the better-seeing eye) (%)	Blindness (presenting visual acuity worse than 3/60 to no light perception in the better-seeing eye) (%)	Total vision impairment (presenting visual acuity worse than 6/18 to no light perception in the better-seeing eye) (%)
VI causes—eyes (n=1215)				
	n=287	n=46	n=73	n=406
Posterior capsule opacification (PCO)	35.9	28.3	17.8	31.8
Uncorrected refractive error (URE)	32.1	4.3	5.5	24.1
Other posterior segment disorders	8.4	13.0	15.1	10.1
Age-related macular degeneration	4.9	13.0	20.5	8.6
Glaucoma	6.3	8.7	13.7	7.9
Optic atrophy	5.2	13.0	8.2	6.7
Other causes	3.5	6.5	5.5	4.2
Corneal scar	1.7	4.3	11.0	3.7
Diabetic retinopathy	1.0	4.3	1.4	1.5
Chorioretinal scars	1.0	4.3	1.4	1.5
	100.0	**100.0**	**100.0**	**100.0**
Causes—persons (n=512)				
	n=78	**n=11**	**n=6**	**n=95**
URE	38.5	18.2	0.0	33.7
PCO	37.2	18.2	16.7	33.7
Glaucoma	7.7	0.0	16.7	7.4
Age-related macular degeneration	3.8	18.2	16.7	6.3
Optic atrophy	5.1	9.1	16.7	6.3
Other posterior segment disorders	3.8	9.1	16.7	5.3
Corneal scar	1.3	9.1	16.7	3.2
Other causes	1.3	9.1	0.0	2.1
Diabetic retinopathy	1.3	0.0	0.0	1.1
Chorioretinal scars	0.0	9.1	0.0	1.1
	100.0	**100.0**	**100.0**	**100.0**

Among the participants who had bilateral cataract surgery and had VI postsurgery, URE was the leading cause of VI in the age group of 60–69 years and 70–79 years, whereas PCO was the leading cause in participants aged ≥80 years (p<0.01). URE was the leading cause among those without any education and PCO was the leading cause among those who were educated (p<0.01). While the causes of VI did not vary with diabetes status (p=0.17), those with self-reported hypertension had PCO as the leading cause of VI compared to URE among those without hypertension (p<0.01). PCO was the leading cause of VI (68.8%) among the participants who were immobile/bedridden, while URE was the leading cause in those who had mobility with support or independently mobile (p<0.05). The causes of VI did not vary with gender (p=0.29).

The association of causes of VI after cataract surgery with place of surgery, paid versus free surgery and duration in years since surgery was assessed. Posterior segment disease was the leading cause of VI after cataract surgery though its proportion varied with place of surgery; it was not statistically significant (p=0.30). Posterior segment disease (38.4%), URE (28.7%) and PCO (21.9%) were the causes among free surgeries compared to posterior segment disease (36.1%), URE (24.7%) and PCO (30.5%) among paid surgeries (p<0.01). The causes of VI did not vary with duration since surgery (p=0.16).

Risk factors related to visual outcomes after cataract surgery

On applying multiple logistic regression analysis, those ≥80 years had substantially lower odds of good outcomes (definition 1), though this was not statistically significant (OR: 0.68; 95% CI 0.44 to 1.04). Those with self-reported hypertension were more likely to have good visual outcomes (OR: 1.45; 95% CI 1.10 to 1.91). Compared to those who were bedridden, the odds of good outcomes were higher for those who needed assistance for mobility (OR: 1.69; 95% CI 1.07 to 2.67) and also for those who were independently mobile (OR: 2.34; 95% CI 1.50 to 3.66). Having been operated on in a NGO-run hospital (OR: 1.91; 95% CI 1.19 to 3.08) and undergoing paid surgery (OR: 1.64; 95% CI 1.09 to 2.50) had higher odds for good outcomes. Length of time after surgery and self-report of diabetes was not associated with outcomes (table 5). Similar associations were found when definition 2 (presenting VA 6/12 or better) was used as a good outcome except for a positive association between self-report of diabetes and good outcomes.

DISCUSSION

One-third of the eyes of elderly residents living in homes for the aged in Hyderabad, India, had VI (defined as presenting VA worse than 6/18) after cataract surgery. This increased to 58.2% when VI was defined as VA worse than 6/12. Nearly 20% of those who had undergone bilateral cataract surgery had bilateral VI defined

Table 5 Multivariable logistic regression analysis (generalised estimating equation) showing the factors associated with good visual outcomes after cataract surgery with intraocular lens implantation

	Adjusted OR (95% CI) for good outcomes Definition1 (presenting visual acuity 6/18 or better)	P value	Adjusted OR (95% CI) for good outcomes Definition 2 (presenting visual acuity 6/12 or better)	P value
Age group (years)				
60–69	Reference		Reference	
70–79	1.16 (0.76 to 1.78)	0.47	1.04 (0.71 to 1.52)	0.83
≥80	0.68 (0.44 to 1.04)	0.78	0.71 (0.48 to 1.07)	0.10
Gender				
Male	Reference		Reference	
Female	0.96 (0.66 to 1.38)	0.81	0.85 (0.60 to 1.20)	0.60
Hypertension				
No	Reference		Reference	
Yes	1.45 (1.10 to 1.91)	0.01	1.01 (0.78 to 1.31)	0.94
Diabetes				
No	Reference		Reference	
Yes	1.24 (0.91 to 1.68)	0.17	1.51 (1.15 to 1.98)	<0.01
Mobility score				
Immobile/bedridden	Reference		Reference	
Mobile with support	1.69 (1.07 to 2.67)	0.02	1.56 (0.96 to 2.52)	0.07
Independent	2.35 (1.50 to 3.66)	<0.01	1.95 (1.23 to 3.10)	0.01
Smoking				
Never	Reference		Reference	
Past/current	0.88 (0.54 to 1.44)	0.60	1.05 (0.67 to 1.65)	0.82
Alcohol				
Never	Reference		Reference	
Past/current	1.37 (0.86 to 2.19)	0.19	1.20 (0.79 to 1.83)	0.40
Years after surgery				
<5	Reference		Reference	
6–10	0.95 (0.70 to 1.28)	0.74	1.15 (0.87 to 1.52)	0.34
>10	0.99 (0.68 to 1.44)	0.96	0.82 (0.57 to 1.18)	0.29
Place of surgery				
Government hospital	Reference		Reference	
Non-governmental organisation (NGO)-run hospital	1.91 (1.19 to 3.08)	0.01	2.69 (1.55 to 4.66)	<0.01
Private clinic	1.67 (0.96 to 2.90)	0.07	2.21 (1.20 to 4.08)	0.01
Cost of surgery				
Free surgery	Reference		Reference	
Paid surgery	1.65 (1.09 to 2.49)	0.02	1.90 (1.28 to 2.81)	<0.01

as presenting vision worse than 6/18 in both eyes.[19] A large proportion of VI was moderate with only a small proportion having severe VI or blindness. PCO was the leading cause of VI, a unique finding though earlier studies also had reported it as one cause of VI, but not the number one cause.[20] The APEDS reported that half of the operated eyes in Hyderabad in 1999 had VI after cataract surgery.[11] In 2009, another study that included urban areas of Andhra Pradesh reported better outcomes compared to the 1999 study, with 22.4% of operated eyes having poor outcomes after cataract surgery, similar to the findings of the present study among elderly in residential care.[8]

Several population-based studies from the rest of India have reported on visual outcomes after cataract surgery, and[7 8 20–22] URE is the leading cause for poor outcomes.[7–9 11 20] We confirm the importance of UREs, but in this study, PCO was the leading cause. The younger participants in earlier population-based studies compared to our study may explain to some extent the higher PCO rates in our study. We also actively assessed for PCO using a standardised grading system. Others may have missed this as a cause of VI due to the examination protocols used.

The higher prevalence of cataract surgery in older age groups and among women in our study is similar to that in earlier studies from this region.[9 11] We found a very high prevalence of bilateral cataract surgery in our study population, indicating that cataract surgical services are both available as well as accessed by the elderly in this urban region. As in previous studies, we found poorer visual outcomes in older age groups.[7 8 11] This is likely due to ocular co-morbidities that are more common in older age groups as well as time since surgery resulting in a lower likelihood of having appropriate spectacles and a higher likelihood of having PCO. We also found that the odds were higher for good outcomes among those with self-reported hypertension. As our definition of hypertension relied on self-report, it is probable that this association is due to better access to

healthcare and possibly increased utilisation of health facilities by those who reported hypertension. However, we did not find a significant association between self-reported diabetes and visual outcomes (6/18 definition) following cataract surgery though a positive association was found for definition 2 (6/12 definition). Those with diabetes who end up in homes for the aged may be survivors and healthier, and/or may have been undergoing regular health check-up, which helped detection and management of ocular conditions resulting in better outcomes.

Eyes operated in hospitals run by NGOs that provide both paying and non-paying surgeries had better visual outcomes. The possible reason for better outcomes in NGO or private facilities is the greater use of biometry and greater access to IOLs with a wide range of powers for implantation. Furthermore, those who paid for surgery had higher odds of good outcomes. This is probably indicative of the quality and type of surgery with better IOLs and more attention to refraction and PCO after surgery for patients who pay for surgical services.[2,3] Also, those who paid for surgery may have been operated by more experienced surgeons, which may have resulted in better outcomes.

Overall, our findings indicate that people seek and receive cataract surgery but miss out on regular follow-up consultations, which are essential to maintain clear vision. Our study population is especially vulnerable as they live in residential care and lack independence. Typically, NGOs reach out to provide cataract surgery to the elderly, often without a user fee. They provide transport facilities and other support for surgery. However, continuity of care is lacking after cataract surgery. Service providers need to reach out to this population to ensure proper follow-up care. While refractive errors can be corrected in homes for the aged, those who require additional treatment will need to be referred for care. Portable neodymium-doped yttrium aluminium garnet (Nd:YAG) lasers have been used in the past for performing iridotomy and could similarly be considered for capsulotomy.[24] Portable retinal lasers are used to treat retinopathy of prematurity in infants. The use of such technologies could allow for a more streamlined provision of care to those who are immobile, bedridden or have limited mobility. Though the number of people who can benefit from portable Nd:YAG laser may not be high, with an ageing population and ever-increasing number of cataract surgeries over the years, portable technology usage could be beneficial.

Our study focused on the elderly population in residential care in Hyderabad; hence, results are not generalisable to other populations. The primary limitations of our study are limited information on the details of the surgeries provided. Residents did not have their surgical records and were operated at many locations, so it was not possible to review surgical records. Furthermore, the diagnosis of posterior segment conditions was performed using images taken through undilated pupils. While we were able to get good quality images in most cases, the details were not clear in a few cases where there were media opacities, such as a dense PCO. We may have underestimated the importance of posterior segment pathologies. PCO was also assessed without pupillary dilatation, which could have led to an underestimation of PCO. Also, our study sample had a higher representation of women, possibly due to a longer life expectancy among women.

In conclusion, homes for the aged are relatively new in India, but the number residing in them is rapidly rising.[25] A large proportion of residents had poor outcomes after cataract surgery that could readily be addressed by simple interventions. A strategic framework for healthcare including eye care would provide surveillance of vision status and open avenues to routinely render appropriate follow-up care for all those who undergo cataract surgery. The elderly in residential care would then be assured of lifelong good eye health.

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