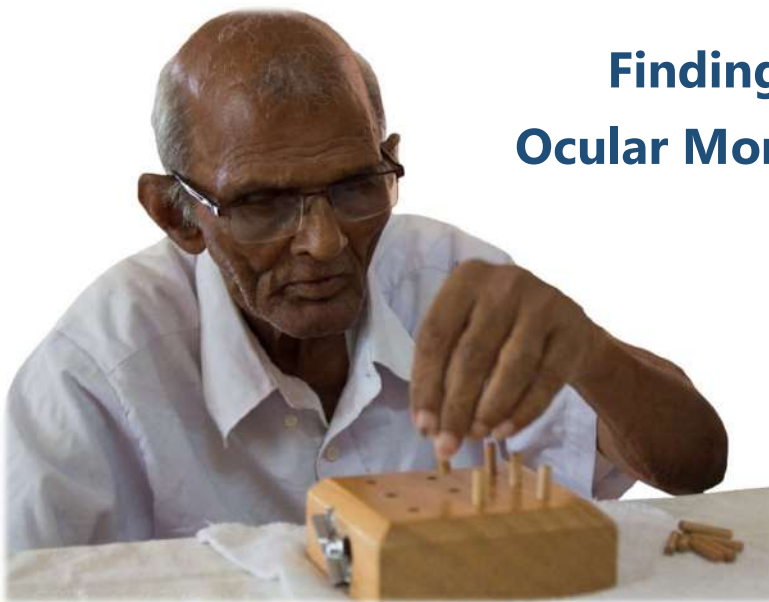


Research Report on Elderly Eye Health



Findings from the Hyderabad Ocular Morbidity in Elderly Study (HOMES)

Submitted by:

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Dr Srinivas Marmamula
27 August 2024

Executive Summary

Visual Impairment (VI) is common among the elderly population. Studies from developed countries indicated a much higher prevalence of VI among the elderly in residential care facilities (homes for the aged centres). In countries like India though, barring a few studies with small sample sizes, there is little data or metrics that describe this vulnerable community. To address this lacuna, the Hyderabad Ocular Morbidity in Elderly Study (HOMES), a large-scale longitudinal study, was conducted between 2017 and 2020. The HOMES study is one of the most comprehensive eye health studies on the elderly living in residential care in India. A trained team of social investigators and clinicians carried out a detailed interview followed by eye examination for each of the participants. A makeshift clinic was set up in each of these homes for carrying out eye examinations. In total, 1,512 elderly residents (aged ≥ 60 years) were enumerated, and 1,182 participants (78.1%) were examined from 41 'homes for the aged' in Hyderabad, Telangana.

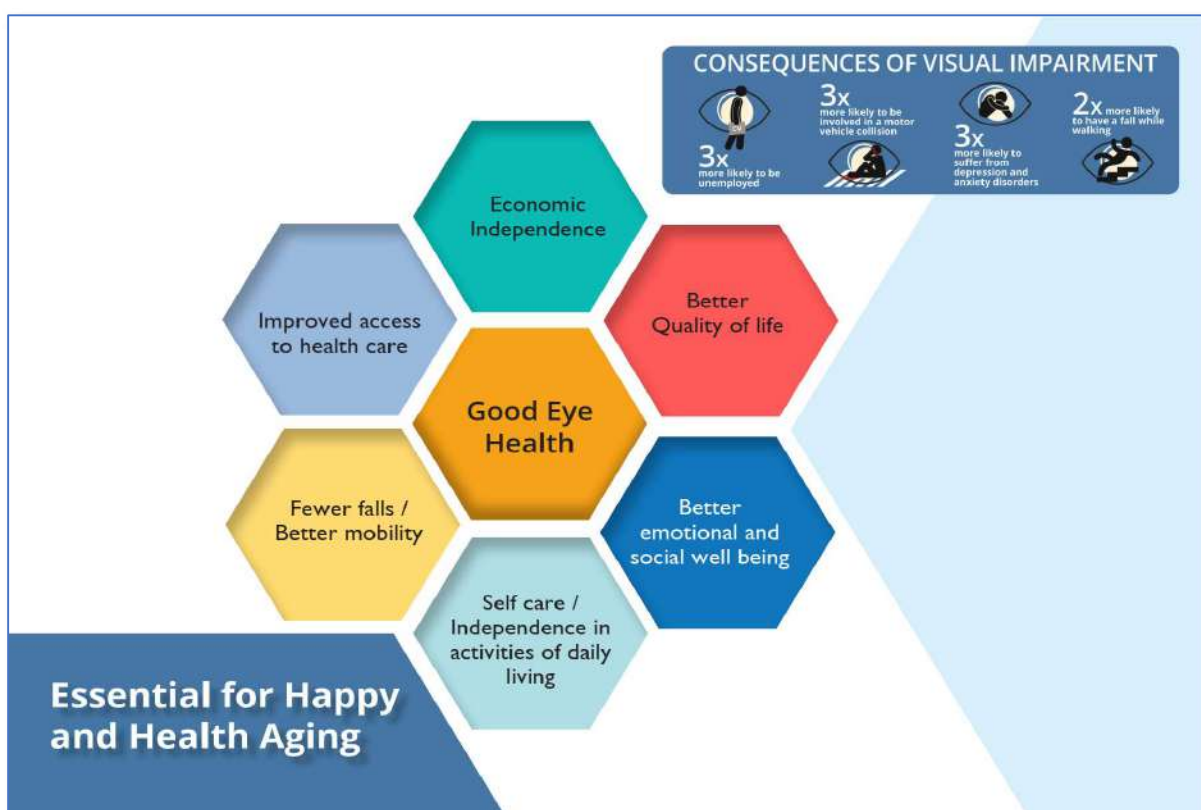
Till date, HOMES has led to the publication of 14 peer-reviewed papers in high-impact journals with a few more in the pipeline. Here are the major findings from the study:

1. Over 30% of the elderly were found to have vision loss. Cataract was identified as the leading cause of vision loss (46.3%), followed by uncorrected refractive error (27.0%). Over 88.2% of the vision impairment could be either treated or corrected.
2. The prevalence of Uncorrected Refractive Errors was 13.5%
3. One-third of the eyes of elderly individuals living in homes for the aged that had previously undergone cataract surgery had visual impairment. Posterior capsular opacification (31.8%; $n=129$) was the leading cause of visual impairment followed by uncorrected refractive error (24.1%; $n=98$) were the leading causes of visual impairment after cataract surgery. Both these causes are avoidable or easily treatable.
4. The prevalence of falls was higher among those with visual impairment due to uncorrected refractive errors. Addressing visual impairment can result in fewer falls and contribute to healthy aging in India.
5. Nearly half of the elderly in residential care had near visual impairment.
6. Vision loss adversely affects the the quality of life and visual functioning in the elderly living in residential care.
7. Simple and cost-effective interventions have significant impact on the quality of life among the elderly. The improvement was higher in cataract surgery group compared to those provided with spectacles.
8. The prevalence of depression among the elderly with combined Vision and hearing impairment was 60.0% (95% CI: 45.2 – 73.4). It was 20.9% (95% CI: 14.4 – 28.8) among those with vision impairment and 37.8% (95% CI: 26.6 – 46.5) among those with hearing impairment. The prevalence of depression was the least among those with no sensory impairment (19.4%; 95% CI: 16.3 – 22.8).

HOMES is one of the most comprehensive eye health studies focusing on the elderly in India. It provides insights on the prevalence, causes, and association of vision loss in the elderly in residential care. As the Indian population ages, there will be an increasing burden of vision loss in these homes. The information from this study can be used for developing strategies to ensure that this vulnerable population does not suffer due to needless vision loss in their 'sunset' years of life.

Introduction

Aging is associated with decline in health status, physical function, cognition, frailty, and other functions.¹ Aging also makes one vulnerable to other health problems, including vision loss. Over a billion 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 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 Reports have shown a delay in the risk of mortality as a result of cataract surgery.^{14,15} and correction of refractive errors resulting in a significant improvement in the quality of life.^{16,17} Furthermore, visual impairment may lead to falls which may lead to fractures resulting in an adverse impact on the quality of life of the individuals.¹⁸⁻²³ Eye health is also linked with sustainable development goals.²⁴



Aging in India

The population of the elderly in India is increasing significantly and is estimated to reach 323 million by the year 2050 (a number greater than the total population of the United States in the year 2012). In India, elders hold high respect, and over the centuries, their families were expected to care for them. But the rise of the middle class, and its key features, the nuclear family, has deprived the elderly population of this family support. India's aging population is now facing privations and lack of basic comforts and necessities. Some recent studies among the elderly have revealed some disheartening facts. A large proportion of the elderly feel neglected and consider themselves a burden to their family. Several socio-demographic factors such as increasing urbanization, economic development, and rural to urban migration for employment opportunities are threatening the traditional joint family-based system by separating families, changing social expectations and family obligations, and causing attitudinal changes. The population of the elderly living alone or with their spouses has increased from 7% in the 90s to over 20% in 2006. Whereas the proportion of adult children caring for elderly parents has declined from 91% in 1984 to 51% in the year 2001. Women in the elderly age group appear to be the most vulnerable due to this changing scenario.²⁵

In urban India, factors such as the complexity of aging and associated infirmity, aging alone, and having to navigate unfamiliar urban spaces and procedures are increasingly leading to dependence on others, thus often necessitating a shift to the Homes for the Aged.²⁶ Homes for the Aged are a recent phenomenon in India and hence are not part of a well-organised sector. There is diversity both in terms of scope and amenities provided, and the number of elderly living in them. There are no eligibility criteria for entry into these homes. These Homes are typically run by non-government, 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'. Most of them offer food and accommodation. Some private homes also have nursing staff to attend to medical needs and have other support staff to assist elderly residents with their daily routine tasks.

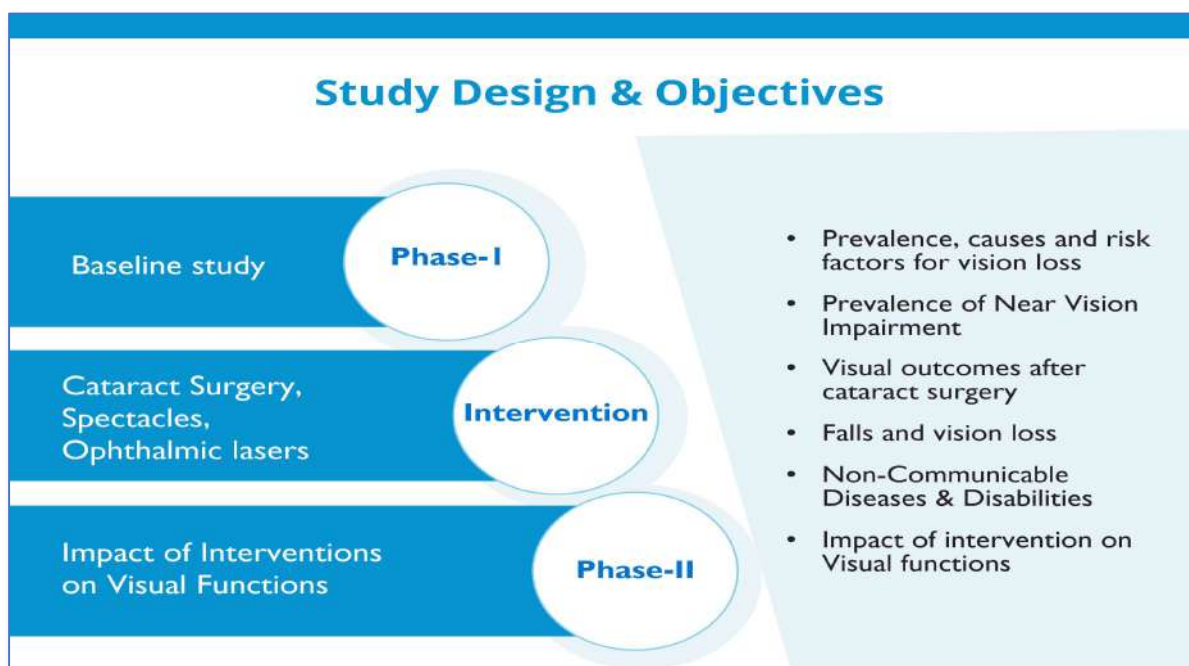
There is limited information on general health and eye health among the elderly in residential care in India

Visual impairment among the elderly in residential care

Visual impairment is more common among the elderly living in residential care when compared to those living in their own homes in communities and non-institutionalized environments.²⁷⁻³¹ A significant proportion of this visual impairment among the elderly in residential care can be corrected by simple interventions such as spectacles and cataract surgery.⁴⁻⁷ Sound epidemiological data on prevalence and causes of visual impairment is needed to formulate strategies to address vision loss in the elderly in residential care. Developed countries have researched the prevalence and impact of visual impairment among the elderly population, but such research is still in a stage of infancy in India.^{27,31-36}

To address this lacuna, a well-designed epidemiological study focused on elderly living in care facilities is needed. In this background, the Hyderabad Ocular Morbidity in Elderly Study (HOMES), was undertaken. HOMES is a longitudinal study with pre- and post-intervention phases designed to:

- a) investigate the prevalence, causes and risk factors for visual impairment among elderly individuals living in residential care facilities in Hyderabad, India
- b) assess the impact of interventions such as spectacles and cataract surgery on visual functions in the elderly living in residential care and
- c) assess the prevalence of fear of falls (FOF), depression and hearing impairment, and their association with vision loss.



Study methods

Ethics Approval

The study protocol was approved by the institutional review board of the Hyderabad Eye Research Foundation, L V Prasad Eye Institute, Hyderabad, India. The study was carried out in accordance with the Declaration of Helsinki. The elderly residents were enrolled in the study after obtaining written informed consent.

Study Design and Sampling method

HOMES was a longitudinal study with pre- and post-intervention phases and carried out in the 'homes for the aged' in Hyderabad, a city in the south Indian state of Telangana and its surrounding regions.

Study Team

The study team comprised two social investigators - professionals with a master's degree in social work and also trained in survey research methods. The clinical team had an optometrist and vision technicians - personnel trained to provide primary eye care including basic eye examination, visual acuity assessment and refraction. The team visited the home for the aged centres and conducted eye examinations there. A study coordinator organized the logistics for the study and also took care of the referrals. At the data centre, two data entry personnel were deputed for data entry. The study was led by the principal investigator who was responsible for the scientific and administrative aspects of the study.

Non-clinical protocol

The non-clinical protocol included administration of questionnaires by the trained investigators. The questionnaires included personal, sociodemographic, ocular and systemic history, Indian Visual Function Questionnaire (IND-VFQ 33),^{37,38} Patient Health Questionnaire (PHQ9),³⁹ Hindi Mini-Mental State Examination (HMSE) questionnaire,⁴⁰ Hearing Handicap Inventory for the Elderly Screening (HHIE),⁴¹ and Short Falls Efficacy Scale (SFES) questionnaire.^{42,43} Based on interviewers observations and self-report, the mobility status of the participants was classified as 'independently mobile', 'mobile with assistance' and 'immobile/bedridden'.

Independent bilingual reviewers translated all the questionnaires from the English language into the local language (Telugu), and also reverse translated into English to ensure that the content of the questionnaire was unchanged. The questionnaire administration process was audio recorded for random reviews as a part of the quality control measure. The investigators who conducted the interviews in the homes prepared the folder containing all

the study instruments (forms). The consent form in the local language (Telugu) was also available in the folder. Once the interviews were completed, the folders were verified and handed over to the study coordinator. They, in turn, passed it on to the clinical team for an examination.

Participants who were bedridden were also examined but not all the questionnaires were administered to that group. After the collection of personal and demographic information, Hindi mini-mental state examination (HMSE) assessment questionnaire was administered. If the HMSE score was less than 20 (suggestive of mild cognitive impairment), then questionnaires were restricted to systemic and ocular history, risk factors and complete clinical examinations.

The administration of questionnaires was always done before the clinical examination. After this, the trained vision technician recorded the anthropometry measures and performance-based measures (PBM).⁴⁴ This was followed by clinical eye examination by trained optometrist and vision technician. The interviews and non-clinical examination were always scheduled on different days to ensure that the elderly participants did not get tired. And, if needed, for them to take rest ample time was provided in between the procedures.

Clinical examination protocol

The eye examination included assessment of visual acuity (VA) for distance and near using logMAR (logarithm of the minimum angle of resolution) charts. Distance VA was assessed at a distance of three meters 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 was assessed. Both autorefraction and subjective refraction were 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. Fundus images were taken through undilated pupils using a non-mydratic fundus camera. Images were reviewed by an expert and were graded.

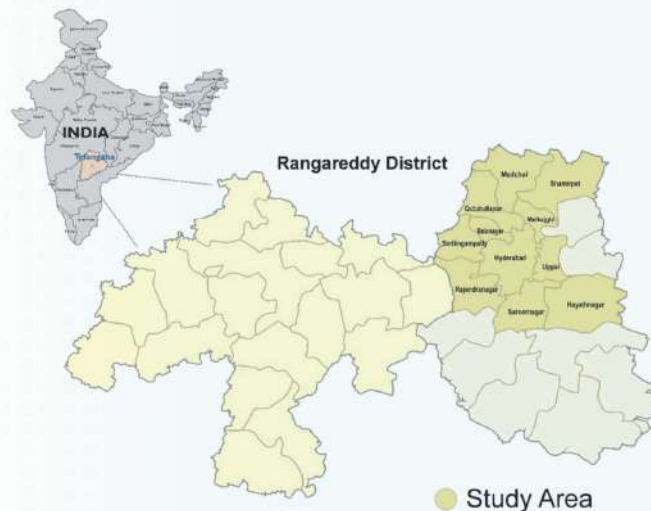
The main cause of VI was assigned by the clinician for each eye and then for the person. Wherever there were multiple causes, based on the clinical examination and the retinal images, the cause that was more likely to explain the vision loss was considered as the main cause in that eye. At the person 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. VI was defined as presenting VA worse than 6/18 in the better eye. VI is sub-divided into blindness

(worse than 3/60), severe VI (worse than 6/60 to 3/60) and moderate VI (worse than 6/18 to 6/60). VI caused by cataract, URE or Posterior Capsular Opacification (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.

Methods

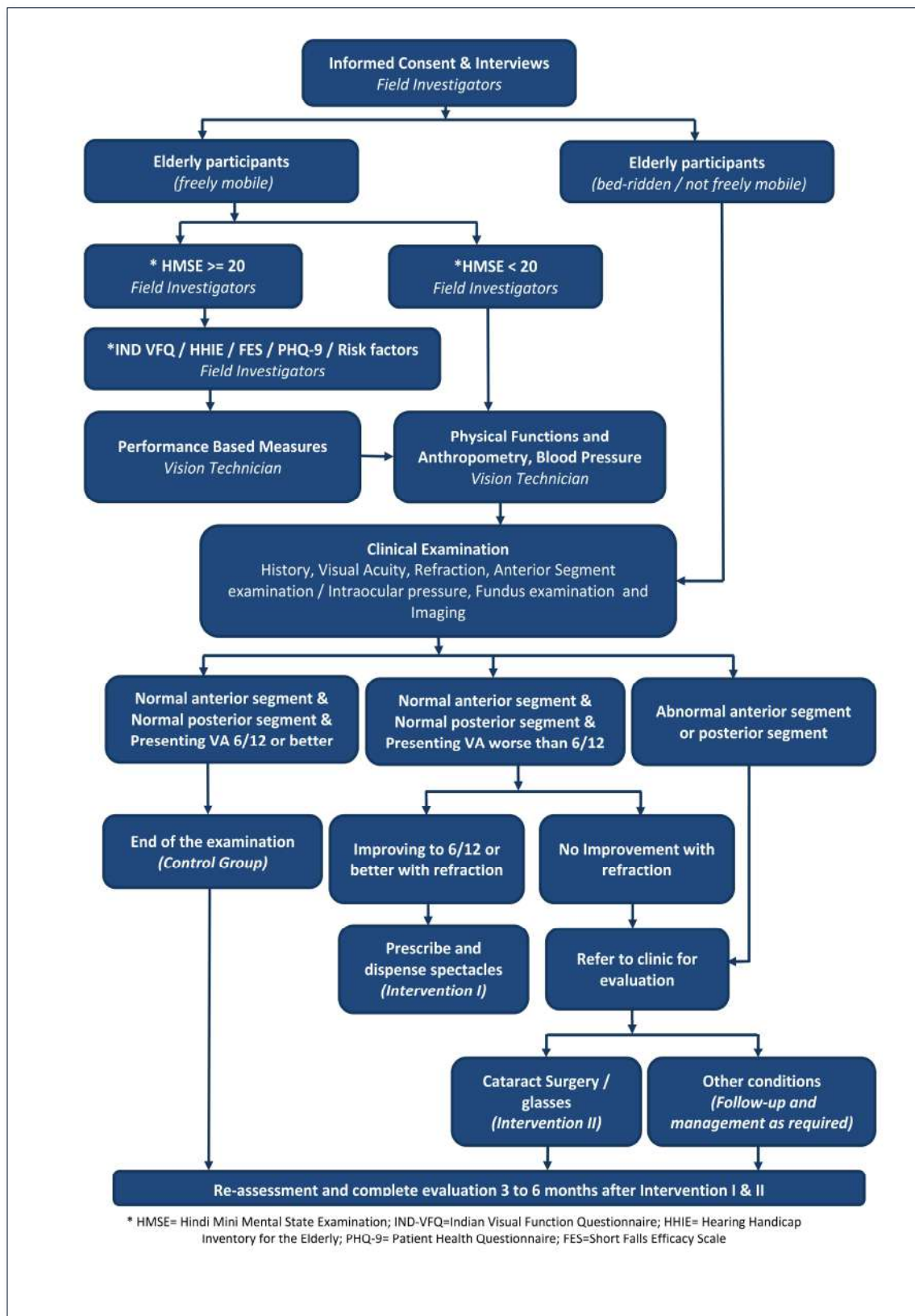
- **Study Design:** Longitudinal study
- **Study Location:** 'Home for the aged' centres in and around Hyderabad, India
- **Study team:** Study coordinator, Social investigators, optometrists, vision technicians and data entry personnel
- **Study procedures:** Comprehensive clinical eye examination, fundus imaging and administration of a questionnaires`



Hyderabad Ocular Morbidity in Elderly Study (HOMES)



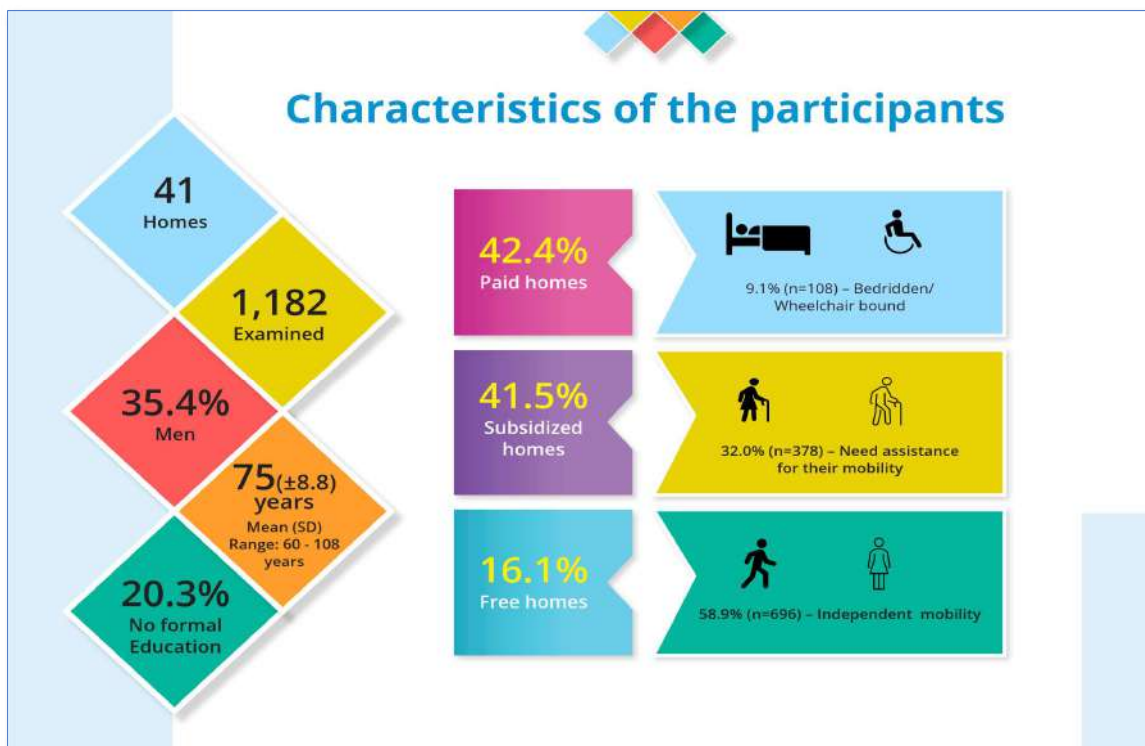
Images showing the eye examination procedures



Flowchart showing the study protocol

Study Participants

In total, 1,513 elderly participants were enumerated from 41 homes for the aged of which 1,182 participants (78.1%) were examined, 179 (11.8%) were not available for examination even 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 ($p=0.31$). The mean age of examined participants was 75.0 years (standard deviation 8.8 years; Range: 60 to 108 years), 35.4% ($n=418$) were men. 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% ($n=109$) 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 subsidized 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 five years (68.2%, $n=806$), 17.3% (205) reported living in homes for 5-9 years, and 14.5% ($n=171$) reported living in homes for ten years or more.



Visual Impairment (VI) for distance

Background: Visual impairment is more common among the elderly living in residential care when compared to those living in their own homes in communities and non-institutionalized environments.²⁷⁻³¹ Developed countries have researched the prevalence and impact of visual impairment among the elderly population, but such research is still in a stage of infancy in India.^{27,31-36}

Findings: Based on presenting VA, the prevalence of VI was 30.1% (95% CI: 27.5–32.8) which included Moderate VI in 279 (23.6%) participants (95% CI: 21.1–26.1), Severe VI in 38 (3.2%) participants (95% CI: 2.3–4.4) and Blindness in 39 (3.3%) participants (95% CI: 2.4 – 4.5). 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: 49.8–55.6). 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 VI was either treatable or correctable.

In multivariate logistic regression analysis, those aged 80 years and older had higher odds for VI (OR: 1.70; 95% CI: 1.6–2.47) compared to their younger counterparts. Compared to those with no formal education, those with school education (OR: 0.35; 95% CI: 0.25–0.49) or higher education (OR: 0.21; 95% CI: 0.13–0.35) had lower odds for VI. When compared to those residing in private homes, those living in free homes (OR: 1.51; 95% CI: 1.00–2.30) had higher odds for VI. VI was more common in those with a shorter length of stay in the homes.

Compared to those living in residential care for less than five years, those who resided for 5 to 9 years had similar odds of VI (OR: 0.82; 95% CI: 0.56–1.20), while those residing for 10 years or more had lower odds of VI (OR: 0.46; 95% CI: 0.30–0.72). Compared to the elderly who were independently mobile, those with mobility with assistance (OR: 1.44; 95% CI: 1.06–2.16) and those who were immobile/bedridden (OR: 3.02; 95% CI: 1.91–4.80) had significantly higher odds for 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: 0.49–0.96). The odds were also lower for those who self-reported hypertension (OR: 0.67; 95% CI: 0.50–0.88).

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. Almost all of this VI (88%) was

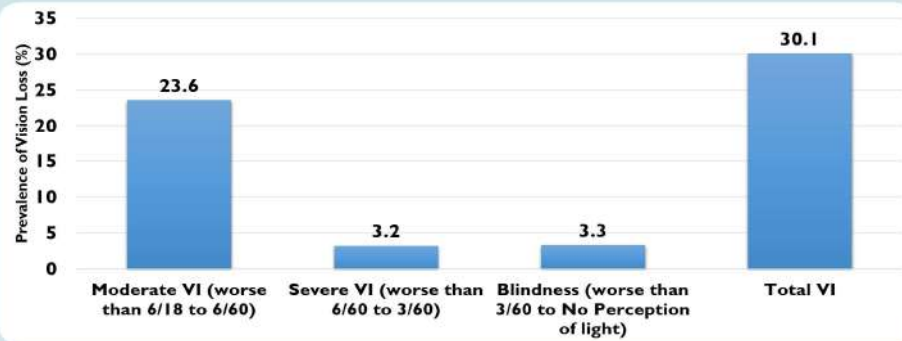
correctable with either cataract surgery, glasses or laser treatment (for posterior capsule opacification). The two most common causes of VI were cataract and URE, a finding that is common to almost all population-based prevalence surveys in adults.³¹ Strategies are needed to reach out to this elderly 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.

Lay summary: 1 out of every 3 elderly individuals in homes for the aged centres in Hyderabad region are affected with vision loss. As most of this vision loss can be addressed using cost effective interventions such as cataract surgery and spectacles, strategies are needed to reach out to this vulnerable population and provide care.

Publication. : Marmamula S, Barrenakala NR, Challa R, Kumbham TR, Modepalli SB, Yellapragada R, Bhakki M, Khanna RC, Friedman DS. 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). Br J Ophthalmol. 2021 Jan;105(1):32-36. doi: 10.1136/bjophthalmol-2019-315678. Epub 2020 Mar 25. PMID: 32217544; PMCID: PMC7116480.

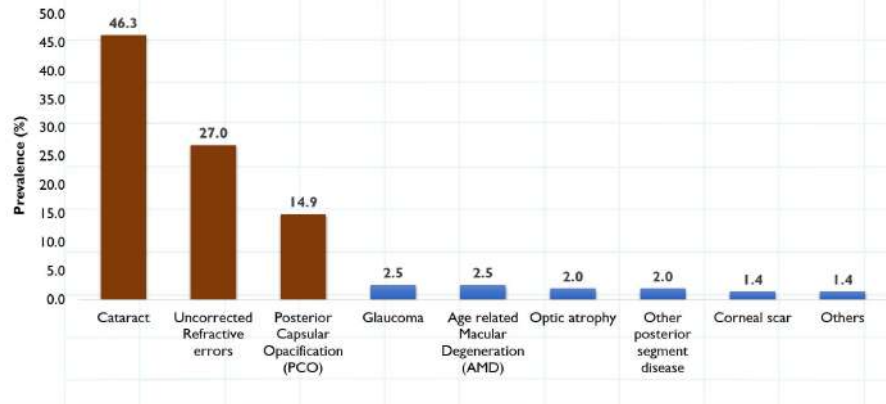
Vision Impairment

3/10 elderly in residential care had vision impairment



Causes of Vision Impairment

88% of the vision impairment is avoidable or 'needless' (either preventable or treatable or correctable)



Near Vision Impairment (NVI)

Background: Over 1.1 billion people have near vision impairment (NVI),⁴⁵ the vast majority of which is due to presbyopia.⁴⁶ The prevalence of presbyopia varies significantly across different regions and also with the definitions used.⁴⁷⁻⁵⁷ Cataract surgery with intraocular lens implantation also can result in NVI with a need for spectacles at near. NVI is easily corrected with spectacles at the community level without the need for complex eye care infrastructure and resources. The global productivity loss due to uncorrected presbyopia in the year 2011 was reported as the US \$11 billion.⁵⁸ Studies have also shown an increase in productivity with appropriate correction of presbyopia.⁵⁹ However there is limited data on NVI among the elderly in residential care in India.

Findings: Among those examined, 356 (30.1%) had vision impairment (moderate or worse) for distance (presenting visual acuity worse than 6/18 in the better eye). Excluding them for the analysis, the data of the remaining 826 participants were analysed. Reading books/newspapers was reported as an important leisure activity by 417 (50.5%) of the participants, watching television by 336 (40.7%), and helping in routine household activities by 118 (14.3%) participants.

The prevalence of NVI was 51.2% (95% CI: 47.7 – 54.7; n=423) based on presenting vision. On applying multiple logistic regression analysis, the odds of NVI were higher in 80 years and older age groups as compared to those in 60-69 years age group (OR: 2.17; 95% CI: 3.44 - 13.6). Compared to those without any education, those with school education (OR:0.58; 95% CI: 0.36 – 0.94) and higher education (OR: 0.38; 95% CI: 0.21 – 0.69) had lower odds for NVI. Similarly, those with self-reported diabetes (OR:0.69; 95% CI: 0.49 - 0.97), those using spectacles (OR: 0.09; 95% CI: 0.05 – 0.16), and those who had undergone cataract surgery (OR: 0.51; 95% CI: 0.36 – 0.74) had lower odds for NVI.

Discussion: Almost half of the residents in homes for the aged in Hyderabad had NVI. Of which, easily over 60% of it, could be addressed by dispensing a pair of new spectacles. Half of the participants reported that they had not had an eye examination within the last two years. It highlights a large unmet need for correction of NVI among the elderly in residential care. Older individuals spend much of their time engaged in near tasks such as reading. Reading was rated the most 'important leisure' activity among the elderly in our study. A lack of clear-near vision can significantly impact their quality of life.^{56,60}

Strikingly, nearly half of those studied who had spectacles for use at near still had NVI. As we reported previously, these residents of homes for the elderly need more frequent eye examinations to update their glasses.⁶¹ Presbyopia correction is a basic-minimum that can be provided at a low cost to the elderly to enhance their quality of life. Most leisure time activities that older people are engaged in require near vision. Correction of their presbyopia could improve the quality of life.

Lay summary: Half of the elderly in residential care are affected by Near Vision Impairment. A large proportion of those even with spectacles had NVI due to outdated spectacles or inadequately corrected spectacles. Reading is an important pastime among the elderly and poor near vision is likely to impact them adversely. A simple pair of correctly powered spectacles can positively help many elderly individuals in residential care.

Publication: Marmamula S, Barrenkala NR, Khanna RC, Challa R, Bhakki M, Kumbham TR, Modepalli SB, Yellapragada R, Friedman DS. Near vision impairment among the elderly in residential care-the Hyderabad Ocular Morbidity in Elderly Study (HOMES). Eye (Lond). 2021 Aug;35(8):2310-2315. doi: 10.1038/s41433-020-01243-w. Epub 2020 Nov 6. PMID: 33159176.



Visual outcomes after cataract surgery

Background: The cataract is the leading cause of visual impairment (VI) worldwide, affecting 65.2 million people.³ Cataract surgery is a cost-effective, safe, and predictable procedure,⁶² and it improves the quality of life and visual function.^{63,64,65} Yet, millions suffer from vision loss due to cataract, and a few who are operated have poor vision due to issues with the quality of eye surgery or pre-existing eye conditions.⁶⁶⁻⁷⁰ In India, nearly 30% of operated eyes remain visually impaired due to uncorrected refractive errors, posterior segment diseases, and surgical complications.⁶⁶⁻⁶⁹ However there are no studies reporting on the outcomes after cataract surgery among the elderly population and also among those residing in residential care.

Major findings: In all, 1,215 eyes of 703 individuals were operated for cataract; 1173 (96.5%) had intraocular lens implantation, 39 (3.2%) were aphakic, and there was no view of the lens in 3 (0.2%) cases. Of the 406/1,215 (33.3%; 95% CI: 30.0 – 36.1) eyes had VI after cataract surgery, 287 (23.6%; 95% CI: 21.3 – 26.1) eyes had moderate VI, 46 (3.8%; 95% CI: 2.8 – 5.0) eyes had severe VI and 73 (6%; 95% CI: 4.7 – 7.5) eyes were blind.

Posterior Capsular Opacification (PCO) (31.8%; n=129) was the leading cause of VI, followed by uncorrected refractive error (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 to 6/18) was present in 301/1,215 (24.8%; 95% CI: 22.3 – 27.3) operated eyes of which about 66% was due to avoidable causes (uncorrected refractive errors - 41.5% (n=125) and posterior capsular opacification - 24.6% (n=74).

In total, 95/512 (18.5%, 95% CI: 15.3 – 22.2) people who had VI after bilateral cataract surgery included 78 (15.2%; 12.2 – 18.6) participants with moderate VI, 11 with severe VI (2.1%; 95% CI: 1.1 – 3.8) and 6 (1.2%; 95% CI: 0.4 – 2.5) with blindness. Posterior capsular opacification (33.7%; n=32) and uncorrected refractive errors (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). 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 to 6/18) was present in 130/512 (25.4%; 95% CI: 21.7 – 29.4) participants who had bilateral cataract surgery of which 65.3% were due to avoidable causes (uncorrected refractive errors - 46.1% (n=60) and posterior capsular opacification - 19.2% (n=25)).

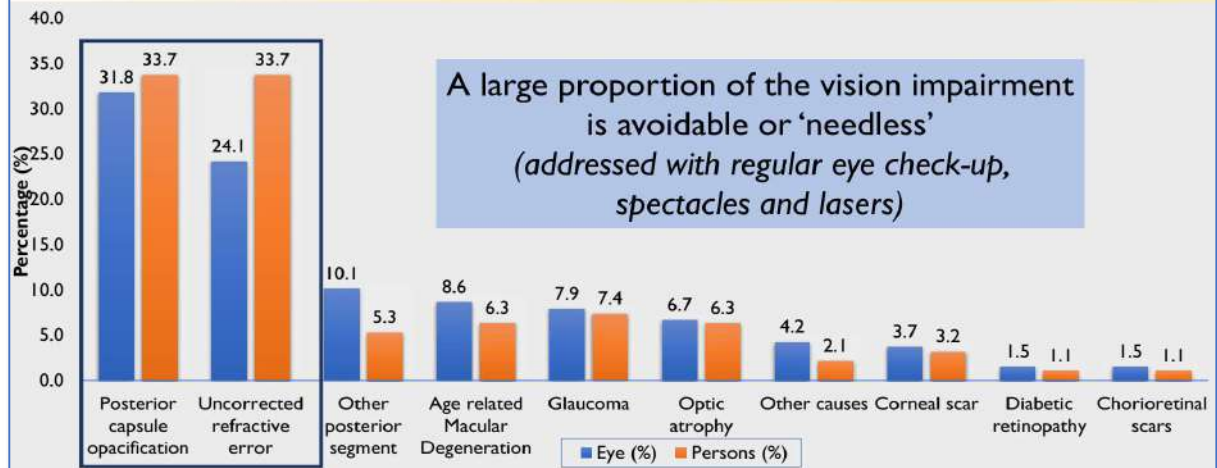
Among the participants who had bilateral cataract surgery and had VI post-surgery, URE was the leading cause of VI in 60-69 years and 70-79 years group. Whereas PCO was the leading cause in participants aged 80 and older ($p<0.01$). URE was the leading cause among those without any education, and PCO 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, and URE was the leading cause among those who had mobility with support or independently mobile ($p<0.05$). The cause of VI did not vary with gender ($p=0.29$).

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. It 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 as presenting vision worse than 6/18 in both eyes.⁷¹ 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. Earlier studies also had reported it as one of the causes of VI, but not as the number one cause.⁷² A strategic framework for health care, 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. Only then, the lifelong-good-eye health for the elderly in residential care be assured.

Lay summary: A third of the operated eyes had visual impairment (VI). 20% of those operated in both eyes had VI. Fortunately, over 2/3rd of this VI is avoidable. Posterior Capsular Opacification (a thin layer formed behind the intra ocular lens) and Uncorrected Refractive Errors are the leading causes of VI. The large prevalence of PCO is a novel finding reported from this study. Regular eye exams and timely intervention in forms of spectacles and laser for PCO can help elderly people fully benefit from cataract surgery.

Publication: Marmamula S, Barrenakala NR, Challa R, Kumbham TR, Modepalli SB, Yellapragada R, Bhakki M, Reddy JC, Friedman DS, Khanna RC. 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. Br J Ophthalmol. 2021 Aug;105(8):1087-1093. doi: 10.1136/bjophthalmol-2020-317167. Epub 2020 Aug 27. PMID: 32855164; PMCID:

Causes of poor vision after cataract surgery (presenting visual acuity worse than 6/18)



Combined Visual and Hearing impairment (Dual Sensory Loss (DSI)) and depression among the elderly.

Background: The Global Burden of Disease estimated that 45.7 million individuals are affected by depressive disorders in India.⁷³ Depression is an emerging public health challenge affecting over a third of the elderly population in India.^{74,75 76 77,78} A more recent population-based study done in northern India has reported even a higher prevalence of 41% of elderly with depression in a rural community.^{79 80} The multi-country World Health Organization (WHO) Study on Global AGEing and Adult Health (SAGE) – wave 1, conducted during 2007 to 2010 reported a higher prevalence of 27.1% among those aged 50 years or older in India compared to 23.7% in Mexico, 15.6% in Russia, 11% in Ghana, 6.4% in South Africa and the least prevalence of 2.6% in China.⁸¹

Depression is known to be associated with vision impairment (VI) in the elderly.⁸² Similarly, depression is also reported to be associated with hearing impairment (HI).^{83 84} Most studies on depression in the elderly report effects of either VI and depression or HI and depression independent of one another. This overlooks the possibility that VI and HI may, and often do, occur together in the elderly. This combination of VI and HI in an individual is called dual sensory impairment (DSI).⁸⁵ Till date there are no studies on depression among those with combined VI and HI in the elderly living in residential care in India. Given the increase in the elderly population in India associated with changing living arrangements, research into the health status of the elderly in residential care assumes significance.

Findings: The prevalence of depression among the elderly with DSI was 60.0% (95% CI: 45.2 – 73.4). It was 20.9% (95% CI: 14.4 – 28.8) among those with VI and 37.8% (95% CI: 26.6 – 46.5) among those with HI. The prevalence of depression was the least among those with no sensory impairment (19.4%; 95% CI: 16.3 – 22.8). (Figure 5)

On multiple logistic regression analyses, depression was approximately five times higher among the participants with DSI (OR: 4.90; 95% CI: 2.63 – 9.14) after adjusting for other covariates. The odds of depression were also higher among those with no education (OR: 1.39; 95% CI: 1.46 – 4.60) compared to participants with higher education while it was of borderline significance (OR: 1.60; 95% CI: 1.00 – 2.56; $p=0.05$) among those with school education. Participants with poor mobility were more likely to have depression (OR: 1.54; 95% CI: 1.06 – 2.23).

Discussion: One out of every four elderly in residential care in Hyderabad, India had depression. The elderly with DSI were five times more at risk for depression. Also, depression was higher among those with single sensory impairment than in those without

any sensory impairment. Several factors may have contributed to their depression.^{81,86 87 76}

Apart from a singular or double sensory impairment, other health issues or psychosocial and emotional factors are reported to be associated with depression.⁷⁶ We did not find any association between hypertension or diabetes and depression. Poor mobility was also associated with depression after controlling for other covariates.

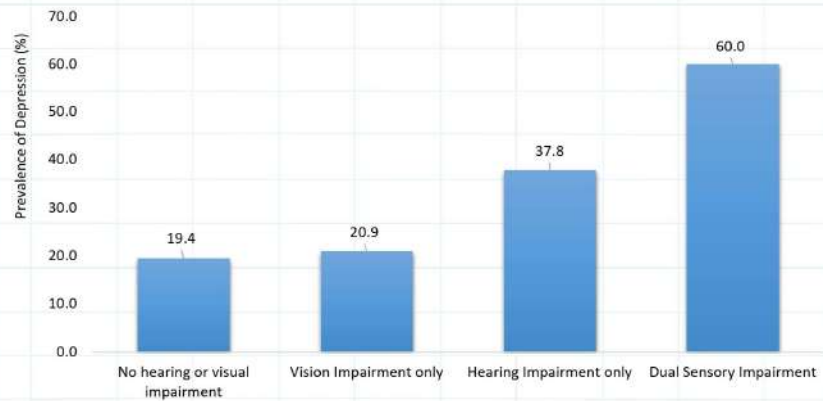
As vision and hearing are vital senses that one heavily depends on and is habituated to using routinely, their lack may be perceived as a grievous loss. Thus, one's inability to see clearly and or hear properly may predispose the elderly to depression. While DSI can lead to loss of independence, difficulties with self-care can adversely affect one's emotional well-being.⁸⁸⁻⁹¹ Since patients with DSI are at higher risk of developing depression, assessment of depression should be performed as part of the routine practice in India in eye and ear clinics in India. A multi-pronged approach to address this important multi-morbidity is critical to improve the quality of life and facilitate healthy aging for elderly in India.

Lay summary: 60% of the elderly with dual sensory impairment (combined hearing and vision loss) had depression. The prevalence of depression was also high even among those with single sensory loss. Screening for depression should be done as part of the routine practice in eye and ear clinics in India. A multi-pronged approach to address this important multi-morbidity is critical to improve the quality of life and facilitate healthy aging for elderly in India.

Publication: Marmamula S, Kumbham TR, Modepalli SB, Barrenkala NR, Yellapragada R, Shidhaye R. Depression, combined visual and hearing impairment (dual sensory impairment): a hidden multi-morbidity among the elderly in Residential Care in India. Sci Rep. 2021 Aug 10;11(1):16189. doi: 10.1038/s41598-021-95576-5. PMID: 34376737; PMCID: PMC8355224.

Depression and Dual Sensory Impairment (DSI) (Combined Hearing and Vision loss)

Elderly with DSI were 5x more likely to have depression
after adjusting for other covariates



Falls and visual impairment among elderly.

Background: Falls are common in the elderly, often resulting in catastrophic consequences including pain, loss of independence and poor quality of life.⁹² It is estimated that one out of every three elderly individuals report a fall at least once every year of which 20% have serious consequences.⁹³ The reported prevalence of falls in elderly people in India ranges from about 10% to 53%.⁹⁴⁻¹⁰⁰ Falls and their association with visual impairment is reported from large scale epidemiological studies.^{23,43} Earlier studies conducted in India found that poor vision, chronic diseases, poor balance and fear of falling and history of a previous fall as the risk factors for falls in the elderly population.^{101,102} However all the studies mentioned above had a small sample size and limited eye health assessment that is often limited to vision assessment and self-rated vision. Fear of Falling (FOF) was assessed using the Short Falls Efficacy Scale (SFES).

Major findings: The prevalence of falls was 35.3% among those who had VI. Based on the WHO definitions, the prevalence of falls was highest among those with low vision (36.0%) followed by those with no visual impairment (25.9%) and least in those with blindness (22.2%). The prevalence of falls also varied with the cause of VI with the highest prevalence of falls among those with VI due to uncorrected refractive errors.

The association between visual impairment and falls was tested using binary logistic regression after adjusting for all other socio-demographic and health-related variables. The odds of falls were significantly higher for both definition 1 ($p=0.04$) and definition 2 ($p=0.05$) of visual impairment. Those with low vision had significantly higher odds of falls compared to those without visual impairment ($p=0.03$). Similarly, visual impairment caused due to uncorrected refractive errors had higher odds for falls ($p<0.014$).

The prevalence of FOF was 56.1% (95% CI: 52.7 – 59.4; $n=486$). On multivariate analysis, the elderly with DSI were eleven times more likely to have FOF (OR:11.14; 95% CI:3.15 –41.4.) Similarly, those with moderate depression were seven times more likely (OR:6.85; 95% CI:3.70 – 12.70), and those with severe depression were eight times (OR:8.13; 95% CI: 3.50 – 18.90) more likely to report FOF.

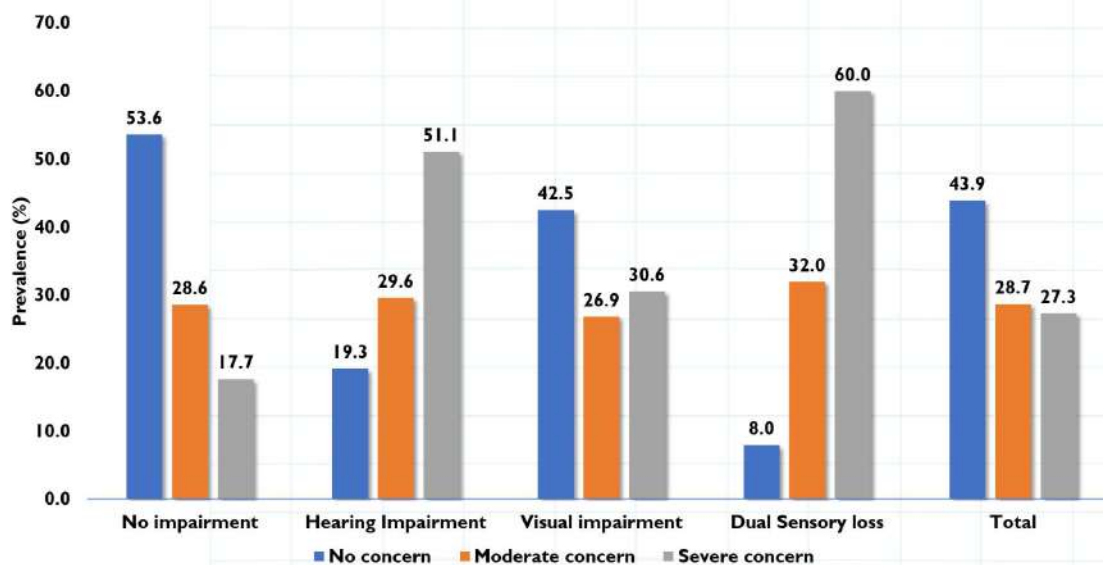
Discussion: We found a very high prevalence of falls in elderly individuals living in homes for the aged centres in Hyderabad, India. The prevalence of falls was significantly higher among those with low vision. The elderly with uncorrected refractive error had a higher odd of falls even after controlling for all other risk factors. This is an important finding from our study and has far-reaching consequences. Uncorrected refractive error can be corrected with a pair of spectacles and can contribute to fewer falls or prevention of falls in the elderly population.

Lay summary: More than one third of the elderly in residential care experience a fall in the previous year. The falls were more common among those with visual impairment. Those who had visual impairment due to uncorrected refractive errors had a higher risk of falls. These errors can be corrected with a pair of spectacles which results in fewer falls or prevention of falls among the most vulnerable. The impact of this intervention could be substantial as falls often result in catastrophic consequences among the elderly.

Publication: Marmamula S, Barrenkala NR, Challa R, Kumbham TR, Modepalli SB, Yellapragada R, Bhakki M, Friedman DS, Khanna RC. Falls and visual impairment among elderly residents in 'homes for the aged' in India. Sci Rep. 2020 Aug 7;10(1):13389. doi: 10.1038/s41598-020-70066-2. PMID: 32770042; PMCID: PMC7414840.



Fear of Falling & Sensory loss...



Falls and Fear of falling..

Falls

- **Prevalence:** 29.1% (95% CI: 26.4 – 32.0)
- **Risk factors:** Hearing impairment; Depression; Vision Impairment

Fear of Falling (FOF)

- **Prevalence:** 56.1% (95% CI: 52.7 – 59.4; n=486)
- **Risk factors:** Poor mobility; Depression; Previous fall; Dual Sensory Impairment



Impact of intervention for avoidable vision loss on visual functions

Background: Studies have shown that VI in the elderly affects all dimensions of their life, including mobility, self-care, driving, participation in social and religious activities and overall quality of life.^{8-10,103} Patient-reported outcome measures are increasingly emphasized in addition to visual acuity to assess the impact of interventions.¹⁰⁴ There are few studies on VI among the elderly in residential care in India,³¹ however longitudinal studies on visual function and the impact of interventions on visual function have not been reported.

Major findings: In total, 867 participants had Indian Visual Functioning Questionnaire (INDVFQ) administered at the baseline. Post-intervention, 613/867 (70.7%) were available for assessment. After excluding the five participants who were unable to participate in the interview completely, the data of the remaining 608 participants were included in the analysis. In total, 228 participants had Distance Visual Impairment (DVI), and 109 participants had Near Visual Impairment (NVI). The intervention was received by 128/228 in the DVI group and 61/109 in the NVI group.

In all, 189 participants with either DVI or NVI received the intervention, including spectacles by 114 participants and 75 received surgery / YAG capsulotomy. Post intervention, overall, IVFQ score changed by 13.5% (42.2 (SD:17.0) versus 36.5 (SD:12.7); $p < 0.01$) suggestive of a significant improvement in visual functions. The improvement was higher in cataract surgery group compared to those provided with spectacles.

Discussion: Interventions to address DVI and NVI in residents of homes for the aged in India had a significant positive impact on self-reported visual function. There was substantial improvement in the domains of activity limitation and visual symptoms and less improvement for mobility. Both spectacles and cataract surgery resulted in improved visual function scores in the elderly, but cataract surgery had an even larger impact. We propose an elderly centric eye care model on similar lines to the school eye model programme where annual eye health assessments can be conducted in the homes and followed with provision of services.¹⁰⁵

Lay summary: Cost effective interventions such as cataract surgery, spectacles for distance and near vision and ophthalmic lasers improve daily functions of the elderly in residential care. Annual eye examinations of the elderly in residential care are recommended.

Publication: Marmamula S, et al DS. Impact of an intervention for avoidable vision loss on visual function in the elderly-The Hyderabad Ocular Morbidity in Elderly Study (HOMES). Eye (Lond). 2023 Jun;37(8):1725-1731.Epub 2022 Sep 14. PMID: 36104520; PMCID: PMC10220055.



Visual impairment and cognitive impairment

Background: Cognition is defined as the processes an individual uses to organize information. It is a mental action or process of acquiring knowledge and understanding through thought, experience, and the senses. Vision is the main portal for environmental input to the human brain and hence visual impairment is likely to affect cognition. Studies of indicated visual impairment as a risk factor for cognition decline.¹⁰⁶ Cognition status was assess using Hindi Mini Mental Status (HMSE). The HMSE score work than 24/30 was considered Cognitive Impairment (CI).

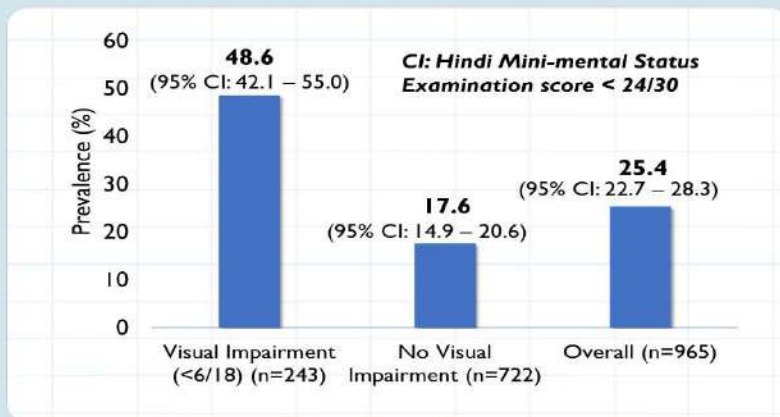
Major findings: In total, 965 individuals were included in the analysis. Overall prevalence of cognitive impairment was 25.4% (95% CI: 22.7 – 28.3). The prevalence of CI was higher among those with visual impairment (48.6%; 95% CI: 42.1 – 55.0) compared to those without visual impairment (17.6%; 95% CI: 14.9 – 20.6). The prevalence of CI increased with worse grades of visual impairment ($p < 0.01$). Those with visual impairment due to cataract and uncorrected refractive had significantly higher odds for CI after adjusting for age, gender and level of education in multivariable analysis. Also, those with dual sensory impairment had three times higher odds for CI compared to those with no impairment.

Discussion: Over a quarter of the elderly in residential care has CI and those who had dual sensory loss were at a higher risk of CI. Addressing visual impairment is likely to improve cognition functions or at least likely to slow down the cognitive decline. However, there are no studies that have evaluated the impact of intervention on cognition decline using randomised control trial approach.

Lay summary: Elderly with visual impairment and dual sensory loss are at higher risk of developing cognitive impairment. Intervention such as spectacles and cataract surgery is likely to prevent cognitive decline. More research is necessary to understand interventions that can arrest such decline.

Publication: Marmamula S, et al. Cross-sectional study of cognitive impairment and visual impairment among the elderly population in residential care in India: the Hyderabad Ocular Morbidity in Elderly Study (HOMES). *BMJ Open*. 2024 Jul 22;14(7):e084348. doi: 10.1136/bmjopen-2024-084348. PMID: 39038860.

Prevalence of Cognitive Impairment (CI)

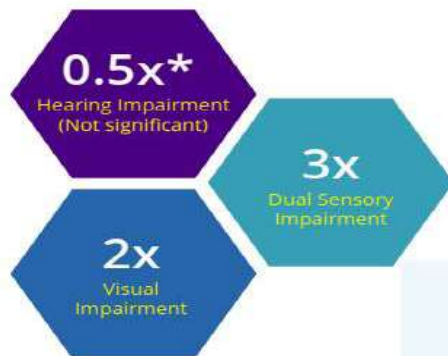


Causes of Visual Impairment & Cognition Impairment (n=965)



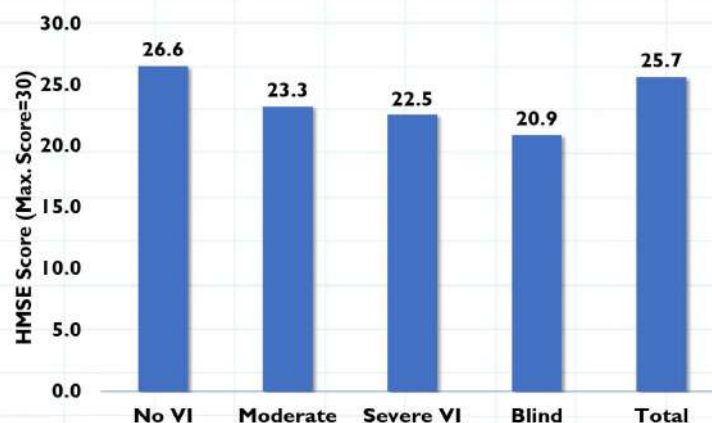
Adjusted for age,
gender and education

Sensory loss and Cognitive Impairment (n=867)



Severity of Visual Impairment & Cognitive Impairment

* Lower HMSE Scores are suggestive of poor cognition



HOMES Publications and Press Coverage

Publications from HOMES (n=14) (2019-2023)

OPHTHALMIC EPIDEMIOLOGY
https://doi.org/10.1093/oxford/monographs/monographs-2019-1000007

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OPEN ACCESS

Hyderabad Ocular Morbidity in Elderly Study (HOMES) – Rationale, Study Design and Methodology

Srinivas Marmamula^{1,2,3,4,5}, Navya Rekha Barrenakala^{1,2}, Rajesh Challa^{1,2}, Thirupathi Reddy Kumbham¹, Satya Brahmanandam Modepalli¹, Ratnakar Yellapragada^{1,2}, Madhuri Bhakki¹, Rohit C. Khanna^{1,2}, and David S. Friedman^{1,2}

OPHTHALMIC & PHYSIOLOGICAL OPTICS
THE JOURNAL OF THE OPTICAL SOCIETY OF THE UNITED KINGDOM

Optometric & Physiological Optics ISSN 0275-5408

Uncorrected refractive errors for distance among the residents in 'homes for the aged' in South India: The Hyderabad Ocular Morbidity in Elderly Study (HOMES)

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Article

Impact of Vision Loss on Visual Function Among Elderly Residents in the "Home for the Aged" in India: The Hyderabad Ocular Morbidity in Elderly Study

Srinivas Marmamula^{1,2,3,4,5}, William Mitchell^{1,2}, Nazlee Zebardast^{1,2}, Joseph Locascio^{1,2}, Navya Rekha Barrenakala^{1,2}, Thirupathi Reddy Kumbham¹, Satya Brahmanandam Modepalli¹, Rohit C. Khanna^{1,2}, and David S. Friedman^{1,2}

scientific reports

Multimorbidity and multi-disability among the elderly in residential care in India: the Hyderabad Ocular Morbidity in Elderly Study (HOMES)

Srinivas Marmamula^{1,2,3,4,5}, Navya Rekha Barrenakala^{1,2}, Rajesh Challa^{1,2}, Thirupathi Reddy Kumbham¹, Satya Brahmanandam Modepalli¹, Ratnakar Yellapragada^{1,2}, Madhuri Bhakki¹, Rohit C. Khanna^{1,2}, and David S. Friedman^{1,2}

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SCIENTIFIC REPORTS

Falls and visual impairment among elderly residents in 'homes for the aged' in India

Srinivas Marmamula^{1,2,3,4,5}, William Mitchell^{1,2}, Nazlee Zebardast^{1,2}, Joseph Locascio^{1,2}, Navya Rekha Barrenakala^{1,2}, Thirupathi Reddy Kumbham¹, Satya Brahmanandam Modepalli¹, Rohit C. Khanna^{1,2}, and David S. Friedman^{1,2}

Article

Barriers to uptake of referral eye care services among the elderly in residential care: the Hyderabad Ocular Morbidity in Elderly Study (HOMES)

Srinivas Marmamula^{1,2,3,4,5}, Thirupathi Reddy Kumbham¹, Satya Brahmanandam Modepalli¹, Subhabrata Chakrabarti¹, Jill Elizabeth Keffe¹

SCIENTIFIC REPORTS

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

Marmamula Srinivas^{1,2,3,4,5}, Navya Rekha Barrenakala^{1,2}, Rajesh Challa^{1,2}, Thirupathi Reddy Kumbham¹, Satya Brahmanandam Modepalli¹, Ratnakar Yellapragada^{1,2}, Madhuri Bhakki¹, Jagadeesh C. Reddy^{1,2}, Rohit C. Khanna^{1,2}, and David S. Friedman^{1,2}

SCIENTIFIC REPORTS

Psychometric validation techniques applied to the IND-VEQ-23 visual function questionnaire: the Hyderabad ocular morbidity in the elderly study (HOMES)

Srinivas Marmamula^{1,2,3,4,5}, Navya Rekha Barrenakala^{1,2}, Rajesh Challa^{1,2}, Thirupathi Reddy Kumbham¹, Satya Brahmanandam Modepalli¹, Ratnakar Yellapragada^{1,2}, Madhuri Bhakki¹, Rohit C. Khanna^{1,2}, and David S. Friedman^{1,2}

The Hindu (10-03-2022) National Edition

One in four elderly suffering from depression, finds study

41 Homes For Aged Surveyed In The City

U.Sudhakarreddy
@timesgroup.com

Hyderabad: LV Prasad Eye Institute (LVPEI) has conducted a study in elderly homes in Hyderabad and found that one out of four has depression. The study done in 41 such homes, revealed that 40% of the elderly had depression associated with eye and/or hearing impairments.

According to Dr Srinivas Marmamula, associate director of Public Health Research and Training, "Elderly people with double sensory impairment are five times more at risk for depression. In addition, depression is higher among those with single sensory impairment than in those without any sensory impairment."

"Nature Journal" published the study in its recent edition titled 'Depression, combined visual and hearing impairment (dual sensory impairment): A hidden multi-morbidity among the elderly in residential care in India'.

Dr Srinivas told TOI, "This is one of the most extensive studies carried out among the elderly population in the residential care area. Visual and hearing problems and feeling of loneliness drive the elderly into depression. Other health and psychosocial issues are also contributing factors for depression."



Researchers did not find any link between hypertension or diabetes and depression. However, they identified poor mobility as another factor. In addition, researchers said that six out of 10 elderly diagnosed with both eye and ear impairments had depression and highlighted the need for screening and referral for medical care. LVPEI's earlier studies have found that close to a third of the elderly had visual impairment. Out of them, over 80% of visual impairment cases were due to avoidable causes.

The elderly homes are classified into three categories. The first category is private homes where the elderly or their kin pay a monthly or annual user fee. The second category is a partially subsidised homes where the elderly or their kin pay only a part of the user fee and the rest of the amount is met by philanthropic support. Finally, free homes where the elderly need not pay any user fee as external funding sources support the homes. The number of elderly residents ranges from less than 30 to over 100 in these homes.

Researchers observed that clinical assessment of depression should be done as part of the routine practice in India's eye and ear examination clinics.

A new vision for old age care

A formal approach to homes for the elderly is an important policy and planning issue for India



As India becomes increasingly urbanised and families break up into smaller units, homes for the elderly have sprung up. The care of elderly people is managed by a set of professionals or voluntary organisations in residential care services. The number of such care homes is rising rapidly in urban and semi-urban India. These homes are either paid for, or offer free or subsidised service. Typically, such homes are run by NGOs, religious or voluntary organisations with support from the government, or by local philanthropists. They provide accommodation, timely care, and a sense of security for their residents. However, the quality of service varies as these homes lack regulatory oversight. Many homes lack clearly established standard operating procedures, and their referral paths to health care are informal. There is an urgent need to understand the quality of life at such institutions, including the impact of these homes on the mental health of their residents.

A rapidly growing sector

A formal approach to homes for the elderly is an important policy and planning issue for India. The UN World Population Ageing Report notes that India's ageing population (those aged 60 and above) is projected to increase to nearly 20% by 2050 from about 8% now. By 2050, the percentage of elderly people will increase by 20%, with those aged 60 years and above set to increase by 70%, making them the fastest growing age group in India. With this future in mind, it is essential that our policy framework and social responses are geared to meet this reality.

A recent set of research papers from Hyderabad focusing on the quality of health in homes for the elderly has some interesting insights. The papers highlight the fact that good intentions and a sense of charity are often inadequate when it comes to addressing the basic health needs of their elderly residents. These papers are outcomes of the Hyderabad Ocular Morbidity in Elderly Study (HOMES) by the LV Prasad Eye Institute that was primarily meant to understand the vision needs of elderly residents of such homes. About 20% of the residents who were part of the study (over 1,500 participants from 41 homes) had a vision impairment of some sort, but nearly 40% of this vision impairment could be addressed by

single, relatively low-cost health interventions: issuing better eye glasses or cataract surgery.

The study also found some "unseen" effects of vision impairment: many were prone to depression. In fact, those with both vision and hearing impairment had a rate of depression that was five times higher than those without. Our homes, buildings and social environment are not built keeping the elderly (or people with disabilities) in mind. As people age, and their motor skills weaken, they are at a greater risk of falling down and hurting themselves. Having an impairment increases this risk. Instead of planning for accessible and elderly-friendly structures that allow them to operate safely, we reduce their mobility. People with functional skills are asked to stay away from daily tasks like cooking, sewing, cleaning, or washing up. This reduces their sociability, their sense of independence and well-being – all leading up to mental health issues and depression.

The state of homes for the elderly today offers us some low-hanging fruit we can address easily: build formal pathways for basic health screening between such homes and public health facilities. This can include screenings for blood sugar, blood pressure, periodic vision and hearing screening, and a simple questionnaire to assess mental health. Such interventions are inexpensive. A trial of all the motorcycle-operated screenings outside public grounds for morning walkers and could go a long way in identifying health issues and offering support. The next step would be to build formal pathways to address any health issues that such screenings identify. Many hospitals, clinics, NGO run, and private care can help.

Public policy support

Crucial though will be the need for robust public policy to support homes for the elderly. Health institutions will also need to offer a comprehensive set of packages that are tailored for the elderly – not piecemeal solutions for diabetes, cataracts or cancer, for example. What happens once care is provided? Homes for the elderly must be guided, again by policy, to make their facilities, buildings and social environment elderly- and disabled-friendly. Design, architecture and civic facilities must be thought from the ground up – and these innovations must be available for all residents, not just those living in expensive ones. There are lessons here for society as a whole, but, as they say, let's take one step at a time.

Tejah Balantrapu is Associate Director, Science, Health Data, and Strategy, LV Prasad Eye Institute. Srinivas Marmamula is Associate Director, Public Health Research and Training, LV Prasad Eye Institute.

Times of India Pg-4 (09-09-2021)

'Cognitive loss high among elders with vision issues'

One in four show decline in memory, thinking ability: Study

CITY BUREAU
Hyderabad

In a first-of-its-kind study taken up in Hyderabad, researchers have indicated high prevalence of cognitive impairment and vision loss among the elderly population. They found that 1 in 4 elderly were living with cognitive impairment, which meant a decline in memory and thinking ability.

In fact, those with vision loss had a four times higher chance of cognitive impairment when compared to those without vision loss, the paper on the study of senior citizens published in British Medical Journal (BMJ) on July 22, by L V Prasad Eye Institute (LVPEI), said.

The paper also found that those older persons who had worse vision were more likely to be cognitively impaired. Similarly, cognitive impairment affected

VITAL FINDINGS

HIGH PREVALENCE OF MEMORY AND THINKING IMPAIRMENT ALONG WITH VISION LOSS IN ELDERLY

1 in 4 senior citizens living with cognitive impairment

Those with vision loss have **4 times** higher chance of cognitive impairment

Diabetes was reported by **29.1%** and hypertension by **59.7%** of participants

47.6% of the participants have vision impairment



Overall prevalence of cognitive impairment was **26.9%**

one out of every four individuals with near vision impairment.

1,500 participants

The paper/study is part of Hyderabad Ocular Morbidity in the Elderly Study (HOMES), which is led by Dr Srinivas Marmamula, scientist and public health researcher at LVPEI, which covered over 1,500 elderly participants above 60 years of age and living in care homes for the aged.

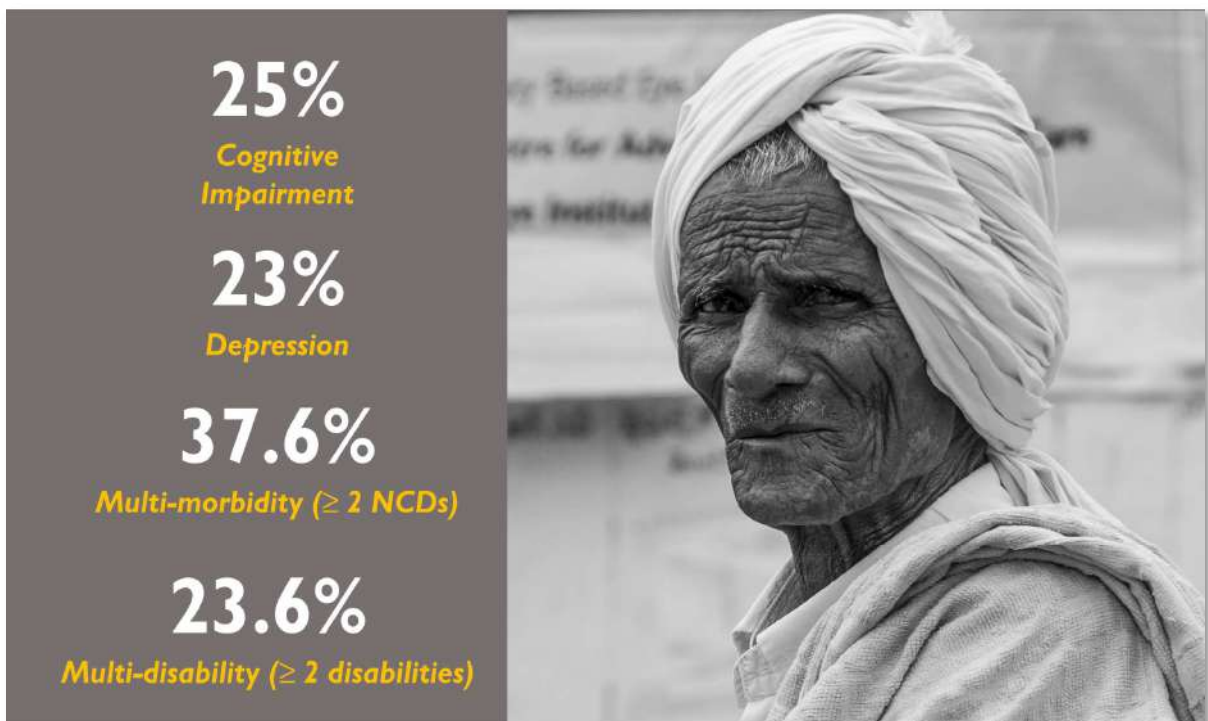
Indicating that addressing vision loss may be key to arresting dementia and other forms of cognitive decline in the elderly population, the paper strives to build a case for screening senior citizens for vision and cognitive loss.

A pair of glasses or safe cataract surgery could help them live independently in their sunset years.

"The results exhibit a strong association between vision loss and cognitive loss. While more and more elderly are living in homes for the aged, we have very few evidence-based policy interventions that can help improve their lives and conserve their quality of life," says Dr Srinivas Marmamula, Scientist and public health researcher at LVPEI.

The LVPEI paper said that close to 30 per cent of elderly with mild vision impairment had cognitive impairment. This percentage steadily increases as vision impairment worsens.

Telangana Today Pg-3 (25-07-2024)



From HOMES to LEADS – The stepping stones

The longitudinal Hyderabad Ocular Morbidity in Elderly Study (HOMES) funded by the Wellcome Trust India Alliance provided vital insights on the burden and causes of vision loss among the elderly in residential care.^{105,107,108} However, the study included only the elderly in residential care and was restricted to urban areas, so the results cannot be extrapolated to the general population. Also, the sample size was insufficient to draw insights on the factors related to the incidence of VI and its association with other systemic and cognitive risk factors.

The annual incidence of vision loss in the elderly and the associated risk factors at the population level are not known. An equally important issue that is inadequately explored is the interaction and impact of multi-morbidity and vision loss on quality of life and overall well-being of the elderly living in the community (that is, not in care).¹⁰⁹ There are no population-based studies that reported on dual sensory loss and its impact on quality of life, depression, and other factors in the elderly in India. The proportion of elderly in India is expected to increase dramatically and is expected to reach 323 million people by the year 2050 (about 20% of the population from 8% now). Therefore, data on vision loss and its correlates in this population will be essential for planning eye care programmes.¹¹⁰ Addressing vision loss is vital as it has complex and far-reaching consequences on the overall health and well-being of the elderly.

A multi-centre, population-based longitudinal study with a large sample size and longer duration, with assessments at different time points can provide valuable insights that can be generalised to the elderly population living in the community. Such insights can help in planning long-term comprehensive and holistic elderly-centric eye care services. The Longitudinal Eye Health, Aging, and Disability Study (LEADS) is proposed now to provide this vital information on eye health in the elderly. LEADS will be building on the experiences and learnings of HOMES to study a much larger general population to provide comprehensive information on eye health including VI and its association with other aging factors.^{105,107,108}

Good Eye Health
is Essential for
Happy and Healthy Aging

*"Universal Eye Health is
incomplete without holistic Eye
Health care for our Elderly"*

*"Eye Health Drives Sustainable
Development Goals"*



- Every elderly has a 'Right to See' this colourful world till the last day of their life...
- Ensuring that Right is our "Responsibility"



References

1. Balcombe NR, Sinclair A. Ageing: definitions, mechanisms and the magnitude of the problem. *Best Pract Res Clin Gastroenterol* 2001; **15**: 835-49.
2. Bourne RRA, Flaxman SR, Braithwaite T, Cicinelli MV, Das A, Jonas JB, Keeffe J, Kempen JH, Leasher J, Limburg H, Naidoo K, Pesudovs K, Resnikoff S, Silvester A, Stevens GA, Tahhan N, Wong TY, Taylor HR, Vision Loss Expert G. Magnitude, temporal trends, and projections of the global prevalence of blindness and distance and near vision impairment: a systematic review and meta-analysis. *Lancet Glob Health* 2017; **5**: e888-e97.
3. Flaxman SR, Bourne RRA, Resnikoff S, Ackland P, Braithwaite T, Cicinelli MV, Das A, Jonas JB, Keeffe J, Kempen JH, Leasher J, Limburg H, Naidoo K, Pesudovs K, Silvester A, Stevens GA, Tahhan N, Wong TY, Taylor HR, Vision Loss Expert Group of the Global Burden of Disease S. Global causes of blindness and distance vision impairment 1990-2020: a systematic review and meta-analysis. *Lancet Glob Health* 2017; **5**: e1221-e34.
4. Evans BJ, Rowlands G. Correctable visual impairment in older people: a major unmet need. *Ophthalmic Physiol Opt* 2004; **24**: 161-80.
5. Foran S, Rose K, Wang JJ, Mitchell P. Correctable visual impairment in an older population: the blue mountains eye study. *Am J Ophthalmol* 2002; **134**: 712-9.
6. Fung MM, Yap M, Cheng KK. Correctable visual impairment among people with diabetes in Hong Kong. *Clin Exp Optom* 2010; **93**: 453-7.
7. Hollands H, Brox AC, Chang A, Adilman S, Chakraborti B, Kliever G, Maberley DA. Correctable visual impairment and its impact on quality of life in a marginalized Canadian neighbourhood. *Can J Ophthalmol* 2009; **44**: 42-8.
8. Lamoureux EL, Fenwick E, Moore K, Klaic M, Borschmann K, Hill K. Impact of the severity of distance and near-vision impairment on depression and vision-specific quality of life in older people living in residential care. *Invest Ophthalmol Vis Sci* 2009; **50**: 4103-9.
9. Varma R, Wu J, Chong K, Azen SP, Hays RD, Los Angeles Latino Eye Study G. Impact of severity and bilaterality of visual impairment on health-related quality of life. *Ophthalmology* 2006; **113**: 1846-53.
10. Jacobs JM, Hammerman-Rozenberg R, Maaravi Y, Cohen A, Stessman J. The impact of visual impairment on health, function and mortality. *Aging clinical and experimental research* 2005; **17**: 281-6.
11. Karpa MJ, Mitchell P, Beath K, Rochtchina E, Cumming RG, Wang JJ, Blue Mountains Eye S. Direct and indirect effects of visual impairment on mortality risk in older persons. *Archives of ophthalmology* 2009; **127**: 1347-53.
12. Foong AW, Fong CW, Wong TY, Saw SM, Heng D, Foster PJ. Visual acuity and mortality in a chinese population. The Tanjong Pagar Study. *Ophthalmology* 2008; **115**: 802-7.
13. Freeman EE, Egleston BL, West SK, Bandeen-Roche K, Rubin G. Visual acuity change and mortality in older adults. *Invest Ophthalmol Vis Sci* 2005; **46**: 4040-5.
14. Fong CS, Mitchell P, Rochtchina E, de Lorn T, Tan AG, Wang JJ. Visual impairment corrected via cataract surgery and 5-year survival in a prospective cohort. *Am J Ophthalmol* 2014; **157**: 163-70 e1.
15. Fong CS, Mitchell P, Rochtchina E, Teber ET, Hong T, Wang JJ. Correction of visual impairment by cataract surgery and improved survival in older persons: the Blue Mountains Eye Study cohort. *Ophthalmology* 2013; **120**: 1720-7.

16. Lamoureux EL, Saw SM, Thumboo J, Wee HL, Aung T, Mitchell P, Wong TY. The impact of corrected and uncorrected refractive error on visual functioning: the Singapore Malay Eye Study. *Invest Ophthalmol Vis Sci* 2009; **50**: 2614-20.
17. Owsley C, McGwin G, Jr., Scilley K, Meek GC, Seker D, Dyer A. Effect of refractive error correction on health-related quality of life and depression in older nursing home residents. *Archives of ophthalmology* 2007; **125**: 1471-7.
18. Cox A, Blaikie A, MacEwen CJ, Jones D, Thompson K, Holding D, Sharma T, Miller S, Dobson S, Sanders R. Visual impairment in elderly patients with hip fracture: causes and associations. *Eye (Lond)* 2005; **19**: 652-6.
19. Felson DT, Anderson JJ, Hannan MT, Milton RC, Wilson PW, Kiel DP. Impaired vision and hip fracture. The Framingham Study. *J Am Geriatr Soc* 1989; **37**: 495-500.
20. Ivers RQ, Norton R, Cumming RG, Butler M, Campbell AJ. Visual impairment and risk of hip fracture. *American journal of epidemiology* 2000; **152**: 633-9.
21. Lord SR. Visual risk factors for falls in older people. *Age and ageing* 2006; **35 Suppl 2**: ii42-ii5.
22. Wood JM, Lacherez P, Black AA, Cole MH, Boon MY, Kerr GK. Risk of falls, injurious falls, and other injuries resulting from visual impairment among older adults with age-related macular degeneration. *Invest Ophthalmol Vis Sci* 2011; **52**: 5088-92.
23. Lamoureux EL, Chong E, Wang JJ, Saw SM, Aung T, Mitchell P, Wong TY. Visual impairment, causes of vision loss, and falls: the singapore malay eye study. *Invest Ophthalmol Vis Sci* 2008; **49**: 528-33.
24. Zhang JH, Ramke J, Jan C, Bascaran C, Mwangi N, Furtado JM, Yasmin S, Ogundo C, Yoshizaki M, Marques AP, Buchan J, Holland P, Ah Tong BAM, Evans JR, Congdon N, Webson A, Burton MJ. Advancing the Sustainable Development Goals through improving eye health: a scoping review. *Lancet Planet Health* 2022; **6**: e270-e80.
25. Lahariya C, Khandekar J, Pradhan SK. Effect of impairment and disability on health-related quality of life of elderly: a community-based study from urban India. *Indian journal of community medicine : official publication of Indian Association of Preventive & Social Medicine* 2012; **37**: 223-6.
26. Ara S. Old-age homes & the profile of their residents. *The Indian journal of medical research* 1997; **106**: 409-12.
27. Mitchell P, Hayes P, Wang JJ. Visual impairment in nursing home residents: the Blue Mountains Eye Study. *Med J Aust* 1997; **166**: 73-6.
28. Owsley C, McGwin G, Scilley K, Meek GC, Dyer A, Seker D. The visual status of older persons residing in nursing homes. *Archives of ophthalmology* 2007; **125**: 925-30.
29. Sinoo MM, Kort HS, Duijnste MS. Visual functioning in nursing home residents: information in client records. *J Clin Nurs* 2012; **21**: 1913-21.
30. Eichenbaum JW, Burton WB, Eichenbaum GM, Mulvihill M. The prevalence of eye disease in nursing home and non-nursing home geriatric populations. *Archives of gerontology and geriatrics* 1999; **28**: 191-204.
31. Marmamula S, Ravuri CS, Boon MY, Khanna RC. A cross-sectional study of visual impairment in elderly population in residential care in the South Indian state of Andhra Pradesh: a cross-sectional study. *BMJ open* 2013; **3**.
32. Tielsch JM, Javitt JC, Coleman A, Katz J, Sommer A. The prevalence of blindness and visual impairment among nursing home residents in Baltimore. *The New England journal of medicine* 1995; **332**: 1205-9.
33. van der Pols JC, Bates CJ, McGraw PV, Thompson JR, Reacher M, Prentice A, Finch S. Visual acuity measurements in a national sample of British elderly people. *Br J Ophthalmol* 2000; **84**: 165-70.

34. VanNewkirk MR, Weih L, McCarty CA, Stanislavsky YL, Keeffe JE, Taylor HR. Visual impairment and eye diseases in elderly institutionalized Australians. *Ophthalmology* 2000; **107**: 2203-8.
35. Wang JJ, Mitchell P, Cumming RG, Smith W, Blue Mountains Eye S. Visual impairment and nursing home placement in older Australians: the Blue Mountains Eye Study. *Ophthalmic Epidemiol* 2003; **10**: 3-13.
36. Marmamula S, Ravuri LV, Boon MY, Khanna RC. Spectacle coverage and spectacles use among elderly population in residential care in the south Indian state of Andhra Pradesh. *Biomed Res Int* 2013; **2013**: 183502.
37. Gothwal VK, Bagga DK, Sumalini R. Rasch analysis of the Indian vision function questionnaire. *Br J Ophthalmol* 2012; **96**: 619-23.
38. Finger RP, Kupitz DG, Holz FG, Balasubramaniam B, Ramani RV, Lamoureux EL, Fenwick E. The impact of the severity of vision loss on vision-related quality of life in India: an evaluation of the IND-VFQ-33. *Invest Ophthalmol Vis Sci* 2011; **52**: 6081-8.
39. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med* 2001; **16**: 606-13.
40. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res* 1975; **12**: 189-98.
41. Ventry IM, Weinstein BE. The hearing handicap inventory for the elderly: a new tool. *Ear Hear* 1982; **3**: 128-34.
42. Kempen GI, Yardley L, van Haastregt JC, Zijlstra GA, Beyer N, Hauer K, Todd C. The Short FES-I: a shortened version of the falls efficacy scale-international to assess fear of falling. *Age and ageing* 2008; **37**: 45-50.
43. Reed-Jones RJ, Solis GR, Lawson KA, Loya AM, Cude-Islas D, Berger CS. Vision and falls: a multidisciplinary review of the contributions of visual impairment to falls among older adults. *Maturitas* 2013; **75**: 22-8.
44. Owsley C, McGwin G, Jr., Sloane ME, Stalvey BT, Wells J. Timed instrumental activities of daily living tasks: relationship to visual function in older adults. *Optom Vis Sci* 2001; **78**: 350-9.
45. Fricke TR, Tahhan N, Resnikoff S, Papas E, Burnett A, Ho SM, Naduvilath T, Naidoo KS. Global Prevalence of Presbyopia and Vision Impairment from Uncorrected Presbyopia: Systematic Review, Meta-analysis, and Modelling. *Ophthalmology* 2018.
46. Holden BA, Fricke TR, Ho SM, Wong R, Schlenther G, Cronje S, Burnett A, Papas E, Naidoo KS, Frick KD. Global vision impairment due to uncorrected presbyopia. *Archives of ophthalmology* 2008; **126**: 1731-9.
47. He M, Abdou A, Naidoo KS, Sapkota YD, Thulasiraj RD, Varma R, Zhao J, Ellwein LB. Prevalence and correction of near vision impairment at seven sites in China, India, Nepal, Niger, South Africa, and the United States. *Am J Ophthalmol* 2012; **154**: 107-16 e1.
48. Han X, Lee PY, Keel S, He M. Prevalence and incidence of presbyopia in urban Southern China. *Br J Ophthalmol* 2018.
49. Hashemi H, Khabazkhoob M, Jafarzadehpour E, Mehravaran S, Emamian MH, Yekta A, Shariati M, Fotouhi A. Population-based study of presbyopia in Shahroud, Iran. *Clin Experiment Ophthalmol* 2012; **40**: 863-8.
50. Lavers H. The prevalence of presbyopia and the feasibility of community distribution of near spectacles in adults in Zanzibar, East Africa. *Community Eye Health* 2007; **20**: 73.

51. Lu Q, He W, Murthy GV, He X, Congdon N, Zhang L, Li L, Yang J. Presbyopia and near-vision impairment in rural northern China. *Invest Ophthalmol Vis Sci* 2011; **52**: 2300-5.
52. Marmamula S, Keeffe JE, Rao GN. Uncorrected refractive errors, presbyopia and spectacle coverage: results from a rapid assessment of refractive error survey. *Ophthalmic Epidemiol* 2009; **16**: 269-74.
53. Mashayo ER, Chan VF, Ramson P, Chinanayi F, Naidoo KS. Prevalence of refractive error, presbyopia and spectacle coverage in Kahama District, Tanzania: a rapid assessment of refractive error. *Clinical & experimental optometry : journal of the Australian Optometrical Association* 2015; **98**: 58-64.
54. Nirmalan PK, Krishnaiah S, Shamanna BR, Rao GN, Thomas R. A population-based assessment of presbyopia in the state of Andhra Pradesh, south India: the Andhra Pradesh Eye Disease Study. *Invest Ophthalmol Vis Sci* 2006; **47**: 2324-8.
55. Obajolowo TS, Owoeye J, Adepoju FG. Prevalence and Pattern of Presbyopia in a Rural Nigerian Community. *J West Afr Coll Surg* 2016; **6**: 83-104.
56. Patel I, Munoz B, Burke AG, Kayongoya A, McHiwa W, Schwarzwaldner AW, West SK. Impact of presbyopia on quality of life in a rural African setting. *Ophthalmology* 2006; **113**: 728-34.
57. Patel I, West SK. Presbyopia: prevalence, impact, and interventions. *Community Eye Health* 2007; **20**: 40-1.
58. Frick KD, Joy SM, Wilson DA, Naidoo KS, Holden BA. The Global Burden of Potential Productivity Loss from Uncorrected Presbyopia. *Ophthalmology* 2015; **122**: 1706-10.
59. Reddy PA, Congdon N, MacKenzie G, Gogate P, Wen Q, Jan C, Clarke M, Kassalow J, Gudwin E, O'Neill C, Jin L, Tang J, Bassett K, Cherwek DH, Ali R. Effect of providing near glasses on productivity among rural Indian tea workers with presbyopia (PROSPER): a randomised trial. *Lancet Glob Health* 2018; **6**: e1019-e27.
60. Patel I, West SK. Functional presbyopia in Kenya. *Clin Experiment Ophthalmol* 2008; **36**: 699-700.
61. Marmamula S, Barrenkala NR, Challa R, Kumbam TR, Modepalli SB, Yellapragada R, Bhakki M, Khanna RC, Friedman DS. Uncorrected refractive errors for distance among the residents in 'homes for the aged' in South India-The Hyderabad Ocular Morbidity in Elderly Study (HOMES). *Ophthalmic Physiol Opt* 2020.
62. Davis G. The Evolution of Cataract Surgery. *Mo Med* 2016; **113**: 58-62.
63. Finger RP, Kupitz DG, Fenwick E, Balasubramaniam B, Ramani RV, Holz FG, Gilbert CE. The impact of successful cataract surgery on quality of life, household income and social status in South India. *PLoS One* 2012; **7**: e44268.
64. Lamoureux EL, Fenwick E, Pesudovs K, Tan D. The impact of cataract surgery on quality of life. *Curr Opin Ophthalmol* 2011; **22**: 19-27.
65. Lansingh VC, Carter MJ, Martens M. Global cost-effectiveness of cataract surgery. *Ophthalmology* 2007; **114**: 1670-8.
66. Khanna R, Pujari S, Sangwan V. Cataract surgery in developing countries. *Curr Opin Ophthalmol* 2011; **22**: 10-4.
67. Khanna RC, Pallerla SR, Eeda SS, Gudapati BK, Cassard SD, Rani PK, Shantha GP, Chakrabarti S, Schein OD. Population based outcomes of cataract surgery in three tribal areas of Andhra Pradesh, India: risk factors for poor outcomes. *PLoS One* 2012; **7**: e35701.
68. Marmamula S, Khanna RC, Shekhar K, Rao GN. Outcomes of Cataract Surgery in Urban and Rural Population in the South Indian State of Andhra Pradesh: Rapid Assessment of Visual Impairment (RAVI) Project. *PLoS One* 2016; **11**: e0167708.

69. Dandona L, Dandona R, Anand R, Srinivas M, Rajashekar V. Outcome and number of cataract surgeries in India: policy issues for blindness control. *Clin Experiment Ophthalmol* 2003; **31**: 23-31.
70. Bachani D, Gupta SK, Murthy GV, Jose R. Visual outcomes after cataract surgery and cataract surgical coverage in India. *International ophthalmology* 1999; **23**: 49-56.
71. WHO. Informal consultation on analysis of blindness prevention outcomes. In: *Informal consultation on analysis of blindness prevention outcomes*, Geneva: World Health Organization, 1998.
72. Murthy GV, Vashist P, John N, Pokharel G, Ellwein LB. Prevalence and vision-related outcomes of cataract surgery in Gujarat, India. *Ophthalmic Epidemiol* 2009; **16**: 400-9.
73. India State-Level Disease Burden Initiative Mental Disorders C. The burden of mental disorders across the states of India: the Global Burden of Disease Study 1990-2017. *Lancet Psychiatry* 2020; **7**: 148-61.
74. Pilania M, Bairwa M, Kumar N, Khanna P, Kurana H. Elderly depression in India: An emerging public health challenge. *The Australasian medical journal* 2013; **6**: 107-11.
75. Pilania M, Yadav V, Bairwa M, Behera P, Gupta SD, Khurana H, Mohan V, Baniya G, Poongothai S. Prevalence of depression among the elderly (60 years and above) population in India, 1997-2016: a systematic review and meta-analysis. *BMC public health* 2019; **19**: 832.
76. Grover S, Malhotra N. Depression in elderly: A review of Indian research. *Journal of Geriatric Mental Health* 2015; **2**: 4-15.
77. Shidhaye R, Gangale S, Patel V. Prevalence and treatment coverage for depression: a population-based survey in Vidarbha, India. *Social psychiatry and psychiatric epidemiology* 2016.
78. Devi ES, Neenu A, Anu P, Rosemary J, Anju B, Dalphina S, Divya KY, Sonia J, Bindu M, Anit JN. Elderly and depression. *The Nursing journal of India* 2007; **98**: 221-3.
79. Sahni B, Bala K, Kumar T, Narangyal A. Prevalence and determinants of geriatric depression in North India: A cross-sectional study. *Journal of family medicine and primary care* 2020; **9**: 2332-6.
80. Sinha SP, Shrivastava SR, Ramasamy J. Depression in an older adult rural population in India. *MEDICC review* 2013; **15**: 41-4.
81. Anand A. Understanding Depression among Older Adults in Six Low-Middle Income Countries using WHO-SAGE Survey. *Behavioral Health* 2015; **1**.
82. Tetteh J, Fordjour G, Ekem-Ferguson G, Yawson AO, Boima V, Entsuh-Mensah K, Biritwum R, Essuman A, Mensah G, Yawson AE. Visual impairment and social isolation, depression and life satisfaction among older adults in Ghana: analysis of the WHO's Study on global AGEing and adult health (SAGE) Wave 2. *BMJ Open Ophthalmol* 2020; **5**: e000492-e.
83. Niazi Y, Ejaz B, Muazzam A. Impact of hearing impairment on psychological distress and subjective well-being in older adults. *Pak J Med Sci* 2020; **36**: 1210-5.
84. Cosh S, Helmer C, Delcourt C, Robins TG, Tully PJ. Depression in elderly patients with hearing loss: current perspectives. *Clinical interventions in aging* 2019; **14**: 1471-80.
85. Wittich W, Southall K, Sikora L, Watanabe DH, Gagné J-P. What's in a name: Dual sensory impairment or deafblindness? *British Journal of Visual Impairment* 2013; **31**: 198-207.
86. A RA, Noronha JA. Depression among older adults: a systematic review of South Asian countries. 2020.
87. Arokiasamy P, Verma U, Kowal P. On depression in an older adult population of rural India. *MEDICC review* 2014; **16**: 5.

88. Bouscaren N, Yildiz H, Dartois L, Vercambre MN, Boutron-Ruault MC. Decline in Instrumental Activities of Daily Living over 4-Year: The Association with Hearing, Visual and Dual Sensory Impairments among Non-Institutionalized Women. *J Nutr Health Aging* 2019; **23**: 687-93.
89. Brennan M, Horowitz A, Su YP. Dual sensory loss and its impact on everyday competence. *The Gerontologist* 2005; **45**: 337-46.
90. Kiely KM, Anstey KJ, Luszcz MA. Dual Sensory Loss and Depressive Symptoms: The Importance of Hearing, Daily Functioning, and Activity Engagement. *Frontiers in Human Neuroscience* 2013; **7**.
91. McDonnall MC. The effects of developing a dual sensory loss on depression in older adults: a longitudinal study. *Journal of aging and health* 2009; **21**: 1179-99.
92. WHO. Global Report on Falls Prevention in older age. In: *Global Report on Falls Prevention in older age*, France: World Health Organization, 2007.
93. Tinetti ME, Speechley M, Ginter SF. Risk factors for falls among elderly persons living in the community. 1988.
94. Dsouza HA, Rajashekar B, Dsouza H, Kumar KB. Falls in Indian older adults: a barrier to active ageing. *Asian J Gerontol Geriatr* 2014; **9**: 33-40.
95. Johnson SJ. Frequency and nature of falls among older women in India. *Asia-Pacific journal of public health / Asia-Pacific Academic Consortium for Public Health* 2006; **18**: 56-61.
96. Tripathy NK, Jagnoor J, Patro BK, Dhillon MS, Kumar R. Epidemiology of falls among older adults: A cross sectional study from Chandigarh, India. *Injury* 2015; **46**: 1801-5.
97. Peter RM, Joseph A, John KR, Logaraj M. A Community-Based Case-Control Study on the Risk of Fall among the Elderly in Rural Kattankulathur Block, Tamil Nadu. *Indian journal of community medicine : official publication of Indian Association of Preventive & Social Medicine* 2019; **44**: 277-80.
98. Jindal HA, Duggal M, Jamir L, Sharma D, Kankaria A, Rohilla L, Avasthi A, Nehra R, Grover S. Mental health and environmental factors associated with falls in the elderly in North India: A naturalistic community study. *Asian journal of psychiatry* 2019; **39**: 17-21.
99. Sharma PK, Bunker CH, Singh T, Ganguly E, Reddy PS, Newman AB, Cauley JA. Burden and Correlates of Falls among Rural Elders of South India: Mobility and Independent Living in Elders Study. *Current gerontology and geriatrics research* 2017; **2017**: 1290936.
100. Thakur R, Banerjee A, Nikumb V. Health problems among the elderly: a cross-sectional study. *Ann Med Health Sci Res* 2013; **3**: 19-25.
101. Dhargave P, Sendhilkumar R. Prevalence of risk factors for falls among elderly people living in long-term care homes. *Journal of Clinical Gerontology and Geriatrics* 2016; **7**: 99-103.
102. D'Souza SA, A. S, J. K. Circumstances and consequences of falls in Indian older adults. *Ind J Occup Ther* 2008; **40**: e9.
103. Marmamula S, Mitchell W, Zebardast N, Locascio J, Barrenkala NR, Kumbham TR, Modepalli SB, Khanna RC, Friedman DS. Impact of Vision Loss on Visual Function Among Elderly Residents in the "Home for the Aged" in India: The Hyderabad Ocular Morbidity in Elderly Study. *Transl Vis Sci Technol* 2020; **9**: 11.
104. Snyder CF, Jensen RE, Segal JB, Wu AW. Patient-reported outcomes (PROs): putting the patient perspective in patient-centered outcomes research. *Med Care* 2013; **51**: S73-9.

105. Marmamula S, Barrenakala NR, Challa R, Kumbham TR, Modepalli SB, Yellapragada R, Bhakki M, Khanna RC, Friedman DS. 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). *Br J Ophthalmol* 2021; **105**: 32-6.
106. Vu TA, Fenwick EK, Gan ATL, Man REK, Tan BKJ, Gupta P, Ho KC, Reyes-Ortiz CA, Trompet S, Gussekloo J, O'Brien JM, Mueller-Schotte S, Wong TY, Tham YC, Cheng CY, Lee ATC, Rait G, Swenor BK, Varadaraj V, Brenowitz WD, Medeiros FA, Nael V, Narasimhalu K, Chen CLH, Lamoureux EL. The Bidirectional Relationship between Vision and Cognition: A Systematic Review and Meta-analysis. *Ophthalmology* 2021; **128**: 981-92.
107. Marmamula S, Barrenkala NR, Challa R, Reddy KT, Yellapragada S, Brahmanandam MS, Friedman DS, Khanna RC. Hyderabad Ocular Morbidity in Elderly Study (HOMES) - Rationale, Study Design and Methodology. *Ophthalmic Epidemiol* 2020; **27**: 83-92.
108. Marmamula S, Barrenkala NR, Khanna RC, Challa R, Bhakki M, Kumbham TR, Modepalli SB, Yellapragada R, Friedman DS. Near vision impairment among the elderly in residential care-the Hyderabad Ocular Morbidity in Elderly Study (HOMES). *Eye (Lond)* 2020.
109. Wang C-w, Chan C, Chi I. Overview of Quality of Life Research in Older People with Visual Impairment. *Advances in Aging Research* 2014; **3**: 79-94.
110. Division UNP. World Population Prospects: The 2012 Revision. In: *World Population Prospects: The 2012 Revision*, Vol. 2014: United Nations Department of Economic and Social Affairs