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Original Research Article

Screening-detected ocular morbidities and gaps in eye care utilization among older adults in rural Uttar Pradesh: a cross-sectional study

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ABSTRACT

Background: Older adults in rural Uttar Pradesh face a high burden of avoidable visual impairment. Community-based eye health evidence from this state, home to India's largest rural older-adult population, remains scarce.
Methods: A community-based cross-sectional study was conducted (February–March 2026) in five rural villages of Greater Noida, Uttar Pradesh. Adults aged ≥50 years were enrolled using stratified random sampling (n=302; response rate 94.5%). Basic ocular screening (Snellen visual acuity at 6 metres and torchlight anterior segment examination) and a pretested questionnaire were used. Associations were assessed using Chi-square tests.
Results: Among 302 participants (mean age 58.3±9.2 years; 58.9% female), 266 (88.1%) had at least one screening-detected ocular condition. Refractive error (53.8%) and suspected cataract (44.7%) were most prevalent. The refractive error correction gap was 52.6% and the cataract surgical gap was 67.0%. Awareness of government eye screening camps was 44.0%, and only 42.1% had ever attended one. Visual impairment was significantly more prevalent among older participants, females, illiterate individuals, and those of lower socioeconomic status (all $p<0.05$).
Conclusions: There is a high burden of largely avoidable ocular morbidity in this rural population, with substantial refractive error correction and cataract surgical gaps. Integrating ocular screening into primary care and strengthening NPCBVI referral pathways are essential for reducing avoidable visual impairment in similar settings.

Keywords: Aged, Cataract, India primary health care, Refractive errors, Rural population, Vision disorders

INTRODUCTION

Visual impairment and age-related ocular conditions constitute a major public health concern among older adults worldwide, particularly in low- and middle-income countries where access to eye care is constrained.[1,2] After the age of 50 years, the prevalence of correctable vision problems rises sharply, with refractive errors, age-related cataract, presbyopia, and degenerative conditions contributing substantially to functional dependency, poor quality of life, and increased healthcare utilisation.[1,3]

In India, older adults in rural areas bear a disproportionate burden of untreated ocular morbidity.[3-5] Age-related cataract remains the leading cause of avoidable blindness, while uncorrected refractive error is a major contributor to moderate and severe visual impairment in community-based surveys.[3-5]

Despite improvements in cataract surgical coverage and the expansion of eye care services under the National Programme for Control of Blindness and Visual Impairment (NPCBVI), preventable visual loss continues to be highly prevalent in rural settings.[3-5]

Most published community eye health data from India originate from southern states or hospital-based populations. Uttar Pradesh, home to the largest rural older-adult population in the country and among the states with the greatest burden of preventable blindness, is substantially under-represented in the literature. Field practice area-based data linked to medical college primary care systems are particularly scarce for this region yet are directly relevant to district-level programme planning and monitoring under NPCBVI.

Primary care physicians and community health workers occupy a strategic position for early detection and referral of vision-threatening conditions through simple screening methods such as visual acuity assessment and basic anterior segment examination.[6] Indicators such as the refractive error correction gap (the difference between those who need and those who use spectacles) and the cataract surgical gap (the difference between those with lens opacity and those who have undergone surgery) are pragmatic programmatic measures of how effectively services are reaching rural elderly populations.[3-7]

The present study aimed to estimate the prevalence of screening-detected ocular conditions, assess management gaps, examine sociodemographic associations with visual impairment, and evaluate awareness and utilisation of eye care services among adults aged ≥50 years in a rural field practice area of western Uttar Pradesh, with the goal of providing locally contextualised, actionable evidence for NPCBVI implementation and primary care integration.

METHODS

Study design and setting

A community-based cross-sectional study was conducted from February to March 2026 in five rural villages of Greater Noida, Uttar Pradesh the field practice area of the Department of Community Medicine, Sharda School of Medical Sciences and Research (Formerly School of Medical Sciences and Research), Sharda University. The setting represents a typical rural area of western Uttar Pradesh with limited access to specialised ophthalmic services.

Sample size

Sample size was calculated using the formula $n=4PQ/d^2$, with p=0.92 (expected prevalence of any ocular morbidity from prior rural studies), Q=0.08, and d=0.025 (allowable error; 95% confidence level), yielding n=471. Due to logistical constraints during a restricted field posting period, 302 participants were enrolled (64.1% of calculated sample).

Post-hoc power analysis indicated 80% power to detect associations with odds ratio ≥1.8 at α =0.05, adequate for primary outcomes. The sample size limitation is acknowledged, and findings should be interpreted accordingly.

Participant selection

Adults aged ≥50 years who were permanent residents of the selected villages (≥1 year) and able to provide informed consent were included. Individuals with severe cognitive impairment, those bedridden or unable to attend screening camps, and those with pre-existing diagnosed glaucoma or advanced eye disease under specialist care were excluded. Stratified random sampling with villages as strata and systematic random sampling within each village (using census data and household registers) was employed.

Data collection

A pretested semi-structured questionnaire, validated through cognitive interviews with 30 community members, assessed sociodemographic characteristics, self-reported eye symptoms, corrective lens use, awareness and utilisation of government eye screening programmes, risk factors (smoking, alcohol), chronic conditions (diabetes, hypertension), family history of eye disease, and history of ocular trauma. Response rate was 94.5% (302/319 eligible individuals). Basic ocular screening was conducted at village-level screening camps. Screening comprised: (1) visual acuity (Snellen chart at 6 metres; refractive error defined as VA ≤6/9 in either eye correctable with pinhole); and (2) anterior segment examination (hand torch, 5W, 500 lux) for gross abnormalities, pupillary response, media clarity, and corneal integrity. All findings are described as screening-detected conditions rather than clinical diagnoses. Both screening physicians received standardised training prior to data collection.

Statistical analysis

Data were entered in SPSS Version 20.0. Descriptive statistics were computed for all variables.

Bivariate associations between demographic factors and screening-detected visual conditions were assessed using Chi-square tests (χ^2); $p<0.05$ was considered statistically significant. Multivariate analysis was not performed due to sample size constraints and collinearity; independent predictors should be examined in future studies.

Ethical considerations

Ethical approval was obtained from the Institutional Ethics Committee, Sharda University. Written informed consent was obtained from all participants. Participants with identified visual impairment were referred to district eye hospital services.

RESULTS

Sociodemographic characteristics

A total of 302 adults aged ≥50 years were included (mean age 58.3±9.2 years; range 50-85 years). Females

constituted 58.9% of the sample. Most participants were illiterate (63.3%), unemployed or retired (53.0%), and of lower socioeconomic status (75.2% in lower and lower-middle BG Prasad categories). Sociodemographic characteristics are presented in Table 1.

Table 1: Sociodemographic characteristics of study participants (n=302).

Variable	Category	Number (N)	Percentage (%)
Age group (years)	50-55	102	33.8
	56-60	74	24.5
	61-65	56	18.5
	≥66	70	23.2
Sex	Male	124	41.1
	Female	178	58.9
Educational status	Illiterate	191	63.3
	Primary	63	20.9
	Secondary and above	48	15.8
Occupation	Unemployed/ retired	160	53.0
	Employed	142	47.0
SES (BG Prasad Scale)	Lower	111	36.8
	Lower middle	116	38.4
	Middle and above	75	24.8

Prevalence of screening-detected ocular conditions

Overall, 266 participants (88.1%) demonstrated at least one screening-detected ocular condition (Table 2). Refractive error was the most prevalent finding (53.8%), followed by suspected cataract (44.7%), presbyopia (22.9%), corneal abnormalities (5.3%), and minor ocular conditions (4.1%).

Table 2: Prevalence of screening-detected ocular morbidities among study participants (n=302).

Ocular morbidity	Number (N)	Percentage (%)
Any ocular morbidity (≥1 condition)	266	88.1
Refractive errors (VA ≤6/9, pinhole-correctable)	143	53.8*
Screening-suspected cataract (gross lens opacity)	119	44.7*
Presbyopia (age-related accommodation loss)	61	22.9*
Corneal abnormalities	14	5.3*
Minor ocular conditions (stye, conjunctivitis)	11	4.1*

*Percentages calculated from 266 participants with ≥1 condition; individuals could have multiple findings (totals exceed 100%). SES = socioeconomic status; VA = visual acuity

Management status: refractive error correction gap and cataract surgical gap

Of 143 participants with screening-detected refractive error, 76 (52.6%) were not using corrective spectacles, representing a substantial refractive error correction gap. Of 119 participants with screening-suspected cataract, 80 (67.0%) had not undergone surgery, representing the cataract surgical gap at the screening level. Surgical indication cannot be determined from torchlight screening alone; these findings identify individuals requiring formal ophthalmologic evaluation. Management status is shown in Table 3.

Table 3: Management status of major screening-detected ocular morbidities.

Ocular condition	Management status	Number (N)	Percentage (%)
Screening-suspected cataract (n=119)	Operated	39	33.0
	Not operated†	80	67.0
Refractive errors (n=143)	Using spectacles	67	47.4
	Not using spectacles	76	52.6

†'Not operated' reflects the cataract surgical gap at screening level; surgical indication requires formal ophthalmologic evaluation and cannot be determined from torchlight screening alone.

Risk factors

Among the 266 with screening-detected conditions, smoking (current or past) was reported by 101 (38.1%) and was significantly more prevalent compared to those without detected conditions (38.1% vs. 22.2%; χ^2=3.87, p=0.049). Chronic systemic disease was reported by 64 (24.2%), family history of ocular disease by 34 (12.9%), alcohol consumption by 27 (10.3%), and ocular trauma by 21 (7.9%) (Table 4).

Table 4: Distribution of risk factors among participants with screening-detected ocular conditions (n=266).

Risk factor	N	(%)
Smoking (current or past)	101	38.1
Chronic systemic disease (diabetes/hypertension)	64	24.2
Family history of ocular disease	34	12.9
Alcohol consumption (regular)	27	10.3
History of ocular trauma or injury	21	7.9

Demographic associations with visual impairment

All four demographic variables were significantly associated with the presence of screening-detected ocular

conditions (Table 5): prevalence increased with age (84.3% in 50-55 years to 91.4% in ≥66 years; χ^2=12.43, p=0.006); females had higher prevalence (92.1% vs. 82.3%; χ^2=6.71, p=0.009); illiterate participants had higher prevalence than those with secondary education (91.1% vs. 70.8%; χ^2=5.64, p=0.018); and lower SES was associated with higher prevalence (93.7% lower vs. 76.0% middle and above; χ^2=4.82, p=0.028).

Table 5: Bivariate analysis-demographic associations with screening-detected visual impairment.

Variable	Category	With condition (N)	Without condition (N)	% With condition	χ^2 (p value)
Age group	50-55	86	16	84.3	12.43 (p=0.006)
	56-60	66	8	89.2	-
	61-65	50	6	89.3	-
	≥66	64	6	91.4	-
Gender	Male	102	22	82.3	6.71 (p=0.009)
	Female	164	14	92.1	-
Education	Illiterate	174	17	91.1	5.64 (p=0.018)
	Primary	58	5	92.1	-
	Secondary+	34	14	70.8	-
Socioeconomic status	Lower	104	7	93.7	4.82 (p=0.028)
	Lower-middle	105	11	90.5	-
	Middle+	57	18	76.0	-

Awareness and utilisation of eye care services

Among all 302 participants, 133 (44.0%) were aware of government eye screening programmes, while 169 (56.0%) were unaware. Only 127 (42.1%) had ever attended a government eye screening camp; 175 (57.9%) had never done so (Figure 1).

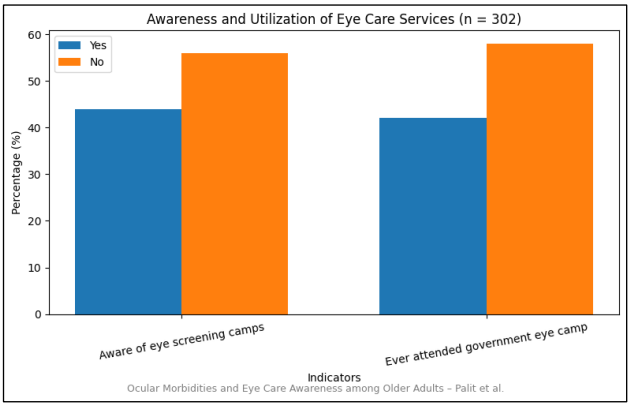

Figure 1: Awareness and utilisation of eye care services among study participants (n=302).

DISCUSSION

This study found a very high prevalence (88.1%) of screening-detected ocular conditions among adults aged ≥50 years in rural western Uttar Pradesh a state substantially under-represented in the published Indian community eye health literature. Refractive error (53.8%) and suspected cataract (44.7%) accounted for most of the potentially correctable visual impairment. These findings are broadly consistent with prior Indian data, though direct comparison is limited by methodological differences. Gupta et al reported cataract prevalence of 21.4% in an urban North Indian population using slit-lamp grading, and Vashist et al reported 36.2% across all ages in the India Eye Disease Study; the higher figure observed here reflects detection of any gross lens opacity by torchlight in an older, rural sample rather than clinically graded vision-limiting cataract.[3,4] Similarly, while Murthy et al documented refractive error predominantly in urban settings, our data confirm its high prevalence in the rural elderly of UP, with more than half of affected individuals not using corrective lenses.[5]

The refractive error correction gap (52.6%) and cataract surgical gap (67.0%) are high by national standards and indicate that case identification is not translating into correction or treatment. These indicators are recognised by NPCBVI as key programmatic targets.[7] The present study provides baseline values for this under-studied region, directly informing district-level programme planning.

The significantly higher prevalence of screening-detected conditions among females (92.1% vs. 82.3%, p=0.009) raises important equity concerns, consistent with evidence on gender disparities in cataract surgical uptake in India. This underscores the need for gender-sensitive outreach strategies, including targeting of elderly women and involvement of family decision-makers.

Despite NPCBVI-supported initiatives, 56.0% of participants lacked awareness of eye screening programmes, and only 42.1% had ever attended a government camp. The low utilisation even among those aware suggests that awareness alone is insufficient. Integrating eye health promotion into routine primary care visits, expanding outreach through ASHAs, and deploying mobile screening services are needed to bridge this gap.[6,7]

The higher smoking prevalence among those with versus without detected conditions (38.1% vs. 22.2%, p=0.049) is consistent with evidence on tobacco as a risk factor for cataract and reinforces the importance of cessation counselling in primary care.

Key strengths of this study include its community-based design, stratified random sampling, high response rate (94.5%), pretested questionnaire, standardised screening protocol, and articulation of programmatically relevant gap indicators. The achieved sample (n=302) was smaller than the calculated sample (n=471) due to logistical constraints. While adequate power was demonstrated for primary outcomes, generalisability is limited, and multivariate analysis was not possible. Additional limitations include the inability of basic screening methods to confirm diagnoses, assess glaucoma, or evaluate posterior segment pathology; potential attendance bias; the absence of an urban comparison group; and unmeasured confounders such as distance to eye care facilities.

CONCLUSION

This study demonstrates a high burden of screening-detected, largely avoidable ocular morbidity among rural older adults in western Uttar Pradesh, with a refractive error correction gap of 52.6% and a cataract surgical gap of 67.0%. More than half of participants were unaware of government eye screening programmes and had never attended a camp. These findings provide actionable, locally contextualised evidence for strengthening primary-care-based ocular screening, reinforcing NPCBVI referral pathways, and deploying targeted community health worker outreach. Future studies with adequately powered samples and formal ophthalmologic validation are needed to identify independent predictors and evaluate primary-care integration models in this under-studied region.

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Ethical approval: The study was approved by the Institutional Ethics Committee of Sharda University (Approval No. SU/SMS&R/76-A/2026/14; 09 February 2026

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