Original Article

Prevalence of presbyopia, spectacles coverage and barriers for unmet need among adult population of rural Jhajjar, Haryana

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Abstract

Background: Presbyopia is a major cause for near visual impairment among adults. Presbyopia induced visual impairment can be corrected easily by spectacles. We aimed to study the prevalence of presbyopia among adults aged ≥35 years and spectacles coverage among them. We also studied the unmet need for presbyopia along with the barriers to uptake of services. **Methods:** This is a population-based cross-sectional study conducted among adults aged ≥35 years in a rural district of Haryana. Near vision assessment and semistructured interview schedule were administered by a team of trained ophthalmic assistant, social worker and health assistant. **Results:** A total of 3832 adults aged ≥35 years were enumerated, from which 3246 (84.7%) were examined. Prevalence of presbyopia was found to be 42.9% (95% confidence interval 41.2–44.6). Participants with increasing age, literacy and women had higher prevalence, and those that were employed and belonged to below poverty line economic status had lower prevalence of presbyopia. Spectacles coverage among presbyopes was found to be 25.8%. There was an inverse association between unmet need for presbyopia and women, increasing education status and office work. Lack of felt need and personal reasons were the most common barriers for unmet need due to presbyopia. **Conclusions:** There is high prevalence of presbyopia among adult population, with spectacles coverage being low. Awareness activities along with affordable, accessible and socially acceptable services for those affected with presbyopia would be one of the key components of management.

Keywords: Presbyopia, spectacles coverage, unmet need

Introduction

Presbyopia, an age-related public health concern, limits near vision tasks due to changes in the accommodative ability of the lens.[1] Uncorrected presbyopia is the leading cause of visual impairment throughout the world.[2] There are 1.8 billion people (95% confidence interval (CI) 1.7–2.0 billion) suffering from presbyopia globally as per global estimates. Out of these, 826 million had near vision impairment because they had no, or inadequate, vision correction.[3] Prevalence of uncorrected presbyopia ranged from 28.1 to 63% among adults aged more than 30 years.[4–10] This estimate is likely to increase with increasing

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proportion of elderly. Presbyopia not only affects the quality of life of individuals but also takes a toll on the economy of the country as a whole, specifically low- and middle-income countries like India.[11–14] Thus, addressing presbyopia is imperative for achieving sustainable development goals that strive for promoting health and well-being for all.[15]

Universal eye care action plan advocates for conduct of epidemiological studies for generating sufficient evidence on burden related to visual impairment to guide planning for programmatic actions.[16] The Government of India recently under its strategic planning cycles (2017–2020) laid emphasis on screening of presbyopia at public health facilities and revised assistance provision norms for near vision spectacles.[17] Primary care physicians are critical in performing this screening, and burden estimates at local level will be required in different geographic regions. There are very few studies focusing on presbyopia and still fewer available from North India. Therefore, this study was primarily aimed at studying the prevalence of presbyopia and spectacles coverage among adults aged 35 years and above. We also aimed to study the unmet need, along with the barriers to uptake of services among the presbyopes. The secondary objective was to relate this prevalence and unmet need with the various sociodemographic factors.

Material and Methods

This was a community-based cross-sectional study conducted in Jhajjar district of Haryana with around 9,00,000 population distributed in five subdistricts.[18] This study was conducted in two randomly selected subdistricts (Bahadurgarh and Jhajjar). A list of villages in these blocks/subdistricts were prepared and were arranged in increasing population size. Selection of villages was done according to probability proportionate to size. A total of 34 villages were selected in this study which were clusters for this study. Each village was further broken down to segments of 400–600 population. One compact segment was selected randomly using sealed opaque envelopes. All adults aged 35 years and above were enumerated. It was ensured that at least 50 participants in the target age group in each cluster were selected. A minimum sample size of 2664 was calculated with presbyopia prevalence of 58% with relative precision of 5%, design effect of 2 and a nonresponse rate of 15%.[9]

The data collection team consisted of ophthalmic assistant, social worker and health assistant experienced in community-based eye care and survey techniques. The teams were sensitized and trained in all procedures related to data collection and examination. Initially, house to house visits were carried out by a social worker and a health assistant. This team collected demographic details and other ocular disease history and spectacles use. Binocular near vision was measured in adults aged 35 years and above, using N notation near vision chart at the customary working distance for each individual (usual range 33–35 cm). Participants who failed to read N8 were referred for refraction to a temporary makeshift clinic arranged within the village. A semistructured interview schedule was administered to ascertain the barriers for unmet need for spectacles for presbyopia.

Met Need was defined as unaided near vision < N8, but improved to N8 or better with the spectacles they were using. Unmet need was defined as unaided near vision < N8 and had no spectacles, but improved to N8 or better with a near addition. Total need was the sum total of met need and unmet need in the population, which was the prevalence of presbyopia.[5] Spectacles coverage was defined as [met need/(met need + unmet need)] × 100%. Below poverty line (BPL) was considered when monthly income of the family was less than US$ 4.6 (Indian National Rupees INR 300) and was confirmed by BPL ration card of the family.[19]

Continuous scrutiny of all study procedures and equipment was done throughout the conduct of the study. Pilot testing of all the procedures conducted during the main study was done at another village that was not included in the study. An investigating team consisting of an epidemiologist and an ophthalmologist supervised data collection and the examination procedure. Random checking of presbyopic participants was done by the ophthalmologist.

Data were entered and managed in MS Excel 2016, and statistical analysis was carried out using Stata 12.0 (StataCorp LP, 4905 Lakeway Drive, College Station, Texas, USA). The prevalence of presbyopia and spectacles coverage were calculated and reported as percentages with 95% CI. Bivariable and multivariable analysis was carried out using logistic regression for determining associated sociodemographic factors with presbyopes and unmet need for spectacles. Both unadjusted and adjusted odds ratio with 95% CI were computed. The *P* value less than 0.05 was considered statistically significant.

Ethics approval was taken from Institute Ethics Committee of All India Institute of Medical Sciences (AIIMS), New Delhi. Consent was also taken from the community leaders at cluster level. Written consent was taken from the participants. The study procedures conformed to the principles laid by Declaration of Helsinki. All participants with detected near vision impairment were referred to the eye department of Jhajjar outpatient services at AIIMS, Jhajjar complex.

Results

A total of 3832 adults aged 35 years and above were enumerated, from which 3246 (84.7%) were examined, **as shown in Table 1**. The largest group was aged 40–49 years (29.8%) followed by those in the age group of 50–59 years. Similarly, among the enumerated participants, there was equal distribution with respect to gender, whereas among those who were examined, 53.5% were women and the rest were men. Majority of the examined participants were married (81.7%), belonged to above poverty line category (81.2%) and were involved in household work (59.0%). Forty percent of participants were educated up to the secondary level and followed by illiterate participants (35.6%) [Table 1].

Table 1: Distribution of participants by sociodemographic characteristics

Characteristics	Examined Adults *n*=3246 (%)
Age (years)	
35-39	663 (20.4)
40-49	966 (29.8)
50-59	608 (18.7)
60-69	599 (18.5)
≥70	410 (12.6)
Gender	
Men	1508 (46.5)
Women	1738 (53.5)
Marital status	
Married	2652 (81.7)
Single (Unmarried/Widower)	594 (18.3)
Occupation	
Homemaker	1915 (59.0)
Labour-Agricultural/Nonagricultural	706 (21.8)
Office/Skilled work	422 (13.0)
Unemployed/Retired	203 (6.3)
Education	
Illiterate	1154 (35.6)
Primary	443 (13.7)
Secondary	1249 (38.5)
Senior Secondary and above	400 (12.3)
Economic status	
Above poverty line	2635 (81.2)
Below poverty line	611 (18.8)

Prevalence of presbyopia

Among the total 3246 participants, the prevalence of presbyopia was found to be 42.9% (95% CI 41.2–44.6). Within this, 552 men (36.6%, 95% CI 34.2–39.1) and 841 women (48.4%, 95% CI 46.0–50.8) had presbyopia. Highest prevalence was observed among those belonging to the age group of 50–59 years (47.9%) followed by those in the age group of 40–49 years and 60–69 years. The prevalence of presbyopia among married participants, homemakers or unemployed and participants with primary education was 43.7, 48.5 and 48.5%, respectively. Participants who belonged to the above poverty line had 44.0% prevalence of presbyopia.

Factors associated with presbyopia

Table 2 depicts factors associated with presbyopia. In the multivariable model, compared to adults aged 35–39 years, adults in age group 40–49 years had five times higher odds of presbyopia (AOR = 5.5 95% CI 4.5–6.7); 50–59 years had almost 12 times increased odds of presbyopia (AOR = 11.7 95% CI 8.6–15.9); 60–69 years had five times increased odds of presbyopia (AOR = 5.1 95% CI 3.6–7.3) and ≥70 years had three times increased odds of presbyopia (AOR = 2.9 95% CI 1.9-4.4), and all these associations were statistically significant. Women had 1.5 times higher odds (AOR = 5.5 95% CI 4.5–6.7) of presbyopia than men. Participants who were involved in labour work and office/skilled work had 30% (AOR = 0.7 95% CI 0.5–0.9) and 60% (AOR = 0.4 95% CI 0.3–0.6) lower odds of presbyopia, respectively, compared to homemakers. Participants with primary (AOR = 1.6 95% CI 1.3–2.0), secondary (AOR = 1.7 95% CI 1.4–2.1) and senior secondary education (AOR = 1.6 95% CI 1.2–2.2) had almost two times higher prevalence of presbyopia than illiterates and was statistically significant. There was no association of presbyopia with marital status [Table 2].

Spectacles coverage

Of the 1393 presbyopes, the spectacles were used by 359 participants (25.8%). Highest spectacles coverage was found among adults aged 50–59 years (28.7%) followed by 60–69 years (26.1%), as presented in Table 3. The lowest coverage was found in the age group of ≥70 years (17.0%). In total, 183 men (33.1%) and 176 women (20.9%) were using spectacles. The spectacles coverage among married participants was 27.5%. Among various occupational groups, spectacles coverage was 49.4% among unemployed participants and 20.3% among homemakers. Illiterates had spectacles coverage of 12.0% and participants with education of senior secondary and above had 50% spectacles coverage. Above poverty line participants had 26.8% spectacles coverage [Table 3].

Factors associated with unmet need

Table 3 presents results of factors associated with unmet need for presbyopia. In the multivariable model, women had significantly 40% lesser odds of having unmet need for presbyopia than men (AOR = 0.6 95% CI 0.4–0.9). Participants in office or skilled work had 60% lower odds of unmet need of presbyopia (AOR = 0.4 95% CI 0.2–0.9). As the level of education increased, the odds of unmet need for presbyopia reduced. In participants with education level senior secondary and above, there was an 80% lesser odds of unmet need compared to illiterates (AOR = 0.2 95% CI 0.1–0.3) and was statistically significant. There was no association of age, marital status and economic status with unmet need for presbyopia [Table 3].

Barriers responsible for unmet need of spectacles for presbyopia

Out of 1034 participants with unmet need for presbyopia correction, 782 provided information on barriers to usage of spectacles. Out of these, 675 were never examined for poor vision, 30 were prescribed spectacles but did not buy them and 77 discontinued using spectacles. When we segregated the causes as depicted in Table 4, we found that the main cause for not undergoing examination for presbyopia was the lack of felt need, followed by personal reasons and then followed by financial reasons. Similarly, the main cause for not using spectacle was the lack of felt need. On the other hand, personal reasons were the only cause for discontinuing spectacles [Table 4].

Discussion

The prevalence of presbyopia in this study was found to be 42.9% (95% CI 41.2–44.6). Increased age, women and

Table 2: Bivariable and multivariable analysis for factors associated with presbyopia

Characteristics	Participants *n*=3246	Presbyopia *n*=1393 (%)	Unadjusted Odds Ratio (95% CI)	*P*	Adjusted Odds Ratio (95% CI)	*P*
Age (Years)						
35-39	663	105 (15.8%)	Reference		Reference	
40-49	966	463 (47.9%)	4.9 (3.9-6.0)	<0.001	5.5 (4.5-6.7)	<0.001
50-59	608	403 (66.3%)	10.4 (7.7-14.3)	<0.001	11.7 (8.6-15.9)	<0.001
60-69	599	287 (47.9%)	4.9 (3.5-6.9)	<0.001	5.1 (3.6-7.3)	<0.001
≥70	410	135 (32.9%)	2.6 (1.8-3.7)	<0.001	2.9 (1.9-4.4)	<0.001
Gender						
Men	1508	552 (36.6%)	Reference		Reference	
Women	1738	841 (48.4%)	1.6 (1.4-1.9)	<0.001	1.5 (1.2-1.8)	0.002
Marital status						
Married	2652	1158 (43.7%)	Reference		Reference	
Unmarried/Widower	594	235 (39.6%)	0.8 (0.7-1.0)	0.08	0.8 (0.7-1.0)	0.06
Occupation						
Homemaker	1915	928 (48.5%)	Reference		Reference	
Labour-Agricultural/Nonagricultural	706	260 (36.8%)	0.6 (0.5-0.7)	<0.001	0.7 (0.5-0.9)	0.008
Office/Skilled work	422	112 (28.9%)	0.4 (0.3-0.5)	<0.001	0.4 (0.3-0.6)	<0.001
Unemployed/Retired	203	93 (45.8%)	0.9 (0.6-1.3)	0.5	1.1 (0.8-1.6)	0.63
Education						
Illiterate	1154	500 (43.3%)	Reference		Reference	
Primary	443	215 (48.5%)	1.2 (1.0-1.5)	0.02	1.6 (1.3-2.0)	<0.001
Secondary	1249	542 (43.4%)	1.0 (0.8-1.2)	0.97	1.7 (1.4-2.1)	<0.001
Senior Secondary and above	400	136 (34.0%)	0.7 (0.5-0.9)	0.009	1.6 (1.2-2.2)	0.006
Economic status						
Above poverty line	2635	1159 (44.0%)	Reference		Reference	
Below poverty line	611	234 (38.3%)	0.8 (0.7-0.9)	0.008	0.8 (0.7-1.0)	0.02

Table 3: Bivariable and multivariable analysis for factors associated with unmet need for spectacles in presbyopia

Characteristics	Total need *n*=1393	Spectacle coverage *n*=359 (%)	Unmet need *n*=1034	Unadjusted Odds Ratio (95% CI)	*P*	Adjusted Odds Ratio (95% CI)	*P*
Age (Years)							
35-39	105	26 (24.7)	79	Reference		Reference	
40-49	543	119 (25.7)	344	0.9 (0.5-1.8)	0.87	0.8 (0.4-1.6)	0.51
50-59	403	116 (28.7)	287	0.8 (0.4-1.6)	0.52	0.6 (0.3-1.3)	0.18
60-69	287	75 (26.1)	212	0.9 (0.5-1.7)	0.82	0.5 (0.2-1.2)	0.13
≥70	135	23 (17.0)	112	1.6 (0.7-3.5)	0.22	1.1 (0.4-2.8)	0.91
Gender							
Men	552	183 (33.1)	369	Reference		Reference	
Women	841	176 (20.9)	665	1.9 (1.5-2.4)	<0.001	0.6 (0.4-0.9)	0.03
Marital status							
Married	1158	319 (27.5)	839	Reference		Reference	
Unmarried/Widower	235	40 (17.0)	195	1.9 (1.3-2.7)	0.002	1.5 (1.0-2.3)	0.07
Occupation							
Homemaker	928	189 (20.3)	739	Reference		Reference	
Labour-Agricultural/Nonagricultural	260	72 (27.6)	188	0.7 (0.5-0.9)	0.008	0.7 (0.4-0.1)	0.12
Office/Skilled work	112	52 (46.4)	60	0.3 (0.2-0.5)	<0.001	0.4 (0.2-0.9)	0.01
Unemployed/Retired	93	46 (49.4)	47	0.3 (0.2-0.4)	<0.001	0.3 (0.2-0.5)	<0.001
Education							
Illiterate	500	60 (12.0)	440	Reference		Reference	
Primary	215	53 (24.6)	162	0.4 (0.3-0.6)	<0.001	0.4 (0.3-0.6)	<0.001
Secondary	542	178 (32.8)	364	0.3 (0.2-0.4)	<0.001	0.3 (0.2-0.4)	<0.001
Senior Secondary and above	136	68 (50.0)	68	0.1 (0.09-0.2)	<0.001	0.2 (0.1-0.3)	<0.001
Economic status							
Above poverty line	1159	311 (26.8)	848	Reference		Reference	
Below poverty line	234	48 (20.5)	186	1.4 (1.0-1.9)	0.04	1.2 (0.8-1.6)	0.32

Table 4: Distribution of barriers that caused unmeet due to presbyopia (*n*=782)

Various barriers	Uncorrected Presbyopia		
	Not examined *n*=675 (%)	Not using spectacle *n*=30 (%)	Discontinued spectacles *n*=77 (%)
Lack of felt need	396 (58.7)	10 (33.3)	0
Lack of awareness	35 (5.2)	7 (23.3)	0
Financial reasons	61 (9.0)	5 (16.7)	0
Accessibility of health facility	2 (0.3)	0 (0.0)	0
Personal reasons	179 (26.5)	7 (23.3)	77 (100)
Using other medications	2 (0.3)	1 (3.3)	0

literate participants had higher prevalence of presbyopia. Participants who were employed and those that belonged to BPL households had lower prevalence of presbyopia. Overall, the spectacle coverage among presbyopes was found to be around 25.8%. Unmet need for presbyopia was lower among women, participants with primary education and above and whose occupation involved office or skilled work and retired or unemployed participants.

In this study, the prevalence of presbyopia was found to be 42.9%. This was lower than that reported by Nirmalan *et al.*[6] in their study in Andhra Pradesh (55.3%). Marmamula *et al.*[5] also reported a higher prevalence in Andhra Pradesh and Telangana.[9,20-22] The higher prevalence in these studies might be due to inclusion of age group more than 40 years where the prevalence is expected to be higher. Also, the higher prevalence was noted in the weaving community due to the nature of work they are involved in. Varying geographical regions and settings could explain differences obtained in prevalence of presbyopia in these studies.

The current prevalence was found to be higher than that reported by Gupta *et al.*[10] conducted in Delhi (34.2%). The lower prevalence by Gupta *et al.*[10] might be due to different study setting, that is, urban Delhi, whereas the current study was conducted in rural population. Similar prevalence of presbyopia was observed in study reported by Marmamula *et al.*[23] in their study among marine fishing communities (45.2%). In a systematic review and meta-analysis of 288 studies contributing data from 98 countries, functional presbyopia was reported to be affecting an estimated 1094·7 million (80% UI 581·1–1686·5) people aged 35 years and older, with 666·7 million (80% UI 364·9–997·6) being aged 50 years or older.[24] In a systematic review and meta-analysis by Sheeladevi *et al.*,[25] the prevalence of uncorrected presbyopia among adults aged 30 years and above in India was 33% (95% CI 19.1–50.8).

In the current study, it was found that gender, education and age were associated with presbyopia. Similar results were obtained in studies conducted in Telangana, Delhi and multicentric study that included India.[9,10,26] Nirmalan *et al.*[6] also found that rural location and alcohol consumption was associated with presbyopia. Alcohol consumption data were not taken into account in this study.

Prevalence of spectacle coverage in this study was found to be 25.8%. This result was found consistently similar as reported by other studies.[6,20] A higher spectacles coverage was reported by weaving community in Andhra Pradesh by Marmamula *et al.*[5] and Gupta *et al.*[10] in Delhi. The higher coverage in the weaving community could be attributed to the felt need of the community as expected by their profession, whereas in Delhi, it could be attributed to the awareness and availability of facility. Lower coverage was observed in study done by Marmamula *et al.*[20] in Andhra Pradesh. This might be due to the higher proportion of women in the study which skewed the final prevalence.

In this study, we found that gender, occupation and education were associated with unmet need of spectacles among presbyopes. Study by Marmamula *et al.*[5] in Andhra Pradesh found that education was related with unmet need. All these factors could be seen as influencing the health-seeking behaviour of an individual. For instance, illiteracy might adversely affect the access to health care services and the knowledge regarding how to obtain it. Although some services are provided at no cost, indirect expenses such as lost wages, travel and other incidental expenses might be posing an economic hurdle for uptake of services.

In this study, we found that majority of the presbyopia participants remained presbyopic mainly due to lack of felt need. This was similar to the results as obtained by Marmamula *et al.*[27] in their studies in rural Andhra Pradesh.[28] Similar results were also obtained by Nirmalan *et al.*[6] in their study.

An important finding of our study is the gap between the professionally determined need and the perceived need of the subjects. This can be explained in terms of Bradshaw's category of needs.[29] The gap in normative need and felt need is an 'attitude-related' barrier that would pose a challenge to primary care physicians as it would entail requirement of greater behavioural change efforts. On the other hand, this lack of felt need may also be because they do not face problems in day-to-day activities. Setting targets purely based on prevalence estimates from epidemiological studies, without discounting for those who do not feel the need for correction, may be difficult to achieve. The social and cultural factors that lead to someone 'not feeling' the need for vision correction need to be studied further.

Our study has certain strengths. House-to-house survey ensured a high response rate of 92%. Close scrutiny of the data collection procedure and cross-check by the ophthalmologist allowed us to determine the need of the surveyed people objectively in terms of professionally defined thresholds. The study generates important evidence about the unmet need for presbyopic correction and will aid in planning out for programmatic actions. The study is limited by the noninclusion of urban localities.

Conclusion

This study clearly shows the high prevalence of presbyopia among adult population aged 30 years and more (43%), with

spectacles coverage being low (26%). Increasing age, women and higher literacy status had higher prevalence of presbyopia with unmet need for presbyopia being lower among women, literates and employed participants. Primary care and family physicians while examining patients aged 30 years and above have an important role to enquire about near vision problems and undertake near vision assessment. Awareness activities along with affordable, accessible and socially acceptable services for those affected with presbyopia would be one of the key components of management through outreach and facility-based approaches within primary care settings. Intensive Information, Education and Communication efforts should be undertaken so as to overcome the lack of perceived need for spectacles amongst population.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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