HHS Public Access

Author manuscript

Nat Aging. Author manuscript; available in PMC 2023 May 07.

Published in final edited form as:

Nat Aging. 2022 November ; 2(11): 1000–1007. doi:10.1038/s43587-022-00298-6.

The Prevalence of Vision Impairment and Blindness among Older Adults in India: Findings from the Longitudinal Ageing Study in India

Joshua R. Ehrlich[1,2,*], **Arunika Agarwal**[3], **Codi Young**[4], **Jinkook Lee**[4,5], **David E. Bloom**[3]

[1]Institute for Social Research, University of Michigan, Ann Arbor, MI, USA

[2]Department of Ophthalmology and Visual Sciences, University of Michigan, Ann Arbor, MI, USA

[3]Department of Global Health and Population, Harvard TH Chan School of Public Health, Boston, MA, USA

[4]Center for Economic & Social Research, University of Southern California, Los Angeles, CA, USA

[5]Department of Economics, University of Southern California, Los Angeles, CA, USA

Abstract

Vision impairment and blindness are strongly associated with aging and late-life disability. While home to about 17% of the world's population, an estimated 25% of visually impaired people globally live in India. This proportion is expected to increase as India's population rapidly ages and continues to grow. There is a need for up-to-date epidemiologic data on the prevalence of vision impairment and blindness in India and on the socioeconomic determinants of poor vision, especially among older adults, to promote visual and overall health and well-being in later life. This paper uses newly available data from Wave 1 (2017–2019) of the population-based Longitudinal Ageing Study in India to estimate the overall and sex-specific prevalence of presenting visual acuity impairment and blindness among individuals aged 45 and older at the national level and for all constituent states and union territories. Overall, 33.8% (95% CI: 33.31, 34.26) of the Indian population aged 45 and older had distance visual acuity impairment or was blind (visual acuity in the better-seeing eye <20/40). The age-standardized prevalence varied considerably among states (22.3%–54.6%), and women were more likely than men to be visually impaired or blind in all states. Near visual acuity impairment was also highly prevalent (43.0%, 95% CI: 42.45, 43.46). Vision impairment and blindness were more common among marginalized groups and were associated with lower socioeconomic status. Findings from this study are relevant

*Corresponding Author: Joshua R. Ehrlich, MD, MPH, Institute for Social Research, University of Michigan, 426 Thompson Street, Ann Arbor, MI 48104, USA, joshre@umich.edu, phone: +1 (734) 615-1724.

Author Contributions

JRE: Conceptualization and design of study, planning of analyses, interpretation of results, drafting of manuscript
AA: Conceptualization and design of study, planning of analyses, data analysis, interpretation of results, drafting of manuscript
CY: Data analysis, interpretation of results, drafting of manuscript
JL: Conceptualization and design of study, planning of analyses, oversight of study team, critical revision of manuscript
DEB: Conceptualization and design of study, planning of analyses, oversight of study team, critical revision of manuscript

Competing Interests

All authors declare no competing interests.

for surveillance of vision health, design of targeted eyecare policies and programs, and efforts to promote human and economic development.

Editor summary:

The prevalence and consequences of vision impairment are increasing due to population growth and aging. This study finds that in India, one in three older adults has distance visual impairment or is blind, which may impact not only how they see the world, but also overall health and wellbeing.

Background

India is home to more than 17% of the world's population and to an estimated 25% of those who are blind or visually impaired worldwide.[1] Blindness and vision impairment (VI) are associated with wide-ranging health consequences, including an increased risk of falls, depression, dementia, decreased economic productivity and well-being, and even mortality.[2-4] The United Nations (UN) General Assembly has formally recognized healthy vision as a key to achieving the Sustainable Development Goals.[5-7] Accordingly, public health and policy programs to promote optimal aging depend on accurate estimates of the epidemiology of VI and blindness segregated by demographic and socioeconomic characteristics.

A recent meta-analysis by the Global Burden of Disease (GBD) project of the magnitude of VI and blindness globally included 21 studies from India,[8] though the only two nationally representative studies included are both more than 14 years old.[9,10] The National Programme for the Control of Blindness and Visual Impairment in India conducted a more recent rapid assessment of avoidable blindness (RAAB)[11] in 2015–2019 in 31 randomly selected districts across India.[12] However, these prior national studies did not include detailed data on other aspects of health and aging, which are essential to understand the predictors and consequences of VI and to frame targeted programs and policies. Data from the World Health Organization's (WHO's) 2007 Study on global AGEing and adult health (SAGE) indicated that the prevalence of presenting distance VI (defined as presenting visual acuity [PVA] <20/60) among adults aged 50 and older in India was 18.5%,[13] compared with 25.1% in the recent meta-analysis from the Global Burden of Disease Study.[8] The relatively small Indian study sample in SAGE (n=7,150 adults aged 50 and older) was drawn from only six states, and a high rate of incomplete data may have reduced population representativeness, particularly among high-risk groups.[14] These issues also precluded the conduct of representative subnational or state-level analyses to assess within-country variation in a heterogenous country like India.

The Longitudinal Ageing Study in India (LASI) is a panel study of more than 72,000 adults from 35 states and union territories in India (excluding Sikkim) that is population representative at national and state levels.[15] Wave 1 of LASI, which was conducted between 2017 and 2019, assessed distance and near PVA. These data therefore represent a unique and vital source of information on the vision health of older adults in India.[16] The current study used data from Wave 1 of LASI to estimate the overall and sex-specific prevalence of VI and

blindness for India and for its 35 states and union territories and to describe the associations of VI and blindness with other key age-related health and socioeconomic conditions. These findings are relevant for designing targeted eyecare policies and programs for the large and growing population of older adults in India.

Methods

Study Population

The baseline wave of LASI, conducted in 2017–2019, included more than 72,000 individuals aged 45 and older and their spouses (regardless of age) residing in households across 35 states and union territories in India (excluding Sikkim). The sample frame excluded those living in institutions (e.g., nursing homes, long-term dependent or care facilities, boarding houses, messes, hotels, residential hotels, rescue homes, jails, prisons, army camps, boarding schools, and ashrams). After restricting the sample to age 45 and older, the resulting sample size was 65,575.

Study Design

The LASI sample, which has been described in detail elsewhere,[17,18] is based on a multistage stratified cluster-sampling design that involves geographic stratification, clustering, and oversampling. As LASI used a complex sample design that oversamples adults age ≥65 years and in four major cities in India (Delhi, Mumbai, Chennai, and Kolkata), compensatory weighting was employed. LASI weights were created in a two-step process. In the first step, a design weight was created to account for unequal selection probabilities of households and therefore of individuals within selected households. In the second step, post-stratification weights were generated to correct for differential nonresponse rates and to align the sample with the reference population in terms of the distribution of key sociodemographic variables. LASI constructed two sets of weights to allow for estimation of parameters that were population representative at the national and state levels for households and individuals.

Data Collection

In 2017–2019, LASI collected comprehensive data on health, social, and economic well-being from more than 72,000 individuals aged 45 and older and their spouses, irrespective of age, from 35 states and union territories of India (excluding Sikkim). All interviews were conducted in person at respondents' residences.

Ethics and Inclusion

Research on late life vision was deemed an important topic through collaboration with local partners who were involved throughout the process of designing LASI and collecting data. The LASI study team was comprised on local investigators and a local PI. We have considered local and regional research relevant to this study in our citations. Ethics approval for LASI was obtained from the Indian Council of Medical Research (ICMR) and all collaborating institutions, including Harvard University, the University of Southern California, and the International Institute of Population Sciences, Mumbai. All study participants provided written informed consent. The research presented herein did not

result in personal risk to participants. The International Institute for Population Sciences, Mumbai describes the LASI data on their site and provides a public data access link (https://www.iipsindia.ac.in/content/LASI-data). The ICMR approved the LASI public data sharing plan.

Vision Measures

Health investigators (with a minimum of an undergraduate degree in health sciences), who were trained for more than a month on standardized LASI protocol, survey instrument, and performance tests including the vision test, performed vision acuity tests. The LASI Wave 1 report describes details on the training of the investigators.[18] During each participant's data collection site visit, the health investigator evaluated PVA using a computer-assisted personal interviewing (CAPI) technique. The WHO's SAGE study in India has used this CAPI-based visual acuity test. In addition, it was field-tested by the LASI team and found to be reliable and had comparable measurements with that of the standard logMAR chart method. Presenting visual acuity was measured with participants wearing their usual glasses or contact lenses, if available. Before administering the LASI vision test, respondents were asked if they could see light with each eye and count the fingers of the interviewer's hand when held 50 cm from their face (with glasses or contacts, if needed). If the participant was able to do so, each eye's distance and near vision were assessed. Interviewers first assessed distance and then near vision.

For distance acuity testing, the Tumbling E logMAR chart (on CAPI) was administered at a distance of 3m. The first screen tested corresponded to 20/125, 20/100, 20/80, or 20/63 and was adaptive based on participant responses. Depending on whether the respondent could see ≥3 out of 5 letters on the screen, the computer displayed a smaller or larger E on the next screen. The near acuity test was conducted in the same manner with the respondent positioned 40 cm from the screen. For both tests, care was taken to minimize glare. Visual acuity was categorized according to WHO definitions of VI based on PVA in the better-seeing eye: no VI (≥20/40), mild VI (<20/40–20/60), moderate VI (<20/60–20/200), and severe VI or blindness (<20/200).[19] For regression models, responses were recoded into a dichotomous variable to indicate the presence of moderate or worse VI by grouping moderate VI and severe VI or blindness (better-eye PVA <20/60). No additional information was collected as to whether participants used glasses or contact lenses at the time of the survey. All definitions of VI in this report therefore refer to *presenting* visual acuity.

Sociodemographic and Health Data

Data on demographic and socioeconomic variables (age, sex, religion, caste, marital status, education, household wealth, employment status, occupation, and urban vs. rural residence), health conditions (general self-reported health, diabetes, and high blood pressure), health insurance, and living arrangement were obtained as part of the interviewer-administered questionnaire. For household wealth, sources and amounts of income, assets, and debts for each member of the household in the past 12 months were collected and aggregated to derive total household wealth, which was categorized into quartiles. Individual questionnaires were

administered to all age-eligible (aged 45 and older and their spouses irrespective of age) individuals in a selected household.

Statistics and Reproducibility

We first conducted descriptive analyses to report sample characteristics and the prevalence of VI. We also examined bivariate associations between VI and demographic variables, socioeconomic status, and health measures. We further calculated the overall and age-standardized prevalence of distance VI by state and gender. Age standardization was based on the WHO's world standard population distribution for the years 2000–2025.[21] Proportions for age 45 and older were taken from the WHO's standard and adjusted to equal a sum of 100. Multivariable logistic regression was used to identify independent predictors of distance and near VI, while adjusting for state fixed effects. All statistical tests were two-sided. Survey weights were used in analyses to account for the complex survey design of LASI. Respondents with missing visual acuity data were excluded from the analysis, resulting in a final analytic sample of 59,540. All analyses were conducted using Stata version 14.2. This study conforms to the Guidelines for Accurate and Transparent Health Estimates Reporting statement. [20]

Results

Sample Characteristics and Epidemiology

Table 1 reports the characteristics of the LASI Wave 1 sample. Overall, 47% (95% CI: 46.16, 47.13) of the weighted LASI sample were females, with 39% (95% CI: 38.72, 39.70) in the 45-54-year age group and about 9% (95% CI: 8.67, 9.18) aged 75 years and older. Educational attainment was low, with more than 50% (95% CI: 51.87, 52.85) reporting zero years of formal education. About 34% of the sample was found to have mild distance vision impairment or worse, based on the threshold of 20/40 or worse. The prevalence was much higher for any vision impairment (distance or near): around 43% of the respondents had either distance or near VI, based on the same <20/40 threshold (a detailed analysis for the prevalence of *any* vision impairment [distance and near combined] is not part of this paper and can be made available to interested readers on request).

Table 2 reports the prevalence of distance and near VI. Overall, about 12% (95% CI: 11.98, 12.65) of respondents had mild distance VI, 19% (95% CI: 18.94, 19.72) had moderate distance VI, and 2% (95% CI: 2.01, 2.29) had severe distance VI or were blind. For near vision, 13% (95% CI: 12.72, 13.40) had mild, 24% (95% CI: 23.85, 24.71) had moderate, and almost 6% (95% CI: 5.39, 5.85) had severe VI or were blind. Table 3 presents the age-standardized prevalence of distance VI for each state and union territory in India. The age-standardized prevalence of distance VI was highest in Arunachal Pradesh (55%, 95% CI: 51.44, 57.76), followed by Uttar Pradesh (43%, 95% CI: 41.22, 44.11), and Dadra and Nagar Haveli (42%, 95% CI: 38.86, 44.78). The states with the lowest age-standardized prevalence of distance VI were Himachal Pradesh (22%, 95% CI: 20.32, 24.39), Chandigarh (24%, 95% CI: 21.50, 27.51), and Jammu and Kashmir (26%, 95% CI: 23.62, 28.10). Severe VI/blindness was most prevalent in Uttar Pradesh, Rajasthan, and Madhya Pradesh, each of which had an age-standardized prevalence of approximately 3%. Supplemental Table 1

provides the distribution of LASI sample by age groups for each of the 35 states and union territories.

Figure 1 presents a heat map of India, depicting the age-standardized prevalence of moderate or worse distance VI across all states. Supplemental Table 2 presents national and state estimates of the prevalence of moderate or worse distance VI disaggregated by gender. Nationally, the age-standardized prevalence of moderate or worse distance VI was 20% (95% CI: 19.27, 20.33) in males and 24% (95% CI: 23.83, 24.91) in females. The prevalence was higher for females in all states, with the largest gender differences found in Dadra and Nagar Haveli (10%), Assam (9%), and Uttar Pradesh (8%).

Bivariate analyses were performed to test the associations between distance and near VI and demographic and socioeconomic characteristics (Supplemental Tables 3 and 4). Statistically significant associations were observed between distance VI and older age, female sex, less education, scheduled caste, religions other than Hindu, rural residence, presence of diabetes, self-reported fair or poor health, and lower wealth. Similar associations were seen with near VI. In multivariable models (Supplemental Table 5), the strongest predictor of moderate or worse distance VI was older age, with individuals aged 65–74 and 75+ experiencing 4.7 (95% CI: 4.30, 5.08) and 9.5 (95% CI: 8.56, 10.52) times higher odds, respectively, of distance VI compared with the youngest age group (45–54 years). Similar results were observed with near VI, to a lesser magnitude. Individuals aged 65–74 and 75+ experienced 4.4 (95% CI: 4.12, 4.77) and 8.7 (95% CI: 7.93, 9.59) times higher odds, respectively, of near VI compared with the youngest group of age 45–54. Low education, self-reported fair or poor health, currently unmarried (divorced, separated, partnered, widow, and never married), rural residence, and lower household wealth quartiles were also independently associated with significantly increased odds of both distance and near VI.

Discussion

Good vision is a key determinant of healthy and successful aging. Given India's large and rapidly aging population, ensuring healthy vision through effective public health and policy programs may be important for promoting economic development and late-life health, independence, and overall well-being. In this study we provide up-to-date data on the national- and state-level prevalence of VI in India based on newly available population-representative visual acuity data coupled with data on late-life socioeconomic and health factors in Wave 1 of LASI.

Prior epidemiological studies in India reported a high prevalence of VI.[8] The most recent national study conducted in India, a 2015–2019 RAAB, reported an overall 26.7% prevalence of any distance VI (mild: 12.9%, moderate: 9.8%, severe/blind: 3.95%) for adults aged 50 years and older based on PVA, the same metric used to objectively assess vision in LASI.[12] In comparison, we measured an overall 33.8% (95% CI: 33.31, 34.26) prevalence of any distance VI (mild: 12.3%, moderate: 19.33%, severe/blind: 2.1%). Thus, our data suggest a considerably higher prevalence of overall and moderate distance VI. In fact, the prevalence in LASI aligns more closely with the 2019 GBD prevalence estimates[8,22] derived from a Bayesian metaregression[23] that included all available national and subnational

data. Compared with LASI, the 2019 GBD estimates suggest an even higher prevalence of moderate or worse distance VI (25.1% vs. 21.5%) and a slightly lower prevalence of mild VI (10.4% vs. 12.3%[8]).[22] Because LASI measures visual acuity but does not assess other visual functions (e.g., visual fields) that may indicate impairment, our prevalence estimates of visual acuity impairment may not capture all prevalent VI and blindness in India. Notwithstanding, these data confirm a very high prevalence of VI and blindness in the older Indian population. For comparison, the prevalence of moderate or worse VI in India is almost four times greater than in the United Kingdom and more than six times greater than in the U.S. population aged 50 and older.[8]

Indian states varied widely in the age-standardized prevalence of distance VI. The state with the lowest prevalence of any distance VI was Himachal Pradesh (22%, 95% CI: 20.32, 24.39), whereas in Arunachal Pradesh, more than half (55%, 95% CI: 51.44, 57.76) of the participants were visually impaired. Our findings diverged somewhat from the recent national RAAB in India, which found that the districts with the lowest prevalence of VI were Thrissur district (Kerala) and Thoubal district (Manipur), while Bijnor district (Uttar Pradesh) had the highest prevalence.[12] Differences may reflect the weighting of data in LASI to represent entire states, versus the RAAB data, which were drawn from single districts. Of the five states with the lowest age-standardized prevalence of any distance VI, all but one (Jammu and Kashmir) were included in the 14 Indian states that had a UN Human Development Index (HDI)[24] of “high” in 2019. Many factors likely shape differences in vision health across states in India, including state-level public health policies and local access to high-quality and affordable eye care. Future research might consider how variation in these factors is associated with the prevalence of VI across the nation.

To our knowledge, LASI is the first to report age-standardized prevalence data for all states and union territories in a single unified study. Data disaggregated by gender showed that the age-standardized prevalence of moderate or worse distance VI was higher among females across all states, while nationally the prevalence difference was about 5%, similar to the difference reported in the recent Indian RAAB.[12] However, we found that the prevalence difference varied greatly across states, from a low of 0.2% in Telangana to more than 10% in Dadra and Nagar Haveli. The very small difference in prevalence between females and males in Madhya Pradesh (0.3%) and Bihar (0.6%) was surprising given that they have the fourth and first lowest HDIs, respectively, of any Indian states.[24] However, a 2020 population-based study from Siwan District, Bihar, supports our finding.[25] Notwithstanding, nationally and in most states, a substantial gender inequity exists in the prevalence of VI and blindness. In fact, a recent meta-analysis of 22 studies from India reported that the odds of blindness were 35% higher among women and the odds of receiving cataract surgery were 27% lower compared to men.[26] Targeted outreach and interventions are needed to promote delivery of eye care to girls and women to address this large gender inequity. The current study contributes important data that may help to inform policy making at the state and national levels.

We evaluated the association of demographic and socioeconomic factors with VI. As expected, participants who were older, female, and from lower socioeconomic strata had greater odds of VI. A dose-response pattern was also evident in the association of VI

with self-rated general health, wherein the odds of VI increased with worse self-rated health. Compared with those who did not wear eyeglasses, the odds of VI were 36% lower among participants who reported wearing eyeglasses. These results confirm findings from other studies in high-income and low- and middle-income countries demonstrating that disadvantaged and marginalized groups are more likely to be visually impaired or blind and are less likely to receive eyecare.[2,4,13]

This study has several limitations. First, LASI measured only PVA and did not assess uncorrected or best-corrected visual acuity. Therefore, determining the proportion of VI cases due to uncorrected and undercorrected refractive error or estimating the prevalence of uncorrected presbyopia was not possible. Second, because LASI did not include an eye exam or imaging of the eye, it was not possible to attribute cases of VI and blindness to specific causes (e.g., cataract, glaucoma, etc.). Third, although VI and blindness without visual acuity loss is relatively uncommon, LASI may underestimate the true prevalence because it did not assess visual field loss, which can be used to satisfy the WHO definition of blindness.[19] Finally, the availability of eye care services is likely to play a role in the prevalence of VI and blindness, and this may modify associations with socioeconomic and demographic factors.

This study also has important strengths. It provides up-to-date nationally representative and age-adjusted prevalence data on distance and near VI and blindness in India at the national and state levels. As a comprehensive survey of older adults in India, LASI provides unique opportunities to study relationships between vision and key domains that VI may affect, including cognitive, psychological, and systemic health; social interactions; well-being; and economics. When data from Wave 2 of LASI are available, the panel design of LASI will enable analyses on VI and blindness incidence and on the impact of changes in vision on late-life health and well-being.

An estimated 90% of cases of VI and blindness globally are avoidable or have yet to be treated, and a large majority are treatable with low cost and widely available interventions like cataract surgery and eyeglasses.[4] Approximately 80% of those affected are aged 50 years and older, 90% live in low- and middle-income countries including India, and women are at considerably greater risk. Accordingly, ensuring optimal vision is a critical and accessible component of strategies to achieve the UN Sustainable Development Goals,[5] as recognized by the recent passage by the UN General Assembly of the resolution, “Vision for Everyone; accelerating action to achieve the sustainable development goals”.[6] Thus, the data presented in this study may play an important role in devising national and regional strategies to promote overall health, economic well-being, and successful aging through healthy vision.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

AA, CY, JL, and DEB were supported by the U.S. National Institute on Aging (5R01AG042778). JRE is supported by a grant from the U.S. National Eye Institute (K23EY027848) and an unrestricted grant to the University of Michigan Department of Ophthalmology and Visual Sciences from Research to Prevent Blindness. The authors would like to thank Indzara.com for providing the image template for Figure 1.

Data Availability

The LASI dataset analyzed in this study is available through the Gateway to Global Aging Data repository, [https://g2aging.org/?section=lasi-downloads]. To access the dataset, the user needs to create an account on Gateway to Global Aging Data and complete the Data Access Use Agreement (online form). The LASI team reviews the request and verifies the identity and institutional affiliation. Once this authentication process has been completed, the team will authorize access to the desired data set. This process usually takes a week.

Code Availability

Statistical code is available upon request.

References

1. Institute for Health Metrics and Evaluation. GBD compare. Seattle, United States. (2021).
2. National Academies of Sciences, Engineering, and Medicine, et al. Making eye health a population health imperative: vision for tomorrow. Washington (DC), US (National Academies Press, 2016). doi:10.17226/23471.
3. World Health Organization. World report on vision. Geneva, Switzerland. (World Health Organization, 2019).
4. Burton MJ et al. The Lancet Global Health Commission on Global Eye Health: vision beyond 2020. Lancet Global Health 9, e489–e551 (2021). doi:10.1016/S2214-109X(20)30488-5 [PubMed: 33607016]
5. Nations United. Transforming our world: the 2030 agenda for sustainable development. New York, US (UN Publishing, 2015).
6. Nations United. General Assembly Resolution 75/310. Vision for everyone; accelerating action to achieve the sustainable development goals. New York, US (2021).
7. Zhang JH et al. Advancing the sustainable development goals through improving eye health: a scoping review. Lancet Planet Health 270–280 (2022). doi:10.1016/s2542-5196(21)00351-x.
8. Bourne RRA et al. Trends in prevalence of blindness and distance and near vision impairment over 30 years: an analysis for the Global Burden of Disease Study. Lancet Global Health 9, e130–e143 (2021). doi:10.1016/S2214-109X(20)30425-3 [PubMed: 33275950]
9. Murthy GVS, Gupta SK, Bachani D, Jose R & John N Current estimates of blindness in India. British Journal of Ophthalmology 89, 257–260 (2005). doi: 10.1136/bjo.2004.056937. [PubMed: 15722298]
10. Neena J, Rachel J, Praveen V & Murthy GVS Rapid assessment of avoidable blindness in India. PLoS One 3, 1–7 (2008).doi: 10.1371/journal.pone.0002867
11. Mactaggart I, Limburg H, Bastawrous A, Burton MJ & Kuper H Rapid assessment of avoidable blindness: looking back, looking forward. British Journal of Ophthalmology 103, 1549–1552 (2019).doi: 10.1136/bjophthalmol-2019-314015 [PubMed: 31266777]
12. Ministry of Health & Family Welfare Government of India. National blindness and visual impairment survey 2015–2019—a summary report. MoHFW, New Delhi, India (2019).
13. Ehrlich JR, Stagg BC, Andrews C, Kumagai A & Musch DC Vision impairment and receipt of eye care among older adults in low- and middle-income countries. JAMA Ophthalmology 137, 146–158 (2019). doi: 10.1001/jamaophthalmol.2018.5449 [PubMed: 30477016]

14. Foreman J et al. Prevalence and causes of visual loss among the indigenous peoples of the world a systematic review. JAMA Ophthalmology 136, 567–580 (2018). doi: 10.1001/jamaophthalmol.2018.0597 [PubMed: 29596691]
15. Perianayagam A et al. Longitudinal aging study in India. Encyclopedia of Gerontology and Population Aging 2050, 1–5 (2019). doi:10.1007/978-3-030-22009-9
16. Bloom DE, Sekher TV & Lee J Longitudinal aging study in India (LASI): new data resources for addressing aging in India. Nature Aging 1, 1070–1072 (2021). 10.1038/s43587-021-00155-y [PubMed: 37117520]
17. Arokiasamy P, Bloom DE, Feeney KC & Ozolins M Longitudinal aging study in India: vision, design, implementation, and some early results. In: National Research Council (US) Panel on Policy Research and Data Needs to Meet the Challenge of Aging in Asia; Smith JP, Majmundar M, editors. Aging in Asia: Findings From New and Emerging Data Initiatives. Washington (DC): National Academies Press (US); 2012. 3.
18. International Institute for Population Sciences (IIPS), National Programme for Health Care of Elderly (NPHCE), MoHFW, Harvard T.H. Chan School of Public Health (HSPH), and the University of Southern California (USC). Longitudinal ageing study in India (LASI) wave 1, 2017-18, India report. 1–632 (2020). Mumbai, India
19. World Health Organization. ICD-11 for mortality and morbidity statistics (version : 04 / 2019). 9D90 vision impairment including blindness. (2019). Geneva, Switzerland.
20. Stevens GA et al. Guidelines for Accurate and Transparent Health Estimates Reporting: the GATHER statement. Lancet (London, England) 388, e19–e23 (2016). [PubMed: 27371184]
21. Ahmad OB et al. Age standardization of rates: a new WHO standard. GPE Discussion Paper Series: No.31. (2001). World Health Organization, Geneva.
22. International Association for the Prevention of Blindness. IAPB vision atlas. http://atlas.iapb.org/.
23. Flaxman AD, Vos T, & Murray CJ An integrative metaregression framework for descriptive epidemiology. (University of Washington Press, 2015) Seattle, US.
24. Smits J, Permanyer I The subnational human development database. Sci Data. 2019 Mar 12;6:190038. doi:10.1038/sdata.2019.38. [PubMed: 30860498]
25. Poddar AK et al. Prevalence and causes of avoidable blindness and visual impairment, including the prevalence of diabetic retinopathy in Siwan district of Bihar, India: a population-based survey. Indian Journal of Ophthalmology 68, 375–380 (2020). doi: 10.4103/ijo.IJO_1709_18 [PubMed: 31957732]
26. Prasad M, Malhotra S, Kalaivani M, Vashist P & Gupta SK Gender differences in blindness, cataract blindness and cataract surgical coverage in India: a systematic review and meta-analysis. British Journal of Ophthalmology 104, 220–224 (2020). doi: 10.1136/bjophthalmol-2018-313562 [PubMed: 31221669]

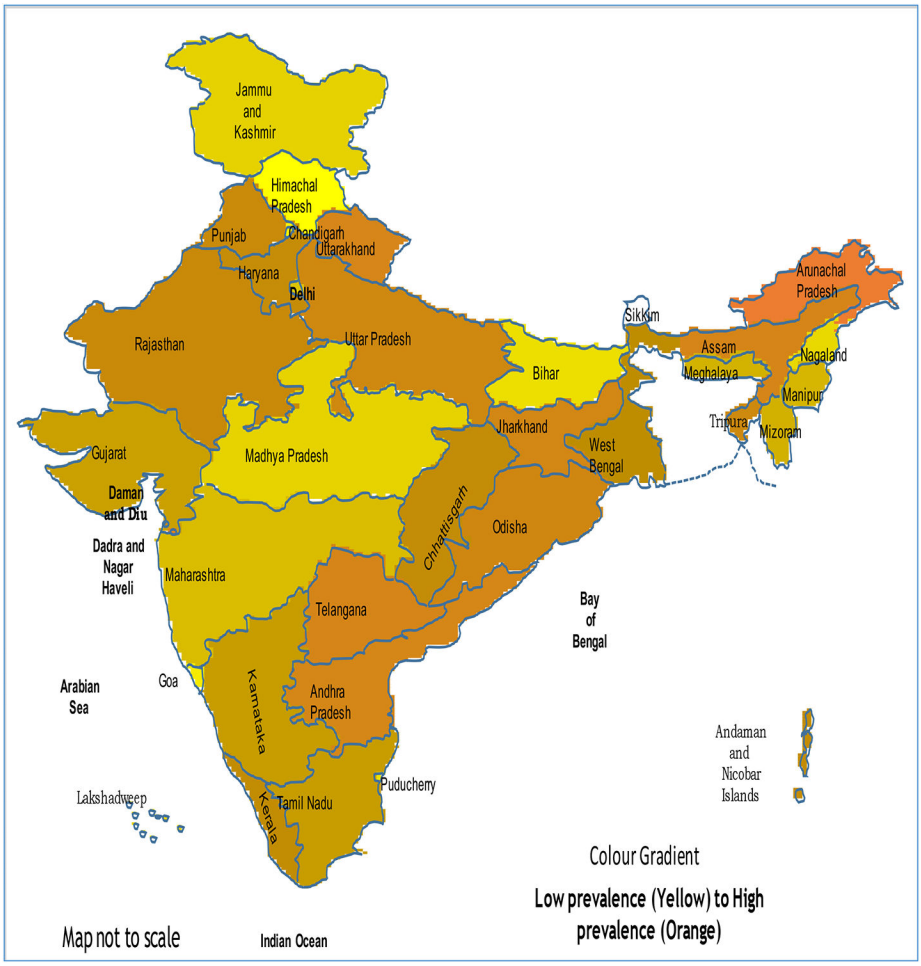

Figure 1. Prevalence of Age-Standardized Moderate or Worse Distance VI in India by State.
States with a higher prevalence of moderate or worse distance vision impairment (<20/60) appear in orange.

Table 1.

Sample Characteristics of LASI

	Sample size (N)	Weighted %	95% CI
Age			
45–54	24,093	39.21	[38.72, 39.70]
55–64	20,139	31.58	[31.12, 32.03]
65–74	14,591	20.29	[19.93, 20.67]
75+	6,752	8.92	[8.67, 9.18]
Gender			
Female	35,088	46.65	[46.16, 47.13]
Male	30,487	53.35	[52.87, 53.84]
Marital Status			
Married	48,775	76.36	[75.96, 76.76]
Partnered	464	0.75	[0.67, 0.85]
Separated	438	0.62	[0.55, 0.70]
Divorced	531	0.68	[0.61, 0.77]
Widowed	14,543	20.43	[20.06, 20.81]
Never married	819	1.15	[1.04, 1.26]
Education			
No schooling	30,826	52.36	[51.87, 52.85]
Less than 5 years	7,479	9.92	[9.65, 10.20]
5–9 years of schooling	14,862	18.95	[18.58, 19.31]
10+ years	12,407	18.78	[18.39, 19.17]
Religion			
Hindu	48,110	81.00	[80.62, 81.38]
Muslim	7,804	12.11	[11.78, 12.44]
Christian	6,537	3.23	[3.08, 3.37]
Others	3,121	3.66	[3.50, 3.83]
Caste			
Scheduled caste	10,921	19.71	[19.31, 20.11]
Scheduled tribe	11,471	8.60	[8.34, 8.86]
OBC	24,630	44.60	[44.11, 45.08]
Others	18,049	27.10	[26.67, 27.53]
Type of Residence			
Rural	42,416	67.84	[67.38, 68.29]
Urban	23,159	32.16	[31.71, 32.62]
In Labor Force			
No	32,767	43.85	[43.37, 44.33]
Yes	32,571	56.15	[55.67, 56.63]
Diabetes			

	Sample size (N)	Weighted %	95% CI
No	56,955	88.05	[87.73, 88.35]
Yes	8,431	11.95	[11.65, 12.27]
Hypertension			
No	46,539	73.88	[73.46, 74.29]
Yes	18,850	26.12	[25.71, 26.54]
Self-Report of Health			
Excellent	2,515	4.68	[4.47, 4.91]
Very Good	12,054	18.13	[17.75, 18.52]
Good	25,382	37.26	[36.79, 37.74]
Fair	18,069	29.06	[28.62, 29.51]
Poor	6,645	10.86	[10.57, 11.17]
Wealth Quartiles			
Low	16,198	25.23	[24.81, 25.66]
Low-Mid	16,355	26.82	[26.38, 27.26]
Mid-High	16,415	25.06	[24.64, 25.49]
High	16,584	22.89	[22.49, 23.29]

OBC – Other Backward Class

Table 2.

Prevalence of Vision Impairment and Self-Reported Visual Difficulty

	Vision impairment[1]			
	None	**Mild**	**Moderate**	**Severe/Blind**
Distance vision (%)	66.22 [65.74, 66.69]	12.31 [11.98, 12.65]	19.33 [18.94, 19.72]	2.14 [2.01, 2.29]
Near vision (%)	57.05 [56.54, 57.55]	13.06 [12.72, 13.40]	24.28 [23.85, 24.71]	5.62 [5.39, 5.85]

[1] Vision impairment (based on presenting visual acuity in better-seeing eye): None ≥ 20/40; mild <20/40–20/60; moderate <20/60–20/200; severe/blind <20/200. All prevalence estimates are weighted.

Nat Aging. Author manuscript; available in PMC 2023 May 07.

Table 3.

Weighted Age-Standardized Prevalence of Distance Vision Impairment in Indian States and Union Territories

		Distance Visual Acuity[1]			
		No VI (≥20/40)	***Mild VI (<20/40–20/60)***	***Moderate VI (<20/60–20/200)***	***Severe VI/ Blind (<20/200)***
Overall (%, 95% CI)		65.83 [65.39, 66.26]	12.19 [11.87, 12.53]	19.68 [19.31, 20.06]	2.30 [2.15, 2.45]
Indian States (%, 95% CI)	*N*				
Himachal Pradesh	1,185	77.71 [75.61, 79.68]	7.92 [6.57, 9.52]	12.05 [10.45, 13.85]	2.32 [1.56, 3.44]
Chandigarh	788	75.62 [72.49, 78.50]	9.86 [7.90, 12.24]	12.55 [10.41, 15.06]	1.97 [1.12, 3.43]
Jammu and Kashmir	1,292	74.20 [71.90, 76.38]	9.00 [7.54, 10.71]	14.63 [12.85, 16.61]	2.17 [1.53, 3.07]
Goa	1,112	74.11 [71.35, 76.70]	10.51 [8.76, 12.55]	14.30 [12.20, 16.70]	1.08 [0.62, 1.87]
Puducherry	1,163	73.66 [71.28, 75.92]	10.39 [8.79, 12.24]	14.89 [13.08, 16.91]	1.06 [0.63, 1.77]
Madhya Pradesh	2,457	73.28 [71.57, 74.91]	10.06 [8.90, 11.35]	13.75 [12.49, 15.11]	2.92 [2.34, 3.64]
Lakshadweep	1,011	73.11 [70.11, 75.91]	10.03 [8.15, 12.28]	15.45 [13.20, 18.00]	1.42 [0.81, 2.48]
Manipur	1,091	71.29 [68.73, 73.72]	10.47 [8.75, 12.47]	16.44 [14.46, 18.63]	1.80 [1.12, 2.89]
Meghalaya	812	70.85 [67.55, 73.94]	10.73 [8.67, 13.20]	17.05 [14.50, 19.94]	1.38 [0.92, 2.05]
Bihar	3,191	70.82 [69.31, 72.28]	13.12 [11.97, 14.35]	14.85 [13.71, 16.05]	1.22 [0.90, 1.65]
Maharashtra	3,048	70.77 [69.18, 72.31]	11.37 [10.26, 12.58]	15.81 [14.58, 17.11]	2.05 [1.58, 2.67]
Nagaland	1,110	70.51 [67.92, 72.98]	13.08 [11.18, 15.24]	16.08 [14.20, 18.16]	0.33 [0.12, 0.90]
Tamil Nadu	2,987	70.22 [68.57, 71.82]	10.26 [9.18, 11.46]	18.58 [17.22, 20.02]	0.94 [0.64, 1.38]
West Bengal	3,075	69.31 [67.68, 70.88]	10.40 [9.31, 11.60]	18.91 [17.57, 20.31]	1.39 [1.01, 1.91]
Gujarat	1,901	69.27 [67.19, 71.27]	11.40 [9.97, 13.01]	17.14 [15.45, 18.98]	2.18 [1.53, 3.11]
Karnataka	1,911	68.69 [66.65, 70.66]	11.74 [10.33, 13.32]	16.88 [15.25, 18.64]	2.69 [2.04, 3.55]
Delhi	1,141	68.45 [65.65, 71.12]	14.07 [11.98, 16.45]	15.14 [13.12, 17.40]	2.35 [1.55, 3.54]
Mizoram	1,021	67.63 [65.01, 70.15]	13.92 [11.92, 16.19]	17.40 [15.36, 19.65]	1.05 [0.58, 1.88]
Chhattisgarh	1,800	66.45 [64.35, 68.49]	11.09 [9.64, 12.72]	19.93 [18.17, 21.83]	2.53 [1.84, 3.46]
Andaman and Nicobar	1,022	65.54 [62.74, 68.24]	12.23 [10.34, 14.41]	19.62 [17.38, 22.06]	2.61 [1.87, 3.62]
Kerala	2,107	64.90 [62.75, 66.99]	13.43 [11.92, 15.10]	19.62 [17.88, 21.49]	2.05 [1.46, 2.86]
Haryana	1,584	64.16 [61.94, 66.32]	13.14 [11.53, 14.94]	20.10 [18.31, 22.02]	2.60 [1.91, 3.54]

		Distance Visual Acuity[1]			
		No VI (≥20/40)	***Mild VI (<20/40–20/60)***	***Moderate VI (<20/60–20/200)***	***Severe VI/ Blind (<20/200)***
Punjab	1,829	64.13 [62.00, 66.20]	12.07 [10.62, 13.70]	21.59 [19.78, 23.51]	2.21 [1.66, 2.94]
Rajasthan	1,978	63.87 [61.89, 65.81]	12.35 [10.96, 13.90]	20.61 [18.99, 22.33]	3.17 [2.48, 4.04]
Uttarakhand	1,186	62.92 [60.33, 65.43]	11.53 [9.82, 13.50]	22.95 [20.67, 25.41]	2.60 [1.78, 3.77]
Daman and Diu	846	62.80 [59.60, 65.88]	12.76 [10.64, 15.23]	22.63 [19.92, 25.60]	1.81 [1.08, 3.03]
Odisha	2,377	60.40 [58.65, 62.12]	13.63 [12.30, 15.09]	23.09 [21.59, 24.66]	2.88 [2.27, 3.65]
Telangana	1,946	60.14 [58.08, 62.17]	12.08 [10.67, 13.64]	25.67 [23.86, 27.58]	2.11 [1.57, 2.82]
Tripura	954	60.03 [57.02, 62.96]	14.97 [12.78, 17.46]	23.88 [21.31, 26.65]	1.13 [0.61, 2.10]
Andhra Pradesh	1,999	59.89 [57.76, 61.98]	12.80 [11.36, 14.39]	24.45 [22.63, 26.37]	2.86 [2.18, 3.75]
Jharkhand	2,087	59.73 [57.64, 61.80]	13.60 [12.16, 15.18]	24.46 [22.65, 26.36]	2.21 [1.65, 2.95]
Assam	1,801	58.79 [56.54, 61.01]	13.39 [11.82, 15.14]	25.54 [23.58, 27.60]	2.28 [1.63, 3.17]
Dadra and Nagar Haveli	882	58.21 [55.22, 61.14]	11.09 [9.13, 13.40]	28.32 [25.54, 31.27]	2.39 [1.47, 3.86]
Uttar Pradesh	3,919	57.34 [55.89, 58.78]	14.49 [13.39, 15.66]	24.95 [23.70, 26.24]	3.22 [2.72, 3.81]
Arunachal Pradesh	927	45.38 [42.24, 48.56]	19.80 [17.15, 22.75]	33.62 [30.57, 36.81]	1.20 [0.62, 2.32]

[1] Based on presenting visual acuity in the better-seeing eye