Published in final edited form as:
JAMA Ophthalmol. 2016 July 1; 134(7): 802–809. doi:10.1001/jamaophthalmol.2016.1284.

Visual Impairment and Blindness in Adults in the United States: Demographic and Geographic Variations from 2015 to 2050

Rohit Varma[1,2], **Thasarat S. Vajaranant**[3], **Bruce Burkemper**[1], **Shuang Wu**[1], **Mina Torres**[1], **Chunyi Hsu**[1], **Farzana Choudhury**[1], and **Roberta McKean-Cowdin**[2]

[1]USC Eye Institute, Department of Ophthalmology, Keck School of Medicine of the University of Southern California, Los Angeles, CA, USA

[2]Department of Preventive Medicine, Keck School of Medicine of the University of Southern California, Los Angeles, CA, USA

[3]Department of Ophthalmology and Visual Sciences, University of Illinois at Chicago Eye and Ear Infirmary, Chicago, IL, USA

Abstract

Importance—This paper describes the current and projected prevalence of visual impairment (VI) (visual acuity worse than 20/40, but better than 20/200) and blindness (visual acuity 20/200 or worse) in the United States.

Objective—To determine the demographic and geographic variations in VI and blindness in adults in the US population in 2015 and to estimate the projected prevalence through 2050

Design—Descriptive

Setting—Population-based cross-sectional

Participants—Pooled data from adults, 40 years and older, from six major population-based studies on VI and blindness in the US. Prevalence of VI and blindness were reported by age, sex, race/ethnicity, and per capita prevalence by state, using the US census projections (2015 – 2050).

Main Outcome and Measures—Prevalence of VI and blindness

Results—In 2015, 1.02 million people were blind, and approximately 3.22 million people in the US had VI (best-corrected VA in the better-seeing eye), while up to 8.2 million people had VI due to uncorrected refractive error. By 2050, the number of these conditions are projected to double to approximately 2.01 million people with blindness, 6.95 million people with VI, and 16.4 million with VI due to uncorrected refractive error. The highest numbers of these conditions are predicted

Corresponding Author: Rohit Varma, MD, MPH, Department of Ophthalmology, Keck School of Medicine of USC, USC Eye Institute, 1450 San Pablo Street, Room 4900, Los Angeles, CA 90033, Tel: 323-442-6411, Fax: 323-442-6412, rvarma@usc.edu.

Author Contributions: Study design and conduct: R. Varma, R. McKean-Cowdin; Data collection, management, analysis, and interpretation: R. Varma, F. Choudhury, S. Wu, C. Hsu, B. Berkemper, M. Torres, R. McKean-Cowdin; Preparation, review/revision, and approval of the manuscript: all authors

Data Access, Responsibility and Analysis: R. Varma and R. McKean-Cowdin had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Financial Disclosure(s)/Conflict of Interest: None reported

Statement Regarding Conformity with Author Information: No IRB approval required

among non-Hispanic whites, women, and older adults, however African Americans are projected to experience the highest prevalence of blindness. By 2050, the highest prevalence of VI among minorities will shift from African Americans to Hispanics. From 2015-2050, the states projected to have the highest per-capita prevalence of VI are Florida and Hawaii and highest projected per-capita prevalence of blindness are Mississippi, Louisiana, and Florida.

Conclusion & Relevance—These data suggest that vision screening for refractive error and early eye disease may reduce or prevent a high proportion of individuals from experiencing unnecessary vision loss and blindness, decrease associated costs to the US economy for medical services and lost productivity, and contribute to better quality of life. Targeted education and screening programs for non-Hispanic white women and minorities should become increasingly important due to the projected growth of these populations and their relative contribution to the overall numbers of these conditions.

INTRODUCTION

The number of individuals with visual impairment (VI) and blindness is increasing in the US and around the globe as a result of shifting demographics and aging populations.[1-4] Tracking the number and characteristics of individuals with VI and blindness is especially important given the negative impact of these conditions on both physical and mental health.[5,6] In particular, individuals who are visually impaired or blind have a higher risk of chronic health conditions,[7] accidents,[8] social withdrawal,[9] depression,[9,10] and mortality.[11]

Accordingly, an important aim of Health Vision 2020 is to improve visual health and wellbeing through interventions to reduce VI and blindness in the US. Such interventions, including public health services and policy planning, rely on projections of the estimated magnitude of VI and blindness in the US. These projections should be based on the most recently available census data as well as prevalence estimates, defined as the proportion of people with VI or blindness out of the total number of people at risk. A 2004 analysis of the magnitude of legal blindness in the US determined its prevalence as 0.78% in adults aged 40 years and older in 2000, and projected a 70% increase from 937,000 in 2000 to 1.6 million in 2020.[12]

In the current report, we present an updated projection of the numbers and prevalence of uncorrected refractive error that could potentially be improved through refraction (e.g., glasses, contacts lenses, and refractive surgery). In addition, we describe the numbers and prevalence of VI and legal blindness in the US from 2015 to 2050, using pooled prevalence data from population-based studies representing 5 major racial/ethnic groups in the US. Furthermore, we identify subgroups of the population (age, sex, and race/ethnicity) expected to experience a higher prevalence of VI and blindness over the next 4 decades in the US.

METHODS

We calculated the prevalence and numbers of individuals with VI and blindness in the US among 5 racial/ethnic groups: African Americans, Asians, Latino/Hispanics, non-Hispanic whites, and other minorities (racial groups). The term “other minorities” is based on the census and refers to populations classified as American Indian, Alaskan Native, Native

Hawaiian, and other Pacific Islander. All US population estimates and projections were obtained from data available at census.gov.

Study Selection and Data Extraction

The studies with data representing each racial/ethnic group in the US were selected according to the following inclusion criteria: 1) population-based studies conducted in the US, in order to avoid inherent differences with other countries' healthcare systems; 2) studies including data after 1980, in order to minimize differences in screening methods, medical treatments, and ophthalmic surgery; 3) studies that used US definitions for VI and blindness; and 4) studies with available age-, sex-, and race/ethnicity-specific estimates of participants, aged 40 years or older.

Six major population-based studies were included to provide race-specific data: Beaver Dam Eye Study (non-Hispanic white populations); Baltimore Eye Survey and Salisbury Eye Evaluation Study (white and African American populations); Proyecto VER and Los Angeles Latino Eye Study (LALES) (Latino/Hispanic populations); and Chinese American Eye Study (CHES) (Asian American populations).[13-21] Summary descriptions of these studies are shown in eTable 1. Age-specific and age-adjusted summary pooled prevalence estimates of VI and blindness were calculated by combining age, race/ethnicity, and sex-specific numbers from the 6 studies (eTable 2).

Statistical Methods

Pooled prevalence estimates for VI and blindness by age, sex, and race/ethnicity were multiplied by corresponding stratum-specific population estimates to obtain the number of persons with VI and blindness in the US from 2015 to 2050. This number was then divided by the total population size. Ninety-five percent confidence intervals (95% CI) were calculated as the prevalence ± 1.96 × standard error. Prevalence per capita was defined as the number of people with VI or blindness out of the number of people in each state based on the US census. The criterion for VI (presenting) was presenting visual acuity (VA) worse than 20/40 in the better seeing eye (excluding blindness). The criterion for blindness (presenting) was presenting VA of 20/200 or worse in the better seeing eye. The criterion for VI (best corrected) was best corrected VA of worse than 20/40 in the better seeing eye. The criterion for blindness (best corrected) was best corrected VA of 20/200 or worse in the better seeing eye. Estimates of VI due to uncorrected refractive error (URE) were estimated by calculating the difference between the prevalence of presenting VI and best corrected VI, relative to the prevalence of presenting VI. Studies with data available for both presenting and best corrected VA calculations included the Baltimore Eye Survey, the Salisbury Eye Evaluation, LALES, and CHES. A regression of VI or blindness prevalence by age, sex, and race/ethnicity was used to impute missing stratum-specific. Calculations were based on the 2014 census data.

Sensitivity Analysis

Sensitivity analyses were performed on prevalence estimates by using several models and different pooled prevalence (eTable 3). For scenario 1, the pooled prevalence from the Eye Disease Prevalence Research Group (EDPRG) and the combined data for European-derived non-Hispanic whites were used to represent non-Hispanic whites.[1] For scenario 2, the pooled prevalence was calculated based on data from the Baltimore Eye Survey, the Beaver Dam Study, the Salisbury Eye Evaluation, the Proyecto VER, and LALES for Asians.[13-18] For scenario 3, the pooled prevalence from the EDPRG for minorities was used for Asians.[1] For scenario 4, the pooled prevalence from the EDPRG was used for other minorities. We then compared the estimates from each scenario to those obtained from the main model.

RESULTS

Current and Projected Estimates of VI and Blindness in the US in 2015 and 2050

In 2015, for persons aged 40 years and older in the US, the overall estimated prevalence of VI was 2.14% (95% CI, 2.12–2.15%), and the overall estimated prevalence of blindness was 0.68% (95% CI, 0.66–0.69%). We based these summary estimates on pooled prevalence estimates by age and race/ethnicity (eTable2) that show the highest prevalence of VI and blindness among African American men and women, followed by non-Hispanic white men and women.

In 2015, approximately 3.22 million persons in the US were visually impaired based on the best corrected, better seeing eye. By age, the largest proportion of VI was among those aged 80 years and older (1.61 million/3.22 million or 50%), followed by those aged 70–79 years (24%), 60–69 years (16%), 50–59 years (5%), and 40–49 years (4%) (Table 1). In 2050, an estimated 6.95 million persons are projected to be visually impaired—an increase of 116%. The proportion of VI cases are projected to range from 64% (4.4 million/6.95 million) for individuals aged 80 years and older, to 2% for individuals aged 40–49 (Table 1). The projected pattern of VI prevalence by age from 2015 to 2050 is shown in eFigures 1–3 for the total US population and by sex. The number of women with VI outnumbered men by approximately 33% in 2015 (Table 1), and this pattern is projected to continue through 2050 (eFigure 4). In 2015, with respect to race/ethnicity, non-Hispanic whites (2.28 million/ 3.22 million, or 71%) represented the largest proportion of VI cases, followed by African Americans (15%), Hispanics (10%), Asians (3%), and other minorities (1%) (eTable 4). Through 2050, the number of people with VI are projected to continue to increase and remain higher among non-Hispanic whites compared to other racial/ethnic groups for both men and women (Figure 1 and eFigures 5–6). In 2050, the majority of VI cases are projected to remain among non-Hispanic whites, but to a lesser degree (projected 57% vs. current 71%; eTable 4). In 2050, the second highest number of VI cases are projected to shift from African American to Hispanic adults (20% for Hispanics vs. 16% for African Americans; Figure 1 and eFigures 5–6).

In 2015, 1.02 million persons in the US were legally blind (Table 1). By age, the prevalence of people with blindness ranged from 42% (0.43 million/1.02 million) for those aged 80 years and older, to 11% for those 40–49 (Table 1). In 2050, an estimated 2.01 million persons are projected to be blind—an increase of 97.1%. From 2015 to 2050, the number of people with blindness are projected to increase most dramatically in adults 80 years of age and older for both men and women (eFigure 7–9). Through 2050, the number of women with blindness compared to men are projected to remain higher (Table 1 and eFigure 10). In 2015, with respect to race/ethnicity, non-Hispanic whites (0.69 million/1.02 million, or 68%)

comprised the largest number of cases of legal blindness, followed by African Americans (21%), Hispanics (10%), Asians (1%), and other minorities (<1%) (eTable 4). The pattern of blindness by race/ethnicity through 2050 is shown in Figure 2 and eFigures 11–12. Similar to the projections for VI, non-Hispanic white adults are projected to continue to represent the majority of cases of blindness (projected 53% vs. current 68%; eTable 4), followed by African Americans (projected 23% vs. 21% current).

Geographic Distribution of the Estimated Number of Cases of VI and Legal Blindness in the US in 2015 and 2050

In 2015, the 3 states with the highest per capita prevalence of VI were Florida, Hawaii, and Mississippi (2.56%, 2.35%, and 2.35%; Figure 3). In 2050, states projected to have the highest per capita VI prevalence are Florida, Hawaii, and South Dakota (3.98%, 3.93%, and 3.70; Figure 4).

In 2015, the states with the highest per capita prevalence of blindness were Mississippi, Louisiana, and Florida (0.83%, 0.79%, and 0.78%; eFigure 13). In 2050, the prevalence of blindness is projected to be highest in Mississippi and Louisiana (1.25%, 1.20%; eFigure 13). By 2050, the per capita prevalence of blindness by state is projected to increase and reach 1–1.25% in 18 states (eFigure 14).

Projected Number of People with Uncorrected Refractive Error in 2015 and 2050

In 2015 in the US, the estimated numbers of people with VI and blindness due to URE were 8.24 million (95% confidence interval [CI], 4.52–17.77) and 290,000 (CI, 20,000-4,200,000), respectively (data not shown). In 2050, the numbers with VI and blindness due to URE are projected to increase to 16.4 million (CI, 8.76-25.84) and 529,000 (CI, 40,000-4,380,000), respectively. An epidemiologic map showing the change in the per capita prevalence of VI due to URE from 2015 to 2050 is shown in eFigures 15 and 16. The expected prevalence will increase across the country, with the projected prevalence reaching 10% or more in 15 states by 2050. The patterns of the per capita prevalence of blindness are shown in eFigures 17 and 18.

Sensitivity Analysis

For the projections for 2015 and 2050, the sensitivity analyses for VI revealed minimal differences among models from different scenarios (eTable 3), ranging from 0% to 4.89%. For the 2050 projections, the sensitivity analyses for blindness revealed minimal differences among models from different scenarios (eTable 3).

DISCUSSION

We estimate that in 2015 in the US, among people aged 40 and older, 3.22 million people were visually impaired and 1.02 million were legally blind. Our 35-year projections indicate an approximate 25% increase per decade in VI and a 21% increase per decade in blindness, predicting 6.95 million people with VI and 2.01 million people with blindness in 2050. This increase in VI and blindness results from an aging population: All members of the Baby Boomer generation (born between 1946–1964) will reach the ages of 65 years and older by

2029. Further, the proportion of the US population aged 75 years and older will rise to 12% by 2050.

Between 2015 and 2050, non-Hispanic whites and women are projected to remain the largest demographics with respect to absolute numbers of VI and blindness. Women are projected to outnumber men by 30–32% with respect to VI, and by 6–11% with respect to blindness. After non-Hispanic whites, Hispanics are projected to have the most cases of VI, and African Americans are projected to have the most cases of blindness.

The EDPRG group previously projected that the number of cases of legal blindness in the US would increase by 35% per decade—from 0.94 million in 2000 to 1.6 million in 2020.[1] Our analysis predicted a per-decade increase of 25%, and our model projected 44% fewer cases of legal blindness in 2020 (1.12 million). This discrepancy is most likely due to differences in methodology and data sources. The EDPRG used population estimates and projections based on the 2000 census, whereas our model generated population estimates and projections based on the 2014 census. Further, the numbers of cases were estimated using prevalence from different selected population-based studies (eTable 2).

Changes in the Estimated Numbers of VI and Blindness in the US from 2015 to 2050 by Sex

Similar to previous reports, we found that women outnumber men with respect to both VI and blindness,[4,19] and attributed this difference to the higher prevalence and longer life expectancy of women compared to men (81 years in women vs. 76 years in men).[20] In addition, previous studies suggest that women are less likely to be treated for various medical conditions, including blinding ophthalmological diseases such as glaucoma.[21-23]

Changes in the Estimated Numbers of VI and Blindness in the US from 2015 to 2050 by Race/Ethnicity

African Americans and Hispanics experience a relatively high prevalence of VI and blindness. However, as the largest proportion of the overall population, non-Hispanic whites represent the largest number of people impacted by these conditions.

Our analysis predicts that between 2015 and 2050, non-Hispanic whites will continue to represent the largest numbers of people with VI and blindness, while African Americans, Hispanics, and Asians will experience a rising prevalence over time.

African Americans are the minority most frequently afflicted by VI and blindness, and will remain the most affected minority with regard to blindness in 2050.

However, Hispanics are projected to become the most affected minority with regards to VI by 2050. This shift reflects the fact that, despite the lower overall prevalence of VI in Hispanics, their population size is larger than that of African Americans. Hispanics are the fastest growing US minority group, with a longer life expectancy than all other non-Hispanic groups.

Changes in VI and Blindness from 2015 to 2050 in the US by Geographic Area

While the highest estimates and projections for total cases of VI and legal blindness in the US are within populous states such as California, Florida, Texas, and New York, the highest per capita prevalence is in Florida for VI and Mississippi for blindness. From 2015 to 2050, the states with the highest per capita prevalence for VI and blindness are projected to remain unchanged.

Impact of Uncorrected Refractive Error on the US Population

We estimate that up to 72% of US individuals with VI (8.24 million estimated with URE/ 3.22 million with best corrected RE + 8.24 million with URE) and up to 20% of individuals with blindness could experience clinical improvement with vision screening followed by proper refractive correction. Refractive error is the leading cause of VI in the US and worldwide[24,25], and uncorrected refractive error can diminish a person's quality of life and ability to complete vision-related daily tasks.[26,27] It also contributes to the annual cost of VI and blindness to the US economy, estimated at $5.48 billion in medical and informal care.[28,29]

These data suggest that vision screening for refractive error and early eye disease may prevent a high proportion of unnecessary vision loss and blindness, and promote better quality of life with age. Further, the relatively low cost of vision screening and refractive correction may result in lower costs to the US economy for medical services and lost productivity related to VI and blindness.

Study Limitations

Our study has several limitations to consider.

First, inherent errors in the data from selected studies and the US census might lead to differences between our predictions and actual future occurrences.[30] For instance, our projections assume that the age, sex, and race/ethnicity-specific prevalence of VI and blindness will not change dramatically over time. Also, we assume that the selected population-based studies provide a reasonable estimate of VI, blindness, and uncorrected refractive error experienced by individuals of similar age, sex, and racial/ethnic groups in the US. Furthermore, our model does not account for changes in the future treatment or prevention of the leading causes of VI and blindness. Additionally, the race/ethnicity and age data in the census are self-reported.

Lastly, the criterion for blindness is based solely on VA, and visual field is not included in this report or in other previous studies. This limitation might lead to an underestimation of the prevalence of VI and blindness consequent to diseases, such as glaucoma and certain retinal degenerations that cause peripheral visual field loss.

Regardless of these limitations and uncertainties, the present study uses the best currently available resources to provide estimated numbers and trends with regard to VI and blindness in the US population from 2015 to 2050.

CONCLUSION

Currently, the highest prevalence of visually impaired and blind individuals is among non-Hispanic white women. In 2050, non-Hispanic whites are projected to continue to represent the largest prevalence of VI cases, followed by African Americans. However, the minority group with the largest prevalence of visually impaired and blind individuals are projected to shift from African Americans in 2015 to Hispanics in 2050.

These data suggest that the yield from screening programs for VI, blindness, and other eye disease would be greatest when focused on high-risk populations (older non-Hispanic white women). Finally, these data suggest that different regions of the country will experience the impact of VI and potentially benefit from screening programs differentially over the next several decades.

In summary, given a projected doubling of the prevalence of VI and blindness over the next 35 years, vision screening and intervention for refractive error and early eye disease may prevent and/or reduce a high proportion of individuals from suffering from these conditions, enhance their quality of life, and potentially decrease direct and indirect costs to the US economy.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

ACKNOWLEDGEMENTS

Funding/Support: NIH/NEI K23EY022949-01 (PI: Vajaranant); NIH/NEI U10EY017337-05 (PI: Varma); and Research to Prevent Blindness, NY

Role of the Sponsor: The funding organization had no role in the design and conduct of the data collection, management, analyses, and interpretation of the data; preparation, review, or approval of the manuscript; or decision to submit the manuscript for publication.

Other Acknowledgements: We would like to thank Joanne Katz, ScD, MS, James Tielsch, PhD, and Tien Wong, MD, PhD, for providing unpublished data from their studies.

REFERENCES

1. Congdon N, O'Colmain B, Klaver CC, et al. Causes and prevalence of visual impairment among adults in the United States. Archives of ophthalmology. Apr; 2004 122(4):477–485. [PubMed: 15078664]
2. Congdon NG, Friedman DS, Lietman T. Important causes of visual impairment in the world today. JAMA : the journal of the American Medical Association. Oct 15; 2003 290(15):2057–2060. [PubMed: 14559961]
3. Bourne R, Price H, Stevens G, Group GBDVLE. Global burden of visual impairment and blindness. Archives of ophthalmology. May 1; 2012 130(5):645–647. [PubMed: 22652851]
4. Stevens GA, White RA, Flaxman SR, et al. Global Prevalence of Vision Impairment and Blindness: Magnitude and Temporal Trends, 1990-2010. Ophthalmology. Jul 10.2013
5. Engelgau MM, Narayan KM, Saaddine JB, Vinicor F. Addressing the burden of diabetes in the 21st century: better care and primary prevention. J Am Soc Nephrol. Jul; 2003 14(7 Suppl 2):S88–91. [PubMed: 12819309]

6. Li Y, Crews JE, Elam-Evans LD, et al. Visual impairment and health-related quality of life among elderly adults with age-related eye diseases. Qual Life Res. Aug; 2011 20(6):845–852. [PubMed: 21191655]
7. Crews JE, Campbell VA. Vision impairment and hearing loss among community-dwelling older Americans: implications for health and functioning. American journal of public health. May; 2004 94(5):823–829. [PubMed: 15117707]
8. Ivers RQ, Norton R, Cumming RG, Butler M, Campbell AJ. Visual impairment and risk of hip fracture. American journal of epidemiology. Oct 1; 2000 152(7):633–639. [PubMed: 11032158]
9. Jones GC, Rovner BW, Crews JE, Danielson ML. Effects of depressive symptoms on health behavior practices among older adults with vision loss. Rehabilitation psychology. May; 2009 54(2):164–172. [PubMed: 19469606]
10. Zhang X, Bullard KM, Cotch MF, et al. Association Between Depression and Functional Vision Loss in Persons 20 Years of Age or Older in the United States, NHANES 2005-2008. JAMA ophthalmology. Mar 7.2013:1–9.
11. Lee DJ, Gomez-Marin O, Lam BL, Zheng DD. Visual acuity impairment and mortality in US adults. Archives of ophthalmology. Nov; 2002 120(11):1544–1550. [PubMed: 12427070]
12. Friedman DS, Wolfs RC, O'Colmain BJ, et al. Prevalence of open-angle glaucoma among adults in the United States. Archives of ophthalmology. Apr; 2004 122(4):532–538. [PubMed: 15078671]
13. Varma R, Ying-Lai M, Klein R, Azen SP, Los Angeles Latino Eye Study G. Prevalence and risk indicators of visual impairment and blindness in Latinos: the Los Angeles Latino Eye Study. Ophthalmology. Jun; 2004 111(6):1132–1140. [PubMed: 15177963]
14. Tielsch JM, Sommer A, Witt K, Katz J, Royall RM. Blindness and visual impairment in an American urban population. The Baltimore Eye Survey. Archives of ophthalmology. Feb; 1990 108(2):286–290. [PubMed: 2271016]
15. Sommer A, Tielsch JM, Katz J, et al. Racial differences in the cause-specific prevalence of blindness in east Baltimore. The New England journal of medicine. Nov 14; 1991 325(20):1412–1417. [PubMed: 1922252]
16. Rubin GS, West SK, Munoz B, et al. A comprehensive assessment of visual impairment in a population of older Americans. The SEE Study. Salisbury Eye Evaluation Project. Investigative ophthalmology & visual science. Mar; 1997 38(3):557–568. [PubMed: 9071208]
17. Rodriguez J, Sanchez R, Munoz B, et al. Causes of blindness and visual impairment in a population-based sample of U.S. Hispanics. Ophthalmology. Apr; 2002 109(4):737–743. [PubMed: 11927431]
18. Munoz B, West SK, Rodriguez J, et al. Blindness, visual impairment and the problem of uncorrected refractive error in a Mexican-American population: Proyecto VER. Invest Ophthalmol Vis Sci. Mar; 2002 43(3):608–614. [PubMed: 11867574]
19. Abou-Gareeb I, Lewallen S, Bassett K, Courtright P. Gender and blindness: a meta-analysis of population-based prevalence surveys. Ophthalmic Epidemiol. Feb; 2001 8(1):39–56. [PubMed: 11262681]
20. Central Intelligence Agency. The World Factbook. Life expectancy at birth. The world factbook. Central Intelligence Agency; Mar 11. 2010 [Life expectancy at birth. Available at: https://www.cia.gov/library/publications/the-world-factbook/fields/2102.html [October, 2013]
21. Why do women carry the greater burden of blindness, and what can be done?. Vol. 16. Community eye health / International Centre for Eye Health; 2003. p. 64
22. Vajaranant TS, Nayak S, Wilensky JT, Joslin CE. Gender and glaucoma: what we know and what we need to know. Current opinion in ophthalmology. Mar; 2010 21(2):91–99. [PubMed: 20051857]
23. Friedman DS, Nordstrom B, Mozaffari E, Quigley HA. Variations in treatment among adult-onset open-angle glaucoma patients. Ophthalmology. Sep; 2005 112(9):1494–1499. [PubMed: 16019072]
24. Vitale S, Cotch MF, Sperduto RD. Prevalence of visual impairment in the United States. JAMA : the journal of the American Medical Association. May 10; 2006 295(18):2158–2163. [PubMed: 16684986]

25. Dandona R, Dandona L. Refractive error blindness. Bull World Health Organ. 2001; 79(3):237–243. [PubMed: 11285669]
26. Varma R, Wu J, Chong K, Azen SP, Hays RD. Impact of severity and bilaterality of visual impairment on health-related quality of life. Ophthalmology. Oct; 2006 113(10):1846–1853. [PubMed: 16889831]
27. McKean-Cowdin R, Varma R, Hays RD, et al. Longitudinal changes in visual acuity and health-related quality of life: the Los Angeles Latino Eye study. Ophthalmology. Oct; 2010 117(10): 1900–1907. 1907, e1901. [PubMed: 20570364]
28. Frick KD, Gower EW, Kempen JH, Wolff JL. Economic impact of visual impairment and blindness in the United States. Archives of ophthalmology. Apr; 2007 125(4):544–550. [PubMed: 17420375]
29. Rein DB, Zhang P, Wirth KE, et al. The economic burden of major adult visual disorders in the United States. Archives of ophthalmology. Dec; 2006 124(12):1754–1760. [PubMed: 17159036]
30. Rein DB, Wittenborn JS, Zhang X, et al. Forecasting age-related macular degeneration through the year 2050: the potential impact of new treatments. Archives of ophthalmology. Apr; 2009 127(4): 533–540. [PubMed: 19365036]

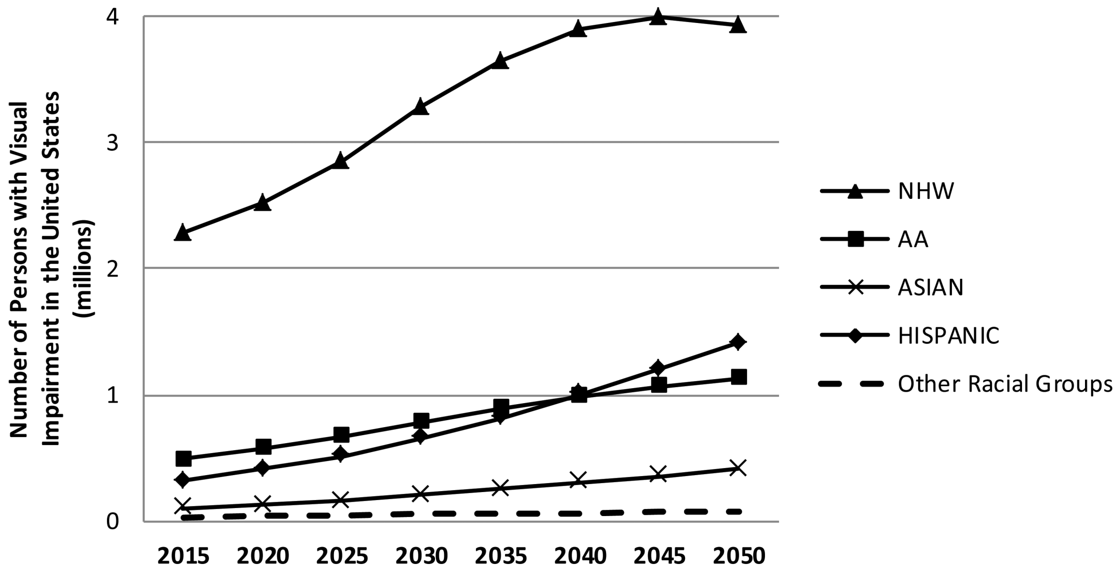

Figure 1.

Estimated numbers of persons with visual impairment in the United States by race/ethnicity all persons and year

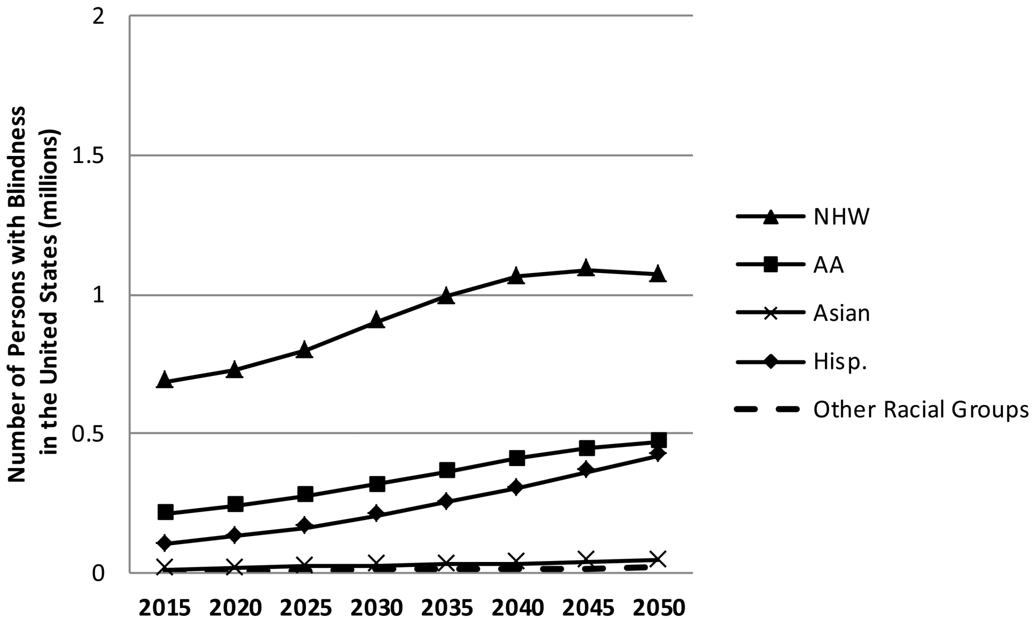

Figure 2.

Estimated number of persons with blindness in the United States by race/ethnicity (all persons) and year

Figure 3.

Per capita prevalence of visual impairment in the United States in 2015

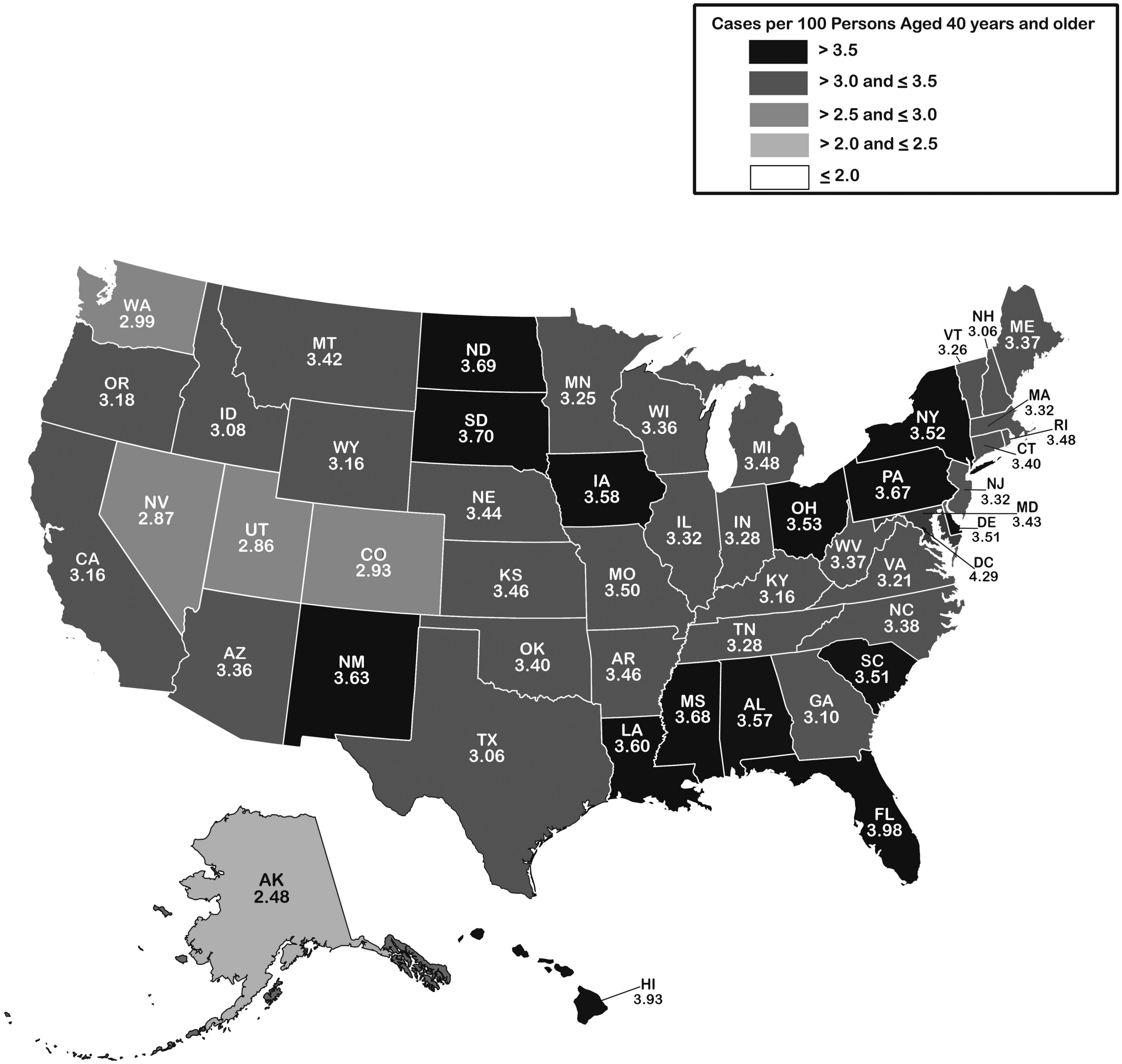

Figure 4.
Per capita prevalence of visual impairment in the United States in 2050

Table 1

Projected number of persons with visual impairment[1] and blindness[2] in the US, stratified by age group, from 2015 to 2050 (in millions)

Visual Impairment

	2015	2020	2025	2030	2035	2040	2045	2050
Age groups								
40–49 years	0.13	0.13	0.14	0.15	0.16	0.17	0.16	0.16
50–59 years	0.17	0.17	0.16	0.16	0.17	0.19	0.20	0.21
60–69 years	0.52	0.59	0.63	0.62	0.60	0.61	0.65	0.70
70–79 years	0.78	0.99	1.21	1.37	1.47	1.44	1.41	1.43
≥80 years	1.61	1.77	2.10	2.67	3.26	3.85	4.27	4.44
Total	3.22	3.67	4.24	4.97	5.67	6.26	6.69	6.95
Women/Men	1.33	1.32	1.32	1.31	1.30	1.30	1.30	1.30

Blindness

	2015	2020	2025	2030	2035	2040	2045	2050
Age groups								
40–49 years	0.11	0.11	0.11	0.12	0.13	0.13	0.13	0.13
50–59 years	0.15	0.14	0.13	0.13	0.13	0.14	0.15	0.15
60–69 years	0.16	0.19	0.20	0.20	0.19	0.20	0.21	0.23
70–79 years	0.17	0.21	0.26	0.30	0.32	0.32	0.31	0.32
≥80 years	0.43	0.47	0.55	0.70	0.86	1.02	1.14	1.18
Total	1.02	1.12	1.26	1.45	1.64	1.82	1.94	2.01
Women/Men	1.07	1.06	1.06	1.08	1.10	1.11	1.11	1.09

[1] worse than 20/40 but better than 20/200, based on the visual acuity in the best corrected, better seeing eye

[2] 20/200 or worse, based on visual acuity in the best corrected, better seeing eye