HHS Public Access

Author manuscript

Am J Public Health. Author manuscript; available in PMC 2016 June 23.

Published in final edited form as:

Am J Public Health. 2015 June ; 105(6): 1262–1268. doi:10.2105/AJPH.2014.302475.

Association of Socioeconomic Position With Sensory Impairment Among US Working-Aged Adults

Chiu-Fang Chou, DrPH, **Gloria L. A. Beckles, MD, MSc**, **Xinzhi Zhang, MD, PhD**, and **Jinan B. Saaddine, MD, MPH**

Division of Diabetes Translation, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, GA

Abstract

Objectives—We examined the relationship between socioeconomic position (SEP) and sensory impairment.

Methods—We used data from the 2007 to 2010 National Health Interview Surveys (n = 69 845 adults). Multivariable logistic regressions estimated odds ratios (ORs) for associations of educational attainment, occupational class, and poverty–income ratio with impaired vision or hearing.

Results—Nearly 20% of respondents reported sensory impairment. Each SEP indicator was negatively associated with sensory impairment. Adjusted odds of vision impairment were significantly higher for farm workers (OR = 1.41; 95% confidence interval [CI] = 1.01, 2.02), people with some college (OR = 1.29; 95% CI = 1.16, 1.44) or less than a high school diploma (OR = 1.36; 95% CI = 1.19, 1.55), and people from poor (OR = 1.35; 95% CI = 1.20, 1.52), low-income (OR = 1.28; 95% CI = 1.14, 1.43), or middle-income (OR = 1.19; 95% CI = 1.07, 1.31) families than for the highest-SEP group. Odds of hearing impairment were significantly higher for people with some college or less education than for those with a college degree or more; for service groups, farmers, and blue-collar workers than for white-collar workers; and for people in poor families.

Conclusions—More research is needed to understand the SEP–sensory impairment association.

Correspondence should be sent to Gloria L. Beckles, MD, MSc, Division of Diabetes Translation, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, 4770 Buford Hwy, NE (F-73), Atlanta, GA 30341-3727 (glb4@cdc.gov).

Note. The findings and conclusions in this article are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Contributors

C.-F. Chou had full access to all the data in the study, conducted the statistical analysis, and takes responsibility for the integrity of the data and the accuracy of the data analysis. G. L. A. Beckles and C.-F. Chou developed the study concept and design and drafted the article. All authors critically interpreted the findings and edited the article.

Human Participant Protection

No institutional review board approval was needed because publicly available secondary data were used. NHIS was approved by the National Center for Health Statistics research ethics review board.

Working-aged adults (defined as people aged 25–64 years) accounted for 53% of the US population in 2010, and the number of Americans in this age group increased by 11.3% in a decade, from 147 million in 2000 to 164 million in 2010. In 2007, nearly 39% of US adults aged 18 to 64 years had at least 1 chronic condition, and 13% of these lacked health insurance.[1] In addition, workers with poor health or health problems are less productive and have increased risk of future disability and illness.

The prevalence of sensory impairment is increasing in the US adult population.[2] The number of US adults with hearing impairment has doubled, from 13.2 million in 1971 to 28.6 million in 2000. According to the National Eye Institute, approximately 4 million US adults aged 40 years or older had vision impairment in 2010, and this number is projected to reach 13 million by 2050. Sensory impairment has been associated with diminished quality of life, physical function limitations, mental health problems, and loss of productivity.[3–5] In addition, use of health care and rehabilitation services and lost productivity attributable to chronic conditions such as sensory impairments may impose considerable societal costs.[6,7] In the United States, hearing impairment among adults aged 18 years or older was estimated to cost $4.6 billion in 1998, and vision impairment and blindness among those older than 40 years were estimated to cost $5.5 billion annually in 1996 to 2004.

Socioeconomic position (SEP), whether measured as education, family income, or occupational class, shows an inverse gradient in risk of mortality and several chronic conditions, including heart disease, cancer, and diabetes, and in access to health care.[8] In both developed and developing countries, middle-aged and older people with low SEP were more likely than their more advantaged counterparts to have vision impairment[9–11] or hearing impairment.[12–14] Persons with low SEP lack the knowledge and resources necessary to protect themselves against the onset and progression of sensory impairment. They are more likely to develop diseases related to vision impairment or hearing impairment[15] and to live and work in noisy environments. They are also less likely to seek eye care and to be aware of the need for such care and more likely to report lack of eye care insurance coverage and cost as barriers to seeking care.

Few studies have addressed the association between SEP and sensory impairment among younger adults of working age; therefore, we examined this relationship among US adults aged 25 to 64 years.

METHODS

We used data from the 2007 to 2010 waves of the National Health Interview Survey (NHIS), a cross-sectional household survey that has been conducted annually since 1957 in the United States by the National Center for Health Statistics. NHIS uses a multistage area probability design among the noninstitutionalized US population. Each year, an average of 100 000 people in 40 000 households are interviewed. Our sample comprised respondents aged 25 to 64 years (n = 69 845). We used a minimum age of 25 years because most people have completed their formal education by then.

Measures

The outcome variable was sensory impairment, defined as self-reported vision or hearing impairment. Participants were asked, “Do you have any trouble seeing, even when wearing glasses or contact lenses?” We classified those who responded yes as having vision impairment. We identified people with hearing impairment from the question, “Without the use of hearing aids or other listening devices, is your hearing excellent, good, a little trouble hearing, moderate trouble, a lot of trouble, or are you deaf?” We categorized those who answered moderate trouble, a lot of trouble, or deaf as having hearing impairment.

We measured the exposure variable, SEP, by 3 hierarchical indicators commonly used to assess the association between socioeconomic circumstances and health outcomes: (1) educational attainment (not a high school graduate, high school graduate–general educational development, some college, or college graduate), (2) occupational class (white collar, service group, farm worker, blue collar, or not in labor force), and (3) income classification derived from the poverty-to-income ratio (PIR; ratio of total annual family income to the federal poverty threshold according to the US Census; poor, PIR < 1.00; low income, PIR = 1.00–2.99; middle income, PIR = 3.00–3.99; high income, PIR ≥ 4.00).[9] Respondents were asked what their main occupation had been during the week before the interview. The NHIS data set provides the reported occupations coded according to the Standard Occupational Classification System, a US federal system for classifying all occupations. We regrouped these codes into the 5 categories of occupational class. The detailed codes and corresponding occupations are shown in Appendix A (available as a supplement to the online version of this article at http://www.ajph.org).

Study covariates were as follows:

- Demographic factors: age, gender, race/ethnicity (non-Hispanic White, non-Hispanic Black, non-Hispanic Asian, Hispanic, or non-Hispanic other), nativity (foreign born or US born), and marital status (never married, divorced–separated–widowed, or married–living with a partner);
- Health care access factors: insurance coverage at time of interview (uninsured, private insurance only, public insurance only, or both private and public insurance), usual place to go for routine health care (yes or no), and office visits during the past 12 months (none or ≥1);
- Behavior: ever smoked at least 100 cigarettes (yes or no);
- Clinical conditions: diagnosed diabetes (yes or no to the question, “ever been told by a doctor or other health professional that you have diabetes, or sugar diabetes?”), diagnosed hypertension (yes or no to the question, “ever been told by a doctor or other health professional that you had hypertension, also called high blood pressure?”), and self-reported health status (excellent to good or poor to fair).

Analytic Methods

For all analyses, we used SAS-callable SUDAAN version 9.3 (Research Triangle Institute, Research Triangle Park, NC) and STATA statistical software SE version 12.1 (StataCorp LP, College Station, TX), which account for the complex sampling design of the NHIS. We weighted all data to produce prevalence estimates for the overall population of US residents aged 25 to 64 years. We used Taylor linearization to produce variance estimates. We used univariate analyses to describe the population characteristics and bivariate analyses to estimate crude and age-standardized prevalence of vision and hearing impairment. We used the direct method to age-standardize prevalence estimates to the 2000 US Census population.

Because education, income, and occupational class are not interchangeable measures of the SEP construct,[29] we first estimated unadjusted and adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for the association of each SEP indicator with visual impairment and hearing impairment in turn. Then, we entered the other 2 SEP indicators into each adjusted SEP model to test the extent to which each indicator was independently associated with the health outcomes once we accounted for the other 2.

We used the Pearson χ^2 test to compare impairment prevalence estimates between SEP groups. The Wald test evaluated the relationship between vision and hearing impairment and SEP indicators. We assessed linear trends in the prevalence estimates by weighted least squares regression. We considered differences statistically significant at $P < .05$.

RESULTS

Among the study population, 50.8% were female, 62.3% were married or living with a partner, 67.6% were non-Hispanic White, 67.5% were covered by private insurance, 90.2% had no usual place to go for routine care, 87.9% reported being in excellent–very good–good health, 7.4% reported having been diagnosed with diabetes, and 25.6% reported having been diagnosed with hypertension (Table 1).

We estimated that the crude prevalence and age-standardized prevalence of vision impairment in the study population were 9.2% (95% CI = 8.9%, 9.5%) and 6.3% (95% CI = 6.0%, 6.7%), respectively, and that the crude prevalence and age-standardized prevalence of hearing impairment were 12.6% (95% CI = 12.2%, 12.9%) and 6.9% (95% CI = 6.5%, 7.2%), respectively (Table 2). The crude prevalence of either vision or hearing impairment was 19.3% (data not shown). Age-standardized prevalence of vision impairment was highest among respondents who did not graduate from high school (7.7%; 95% CI = 6.9%, 8.7%) and lowest among those with college or more education (4.4%; 95% CI = 4.0%, 4.9%). Age-standardized prevalence of hearing impairment was highest among high school graduates who did not attend college (8.6%; 95% CI = 7.8%, 9.4%) and lowest among college graduates (4.6%; 95% CI = 4.2%, 5.1%).

Respondents in service occupations had the highest age-standardized prevalence of vision impairment (7.2%; 95% CI = 6.5%, 8.1%), followed by farm workers (6.7%; 95% CI = 4.1%, 10.9%). Blue-collar workers had the highest age-standardized prevalence of hearing

impairment (9.3%; 95% CI = 8.4%, 10.1%), followed by service groups (6.7%; 95% CI = 6.0%, 7.5%); respondents who were not in labor force had the lowest prevalence (5.5%; 95% CI = 4.2%, 7.1%). Participants from high-income households had the lowest age-standardized prevalence of vision impairment (4.5%; 95% CI = 4.1%, 5.1%) and hearing impairment (5.7%; 95% CI = 5.3%, 6.3%), and those from poor households had the highest prevalence of vision impairment (9.9%; 95% CI = 8.9%, 11.0%) and hearing impairment (8.9%; 95% CI = 7.9%, 9.9%).

Our regression analyses showed that all SEP indicators were associated with vision impairment, even after adjustment for all covariates (Table 3). For example, people with some college and those who did not graduate from high school had significantly higher odds than college graduates of reporting vision impairment (OR = 1.29; 95% CI = 1.16, 1.44 and OR = 1.36; 95% CI = 1.19, 1.55, respectively; all $P < .001$). Farm workers were more likely than white-collar workers to have impaired vision (OR = 1.41; 95% CI = 1.01, 2.02; $P < .05$). Vision impairment was more prevalent among people from poor (OR = 1.35; 95% CI = 1.20, 1.52; $P < .001$), low-income (OR = 1.28; 95% CI = 1.14, 1.43; $P < .001$), and middle-income (OR = 1.19; 95% CI = 1.07, 1.31; $P < .01$) than high-income households. Adjustment for all covariates and SEP indicators did not alter the results for education and PIR, but occupational class was no longer significant.

Our regression analyses also showed that SEP indicators were associated with hearing impairment even after adjustment for all covariates (Table 4). For example, odds of impairment were significantly higher among people with some college (OR = 1.26; 95% CI = 1.16, 1.37), high school graduates (OR = 1.26; 95% CI = 1.15, 1.37), and those who did not graduate from high school (OR = 1.34; 95% CI = 1.19, 1.50) than among college graduates (all $P < .001$). Service workers (OR = 1.12; 95% CI = 1.03, 1.22; $P < .01$), farm workers (OR = 1.45; 95% CI = 1.04, 2.01; $P < .05$), and blue-collar workers (OR = 1.27; 95% CI = 1.17, 1.37; $P < .001$) had significantly higher odds than white-collar workers of reporting hearing impairment. Odds of hearing impairment were significantly higher among respondents from poor than from high-income households (OR = 1.16; 95% CI 1.02, 1.32; $P < .01$). After adjustment for all covariates and SEP indicators, education remained significantly associated with hearing impairment. The adjusted odds of hearing impairment also remained significant for blue-collar workers (OR = 1.17; 95% CI = 1.08, 1.27; $P < .001$) and people who lived in poor families (OR = 1.30; 95% CI = 1.14, 1.50; $P < .001$).

DISCUSSION

We found that approximately 1 in 5 US adults of working age (25–64 years) had either vision or hearing impairment and that each impairment was associated with SEP indicators even after adjustments for all covariates in our study.

Our findings are not strictly comparable with those from previous studies of the relationship between sensory impairment and SEP indicators, because of differences either in the characteristics of the study samples or in the definition of sensory impairment. In an analysis of earlier NHIS data from all adults aged 18 years or older, Caban et al. reported lower estimates for the crude prevalence of vision impairment (6.0%) and similar estimates for the

crude prevalence of hearing impairment (13.1%). By contrast, in an analysis that included data from the 1999 to 2004 waves of the National Health and Nutrition Examination Survey, Cheng et al. found a higher crude prevalence of hearing impairment (19.1%) among people of similar age (25–69 years). The differences in prevalence estimates of hearing impairment may be because the National Health and Nutrition Examination Survey's classification of participants' hearing status was derived from audiometric measurement rather than self-report.

Our finding that SEP (as assessed by income level and education level) was inversely associated with vision and hearing impairment was consistent with results from previous studies that used objective measures of impairment. For example, cross-sectional studies that extracted audiometric and visual acuity measurements from the National Health and Nutrition Examination Survey 1999 to 2004 waves demonstrated a strong, inverse, and graded association between SEP and sensory impairment, even after adjustment for demographic and behavioral factors, clinical conditions, and exposure to occupational or recreational noise.[9] After adjustment in 1 study, respondents with more than a high school education were 70% less likely to have bilateral, 40% less likely to have unilateral, and 50% less likely to have high-frequency hearing loss than persons with less than a high school education. In another study, the adjusted prevalence ratio was 25% lower for persons with a high school diploma and 40% lower for persons who had more than a high school education.

The adjusted odds of vision impairment were 21% higher for persons who had a high school education and 31% higher for respondents with less than a high school diploma than for persons with more education. Odds also differed between participants living near (45% higher) or below (123% higher) the federal poverty level and more affluent persons. The SEP association was also significant for persons with both uncorrectable and correctable vision impairment.

Our findings that blue-collar and farming occupations were associated with vision or hearing impairment are also supported by previous research.[10,11] Damaging occupational exposures, such as high noise levels, could cause hearing impairment among farmers and construction workers,[9] and exposures such as sunlight, chemicals, and dust could cause vision impairment among farmers and blue-collar workers.[11] Previous study findings indicate that workers with low SEP are more likely than workers with high SEP to be employed in dangerous jobs and to be less likely to have access to safety equipment and other industrial protections. Although studies have emphasized racial/ethnic differences in risk of sensory impairment,[11] our findings demonstrate that socioeconomic disparities in this health outcome are common among working-aged adults.

Limitations

We were unable to draw causal inferences from our findings because of the cross-sectional study design. Sensory impairment in early life may lead to low levels of educational attainment, future employment, and economic resources in adulthood. Though limited, life course research that used data from the 1958 British birth cohort showed that low SEP in childhood and adulthood were both associated with increased risks of visual and hearing impairment in midlife.[7] Middle-aged adults with visual and hearing impairment were more

likely to be of low socioeconomic status, to be unable to work because of permanent poor health, and to be exposed to loud occupational noise. They were also more likely to report socially patterned early life factors such as low birth weight or being small for gestational age, mothers who smoked during pregnancy, fathers with manual occupational social status, and crowded accommodation in childhood.

A recent report from the United States found that working-aged adults with hearing loss who had completed postsecondary education were more likely than those who had not to be employed and to be paid closer to the amount earned by those without hearing loss. However, the NHIS does not collect information on SEP indicators and health events at multiple points across the life course of participants, which precludes examination of the potential effect of reverse causation.

Because variables were measured by self-report, our findings may have been subject to recall and social desirability biases. The NHIS questions required participants to self-evaluate, or rate their vision and hearing health. Although this method of assessment is widely used as an inexpensive way to obtain health information, several studies show that self-report may not be a direct measure of health status.[–] Further, respondents may interpret seemingly straightforward questions differently depending on their experience of disability and current disability status. For example, among older Americans, Blacks have poorer visual acuity than Whites but self-rate their vision similarly to Whites. Therefore, the reliability of responses is influenced by the process of adaptation to impairment.

Other research indicates that self-report may capture perception or nonbiological features of sensory impairment and suggests that SEP may not be directly related to impairment but may reflect disparities in access to diagnosis and treatment of conditions such as refractive errors and eye diseases and environmental conditions such as poor lighting—all of which result in effective visual impairment. Therefore, self-reported sensory impairment may provide a more accurate indication of functioning than of health status per se.[,] Although the NHIS data did not permit assessment of how individuals with varying degrees of sensory impairment responded to the questions, we controlled for nonbiological factors (behavior, perceived global health, access to health care) known to confound the SEP–sensory impairment relationship.

Because the NHIS data did not include information about family history of sensory impairment, specific occupations, or occupational hazards such as noise or sunlight, we were unable to assess the extent to which these exposures confounded or modified the association between SEP and vision or hearing impairment. Finally, our analyses were limited to an assessment of factors related to impairment of only 2 senses (vision and hearing), because these were the only types of sensory impairment available from the NHIS.

Conclusions

We analyzed a large, representative sample of noninstitutionalized US residents aged 25 to 64 years. This major strength of our study makes our findings generalizable to all US working-aged adults. Moreover, in our analyses we used an NHIS data set with imputed

income values; therefore, the findings for income-based PIR are less likely to be biased because of the usually high level of nonresponse to questions on income.

Approximately 1 in 5 US adults of working age reports sensory impairment. If we extrapolate that prevalence estimate to the 2010 US Census population aged 25 to 64 years, nearly 33 million adults of working age have either vision or hearing impairment. Sensory impairment in the labor force has implications for increased risk of injuries, early onset of disability, mental health problems, increased burden on the health care system, lost productivity, and unemployment. Because of the numerous risks associated with these impairments and the possible consequences of impairment for affected individuals, their dependents, and society, interventions to help working-aged adults avoid vision or hearing impairment are needed. More research is needed to understand the mechanisms by which SEP is related to sensory impairment in the working-aged population and to provide information useful for policy formulation aimed at risk reduction.

References

1. Howden, LM.; Meyer, JA. Age and sex composition: 2010. US Census Bureau; 2011. Available at: http://www.census.gov/prod/cen2010/briefs/c2010br-03.pdf [Accessed February 27, 2013]
2. Tu, HT.; Cohen, GR. Financial and Health Burdens of Chronic Conditions Grow. Washington, DC: Centers for Studying Health System Change; 2009. Tracking report 24. Available at: http://www.hschange.com/CONTENT/1049 [Accessed August 10, 2012]
3. Collins SR, Robertson R, Garber T, Doty MM. The income divide in health care: how the Affordable Care Act will help restore fairness to the US health system. Issue Brief (Commonw Fund). 2012; 3:1–24. [PubMed: 22351972]
4. Davis, K.; Collins, SR.; Doty, MM.; Ho, A.; Holmgren, AL. Health and productivity among US workers. Commonwealth Fund; 2005. Available at: http://www.commonwealthfund.org/usr_doc/856_Davis_hlt_productivity_USworkers.pdf [Accessed August 27, 2012]
5. Cheng YJ, Gregg EW, Saaddine JB, Imperatore G, Zhang X, Albright AL. Three decade change in the prevalence of hearing impairment and its association with diabetes in the United States. Prev Med. 2009; 49(5):360–364. [PubMed: 19664652]
6. Campbell VA, Crews JE, Moriarty DG, Zack MM, Blackman DK. Surveillance for sensory impairment, activity limitation, and health-related quality of life among older adults—United States, 1993–1997. MMWR CDC Surveill Summ. 1999; 48(8):131–156. [PubMed: 10634273]
7. Mohr PE, Feldman JJ, Dunbar JL, et al. The societal costs of severe to profound hearing loss in the United States. Int J Technol Assess Health Care. 2000; 16(4):1120–1135. [PubMed: 11155832]
8. National Eye Institute. [Accessed February 21, 2013] Projections for vision impairment (2010–2030–2050). Available at: http://www.nei.nih.gov/eyedata/vision_impaired.asp#4
9. Fischer ME, Cruickshanks KJ, Klein BE, Klein R, Schubert CR, Willey TL. Multiple sensory impairment and quality of life. Ophthalmic Epidemiol. 2009; 16(6):346–353. [PubMed: 19995199]
10. Crews JE, Campbell VA. Vision impairment and hearing loss among community-dwelling older Americans: implications for health and functioning. Am J Public Health. 2004; 94(5):823–829. [PubMed: 15117707]
11. 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 Ophthalmol. 2013; 131(5):573–581. [PubMed: 23471505]
12. Li CM, Zhang X, Hoffman HJ, Cotch MF, Themann CL, Wilson MR. Hearing impairment associated with depression in US adults. National Health and Nutrition Examination Survey 2005–2010. JAMA Otolaryngol Head Neck Surg. 2014; 140(4):293–302. [PubMed: 24604103]
13. Boles M, Pelletier B, Lynch W. The relationship between health risks and work productivity. J Occup Environ Med. 2004; 46(7):737–745. [PubMed: 15247814]

14. Rein DB, Zhang P, Wirth KE, et al. The economic burden of major adult visual disorders in the United States. Arch Ophthalmol. 2006; 124(12):1754–1760. [PubMed: 17159036]
15. Frick KD, Gower EW, Kempen JH, Wolff JL. Economic impact of visual impairment and blindness in the United States. Arch Ophthalmol. 2007; 125(4):544–550. [PubMed: 17420375]
16. Lynch, JW.; Kaplan, GA. Socioeconomic factors. In: Berkman, LF.; Kawachi, I., editors. Social Epidemiology. New York, NY: Oxford University Press; 2000. p. 13-35.
17. Krieger N, Williams DR, Moss NE. Measuring social class in US public health research: concepts, methodologies, and guidelines. Annu Rev Public Health. 1997; 18:341–378. [PubMed: 9143723]
18. Ulldemolins AR, Lansingh VC, Valencia LG, Carter MJ, Eckert KA. Social inequalities in blindness and visual impairment: a review of social determinants. Indian J Ophthalmol. 2012; 60(5):368–375. [PubMed: 22944744]
19. Varma R, Ying-Lai M, Klein R, Azen SP. Prevalence and risk indicators of visual impairment and blindness in Latinos: the Los Angeles Latino Eye Study. Ophthalmology. 2004; 111(6):1132–1140. [PubMed: 15177963]
20. Dandona R, Dandona L, Srinivas M, et al. Moderate visual impairment in India: the Andhra Pradesh Eye Disease Study. Br J Ophthalmol. 2002; 86(4):373–377. [PubMed: 11914201]
21. Huang S, Zheng Y, Foster PJ, Huang W, He M. Liwan Eye Study. Prevalence and causes of visual impairment in Chinese adults in urban southern China. Arch Ophthalmol. 2009; 127(10):1362–1367. [PubMed: 19822854]
22. Cruickshanks KJ, Nondahl DM, Tweed TS, et al. Education, occupation, noise exposure history and the 10-yr cumulative incidence of hearing impairment in older adults. Hear Res. 2010; 264(1–2):3–9. [PubMed: 19853647]
23. Agrawal Y, Platz EA, Niparko JK. Prevalence of hearing loss and differences by demographic characteristics among US adults: data from the National Health and Nutrition Examination Survey, 1999–2004. Arch Intern Med. 2008; 168(14):1522–1530. [PubMed: 18663164]
24. Lin FR, Thorpe R, Gordon-Salant S, Ferrucci L. Hearing loss prevalence and risk factors among older adults in the United States. J Gerontol A Biol Sci Med Sci. 2011; 66(5):582–590. [PubMed: 21357188]
25. Hong O. Hearing loss among operating engineers in American construction industry. Int Arch Occup Environ Health. 2005; 78(7):565–574. [PubMed: 16021464]
26. Caban AJ, Lee DJ, Gomez-Marin O, Lam BL, Zheng D. Prevalence of concurrent hearing and visual impairment in US adults: the National Health Interview Survey, 1997–2002. Am J Public Health. 2005; 95(11):1940–1942. [PubMed: 16195516]
27. Gomes J, Lloyd O, Norman N. The health of the workers in a rapidly developing country: effects of occupational exposure to noise and heat. Occup Med (Lond). 2002; 52(3):121–128. [PubMed: 12063357]
28. Centers for Disease Control and Prevention. Reasons for not seeking eye care among adults aged ≥40 years with moderate-to-severe visual impairment—21 states, 2006–2009. MMWR MOrb MOrtal Wkly Rep. 2011; 60(19):610–613. [PubMed: 21597453]
29. Zhang X, Gregg EW, Cheng YJ, et al. Diabetes mellitus and visual impairment: National Health and Nutrition Examination Survey, 1999–2004. Arch Ophthalmol. 2008; 126(10):1421–1427. [PubMed: 18852421]
30. Bainbridge KE, Hoffman HJ, Cowie CC. Diabetes and hearing impairment in the United States: audiometric evidence from the National Health and Nutrition Examination Survey, 1999 to 2004. Ann Intern Med. 2008; 149(1):1–10. [PubMed: 18559825]
31. DeNavas-Walt, C.; Proctor, BD.; Smith, JC. Income, Poverty, and Health Insurance Coverage in the United States: 2007. Washington, DC: US Census Bureau; 2008. p. P60-235.Current Population ReportsAvailable at: http://www.census.gov/prod/2008pubs/p60-235.pdf [Accessed January 28, 2015]
32. Krieger N, Barbeau EM, Soobader MJ. Class matters: US versus UK measures of occupational disparities in access to health services and health status in the 2000 US National Health Interview Survey. Int J Health Serv. 2005; 35(2):213–236. [PubMed: 15932004]

33. Geyer S, Hemstrom O, Peter R, Vågeroö D. Education, income, and occupational class cannot be used interchangeably in social epidemiology. Empirical evidence against a common practice. J Epidemiol Community Health. 2006; 60(9):804–810. [PubMed: 16905727]
34. Verma A, Schulz MR, Quandt SA, et al. Eye health and safety among Latino farmworkers. J Agromedicine. 2011; 16(2):143–152. [PubMed: 21462026]
35. Rahi JS, Cumberland PM, Peckham CS. Visual function in working-age adults: early life influences and associations with health and social outcomes. Ophthalmology. 2009; 116(10):1866–1871. [PubMed: 19560208]
36. Ecob R, Sutton G, Rudnicka A, et al. Is the relation of social class to change in hearing threshold levels from childhood to middle age explained by noise, smoking, and drinking behavior? Int J Audiol. 2008; 47(3):100–108. [PubMed: 18307089]
37. Power C, Atherton K, Strachan DP, et al. Life-course influences on health in British adults: effects of socioeconomic position in childhood and adulthood. Int J Epidemiol. 2007; 36(3):532–539. [PubMed: 17255345]
38. Walter GG, Dirmyer R. The effect of education on the occupational status of deaf and hard of hearing 26-to-64-year-olds. Am Ann Deaf. 2013; 158(1):41–49. [PubMed: 23858702]
39. Schwartz CE, Andresen EM, Nosek MA, Krahn GL. Response shift theory: important implications for measuring quality of life in people with disability. Arch Phys Med Rehabil. 2007; 88(4):529–536. [PubMed: 17398257]
40. El-Gasim M, Munoz B, West SK, Scott AW. Discrepancies in the concordance of self-reported vision status and visual acuity in the Salisbury Eye Evaluation Study. Ophthalmology. 2012; 119(1):106–111. [PubMed: 21962256]
41. Whillans J, Nazroo J. Assessment of visual impairment: the relationship between self-reported vision and “gold-standard” measured visual acuity. Br J Vis Impair. 2014; 32(3):236–248.
42. Lee PP, Smith JP, Kington RS. The associations between self-rated vision and hearing and functional status in middle age. Ophthalmology. 1999; 106(2):401–405. [PubMed: 9951498]

TABLE 1

Characteristics of US Adults Aged 25–64 Years: National Health Interview Survey, 2007–2010

Characteristic	No.	% or Mean (SE)
Demographic factors		
Age, y		43.9 (0.1)
Gender		
Female	38 401	50.8 (0.2)
Male	31 444	49.2 (0.2)
Marital status		
Never married	16 714	19.5 (0.3)
Divorced/separated/widowed	17 154	18.0 (0.2)
Married/living with partner	35 704	62.3 (0.4)
Missing	273	0.3 (0.0)
Race/ethnicity		
Non-Hispanic Black	11 348	12.0 (0.3)
Non-Hispanic Asian	4 170	4.9 (0.1)
Non-Hispanic White	40 067	67.6 (0.4)
Hispanic	13 544	14.5 (0.3)
Non-Hispanic other	606	0.9 (0.1)
Missing	110	0.2 (0.0)
Nativity		
Foreign-born	15 342	18.1 (0.3)
US-born	54 429	81.8 (0.3)
Missing	74	0.1 (0.0)
Health care access factors		
Insurance coverage		
None	16 102	20.9 (0.3)
Private only	44 080	67.5 (0.4)
Public only	8 772	10.1 (0.2)
Both	713	1.1 (0.1)
Missing	178	0.3 (0.0)
Usual place to go for routine health care		
No	62 754	90.2 (0.2)
Yes	6 286	8.7 (0.2)
Missing	805	1.1 (0.1)
Office visits during past 12 mo		
None	14 666	20.3 (0.2)
≥ 1	53 952	78.1 (0.2)
Missing	1 227	1.7 (0.1)
Health factors		
Smoked 100 cigarettes in life		
No	40 403	56.8 (0.3)

Characteristic	No.	% or Mean (SE)
Yes	28 814	42.3 (0.3)
Missing	628	0.9 (0.1)
Ever diagnosed with diabetes		
No	64 428	92.6 (0.1)
Yes	5 367	7.4 (0.1)
Missing	50	0.1 (0.0)
Ever diagnosed with hypertension		
No	51 535	74.3 (0.2)
Yes	18 229	25.6 (0.2)
Missing	81	0.1 (0.0)
Health status		
Good/excellent	60 606	87.9 (0.2)
Fair/poor	9 204	12.0 (0.2)
Missing	35	0.0 (0.0)
Socioeconomic factors		
Educational attainment		
< high school diploma	10 290	12.7 (0.2)
High school diploma/GED	15 729	23.2 (0.2)
Some college	22 504	31.9 (0.3)
College graduate	20 886	31.5 (0.4)
Missing	436	0.7 (0.1)
Occupational class		
White collar	37 980	55.9 (0.3)
Service	11 718	15.3 (0.2)
Farming	552	0.7 (0.1)
Blue collar	14 648	21.8 (0.3)
Not in labor force	2 901	3.5 (0.1)
Missing	2 046	2.7 (0.1)
PIR-based income classification		
Poor (PIR < 1.00)	10 324	10.9 (0.1)
Low income (PIR = 1.00–2.99)	12 658	16.3 (0.2)
Middle income (PIR = 3.00–3.99)	20 216	29.5 (0.2)
High income (PIR ≥ 4.00)	26 647	43.3 (0.2)

Note. GED = general educational development; PIR = poverty-to-income ratio. Sample size was 69 845. Some characteristics may not total 100% because of rounding.

TABLE 2

Crude and Age-Standardized Prevalence of Sensory Impairment by Socioeconomic Position Among US Adults Aged 25–64 Years: National Health Interview Survey, 2007–2010

	Vision Impairment		Hearing Impairment	
SEP Indicator	**Crude Prevalence, % (95% CI)**	**Age-Standardized Prevalence,[a] % (95% CI)**	**Crude Prevalence, % (95% CI)**	**Age-Standardized Prevalence,[a] % (95% CI)**
Total	9.2 (8.9, 9.5)	6.3 (6.0, 6.7)	12.6 (12.2, 12.9)	6.9 (6.5, 7.2)
Educational attainment				
< high school diploma	13 (12.1, 14.0)	7.7 (6.9, 8.7)	14.2 (13.3, 15.3)	6.6 (5.8, 7.6)
High school diploma/GED	9.5 (8.9, 10.1)	6.4 (5.8, 7.2)	14.1 (13.4, 14.8)	8.6 (7.8, 9.4)
Some college	10.6 (10.1, 11.2)	7.4 (6.8, 8.0)	13.9 (13.4, 14.5)	8.1 (7.5, 8.7)
College graduate	6.1 (5.6, 6.5)	4.4 (4.0, 4.9)	9.4 (9.0, 9.9)	4.6 (4.2, 5.1)
Linear trend test		***		***
Occupational class				
White collar	8.4 (8.1, 8.8)	6.1 (5.8, 6.6)	11.1 (10.7, 11.5)	6.1 (5.7, 6.5)
Service	11.4 (10.6, 12.2)	7.2 (6.5, 8.1)	12.1 (11.3, 12.9)	6.7 (6.0, 7.5)
Farming	13 (9.8, 17.1)	6.7 (4.1, 10.9)	15.9 (11.5, 21.6)	5.7 (3.4, 9.3)
Blue collar	10 (9.3, 10.7)	6.1 (5.4, 6.8)	17.4 (16.6, 18.1)	9.3 (8.4, 10.1)
Not in labor force	9.9 (8.6, 11.5)	6.4 (4.8, 8.5)	8.9 (7.8, 10.2)	5.5 (4.2, 7.1)
Linear trend test		ns		ns
PIR-based income classification				
Poor (PIR < 1.00)	15.1 (14.2, 16.1)	9.9 (8.9, 11.0)	15.2 (14.3, 16.2)	8.9 (7.9, 9.9)
Low income (PIR 1.00–2.99)	12.1 (11.4, 12.9)	7.6 (6.8, 8.5)	12.7 (12.0, 13.5)	7.2 (6.5, 8.0)
Middle income (PIR 3.00–3.99)	9.1 (8.1, 9.6)	6.0 (5.5, 6.6)	12.4 (11.8, 13.0)	7.1 (6.5, 7.7)
High income (PIR ≥ 4.00)	6.7 (6.3, 7.1)	4.5 (4.1, 5.1)	11.9 (11.5, 12.4)	5.7 (5.3, 6.3)
Linear trend test		***		***

Note. CI = confidence interval; GED = general educational development; ns = nonsignificant; PIR = poverty-to-income ratio; SEP = socioeconomic position. Linear trend was assessed by weighted least squares regression.

[a]Standardized by the direct method to the 2000 US Census population

***$P < .001$.

TABLE 3

Unadjusted and Adjusted Odds Ratios for Association Between Socioeconomic Position and Vision Impairment Among US Adults Aged 25–64 Years: National Health Interview Survey, 2007–2010

SEP Indicator	OR (95% CI)	AOR (95% CI)[a]	AOR (95% CI)[b]
Educational attainment			
< high school diploma	2.32*** (2.08, 2.59)	1.36*** (1.19, 1.55)	1.26** (1.09, 1.46)
High school diploma/GED	1.63*** (1.46, 1.81)	1.11 (0.99, 1.25)	1.04 (0.92, 1.19)
Some college	1.84*** (1.66, 2.03)	1.29*** (1.16, 1.44)	1.25*** (1.12, 1.41)
College graduate (Ref)	1.00	1.00	1.00
Occupational class			
White collar (Ref)	1.00	1.00	1.00
Service	1.40*** (1.27, 1.53)	1.03 (0.93, 1.14)	0.95 (0.85, 1.06)
Farming	1.61** (1.16, 2.25)	1.41* (1.01, 2.02)	1.23 (0.86, 1.74)
Blue collar	1.21*** (1.10, 1.32)	1.05 (0.95, 1.15)	0.96 (0.87, 1.06)
Not in labor force	1.18* (1.01, 1.39)	0.80* (0.67, 0.96)	0.70*** (0.58, 0.84)
PIR-based income classification			
Poor (PIR < 1.00)	2.5*** (2.24, 2.74)	1.35*** (1.20, 1.52)	1.45*** (1.27, 1.65)
Low income (PIR 1.00–2.99)	1.93*** (1.74, 2.13)	1.28*** (1.14, 1.43)	1.35*** (1.20, 1.53)
Middle income (PIR 3.00–3.99)	1.39*** (1.27, 1.53)	1.19** (1.07, 1.31)	1.23*** (1.12, 1.37)
High income (PIR ≥ 4.00; Ref)	1.00	1.00	1.00

Note. AOR = adjusted odds ratio; CI = confidence interval; GED = general educational development; PIR = poverty-to-income ratio; SEP = socioeconomic position.

[a]Adjusted for all covariates (age, gender, marital status, race/ethnicity, nativity, insurance coverage, usual place to go for routine health care, number of office visits during the past 12 months, diabetes status, hypertension status, health status, smoking status).

[b]Adjusted for all covariates and socioeconomic position indicators (educational attainment, occupational class, PIR-based income classification).

*$P < .05$;

**$P < .01$;

***$P < .001$.

TABLE 4

Unadjusted and Adjusted Odds Ratios for Association Between Socioeconomic Position and Hearing Impairment Among US Adults Aged 25–64 Years: National Health Interview Survey, 2007–2010

SEP Indicator	OR (95% CI)	AOR (95% CI)[a]	AOR (95% CI)[b]
Educational attainment			
< high school diploma	1.60*** (1.44, 1.77)	1.34*** (1.19, 1.50)	1.23** (1.08, 1.40)
High school diploma/GED	1.58*** (1.46, 1.72)	1.26*** (1.15, 1.37)	1.19** (1.08, 1.31)
Some college	1.56*** (1.44, 1.68)	1.26*** (1.16, 1.37)	1.28*** (1.17, 1.39)
College graduate (Ref)	1.00	1.00	1.00
Occupational class			
White collar (Ref)	1.00	1.00	1.00
Service	1.10** (1.01, 1.19)	1.12** (1.03, 1.22)	1.04 (0.96, 1.14)
Farming	1.51* (1.04, 2.20)	1.45* (1.04, 2.01)	1.34 (0.97, 1.87)
Blue collar	1.68*** (1.57, 1.80)	1.27*** (1.17, 1.37)	1.17*** (1.08, 1.27)
Not in labor force	0.78** (0.67, 0.92)	0.96 (0.80, 1.16)	0.87 (0.72, 1.04)
PIR-based income classification			
Poor (PIR < 1.00)	1.32*** (1.21, 1.45)	1.16** (1.02, 1.32)	1.30*** (1.14, 1.50)
Low income (PIR 1.00–2.99)	1.08 (0.99, 1.18)	0.98 (0.89, 1.08)	1.06 (0.97, 1.19)
Middle income (PIR 3.00–3.99)	1.04 (0.97, 1.12)	1.03 (0.96, 1.12)	1.06 (0.98, 1.16)
High income (PIR ≥ 4.00; Ref)	1.00	1.00	1.00

Note. AOR = adjusted odds ratio; CI = confidence interval; GED = general educational development; OR = odds ratio; PIR = poverty-to-income ratio; SEP = socioeconomic position.

[a]Adjusted for all covariates (age, gender, marital status, race/ethnicity, nativity, insurance coverage, usual place to go for routine health care, number of office visits during the past 12 months, diabetes status, hypertension status, health status, smoking status).

[b]Adjusted for all covariates and socioeconomic position indicators (educational attainment, occupational class, PIR-based income classification).

*$P < .05$;

**$P < .01$;

***$P < .001$.