eye reports er

Vision loss in older veterans is greater in rural than urban areas

Justin T McDaniel, PhD[1]; David Albright, PhD[2]; Juliane Wallace, PhD[1]; Wiley Jenkins, PhD[4]

[1] School of Human Sciences, Southern Illinois University, Carbondale, Illinois
[2] School of Social Work, The University of Alabama, Tuscaloosa, Alabama
[3] Department of Population Science and Policy, Southern Illinois University School of Medicine, Springfield, Illinois

Abstract

Purpose: Although rurality has been shown to be a risk factor for vision loss in the general population, there are no published studies to evaluate the relative risk of vision loss in older veterans (age greater than 64 years). Given that veterans have access to a separate healthcare system, the Veterans Health Administration system, this study sought to determine whether older rural veterans had a higher prevalence of vision loss than older urban veterans.

Methods: Data for this cross-sectional study were obtained from the 2016-2018 Behavioral Risk Factor Surveillance System (BRFSS) surveys. Older veteran (n = 49,697) self-reported vision loss was regressed on rural-urban area of residence in a mixed logit model, where state of residence served as a random intercept. This study model controlled for age, race, sex, income, binge drinking behavior, cigarette use, BMI, exercise, diabetes, and mental distress.

Results: Analysis demonstrated that vision loss among older veterans was more prevalent in rural areas (6.73%, 95% CI = 6.27, 7.22) than in urban areas (5.89%, 95% CI = 5.57, 6.23). After controlling for all confounders previously described, rurality was independently associated with vision loss among older veterans (aOR = 1.12, 95% CI = 1.02, 1.23).

Conclusions: In a search of the peer-reviewed medical literature (using MEDLINE and cross-referenced literature), this study is the first to demonstrate a rural-to-urban disparity in vision loss among older veterans in the United States. The results of this study demonstrate the need for broader access to health care, including evidence-based remote or telehealth eye care screening and rehabilitation programs for rural veterans, especially within the Veterans Health Administration system.

Introduction

Low vision is characterized by an uncorrectable, chronic vision impairment.[1] Individuals, especially the elderly, living with vision loss are impaired in terms of their ability to be mobile, read, interact with family or friends, and recognize faces.[2] Vision loss is also accompanied by a loss of personal independence[3] and self-esteem,[4] as well as lower quality of life,[5] generally, and injury,[6] depression,[7] and early mortality,[8] specifically.

Vision loss becomes increasingly prevalent with age, especially after 65 years of age.[9] Recent studies show that low vision may be more common in older United States veterans compared to their civilian peers (7.4% vs. 6.7%).[10,11] Veterans may be at greater risk for

Correspondence:
Justin T McDaniel, PhD
School of Human Sciences, Southern Illinois Univ.
475 Clocktower Drive, Mailcode 4632
Carbondale, IL 62901
E-mail: jtmcd@siu.edu
Phone: (618) 453-1832

Conflict of Interest: The authors report no conflicts of interest.
Contributions: All authors contributed equally.
Accepted for Publication: March 27, 2020

low vision due to certain risk factors that are akin to military service, such as traumatic brain injury,[12] post traumatic stress disorder,[13] as well as outcomes associated with these injuries, like cigarette use,[14] heavy episodic alcohol use,[15] and diabetes.[16] Although the overall veteran population is projected to decline by 2024, the percent of veterans older than 65 years is projected to increase from 48.63% to 51.48% between 2014 and 2024.[17] As such, the study of low vision in the veteran population is important.

Studies of the general population have found that rural areas have higher low vision prevalence rates;[18,19] however, no such study has examined veterans, specifically. Rural dwelling adults are more likely to live in poverty, have lower educational status, and lack health insurance,[20] which are major contributing factors to vision health.[21] A disproportionate number of veterans live in rural areas compared to the United States as a whole (24.1% vs. 19.3%).[22] Furthermore, rural veterans are more likely to be of older age and experience a disability than their peers.[22] For further context, rural populations also experience higher rates of alcohol misuse, and use of tobacco and some drugs,[23] which may affect vision. In spite of this need and population size, less than 10% of physicians practice in rural areas, and there is a projected shortage of 20,000 physicians for rural areas by 2025.[24]

Given the evidence cited above, this current study sought to determine whether there was a disparity in vision loss among older veterans in rural and urban areas. In order to isolate the effect of the disparity in vision loss between rural and urban veterans, this study controlled for previously validated risk factors for vision loss, including diabetes, BMI, cigarette use, alcohol consumption, physical activity, and mental distress.[25-27]

Methods

In this cross-sectional study, merged data from the 2016-2018 Behavioral Risk Factor Surveillance System (BRFSS) surveys were used.[28] The Centers for Disease Control and Prevention's BRFSS has been conducted yearly with adults via landline or cellular telephones in all 50 states. In 2016, 2017, and 2018, respectively, landline-based interviews resulted in 48%, 45%, and 53% response rates while cellular telephone-based interviews resulted in response rates of 46%, 45%, and 43%.[29-31] Each state/territory used a disproportionate stratified sampling design in order to collect data from landlines and a simple random sampling design to gather data via cellular telephone.[32]

Military service status was determined by the following binary yes-or-no question: "Have you ever served on active duty in the United States Armed Forces, either in the regular military or in a National Guard or military reserve unit?" The sample for the present study included respondents who answered "yes" to the aforementioned question. Data from a total of 63,919 service members or veterans, 57,868 service members or veterans, and 56,054 service members or veterans were collected in the 2016, 2017, and 2018 BRFSS surveys, respectively. Because of missing data on the measures described below, as well as this study's delimitation of the sample to individuals aged greater than 64 years, the final analytic sample included 49,697 veterans.

Numerous studies have documented the validity and reliability of BRFSS questions.[33] This current study used information about each respondent's age in years, race/ethnicity (white, black, and "other" race/ethnicity), sex (male or female), and annual income (less than $25,000 or $25,000 or more). Mental distress was measured with the following question: "Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?" Unsafe alcohol consumption, operationalized as binge drinking, was measured with the following question: "Considering all types of alcoholic beverages, how many times during the past 30 days did you have 5 or more drinks (for men) or 4 or more drinks (for women) on an occasion?"

One "current cigarette use" variable was created by combining responses from two survey questions: "Have you smoked at least 100 cigarettes in your entire life?" and "Do you now smoke cigarettes every day, some days, or not at all?" Based on responses to these two questions, this study coded survey respondents into two categories: not currently smoking cigarettes and currently smoking cigarettes. A diabetes diagnoses was determined by the following question: "[Have] you ever [been] told you have diabetes?" Women who reported having been diabetic during a pregnancy were not considered diabetic in this study.

Participation in exercise was measured with the following question: "During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?" Body mass index was calculated as self-reported weight (in kilograms) divided by self-reported height (in meters squared).

Geographic measures, such as state of residence and rural-urban area of residence, were also ascertained. Rural-urban codes in the 2016-2018 BRFSS surveys included (a) in the center city of a United States Office of Management and Budget-defined metropolitan statistical area (MSA), (b) outside the center city of an MSA but inside the county containing the center city, (c) inside a suburban county of the MSA, and (d) not in an MSA. This study dichotomized the rural-urban codes as follows: (a), (b), and (c) above indicated an urban area and (d) indicated a rural area.[34]

The dependent variable in this study was self-reported vision loss. The following question was used to measure the dependent variable: "Are you blind or do you have serious difficulty seeing, even when wearing glasses?" Response options to this question included the following: yes, no, don't know, and refused. Respondents who answered "don't know" or refused to answer the question were omitted from the analytic data set.

This study used the BRFSS complex survey design weights, the methodology for which is described elsewhere,[35] in all analyses. This study examined factors associated with vision loss in a generalized linear mixed model with a logit link, where vision loss (yes = 1, no = 0) served as the dependent variable. State of residence was included in the model as a random intercept. The primary independent variable in this model was rurality. This study also controlled for age, race, sex, income, binge drinking behavior, cigarette use, BMI, exercise, diabetes, and mental distress.

Results

The median age of the veteran sample was 75 years. Regarding other demographic characteristics, 4% of the sample was female and 89% of the sample was white. Overall, 6.18% (95% CI = 5.92, 6.45) of the veterans in this study reported vision loss. Results showed that vision loss among veterans was more prevalent in rural areas (6.73%, 95% CI = 6.27, 7.22) than in urban areas (5.89%, 95% CI = 5.57, 6.23). Without controlling for other confounding variables, the rural-urban disparity in vision loss among older veterans was statistically significant, $F_{(1, 49696)} = 8.39$, $p = 0.004$. After controlling for multiple confounders (age, race, sex, income, binge drinking behavior, cigarette use, BMI, exercise, diabetes, and mental distress), some of which were statistically-significant variables associated with vision loss, in a generalized linear mixed model, rurality remained independently associated with vision loss among older veterans, with an adjusted odds ratio [aOR] of 1.12 (95% CI = 1.02, 1.23), as shown in Table 1.

Discussion

This study extends previous population studies of vision loss among veterans, such as that conducted by Smith and colleagues,[11] by examining rural-urban disparities. This current study provides preliminary evidence in support of a disparity in vision loss between rural- and urban-dwelling older military

Variable	B		aOR	95% CI
Sex	0.189		1.209	0.941, 1.55
Race:				
White	reference			
Black	0.477	*	1.611	1.368, 1.898
Other	0.220	*	1.247	1.054, 1.475
Age	0.067	*	1.069	1.059, 1.079
Binge Drinking	- 0.098		0.906	0.747, 1.100
Cigarette Use	0.335	*	1.398	1.215, 1.609
Exercise	- 0.253	*	0.776	0.709, 0.850
BMI	<0.001	*	1.001	1.000, 1.002
Diabetes	0.277	*	1.319	1.199, 1.452
Mental Distress	0.040	*	1.041	1.036, 1.046
Income	- 0.499	*	0.607	0.552, 0.667
Rural	0.114	*	1.120	1.019, 1.231
Random Effect Variance:				
State	0.047			

Table 1

A generalized linear mixed model analysis demonstrates factors associated with vision loss among 49,697 older military veterans in the United States from 2016-2018. The table presents generalized linear mixed model average coefficient estimates (B) as a function of variable, along with the associated adjusted odds ratio (aOR) and confidence interval (CI). An asterisk (*) indicates $p < 0.05$.

veterans. Older rural veterans are more likely to experience vision loss, by 1.12 times based on the results of this study.

This study included the following limitations. First, all data used were obtained via self-report and, therefore, could be contaminated by recall or social desirability bias. Second, data about the nature and extent of vision loss were not available. Third, our control measure for physical activity was likely over-reported for both groups, and only included a measure of aerobic activity, neglecting the potential influence of strength training with age. Future studies should attempt to examine more geographically granular comparisons of vision loss among veterans, such as within specific states.

Because rural patients are less likely to have comprehensive eye exams, in large part due to lack of geographic proximity to a clinic,[36] this population may be at risk of not receiving or receiving a late diagnosis of a potentially blinding ocular condition, particularly a potentially treatable blinding ocular condition. As such, there is need for broader access to health care, including evidence-based remote or telehealth eye care screening programs for rural veterans, such as the ones created by Maa, *et al.*[37] or Murchinson, *et al.*[38], especially within the Veterans Health Administration system.

References

1. Stelmack JA, Tang C, Wei Y, et al. Outcomes of the Veterans Affairs low vision intervention trial II (LOVEIT II): a randomized clinical trial. JAMA Ophthalmology 2017; 135(2): 96-104.
2. Crews JE, Campbell VA. Health conditions, activity limitations, and participation restrictions among older people with vision impairments. Journal of Visual Impairment and Blindness 2001; 95(8): 453-67.
3. West SK, Munoz B, Rubin GS, et al. Function and visual impairment in a population based study of older adults: The SEE project. Investigative Ophthalmology and Visual Science 1997; 38(1): 72-82.
4. Burmedi D, Becker S, Heyl V, et al. Emotional and social consequences of age-related low vision. Visual Impairment Research 2002; 4(1): 47-71.
5. Mitchell J, Bradley C. Quality of life in age-related macular degeneration: a review of the literature. Health and Quality of Life Outcomes 2006; 4: 97-117.
6. Leat SJ, Zecevic AA, Keeling A, et al. Prevalence of vision loss among hospital in-patients: a risk factor for falls? Ophthalmic and Physiological Optics 2018; 38: 106-14.
7. Zhang X, Bullar 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 2013; 131(5): 573-81.
8. Siantar RG, Cheng C, Cheung CMG, et al. Impact of visual impairment and eye diseases on mortality: the

Singapore Malay eye study (SiMES). Science Reports 2015; 5: 16304-12.
9. Chan T, Friedman DS, Bradley C, et al. Estimates of incidence and prevalence of visual impairment, low vision, and blindness in the United States. JAMA Ophthalmology 2018; 136(1): 12-9.
10. Crews JE, Chou C-F, Stevens JA, et al. Falls among persons aged ≥65 years with and without severe vision impairment – United States, 2014. Morbidity and Mortality Weekly Report MMWR 2016; 65(17): 433-7.
11. Smith SL, Bennett LW, Wilson RH. Prevalence and characteristics of dual sensory impairment (hearing and vision) in a veteran population. Journal of Rehabilitation Research and Development 2008; 45(4): 597-610.
12. Urosevich TG, Boscarino JJ, Hoffman SN, et al. Traumatic brain injury seen among veterans in non-VA facilities: implications for clinical practice. Military Medicine 2018; 183(11-12): e564-70.
13. Pogoda TK, Hendricks AM, Iverson KM, et al. Multisensory impairment reported by veterans with and without mild traumatic brain injury history. Journal of Rehabilitation and Research Development 2012; 49(7): 971-84.
14. Richer S, Stiles W, Statkute L, et al. Double-masked, placebo-controlled trial of lutein and antioxidant supplementation in the intervention of atrophic age-related macular degeneration: the veterans LAST study (lutein antioxidant supplementation trial). Optometry 2004; 75(4): 216-30.
15. Stevelink SAM, Malcolm EM, Gill PC, et al. The mental health of UK ex-servicemen with a combat-related or a non-combat related visual impairment: does the cause of visual impairment matter? British Journal of Opthalmology 2015; 99(8): 1103-8.
16. Boyko EJ, Jacobson IG, Smith B, et al. Risk of diabetes in US military service members in relation to combat deployment and mental health. Diabetes Care 2010; 33(8): 1771-7.
17. Amaral EFL, Pollard MS, Mendelsohn J, et al. Current and future demographics of the veteran population, 2014-2024. Population Review 2018; 57(1): 28-60.
18. Kirtland KA, Saadine JB, Geiss LS, et al. Geographic disparity of severe vision loss – United States, 2009-2013. Morbidity and Mortality Weekly Report MMWR 2015; 64(19): 513-7.
19. Hale NL, Bennett KJ, Probst JC. Diabetes care and outcomes: Disparities across rural America. Journal of Community Health 2010; 35: 365-74.
20. Blumenthal SJ, Kagen J. The effects of socioeconomic status on health in rural and urban America. JAMA 2002; 287(1): 109.
21. Yip JLY, Luben R, Hayat S, et al. Area deprivation, individual socioeconomic status and low vision in the EPIC-Norfolk eye study. Journal of Epidemiology and Community Health 2014; 68: 204-10.
22. Holder KA. Veterans in rural America: 2011–2015. American Community Survey Reports, ACS-36, U.S. Census Bureau, Washington, DC, 2016.
23. Substance Abuse and Mental Health Services Administration. Results from the 2016 national survey on drug use and health: Detailed tables. Available at https://www.samhsa.gov/data/sites/default/files/NSDUH-DetTabs-2016/NSDUH-DetTabs-2016.pdf (Accessed March 23, 2020).
24. Gudbranson E, Glickman A, Emanuel EJ. Reassessing the data on whether a physician shortage exists. JAMA 2017; 317(19): 1945-6.
25. Chakravarthy U, Wong TY, Fletcher A, et al. Clinical risk factors for age-related macular degeneration: a systematic review and meta-analysis. BMC Ophthalmology 2010; 10: 31-43.
26. Cho E, Hankinson SE, Willett WC, et al. Prospective study of alcohol consumption and the risk of age-related macular degeneration. Epidemiology and Biostatistics 2000; 118(5): 681-8.
27. Sabel BA, Wang J, Cardenas-Morales L, et al. Mental stress as a consequence and cause of vision loss: the dawn of psychosomatic ophthalmology for preventive and personalized medicine. EPMA Journal 2018; 9(2): 133-60.
28. Centers for Disease Control and Prevention. Behavioral risk factor surveillance system: Survey data and documentation. Available at https://www.cdc.gov/brfss/data_documentation/index.htm (Accessed October 10, 2019).
29. Centers for Disease Control and Prevention. 2016 summary data quality report. Available at https://www.cdc.gov/brfss/annual_data/2016/pdf/2016-sdqr-508.pdf (Accessed October 15, 2019).
30. Centers for Disease Control and Prevention. 2017 summary data quality report. Available at

https://www.cdc.gov/brfss/annual_data/2017/pdf/2017-sdqr-508.pdf (Accessed October 15, 2019).
31. Centers for Disease Control and Prevention. 2018 summary data quality report. Available at https://www.cdc.gov/brfss/annual_data/2018/pdf/2018-sdqr-508.pdf (Accessed October 15, 2019).
32. Centers for Disease Control and Prevention. Overview: BRFSS 2018. Available at https://www.cdc.gov/brfss/annual_data/2018/pdf/overview-2018-508.pdf (Accessed October 15, 2019).
33. Centers for Disease Control and Prevention. BRFSS data quality, validity, and reliability: BRFSS data quality and national estimates. Available at https://www.cdc.gov/brfss/publications/data_qvr.htm (Accessed October 15, 2019).
34. McDaniel JT, Albright DL, Lee HY, Patrick S, McDermott RJ, Jenkins WD, Diehr AJ, Jurkowski E. Rural-urban disparities in colorectal cancer screening among military service members and veterans. Journal of Military Veteran and Family Health 2019; 5(1): 40-8.
35. Centers for Disease Control and Prevention. Complex sampling weights and preparing 2018 BRFSS module data for analysis. Available at https://www.cdc.gov/brfss/annual_data/2018/pdf/Complex-Smple-Weights-Prep-Module-Data-Analysis-2018-508.pdf (Accessed October 15, 2019).
36. Kilmer G, Bynum L, Balamurugan A. Access to and use of eye care services in rural Arkansas. Journal of Rural Health 2010; 26(1): 30-5.
37. Maa AY, Wojciechowski B, Hunt K, et al. Remote eye care screening for rural veterans with technology-based eye care services: a quality improvement project. Rural and Remote Health 2017; 17(1): 4045-54.
38. Murchinson AP, Haller JA, Mayro E, et al. Reaching the unreachable: novel approaches to telemedicine screening of underserved populations for vitreoretinal disease. Current Eye Research 2017; 42(7): 963-70.