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Disparity in Prevalence of Self-Reported Visual Impairment in Older Adults Among US Race-Ethnic Subgroups

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Abstract

Purpose—Prevalence of visual impairment (VI) in the United States (US) has not been carefully examined by race-ethnic subgroups. This study examines self-reported VI prevalence in race-ethnic subgroups using data representative of the US population age ≥45 years.

Methods—The National Health Interview Survey (NHIS) is a population-based multipurpose and multistage area probability annual survey of the US civilian non-institutionalized population conducted by the National Center for Health Statistics. Data from a total of 122,649 participants age ≥45 years from the pooled 1999–2006 National Health Interview Surveys was used; VI prevalence was based on two questions asked to participants, “Do you have any trouble seeing, even when wearing glasses or contact lenses?” (some VI), and “Are you blind or unable to see at all?” (severe VI).

Results—For middle-aged adults age 45–64 years, race/ethnic groups with high age-adjusted rates of any self-reported VI (some or severe VI) include Native Americans, Puerto Ricans, Dominicans, and those reporting mixed race/ethnicity. Among older adults age ≥65 years, understudied race/ethnic groups with high age-adjusted rates of any self-reported VI include Native Americans, Chinese Americans, Puerto Ricans, Dominicans, Central/South Americans, and those reporting mixed race/ethnicity. Among older adults with severe VI, race/ethnic groups with VI prevalence include Filipino, Chinese Americans, Dominicans, Cubans, and Puerto Ricans and those reporting mixed race/ethnicity.

Conclusions—Among understudied US race-ethnic groups, older Native Americans, Chinese Americans, Puerto Ricans, Dominicans, and Central/South Americans generally have high rates of self-reported VI suggesting further targeted epidemiologic and intervention studies may be warranted.

Keywords

visual impairment; aged; adult; Native Americans; Puerto Ricans; Dominicans; Chinese Americans; Hispanics; Blacks; whites

INTRODUCTION

Visual impairment (VI) is a significant source of morbidity for the aging United States (US) population and is associated with a range of adverse psychosocial outcomes including poor functioning, lower quality of life and depression,^{1–3} increased injury and accident risk,^{4, 5} and reduced survival.^{1, 2, 6} The estimated annual total financial burden of major adult visual disorders for the U.S. is \$5 billion to \$35 billion.^{7–9}

The US population is becoming more diverse racially and ethnically, and several studies have demonstrated differences in the prevalence of VI as well as the disparity of eye care among some race-ethnic groups.^{10–13} However, population-based prevalence estimates of VI have not been previously examined for small race-ethnic groups, particularly for older adults. This study examines reported VI prevalence in small race-ethnic subgroups using data representative of the US population aged 45 years and older. The study received approval from the University of Miami Human Subjects Committee.

MATERIALS AND METHODS

The National Health Interview Survey (NHIS) is a continuous population-based multipurpose and multistage area probability annual survey of the US civilian non-institutionalized population conducted by the National Center for Health Statistics (NCHS).¹⁴ The NHIS employs a complex sample survey design to obtain population-based samples that are representative of the US civilian non-institutionalized population.

For the present analyses, complete VI and race-ethnic data were available on 122,649 participants of the 1999–2006 NHIS who were 45 years of age or older. During this period, one adult from each household surveyed was randomly selected for the survey. Participants were asked, “Do you have any trouble seeing, even when wearing glasses or contact lenses?” (some VI), and “Are you blind or unable to see at all? (severe VI). Participants were classified as “VI” if they responded yes to either question. The data were analyzed using Statistical Analysis System (SAS)¹⁵ survey procedures to compute 1999–2006 pooled VI prevalence adjusted for survey weights, design effects, and age.¹⁶ To account for the aggregation of data over multiple survey years, these sample weights were modified by dividing the annual weight by 8, the number of years combined; the sample weights used were those required for the analysis of NHIS data from combined survey years and were calculated as specified by Botman and Jack.¹⁷ For Age adjusted VI prevalence calculations, the direct age adjustment method was used as specified by Klein and Schoenborn.¹⁶

RESULTS

Tables 1 to 4 present the 1999–2006 NHIS pooled self-reported VI prevalence rates for the race-ethnic subgroups for adults aged 45–64 and aged 65. Table 1 displays the age-adjusted prevalence of any VI (some or severe VI) by race and Hispanic subgroups. The age-adjusted prevalence of any VI for all adults aged 65 years was 17.4% [95% Confidence Interval 16.9–17.9]. All race and all ethnic subgroup prevalence rates are significantly different from the corresponding survey prevalence rate and age-adjusted

prevalence rate for whites and for non-Hispanics, respectively ($p < 0.05$). Those aged 65 years reporting more than one race designation (“multiple race”) had the highest age-adjusted prevalence rate of any VI (25.5% [13.4–43.0]) followed by Native Americans (25.1% [18.5–33.1]), African Americans (21.0% [19.5–22.6]), and Chinese (20.5% [14.0–29.0]). Hispanic subgroups with rates of any VI higher than non-Hispanics included: those reporting more than one Hispanic designation (40.0% [25.8–56.0]), Dominicans (23.6% [16.5–32.5]), Puerto Ricans (22.9% [19.1–27.2]), Central/South Americans (20.6% [15.6–26.7]), Mexican-Americans (19.2% [16.9–21.8]), and those reporting “other Hispanic” designation (23.4% [17.2–31.0]).

Table 2 displays the pooled prevalence rates of some VI and severe VI among middle age (45–64 years) and older (65 years) adults. Among older adults with severe VI, individuals of multiple race (1.5% [0.4–6.1]), Chinese (1.4% [0.4–5.6]), and African Americans (1.2% [0.9–1.6]) had the highest VI prevalence. Furthermore, among older adults with severe VI with respect to Hispanic subgroups, Dominicans (3.7% [1.2–10.9]), Cubans (2.1% [0.8–5.1]), Puerto Ricans (2.0% [1.2–3.3]), and those reporting “other Hispanic” designation (3.3% [1.6–6.5]) had the highest VI prevalence.

The association between socio-demographics and some and severe VI by race are shown in Table 3. Because of sample size limitations, individuals who are not white or not African American were placed in the category of “all other”. Regardless of racial identity, the odds of reporting some VI was significantly greater in females than in males (range of Odds Ratio (OR) 1.21–1.28), even after adjusting for other demographics. However, female gender was associated with lower odds of severe VI (range of ORs 0.53–0.88), but the association was generally not significant. Higher education levels were associated with lower odds of some VI in a dose-response fashion. Being insured, compared to uninsured, or married, compared to not married, were found to be protective against some VI among whites and African Americans. Among whites and blacks, greater educational attainment was also inversely related to severe VI.

Table 4 shows the correlation between socio-demographics and VI by Hispanic subgroups. Being female was associated with significantly greater odds of severe VI among Puerto Ricans (OR 1.09 [1.06–1.12]) but significantly lower odds among Cuban Americans (OR 0.15 [0.11–0.22]). In general, greater educational attainment was associated with significantly lower odds of self-reported VI.

DISCUSSION

Our results reveal up to 4-fold differences in self-reported age-group-specific VI rates among race and ethnic subgroups. The results of our study are important to identify those understudied race-ethnic groups with high self-reported VI who are likely in need of improved eye care and health education. Similar to previous population-based studies, African Americans and Mexican Americans were found to have high rates of VI compared to whites and non-Hispanics (Table 1).^{13, 18, 19} This study expands on previous work to highlight specific understudied race-ethnic groups with significantly higher prevalence of any VI (some VI or severe VI) for both age 45–64 and 65 categories. These groups

include Native Americans (compared to whites) and Puerto Ricans and Dominicans (compared to non-Hispanics). In addition, for participants aged ≥ 65 years, other groups with significantly higher prevalence of VI include Chinese Americans, and Central or South Americans. Reasons for disparities in the prevalence rates of self-reported VI among race-ethnic subgroups may be related to a variety of factors including differences in ocular structure,^{20, 21} differences in the prevalence of ocular diseases,^{13, 19, 22, 23} and disparities in access to eye care.^{18, 24–29} Ocular epidemiologic and intervention studies targeting these racial-ethnic groups with high prevalence of self-reported VI could potentially lead to reductions in the VI prevalence disparities noted in this study. Of interest, those with self-designated “multiple race” or “multiple Hispanics” also had significantly higher prevalence of any VI for both age 45–64 and ≥ 65 categories. The reason for this finding is not clear, and because these categories are heterogeneous race-ethnic groups, they would be difficult to study epidemiologically or be targeted by interventional studies.

When further analysis were performed separately for some VI and severe VI, we found that, among older adults aged ≥ 65 years with severe VI, individuals of multiple race, Filipino, Chinese, and African Americans had the highest VI prevalence (Table 2), and among Hispanic subgroups, Dominicans, Cubans, and Puerto Ricans had the highest severe VI prevalence. These findings suggest further studies targeting the elderly in these race-ethnic groups may be helpful to determine the need for intervention. Similar to previous studies of VI^{19, 30, 31}, we found the odds of reporting some VI was significantly greater in females than in males, but the females in our study had lower odds of reporting severe VI than males although this was generally not significant except for Cubans. Also similar to previous studies of VI^{32–35}, higher education, being insured, or married were associated with lower odds of reporting VI.

Advantages of the NHIS include large sample size and the fact that NHIS is designed to be representative of the US population, allowing for prevalence-estimation among small racial-ethnic groups. Disadvantages of NHIS include self-reported measures of VI, likely resulting in some misclassification of VI. To our knowledge, the specific visual impairment questions employed in the NHIS have not been validated, although validation of similar questions have been reported in the literature. For example, in one study, the specificity and sensitivity of self-reported VI with clinical visual acuity measures as the ‘gold standard’ range from 82%–89%.³⁶ In another study, the concordance of distance acuity results with the question “Are you able to recognize a face from a distance of four meters” was reported to be 79%.³⁷ However, the use of visual acuity as the ‘gold-standard’ or the only dimension of VI to evaluate self-reported VI is subject to its own limitations given that other components of the visual system can affect visual functioning. For instance, contrast sensitivity and stereoacuity as well as visual acuity are independently associated with self-reported near and far visual impairments in community-residing populations.³⁸ In addition, visual acuity, contrast and glare sensitivity, stereoacuity, and visual fields are significant independent risk factors for self-reported visual disability in the elderly.³⁹

In summary, in our analysis of older adults, we found high rates of self-reported VI several understudied racial-ethnic groups such as Native Americans, Chinese Americans, Puerto Ricans, Dominicans, Central/South Americans, and those with multiple race or Hispanic

designations. This information has public health implications and is helpful to guide future ocular epidemiologic and intervention studies.

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Table 1

Prevalence of Any Visual Impairment (VI) for US Adults Age 45 Years and Older: National Health Interview Survey 1999–2006

Race/Ethnic Category	Estimated US Population	Sample N	Any VI (%)	95% LL [†]	95% UL [*]	Age-adjusted VI (%)	95% LL [†]	95% UL [*]
Age 45–64 Years								
All Participants	66340737	76016	11.2	10.9	11.5	11.2	10.9	11.5
Race[§]								
White	55024103	59829	10.9	10.6	11.2	10.9	10.6	11.2
African American	7018198	10785	13.8	13.0	14.7	13.9	13.0	14.7
Native American	471595	565	19.9	16.2	24.2	19.9	16.3	24.0
Chinese	473159	449	8.9	5.4	14.1	8.9	5.5	14.1
Filipino	520503	498	7.8	5.3	11.5	7.8	5.3	11.5
Asian Indian	357415	313	4.8	2.9	7.8	4.9	2.8	8.2
Other Asian Pacific Islander	846715	853	7.0	5.6	8.8	7.3	5.7	9.3
Multiple Race	98473	148	15.9	9.4	25.5	16.4	10.0	25.9
Other or unknown Race	1530571	2576	13.5	12.1	15.0	14.0	12.5	15.6
Hispanic Origin[‡]								
Non-Hispanic	60602694	65978	11.1	10.8	11.5	11.1	10.8	11.5
Puerto Rican	684708	1178	14.3	12.2	16.8	14.3	12.2	16.8
Mexican	3232258	5727	12.7	11.6	13.9	12.9	11.7	14.1
Cuban	365658	700	4.5	3.3	6.3	4.3	3.0	6.1
Dominican Republic	199620	353	14.4	10.0	20.4	14.6	10.3	20.3
Central or South American	944901	1456	9.3	7.6	11.3	9.3	7.6	11.3
Multiple Hispanic	54182	92	17.4	10.2	28.0	18.0	10.8	28.5
Other Hispanic	256714	532	12.8	9.1	17.8	12.8	9.1	17.8
All Age 65 Years								
All Participants	33787806	46633	17.1	16.7	17.6	17.4	16.9	17.9
Race[§]								
White	29615273	39267	16.7	16.2	17.2	16.9	16.4	17.4
African American	2813825	5362	20.5	19.0	22.0	21.0	19.5	22.6
Native American	135943	194	24.3	17.4	32.8	25.1	18.5	33.1
Chinese	182915	214	20.3	14.2	28.3	20.5	14.0	29.0

Race/Ethnic Category	Estimated US Population	Sample N	Any VI (%)	95% LL [†]	95% UL [*]	Age-adjusted VI (%)	95% LL [‡]	95% UL [*]	
Filipino	176327	197	13.8	8.6	21.4	13.7	8.5	21.4	
Asian Indian	62198	61	10.0	4.2	22.2	10.4	4.3	23.2	
Other Asian Pacific Islander	334624	442	13.5	10.0	18.1	13.8	10.1	18.7	
Multiple Race	33164	54	26.7	13.2	46.7	25.5	13.4	43.0	
Other or unknown Race	433534	842	22.9	19.3	27.0	24.4	20.7	28.5	
Hispanic Origin[‡]									
Non-Hispanic	31719118	42320	17.1	16.6	17.6	17.3	16.8	17.8	
Puerto Rican	273500	491	20.4	17.0	24.3	22.9	19.1	27.2	
Mexican	1028406	2267	17.9	15.8	20.2	19.2	16.9	21.8	
Cuban	326332	699	14.5	10.2	20.2	14.7	10.5	20.2	
Dominican Republic	39624	82	20.5	13.6	29.5	23.6	16.5	32.5	
Central or South American	250438	410	19.5	14.9	25.1	20.6	15.6	26.7	
Multiple Hispanic	19764	45	35.7	21.7	52.7	40.0	25.8	56.0	
Other Hispanic	130622	319	22.2	16.6	29.0	23.4	17.2	31.0	

[†] 95% LL=95% confidence lower limit

^{*} 95% UL=95% confidence upper limit

[§] All race sub-group prevalence estimates are significantly different ($p < 0.01$) from the corresponding survey-adjusted and survey and age-adjusted prevalence rate for whites⁴⁰.

[‡] All ethnic sub-group prevalence estimates are significantly different ($p < 0.01$) from the corresponding survey-adjusted and survey- and age-adjusted prevalence rate for non-Hispanics⁴⁰.

Table 2

Prevalence of Some and Severe Visual Impairment (VI) for US Adults Age 45 Years and Older: National Health Interview Survey 1999–2006

Race/Ethnic Category	Sample N	Some VI (%)	95% LL	95% UL	Severe VI (%)	95% LL	95% UL
Age 45–64 Years							
All Participants	76016	10.8	10.5	11.1	0.4	0.33	0.43
Race[§]							
White	59829	10.5	10.2	10.9	0.3	0.3	0.4
African American	10785	13.1	12.3	14.0	0.7	0.5	0.9
Native American	565	18.8	15.2	23.0	1.1	0.5	2.5
Chinese	449	8.6	5.4	14.1	-	-	-
Filipino	498	7.8	5.8	11.5	-	-	-
Asian Indian	313	4.8	2.9	7.8	-	-	-
Other Asian Pacific Islander	853	7.0	5.6	8.8	-	-	-
Multiple Race	148	15.9	9.4	25.5	-	-	-
Other or unknown Race	2576	12.9	11.5	14.3	0.6	0.3	1.2
Hispanic Origin[‡]							
Non-Hispanic	65978	10.8	10.5	11.1	0.4	0.3	0.4
Puerto Rican	1178	13.4	11.4	15.8	0.9	0.4	2.4
Mexican	5727	12.2	11.1	13.4	0.5	0.3	0.8
Cuban	700	4.0	2.7	5.9	0.6	0.2	1.4
Dominican Republic	353	12.6	8.5	18.1	1.9	0.7	5.2
Central or South American	1456	8.9	7.2	10.8	0.4	0.2	0.9
Multiple Hispanic	92	16.4	9.4	27.0	1.0	0.1	6.9
Other Hispanic	532	12.3	8.6	17.4	0.5	0.1	2.2
All Age 65 Years							
All Participants	46633	16.0	15.5	16.5	1.1	1.0	1.2
Race[§]							
White	39267	15.6	15.2	16.1	1.1	0.9	1.2
African American	5362	19.3	17.8	20.9	1.2	0.9	1.6
Native American	194	23.7	17.1	32.1	0.5	0.1	2.7
Chinese	214	18.9	12.9	26.9	1.4	0.4	5.6

Race/Ethnic Category	Sample N	Some VI (%)	95% LL	95% UL	Severe VI (%)	95% LL	95% UL
Filipino	197	12.2	7.5	19.2	1.6	0.3	7.9
Asian Indian	61	10.0	4.2	22.2	-	-	-
Other Asian Pacific Islander	442	13.0	9.5	17.4	0.6	0.2	1.6
Multiple Race	54	25.2	11.9	45.6	1.5	0.4	6.1
Other or unknown Race	842	20.4	16.9	24.5	2.5	1.7	3.6
Hispanic Origin[‡]							
Non-Hispanic	42320	16.0	15.5	16.4	1.1	1.0	1.2
Puerto Rican	491	18.4	15.0	22.4	2.0	1.2	3.3
Mexican	2267	17.0	14.7	19.0	1.1	0.7	1.7
Cuban	699	12.4	9.2	16.5	2.1	0.8	5.1
Dominican Republic	82	16.7	8.9	29.1	3.7	1.2	10.9
Central or South American	410	19.0	14.4	24.7	0.4	0.1	1.4
Multiple Hispanic	45	34.9	21.5	51.2	0.8	0.2	3.8
Other Hispanic	319	18.9	14.2	24.7	3.3	1.6	6.5

Table 3
Sociodemographic Correlates of Visual Impairment (VI) by Race: The 1999–2006 National Health Interview Survey*

	White			Black			All Other		
	Some VI [†]	Severe VI [†]	Severe VI [†]	Some VI [†]	Severe VI [†]	Severe VI [†]	Some VI [†]	Severe VI [†]	Severe VI [†]
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Age in 1 year increment	1.02 (1.02–1.02)	1.06 (1.05–1.07)	1.03 (1.01–1.05)	1.02 (1.01–1.02)	1.03 (1.01–1.05)	1.02 (1.01–1.03)	1.02 (1.01–1.03)	1.06 (1.04–1.08)	
Male	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Female	1.23 (1.18–1.30)	0.88 (0.72–1.07)	0.70 (0.45–1.07)	1.28 (1.50–1.42)	0.70 (0.45–1.07)	1.21 (1.03–1.43)	0.53 (0.28–0.97)		
Education									
Less than high school	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
High school diploma	0.70 (0.66–0.74)	0.68 (0.54–0.85)	0.60 (0.60–0.78)	0.60 (0.60–0.78)	0.83 (0.50–1.38)	0.71 (0.56–0.88)	0.74 (0.28–1.92)		
Some college or higher	0.64 (0.60–0.67)	0.48 (0.38–0.62)	0.62 (0.54–0.72)	0.62 (0.54–0.72)	0.58 (0.34–1.00)	0.66 (0.56–0.78)	0.34 (0.15–0.76)		
Insurance									
Not Covered	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Covered	0.75 (0.69–0.82)	0.80 0.52–1.22	0.84 0.72–0.97	0.84 0.72–0.97	0.82 0.37–1.82	0.86 0.70–1.05	3.30 1.05–10.37		
Marital Status									
Other	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Married	0.78 (0.75–0.82)	0.56 (0.46–0.69)	0.84 (0.75–0.94)	0.84 (0.75–0.94)	1.06 (0.68–1.65)	0.62 (0.51–0.73)	0.40 (0.20–0.80)		

Each odds ratio estimate is adjusted for all other socio-demographic indicators; [†]the comparison groups are respondents who reported no VI

Table 4

Sociodemographic Correlates of Visual Impairment (VI) in Hispanic Subgroups: The 1999–2006 National Health Interview Survey*

	Non-Hispanic			Mexican-American			Puerto Rican			Cuban-American			Other/Multiple Hispanic		
	Some VI [†]	Severe VI [†]	OR (95% CI)	Some VI [†]	Severe VI [†]	OR (95% CI)	Some VI [†]	Severe VI [†]	OR (95% CI)	Some VI [†]	Severe VI [†]	OR (95% CI)	Some VI [†]	Severe VI [†]	OR (95% CI)
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Age in year increment	1.02 (1.02–1.02)	1.05 (1.04–1.05)	1.02 (1.01–1.03)	1.04 (1.01–1.03)	1.04 (1.01–1.06)	1.02 (1.02–1.03)	1.09 (1.06–1.12)	1.04 (1.00–1.09)	1.05 (1.02–1.08)	1.03 (1.02–1.04)	1.07 (1.02–1.12)				
Male	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Female	1.30 (1.20–1.32)	0.87 0.72–1.03	1.08 (0.93–1.25)	0.71 (0.37–1.34)	1.25 (0.87–1.80)	1.20 (0.4–3.65)	0.83 (0.49–1.41)	0.15 (0.11–0.22)	0.93 (0.72–1.21)	0.93 (0.72–1.21)	0.47 (0.20–1.10)				
Education															
Less than high school	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
High school diploma	0.66 (0.62–0.70)	0.72 (0.58–0.89)	1.05 (0.87–1.28)	1.22 (0.60–2.51)	0.73 (0.48–1.10)	0.29 (0.07–1.28)	1.05 (0.49–2.26)	0.04 (0.01–0.25)	0.73 (0.55–0.95)	0.73 (0.55–0.95)	0.52 (0.21–1.33)				
Some college or higher	0.60 (0.57–0.64)	0.49 (0.39–0.62)	0.83 (0.68–1.02)	0.59 (0.26–1.34)	0.58 (0.40–0.83)	2.68 (0.73–9.88)	0.82 (0.40–1.67)	0.13 (0.02–0.92)	0.70 (0.51–0.96)	0.70 (0.51–0.96)	0.31 (0.13–0.76)				
Insurance [^]															
Not Covered	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Covered	0.71 (0.66–0.77)	0.79 (0.51–1.21)	0.93 (0.77–1.14)	2.37 (0.99–5.69)		--	1.37 (0.67–2.82)	1.85 (0.42–8.14)	1.29 (0.94–1.75)	1.29 (0.94–1.75)	0.65 (0.29–1.47)				
Marital Status															
Other	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Married	0.77 (0.74–0.81)	0.60 (0.47–0.67)	0.91 (0.77–1.07)	0.94 (0.51–1.72)	0.65 (0.48–0.88)	0.49 (0.15–1.70)	0.73 (0.43–1.23)	0.61 (0.45–1.49)	0.83 (0.67–1.02)	0.83 (0.67–1.02)	0.90 (0.42–1.94)				

* Each odds ratio estimate is adjusted for all other socio-demographic indicators;

[†] the comparison groups are respondents who reported no VI[^] The model for Puerto Rican with Severe VI did not include Insurance status