Demographic and Socioeconomic Differences in Outpatient Ophthalmology Utilization in the United States

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• PURPOSE: The purpose was to assess differences in outpatient ophthalmologic usage based on patient characteristics such as race/ethnicity, income, insurance type, geographical region, and educational attainment.

• DESIGN: Retrospective cross-sectional study.

• METHODS: The Medical Expenditure Panel Survey (MEPS) is a nationally representative data set for the noninstitutionalized population cosponsored by the Agency for Healthcare Research. This study involved 183,054 MEPS respondents from 2007 to 2015. Primary outcome measure was patient utilization of outpatient ophthalmologic care. Secondary outcome measure was annual health care use and costs by patients in outpatient, inpatient, and the emergency department settings based on race.

• RESULTS: Overall, 21,673 participants self-reported an ophthalmologic condition, and 12,462 had at least 1 outpatient ophthalmologic visit. Hispanic (adjusted odds ratio [aOR] 0.72; P < .001) and black patients (aOR 0.74; P < .001) had fewer outpatient visits than their non-Hispanic white counterparts. Uninsured (aOR 0.41; P = .009) and Medicare/Medicaid (aOR 0.92; P < .001) patients had less outpatient care than their privately insured counterparts. Increasing income and education was associated with higher outpatient ophthalmologic care utilization. In the emergency department, non-Hispanic white patients had the least encounters (1.1 per 100 patients) and highest costs ($25,314.05) when compared to non-Hispanic black patients (3.2 encounters per 100 patients and $10,780.22 respectively) and Hispanic patients (2.2 encounters per 100 patients and $9,837.03 respectively).

• CONCLUSIONS: This study's findings demonstrate differences in outpatient ophthalmologic utilization based on demographic and socioeconomic characteristics. Concurrently, minority Americans had more ophthalmic emergency department visits but lower cost per visit. There is a need to further characterize these differences to predict future ophthalmologic care needs. (Am J Ophthalmol 2020;218:156–163. © 2020 Elsevier Inc. All rights reserved.)

INTRODUCTION

OPHTHALMOLOGIC ILLNESS IS COMMON, AFFECTING 2.9% OF all Americans.[1] Blindness or low vision affects approximately 1 in 28 Americans older than 40 years.[1] The most common causes of severe vision loss in older adults include age-related macular degeneration (AMD), ocular complications of diabetes mellitus, glaucoma, and cataracts.[2–5] These diseases can have serious, detrimental effects on the quality of life of those affected and can lead to more falls, increased social isolation, and performance of daily activities.[6–11] Approximately 8.6% of Americans aged 18 years and older have been diagnosed with cataracts, 2.0% have been diagnosed with glaucoma, and 1.1% have been diagnosed with macular degeneration.[12] In addition to the primary ophthalmologic diseases, diabetic retinopathy can result as a sequelae of diabetes mellitus and can pose serious ophthalmologic problems. The number of people with visual impairment disorders has been projected to increase 71% from 2010 to 2030, and 210% from 2010 to 2050.[12] Better methods of detection, longer life spans, and an aging population all contribute to the increasing prevalence of ophthalmologic diseases.

Discrepancies have been observed in access to health care and prevalence of ophthalmologic conditions based on demographic characteristics. For patients with a self-reported visual impairment, patients with less than a high school education and income below the poverty threshold are less likely to have visited an ophthalmologist every year.[13] Additionally, the prevalence of the primary ophthalmologic diseases differ along racial/ethnic subgroups. The importance of access to health care among the underprivileged is underscored by the fact that the prevalence of diabetic retinopathy is higher among those with less than high school education, lower income levels, and non-Hispanic blacks.[14] Additionally, the prevalence of glaucoma is higher among non-Hispanic blacks than among non-Hispanic whites whereas the prevalence is

higher among non-Hispanic whites for AMD and cataract surgery. The prevalence of AMD is also higher among those with lower income levels.

The prevalence of these conditions are all expected to rise in the coming years. Current projections may be inadequate for generating reliable prediction model due to the expected changes in the demographics of the populations expected in the future.[15] As such, there is a need to better categorize socioeconomic and demographic differences in the utilization of ophthalmologic care. The goal of this study was to assess differences in outpatient ophthalmologic usage based on patient demographic characteristics.

METHODS

• STUDY POPULATION: The Medical Expenditure Panel Survey (MEPS) is a set of large-scale surveys of families and individuals, their medical providers, and employers across the United States and was used for this retrospective study.[16] The MEPS survey is cosponsored by the Agency for Healthcare Research and Quality (AHRQ) and the National Center for Health Statistics (NCHS). It is a nationally representative survey of the noninstitutionalized American civilian population based on a subsample of households that participate in the National Health Interview Survey (conducted by the National Center for Health Statistics) and collects patient data such as medical expenses, demographic characteristics, health conditions, and access to care using questionnaires fielded to individual household members and their medical providers. More details about the MEPS designs and methods are available elsewhere.[16] Institutional review board approval was not needed to use this deidentified and publicly available database, and waiver of approval was obtained for this study. Data collection was in conformity with all federal and state laws, informed consent was obtained, and was in adherence to the tenets of the Declaration of Helsinki. This study is a retrospective analysis of 9 years of data from the MEPS database (2007-2015), which was used to assess patterns of use of outpatient ophthalmologic care in the United States.

To analyze outpatient ophthalmic use and expenditures with demographic characteristics and medical diagnoses, the household component of the MEPS database, event files, and medical conditions were linked. Patients were determined to have an ophthalmic condition based on its International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) code. MEPS clinical classification codes (which correlate with ICD-9-CM codes that can be found on the MEPS website) that were considered ophthalmic conditions included cataracts, glaucoma, blindness and vision defects, inflammatory condition of the eye, retinal detachments, retinal vascular occlusions, retinopathies, and other conditions of the eye.[16]

• STUDY VARIABLES AND STATISTICAL ANALYSIS: For each patient, total outpatient ophthalmology visits and expenditures, which included all payments by third-party payers and out-of-pocket costs, were recorded. Using total outpatient ophthalmic visits for these individuals, the percentage of individuals with an ophthalmologic condition with 1 or more visits to an outpatient ophthalmology site from 2007 to 2015 was reported. All expenditures were adjusted to 2015 US dollars using the urban Consumer Price Index of the US Bureau of Labor Statistics.[17] With these data, we investigated the per capita expenditures and visit rates for ophthalmologic visits based on certain demographic characteristics. Self-identified race/ethnicity were categorized as non-Hispanic white, Hispanic, or black. Other racial/ethnic groups were not included because of the wide 95% confidence intervals (CIs) produced by MEPS for those groups. Age was categorized as younger than 18, 18-34, 35-64, or 65 years and older. Educational level was categorized as no degree, a high school diploma or equivalent, some college, or a bachelor's degree or higher. Income was calculated in relation to the 2015 federal poverty level (FPL). Individuals were categorized as poor (<100% of FPL), near poor (100%-124% of FPL), low income (125%-199% of FPL), middle income (200%-399% of FPL), or high income (>399% of FPL). Insurance status was categorized as private (includes patients with concurrent Medicare coverage), public (Medicare or Medicaid patients with no private insurance), or uninsured. For regional analysis, patients were categorized as living in the Northeast, South, Midwest, or West. The states that were incorporated into each region as defined by the US Census Bureau can be seen in Supplemental Table 1. Patient self-reported health status was coded on a 5-point scale ranging from poor, fair, good, very good, or excellent.

A multivariable logistic regression model was used to determine the association of the various demographic and socioeconomic characteristics with utilization of outpatient ophthalmologic care during the time frame (2007-2015) as the outcome variable. These characteristics include age, sex, race/ethnicity, geographic region, income levels, educational attainment, insurance type, self-reported condition, and self-reported health status. An alpha level of 0.05 was used to determine statistical significance. Adjusted odds ratios (aORs) and 95% CIs were calculated for each variable to generate multivariable logistic regression models. Lastly, the percentage of patients having at least 1 visit to an outpatient ophthalmic center was stratified based on their race/ethnicity (Hispanic, non-Hispanic white, and black) and the cost per person with an ophthalmic condition for outpatient visits were used to analyze differences in health care expenditures. The referent categories were 65 years and older (age), female (sex), non-Hispanic white (race/ethnicity), Northeast

TABLE 1. Sample Demographics and Percent of Individuals Making at Least 1 Outpatient or Office-Based Ophthalmologist Visit, 2007-2015

Demographic Group of Patients With an Ophthalmologic Condition	Percentage With ≥1 Ophthalmologist Visit From 2007 to 2015 (95% Confidence Interval)
Sex	
Female	13.8 (13.3-14.4)
Male	9.7 (9.3-10.1)
Age, y	
<18	5.6 (5.1-6.0)
18-34	5.7 (5.3-6.2)
35-64	11.1 (10.6-11.5)
≥65	33.4 (32.3-34.4)
Race	
Non-Hispanic white	14.4 (13.8-15.0)
Hispanic	6.0 (5.7-6.4)
Non-Hispanic black	8.0 (7.5-8.5)
Education	
No degree	7 (6.6-7.3)
HS or GED	12.5 (11.9-13.1)
Some college	13.3 (12.6-13.9)
Bachelor or higher	17.8 (17.0-18.7)
Income	
Poor (≤100% of FPL)	7.1 (6.8-7.5)
Near poor (100%-124% of FPL)	9.9 (9.1-10.7)
Low-income (125%-199% of FPL)	10.1 (9.5-10.6)
Middle-income (200%-399% of FPL)	11.1 (10.5-11.6)
High-income (>399% of FPL)	15.1 (14.5-15.7)
Insurance	
Private	13 (12.5-13.6)
Public (Medicaid/Medicare)	13 (12.4-13.6)
Uninsured	3.0 (2.7-3.3)
Region	
Northeast	14.9 (13.5-16.2)
Midwest	12.6 (11.7-13.5)
South	11.1 (10.5-11.8)
West	10.0 (9.2-10.8)

FPL = federal poverty level (2015), GED = General Educational Development, HS = high school.

(geographic region), high income (income), bachelor's degree or higher (educational attainment), privately insured (insurance status), no self-reported condition, and excellent self-reported health status. All of the tables in this study summarize annual averages from 2007 to 2015, which were derived using person-level weights provided by the AHRQ, and was extrapolated to the civilian noninstitutionalized US population. All analyses were performed at the person level using statistical software (R; R Foundation for Statistical Computing, Vienna, Austria).

TABLE 2. Clinical Characteristics of Individuals With Self-Reported Ophthalmologic Conditions, 2007-2015

Self-Reported Ophthalmologic Condition	Percent Receiving ≥1 Outpatient Ophthalmologist Visit From 2007 to 2015 (95% Confidence Interval)
No ophthalmologic condition	7.1 (6.8-7.5)
Any ophthalmologic condition	57.5 (56.2-58.8)
Cataract	81.7 (80.2-83.1)
Retinal detachments; defects; vascular occlusion; and retinopathy	81.1 (78.9-83.3)
Glaucoma	77 (75.1-78.9)
Blindness	47.7 (45.0-50.3)
Inflammatory condition of the eye	30.4 (28.3-32.4)
Other condition of the eye	64.9 (63.2-66.7)
Self-reported overall health	
Excellent	9 (8.5-9.5)
Very good	12.4 (11.8-13.0)
Good	13.8 (13.2-14.4)
Fair	15.8 (15.1-16.5)
Poor	16.3 (15.2-17.3)

RESULTS

IN TOTAL, OUR SAMPLE INCLUDED 183,054 MEPS RESPONDENTS from 2007 to 2015 (Table 1). The mean (SD) age of the population was 34 (23) years, and 52.1% of the participants were female. Of these participants, 21,673 (11.84%) self-reported an ophthalmologic condition.

Of patients with a self-reported ophthalmologic condition, 57.5% had at least 1 visit to an outpatient ophthalmologist from 2007 to 2015. The percentage of patients with at least 1 visit to an outpatient ophthalmologist differed for patients with cataract surgeries (81.7%), glaucoma (77.0%), retinal detachment and retinopathy (81.1%), other inflammatory conditions of the eye (30.4%), and blindness (47.7%) (Table 2).

Analysis of the data using the multivariable logistic regression model revealed significant differences in the use of outpatient ophthalmology services (Table 3).

For the multivariable logistic regression model, a characteristic was defined as references and aORs were calculated based on this reference value. In terms of sex, male patients were less likely than female patients to make visits to outpatient ophthalmologists (reference, female; aOR 0.73, 95% CI 0.70-0.75). In terms of self-reported ethnicity, Hispanic patients (reference, non-Hispanic white; aOR 0.72, 95% CI 0.66-0.78) and black patients (reference, Non-Hispanic white; aOR 0.74, 95% CI 0.69-0.79) were less likely to visit outpatient ophthalmologists than non-Hispanic white patients.

Educational achievement also corresponds to differing likelihoods of visiting outpatient ophthalmologists. Individuals with no degree (reference, bachelor's degree or

Category	Full Model	
	Odds Ratio (95% Confidence Interval)	P Value
Age (reference: ≥65 y)		
<18	0.27 (0.24-0.29)	**<.001**
18-34	0.24 (0.21-0.26)	**<.001**
35-64	0.37 (0.35-0.4)	**<.001**
Sex (reference: female)		
Male	0.73 (0.7-0.75)	**<.001**
Race (reference: non-Hispanic white)		
Hispanic	0.72 (0.66-0.78)	**<.001**
Non-Hispanic black	0.74 (0.69-0.79)	**<.001**
Region (reference: Northeast)		
Midwest	0.75 (0.65-0.87)	**<.001**
South	0.79 (0.69-0.9)	.001
West	0.69 (0.59-0.8)	**<.001**
Insurance (reference: private)		
Public	0.92 (0.87-0.98)	**.009**
Uninsured	0.41 (0.37-0.46)	**<.001**
Income (reference: high)		
Poor	0.71 (0.65-0.76)	**<.001**
Near poor	0.71 (0.63-0.79)	**<.001**
Low income	0.77 (0.71-0.83)	**< 0.001**
Middle income	0.85 (0.8-0.9)	**<.001**
Education (reference: bachelor's degree or higher)		
Some college	0.63 (0.57-0.69)	**<.001**
HS degree or GED	0.69 (0.65-0.74)	**<.001**
No degree	0.82 (0.77-0.88)	**<.001**
Self-reported ophthalmologic condition (reference: no)		
Yes	12.53 (11.82-13.28)	**<.001**
Self-reported health status (reference: excellent)		
Very good	1.12 (1.06-1.19)	**<.001**
Good	1.18 (1.12-1.25)	**<.001**
Fair	1.21 (1.12-1.32)	**<.001**
Poor	1.24 (1.12-1.38)	**<.001**

Bold P values indicate significance.

higher; aOR 0.82, 95% CI 0.77-0.88), those with a high school degree or general equivalency diploma (reference, bachelor's degree or higher; aOR 0.69, 95% CI 0.65-0.74), and those with some college (reference, bachelor's degree or higher; aOR 0.63, 95% CI 0.57-0.69) all were less likely to visit an outpatient ophthalmologist than those individuals with a bachelor's degree or higher.

Increased household income was associated with increased odds of visiting an outpatient ophthalmologist. Individuals with a poor household income (reference, high income; aOR 0.71, 95% CI 0.65-0.76), near poor household income (reference, high income; aOR 0.71, 95% CI 0.63-0.79), low household income (reference, high income; aOR 0.77, 95% CI 0.71-0.83), and middle household income (reference, high income; aOR 0.85, 95% CI 0.80-0.90) all had lower odds of visiting an outpa-

tient ophthalmologist compared to individuals with a high household income.

Individuals with public insurance (reference, private insurance; aOR 0.92, 95% CI 0.87-0.98) and uninsured patients (reference, private insurance; aOR 0.41, 95% CI 0.37-0.46) were both less likely to visit an outpatient ophthalmologist compared with privately insured individuals. Individuals living in the Midwestern region of the United States (reference, Northeast; aOR 0.75, 95% CI 0.65-0.87), those living in the South (reference, Northeast; aOR 0.75, 95% CI 0.69-0.90), and those living in the West (reference, Northeast; aOR 0.75, 95% CI 0.59-0.80) were all less likely to visit an outpatient ophthalmologist than individuals living in the Northeast.

Patients with a self-reported ophthalmologic condition, as determined by patient response during the MEPS survey

TABLE 4. Annual Health Care Utilization of Patients With Ophthalmologic Conditions According to Race/Ethnicity From 2007 to 2015

	Non-Hispanic white	Non-Hispanic black	Hispanic
Outpatient or office based ophthalmologic visits			
Percent of persons with at least 1 visit	60 (58.5-61.4)	53.7 (51.4-56.1)	46.0 (43.6-48.4)
Cost per person with an ophthalmologic condition, USD	$605.65 (560.45-650.85)	$441.36 (380.3-502.42)	$392.76 (324.7-460.81)
Cost per visit, USD	$384.07 (347.91-420.23)	$362.64 (302.75-422.54)	$382.95 (310.7-455.21)
Emergency department visits			
Number of encounters per 100 patients with an ophthalmologic condition	1.1 (0.8-1.3)	3.2 (2.5-3.9)	2.2 (1.6-2.8)
Cost per person with an ophthalmologic condition, USD	$268.71 (236.65-300.77)	$346.29 (291.39-401.2)	$219.61 (187.68-251.54)
Cost per visit, USD	$25,314.05 (21,656.53-28971.57)	$10,780.22 (8,966.01-12,594.43)	$9,837.03 (8,004.61-11,669.46)
Inpatient visits			
Number of encounters per 100 patients with an ophthalmologic condition	0.2 (0.1-0.3)	0.4 (0.2-0.6)	0.4 (0.2-0.6)
Cost per person with an ophthalmologic condition, USD	$2,562.04 (2,293.99-2,830.09)	$2,481.28 (1,978.55-2,984.01)	$1,528.95 (1,188.93-1,868.97)

Note: Cost is adjusted for inflation to 2015 US dollars.
Unless otherwise noted, values within parentheses are 95% confidence intervals.

questionnaire on whether they believe they have an ophthalmologic condition, had substantially greater odds of visiting an outpatient ophthalmologist compared with patients without an ophthalmologic condition (reference, no; aOR 12.53, 95% CI 11.82-13.28).

The racial/ethnic differences persisted in analyses regarding annual health care use among patients self-reporting ophthalmologic conditions (Table 4). Among individuals with ophthalmologic conditions, more non-Hispanic white patients (60.0%) had at least 1 outpatient ophthalmologist visit compared with non-Hispanic black (53.7%) and Hispanic (46.0%) patients. Similarly, the per capita expenditure of outpatient ophthalmologist visits for non-Hispanic white patients ($605.65) was greater than that of non-Hispanic black ($441.36) and Hispanic ($392.76) patients. The cost per visit was also greater for non-Hispanic white patients ($384.07) compared with that of non-Hispanic black ($362.64) and Hispanic ($382.95) patients.

Similar data were acquired for emergency department (ED) visits. Among individuals with ophthalmologic conditions, non-Hispanic white patients (1.1) had a lower number of encounters per 100 patients with an ophthalmologic condition than non-Hispanic black (3.2) and Hispanic (2.2) patients. Interestingly, the per capita expenditure of ED ophthalmologist visits for non-Hispanic black patients ($346.29) was greater than that of non-Hispanic white ($268.71) and Hispanic ($219.61) patients. The cost per visit for non-Hispanic white patients ($25,314.05) was greater than that of non-Hispanic black ($10,780.22) and Hispanic ($9,837.03) patients.

Similar data were acquired for inpatient visits. Among individuals with ophthalmologic conditions, non-Hispanic white patients (0.2) had a lower number of encounters per 100 patients with an ophthalmologic condition than non-Hispanic black (0.4) and Hispanic (0.4) patients. The cost per visit was greater for non-Hispanic white patients ($2,562.04) compared with that of non-Hispanic black ($2,481.28) and Hispanic ($1,528.95) patients.

DISCUSSION

THE FINDINGS DEMONSTRATE DIFFERENCES IN NATIONAL ophthalmologist health care use across demographic and socioeconomic lines. Our findings suggest reduced health care use for lower-income, minority, and less-educated Americans. Geographically, Americans in the Midwest and West had less health care usage compared to other regions. More research is needed to investigate the etiology behind these differences.

The geographic differences in this study highlight the importance of health care access and delivery. Lee and associates, in a cross-sectional study with 2.2 million Medicare patients undergoing cataract surgery, reported disparities in the distance to the nearest cataract surgery provider based on geographic regions. The Northeast region of the nation had the least distance whereas many regions in the Midwest and western portion of the nation such as Great Lakes, Far

West, and Rocky Mountain regions had statistically significantly greater distances.[18] Lundeen and associates, in a cross-sectional study among Medicare Part B fee-for-service beneficiaries with diabetes, reported that Northeastern states had significantly higher rates of regular diabetic eye examinations compared to other regions of the nation.[19] Geographic barriers such as distance to an ophthalmologist office and lack of transportation were cited as potential barriers to health care in these other regions. Although these aforementioned studies focus on specific populations (Medicare and cataract surgery patients), increased geographic distance is one potential reason for our study's findings of decreased outpatient utilization in regions outside the Northeast. Additionally, Gibson, in a cross-sectional study analyzing ophthalmologic and optometric care on a county level in the United States reported that counties with limited eye care access were more likely to have a poorer, older, and less urban population, and these populations have a need for better vision care access.[20] Recruitment of ophthalmologists to regions of the United States that lack specialists may decrease distance for care for many patients and increase health care access and use of outpatient ophthalmologic services. Lack of awareness about vision health is a major problem, especially among low-income, minority, and uninsured families who are at highest risk of not accessing vision screening problems.[21] Our study reported decreased health care utilization with lower income, less educated, and uninsured Americans. Lee and associates, in a prospective cohort study interviewing visual care professionals, reported increased barriers to make eye care appointments among patients with Medicaid.[22] Improving access to eye care professionals for these patients may improve health outcomes and decrease health care spending in the long term.

The disparity seen within the minority patients is especially of concern because the US population is projected by 2044 to be majority minority (the non-Hispanic white population will no longer be the majority population).[23] A previous study demonstrated disparities in vision care based on race, education, and economic status with similar findings and reported a need for interventions to reduce vision loss among socioeconomically disadvantaged groups.[14] The major factors that influence regular eye care visits are affordability, continuity, and regular sources of care and minority patients were less likely to have these circumstances.[24,25] Differences in the use of ophthalmic outpatient care also may be due to lack of awareness about the importance of vision health in minority populations.[21] Additionally, even when controlling for patient insurance status and income, racial and ethnic minority patients tend to receive a lower quality of health care due to pre-existing biases present in all aspects of the health care system, ranging from health care providers to hospital administrative and bureaucratic processes.[26] There is a pertinent need for better access to ophthalmic health care for minority patients to address these disparities.

Our study reported that minority patients with an ophthalmic condition were less likely than non-Hispanic whites to make outpatient visits and more likely to make ED and inpatient visits. ED visits on average cost 4 times more than visits to an office setting for comparable medical problems.[27] Channa and associates, in a retrospective study analyzing nationally representative data for emergency room visits from 2006 to 2017 with nearly 12 million ED visits, reported that nearly half of all ocular visits to the ED were deemed nonurgent.[28] In a study analyzing for frequency of visits to the emergency department for nonurgent and urgent ocular conditions, lower-income and minority patients were more likely to visit the ED for nonurgent ocular problems and our study reports a higher number of encounters for minority patients in the ED.[29] Patients with established eye care professionals had a reduced hazard of visiting the ED for nonurgent ocular conditions. The study concluded that these patients could have considerable cost savings without compromising their care by utilizing an outpatient setting and avoiding the ED. Our study results show similar costs per visit for all races in outpatient visits. However, the cost per ED visit was significantly higher for the non-Hispanic white patient. This may be because nonminority patients were more likely to make ED visits for urgent conditions that incur higher costs.[29] These cost differences also may be partially explained by the prevalence of certain conditions such as diabetic retinopathy and glaucoma that is more prevalent in minority populations.[14]

This study has several limitations. The MEPS database does not represent individuals in institutionalized settings such as prisons or nursing homes.[16] Additionally, recall bias may affect the reports of some patients although most patients are verified by the AHRQ with the clinicians. There are also limitations in the MEPS coding of different diagnoses since many diseases may be contained in a single ICD-9-CM code. Diabetic and hypertensive retinopathy are under the same code in this study, and a large portion of the patients in this study were diagnosed with some other condition of the eye.

Race as a metric to analyze health care access has been debated. Magaña López, in a cross-sectional study comparing self-reported racial data to electronic health record data, reported racial misclassification of Hispanic patients when not accounting for ethnicity and affect public health approaches.[30] This study aimed to mitigate the effects of this limitation by first stratifying patients whether they identify as Hispanic and then collecting their self-reported race. However, there are still limitations when using race/ethnicity as a metric for analyzing public health data. Race/ethnicity is a social construct affected by a multitude of factors such as cultural variations within one racial/ethnic group, physical phenotypes that may be more associated with certain racial/ethnicities, and parental physical phenotypes.[31–33] Because of limited sample size and wide CIs (and correspondingly limited statistical significance), additional racial/ethnic subgroups

such as east Asians, south Asians, and pacific islanders could not be analyzed in this study. Public insurance included both Medicare and Medicaid in this study, and users of these programs are drastically different. Analyses of these 2 groups independently may have yielded additional conclusions.

Our findings suggest that there is an increased need to further characterize and predict future ophthalmologic care needs. This study's findings mirror the findings seen in literature pertaining to other specialties.[34,35] Improving access to eye care professionals for these disadvantaged patients may improve health outcomes for these patients. A better understanding of the visual health care needs of these populations is essential to determine future ophthalmologic health care needs for Americans and improve existing prediction models.

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