HHS Public Access

Author manuscript

Med Care. Author manuscript; available in PMC 2017 November 28.

Published in final edited form as:

Med Care. 2008 May ; 46(5): 497–506. doi:10.1097/MLR.0b013e31816080fe.

Burden and Predictors of Undetected Eye Disease in Mexican-Americans:

The Los Angeles Latino Eye Study

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Abstract

Background—Latinos have one of the highest rates of visual impairment associated with eye disease in the United States. Although little is known about the prevalence and risk of undetected eye disease (UED) in this population, it is known that Latinos encounter disproportionate barriers in accessing health care, which may influence the burden of UED.

Objective—To estimate the burden and to evaluate factors associated with UED among Latinos, a majority of whom were Mexican-American.

Research Design—Population-based, cross-sectional study. A detailed interview and eye examination were performed on participants.

Subjects—A sample of 6357 Latinos (95% of whom had Mexican ancestry), aged ≥ 40, in 6 census tracts in Los Angeles, California.

Main Outcome Measure—UED (macular degeneration, glaucoma, diabetic retinopathy, cataract, and refractive error) was defined as those persons with eye disease and no reported history of that eye disease.

Results—Fifty-three percent (3349 of 6357) of the participants had eye disease. Sixty-three percent (2095 of 3349) of them had UED. Major risk factors for UED included older age odds

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Presented in part at the Association for Research in Vision and Ophthalmology April 2004 Conference; Ft. Lauderdale, FL.

The authors have no proprietary or commercial interest in any materials discussed in the article.

ratio (OR): 4.7 (age ≥ 80), having diabetes mellitus (OR: 3.3), never having had an eye examination (OR: 2.4), being uninsured (OR: 1.6), lower educational attainment (OR: 1.4), and low acculturation (OR: 1.3).

Conclusions—These findings provide evidence of the burden of UED among Latinos. Interventions that address the modifiable risk factors (lack of insurance, never having had an eye examination, etc.) may improve detection of eye disease and decrease the burden of visual impairment in this high-risk minority population.

Keywords

eye disease; screening; glaucoma; diabetic retinopathy; uninsured

Vision is an important indicator of health and quality of life.[1–3] Estimates suggest that at least 3.3 million older Americans are visually impaired, and that the anticipated number of elderly Americans with vision loss will increase with the rapid growth of the aging population.[4,5] It is projected that the number of blind individuals in the United States, older than 40 years of age, will increase to 1.6 million by 2020, and that the number of those with low vision will increase to 3.9 million, resulting in 5.5 million older Americans with visual impairment.[6] Visual impairment, including blindness, costs the US federal government more than $4 billion annually in benefits and lost taxable income.[7] Although it has been shown that there are treatments for some of these age-related eye diseases to help prevent visual impairment and blindness, the best strategy is for early treatment and detection.[6]

Latinos, the largest minority group in the United States, are disproportionately more likely than non-Latino whites and blacks to have visual impairment.[4,8] Latinos have a high prevalence of age-related diseases, including type II diabetes, and thus are at greater risk of diabetic retinopathy.[9] Additionally, Latinos have high prevalences of open-angle glaucoma and cataracts.[10,11] Because the median age of Latinos (age 25.8 years) is a decade less than that of the rest of the US population (35.3 years), there will be an even greater need for eye and other health care as this population ages.[12] No studies have examined the prevalence of undetected eye disease (UED) among Latinos, particularly Mexican-Americans, who constitute the largest ethnic minority group in the United States. According to US Census 2000, Latinos comprise 13% of the US population, with approximately 2.6 million Latinos in California[13]; Mexican-Americans comprise approximately 67% of this Latino group.[14] It is estimated that Latinos will account for 24.3% of the US population by the year 2050.[15] Such figures highlight the importance of identifying the prevalence and causes of undetected but potentially treatable eye disease among this growing US population.

Latinos have less access to health care than do whites or other ethnic groups.[16] Factors influencing this poorer access to care may include sociodemographic factors, because Latinos are more likely to be poor, have less education, and be less acculturated.[17] Health care access and lack of insurance, may also have a negative influence on eye care. Nearly 33% of the 41.2 million uninsured in the United States are Latino, despite the fact that Latinos account for only 13% of the population.[18] Biologic risk factors associated with eye disease include diabetes, which is disproportionately higher among Latinos (particularly

Mexican-Americans) compared with Whites,[19–21] and hypertension, which has inconsistently been shown to be higher, the same, or lower among Mexican-Americans.[19]

The Los Angeles Latino Eye Study (LALES) is a population-based cross-sectional study designed to determine the prevalence rates and risk factors associated with vision impairment and eye diseases in Latinos aged 40 years and older.

We hypothesize that Latinos in the LALES, most of whom were Mexican-American, have high rates of UED due to less access to health care and to sociodemographic factors. Our objective was to assess potential risk indicators for UED within a population-based sample of Latinos.

METHODS

Study Cohort

The LALES population consists of self-identified Latino residents of 6 census tracts in Los Angeles County, California; a majority of the participants were Mexican-American. Details of the study design, sampling plan, and baseline data have been reported.[6] In summary, a door-to-door census of all dwelling units within 6 census tracts in Los Angeles County was performed, and eligible residents who self-identified as Latino were invited to participate in both a home-interview and a clinic examination. To determine residence in the household, LALES used the US Census definition of resident (ie, anyone who considers it his/her permanent residence, lives and sleeps at the residence most of the time, or lives in the household at least 6 months a year). Eligibility criteria were based on (1) self-identification as Latino or of Latino heritage, (2) age 40 years or older on the day of the screening for LALES, and (3) residency in one of the selected census tracts. Ninety-five percent of the eligible sample was defined as Mexican-American; the participant and/or his/her parents or grandparents were born in Mexico. The demographic and socioeconomic characteristics of participants in the study were similar to other Latinos of Mexican-American ancestry in Los Angeles County and in the United States as a whole.[22] Of the 7789 persons classified as eligible, 6357 participated in the study, resulting in a participation rate of 82% (6357 of 7789). Of the 6357 who completed the ophthalmic examination, 6131 completed both an in-home interview and an eye examination at the clinic, 215 completed both an in-home interview and an eye examination at their home, and 11 participants completed the examination at the clinic but did not complete the in-home interview.

The study protocol was approved by the Institutional Review Board/Ethics Committee of the University of Southern California Medical Center and followed the recommendations of the Declaration of Helsinki.

Interview and Clinical Data

After informed consent was obtained, a detailed in-home interview was conducted; this included sociodemographic information, medical history, and ocular history (ie, personal and family history of eye disease and history of eye care service). Eligible individuals were then scheduled for a detailed eye examination, which was performed in a standardized manner at the LALES eye examination center.[22] This examination identifies the following

ocular conditions that can reduce vision and quality of life: age-related macular degeneration (AMD), glaucoma, ocular hypertension, diabetic retinopathy, cataract, and refractive error. AMD is associated with irreversible degeneration of the retina, and is the leading cause of blindness in the United States. Glaucoma is a group of diseases that can damage the optic nerve and result in peripheral vision loss and blindness. Ocular hypertension is a condition in which the intraocular pressure is elevated without any obvious optic nerve damage or visual field defects. Over time, ocular hypertension may evolve into glaucoma. Diabetic retinopathy is the most common diabetic eye disease and a leading cause of blindness in American adults. It is caused by changes in retina blood vessels, leading to a constricted field of vision. A cataract is a clouding of the lens that leads to blurred vision and visual acuity less than 20/40. Refractive error is due to imperfections in the focusing power of the eye, so light rays are not brought into sharp focus on the retina, causing blurred vision that can usually be corrected with glasses, contact lenses, or laser surgery. Nearsightedness (myopia), farsightedness (hyperopia), and astigmatism are refractive errors.

Main Outcome Variable

UED was based on whether the participant had one or more eye diseases (AMD, glaucoma, ocular hypertension, diabetic retinopathy, cataract with visual acuity less than 20/40, and refractive error) on the LALES examination and had no reported history of that disease. AMD was defined based on drusen type and on retinal pigmentary abnormalities, and was classified as early AMD or advanced AMD. Two graders at the Wisconsin Ocular Epidemiology Grading Center performed masked grading using a modification of the Wisconsin Age-Related Maculopathy Grading System.[23,24] Open-angle glaucoma was defined by characteristic optic nerve and peripheral visual field abnormalities[10] Diabetic retinopathy was defined as retinopathy in persons with definite diabetes mellitus. Grading protocols for diabetic retinopathy were modifications of the Early Treatment Diabetic Retinopathy Study adaptation of the modified Airlie House classification of diabetic retinopathy. The specific grading protocols are defined in another report.[9] The definitions of lens opacities (cataracts) were based on a standardized grading of changes in the lens at the time of the eye examination.[11]

Independent Variables

Socio-demographic risk indicators included age, gender, country of birth (United States, Mexico, other country), education level (≤6 years, 7–12 years, >12 years), marital status [married or with partner vs. other (never married, widowed, separated/divorced)], and employment status (employed, unemployed, retired). Acculturation was measured using the Cuellar 9-item Acculturation Rating Scale for Mexican Americans[25,26] (low ≤ 1.9 vs. high > 1.9). Acculturation is based on whether the participant spoke Spanish and/or English, what the preferred language was, and whether the participant was able to read/write Spanish and/or English. A 5-point scale was created based on these results (5, most acculturated). Health care and eye care utilization were measured based on the following: (1) last time participant saw a doctor (never, < 1 year, 1–5 years, 5 or more years ago); (2) last physical examination (< 1 year ago, 1–5 years ago, 5 or more years ago, never); (3) wears prescription glasses for distance (yes, no); (4) wears prescription glasses for close work (yes, no); (5) last eye examination (within 12 months, 1–3 years ago, 3–5 years ago, over 5 years

ago, never). Health insurance was classified as: (1) uninsured; (2) private only; (3) private and other coverage; (4) public insurance (MediCal and/or Medicare); (5) other or other combined insurance. Income data were categorized into $10,000–$14,999, $15,000–$29,000, $30,000–$50,000, and $50,000 or higher. We used mean and mode substitution to impute missing values on all independent variables except for income, for which we used stochastic regression imputation.

Other access to care measures included whether a participant (1) had a particular doctor or clinic; (2) had a doctor he/she usually saw; (3) had trouble getting care or not getting glasses when he/she felt they were needed; (4) recognized any barrier to eye care. Clinical and ocular risk indicators included hypertension, diabetes, number of comorbidities (< 2 vs. ≥2), and perceived general health (excellent/very good vs. good/fair/poor) and general vision (excellent/very good vs. good/fair/poor).

Statistical Analysis

Participants with any eye disease (N = 3349) were included in the analyses, and prevalence of UEDs was calculated. We then performed χ^2 analyses to evaluate bivariate associations between risk indicators and any UED. We explored those variables in the analyses that represent constructs in the Gelberg and Andersen Behavioral Model for Vulnerable Populations.[27,28] This conceptual framework provides a way to examine the following factors associated with access to services among a mostly uninsured, low-income, vulnerable patient population: predisposing characteristics, which include social and cultural factors associated with an individual's tendency to seek care (gender, race/ethnicity, age, education), including predisposing vulnerable domains such as country of origin and acculturation; enabling factors are those factors that may influence access to services and include barriers to access to care (insurance, income/financial barriers, usual source of care); and need factors which reflect a participants perceived need for health and/or eye care (ie, self-reported physical health).

The independent association with UED and the predisposing, enabling, and need characteristics was explored using stepwise logistic regression analysis. Standardized β coefficients were used to characterize the relative contributory effect of each predisposing, enabling, need and health behavior variable on the presence of UED. The Standardized β coefficients are calculated by multiplying the original estimate of the regression coefficient with the standard deviation of the independent variable and dividing by the standard deviation of the dependent variable. A standardized β coefficient of high absolute value indicates a high degree of association of the independent variable with the dependent variable (UED). The planned sample size was adequate to detect relationships between the socioeconomic risk factors and rate of UED. All analyses were conducted at the 0.05 significance level, using SAS software, version 9.1 (SAS Institute, Cary, NC).

RESULTS

Prevalence of UED

Fifty-three percent of participants had eye disease or refractive error on examination. UED prevalence among those with disease on examination was 62.6%. The order of UED prevalence estimates was AMD (97.9%), diabetic retinopathy (95.0%), open-angle glaucoma (82.4%), cataract (57.0%), and refractive error (18.7%).

Population Characteristics

Tables 1–4 show the predisposing, enabling and need factor characteristics of those participants who had eye disease on examination (N = 3349) (6357; 53%). The greatest number of participants was between the ages of 50 and 59 (31%), followed by ages 40–49 (27%). Fifty-nine percent of the target sample was female. The highest proportion of participants had 6 years or less education (45%); only 14% had education past high school. Twenty-nine percent were born in the United States, and 58% were born in Mexico; 62% had low acculturation scores (Cuellar score < 1.9); 69% were married; 43% were employed; 74% had an annual income of less than $30,000; 70% had health insurance; 51% had 2 or more comorbidities; 17% self-reported having excellent/very good health; and 24% self-reported a history of diabetes.

In Tables 1–4, we present a bivariate comparison between participants with UED and those without UED. Among the participants who were found to have eye disease on examination, 62.6% had UED. Among the traditional predisposing variables analyzed, we found that a higher proportion of older subjects, males, those with the lowest education, and those who were unemployed or retired were more likely to have UED ($P < 0.0001$). Among the predisposing variables, if a participant was born in Mexico or was less acculturated, he/she was more likely to have UED ($P < 0.01$).

Among the enabling factors examined (Table 2), uninsured or publicly insured participants, as well as participants with lower incomes and those without a usual source of care, were more likely to have UED. Participants that reported trouble getting any care or not getting glasses when he/she thought they were needed were more likely to have UED.

When examining need factors (Table 3), we discovered that those who were diabetic, had hypertension, or had 2 or more comorbidities had higher rates of UED compared with those who had previously detected eye disease. Those who reported good, fair, or poor general health and vision had higher rates of UED ($P < 0.0001$ for all comparisons).

We explored also the health behaviors of our sample and found that those who had never had a physical examination or eye examination had higher rates of UED (Table 4).

Predictors of UED

Table 5 summarizes the results for stepwise logistic regression. The odds of having UED increased with older age and was highest among participants > 80 years old compared with the age 40–49 subgroup [odds ratio (OR: 4.7 (2.4–9.0)]. Male participants had higher odds of UED [OR: 1.7 (1.4–2.0)], and participants with an educational level of primary school or

less were more likely to have UED compared with those with higher educational attainment [OR: 1.4 (1.1–1.9)]. Those with acculturation scores < 1.9 had higher odds of UED [OR: 1.3 (1.1–1.5)].

Participants reporting a history of diabetes and/or 2 or more comorbidities were significantly more likely to have any UED [OR: 3.3 (2.6–4.1); OR: 1.3 (1.1–1.5)]. Those who perceived having fair, poor, very poor vision, or reported being blind also had higher odds of UED [OR: 1.2 (1.0–1.5)].

Among the enabling factors that influenced a participant's access to care, we found that having private and/or other nonpublic health insurance played a significant role. Uninsured participants [OR: 1.6 (1.3–1.9)] and publicly insured participants [OR: 1.3 (1.05–1.7)] were more likely to have UED than were those with private insurance alone. There was no significant difference in the odds of UED comparing private alone versus private + other coverage or other or other coverage combined with private. If a participant reported trouble getting medical care or reported a need for glasses but did not get them, he/she was more likely to have UED [OR: 1.6 (1.1–2.4), OR: 1.4 (1.1–1.7), respectively]. Furthermore, if a participant reported never having an eye examination, he/she was more likely to have UED compared with those who had an eye examination within the past 12 months [OR: 2.4 (1.9–3.1)].

As shown in Table 5, the most important variables that influence the risk of UED included a history of diabetes mellitus (0.28), never having had a complete eye examination (0.23), being male (0.15), being 70 years of age or older (0.10), and being uninsured (0.11).

DISCUSSION

We found a high prevalence (approximately 63%) of UED among the LALES sample of Latinos. To our knowledge, this is the first study to document both the prevalence and potential risk factors that influence UED in any population-based sample in the United States and, more specifically, in Latinos. Few investigators have explored UED within groups of population-based study participants, so there is a lack of literature on this topic. We discovered that 30% of our study participants were without any type of insurance, 21% were publicly insured, and 21% were without a particular clinic. These enabling characteristics, representative of our study's "access to care" measures, were linked to a higher likelihood of UED, even after controlling for other enabling, predisposing, and need characteristics. Older Latinos were more likely to have UED, despite the fact that older age has been reported to be associated with higher rates of physician utilization among Mexican-Americans.[29] High rates of UED among our cohort may be due to a higher prevalence of eye disease coupled with the fact that they face specific vulnerabilities, including lower acculturation. Based on the ability to speak and read/write in English versus Spanish, we found that those who were less acculturated were more likely to have UED, even after controlling for insurance and numerous sociodemographic characteristics. These findings are consistent with reports that being more acculturated has a positive effect on health care use and self-perception of health.[30,31] More specifically, language differences have been shown to explain some of the disparities in access to health care.[32,33]

We found that limitations in insurance coverage significantly impacted rates of UED among Latinos. In 1997, over one-third (38%) of Mexican-Americans were uninsured,[34] and insurance coverage is known to increase access to care and to improve health outcomes.[35–37] Public insurance, such as Medicaid, is a critical source of health insurance coverage for Mexican-Americans; in 1997, 18% of Mexican-Americans relied on Medicaid for their health insurance.[34] Our findings indicate that the likelihood of UED was similar in publicly insured participants and in those who were uninsured. Therefore, we assume that public insurance may not adequately provide for the eye care that Mexican-Americans need. However, we found that insurance status, albeit important, explained only a fraction of the racial and ethnic disparities in access among our Mexican-American sample.[26] Thus, although broadening eye care coverage among public health insurance recipients may reduce racial and ethnic disparities in eye care among Mexican-Americans, it would not eliminate these disparities. In fact, our findings remain strong even after controlling for insurance status; health behaviors, acculturation factors, age, gender, and focus on specific comorbidities (ie, diabetes or other comorbidities), which account for a significant proportion of UED in our study. One of the strongest independent associations was in the "health behavior" category. This finding highlights the importance of exploring the personal health practice patterns of participants when trying to understand their rates of UED.

Further research is needed to investigate the relationship between language and other factors that influence acculturation and their impact on access to eye care. Additionally, more work is needed to explore and develop focused interventions, particularly in the clinical setting, that are geared toward high-risk subpopulations to help decrease the burden of UED.

One of the most important variables associated with a higher risk of having UED was having diabetes. Although it would seem that persons with a history of diabetes mellitus would be more likely to obtain eye care, we have found that two-thirds of our participants with diabetes mellitus were noncompliant with the American Diabetes Association's vision care guidelines.[38] This underscores the importance to assess such factors as whether or not internists and endocrinologists instruct their patients regarding the need for eye care.

LIMITATIONS

Our analyses were subject to several limitations. First, our participants were younger on average than those who did not have a clinical examination, and there were higher rates of missing or ungradable photographs in older participants. However, the majority of our sample (74%) was older than 50 years of age; additionally, based on our slightly younger sample, we may, in fact, have underestimated the true prevalence of UED among this mostly Mexican-American cohort. Second, our sample was limited to Latinos, so we are unable to make direct comparisons with other racial/ethnic groups. However, the purpose of this study was not to make direct comparisons with other ethnic groups, but, rather, to observe the risk indicators of UED among a well-defined Latino, largely Mexican-American population—a population known to have high rates of eye diseases based on previous reports.[9,23,38] Third, because, as noted, our sample is predominantly Mexican-American, we cannot compare the rates of UED seen to those of other Latino subgroups. However, our data are especially important because of the high rates of visual impairment in US Latinos (particularly

Mexican-Americans), due to diabetic retinopathy[9] and glaucoma.[10] Moreover, Mexicans, make up the largest minority group among the US population.[14,39] Our findings may apply to other areas of the United States with large Mexican-American populations (ie, Texas). Future studies among other Latino subgroups (ie, Cubans, Puerto Ricans) would help us better understand the factors associated with UED among the fastest growing segment of the US population. Fourth, our sample is taken from a specific geographic area within Los Angeles County, so our data may not be generalizable to other neighborhood environments in different parts of the United States whose inhabitants may differ in their access to and use of eye services. A recent study confirms that neighborhood racial and ethnic composition accounts for a large portion of disparities in access to health care in general.[32,40–45] Fifth, a further limitation of our study is the accuracy of the self-reported responses to the questions posed by the LALES study team. Although these questions were explained clearly, we cannot assume that the self-reported data are completely accurate. However, previous studies have shown that self-reported data on medical conditions and utilization of medical care are reasonably accurate.[46–50] Sixth, we did not evaluate certain vulnerable domains, such as personal knowledge about disease and health care, social and personal beliefs regarding disease and the use of health services, or whether such beliefs influence people's behavior in seeking care. We were also unable to examine personal, family, and community resources that may impact an individual's access to eye care. Further work in this area is necessary to examine how certain vulnerabilities that are prevalent among this population, including attitudes to care and social support, impact the rates of UED. Finally, we included refractive error as a clinically significant form of eye disease despite the fact that it typically requires a simple, nonsurgical method of correction. However, even though refractive error can be corrected relatively easily, it has been concluded that in real-world practice, this is not occurring. It has been found in almost every epidemiologic study on the prevalence of eye disease, including ours, that the greatest cause of visual impairment is lack of refractive correction.[6] Sensitivity analyses found that removing refractive error from the analyses did not change the results of the present study.

In conclusion, our data confirm that approximately two-thirds of a large sample of Latinos of primarily Mexican ancestry, aged 40 and older, had UED. By improving access to needed, routine eye care for this population, by manipulating mutable factors such as expanding health care coverage, increasing the number of free community clinics, diminishing language barriers, or focusing on specific health behaviors of patients, we may be able to lessen the threat of increasing visually impairing eye disease among a growing and aging Latino population. However, even with appropriate education programs targeting those Latinos who are less acculturated, individuals without health insurance may not receive the care needed to detect early forms of eye disease. Given that the Latino population is expected to double by 2025, lack of insurance, if not addressed, will result in a dramatic increase in the number of uninsured Americans and may lead to significant public health consequences, including the burden of visual impairment and blindness in the United States.

Additional research may provide information as to whether improving access to eye care among Latinos is best done at the level of the health care system, at the individual level, or within the neighborhood environment. In addition to the potential cost savings resulting from the reduction of vision loss and blindness, the detection and treatment of eye disease

will continue to have important public health implications for safety and for the quality of life.

Acknowledgments

The authors thank the LALES External Advisory Committee for their advice and contributions: Roy Beck, MD, PhD (Chairman); Natalie Kurinij, PhD; Leon Ellwein, PhD; Helen Hazuda, PhD; Eve Higginbotham, MD; Lee Jampol, MD; M. Cristina Leske, MD; Donald Patrick, PhD; and James M. Tielsch, PhD.

The members of the Los Angeles Latino Eye Study Group are: University of Southern California: Rohit Varma, MD, MPH (Principal Investigator), Sylvia H. Paz, MS (Project Director), LaVina Abbott, Stanley P. Azen, PhD (Co-Principal Investigator), Lupe Cisneros, COA, Carolina Cuestas, OD, Elizabeth Corona, Denise R. Globe, PhD, Sora Hahn, MD, Mei Lai, MS, George Martinez, Susan Preston-Martin, PhD, Ronald E. Smith, MD, Mina Torres, MS, Natalia Uribe, OD, Joanne Wu, MPH, Myrna Zuniga; Battelle Survey Research Center: Sonia Chico, BS, Lisa John, MSW, Michael Preciado, BA, Karen Tucker, MA; University of Wisconsin: Ronald Klein, MD, MPH, S. Tiffany Jan, BA, Stacy M. Meuer, BS, Scot E. Moss, MA, Michael W. Neider, BA, Sandra C. Tomany, MS.

Supported by National Institutes of Health Grants, NEI U10-EY-11753 and EY-03040, and an unrestricted grant from the Research to Prevent Blindness, New York, New York. Rohit Varma is a Research to Prevent Blindness Sybil B. Harrington Scholar. Dr. Sarita Mohanty received support from the UCLA/DREW Project EXPORT, NCMHD, P20MD000148/P20MD000182, and the NARSAD Mental Health Research Association Young Investigator Award.

None of the funding sources had any role in the design and conduct of the study, collection, management, or analysis of data, interpretation of results, or preparation of this article.

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TABLE 1

Predisposing Characteristics of Participants With Eye Disease Stratified by Undetected/Detected Eye Disease in LALES

Predisposing Characteristics of Participants	All Participants With Eye Disease (N = 3349)	Previously Detected Eye Disease N = 1254 (37.4%)	Undetected Eye Disease N = 2095 (62.6%)	*P*[*]
Age, yr				<0.0001
40–49	886 (26.5)	374 (29.8)	512 (24.4)	
50–59	1039 (31.0)	424 (33.8)	615 (29.4)	
60–69	852 (25.4)	297 (23.7)	555 (26.5)	
70–79	459 (13.7)	140 (11.2)	319 (15.2)	
80+	113 (3.4)	19 (1.5)	94 (4.5)	
Gender				<0.0001
Male	1369 (40.9)	421 (33.6)	948 (45.3)	
Female	1980 (59.1)	833 (66.4)	1147 (54.7)	
Education (yr)				<0.0001
≤6	1493 (44.7)	458 (36.6)	1035 (49.5)	
7–12	1378 (41.2)	560 (44.8)	818 (39.1)	
>12	470 (14.1)	233 (18.6)	237 (11.3)	
Marital status				0.15
Married/with partner	2320 (69.4)	887 (70.9)	1433 (68.5)	
Other	1022 (30.6)	364 (29.1)	658 (31.5)	
Employment				<0.0001
Working	1421 (42.6)	601 (48.0)	820 (39.3)	
Not working	1218 (36.5)	424 (33.9)	794 (38.0)	
Retired	700 (21.0)	227 (18.1)	473 (22.7)	
Country born				0.002
United States	963 (28.8)	397 (31.7)	566 (27.0)	
Mexico	1942 (58.0)	679 (54.2)	1263 (60.3)	
Other	441 (13.2)	177 (14.1)	264 (12.6)	
Acculturation[†]				<0.0001
Low	2088 (62.4)	692 (55.2)	1396 (66.7)	
High	1258 (37.6)	561 (44.8)	697 (33.3)	

Data are presented as frequency (%) based on column totals. The total number of participants for each item varies depending on completion rates for the item.

[*] *P* values were calculated using χ^2 tests.

[†] Acculturation was measured using the short-form Cuellar Acculturation Scale. Low indicates score <1.9; high indicates score ≥1.9.

TABLE 2

Enabling Characteristics of Participants With Eye Disease Stratified by Undetected/Detected Eye Disease in LALES

Participant Enabling Variables	All Participants With Eye Disease (N = 3349)	Previously Detected Eye Disease N = 1254 (37.4%)	Undetected Eye Disease N = 2095 (62.6%)	*P*[*]
Insurance status				<0.0001
Uninsured	1005 (30.1)	312 (25.0)	693 (33.2)	
Private only	1438 (43.1)	648 (51.9)	790 (37.8)	
Private and other coverage	141 (4.2)	58 (4.6)	83 (4.0)	
Medicare/MediCal	717 (21.5)	214 (17.1)	503 (24.1)	
Other or other combined	37 (1.1)	17 (1.4)	20 (1.0)	
Annual household income				<0.0001
<10 K	528 (17.5)	160 (14.1)	368 (19.6)	
10 K–<15 K	546 (18.1)	194 (17.0)	352 (18.7)	
15 K–<30 K	1163 (38.5)	433 (38.0)	730 (38.8)	
30 K–<50 K	589 (19.5)	262 (23.0)	327 (17.4)	
50 K+	193 (6.4)	90 (7.9)	103 (5.5)	
Usually seen at a clinic/doctor's office				0.01
Yes	2637 (78.8)	1016 (81.1)	1621 (77.4)	
No	709 (21.2)	237 (18.9)	472 (22.6)	
Having a regular physician				0.03
Yes	2213 (66.1)	858 (68.5)	1355 (64.7)	
No	1133 (33.9)	395 (31.5)	738 (35.3)	
Barrier to general health care[†]				0.005
Yes	199 (5.9)	56 (4.5)	143 (6.8)	
No	3146 (94.1)	1196 (95.5)	1950 (93.2)	
Trouble getting glasses				0.0002
Yes	720 (23.8)	236 (20.7)	484 (25.7)	
No	2302 (76.2)	904 (79.3)	1398 (74.3)	
Barriers to eye care[‡]				0.67
Yes	343 (11.4)	133 (11.7)	210 (11.2)	
No	2679 (88.6)	1007 (88.3)	1672 (88.8)	

Data are presented as frequency (%) based on column totals. The total number of participants for each item varies depending on completion rates for the item.

[*] *P* values were calculated using χ^2 tests.

[†] Barrier to general health care is measured by one question, "During the past 12 months, was there any time when you needed medical care or surgery but did not get it."

[‡] Barrier to eye care is measured by one question, "During the past 12 months, was there any time when you needed eye care or surgery but did not get it?"

TABLE 3

Need Variables of Participants With Eye Disease Stratified by Undetected/Detected Eye Disease in LALES

Participant Need Variables	All Participants With Eye Disease (N = 3349)	Previously Detected Eye Disease N = 1254 (37.4%)	Undetected Eye Disease N = 2095 (62.6%)	*P*[*]
History of diabetes				<0.0001
No	2539 (75.9)	1094 (87.3)	1445 (69.0)	
Yes	807 (24.1)	159 (12.7)	648 (31.0)	
History of hypertension				0.0001
No	2112 (63.2)	843 (67.3)	1269 (60.8)	
Yes	1228 (36.8)	409 (32.7)	819 (39.2)	
Comorbidities[†]				<0.0001
<2	1657 (49.5)	714 (57.0)	943 (45.1)	
≥2	1689 (50.5)	539 (43.0)	1150 (54.9)	
General health				<0.0001
Excellent/very good	578 (17.3)	264 (21.1)	314 (15.0)	
Good/fair/poor	2768 (82.7)	989 (78.9)	1779 (85.0)	
General vision				<0.0001
Excellent/good	1320 (39.6)	552 (44.1)	768 (36.9)	
Fair/poor/very poor/blind	2017 (60.4)	701 (55.9)	1316 (63.1)	

Data are presented as frequency (%) based on column totals. The total number of participants for each item varies depending on completion rates for the item.

[*] *P* values were calculated using χ^2 tests.

[†] Number of self-reported comorbidities (arthritis, stroke/brain hemorrhage, high blood pressure, angina, heart attack, heart failure, asthma, skin cancer, other cancer, back problems, hearing problems, and other major health problems).

TABLE 4

Health Behavior Characteristics for Participants With Eye Disease Stratified by Undetected/Detected Eye Disease in LALES

Participant Health Behavior Variables	All Participants With Eye Disease (N = 3349)	Previously Detected Eye Disease N = 1254 (37.4%)	Undetected Eye Disease N = 2095 (62.6%)	*P**
Last time saw doctor				0.31
Never	42 (1.3)	15 (1.2)	27 (1.3)	
< 1 yr ago	2921 (87.5)	1113 (88.8)	1808 (86.6)	
1–5 yr ago	280 (8.4)	93 (7.4)	187 (9.0)	
5 or more years ago	97 (2.9)	32 (2.6)	65 (3.1)	
Last physical examination				0.01
< 1 yr ago	1649 (49.4)	627 (50.1)	1022 (48.9)	
1–5 yr ago	1137 (34.0)	442 (35.3)	695 (33.3)	
5 or more years ago	292 (8.7)	108 (8.6)	184 (8.8)	
Never	262 (7.8)	74 (5.9)	188 (9.0)	
Last complete eye examination				<0.0001
Within 12 mo	717 (24.7)	304 (27.6)	413 (22.9)	
1–3 yr ago	800 (27.6)	368 (33.4)	432 (24.0)	
3–5 yr ago	174 (6.0)	66 (6.0)	108 (6.0)	
Over 5 yr ago	265 (9.1)	100 (9.1)	165 (9.2)	
Never	947 (32.6)	265 (24.0)	682 (37.9)	

Data are presented as frequency (%) based on column totals. The total number of participants for each item varies depending on completion rates for the item.

*P values were calculated using χ^2 tests.

TABLE 5

Predisposing, Need, Enabling, and Health Behavior Predictors of UED in LALES Based on Multiple Logistic Regression With Stepwise Selection (N = 2859)

Variables	Type of Variable	Standardized β Coefficient	Odds Ratio (95% CI)	*P*	Step*
History of diabetes (yes vs. no)	Need	0.28	3.3 (2.6–4.1)	<0.0001	1
Last completed eye exam	Health behavior			<0.0001	2
Within 12 mo		Reference	1		
1–3 yr ago		−0.01	1.0 (0.8–1.3)		
3–5 yr ago		0.05	1.4 (1.0–2.0)		
Over 5 yr ago		0.07	1.6 (1.1–2.2)		
Never		0.23	2.4 (1.9–3.1)		
Age (yr)	Predisposing			<0.0001	3
40–49		Reference	1		
50–59		−0.03	0.9 (0.7–1.1)		
60–69		0.04	1.2 (1.0–1.5)		
70–79		0.10	1.7 (1.2–2.3)		
80+		0.14	4.7 (2.4–9.0)		
Insurance status	Enabling			<0.0001	4
Private only		Reference	1		
Uninsured		0.11	1.6 (1.3–1.9)		
Private and other coverage		−0.03	0.8 (0.5–1.2)		
Medicare/MediCal		0.06	1.3 (1.0–1.7)		
Other or others combine		−0.03	0.6 (0.3–1.3)		
Gender (male vs. female)	Predisposing	0.15	1.7 (1.4–2.0)	<0.0001	5
Education	Predisposing			<0.0001	6
> 12 yr		Reference	1		
≤6yr		−0.03	1.4 (1.1–1.9)		
7–12 yr		−0.07	1.3 (1.0–1.6)		
Trouble getting glasses† (yes vs. no)	Enabling	0.07	1.4 (1.1–1.7)	0.002	7
Comorbidities‡ (≥2 vs. <2)	Need	0.06	1.3 (1.1–1.5)	0.007	8

Variables	Type of Variable	Standardized β Coefficient	Odds Ratio (95% CI)	*P*	Step*
Acculturation// (low vs. high)	Predisposing	0.06	1.3 (1.0–1.5)	0.01	9
Barrier to general care¶ (yes vs. no)	Enabling	0.06	1.6 (1.1–2.4)	0.02	10
General vision	Need			0.02	11
Excellent/good		Reference	1		
Fair/poor/very poor/blind		0.06	1.2 (1.0–1.5)		
Trouble getting eye care (yes vs. no)	Enabling	−0.05	0.8 (0.6–1.0)	0.05	12

Participants with missing data were excluded from this analysis. The variables, which were included in the model, were presented in Tables 1–4.

CI indicates confidence interval.

*The order of the variable entered into the multiple logistic regression model.

†Trouble getting eye glasses is measured by 1 item, “During the past 12 months, was there any time when you needed eye glasses but did not get them?”

‡Number of self-reported comorbidities (arthritis, stroke/brain hemorrhage, high blood pressure, angina, heart attack, heart failure, asthma, skin cancer, other cancer, back problems, hearing problems and other major health problems).

¶Barrier to general health care is measured by 1 item, “During the past 12 months, was there any time when you needed medical care or surgery but did not get it.”

//Acculturation was measured using the short-form Cuellar Acculturation Scale. Low indicates score <1.9; high indicates score ≥1.9.