

Prevalence of Age-Related Macular Degeneration in the US Population

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Objective: To examine the prevalence of age-related macular degeneration (AMD) in non-Hispanic white, non-Hispanic black, Mexican American, and other racial/ethnic groups.

Design: A US nationally representative, population-based, cross-sectional study involving a total of 5553 persons aged 40 years and older from the 2005-2008 National Health and Nutrition Examination Survey. The main outcome measure was AMD determined by the grading of 45° digital images from both eyes using a standardized protocol.

Results: In the civilian, noninstitutionalized, US population aged 40 years and older, the estimated prevalence of any AMD was 6.5% (95% confidence interval, 5.5-7.6) and the estimated prevalence of late AMD was 0.8%

(95% confidence interval, 0.5-1.3). Non-Hispanic black persons aged 60 years and older had a statistically significantly lower prevalence of any AMD than non-Hispanic white persons aged 60 years and older (odds ratio=0.37; 95% confidence interval, 0.21-0.67).

Conclusions: Overall, the prevalence of any AMD in the 2005-2008 National Health and Nutrition Examination Survey was 6.5%, which is lower than the 9.4% prevalence reported in the 1988-1994 Third National Health and Nutrition Examination Survey. While this finding might be explained in part by possible methodological differences, these estimates are consistent with a decreasing incidence of AMD and suggest important public health care implications.

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DESPITE NEW MEDICAL AND surgical interventions, age-related macular degeneration (AMD) remains an important cause of loss of vision in the United States.^{1,2} In 2004, the Eye Diseases Prevalence Group, using a meta-analysis of recent regional population-based studies in the United States, Australia, and Europe, estimated that late AMD was present in more than 1.75 million individuals in the United States and that, owing to longer survival of Americans, the number with AMD would increase to almost 3 million by 2020.¹ These estimates assumed that there would be no changes in the frequency of AMD risk factors such as smoking. In addition, these projections did not take into account the effects of changes in the treatment of people at high risk for developing late AMD, such as an increase in the frequency of recommendation of the use of zinc and antioxidant vitamins following the publication of results from the Age-Related Eye Disease Study.³ More recently, Rein et al⁴ showed that after

including the effects of new AMD treatments in an agent-based simulation model, there would be large increases in the number of people with both early (from 9.1 million to 17.8 million) and late (from 620 000 to 1.6 million) AMD and visual impairment attributable to AMD over the next 40 years owing to the aging of the US population. However, recent data from the 2003-2005 Beaver Dam Eye Study show a lower prevalence and incidence of early AMD in more recent birth cohorts, suggesting that the increases in AMD may not be as large as Rein and colleagues had projected.^{5,6} The last nationally representative estimates of prevalence of AMD in 3 racial/ethnic groups in the US population based on the measurement of AMD from fundus photographs were from the 1988-1994 Third National Health and Nutrition Examination Survey (NHANES III).^{7,8} The purpose of this article is to provide updated estimates of the prevalence of AMD in the US population aged 40 years and older by race/ethnicity as determined in the 2005-2008 NHANES.

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Table 1. Comparisons of Participants Included and Excluded From Analyses of Age-Related Macular Degeneration for Persons Aged 40 Years and Older in the 2005-2008 National Health and Nutrition Examination Survey^a

Characteristic	Included	Excluded ^b	P Value
Age, y			
No.	5553	1244	
Weighted mean (SE) ^c	56.3 (0.4)	69.1 (1.0)	<.001
Total, No. (weighted %)	5553 (100)	1244 (100)	
Sex, No. (weighted %)			.20
Male	2779 (47.4)	594 (45.2)	
Female	2774 (52.6)	650 (54.8)	
Race/ethnicity, No. (weighted %)			<.001
Non-Hispanic white	2980 (77.0)	566 (67.1)	
Non-Hispanic black	1138 (9.6)	331 (15.7)	
Mexican American	859 (5.5)	189 (6.1)	
Other	576 (7.9)	158 (11.1)	
Total annual family income, \$,			<.001
No. (weighted %)			
<20 000	1229 (14.9)	383 (24.4)	
≥20 000	4134 (85.1)	796 (75.6)	
History of diabetes, No. (weighted %)			<.001
Yes	848 (10.8)	271 (17.6)	
No	4699 (89.2)	971 (82.4)	

^aThe denominators for estimates differ according to source and availability of data. Age, sex, and race/ethnicity derived from screening were available for all subjects.

^bIncludes 913 persons who were not photographed (of whom 66 had no light perception or had only light perception in both eyes and 4 who had a severe infection in one or both eyes) and 331 persons with ungradable fundus photographs.

^cThe SEs were computed using the basic weights (ie, the reciprocal of the probability of selection).

METHODS

STUDY POPULATION

The National Health and Nutrition Examination Survey is a national survey conducted by the National Center for Health Statistics and consists of samples of the US, civilian, noninstitutionalized population. National Health Examination Surveys have been conducted periodically since 1959. A nutrition component was added in 1971-1975 and the name was changed from National Health Examination Surveys to NHANES, but retinal photography (needed for determining the presence and severity of AMD) was obtained only at the 1988-1994 and 2005-2008 examinations. A detailed description of the design and data collection of the NHANES has been published elsewhere.⁹ In brief, the NHANES sampled persons who were chosen using a stratified multistage probability design with planned oversampling of older and minority groups. All of the surveys included a household interview followed by a detailed physical examination. The NHANES protocol was approved by a human subjects review board, and informed consent was obtained from all participants.

Of the 7081 persons aged 40 years and older who were selected to participate in the 2005-2008 NHANES examination, 52.1% were non-Hispanic white, 21.4% were non-Hispanic black, 15.6% were Mexican American, and 11.0% were of other races/ethnicities. Of the 7081 persons, 6797 had a full medical examination at an NHANES Medical Examination Center. A total of 1244 persons were excluded, including 913 who were not photographed (of whom 66 had no light perception or had only light perception in both eyes and 4 who had a severe infection in one

or both eyes) and 331 with ungradable fundus photographs. The final sample of 5553 persons included 2980 non-Hispanic white persons, 1138 non-Hispanic black persons, 859 Mexican American persons, and 576 persons of other races/ethnicities.

PHOTOGRAPHY AND GRADING

The National Health and Nutrition Examination Survey used the Canon CR6-45NM Ophthalmic Digital Imaging System and Canon EOS 10D digital camera (Canon USA, Inc, Lake Success, New York). Digital images were captured from all participants aged 40 years and older. The room was darkened, allowing for physiological dilation of the pupil. Each participant had two 45° nonmydriatic digital retinal images taken per eye (4 images per person in total). One image of the macula, field 2, was centered on the fovea; the second image was centered on the optic nerve.

Capture and grading of digital images and quality control have been described in detail elsewhere.^{10,11} Each image was graded twice (a preliminary grade and a detail grade) using a modification of the Wisconsin Age-Related Maculopathy Grading System.^{12,13} Of the 6797 persons examined, 5575 (82.0%) were photographed; of those photographed, 5553 had at least 1 eye that could be evaluated for AMD (right eye in 5300, left eye in 5296, and both eyes in 5043) and are included in the analyses.

Comparisons between persons with gradable photographs for AMD and those without gradable photographs appear in **Table 1**. The 4-year examination weights generated from the Medical Examination Center examination were used for these comparisons. Between persons included and excluded, there were statistically significant differences in age, race/ethnicity, family income, and history of diabetes. We further examined the potential impact of persons without gradable photographs by adjusting the original sampling weights using the standard weighting-class method.^{14,15} Examination of findings using these adjusted weights led to only minor differences in point and variance estimates (0.1%-0.6%); therefore, we present all estimates using the original sampling weights.

DEFINITIONS OF VARIABLES

Among the AMD features evaluated¹³ were drusen size, type, and area, increased retinal pigment, retinal pigment epithelial (RPE) depigmentation, pure geographic atrophy, and signs of exudative macular degeneration (ie, subretinal hemorrhage, subretinal fibrous scar, RPE detachment, and/or serous detachment of the sensory retina or laser treatment for neovascular AMD). Soft distinct drusen were defined by size (minimum of 63 μm, but usually ≥125 μm in diameter) and appearance (sharp margins and a round nodular appearance with a uniform density [color] from center to periphery). Soft indistinct drusen are the same size as the soft distinct drusen but have indistinct margins and a softer, less solid appearance. The RPE depigmentation is characterized by faint grayish-yellow or pinkish-yellow areas of varying density and configuration without sharply defined borders. Increased retinal pigment appears as a deposition of granules or clumps of gray or black pigment in or beneath the retina. Early AMD was defined by the presence of either soft indistinct drusen or the presence of RPE depigmentation or increased retinal pigment, together with any type of drusen, or by the presence of soft drusen with an area of 500 μm or larger in absence of signs of late AMD. Late AMD was defined by the presence of any of the following: geographic atrophy or RPE detachment, subretinal hemorrhage or visible subretinal new vessels, subretinal fibrous scar or laser treatment scar, or self-reported history of photodynamic or anti-vascular endothelial growth factor treatment for exudative AMD. Any AMD as defined in this study included both early and late AMD.

Table 2. Estimated Crude Prevalence of Specific Characteristics of Age-Related Macular Degeneration by Sex, Age, and Race/Ethnicity in the 2005-2008 National Health and Nutrition Examination Survey

Characteristic	No. ^a	% (SE, %)							
		Large Drusen	Soft Drusen ^b	Increased Retinal Pigment	RPE Depigmentation	Early AMD ^c	Late AMD	Exudative AMD	Pure Geographic Atrophy
Total	5482	8.2 (0.5)	14.8 (0.6)	4.9 (0.4)	0.2 (0.1) ^d	5.7 (0.5)	0.8 (0.4) ^d	0.3 (0.2) ^d	0.5 (0.1)
Sex									
Male	2750	8.5 (0.6)	15.9 (0.9)	5.2 (0.4) ^d	0.2 (0.1) ^d	6.0 (0.6)	0.5 (0.1)	0.3 (0.1) ^d	0.7 (0.1)
Female	2732	7.8 (0.6)	13.9 (0.7)	4.6 (0.5)	0.2 (0.1) ^d	5.4 (0.6)	1.0 (0.2)	0.3 (0.1) ^d	0.2 (0.2) ^d
Age, y									
40-59	2815	4.2 (0.5)	9.1 (0.6)	2.6 (0.4)	...	2.8 (0.4)	...	...	...
≥60	2667	15.7 (1.1)	25.7 (1.3)	9.1 (0.8)	0.6 (0.2) ^d	11.1 (0.9)	2.2 (0.4)	0.9 (0.2)	1.4 (0.4)
Race/ethnicity									
Non-Hispanic white									
40-59	1368	4.1 (0.6)	8.5 (0.9)	3.0 (0.5)	...	3.0 (0.6)	...	...	...
≥60	1579	15.6 (1.3)	25.8 (1.5)	10.0 (1.0)	0.7 (0.2)	11.6 (1.1)	2.6 (0.5)	1.0 (0.2)	1.6 (0.5) ^d
Non-Hispanic black									
40-59	605	1.8 (0.6) ^d	5.2 (1.1)	0.9 (0.4) ^d	...	1.4 (0.5)	...	...	...
≥60	509	10.9 (1.8)	20.5 (2.1)	2.4 (0.8) ^d	...	5.0 (1.3)	0.3 (0.3) ^d	...	0.3 (0.3) ^d
Mexican American									
40-59	505	6.0 (0.9)	12.0 (1.2)	1.9 (0.6) ^d	...	2.7 (0.7)	...	...	...
≥60	343	16.9 (2.6)	28.7 (3.0)	5.2 (1.1)	0.4 (0.4) ^d	12.9 (2.0)	0.4 (0.4) ^d	0.4 (0.4) ^d	...
Other									
40-59	337	6.0 (1.5)	16.3 (2.8)	1.9 (1.0) ^d	...	2.1 (1.0) ^d	...	...	...
≥60	236	21.3 (4.4)	28.7 (3.7)	5.2 (2.2) ^d	0.6 (0.6) ^d	10.7 (3.0)	0.9 (0.2)	0.6 (0.6) ^d	0.3 (0.3) ^d

Abbreviations: AMD, age-related macular degeneration; RPE, retinal pigment epithelial; ellipses, no person with specific lesion.

^aNumbers vary owing to the missing cases in each eye condition.

^bIncludes distinct, indistinct, and reticular drusen.

^cSee the "Methods" section for definition of AMD end points.

^dRelative standard error is greater than 30% and the data are unreliable.

When 2 eyes of a participant were discrepant for the severity of a lesion, the grade assigned for the participant was that of the more severely involved eye. For example, in assigning the prevalence of soft drusen, if soft drusen were present in one eye but not in the other eye, the participant was considered to have soft drusen. When drusen or signs of AMD could not be graded in an eye, the participant was assigned a score equivalent to that in the other eye.

Eyes were considered gradable if field 2 was present and if the grader was able to assess whether drusen were present within the grid in 25% or more of the field. The degree of exact agreement achieved between the graders ranged from 66.0% to 73.0% for each of the drusen characteristics and 88.0% or more for the other AMD characteristics. The κ scores were generally in the moderate to substantial agreement categories (0.48-1.00).¹²

Current age was defined as the age at the time of the examination. Age was categorized as 40 to 59 years or 60 years and older. Race/ethnicity was categorized as non-Hispanic white, non-Hispanic black, Mexican American, or other (non-Mexican American Hispanic, Asian, and Native American). Total family income was categorized as either less than \$20 000 per year or \$20 000 or more per year.

STATISTICAL ANALYSIS

We estimated the prevalence of AMD among the US noninstitutionalized population aged 40 years and older. All of the analyses were weighted to make estimates that were representative of the US population. Statistical analyses were conducted using SAS version 9.1 statistical software (SAS Institute, Inc, Cary, North Carolina) for data management. We used SUDAAN version 10.0 statistical software (Research Triangle Institute, Research Triangle Park, North Carolina) to obtain point esti-

mates and standard errors based on sampling weights to produce national estimates accounting for the complex survey design.

We used *t* tests and χ^2 tests for differences in demographic characteristics and risk conditions among participants included and excluded from the analyses of AMD. The relationship of AMD to age, race/ethnicity, and sex was explored using multivariate logistic regression. We produced a series of 6 models for each outcome. Model 1 shows the effects of sex adjusted by age. In models 2 and 3, we stratified by age category to examine whether racial/ethnic disparities in each dependent variable (eg, soft drusen, early AMD, and any AMD) were present within each age group. In models 4 through 6, we stratified by race/ethnicity to examine whether there were age differences in each racial/ethnic group. We calculated odds ratios and corresponding 95% confidence intervals (CIs). Associations were considered to be significant if the *P* value for testing the null hypothesis of no association was less than .05. Variance estimates were produced using the jackknife replication method. A relative standard error greater than 30% was used to identify unreliable estimates. The relative standard error is defined as the ratio of the standard error of the estimate divided by the estimate.¹⁶

RESULTS

The prevalence of large drusen, soft drusen, RPE depigmentation, increased retinal pigment, exudative macular degeneration, geographic atrophy, early AMD, and late AMD are presented in **Table 2** for each of the racial/ethnic subgroups. For all racial/ethnic groups, the highest prevalence of most AMD lesions was found in

Table 3. Relationship of Large Drusen, Soft Drusen, Early Age-Related Macular Degeneration, and Any Age-Related Macular Degeneration to Sex, Race/Ethnicity, and Age in the 2005-2008 National Health and Nutrition Examination Survey

Characteristic	Adjusted OR (95% CI)				
	Large Drusen	Soft Drusen	Increased Retinal Pigment	Early AMD ^a	Any AMD ^{a,b}
Sex ^c					
Male	1.21 (1.00-1.47) ^d	1.27 (1.07-1.50) ^d	1.26 (0.98-1.62)	1.22 (0.96-1.55)	1.12 (0.90-1.39)
Female	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Race/ethnicity according to age					
Aged 40-59 y					
Non-Hispanic white	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Non-Hispanic black	0.43 (0.21-0.91)	0.59 (0.34-1.01)	0.29 (0.12-0.71) ^d	0.46 (0.21-1.02)	0.46 (0.21-1.02)
Mexican American	1.60 (1.06-2.42) ^d	1.59 (1.21-2.10) ^d	0.65 (0.33-1.30)	0.95 (0.51-1.76)	0.95 (0.51-1.76)
Other	1.48 (0.78-2.80)	2.09 (1.21-3.60) ^d	0.56 (0.14-2.19)	0.68 (0.25-1.87)	0.68 (0.25-1.87)
Aged ≥60 y					
Non-Hispanic white	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Non-Hispanic black	0.74 (0.46-1.19)	0.84 (0.61-1.14)	0.24 (0.10-0.59)	0.43 (0.23-0.81)	0.37 (0.21-0.67) ^d
Mexican American	1.33 (0.89-1.99)	1.36 (0.99-1.87)	0.59 (0.32-1.06)	1.33 (0.90-1.98)	1.13 (0.78-1.65)
Other	1.93 (1.00-3.73) ^d	1.47 (0.93-2.31)	0.83 (0.34-2.04)	1.15 (0.55-2.40)	1.05 (0.51-2.18)
Age according to race/ethnicity, per y					
Non-Hispanic white	1.10 (1.07-1.13) ^d	1.08 (1.06-1.11) ^d	1.08 (1.06-1.11) ^d	1.08 (1.06-1.11) ^d	1.11 (1.08-1.13) ^d
Non-Hispanic black	1.05 (1.01-1.11) ^d	1.05 (1.02-1.08) ^d	1.15 (1.05-1.26) ^d	1.08 (1.02-1.15) ^d	1.09 (1.03-1.16) ^d
Mexican American	1.08 (1.02-1.14) ^d	1.07 (1.03-1.10) ^d	1.06 (1.00-1.12) ^d	1.08 (1.01-1.15) ^d	1.08 (1.01-1.16) ^d
Other	1.01 (0.94-1.08)	1.02 (0.97-1.08)	1.08 (0.96-1.22)	1.06 (0.97-1.16)	1.08 (1.00-1.17) ^d

Abbreviations: AMD, age-related macular degeneration; CI, confidence interval; OR, odds ratio.

^aSee the "Methods" section for definition of AMD end points.

^bThere were no cases of late AMD in persons aged 40 to 59 years.

^cAdjusted for age.

^d $P \leq .05$

persons aged 60 years and older (Table 2). Increased retinal pigment was highest in non-Hispanic white persons in both age groups (3.0% for those aged 40-59 years; 10.0% for those aged ≥60 years). The prevalence of early AMD was similar for non-Hispanic white persons aged 40 to 59 years (3.0%) and Mexican American persons aged 40 to 59 years (2.7%) and lowest in non-Hispanic black persons in both age groups (1.4% for those aged 40-59 years; 5.0% for those aged ≥60 years). Late AMD was most prevalent in non-Hispanic white persons (2.6%).

Men were statistically significantly more likely to have soft drusen than women (odds ratio=1.27; 95% CI, 1.07-1.50) (Table 3). In terms of racial/ethnic groups, within each age-specific group Mexican American persons had higher odds and non-Hispanic black persons had lower odds of large drusen and soft drusen than non-Hispanic white persons, although only differences for the groups aged 40 to 59 years were statistically significant (Table 3). Non-Hispanic black persons aged 60 years and older had a statistically significantly lower prevalence of any AMD (odds ratio=0.37; 95% CI, 0.21-0.67) as compared with non-Hispanic white persons. Within all racial/ethnic groups, AMD lesions increased with age (Table 3).

The estimated total prevalence of any AMD in the US, civilian, noninstitutionalized (non-Hispanic white, non-Hispanic black, Mexican American, and other) population aged 40 years and older was 6.5% (95% CI, 5.5-7.6). Of a total 7.2 million persons having any AMD, 0.89 million (95% CI, 552 000-1.2 million) were estimated to have late AMD (Table 4).

COMMENT

The National Health and Nutrition Examination Survey provides unique prevalence data on AMD in a nationwide, multiracial, population-based sample of persons aged 40 years and older. Standardized procedures were used for measuring risk factors and for obtaining color fundus digital images of the macula. An objective system was used for grading these photographs for AMD. In this study, after stratifying by age, the frequency of people with any AMD was highest in non-Hispanic white persons and Mexican American persons aged 60 years and older and was lowest in non-Hispanic black persons, which was consistent with previous findings.

The estimated prevalence of any AMD in the 2005-2008 cohort was 30.8% lower than reported in the 1988-1994 cohort (6.5% [95% CI, 5.5-7.6] vs 9.4% [95% CI, 8.2-10.6], respectively; $P = .006$).⁸ It is uncertain how changes in methods (use of digital images of 2 fields in both eyes in the 2005-2008 NHANES examination vs use of 1 randomly selected 45° film photograph of the macula and disc in the 1988-1994 NHANES III examination) affected the comparisons of AMD prevalence between the 2 examinations. Both studies used physiological dilation of the pupil and the same definition of AMD. It has been shown that there is moderate to almost perfect agreement in detection of AMD lesions when grading high-resolution digital images and film-based photographs, suggesting that this is unlikely to explain differences found for prevalence of AMD between the current study and the NHANES III.¹⁰ Photographs taken of only 1 eye at

the NHANES III examination and 2 eyes at the 2005-2008 NHANES examination would be expected to result in AMD being missed more often in the 1988-1994 examination owing to the likelihood of the involved eye not being photographed. To examine this, we repeated the analysis using data from only 1 eye from the 2005-2008 NHANES and found the prevalence of AMD to be 4.6% (95% CI, 3.5-5.5), which was 29.2% lower than the 6.5% prevalence of AMD ascertained when grading both eyes (data not shown). It is also assumed that the additional photographic field at the 2005-2008 NHANES examination would increase the ability to detect AMD, especially when the quality of field 2 centered on the macula was borderline or poor. For these reasons, we believe that the differences in the estimates between the 2 NHANES examinations are likely to be greater than reported.

Estimates of the prevalence of AMD based on clinical examination findings using ophthalmoscopy from the 1971-1975 NHANES are also consistent with a substantial decrease in the prevalence of AMD when compared with estimates in the 2005-2008 NHANES.¹⁷ However, differences in examination techniques and AMD definitions between the early 1970s and the current examinations limit the inferences that can be made from this comparison.

The lower prevalence of any AMD in non-Hispanic black persons compared with non-Hispanic white persons aged 60 years and older in the 2005-2008 NHANES is consistent with the findings from the NHANES III and most clinical and epidemiological studies.^{1,8,17-24} In the 2005-2008 NHANES, Mexican American persons appeared to have similar frequencies of early AMD but lower frequencies of late AMD compared with non-Hispanic white persons, which is consistent with findings from other population-based studies.^{1,8,11,24-26} The reasons for racial/ethnic differences may reflect differences in environmental or host exposures (eg, smoking, physical activity, diet) and genetic differences in distributions of protective and high-risk genes associated with AMD among the different racial/ethnic groups.^{11,27,28}

While there are many strengths of this study (eg, nationwide, multiracial, population-based sample and AMD detected using an objective system for grading fundus photographs), caution must be taken in interpreting these data. Our study is subject to several limitations. First, the institutionalized population (eg, persons residing in nursing homes) was not included in the NHANES. Second, there were significant numbers of eligible persons who either did not participate or did not have photographs that could be graded for AMD. This reduction in the sample might lead to an underestimate because those persons in whom AMD could not be determined were older and thus were more likely to have AMD. Because the participants who had no light perception or had only light perception in both eyes were excluded, there is further possible underestimation in the prevalence estimates. Limited power owing to the infrequency of some of the AMD lesions (eg, geographic atrophy, exudative AMD, RPE depigmentation) or size of the racial/ethnic group could have explained the absence of significant differences among groups. Because of the large relative standard errors for these AMD lesions in non-Hispanic black and Mexican

Table 4. Estimated Crude Prevalence of Persons Aged 40 Years and Older With Lesions Typical of Any Age-Related Macular Degeneration and of Late Age-Related Macular Degeneration by Race/Ethnicity in the 2005-2008 National Health and Nutrition Examination Survey

Characteristic	Prevalence, % (95% CI)	Cases in Population, No. (95% CI), in Thousands ^a
Any AMD		
All racial/ethnic groups	6.5 (5.5-7.6)	7245 (6133-8357)
Non-Hispanic white	7.3 (6.1-8.7)	6269 (5162-7377)
Non-Hispanic black	2.4 (1.7-3.6)	261 (153-369)
Mexican American	5.1 (3.8-6.8)	310 (192-428)
Other	4.5 (2.7-7.4)	404 (191-619)
Sex		
Male	6.5 (5.4-7.8)	3440 (3763-4125)
Female	6.5 (5.4-7.7)	3801 (3191-4411)
Age, y		
40-59	2.8 (2.0-3.8)	2022 (1400-2645)
Non-Hispanic white	3.1 (2.1-4.4)	1644 (1054-2235)
Non-Hispanic black	1.4 (0.7-2.8) ^b	110 (31-190)
Mexican American	2.7 (1.5-4.7)	126 (54-198)
Other	2.1 (0.8-5.3)	141 (2-280)
≥60	13.4 (11.5-15.5)	5223 (4321-6125)
Non-Hispanic white	14.3 (11.9-16.9)	4625 (3750-5500)
Non-Hispanic black	5.2 (3.2-8.6)	151 (75-226)
Mexican American	13.3 (10.0-17.4)	184 (105-262)
Other	11.5 (6.7-19.1) ^b	264 (113-415)
Late AMD^c		
All racial/ethnic groups	0.8 (0.5-1.3)	890 (552-1228)
Non-Hispanic white	1.0 (0.7-1.5)	854 (519-1189)
Non-Hispanic black	0.1 (0.0-0.7) ^b	10 (0-29)
Mexican American	0.1 (0.0-0.6) ^b	6 (0-17)
Other	0.2 (0.0-1.1) ^b	20 (0-50)
Sex		
Male	0.5 (0.3-0.9)	269 (112-427)
Female	1.0 (0.7-1.7)	620 (345-895)
Age, y		
40-59	0	0
≥60 ^d	2.2 (1.5-3.3)	890 (552-1228)
Non-Hispanic white ^d	2.6 (1.7-3.9)	854 (519-1189)
Non-Hispanic black ^d	0.3 (0.0-2.6) ^b	10 (0-29)
Mexican American ^d	0.4 (0.1-2.6) ^b	6 (0-17)
Other ^d	0.9 (0.2-4.2) ^b	20 (0-50)

Abbreviations: AMD, age-related macular degeneration; CI, confidence interval.

^aThe numbers for the estimated population were all rounded.

^bRelative standard error is greater than 30% and the data are unreliable.

^cThere were no cases of late AMD in persons aged 40 to 59 years.

^dThe numbers of cases in the population and 95% CIs are identical between the race/ethnic groups and the groups by age owing to there being no persons with late AMD among those aged 40 to 59 years.

American persons, caution must be observed in interpreting their prevalence estimates in these racial/ethnic groups in the US population.

In summary, we report that approximately 6.5% of the US population aged 40 years and older in 2005-2008 had signs of AMD, which was significantly lower than the previous estimate of 9.4% in the 1988-1994 NHANES III examination. These estimates are consistent with a decreasing incidence of AMD reported in another population-based study and have important public health implications.^{5,6,29} The decreasing prevalence of AMD may reflect recent changes in the frequency of smoking and other exposures such as diet, physical activity, and blood

pressure associated with AMD.³⁰⁻³² It remains to be seen whether public health programs designed to increase awareness of the relationships of these exposures to AMD in patients at risk and their physicians and eye care providers will continue to result in further decline of the prevalence of AMD in the population.

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