

Running the Numbers

*A Periodic Feature to Inform North Carolina Health Care Professionals
About Current Topics in Health Statistics*

Prevalence of Diabetes-Related Eye Disease in North Carolina: Findings From the North Carolina Behavioral Risk Factor Surveillance System

Diabetes affects approximately 9.8% of North Carolinians (nearly 700,000 people) aged ≥ 18 years. Hyperglycemia in individuals with diabetes can cause a variety of adverse effects, involving both microvascular and macrovascular complications. Macrovascular diabetic complications include coronary artery disease, stroke, and peripheral vascular damage. Major microvascular complications include diabetic neuropathy, renal disease, and ocular complications, such as cataracts, glaucoma, and, most commonly, diabetic retinopathy [1]. Diabetic eye complications, if not caught early and appropriately managed, can result in permanent damage and blindness.

Diabetic retinopathy is the leading cause of new cases of blindness among adults in the United States [2]. Diabetic retinopathy is progressive microvascular damage to the retina caused by long-standing diabetes. The most common form, nonproliferative retinopathy, is characterized by swelling of the capillaries in the back of the eye, which gradually become damaged and occluded. In the advanced stage, referred to as proliferative retinopathy, damaged blood vessels in the basement membrane close off, leading to neovascular proliferation and development of microaneurysms, which eventually rupture and allow serum lipids, proteins, and other deposits to accumulate on the retinal surface. Visual damage from diabetic retinopathy may result from macular edema, vitreous hemorrhage, or retinal detachment.

Current data on the prevalence of diabetic retinopathy are limited. A recent report using 2005-2008 data from the National Health and Nutrition Examination Survey (NHANES) reported that 28.5% of individuals aged ≥ 40 years with diabetes had received a diagnosis of diabetic retinopathy [3]. That study found that the prevalence was highest among males and among non-Hispanic black individuals. Data from the 2005 North Carolina Behavioral Risk Factor Surveillance System (NCBRFSS) found that 26.4% of individuals aged ≥ 18 years with diabetes reported having retinopathy or other diabetes-related eye complications [4]. The following report is an update on the prevalence of diabetic retinopathy in North Carolina.

The NCBRFSS is an ongoing population-based survey of a representative sample of noninstitutionalized North Carolina residents aged ≥ 18 years. NCBRFSS employs a random-digit-dialed telephone survey of North Carolina households. The survey is funded by the Centers for Disease Control and Prevention (CDC) and is conducted by the Survey Operations Unit in the State Center for Health Statistics. This report uses data from the CDC module on diabetes, obtained from the 2006-2010 NCBRFSS surveys. Data for these 5 years were aggregated to ensure a sufficient sample size to provide stable estimates. The results are weighted to reflect the North Carolina population aged ≥ 18 years. The results presented here are derived from 71,610 individuals who responded to the diabetes module.

The overall prevalence of diabetes among persons aged ≥ 18 years in North Carolina was 9.4% (95% confidence interval, 9.1%-9.7%) (Table 1). The prevalence was highest among blacks (14.6%) and Native Americans (11.5%) and lowest among Hispanics and Asians (4.7% and 3.7%, respectively). The prevalence of diabetes increased with increasing age: the prevalence among persons ages ≥ 65 years was 10 times that among persons aged 18-34 years. Higher frequencies of diabetes were also associated with lower education level and lower family income. Persons who reported being disabled were 3 times as likely as persons without disabilities to report having diabetes.

Among persons with diabetes, 19.5% reported having received a diagnosis of diabetic retinopathy or another diabetes-related eye disease (Table 1). Diabetic retinopathy was more common among men than women (22.5% vs 16.7%) and more common among blacks (22.2%), Hispanics (27.5%), and Native Americans (27.5%), compared with whites (17.2%). Numbers for other racial/ethnic groups were

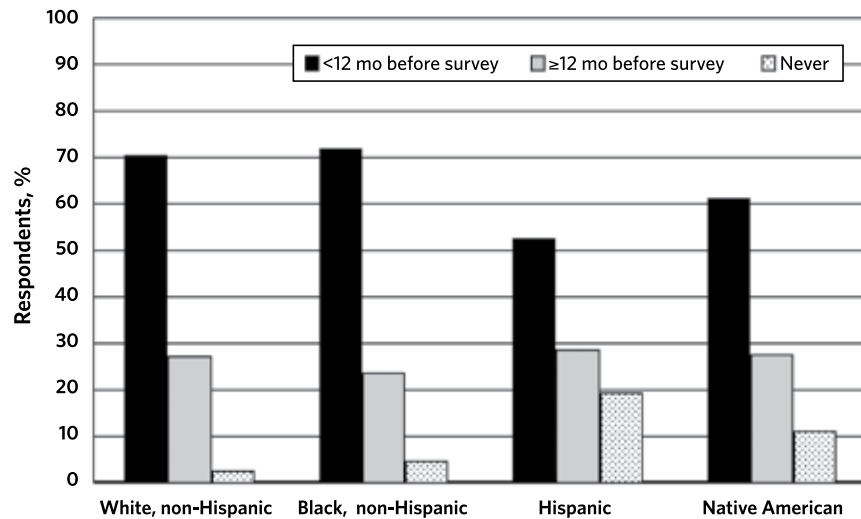
TABLE 1.
Characteristics of Survey Respondents Who Received a Diagnosis of Diabetes and Diabetic Retinopathy

Characteristic	Diabetes diagnosis		Diabetic retinopathy diagnosis	
	No. (%) ^a	95% CI	No. (%) ^a	95% CI
Overall	9,088 (9.4)	9.1-9.7	1,751 (19.5)	18.3-20.7
Sex				
Male	3,537 (9.2)	8.8-9.6	783 (22.5)	20.5-24.4
Female	5,551 (9.6)	9.2-10.0	968 (16.7)	15.3-18.2
Race				
White, non-Hispanic	6,309 (8.7)	8.4-9.0	1,099 (17.2)	15.9-18.5
Black, non-Hispanic	2,118 (14.6)	13.6-15.5	485 (22.2)	19.7-24.8
Hispanic	211 (4.7)	3.8-5.7	61 (27.5)	19.5-35.4
Asian	25 (3.7)	1.7-5.6	5 (15.8)	0.3-31.3
Native American	278 (11.5)	9.6-13.5	67 (27.5)	19.9-35.1
Other	70 (6.2)	3.7-8.6	18 (35.8)	11.7-60.0
Age				
18-24 y	30 (1.3)	0.6-2.0	7 (22.9)	2.2-43.5
25-34 y	165 (2.1)	1.7-2.5	22 (11.2)	5.6-16.7
35-44 y	547 (4.8)	4.2-5.3	94 (18.1)	14.0-22.2
45-54 y	1,372 (9.7)	9.0-10.4	283 (20.3)	17.4-23.2
55-64 y	2,567 (17.8)	16.9-18.7	521 (20.9)	18.6-23.2
65-74 y	2,587 (22.0)	21.0-23.0	501 (20.4)	18.2-22.5
≥75 y	1,774 (20.3)	19.1-21.5	315 (17.5)	15.1-19.9
Education level				
Less than high school	2,142 (14.7)	13.8-15.7	499 (23.9)	21.0-26.7
High school graduate or equivalent	3,017 (10.5)	9.9-11.0	590 (20.1)	18.0-22.2
Some college	2,196 (9.2)	8.7-9.8	386 (17.6)	15.4-19.9
College graduate	1,709 (6.0)	5.6-6.3	268 (15.7)	13.2-18.1
Household income				
<\$15,000	1,774 (17.2)	16.0-18.4	434 (26.3)	22.9-29.6
\$15,000-\$24,999	1,918 (11.9)	11.2-12.7	402 (20.7)	18.2-23.2
\$25,000-\$34,999	1,048 (10.3)	9.4-11.1	193 (18.4)	15.2-21.5
\$35,000-\$49,999	1,105 (9.2)	8.4-9.9	183 (18.6)	15.4-21.9
\$50,000-\$74,999	884 (7.6)	7.0-8.3	136 (14.5)	11.5-17.5
≥\$75,000	883 (5.0)	4.6-5.5	124 (13.1)	10.3-15.9
Disability status				
Disability	5,386 (18.3)	17.6-18.9	1,211 (22.4)	20.9-24.0
No disability	2,655 (5.7)	5.3-6.0	374 (14.9)	12.7-17.0

Note. Data are for 71,610 individuals who responded to North Carolina Behavioral Risk Factor Surveillance System surveys during 2006-2010. Data do not include women who received a diagnosis of gestational diabetes or individuals who received a diagnosis of prediabetes. CI, confidence interval.

^aPercentages are weighted to reflect the entire population of North Carolinians aged ≥18 years.

FIGURE 1.
Timing of the Most Recent Eye Examination Among Survey Respondents With Diabetes,
by Race/Ethnicity



Note. Data are for 71,610 individuals who responded to North Carolina Behavioral Risk Factor Surveillance System surveys during 2006-2010.

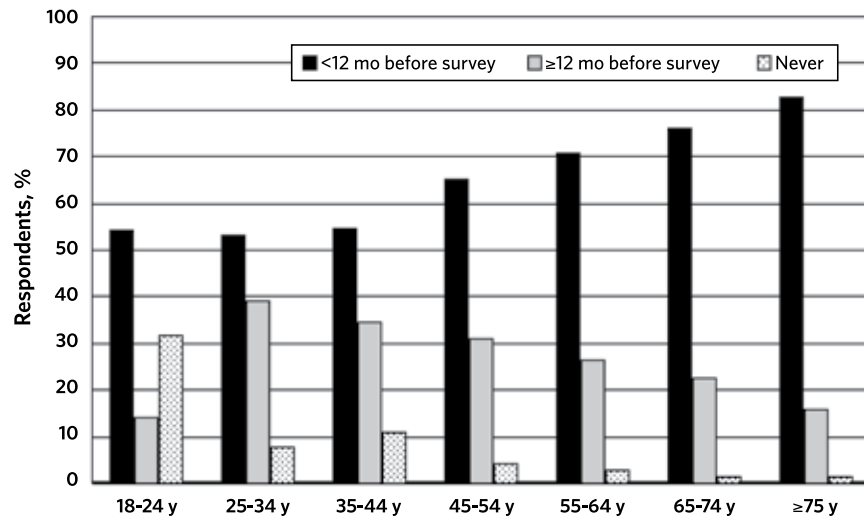
too small for meaningful interpretation. The prevalence of diabetic retinopathy increased with decreasing levels of education and family income. Persons with disabilities also reported a higher prevalence of diabetic retinopathy, compared with their counterparts with no disability.

The percentage of individuals with diabetes who received a recommended annual eye examination also varied by certain demographic characteristics. Only approximately 61% of Native Americans and 52% of Hispanics received an eye examination during the 12-month period before the survey, compared with approximately 70% for non-Hispanic whites and blacks (Figure 1). Nearly 20% of Hispanic respondents reported never having had an eye examination. The percentage of diabetics who had an eye examination within the past year increased with increasing age (Figure 2). More than 80% of diabetics aged ≥ 75 years reported having had an examination within the past 12 months, compared with $<60\%$ of persons <45 years old.

These data from the 2006-2010 NCBRFSS surveys show that approximately 1 of 5 adults with diabetes in North Carolina has received a diagnosis of diabetes-related eye disease. The prevalence of diabetic eye disease in North Carolina, as reported on the NCBRFSS, has declined slightly over previous years. During the previous 5-year period (ie, 2001-2005), the combined prevalence was approximately 26%, which is more in line with the NHANES findings of 28.5% [3]. When less severe forms of vision problems are included, the prevalence is even higher. A 2006 NCBRFSS vision module for people aged ≥ 40 years in North Carolina found that, among individuals with diabetes, 41.4% reported having any degree of visual impairment, including difficulty reading, compared with 31.6% of all adults in that survey [5]. The finding in this study that males and minority populations were at increased risk for developing diabetic eye disease is consistent with the findings by Zhang and colleagues [3].

Diabetes-related eye disease is a common complication among persons with diabetes. Almost all individuals with type 1 diabetes will eventually develop nonproliferative retinopathy, as will the majority of persons with long-standing type 2 diabetes. The likelihood that a person with diabetes will develop eye problems depends on several factors, but maintaining optimal blood pressure and glucose control are of key importance in preventing or minimizing the severity of visual problems. Individuals with dia-

FIGURE 2.
Timing of the Most Recent Eye Examination Among Survey Respondents With Diabetes, by Age



Note. Data are for 71,610 individuals who responded to North Carolina Behavioral Risk Factor Surveillance System surveys during 2006-2010.

betes should have a comprehensive eye examination within 3-5 years after their initial diagnosis, and they should receive an eye examination annually thereafter [6]. Physicians caring for diabetic patients should be mindful of these recommendations, paying particular attention to minorities and other high-risk populations. NCMJ

References

1. Fowler MJ. Microvascular and macrovascular complications of diabetes. Clin Diabetes. 2008;26(2):77-82.
2. Centers for Disease Control and Prevention (CDC). National diabetes fact sheet: national estimates and general information on diabetes and prediabetes in the United States, 2011. Atlanta, GA: CDC, US Department of Health and Human Services; 2011. <http://www.cdc.gov/diabetes/pubs/factsheet11.htm>. Accessed October 27, 2011.
3. Zhang X, Saaddine JB, Chou CF, et al. Prevalence of diabetic retinopathy in the United States, 2005-2008. JAMA. 2010;304(6):649-656.
4. Herrick H, Roberts B. Health Risks Among North Carolina Adults: 2005. Raleigh, NC: State Center for Health Statistics, Division of Public Health, North Carolina Department of Health and Human Services; 2006. <http://www.epi.state.nc.us/SCHS/pdf/BRFSSReport2005.pdf>. Accessed October 27, 2011.
5. North Carolina Risk Factor Surveillance System. Visual impairment and eye care among North Carolina adults: results from the new vision module questionnaire in the 2006 BRFSS survey. SCHS Stud. 2007;(155):1-5. <http://www.epi.state.nc.us/SCHS/pdf/SCHS155.pdf>. Accessed October 27, 2011.
6. American Diabetes Association. Standards of medical care in diabetes—2007. Diabetes Care. 2007;30:S4-S41.

*Contributed by Robert E. Meyer, PhD, MPH, and Harry Herrick, MSPH, MSW, MEd,
State Center for Health Statistics, North Carolina Division of Public Health,
North Carolina Department of Health and Human Services, Raleigh, North Carolina.*