Diabetic retinopathy is the leading cause of new cases of blindness among working-age adults in the United States. The prevalences of diabetic retinopathy and vision-threatening diabetic retinopathy are estimated to be 3.8% and 0.6%, respectively, among the US population aged 40 years or older. Those with diabetes mellitus are also at increased risk for glaucoma and cataracts. Compared with non-Hispanic whites, non-Hispanic African Americans and Mexican Americans have a 2-fold increased risk of having a diagnosis of diabetes. Furthermore, non-Hispanic African Americans and Mexican Americans who already have diabetes diagnosed have increased prevalences of diabetic retinopathy, 46% and 84% higher, respectively, than non-Hispanic whites. In addition, these groups have more severe diabetic retinopathy than non-Hispanic whites, probably owing to differences in socioeconomic status that result in poor glycemic control and disparities in quality of and access to health care.

Visual symptoms may not occur until retinopathy is well advanced and not compliant to treatment. Therefore, the American Diabetes Association, the American Academy of Ophthalmology, and the American Optometric Association recommend that persons with type 1 diabetes undergo an annual dilated eye examination starting 5 years after diagnosis and that persons with type 2 diabetes undergo a dilated eye examination at the time of diagnosis and annually thereafter. Those with diabetes who received recommended eye care during a 3-year period had earlier diagnosis of diabetic retinopathy and lower rates of low vision and blindness. Nonetheless, the proportion of patients with diabetes who undergo an annual eye examination is low. Additional education efforts to increase the perception of need among urban minority populations may be enhanced if focused on younger persons with diabetes.
Eye Care Use in High-Risk Diabetics

Methods

The current investigation is a retrospective cohort study of eye care use among patients with diabetes who visited an outpatient medical clinic operated by Jefferson Health System at Cooper Green Mercy Hospital, a large "public safety net" hospital in Birmingham, Alabama. Jefferson County covers approximately 1100 square miles (2860 km²). In 2010, the county had a population of 658,466, of whom 51% were non-Hispanic white and 42% non-Hispanic African American; overall, 15.5% of the county’s residents live below the poverty level. Cooper Green Mercy Hospital offers health care services to all residents of Jefferson County and includes outpatient clinics for internal medicine and ophthalmology; out-of-pocket fees are based on family size and income. The institutional review boards of the University of Alabama at Birmingham and Cooper Green Mercy Hospital reviewed and approved the study protocol before it was initiated.

Study Population

The study population comprised patients aged 19 years or older who had a diagnosis of diabetes mellitus and visited the facility’s internal medicine outpatient clinic in 2007. Patients with diabetes were identified through the hospital’s electronic administrative records. For January 1987 through July 2011, all patients with records containing an International Classification of Disease, Ninth Revision (ICD-9) diagnosis code of 250.0 through 250.9 were classified as having diabetes. Previous research has indicated that a single outpatient visit for ICD-9 code 250 has high sensitivity and specificity for the identification of patients with diabetes. For patients with diabetes who visited the internal medicine clinic in 2007, the date of their first clinic visit in 2007 was defined as an index date. Excluded from the study were patients with an ICD-9 code indicating ophthalmic complications (250.5) at their index date and patients with an ICD-9 code in their pre-2007 history indicating retinopathy or macular edema (362.0-362.9). For the remaining patients, 2-year follow-up began the day after their index date, with the primary outcomes of interest being eye care use within 1 and 2 years. Follow-up was carried out by linking patients’ personal identifiers (ie, medical record numbers) to electronic records of the hospital’s billing and accounting system, which included dates and procedures of patient encounters in the hospital’s ophthalmology clinic.

Variables of Interest

Patient visits to the eye clinic for any eye care procedures were considered positive outcomes for eye care use, which included new or established patient visits, examinations (eg, ophthalmoscopy and refractions), diagnostic testing (eg, A-scan ultrasound biometry), and treatment (eg, intravitreal injection of medication). The outcome was defined as did or did not have at least 1 eye care visit within 1 and 2 years of follow-up. Independent variables included patient demographics (sex, race/ethnicity, age, and marital status), severity of diabetes, time since diabetes diagnosis, and insurance status. Race/ethnicity was categorized into mutually exclusive groups as non-Hispanic African American, non-Hispanic white, Hispanic, and other. Age was categorized as 19 to 39 years, 40 to 64 years, and 65 years or older. Marital status was categorized as married or not married (ie, divorced, separated, single, or widowed).

Diabetes severity was classified into 3 mutually exclusive groups: controlled without complications (ICD-9 codes 250.00 and 250.01), uncontrolled without complications (ICD-9 codes 250.02 and 250.03), and uncontrolled with complications (ICD-9 codes 250.40, 250.50, 250.60, and 250.90). Previous research has used similar classification schemes based on ICD-9 codes to differentiate glycemic control but without the additional categorization for complications. Time since diabetes diagnosis was derived from the date when a diabetes diagnosis code first appeared in the hospital’s administrative records and was categorized as less than 1, 1 to 4, 5 to 9, or 10 years or more. Finally, patients’ insurance status was categorized as indigent, Medicare, Medicaid, self-pay, or private insurance (eg, Blue Cross). Those classified as indigent were below the federal poverty guidelines scale based on income and number of household members but were not covered by Medicaid.

Statistical Analysis

Crude and adjusted rate ratios (aRRs) and their corresponding 95% CIs were calculated for eye care use within 1 and 2 years. Associations were examined for demographic variables (sex, race/ethnic group, age group, and marital status), diabetes severity group, time since diabetes diagnosis, and in...
Results

Overall, 1157 patients with diabetes were identified as visiting the internal medicine outpatient clinic in 2007; after 290 patients were excluded for having a previous diagnosis of retinopathy or a current diagnosis of diabetes with ophthalmic complications, 867 patients with diabetes were included in the study. Only 1 patient had missing values for any of the variables of interest; this patient had missing insurance information and did not contribute information for crude analysis of this variable and in the adjusted analysis. Most of the patients with diabetes were women (61.9%) and non-Hispanic African American (76.2%). The mean age was 51.8 years (range, 20-90 years), and 74.0% were between 40 and 64 years of age (Table 1). Most patients (80.4%) were not married. The mean (SD) interval since the diagnosis of diabetes was 3.3 (3.7) years. Approximately 27% of the cohort had newly diagnosed diabetes (within 1 year before the index date), and in 54.7% the interval since diagnosis was 1 to 4 years. Most patients were uninsured (61.4% were indigent and 3.1% were self-pay), and the others were covered by Medicare (21.8%), Medicaid (11.8%), or private insurance (1.8%). Based on the ICD-9 diagnosis codes (Table 2), 322 patients (37.1%) had controlled diabetes and 537 (61.9%) had uncontrolled diabetes. Only 8 patients had diabetes with a nonocular complication (neurological in 7).

The 1- and 2-year eye care utilization rates were 33.2% and 45.0%, respectively. There were no significant differences in eye care utilization rates by sex (Table 3). Compared with non-Hispanic white patients, more non-Hispanic African Americans and Hispanics used hospital eye care services within 1 or 2 years, but associations did not reach statistical significance. Relative to patients older than 65 years, the 19- to 39-year age group was less likely to use eye care services within both 1 year (aRR, 0.48; 95% CI, 0.27-0.84) and 2 years (aRR, 0.61; 95% CI, 0.38-0.99). There were no significant differences by time since diabetes diagnosis. Patients with uncontrolled diabetes were similar in eye care use patterns to those with controlled diabetes. Finally, compared with patients classified as indigent, Medicaid recipients received fewer eye care services within 1 and 2 years, but the associations failed to reach statistical significance; similar decreased eye care use patterns (also not significant) were observed for the other insurance groups.

Discussion

This study provides an evaluation of eye care use among patients with diabetes at a county public hospital that serves a largely non-Hispanic African American population, most of whom are uninsured. Within 1 and 2 years of follow-up, 32.2% and 45.0% of patients, respectively, received any of the study’s defined eye care services from the hospital’s ophthalmology outpatient clinic. Investigations of eye care use among persons with diabetes by race and ethnicity have focused primarily on Hispanic populations but not on non-Hispanic African American populations but not on non-Hispanic African American (76.2%). The mean age was 51.8 years (range, 20-90 years), and 74.0% were between 40 and 64 years of age (Table 1). Most patients (80.4%) were not married. The mean (SD) interval since the diagnosis of diabetes was 3.3 (3.7) years. Approximately 27% of the cohort had newly diagnosed diabetes (within 1 year before the index date), and in 54.7% the interval since diagnosis was 1 to 4 years. Most patients were uninsured (61.4% were indigent and 3.1% were self-pay), and the others were covered by Medicare (21.8%), Medicaid (11.8%), or private insurance (1.8%). Based on the ICD-9 diagnosis codes (Table 2), 322 patients (37.1%) had controlled diabetes and 537 (61.9%) had uncontrolled diabetes. Only 8 patients had diabetes with a nonocular complication (neurological in 7).

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Americans. Mier et al,29 in a study of older Mexican Americans with diabetes along the Texas border, reported that 61.7% had undergone an eye examination in the previous year and that those with health insurance were more than 5 times as likely to have done so. Pérez et al30 reported that 49.2% of adults with diabetes living in Puerto Rico underwent an annual dilated eye examination. Both studies found higher 1-year eye examination rates than in the current study. Paz et al,22 however, investigated eye care utilization rates among an urban Hispanic cohort of persons with diabetes and reported rates (35%) that were similar to those in the current study.

Previous research on eye care use among non-Hispanic African Americans with diabetes is scarce. In the current study, 33.7% and 46.1% of non-Hispanic African American patients received eye care services within 1 and 2 years of follow-up, respectively. An earlier study39 of patients with diabetes who were new visitors to the eye clinic of an inner city public hospital found demographic and clinical characteristics similar to those we report here. Those investigators reported that 32% of patients were deemed to have had appropriately timed ophthalmic surveillance.19 A recent assessment of a community-based educational intervention to increase eye care use among non-Hispanic African American adults with diabetes reported preintervention and postintervention dilated eye examination rates that were much higher than in the current study.31 Overall, approximately 70% of participants reported undergoing a dilated eye examination within the previous year during both the preintervention and postintervention periods; in addition, those living in the community who received eye care education were significantly more likely (odds ratio, 1.59) to have undergone a dilated eye examination in the preceding 12 months.31 However, unlike in the current study, outcome and covariate information was obtained from self-report; in addition, more than 80% of participants reported hav-
ing health insurance, indicating that they were dissimilar to the patients in our cohort. Previous research has shown that eye care utilization estimates based on self-report will overestimate the number receiving an eye examination within the previous year.32

A large proportion of the patients with diabetes in the current study had uncontrolled diabetes without complications. Research findings suggest that glycemia is under control in only a small proportion (96%) of patients with diabetes nationwide.33 Uncontrolled diabetes is a risk factor for diabetic retinopathy34; in the current study, focused on a safety net hospital primarily serving the uninsured, the use of eye care services by patients with uncontrolled diabetes was similar to that by those with controlled diabetes.

Eye care use did not differ significantly by insurance group. Nonetheless, even when cost of care is subsidized or removed as a barrier, as it is for patients of this facility, eye care utilization rates remained low. Primary barriers related to individuals' decisions not to seek eye care for diabetic retinopathy have been ranked from most to least important as being related to behavior and culture, costs, and geographic accessibility.35 Barriers to eye care, however, are not equivalent for all groups, and an investigation of perceptions and beliefs of vision care among older African Americans who reside in Birmingham and Montgomery, the 2 largest cities in Alabama, reported that the most frequently cited barrier to care was transportation, followed by trusting the physician, communicating with the physician, and costs.36

Rask et al37 investigated a patient population that was similar to that in the current study and reported that lack of transportation was significantly associated with both not having a source for regular care and delay of care for new health problems. Low educational attainment has been reported to be significantly associated with patients choosing to delay care,37 and racial differences in health literacy might contribute to African Americans' lack of familiarity with eye disease.38,39 In addition, researchers have reported that 87% of African American study participants have the mistaken belief that eye problems are always accompanied by symptoms and that only a small proportion of participants had ever heard of retinopathy, with less than 10% able to correctly describe it.40 Older African Americans have identified difficulty in communicating with eye care providers as a barrier to seeking eye care.39,41 Other research supports the importance of physician-patient communications in race-based health disparities.42

Our study was strengthened by reliance on objective information sources, that is, electronic administrative records for the identification of patients with diabetes and billing and accounting records to determine their eye care use during the 2-year follow-up. In addition, the health system predominantly serves non-Hispanic African Americans who are largely uninsured, the target population of interest. We excluded patients who had a previous diagnosis of diabetic retinopathy or macular edema, which increased internal validity by ensuring that the study patients were free of ophthalmic complications of diabetes before follow-up; alternatively, that restriction limits the study's external validity and generalizability. For example, because of the noted exclusions, the sample had fewer patients with long intervals since diagnosis and fewer older patients than would have otherwise been included.

Limitations of the study should be acknowledged when interpreting the results. Because the study was based on administrative data, it was limited in the number of patient and clinical characteristics that could be examined. Furthermore, a large proportion (21.8%) of patients were covered by Medicare, so they had health care options unavailable to patients covered by Medicaid or with no health insurance. It is noteworthy that 117 patients (61.9%) in the Medicare group were younger than 65 years at their index visit, which suggests that a large proportion of them were disabled. Patients in the Medicare group may have gone to other facilities to receive eye care.

Loss to follow-up (eg, because of death or censoring) may influence results; we are unable to determine which patients died during follow-up. However, an analysis of health care services utilization at the facility through July 2011 indicates that, among the 477 patients who did not visit the ophthalmology clinic during the 2-year follow-up, 417 (87.4%) had used other hospital services within 2 years of their follow-up index date. Furthermore, 97 (20.3%) who did not receive study-defined eye care services during the follow-up did receive such services after that period.

In summary, the current findings indicate that patients with diabetes seen in the internal medicine clinic of a large public safety net hospital have lower eye care utilization rates than national estimates, with rates similar to those reported by others for minority populations with diabetes in urban areas.19,22 Young patients with diabetes had significantly lower rates of eye care utilization, implying that educational efforts aimed at increasing the perception of need for eye care should focus on younger patients.
necessarily represent the official position of the Centers for Disease Control and Prevention.

REFERENCES


