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Eye Care Utilization among a High-Risk Diabetic Population Seen in a Public Hospital's Clinics

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Abstract

Objective—Little is known regarding eye care utilization among low income persons with diabetes, especially African Americans.

Methods—A retrospective cohort study with two-years of follow-up examined eye care utilization among adult diabetes patients seen in 2007 in the internal medicine clinic of a large, urban, county hospital that serves primarily low income, non-Hispanic African American patients. Patients with a history of retinopathy and macular edema or a current diagnosis indicating ophthalmic complications were excluded. Eye care utilization was defined dichotomously as whether or not patients had a visit to the eye clinic for any eye care examination or procedure. We estimated crude and adjusted rate ratios (aRRs) and 95% confidence intervals (CIs) for the association between eye care utilization and selected clinical and demographic characteristics.

Results—There were 867 patients with diabetes identified: 61.9% women, 76.2% non-Hispanic African American, 61.3% indigent, and average age 51.8 years. Eye care utilization was 33.2% within one-year and 45.0% within two-years. For patients 19–39 years of age compared to those 65+ years, significantly decreased eye care utilization was observed within one-year (aRR=0.48, 95% CI 0.27–0.84) and within two-years (aRR=0.61, 95% CI 0.38–0.99).

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Paul A. MacLennan had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Conclusions—Overall eye care utilization was low. Additional education efforts to increase the perception of need among urban minority populations may be enhanced if focused on younger people with diabetes.

Keywords

diabetes; retinopathy; epidemiology; eye exam

INTRODUCTION

Diabetic retinopathy is the leading cause of new cases of blindness among working age adults in the United States.[1] The prevalence of diabetic retinopathy and vision threatening diabetic retinopathy is estimated to be 3.8% and 0.6%, respectively, among the US population 40 years and older.[2] Those with diabetes are also at increased risk for glaucoma,[3,4] and cataracts.[5] Compared to non-Hispanic whites, non-Hispanic African Americans and Mexican Americans have a two-fold increased risk of being diagnosed with diabetes.[6] Furthermore, non-Hispanic African Americans and Mexican Americans already diagnosed with diabetes have increased prevalences of diabetic retinopathy, i.e., 46% and 84% higher, respectively, than non-Hispanic whites.[7] In addition, these groups are diagnosed with diabetic retinopathy of greater severity than non-Hispanic whites,[7] likely due to differences in socioeconomic status that results in poor glycemic control,[8] and disparities in quality and access to health care.[9,10]

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 have an annual dilated eye examination after 5 years of diagnosis and that persons with type 2 diabetes have a dilated eye examination at time of diagnosis and annually thereafter.[11–13] Those with diabetes who received recommended eye care over a three year period had earlier diagnosis of diabetic retinopathy and lower rates of low vision and blindness.[14] Nonetheless, the proportion of diabetes patients who receive an annual eye examination is low. For example, Saaddine et al.[15] reported a dilated eye examination rate of 63.3% for the previous year among adults with self-reported diabetes. Among women 40 years of age and older diagnosed with diabetic retinopathy, those without eye care insurance less frequently followed recommended guidelines for visiting an eye-care provider.[16] Overall, those with vision care insurance are more than twice as likely to have an annual eye examination. Other factors associated with increased likelihood of eye care utilization include higher income, and greater educational attainment.[17]

There are over 100 public hospitals and health systems in the U.S. and these health systems deliver 25% of the uncompensated care in the U.S., including 35 million ambulatory care visits each year.[18] Patients with diabetes who rely on safety-net health systems for healthcare are at increased risk for diabetic eye diseases because many are socioeconomically disadvantaged and medically underserved.[19] Low socioeconomic status is a risk factor for visual impairment,[20] due to decreased preventive services and poor continuity of care, resulting in delayed diagnoses and increased morbidity.[21] Previous

studies of low income diabetic populations from urban areas have focused primarily on Hispanic populations,[19,22] and little is known about eye care utilization among low income non-Hispanic African American adults with diabetes. The objective of this study was to investigate eye care utilization among patients with diabetes who are seen in a county hospital clinic in the South that primarily serves high risk low income patients who are predominantly non-Hispanic African Americans.

METHODS

The current investigation is a retrospective cohort study of eye care utilization among patients with diabetes who visited an out-patient medical clinic operated by Jefferson Health System at Cooper Green Mercy Hospital, a large "public safety net" hospital in Birmingham Alabama and operated by Jefferson County Alabama.[23] Jefferson County covers approximately 1,100 square miles. 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.[24] Cooper Green Mercy Hospital offers health care services to all residents of Jefferson County, and includes out-patient 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 19 years of age and older diagnosed with diabetes who 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 patient records containing an International Classification of Disease, Ninth Revision (ICD-9) diagnosis code of 250.0–250.9 were classified as having diabetes. Previous research has reported that a single out-patient visit for ICD-9 code 250 has high sensitivity and specificity for the identification of diabetes patients.[25] For those 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 indicating ophthalmic complications (250.5) at the time of their index date, and patients who had an ICD-9 in their pre-2007 history indicating retinopathy or macular edema (362.0–362.9). For the remaining patients, two-year follow-up began the day after their index date with the primary outcomes of interest being eye care utilization within one- and two-years. Follow-up was carried out by linking patients' personal identifiers, i.e., 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 as positive outcomes for eye care utilization, which included: new or established patient visits; examinations (e.g., ophthalmoscopy, refractions); diagnostic testing (e.g., A-scan ultrasound biometry); and treatment (e.g., intravitreal injection of medication). The outcome was

defined did/did not have at least one eye care visit within one- and two-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 19–39, 40–64, and 65 years and older. Marital status was categorized as married and not married (i.e., divorced, separated, single, and widowed). Diabetes severity was classified into three mutually exclusive groups: controlled without complications (ICD-9=250.00, 250.01); uncontrolled without complications (ICD-9=250.02, 250.03); and with complications (ICD-9=250.40, 250.50, 250.60, 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.[26,27] 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 one year, one to four years, five to nine years, and ten or more years. Finally, patients' insurance status was categorized as indigent, Medicare, Medicaid, self-pay, and private insurance (e.g., Blue Cross). Those classified as indigent were below the federal poverty guidelines scale based on income and number of household members,[(28)] but were not covered by Medicaid.

Statistical analysis

Crude and adjusted rate ratios (RRs) and their corresponding 95% confidence intervals (CIs) were calculated for eye care utilization within one-year and within two-years. Associations were examined for demographic variables (sex, race/ethnic group, age group, marital status), diabetes severity group, time since diabetes diagnosis, and insurance status. All covariates were included in multivariable models used to estimate adjusted RRs; however, because of high collinearity, age was not included in the regression model used to estimate the association with time since diabetes diagnosis, and time since diabetes diagnosis was not included in the regression model used to estimate the association with age. All statistical analyses were done using SAS 9.2.

RESULTS

Overall, 1,157 patients with diabetes were identified as visiting the internal medicine out-patient clinic in 2007 but 290 were excluded for having a previous retinopathy diagnosis or current diabetes diagnosis with ophthalmic complications, resulting in 867 patients with diabetes included in the study. One- and two-year eye care utilization rates were 33.2% and 45.0%, respectively. Only one patient was missing values for any of the variables of interest, i.e., one subject was missing insurance information and did not contribute information for crude analysis of this variable and in the adjusted analysis. The majority of patients with diabetes were women (61.9%), and non-Hispanic African American (76.2%). Average age was 51.8 years and ranged from 20 to 90 years, and 74.1% were between 40 and 64 years of age (Table 1). Most patients were not married (80.4%). Average time since diabetes diagnosis was 3.3 years (SD=3.7). Approximately 27% of the cohort had been newly diagnosed, i.e., within one year previous to their index date, and 54.7% diagnosed one to four years. Most patients were uninsured (i.e., 61.4% indigent and 3.1% self-pay) followed

by Medicare (21.8%), Medicaid (11.8%) and private insurance (1.8%). Based on the ICD-9 diagnosis codes (Table 2), 37.1% (N=322) of patients had controlled diabetes, but a larger number (61.9%, N=537) had uncontrolled diabetes. Only eight patients had diabetes with a non-ocular complication, the majority neurological (N=7).

There were no significant differences in eye care utilization by gender (Table 3). Compared to non-Hispanic white patients, more non-Hispanic African Americans and Hispanics utilized hospital eye care services within one- and two-years but associations did not reach statistical significance. Relative to the 65+ age group, the 19–39 age group was less likely to utilize eye care services both within one- (aRR=0.48, 95% CI 0.27–0.84) and two-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 utilization patterns to those with controlled diabetes. Finally, compared to patients classified as indigent, Medicaid patients received less eye care services within one- (aRR=0.76, 95% CI 0.51–1.15) and two-years (aRR=0.73, 95% CI 0.51–1.04) but the associations failed to reach statistical significance; similar decreased but non-significant eye care utilization patterns were observed for the other insurance type groups.

DISCUSSION

This study provides an evaluation of eye care utilization among diabetes patients at a county public hospital that largely serves a mostly non-Hispanic African American population, most of whom are uninsured. Within one- and two-years of follow-up, 33.2% and 45.0% of patients, respectively, received any of the study's defined eye care services from the hospital's ophthalmology out-patient clinic. Investigations of eye care utilization among people with diabetes by race and ethnicity have focused primarily on Hispanic populations, but not on non-Hispanic African Americans. Mier et al. investigated older Mexican Americans with diabetes along the Texas border and reported that 61.7% of subjects received an eye examination in the previous year and that those with health insurance were over five times as likely to have an eye examination;[29] whereas Pérez et al. investigated adults with diabetes residing in Puerto Rico and reported that 49.2% received an annual dilated eye examination.[30] Both studies reported higher one-year eye examination rates than the current study. Paz et al.,[22] however, investigated eye care utilization rates among an urban Hispanic cohort of people with diabetes and reported rates (35%) that were similar to the current study.

Previous research of eye care utilization among non-Hispanic African Americans with diabetes is scarce. In the current study, 33.7% and 46.1% of non-Hispanic African American patients, respectively, received eye care services within one- and two-years of follow-up. An earlier study of newly presenting diabetes patients to the eye clinic of an inner city public hospital reported similar demographic and clinical characteristics as the current study.[19] Investigators reported that 32% of patients were deemed to have had appropriate timing of ophthalmic surveillance.[19] A recent assessment of a community based educational intervention to increase eye care utilization among non-Hispanic African American adults with diabetes reported pre- and post-intervention dilated eye examination rates that were much higher than the current study.[31] Overall, approximately 70% of subjects reported

receiving a dilated eye exam within the previous year during both the pre- and post-intervention periods; in addition, those living in the community that received eye care education were significantly more likely (OR=1.59) to have received a dilated eye examination in the preceding 12-months.[31]. However, unlike the current study, outcome and covariate information was from self-report; in addition, over 80% of subjects reported having health insurance, indicating that subjects were dissimilar to those in our cohort. Previous research has reported that eye care utilization estimates based on self-report will overestimate the number receiving an eye exam within the previous year.[32]

A large proportion of the current study's diabetes patients had uncontrolled diabetes without complications. Research suggests that only a small proportion (36%) of diabetes patients nationwide have their glycemia under control.[33] Uncontrolled diabetes is a risk factor for diabetic retinopathy;[34] in the current study, focused on a safety net hospital primarily serving the uninsured, the uncontrolled diabetes group's utilization of eye care services was similar to that of diabetes patients with controlled diabetes.

Eye care utilization was not significantly different 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 may remain low. Primary barriers related to individuals' decisions not to seek eye care for diabetic retinopathy have been ranked from most important to least 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 resided in Birmingham and Montgomery, the two largest cities in Alabama, reported that the most frequently cited barrier to care was transportation, followed by trusting the doctor, communicating with the doctor, and costs.[36] Rask et al. (1994) investigated a patient population that was similar to the current study's and reported that lack of transportation was significantly associated with both not having a source for regular care and in delay of care for new health problems.[37] 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 being less familiar 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 that 10% able to correctly describe the eye disease.[40] Older African Americans have identified difficulty in communicating with eye care providers as a barrier to seeking eye care.[36,41] Other research supports the importance of physician-patient communications in race based health disparities.[42]

The study was strengthened by reliance on objective information sources, i.e., electronic administrative records for the identification of diabetes patients and billing and accounting records for their eye care utilization over the two year follow-up period. 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 retinopathy or macular edema, which increased internal validity by insuring that the study subjects were free of ophthalmic complications of diabetes before follow-up; alternatively, restriction limits the study's external validity and generalizability. 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, thus they had healthcare options unavailable to patients covered by Medicaid and no health insurance. It is noteworthy that 61.9% (N=117) of Medicare patients were less than 65 years of age at the time of their index date, indicating that a large proportion was disabled. It is possible that Medicare patients might have gone to other facilities to receive eye care.

Loss to follow-up (death, censoring, etc.) may potentially 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 two-year follow-up period, 87.4% (N=417) had used other hospital services within two-years of their follow-up index date. Furthermore, 20.3% (N=97) of patients who did not receive study defined eye care services during follow-up, did so after the two-year follow-up period.

In summary, the current study indicates that patients with diabetes managed in the internal medicine clinic of a large public safety net hospital have lower eye care utilization rates than national estimates but rates are similar to those reported by others for minority populations with diabetes in urban areas.[19,22] Young diabetes patients had significantly lower eye care utilization implying that educational efforts aimed at increasing the perception of need for eye care among similar populations should focus on younger patients.

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References

1. [Accessed November 7 2012] National Diabetes Fact Sheet. 2011. http://www.cdc.gov/diabetes/pubs/pdf/ndfs_2011.pdf
2. Zhang X, Saaddine JB, Chou CF, Cotch MF, Cheng YJ, Geiss LS, Gregg EW, Albright AL, Klein BE, Klein R. Prevalence of diabetic retinopathy in the United States, 2005–2008. JAMA. 2010; 304(6):649–656. [PubMed: 20699456]
3. Newman-Casey PA, Talwar N, Nan B, Musch DC, Stein JD. The relationship between components of metabolic syndrome and open-angle glaucoma. Ophthalmology. 2011; 118(7):1318–1326. [PubMed: 21481477]
4. Pasquale LR, Kang JH, Manson JE, Willett WC, Rosner BA, Hankinson SE. Prospective study of type 2 diabetes mellitus and risk of primary open-angle glaucoma in women. Ophthalmology. 2006; 113(7):1081–1086. [PubMed: 16757028]
5. Klein BE, Klein R, Wang Q, Moss SE. Older-onset diabetes and lens opacities. The Beaver Dam Eye Study. Ophthalmic Epidemiol. 1995; 2(1):49–55. [PubMed: 7585233]
6. Cowie CC, Rust KF, Byrd-Holt DD, Eberhardt MS, Flegal KM, Engelgau MM, Saydah SH, Williams DE, Geiss LS, Gregg EW. Prevalence of diabetes and impaired fasting glucose in adults in the U.S. population: National Health And Nutrition Examination Survey 1999–2002. Diabetes Care. 2006; 29(6):1263–1268. [PubMed: 16732006]

7. Harris MI, Klein R, Cowie CC, Rowland M, Byrd-Holt DD. Is the risk of diabetic retinopathy greater in non-Hispanic blacks and Mexican Americans than in non-Hispanic whites with type 2 diabetes? A U.S. population study. Diabetes Care. 1998; 21(8):1230–1235. [PubMed: 9702425]
8. de Rekeniere N, Rooks RN, Simonson EM, Shorr RI, Kuller LH, Schwartz AV, Harris TB. Health, Aging and Body Composition Study. Racial differences in glycemic control in a well-functioning older diabetic population. Findings from the health, aging and body composition study. Diabetes Care. 2003; 26(12):1986–1992. [PubMed: 12832300]
9. Peek ME, Cargill A, Huang ES. Diabetes health disparities: a systematic review of health care interventions. Med Care Res Rev. 2007; 64(5 Suppl):101S–56S. [PubMed: 17881626]
10. Nsiah-Kumi P, Ortmeier SR, Brown AE. Disparities in diabetic retinopathy screening and disease for racial and ethnic minority populations--a literature review. J Natl Med Assoc. 2009; 101(5): 430–7. [PubMed: 19476196]
11. American Diabetes Association. Standards of medical care in diabetes--2012. Diabetes Care. 2012; 35 (Suppl 1):S11–S63. [PubMed: 22187469]
12. [Accessed November 7 2012] Diabetic Retinopathy PPP. 2008. http://one.aao.org/CE/PracticeGuidelines/PPP_Content.aspx?cid=d0c853d3-219f-487b-a524-326ab3cecd9a#section4
13. Optometric Clinical Practice Guidelines. [Accessed November 7 2012] Care of the Patient with Diabetes Mellitus. 2009. http://www.aoa.org/documents/CPG-3.pdf
14. Sloan FA, Grossman DS, Lee PP. Effects of receipt of guideline-recommended care on onset of diabetic retinopathy and its progression. Ophthalmology. 2009; 116(8):1515–1521. [PubMed: 19651311]
15. Saaddine JB, Engelgau MM, Beckles GL, Gregg EW, Thompson TJ, Narayan KM. A diabetes report card for the United States: quality of care in the 1990s. Ann Intern Med. 2002; 136(8):565–574. [PubMed: 11955024]
16. Centers of Disease Control and Prevention (CDC). . Eye-Care Utilization Among Women Aged ≥40 Years with Eye Diseases ---19 States, 2006—2008. MMWR Morb Mortal Wkly Rep. 2010; 59(19):588–591. [PubMed: 20489682]
17. Lee DJ, Lam BL, Arora S, Arheart KL, McCollister KE, Zheng DD, Christ SL, Davila EP. Reported eye care utilization and health insurance status among US adults. Arch Ophthalmol. 2009; 127(3):303–310. [PubMed: 19273794]
18. [Accessed November 7 2012] Addressing disparities and serving diverse patient populations. 2007. http://naph.org/Main-Menu-Category/Publications/Disparities/addressingdisparitiesandservingdiversepatientpopulations.aspx?FT=.pdf
19. Baker RS, Watkins NL, Wilson MR, Bazargan M, Flowers CW Jr. Demographic and clinical characteristics of patients with diabetes presenting to an urban public hospital ophthalmology clinic. Ophthalmology. 1998; 105(8):1373–1379. [PubMed: 9709745]
20. Tielsch JM, Sommer A, Katz J, Quigley H, Ezrine S. Socioeconomic status and visual impairment among urban Americans. Baltimore Eye Survey Research Group. Arch Ophthalmol. 1991; 109(5): 637–641. [PubMed: 2025164]
21. Burns R, Nichols LO, Graney MJ, Applegate WB. Mortality in a public and a private hospital compared: the severity of antecedent disorders in Medicare patients. Am J Public Health. 1993; 83(7):966–971. [PubMed: 8328618]
22. Paz SH, Varma R, Klein R, Wu J, Azen SP. Los Angeles Latino Eye Study Group. Noncompliance with vision care guidelines in Latinos with type 2 diabetes mellitus: the Los Angeles Latino Eye Study. Ophthalmology. 2006; 113(8):1372–1377. [PubMed: 16769120]
23. [Accessed November 7 2012] Welcome to Cooper Green Mercy Hospital. 2012. http://www.coopergreenmercyhospital.org/
24. State and County Quickfacts. [Accessed November 7 2012] Jefferson County, Alabama. 2012. http://quickfacts.census.gov/qfd/states/01/01073.html
25. Zgibor JC, Orchard TJ, Saul M, Piatt G, Ruppert K, Stewart A, Siminerio LM. Developing and validating a diabetes database in a large health system. Diabetes Res Clin Pract. 2007; 75(3):313–319. [PubMed: 16934906]

26. Marchant MH Jr, Viens NA, Cook C, Vail TP, Bolognesi MP. The impact of glycemic control and diabetes mellitus on perioperative outcomes after total joint arthroplasty. J Bone Joint Surg Am. 2009; 91(7):1621–1629. [PubMed: 19571084]
27. Kim S. Burden of hospitalizations primarily due to uncontrolled diabetes: implications of inadequate primary health care in the United States. Diabetes Care. 2007; 30(5):1281–1282. [PubMed: 17290038]
28. Office of The Assistant Secretary for Planning and Evaluation, U.S. Department of Health & Human Services. [Accessed March 31 2010] Prior HHS Poverty Guidelines and Federal Register References. http://aspe.hhs.gov/poverty/figures-fed-reg.cfm
29. Mier N, Wang X, Smith ML, Irizarry D, Treviño L, Alen M, Ory MG. Factors Influencing Health Care Utilization in Older Hispanics with Diabetes along the Texas-Mexico Border. Popul Health Manag. 2012; 15(3):149–156. [PubMed: 22313441]
30. Pérez CM, Febo-Vázquez I, Guzmán M, Ortiz AP, Suárez E. Are adults diagnosed with diabetes achieving the American Diabetes Association clinical practice recommendations? P R Health Sci J. 2012; 31(1):18–23. [PubMed: 22432404]
31. Zhang X, Williams DE, Beckles GL, Gregg EW, Barker L, Luo H, Rutledge SA, Saaddine JB. Project DIRECT Evaluation Study Group. Diabetic retinopathy, dilated eye examination, and eye care education among African Americans, 1997 and 2004. J Natl Med Assoc. 2009; 101(10): 1015–1021. [PubMed: 19860301]
32. MacLennan PA, McGwin G Jr, Searcey K, Owsley C. Medical record validation of self-reported eye diseases and eye care utilization among older adults. Curr Eye Res. 2013; 38(1):1–8. [PubMed: 23078191]
33. Koro CE, Bowlin SJ, Bourgeois N, Fedder DO. Glycemic control from 1988 to 2000 among U.S. adults diagnosed with type 2 diabetes: a preliminary report. Diabetes Care. 2004; 27(1):17–20. [PubMed: 14693960]
34. The Diabetes Control and Complications Trial Research Group. . The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. N Engl J Med. 1993; 329(14):977–986. [PubMed: 8366922]
35. [Accessed November 7 2012] Improving the nation's vision health - a coordinated public health approach. http://www.cdc.gov/visionhealth/pdf/improving_nations_vision_health.pdf
36. Owsley C, McGwin G, Scilley K, Girkin CA, Phillips JM, Searcey K. Perceived barriers to care and attitudes about vision and eye care: focus groups with older African Americans and eye care providers. Invest Ophthalmol Vis Sci. 2006; 47(7):2797–2802. [PubMed: 16799016]
37. Rask KJ, Williams MV, Parker RM, McNagny SE. Obstacles predicting lack of a regular provider and delays in seeking care for patients at an urban public hospital. JAMA. 1994; 271(24):1931–1933. [PubMed: 8201737]
38. American Medical Association. Ad Hoc Committee on Health Literacy for the Council on Scientific Affairs. JAMA. 1999; 281(6):552–557. [PubMed: 10022112]
39. Gasch AT, Wang P, Pasquale LR. Determinants of glaucoma awareness in a general eye clinic. Arch Ophthalmol. 2000; 107(2):303–308.
40. Walker EA, Basch CE, Howard CJ, Zybert PA, Kromholz WN, Shamoon H. Incentives and barriers to retinopathy screening among African-Americans with diabetes. J Diabetes Complications. 1997; 11(5):298–306. [PubMed: 9424171]
41. Ellish NH, Royak-Schaler R, Passmore SR, Higginbotham EJ. Knowledge, attitudes and beliefs about dilated eye examinations among African-Americans. Invest Ophthalmol Vis Sci. 2007; 48(5):1989–1994. [PubMed: 17460251]
42. Cooper, LA.; Roter, DL. Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care. Washington, DC: National Academy Press; 2003. Patient-Provider Communication: The Effect of Race and Ethnicity on Process and Outcomes of Healthcare. In Institute of Medicine Committee on Understanding and Eliminating Racial and Ethnic Disparities in Health Care; p. 552-593.

Table 1

Patient demographics, time since diagnosis, and insurance type at time of 2007

Characteristics	N=867
Sex (%)	
Male	330 (38.1)
Female	537 (61.9)
Race/Ethnicity (%)	
Non-Hispanic African American	661 (76.2)
Non-Hispanic White	164 (18.9)
Hispanic	26 (3.0)
Other	16 (1.9)
Age, mean (SD)	51.8 (11.9)
Age group (%)	
19–39	140 (16.2)
40–64	642 (74.1)
65+	85 (9.8)
Marital status (%)	
Married	170 (19.6)
Not married	697 (80.4)
Time since diabetes diagnosis, mean (SD)	3.3 (3.7)
Time since diabetes diagnosis group (%)	
< 1 year (newly diagnosed)	237 (27.3)
1 to 4 years	474 (54.7)
5 to 9 years	101 (11.7)
10+ years	55 (6.3)
Insurance type (%)	
Indigent	532 (61.4)
Medicare	189 (21.8)
Medicaid	102 (11.8)
Self-pay	27 (3.1)
Private	16 (1.8)

Table 2

Diabetes severity group and primary ICD-9 diabetes diagnosis

	N=867
Controlled	322 (37.1%)
Type 2 diabetes mellitus (250.00)	300
Type 1 diabetes mellitus (250.01)	22
Uncontrolled	537 (61.9%)
Type 2 diabetes mellitus (250.02)	489
Type 1 diabetes mellitus (250.03)	48
With complications	8 (0.9%)
Renal manifestations (250.40)	1
Neurological manifestations (250.60)	7

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Table 3

Crude and adjusted rate ratios (RRs) and 95% confidence intervals (CIs) for eye care utilization within one- and two-years of first clinic visit by demographic and disease characteristics

	Eye care ≤ 1 year			Eye care ≤ 2 years		
Characteristics	**Eye care utilization per 100 patients**	**RR (95% CI)**	**aRR* (95% CI)**	**Eye care utilization per 100 patients**	**RR (95% CI)**	**aRR* (95% CI)**
Sex						
Male	33.3	Ref	Ref	46.1	Ref	Ref
Female	33.2	0.99 (0.78–1.26)	0.95 (0.74–1.21)	44.3	0.96 (0.78–1.18)	0.94 (0.76–1.16)
Race/Ethnicity						
Non-Hispanic White	28.7	Ref	Ref	38.4	Ref	Ref
Non-Hispanic	33.7	1.18 (0.86–1.61)	1.16 (0.84–1.59)	46.1	1.20 (0.92–1.58)	1.19 (0.91–1.57)
African American						
Hispanic	42.3	1.48 (0.77–2.84)	1.31 (0.64–2.67)	57.7	1.50 (0.86–2.64)	1.38 (0.75–2.53)
Other	43.8	1.53 (0.69–3.38)	1.40 (0.62–3.15)	43.8	1.14 (0.52–2.49)	1.05 (0.47–2.32)
Age Group[1]						
65+	41.2	Ref	Ref	51.8	Ref	Ref
40–64	34.4	0.83 (0.58–1.19)	0.76 (0.49–1.16)	46.3	0.89 (0.65–1.22)	0.85 (0.58–1.24)
19–39	22.9	0.55 (0.34–0.90)	0.48 (0.27–0.84)	35.0	0.68 (0.45–1.02)	0.61 (0.38–0.99)
Marital status						
Not married	32.1	Ref	Ref	43.6	Ref	Ref
Married	37.7	1.17 (0.89–1.55)	1.08 (0.80–1.46)	50.6	1.16 (0.91–1.47)	1.09 (0.84–1.41)
Time since diabetes diagnosis[2]						
10+ years	36.4	Ref	Ref	47.3	Ref	Ref
5 to 9 years	45.5	1.25 (0.74–2.12)	1.23 (0.73–2.09)	59.4	1.26 (0.79–1.99)	1.22 (0.77–1.94)
1 to 4 year	31.0	0.85 (0.54–1.36)	0.81 (0.50–1.31)	43.0	0.91 (0.61–1.37)	0.87 (0.57–1.32)
< 1 year	31.7	0.87 (0.53–1.43)	0.83 (0.50–1.39)	42.2	0.89 (0.58–1.37)	0.85 (0.54–1.33)
Diabetes severity						
Controlled	31.7	Ref	Ref	42.2	Ref	Ref
Uncontrolled	34.3	1.08 (0.85–1.38)	1.14 (0.89–1.47)	46.7	1.10 (0.90–1.36)	1.14 (0.92–1.42)
With complications	25.0	0.79 (0.20–3.20)	0.86 (0.21–3.53)	37.5	0.89 (0.28–2.79)	0.93 (0.29–2.94)

Characteristics	Eye care ≤ 1 year			Eye care ≤ 2 years		
	Eye care utilization per 100 patients	RR (95% CI)	aRR* (95% CI)	Eye care utilization per 100 patients	RR (95% CI)	aRR* (95% CI)
Insurance type						
Indigent	34.2	Ref	Ref	46.2	Ref	Ref
Medicare	34.9	1.02 (0.77–1.35)	0.79 (0.55–1.13)	47.6	1.03 (0.81–1.31)	0.86 (0.64–1.16)
Medicaid	27.5	0.80 (0.54–1.20)	0.76 (0.51–1.15)	35.3	0.76 (0.54–1.08)	0.73 (0.51–1.04)
Self-pay	22.2	0.65 (0.29–1.47)	0.63 (0.28–1.42)	37.0	0.80 (0.43–1.51)	0.78 (0.41–1.47)
Private	31.3	0.91 (0.38–2.22)	0.85 (0.35–2.09)	43.8	0.95 (0.45–2.00)	0.89 (0.42–1.89)

*Adjusted for sex, race, age group, marital status, time since diabetes diagnosis, diabetes severity, and insurance type.

[1]Time since diabetes diagnosis not included in the adjusted model

[2]Age not included in the adjusted model