Racial/Ethnic Differences in Use of Health Care Services for Diabetes Management

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Abstract

Research demonstrates consistent racial/ethnic disparities in access to and use of health care services for a variety of chronic conditions. Yet we know little about whether these disparities exist for use of health care services for diabetes management. Racial/ethnic minorities disproportionately suffer from diabetes, complications from diabetes, and diabetes-related mortality. Proper diabetes management can reduce the risk of complications and premature mortality. Using a large national data set (N=37,705) of white, black, Hispanic, Asian, and Native American U.S. adults aged 65 and older who have been diagnosed with diabetes, we examine three specific types of health care provider use for diabetes management: number of times seen by a healthcare professional for diabetes, number of times feet have been checked by a health care professional, and number of visits for a glycosylated hemoglobin check. We found that net of controls for a variety of demographic and socioeconomic characteristics, blacks and Hispanics had significantly more visits to a health care provider (HCP) for their diabetes and significantly more glycosylated hemoglobin checks than whites, and blacks and Native Americans had significantly more HCP feet checks than whites. Our results suggest that the reduced access to health care services traditionally found among racial/ethnic minorities does not hold for access to health care services for diabetes management, where racial/ethnic minority diabetics are actually more likely to use care than are white diabetics. Future research should examine whether higher use of health care services for diabetes among racial/ethnic minorities is due to greater disease severity among racial/ethnic minorities than among non-Hispanic whites.

Introduction

Nearly 10% of the US population suffers from diabetes, and this percentage is expected to increase to one third by 2050 if present trends continue (American Diabetes Association 2013a). Diabetes incidence varies by race/ethnicity, with non-Hispanic whites experiencing the lowest rates (7.1%), followed by Asians (8.4%), Hispanics (11.8%), blacks (12.6%), and American Indians (16.1%) (American Diabetes Association, 2013b). Diabetes is especially problematic among seniors; about 26.9% of individuals aged 65 and older have a diabetes diagnosis (American Diabetes Association, 2013a). Diabetes is associated with increased risk of morbidity and mortality, and the annual economic cost of diabetes in the US is estimated at $245 billion (American Diabetes Association, 2013a).

There are a number of health complications associated with diabetes, including heart, kidney, and nervous system disease, limb amputation, blindness, high blood pressure, and stroke (American Association of Clinical Endocrinologists, 2007; Karter et al., 2002; Torpy, 2011). Blacks and Hispanics disproportionately suffer from these complications (Harris, Eastman, Cowie, Flegal, & Eberhardt, 1999; Cowie et al., 1989; Harris et al., 1998), and racial/ethnic disparities in complications remain even among those with comparable health insurance coverage (Karter et al., 2002). Health care provider (HCP) contact for regular diabetes care is important because HCPs can monitor changes in status, educate and remind patients about proper home self-care, and treat harmful conditions when they arise (Mainous III, Koopman, Gill, Baker, & Pearson, 2004; Morrison, Shubina, Goldberg, & Turchin, 2013). With proper care, diabetes-related morbidity and mortality can be greatly reduced, and living with the disease can become more manageable.

Research suggests that racial/ethnic minorities are less likely than whites to receive ambulatory care for a variety of chronic conditions and are less likely to obtain preventive health care services (Corbie-Smith, Flagg, Doyle, & O'Brien, 2002; Mayberry, Mili, & Ofili, 2000; Weinick, Zuvekas, & Cohen, 2000). Yet the extent to which these differences exist for diabetes care is unclear because prior research in this area has focused only on self-care behaviors, has been restricted to certain geographic areas, or has neglected Asians and Native Americans, the latter of which has the highest diabetes rate of any racial/ethnic group (Lee, Liu, & Sales 2006; Nwasuruba, Khan, & Egede 2007; Nwasuruba et al. 2009). This paper advances previous research on racial/ethnic disparities in diabetes care by identifying whether there are racial/ethnic differences in use of health care services for diabetes management among a large US sample of white, black, Hispanic, Asian, and Native American adults aged 65 and older, controlling for a number of socioeconomic, demographic, health behavior, and diabetes self-care characteristics.

Racial/Ethnic Differences in Health Care Utilization

Racial/ethnic disparities in health care access and utilization are well established. In their expansive review of the literature, Mayberry et al. (2000) concluded that blacks have less access to several diagnostic and therapeutic interventions. Corbie-Smith et al. (2002) note lower rates of blood pressure screening among Hispanics compared to whites, net of controls for a usual source of care. Among older adult who are diagnosed with lung cancer, blacks are less likely to receive surgical resection compared to whites, leading to lower black survival rates (Bach, Cramer, Warren, & Begg, 1999). There are also racial/ethnic disparities in influenza vaccination and lifetime pneumococcal vaccination (Chen, Fox, Cantrell, Stockdale, & Kagawa-Singer, 2007; Egede & Zheng, 2003; Singleton, Santibanez, & Wortley, 2005) and for utilization of

mammography, clinical breast exams, pap tests, and prostate antigen tests (Bigby & Holmes, 2005; Gilligan, Wang, Levin, Kantoff, & Avorn, 2004; Mayberry et al. 2000; Monnat, 2014; Musa, 2009).

Evidence of racial/ethnic disparities in health care service use for diabetes is limited and mixed. In a sample of white and black diabetics within an urban HMO, Wisdom et al. (1997) found no black-white differences in receipt of glycosylated hemoglobin tests, and in small samples of veterans, Smith et al. (2003) found no black-white differences in receipt of glycosylated hemoglobin tests or feet checks, and Jackson, Weinberger, Hamilton, and Edelman (2007) found that non-whites had about 2.5 times the odds of reporting the VA provided high quality diabetes care. Nationally representative studies have been rare. However, in two different national samples of whites, blacks, and Hispanics, Harris (2001) and Lee, Liu, and Sales (2006) found no racial/ethnic differences in HCP visits, receipt of glycosylated hemoglobin tests, and feet checks. Although this research has been important in providing comparisons of diabetes care across the three major racial/ethnic groups, it was not focused on older age groups where disparities that have manifested over the life course may be magnified, and it excluded Asians and Native Americans, the latter of which has the highest incidence of diabetes of any racial/ethnic group in the US (American Diabetes Association, 2013b).

Current Study

We frame our analysis of racial/ethnic differences in diabetes physician care using Andersen's Behavioral Model of Health Services Utilization (Andersen, 1995; Andersen & Newman, 1973; Phillips, Morrison, Andersen, & Aday, 1998). The Andersen model emphasizes individual-level health need factors – in this case, a diabetes diagnosis -, predisposing factors

related to individuals' preferences for health care or attitudes toward seeking care (e.g., age, gender, family status), and enabling/disabling factors that facilitate or inhibit use of care (e.g., SES, health insurance coverage, health care supply).

We focus on three types of health care service use for diabetes: number of times seen by a HCP for diabetes, number of times feet have been checked by an HCP, and number of visits for a glycosylated hemoglobin check. Based upon the Behavioral Model and the previous research discussed earlier, there are two competing hypotheses. First, given widespread disparities in use of various routine and preventive health care services net of access, we might anticipate that racial/ethnic minorities would have lower use of HCP diabetes care, net of controls for SES, insurance coverage, and other measures of access. On the other hand, given that racial/ethnic minorities disproportionately suffer from diabetes-related complications (Harris, Eastman, Cowie, Flegal, & Eberhardt, 1999; Cowie et al., 1989; Harris et al., 1998), their need for regular HCP management may be greater than that for whites, leading them to use HCP services more than whites. We tested these competing hypotheses among U.S. adults aged 65 and older using cross-sectional national data.

Methods

Data come from the 2008-2012 *Behavioral Risk Factor Surveillance System* (CDC, 2012). The BRFSS is a monthly telephone survey designed by the Centers for Disease Control and Prevention to collect information on health practices, risk behaviors and disease prevalence from adults in all 50 states, Washington DC, and US territories. The BRFSS is commonly used in publications in public health, sociology, and epidemiology (CDC, 2013). Information on research design, sampling procedures, and data collection can be obtained by visiting http://www.cdc.gov/brfss/.

Not all BRFSS modules are administered to all respondents every year. Over the course of the five years the diabetes module was available all but six states (Alaska, California, Colorado, Maryland, New York, and Rhode Island) used the optional module in their state survey disseminations. Our sample was restricted to individuals who indicated they were ever diagnosed with diabetes (except during pregnancy). Because the BRFSS does not specify Type 1 and Type II diabetes, we were unable to determine the distribution of types in our sample. Given that only about 5% of the US population is diagnosed with Type I diabetes (American Diabetes Association, 2013b), we are confident that our inability to distinguish between types did not influence our results.

We limited our sample to adults aged 65 and older because, at 26.9%, diabetes prevalence is the highest in this age group (American Diabetes Association, 2013b), and the mechanisms that facilitate use of health care for diabetes are likely to be different among older vs. younger populations because nearly all individuals aged 65 and older are eligible for health insurance coverage. In our weighted sample of those aged 65 and older, 98.4% of respondents indicated having health insurance.

Variables

Consistent with American Diabetes Association guidelines (2013a) and previous research (Nwasuruba et al., 2009), we used three dependent variables to measure use of health care for diabetes: number of times seen by a HCP for diabetes, number of times feet have been checked by a HCP, and number of times checked for glycosylated hemoglobin, all in the past 12 months. Information about other important diabetes services, including low-density lipoprotein (LDL) tests, nephropathy screening, and dilated eye exams, was not available.

Our independent variable was race/ethnicity: non-Hispanic whites (reference group), non-Hispanic blacks, Hispanics, Asians, and American Indians/Alaskan Natives. Respondents who identified as "other race" or "Multiracial" were omitted due to small sample sizes and the potential for substantial racial/ethnic variability in these response categories. We included several predisposing and enabling factors as control variables. Demographic predisposing factors included age, number of years since diabetes diagnosis, gender, marital status, children in the household, and metropolitan status. Socioeconomic status enabling factors included household income, educational attainment, and employment status. Health care access included health insurance status, access to at least one personal doctor, experiencing a cost barrier to obtaining medical care in the past year, and obtaining a routine physical health checkup in the past 2 years. Self-care behaviors, health behaviors, and health status included frequency of checking own feet for sores, frequency of checking own blood glucose level, smoking status, weight status, self-rated health, and currently taking insulin. We also controlled for survey year.

Statistical Analysis

We first present descriptive statistics (means or percentages) by racial/ethnic group for each of our outcomes and all control variables, indicating when blacks, Hispanics, Asians, or American Indians differed significantly from whites using two-tailed independent samples t-tests for means and proportions/percentages. We then present the results of our multivariate regression analyses. Because our outcomes are count variables, we employ poisson regression with a multiplicative overdispersion parameter to adjust for the overdispersion found in preliminary models. Diagnostic testing revealed these models to have the best fit. All models control for the

covariates listed above. All analyses were weighted with the BRFSS person weight to adjust for survey non-response and sampling bias. Tests for multicollinearity revealed no problems.

<Table 1 about here>

Findings

Descriptive Statistics

Table 1 displays weighted descriptive statistics for our sample of 37,705 respondents aged 65 and older. Over the past 12 months, respondents saw HCPs for diabetes on average 3.5 times, had a HCP check their blood sugar just under three times, and had a HCP check their feet for sores or other irritations 2.7 times. There were significant racial/ethnic differences in all three outcomes. Blacks and Hispanics had significantly more HCP visits for their diabetes and more blood sugar checks than whites, and blacks and American Indians had significantly more feet checks than whites. However, Asians had significantly fewer blood sugar checks than whites in these bivariate analyses. There are two other noteworthy findings. First, in terms of diabetes self-care, blacks, American Indians/Alaskan Natives, and Hispanics were all more likely than whites to check their feet for sores at least once per day, and blacks and Hispanics were more likely than whites to check their blood glucose levels at least once per day. Second, all four minority racial/ethnic groups have had diabetes longer than whites; whites have the shortest average number of years since diagnosis (12.9), while blacks, Asians, and American Indians/Alaskan Natives have had diabetes for an average of almost 16 years, and Hispanics have had diabetes for an average of nearly 14 years.

Multivariate Analysis

Results of the regression analyses are presented in Table 2. All three models adjust for all control variables discussed earlier. Results of the model for number of visits to a HCP for

diabetes (Model 1) show that blacks reported about 9% more and Hispanics reported about 15% more visits to an HCP over the past year than whites (ERs = 1.09 and 1.15). There were no significant differences between Asians and non-Hispanic whites or American Indians/Alaskan Natives and non-Hispanic whites.

<Table 2 about here>

Regression results predicting number of blood glucose checks by an HCP are presented in Model 2. As with number of HCP visits for diabetes, blacks and Hispanics reported significantly more HCP blood glucose checks than whites (5% more for blacks, 15% more for Hispanics). Despite bivariate results demonstrating significantly fewer blood glucose checks for Asians than for whites, Asians and American Indians/Alaskan Natives were not significantly different from whites in the adjusted regression analysis.

Finally, Model 3 displays the results of the analysis predicting number of HCP feet checks. Compared with whites, blacks reported about 9% more feet checks, and American Indians/Alaskan Natives reported about 28% more feet checks, but Hispanics reported 7% fewer feet checks. There were no significant differences in number of feet checks between Asians and whites.

Overall, the covariates demonstrated similar associations with all three outcomes. Individuals who were older had their blood glucose and feet checked more often, and those who have had diabetes longer utilized more HCP services for their diabetes. Individuals who are divorced/separated, living in a metro area, disabled, taking insulin, had a routine health checkup in the past 2 years, and who reported fair/poor health also reported significantly more diabetes-related HCP visits, more blood glucose checks, and more feet checks by an HCP. Household income was inversely associated with number of visits, blood glucose checks, and feet checks;

individuals in the lowest household income category had significantly more HCP interactions for diabetes than the other income groups. Though having at least one personal doctor was positively associated with number of feet checks, it was not associated with number of visits or blood glucose checks. Finally, there was a reciprocal relationship between diabetes self-care and number of HCP visits. Individuals who reported checking their feet for sores and checking their blood glucose daily had significantly more HCP visits for their diabetes, HCP feet checks, and HCP blood glucose checks than respondents who reported checking their feet and their blood glucose less frequently.

Discussion

Diabetes is a major US public health problem, and racial/ethnic minorities disproportionately suffer from diabetes, diabetes complications, and diabetes-related premature mortality (American Diabetes Association, 2013b). With proper care, diabetes-related morbidity and mortality can be greatly reduced. Using a large national sample (N=37,705) of US white, black, Hispanic, Asian, and Native American adults aged 65 and older who had been diagnosed with diabetes, we examined racial/ethnic differences in three types of health care use for diabetes management: number of times seen by an HCP for diabetes, number of times feet have been checked by a HCP, and number of visits for a glycosylated hemoglobin check (blood glucose). Based upon previous research on racial/ethnic disparities in access to and use of various health care services (Corbie-Smith et al., 2002; Mayberry et al., 2000; Weinick et al., 2000), one hypothesis was that blacks, Hispanics, Asians, and American Indian diabetics would use diabetes health care less frequently than white diabetics. Though Hispanics did report fewer HCP feet checks than whites, we also found partial support for our alternative hypothesis; blacks and

Hispanics had significantly more visits to a health care provider for their diabetes and significantly more blood glucose checks than whites, and blacks and Native Americans had significantly more HCP feet checks than whites, net of controls for a variety of access, sociodemographic, and health characteristics.

In addition to our finding of higher diabetes-related health care usage for racial minorities, we also found significantly higher diabetes health care usage among the lowest income respondents, suggesting higher use of care among more vulnerable populations overall. One the one hand, these findings are contrary to the framework of the Andersen model (Andersen, 1995). Racial/ethnic minorities and low-SES individuals are expected to face more barriers to health services utilization for various chronic conditions than non-Hispanic whites and individuals with higher SES, resulting in lower overall health care use (Corbie-Smith et al., 2002; Mayberry et al., 2000; Weinick et al., 2000). Indeed, our descriptive statistics demonstrated that blacks, Hispanics, and American Indians/Alaskan Natives were less likely than whites to have health insurance and a personal health care provider, and all four minority racial/ethnic groups were more likely than whites to have experienced a medical cost barrier in the past year. Consistent with the Andersen model, it may be that more severe complications from diabetes or advanced disease stage among these more vulnerable groups (Cowie et al., 1989; Harris et al., 1998; Harris et al., 1999; Karter et al., 2002) increase the *need* for greater interaction with health care providers, thereby necessitating greater use of care. In other words, one possibility for our findings may simply be that racial/ethnic minorities are at more advanced or severe stages of the disease. We found that all four minority racial/ethnic groups have had diabetes longer, on average, than whites, and that those who have had diabetes longer have more of all three types of visits. Controlling for number of years since diagnosis, however, did not

explain the higher use of health care services of diabetes among minority racial/ethnic groups relative to whites. McBean, et al. (2003) found that blacks and Hispanics had significantly greater odds than whites of having poor diabetes control. Other research demonstrates that compared to whites, blacks have poorer glycemic control (Harris, Cowie, & Howie, 1993; Harris et al., 1999). Given these disadvantages and because racial/ethnic minorities have been found to have more complications from diabetes than whites, HCPs may be increasingly aware of the need to be hyper-vigilant with these populations to prevent complications and more severe health problems. This may suggest that public health efforts to educate doctors about racially heterogeneous disease etiologies and care needs have been successful. Future research that controls for diabetes stage or severity may help to better elucidate whether disease severity mediates racial/ethnic differences in use of diabetes care.

Our findings also suggest a reciprocal relationship between self-care behaviors and diabetes-related HCP visits; those who visit the doctor for diabetes care services are more likely to engage in diabetes self-care. Given their greater level of interaction with HCPs, it is likely that these individuals receive more reminders and education about the importance of self-care and home monitoring practices. Accordingly, diabetes health care visits may serve as reinforcement to engage in self-care behaviors.

Our results should be considered in light of some limitations. First, although our sample is representative of 44 states and Washington, DC, it is not representative of the US as a whole. Because Hispanics represent large populations in two excluded states (California and New York), our sample underrepresents Hispanics. If Hispanics living in excluded states are more or less likely to use diabetes care than those living in included states, our results related to Hispanics would be biased. Second, as with all cross-sectional research, we are unable to draw

causal inferences about our findings. Third, the BRFSS does not distinguish between Type 1 and Type II diabetes. If there is a greater representation of Type I diabetes among certain racial/ethnic groups, this could also bias our results. Finally, the BRFSS provides self-reported health behaviors and outcomes rather than measurements drawn from medical reports. As a result, our outcomes may suffer from recall bias.

Despite these limitations, our findings contribute to the literature in a number of important ways and have salient implications for public health policy. First, while previous research in this area has often been restricted to blacks and whites in individual states or regions or specific populations (e.g., veterans, Medicaid-eligible), we use a large sample of white, black, Hispanic, Asian, and Native American adults, allowing us to posit some generalizability from our results. Second, we find evidence contrary to previous research that has suggested that blacks and Hispanics engage in less frequent diabetes self-care behaviors than whites (Karter et al. 2000; Nwasuruba et al. 2007; Nwasuruba et al. 2009; Thackery, Merrill, and Neiger 2004). Third, we find that blacks, Hispanics, and low income individuals have more health care visits for diabetes care. Future research should explore potential mediating factors in associations between race/ethnicity, socioeconomic status, and diabetes health care use, particularly stage and severity of the disease. If these populations are being checked more frequently by HCPs because of their likelihood to have more severe diabetes complications compared to whites, then public health efforts to educate both doctors and racial/ethnic minorities about the disproportionate burden of diabetes for these groups may be working. Continued diligence in targeting vulnerable populations may improve diabetes related complications disproportionately impacting these groups. Fourth, our results suggest the need for additional research on why, among individuals who have been diagnosed with diabetes, blacks and Hispanics have higher rates of mortality and

other complications from diabetes than whites, despite apparent higher use of health care services. Finally, it is possible that as access to care increases through the Affordable Care Act, quality of care may become the more important factor to explore. Given that racial/ethnic minorities appear to have similar or more access to health care for diabetes, but racial differences in diabetes-related morbidity and mortality remain, it is possible that differences in quality of care are more salient predictors of racial/differences in diabetes mortality and complications from diabetes. Thus, future research and policy should aim both to ensure equal access to diabetes care and develop mechanisms to improve *quality* of care.

Table 1. Distribution of Characteristics among US Respondents aged 65+ by Race/Ethnicity

	Full Sample (N=37,705)	non-Hispanic white (N=31,059)	non-Hispanic black (N=4,012)	Hispanic (N=1,580)	Asian (N=583)	AIAN (N=471)
OUTCOMES			Means and standard deviations and 95% confidence intervals			
# times been to HCP in past 12 months for diabetes	3.51 (4.39) 3.44-3.56	3.36 (4.02) 3.31-3.40	4.19 (5.11)*** 4.04-4.34	4.31 (7.87)*** 3.98-4.64	3.30 (4.72) 2.91-3.68	3.68 (3.86) 3.30-4.06
# times in past 12 months that HCP has checked blood sugar level (A1C)	2.93 (3.55) 2.90-2.97	2.86 (3.12) 2.82-2.89	3.25 (4.52)*** 3.12-3.38	3.50 (7.42)*** 3.18-3.81	2.58 (1.60)*** 2.44-2.71	3.07 (2.26) 2.84-3.29
# times in past 12 months that HCP has checked feet for sore or irritations	2.66 (4.22) 2.62-2.71	2.58 (4.09) 2.53-2.63	3.23 (4.82)*** 3.09-3.37	2.58 (4.28) 2.40-2.76	2.39 (4.07) 2.06-2.72	3.46 (6.35)** 2.83-4.10
CONTROL VARIABLES			Means and standard deviations or percentages			
Demographic						
Age	73.22 (6.19)	73.49 (6.16)	72.19 (6.05)***	72.28 (6.62)***	72.29 (6.26)***	71.04 (5.25)***
# years since diagnosis	13.37 (11.25)	12.90 (10.83)	15.71 (12.79)***	13.92 (13.30)***	15.77 (12.14)***	15.84 (12.26)***
Female	46.8	45.2	56.9***	49.9***	41.3	42.3
Marital Status						
married	60.1	62.3	42.8***	62.2	72.6***	62.6
divorced/separated	10.9	9.6	19***	14.5***	4.2***	11.2
widowed	24.8	24.3	32.1***	20.2***	14.5***	20.3*
never married	4.2	3.9	6.1***	3.1	8.8***	5.9
Children under 18 in household	4.4	3.4	10.6***	5.4***	5.2*	9.9***
Lives in a non-metropolitan area	22.6	12.3	12.3***	12.6***	7.4***	33.6***
Socioeconomic Status						
Household income						
less than $25,000	41.1	37.8	55.9***	58.5***	25.9***	55.7***
$25,000-49,999	34.7	36.3	29.5***	26.3***	29.1***	27.1***
$50,000-74,999	12.2	13.3	7.1***	7.7***	12.5	10.5*
$75,000 or more	12.0	12.6	7.5***	7.5***	32.6***	6.7***
Educational attainment						
less than high school	15.5	12.9	24.0***	35.6***	4.9***	26.6***

high school diploma/some college	61.4	63.4	58.2***	47.8***	33.3***	59.6
4-year college degree	23.1	23.8	17.7***	16.6***	61.8***	13.8***
Employment status						
employed	12.5	12.5	11.9	11.4	18.9***	10.4
unemployed, student, or homemaker	6.9	7.0	4.7***	11.3***	5.8	5.3
retired	74.9	75.9	73.8**	65.8***	69.1***	70.4*
disabled	5.8	4.7	9.5***	11.6***	6.2	13.8***
Health Care Access						
Has health insurance	98.4	98.8	97.9***	95.3***	97.2*	98.0
Has at least one personal HCP	97.7	98.0	97.0***	96.6**	95.1**	97.3
Exp. med cost barrier in past 12 mths	5.5	4.6	7.6***	10.2***	9.2***	16.5***
Obtained a routine physical health checkup in past 2 years	96.7	96.4	98.4***	96.0	97.6	96.0
Self-Care, Health Behaviors, Health Status						
Frequency of checking feet for sores						
at least once per day	65.2	63.8	73.4***	68.1**	60.8	72.2***
at least once per week	17.5	18.5	14.4***	12.2***	12.4***	15.0*
less frequently than once per week	6.2	6.3	5.4*	6.3	5.3	4.9
never	11.1	11.4	6.7***	13.4*	21.8***	7.9**
Frequency of checking blood glucose level						
at least once per day	65.1	63.8	73.3***	70.2***	50.1***	57.4**
at least once per week	19.6	20.2	17***	15.7***	19.9	16.4*
less frequently than once per week	6.6	6.9	4.3***	4.9***	11.9***	12.1***
never	8.7	9.0	5.4***	9.2	17.6***	14.1**
Fair/Poor self-rated health	41.8	40.0	48.7***	53.4***	32.8***	49.8***
Smoking status						
never smoked	43.1	41.5	46.4***	55***	56.6***	36.0*
former smoker	49.4	51.2	44.1***	39.0***	40.4***	47.9
current smoker	7.5	7.3	9.5***	6.0*	2.9***	16.2***
Weight status						
not overweight or obese	18.1	17.6	16.3*	22.1***	47.7***	18.0

overweight	38.1	38.9	36.4**	32.9***	33.5**	32.6**
obese	43.7	43.5	47.4***	45.1	18.8***	49.4*
Currently takes insulin	26.3	25.0	34.2***	29.1***	19.7**	28.2

Note: AIAN = American Indian/Alaska Native; HCP = health care provider

***p<.001; **p<.01, *p<.05; two-tailed tests separately compare each minority racial/ethnic group to non-Hispanic whites; weighted

Table 2. Event Ratios and 95% Confidence Intervals from Poisson Regression Models Predicting Racial/Ethnic Differences in use of Health Care Provider Services for Diabetes Management

	Model 1 Number of Visits to HCP for Diabetes	**Model 2 Number of times HCP checked Blood Glucose**	**Model 3 Number of times HCP Checked Feet**
	ER (95% CI)	ER (95% CI)	ER (95% CI)
INDEPENDENT VARIABLES			
Race/Ethnicity			
non-Hispanic white (ref)	-----	-----	-----
non-Hispanic black	1.09 (1.06-1.13)***	1.05 (1.01-1.09)**	1.09 (1.04-1.14)***
Hispanic	1.15 (1.10-1.21)***	1.15 (1.10-1.21)***	0.93 (0.87-0.99)*
Asian	1.06 (0.96-1.17)	0.93 (0.84-1.03)	1.02 (0.90-1.16)
American Indian/Alaska Native	1.04 (0.93-1.16)	1.04 (0.93-1.16)	1.28 (1.13-1.45)***
CONTROL VARIABLES			
Demographic			
Age	0.99 (0.97-1.01)	1.03 (1.01-1.05)**	1.06 (1.03-1.09)***
Number of years since diagnosis	1.01 (1.03-1.04)***	1.02 (1.01-1.02)***	1.04 (1.03-1.05)***
Female	0.10 (0.97-1.03)	1.00 (0.98-1.03)	0.94 (0.91-0.97)***
Marital Status			
married (ref)	-----	-----	-----
divorced/separated	1.15 (1.10-1.19)***	1.14 (1.10-1.18)***	1.178 (1.12-1.23)***
widowed	1.03 (0.10-1.06)	0.98 (0.95-1.01)	1.08 (1.03-1.12)***
never married	1.11 (1.05-1.18)***	1.06 (1.00-1.12)*	1.06 (0.99-1.14)
Children under 18 living in household	1.00 (0.95-1.06)	0.96 (0.91-1.01)	0.96 (0.89-1.03)
Lives in non-metropolitan area	0.91 (0.89-0.94)***	0.93 (0.90-0.95)***	0.87 (0.84-0.90)***
Socioeconomic Status			
Household income			
less than $25,000 (ref)	-----	-----	-----
$25,000-49,999	0.94 (0.91-0.96)***	0.94 (0.91-0.97)***	0.93 (0.89-0.96)***
$50,000-74,999	0.95 (0.91-0.99)*	0.95 (0.91-0.99)*	0.94 (0.90-0.10)*

$75,000 or more	0.90 (0.86-0.94)***	0.96 (0.92-1.01)	0.91 (0.86-0.97)**
Educational attainment			
less than high school (ref)	-----	-----	-----
high school diploma/some college	0.96 (0.93-0.99)**	0.99 (0.96-1.02)	1.05 (1.01-1.09)*
4-year college degree	1.03 (0.99-1.07)	1.05 (1.01-1.10)*	1.10 (1.05-1.16)***
Employment status			
employed (ref)	-----	-----	-----
unemployed, student, or homemaker	1.12 (1.05-1.18)***	1.06 (0.10-1.12)	1.03 (0.96-1.11)
retired	1.06 (1.02-1.10)**	1.03 (0.99-1.07)	1.03 (0.98-1.08)
disabled	1.34 (1.26-1.41)***	1.31 (1.24-1.39)***	1.28 (1.19-1.38)***
Health Care Access			
Has health insurance	0.99 (0.91-1.08)	1.01 (0.93-1.11)	0.93 (0.83-1.05)
Has at least one personal health care provider	1.03 (0.95-1.11)	0.97 (0.90-1.04)	1.48 (1.31-1.67)***
Experienced a medical cost barrier in the past 12 months	0.91 (0.87-0.96)***	0.88 (0.84-0.93)***	0.90 (0.85-0.97)**
Obtained a routine physical health checkup in past 2 years	1.08 (1.01-1.15)*	1.14 (1.07-1.22)***	1.35 (1.23-1.48)***
Self-Care, Health Behaviors, Health Status			
Frequency of checking feet for sores			
at least once per day (ref)	-----	-----	-----
at least once per week	0.96 (0.93-0.99)**	0.99 (0.96-1.02)	0.90 (0.86-0.94)***
less frequently than once per week	0.99 (0.94-1.04)	0.95 (0.91-1.00)	1.00 (0.95-1.07)
never	0.89 (0.86-0.93)***	0.89 (0.85-0.92)***	0.71 (0.67-0.76)***
Frequency of checking blood glucose level			
at least once per day (ref)	-----	-----	-----
at least once per week	0.94 (0.91-0.97)***	0.966 (0.94-0.10)*	0.88 (0.84-0.91)***
less frequently than once per week	0.78 (0.74-0.83)***	0.92 (0.87-0.96)***	0.82 (0.77-0.88)***
never	0.74 (0.70-0.78)***	0.87 (0.83-0.91)***	0.76 (0.71-0.81)***
Fair/Poor self-rated health	1.23 (1.20-1.26)***	1.13 (1.10-1.16)***	1.24 (1.20-1.28)***
Smoking status			
never smoked (ref)	-----	-----	-----
former smoker	0.10 (0.97-1.02)	1.02 (0.10-1.05)	1.03 (1.00-1.07)*
current smoker	1.02 (0.97-1.06)	0.99 (0.94-1.04)	0.99 (0.94-1.06)

Weight status			
not overweight or obese (ref)	-----	-----	-----
overweight	1.04 (1.01-1.08)*	1.05 (1.02-1.09)**	1.00 (0.96-1.05)
obese	1.02 (0.99-1.06)	1.04 (1.01-1.08)*	1.11 (1.06-1.15)***
Currently takes insulin	1.32 (1.28-1.35)***	1.14 (1.11-1.17)***	1.28 (1.24-1.33)***
SCALE	2.13	1.91	2.35

Note: ER = event ratio; CI = 95% confidence interval

[a] Event ratios represent 10 year age increments

[b] Event ratios represent 5 year increments for years since diagnosis

***p<.001; **p<.01, *p<.05; two-tailed tests; weighted

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