Impact of Health Insurance

The Association between Health Insurance Coverage and Diabetes Care; Data from the 2000 Behavioral Risk Factor Surveillance System

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Objective. To describe the association between type of health insurance coverage and the quality of care provided to individuals with diabetes in the United States.

Data Source. The 2000 Behavioral Risk Factor Surveillance System.

Study Design. Our study cohort included individuals who reported a diagnosis of diabetes ($n = 11,647$). We performed bivariate and multivariate logistic regression analyses by age greater or less than 65 years to examine the association of health insurance coverage with diabetes-specific quality of care measures, controlling for the effects of race/ethnicity, annual income, gender, education, and insulin use.

Principal Findings. Most individuals with diabetes are covered by private insurance (39 percent) or Medicare (44 percent). Among persons under the age of 65 years, 11 percent were uninsured. The uninsured were more likely to be African American or Hispanic and report low incomes. The uninsured were less likely to report annual dilated eye exams, foot examinations, or hemoglobin A1c (HbA1c) tests and less likely to perform daily blood glucose monitoring than those with private health insurance. We found few differences in quality indicators between Medicare, Medicaid, or the Department of Veterans Affairs (VA) as compared with private insurance coverage. Persons who received care through the VA were more likely to report taking a diabetes education class and HbA1c testing than those covered by private insurance.

Conclusions. Uninsured adults with diabetes are predominantly minority and low income and receive fewer preventive services than individuals with health insurance. Among the insured, different types of health insurance coverage appear to provide similar levels of care, except for higher rates of diabetes education and HbA1c testing at the VA.

Key Words. Quality of care, health insurance, diabetes

The underuse of recommended preventive practices is common among individuals with diabetes and may be responsible for less-than-optimal health outcomes (Harris 2000). Diabetes is the number one cause of blindness in the working-age population and contributes to nontraumatic amputations and new cases of end-stage renal disease (Harris 1995). Quality indicators focus

primarily on glycemic control, control of comorbid disease, and the provision of preventive services (Saaddine et al. 2002). National objectives outlined in Healthy People 2010 include increasing the proportion of persons with diabetes who (1) have an annual dilated eye exam to 75 percent, (2) have an annual foot examination to 75 percent, (3) have a glycosylated hemoglobin (HbA1c) measurement at least once a year to 50 percent, (4) perform self-monitoring of their blood glucose at least once daily to 60 percent, and (5) have taken a diabetes self-management class to 60 percent (Centers for Disease Control and Prevention [CDC] 2000b). Despite evidence that these practices are effective in reducing both the incidence and progression of diabetes-related complications, recent national data indicate a wide gap between current levels of practice and these 2010 targets (Saaddine et al. 2002).

Although there is evidence of sub-optimal quality of care provided to many individuals with diabetes, it is not clear whether certain health care systems are providing higher quality care than others. To our knowledge, no studies have examined the quality of health care by type of health insurance. Recent data from the 2000 Behavioral Risk Factor Surveillance System (BRFSS) allow for categorization of individuals by health insurance coverage including private, Medicare, Medicaid, or Indian Health Service (IHS), and the Department of Veterans Affairs (VA). The purpose of this study is to compare quality of care by type of health insurance among individuals with diabetes using nationally representative data from BRFSS.

METHODS

Data Source

We analyzed data from the 2000 BRFSS, a cross-sectional telephone survey of the civilian, noninstitutionalized adult population over the age of 18 years.

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This federally funded survey is conducted annually by the Centers for Disease Control and Prevention (CDC) (CDC 2000c). The survey selects state-specific probability samples of households using a multistage cluster design to produce a nationally representative sample. Each respondent is assigned a final sampling weight based on (1) his or her probability of selection and (2) a post-stratification factor to assure that the age and race distribution of the weighted sample agrees with population estimates from the U.S. Census Bureau. The BRFSS uses random-digit dialing within blocks of telephone numbers to identify a probability sample of households with telephones in each state. In each household, one adult is randomly identified and interviewed. The co-operation rate for the 2000 BRFSS was 53.2 percent (CDC 2000a). BRFSS data are in the public domain and this study was exempt from review by the Institutional Review Board.

Study Population

The survey has both a core set of questions asked annually in all states and optional modules from which individual states can choose. Respondents in all states were asked: "Have you ever been told by a doctor that you have diabetes?" If they answered affirmatively, they were considered to have diabetes and are included in our study cohort ($n = 11,647$). Insulin use was also assessed as a self-reported variable for individuals reporting a diagnosis of diabetes. In 2000, a module designed to collect data on clinical characteristics and diabetes-specific preventive care practices was administered in 44 states, the District of Columbia, Guam, and Puerto Rico. States not included in this analysis are Delaware, Kansas, Illinois, Maryland, New York, and Oregon. This module was administered to 86 percent ($n = 10,505$) of individuals with diabetes identified in the core questionnaire. We excluded from our analysis women who were told they had diabetes only during their pregnancy.

Study Variables

Independent Variables. We categorized the sample by demographic characteristics including age (greater or less than 65 years), race/ethnicity (white, Hispanic, African American, or other), annual income ($<$15,000$, between $15,000$ and $35,000$, $>$35,000$), gender, and education ($<$high school, high school, $>$high school) (Table 1). Insulin use was also included as a marker of disease severity.

Our main independent variable was type of health insurance coverage. All respondents were asked: "Have you ever served on active duty in the

Table 1:   Population Characteristics, Adults with Diabetes in the 2000 BRFSS

| Characteristic | BRFSS Sample Population, $n = 11,647$ | Weighted Proportion and U.S. Population Estimate, $n = 13,251,283$ | | Proportion by Age (Years) | |
	n	%	n	< 65	≥ 65
Age < 65[‡]	6,853	60	7,956,315	%	%
Race ethnicity[§]					
White	8,268	66	8,765,677	61	75*
Hispanic	1,220	15	1,940,687	18	9
African American	1,494	15	1,986,490	17	12
Other	590	4	489,239	4	3
Annual income[¶]					
$<$15,000	2,530	22	2,422,893	18	28*
$15,000–$35,000	4,021	42	4,736,024	38	50
$>$35,000	3,140	36	4,036,036	44	22
Gender					
Female	6,835	51	6,791,031	49	54[†]
Education					
$<$High school	2,825	24	3,246,424	21	31*
High school	3,864	33	4,303,978	32	33
$>$High school	4,915	43	5,663,073	47	36
Health insurance coverage[‖]					
Private	4,110	39	4,978,770	63	4*
Medicare	5,177	44	5,563,554	14	88
Medicaid/IHS	660	5	589,390	7	1
Uninsured	695	7	885,922	11	0.7
Some care VA	254	3	317,753	2	3
All care VA	281	2	264,995	2	2
Insulin use	3,087	28	3,189,828	29	27
Dilated eye exam in the past year	7,308	70	7,862,552	65	78*
Foot exam in the past year	6,550	65	7,023,422	63	67[†]
HbA1c test in the past year	7,171	75	8,288,573	78	71
At least daily glucose monitoring	5,296	50	5,561,433	49	51
Diabetes education	5,130	50	5,609,452	52	46*

χ^2: *$p<.001$; [†]$p<.05$.
[‡]Data available for $n = 11,600$.
[§]Data available for $n = 11,572$.
[¶]Data available for $n = 9,691$.
[‖]Data available for $n = 11,177$.
Note: column totals may vary because of missing data and rounding error.
BRFSS, Behavioral Risk Factor Surveillance System; IHS, Indian Health Service; VA, Veterans Affairs; HbA1c, hemoglobin A1c.

United States Armed Forces?" If they answered affirmatively and were not in active military service, they were considered to be a veteran and were then asked: "In the past 12 months, have you received some or all of your health care from VA facilities?" The health insurance status of individuals who reported that they had received some, but not all, of their care from the VA was classified as "some VA," even if they reported another type of health insurance. Sixteen percent ($n = 42$) reported private insurance and 67 percent ($n = 175$) reported dual coverage with Medicare. Because of small sample sizes, reservists and active military who reported other types of coverage from military sources were excluded from this analysis ($n = 55$).

Nonveteran health care coverage was ascertained using a series of questions. Respondents were asked: "Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or governmental plans such as Medicare?" Their responses were categorized: private insurance (either employer based or self-purchased), Medicare, Medicaid ($n = 605$), or the IHS ($n = 55$), other, or none. Individuals who reported "other" sources of health care coverage were not included in our analyses ($n = 135$). If respondents reported no insurance coverage at the time of the survey, they were considered to be uninsured. On the basis of self-report of the type of insurance that covered the majority of a respondent's health care, 11,177 individuals were assigned to one of the following mutually exclusive health insurance categories: Medicare, Medicaid or IHS, all care at the VA, some care at the VA, private insurance, or uninsured.

Data collected from the BRFSS questions related to diabetes diagnosis, sociodemographic information, and insurance coverage have good reproducibility and validity (Stein, Lederman, and Shea 1993; Stein et al. 1995). Using data from one state sample, the validity of self-reported data on having health insurance was high, compared with records from health plans, with a positive predictive value of 98 percent (Nelson et al. 2000). Five studies reported high overall reliability of the BRFSS question about a diagnosis of diabetes (κ: 0.60–0.86) (Nelson et al. 2001).

Dependent Variables. We studied five self-reported measures of diabetes self-management and preventive care practices that are used as national health goals and quality indicators in Healthy People 2010 (MMWR 2000). To assess quality of care, we examined three self-reported measures: (1) having a dilated eye exam within the past year, (2) at least one foot examination by a health professional during the previous 12 months, and (3) receipt of at least one HbA1c test during the previous 12 months. To assess diabetes

self-management we examined two self-reported measures: (1) performing home blood glucose monitoring at least once daily and (2) ever attending a diabetes education class.

Data Analysis

We performed bivariate and multivariate logistic regression analyses to determine the relationship between health insurance status and diabetes self-management and preventive care practices. Because the majority of persons over the age of 65 years were covered by Medicare, we conducted separate analyses for individuals greater or less than 65 years of age. All analyses took into account the complex survey design and weighted sampling probabilities and were performed using *SUDAAN* (1989) software. To assess the independent effects of type of health insurance, we performed logistic regression analysis for dichotomous categorical outcome variables (obtaining a dilated eye exam; receiving at least one foot exam, and reporting one or more HbA1c determinations during the previous year; performing home glucose monitoring at least once daily; and ever participating in a diabetes self-management class), controlling for the independent effects of race/ethnicity, annual income, gender, education, and insulin use. For all of these variables except income (data available for $n = 9,691$), data were missing for less than 1 percent of individuals, who were excluded from these analyses. If respondents did not know or had never heard of an HbA1c test, they were excluded from multivariate analysis ($n = 1,933$).

RESULTS

Demographic variables for individuals who reported a diagnosis of diabetes, the corresponding estimates for the U.S. population derived from the weighted sample of data, and proportions by age less than or greater than 65 years are displayed in Table 1. The majority of individuals with diabetes report private health insurance or Medicare coverage. Health insurance varied by age: 11 percent of those under the age of 65 years reported having no health insurance. Medicare covered the majority of individuals over the age of 65 years. The uninsured were almost all under 65 years of age, were more likely to be African American or Hispanic, and had lower incomes and less education than individuals with health insurance (data not shown).

     Table 2 displays the percentage of individuals under the age of 65 years who reported each self-management or preventive care practice by the type of

Table 2: Percentage of Individuals under Age 65 Years with Reported Service by Type of Insurance

	Total	Private	Medicare	Medicaid/ IHS	Uninsured	Some VA	All VA
				(%)			
Dilated eye exam/past year	65	69	68	67	42	74	67*
Foot exam/past year	63	64	65	62	48	74	84*
HbA1c/past year	78	82	74	70	65	81	92*
At least daily glucose monitoring	49	64	57	56	31	53	46*
Diabetes education	52	54	46	49	42	74	79*

χ^2: *$p<.001$.

IHS, Indian Health Service; VA, Veterans Affairs; HbA1c, hemoglobin A1c.

health insurance. Among individuals over age 65, we found no significant differences in the receipt of services by type of insurance with one exception: the small proportion of individuals reporting private insurance reported more HbA1c testing (data not shown).

Seventy percent of the total population reported a dilated eye exam during the previous year (Table 1). Among persons under 65 years of age, only 42 percent of the uninsured reported having a dilated eye exam within the last year, compared with 69 percent with private insurance (Table 2). In multivariate logistic regression analysis, the uninsured were less likely to have received a dilated eye exam in the past year compared with those with private insurance (OR: 0.4, 95% CI: 0.3, 0.6), controlling for the effects of gender, race/ethnicity, annual income, education, and insulin use (Table 3).

Sixty-five percent of the total sample reported having a foot exam within the last year (Table 1). Among individuals less than 65 years of age, the uninsured reported the lowest rates of foot exams (48 percent) and those who received care at the VA reported the highest (84 percent) (Table 2). In mulitivariate logistic regression analysis controlling for gender, race/ethnicity, annual income, education, and insulin use, the uninsured were less likely to report receiving a foot exam than those covered by private insurance (OR: 0.5, 95% CI: 0.3, 0.8) (Table 3). In both bivariate (data not shown) and multivariate analyses, African Americans and those using insulin were more likely to report receiving a foot exam.

Seventy-five percent ($n = 7,171$) of all respondents reported receiving at least one HbA1c test during the previous year, 9 percent ($n = 1,051$) reported not receiving an HbA1c test during the previous year, and 16 percent reported

Table 3: Diabetes Quality Indicators by Type of Health Insurance in Persons under the Age of 65 Years

Characteristic	Dilated Eye Exam in the Past Year		Foot Exam by Health Professional in the Past Year		HbA1c in the Past Year[‡]		Perform at Least Daily Blood Sugar Checks		Ever Had Diabetes Education	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Private					Reference					
Medicare	1.1	0.7, 1.8	0.9	0.6, 1.4	1.7[†]	1.1, 2.7	1.0	0.7, 1.7	0.7	0.5, 1.1
Medicaid/IHS	1.1	0.6, 1.9	0.7	0.4, 1.3	0.8	0.4, 1.4	1.0	0.7, 1.7	0.7	0.4, 1.2
Uninsured	0.4*	0.3, 0.6	0.5[†]	0.3, 0.8	0.4*	0.3, 0.7	0.6[†]	0.4, 0.9	0.8	0.5, 1.3
Some VA	1.2	0.5, 2.7	1.1	0.5, 2.9	3.4	1.0, 11.8	1.2	0.6, 2.6	3.8*	1.8, 8.0
All VA	1.0	0.5, 2.0	2.2	0.9, 5.8	3.0	0.8, 11	0.7	0.3, 1.4	3.5[†]	1.6, 7.8
Female	1.2	1.0, 1.6	1.0	0.8, 1.3	1.0	0.7, 1.4	1.4[†]	1.0, 1.6	1.4[†]	1.1, 1.8
White					Reference					
African American	1.3	1.0, 1.7	1.9*	1.4, 2.6	2.0[†]	1.3, 3.2	1.0	0.8, 1.3	1.5*	1.1, 1.9
Hispanic	0.8	0.5, 1.3	0.8	0.5, 1.2	2.0[†]	1.2, 3.2	0.3*	0.2, 0.4	0.9	0.6, 1.5
Other race	1.3	0.7, 2.2	1.9	1.0, 3.7	1.5	0.7, 3.1	0.9	0.5, 1.4	1.1	0.7, 1.9
<$15,000 annual income	0.7	0.4, 1.1	1.2	0.8, 1.9	0.5[†]	0.3, 0.8	1.2	0.8, 1.8	1.0	0.6, 1.4
$15–35,000 annual income	0.8	0.6, 1.1	1.1	0.8, 1.5	0.5*	0.3, 0.7	1.3	1.0, 1.7	1.2	0.9, 1.6
>$35,000 annual income					Reference					
<High school education	0.9	0.6, 1.5	0.9	0.6, 1.4	0.7	0.4, 1.0	0.6[†]	0.5, 0.9	0.6[†]	0.4, 1.0
High school education	0.9	0.7, 1.1	0.9	0.7, 1.2	0.9	0.6, 1.2	0.9	0.7, 1.1	0.8	0.7, 1.0
>High school education					Reference					
Insulin use	1.8*	1.4, 2.3	2.2*	1.7, 2.8	1.6[†]	1.1, 2.2	6.4*	4.9, 8.4	2.5*	2.0, 3.2

*$p < .001$;

[†]$p < .05$.

[‡]Data available for $n = 5,271$, compared with individuals who report no HbA1c testing in the previous year.

Note: OR >1 indicates a greater probability of receipt of quality care indicator as compared with the reference group.

HbA1c, hemoglobin A1c; IHS, Indian Health Service; VA, Veterans Affairs.

not knowing whether they received this test ($n = 1,933$). The uninsured reported the lowest rates of HbA1c testing (65 percent) and individuals served by the VA reported the highest (92 percent) (Table 2). In multivariate logistic regression analysis, the uninsured were less likely to report receipt of an HbA1c in the last year (OR: 0.4, 95% CI: 0.3, 0.7) compared with those with private insurance (Table 3).

Only 50 percent of the sample reported daily glucose monitoring (Table 1). The lowest rates for daily glucose monitoring were among the uninsured (31 percent) compared with 50 percent among those with private insurance. In multivariate logistic regression analysis, the uninsured were less likely to report daily glucose monitoring as compared with those with private insurance (OR: 0.6, 95% CI: 0.4, 0.9). Individuals with less than a high school education and those of Hispanic ethnicity were less likely to report home glucose monitoring.

Fifty percent of the total population reported ever attending a diabetes education class (Table 1). Among persons under age 65 years, the highest participation rates were reported at the VA (79 percent), with the lowest rates reported by the uninsured (42 percent). In multivariate analysis of individuals less than age 65 years, compared with individuals covered by private insurance, persons who received some or all of their care at the VA were more likely to report receiving diabetes education (OR: 3.8 and 3.5, respectively) (Table 3). Other groups more likely to report diabetes education include women, African Americans, and insulin users.

DISCUSSION

We found that an estimated 885,000 U.S. adults with diabetes were uninsured in 2000 and received significantly poorer quality health care than those with insurance. Most uninsured adults were under the age of 65 years, compared with the majority of individuals over 65 years who were covered by Medicare. As with previous studies (Harris 1999), we found that the uninsured were disproportionately from low-income and minority populations. Individuals without health insurance were less likely to report recommended annual dilated eye exams, foot exams, and HbA1c monitoring and were less likely to perform home glucose monitoring.

Among individuals with health insurance under the age of 65 years, we found no differences in reported annual rates of dilated eye exams, foot exams, or daily glucose monitoring between individuals covered by Medicare,

Medicaid/IHS, or the VA as compared with those with private insurance. In multivariate analysis, individuals under age 65 years who reported coverage by Medicare were more likely to report HbA1c testing, perhaps reflecting disability or disease severity that allowed them to qualify for Medicare. The highest rates for attending a diabetes education class, HbA1c testing, and foot exams were reported by individuals receiving care at the VA. These relatively high rates may reflect the fact that the VA is the largest integrated health system in the U.S. and has made a concerted effort to improve diabetes care (Krein et al. 2000). Overall, participation in diabetes self-management classes may also be increasing. Data from the 1989 National Health Interview Survey reported that only 35 percent of individuals with diabetes reported having attended a diabetes self-management class (Harris 1996), as compared with 50 percent of the population in this study.

Similar to results of previous studies (Cowie and Harris 1997), we found that a higher proportion of African Americans reported receiving diabetes education. In another nationally representative survey, blood glucose self-monitoring was also found to be less common among Mexican Americans (Harris 1999). In our study, African Americans were more likely to report foot examinations and HbA1c monitoring, perhaps reflecting the great burden of lower extremity disease (Rucker-Whitaker et al. 2003) and relatively poorer glucose control (Harris 1999) in this population.

To our knowledge, this is the first study to use national data to compare quality of care indicators and diabetes self-management by type of health insurance. Our data are consistent with previous reports on the underuse of preventive services for individuals with diabetes and sub-optimal quality of care provided to the uninsured (Beckles et al. 1998; Ayanian et al. 2000). Analysis of 1997 BRFSS data indicates that uninsured adults with diabetes were less likely than insured adults to have received important preventive services and that these deficiencies were more pronounced among long-term uninsured adults (Ayanian et al. 2000).

Our study has several limitations. The cohort does not include adults living in households without telephones, who represent about 5 percent of the U.S. population and are more likely to be poor, nonwhite, and residents of the South (CDC 2000). Because these populations are much more likely to be uninsured, we may have underestimated the proportion of individuals with no insurance. In addition, all data were obtained by self-report and are subject to recall and other biases. Sub-optimal response rates may also impact the generalizability of this sample. Self-report of preventive care measures could reflect a differential awareness of care provided, rather than actual care received.

Finally, because this is a cross-sectional survey, we could not draw conclusions about the impact of preventive services received on clinical outcomes.

In conclusion, we found some variation in the quality of care provided to individuals with diabetes by type of health insurance coverage. Individuals who received care at the VA reported the highest rates of diabetes self-management education, diabetic foot exams, and HbA1c testing. We found that the uninsured were primarily from low-income and minority populations and reported less diabetes care services than those with health insurance. Our findings suggest that providing improved access to high-quality care for uninsured adults with diabetes may increase use of important preventive care services that have been shown to improve care and prevent avoidable, serious, and costly complications (Ferris 1993; Litzelman et al. 1993; Diabetes Control and Complications Trial Research Group 1993).

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