Insurance Coverage and Diabetes Quality Indicators Among Patients in NHANES

Emily D. Doucette, MD; Joanne Salas, MPH; and Jeffrey F. Scherrer, PhD

ABSTRACT

Objectives: Individuals with diabetes have improved care when insured, but outcomes for type of insurance are mixed, and key quality measures have been limited to self-report in most nationally representative studies. This study aims to assess the association between the quality of diabetes care and type of health insurance.

Study Design: This is a cross-sectional, secondary analysis of the 2009-2010 and 2011-2012 National Health and Nutrition Examination Survey (NHANES) of adults aged 18 to 64 years with self-reported diabetes and either no insurance, Medicaid, or private insurance (n = 642).

Methods: Regression analysis was performed before and after adjusting for sociodemographics, chronicity, and severity of disease.

Results: Adjusted analysis indicates that participants with private insurance had 2.73 times (95% CI, 1.24-6.03) the odds of controlled blood pressure compared with the uninsured. Participants with Medicaid were more likely to have had a foot exam and an eye exam in the last year (foot exam: odds ratio (OR), 2.81; 95% CI, 1.28-6.14; eye exam: OR, 4.79; 95% CI, 2.89-7.95), as were patients with private insurance (foot exam: OR, 2.59; 95% CI, 1.71-3.93; eye exam: OR, 2.96; 95% CI, 1.77-4.96) compared with the uninsured. No other statistically significant relationships were observed.

Conclusions: Overall, patients with insurance were more likely to meet 3 of 5 quality indicators for diabetes care compared with those without insurance. Glycated hemoglobin was not different among insurance groups. Results support the conclusion that access to health insurance is associated with improved diabetes management. There was no evidence for differences in diabetes quality measures between the privately and publicly insured. Additional research is needed to determine optimal coverage to maximize care quality.

Am J Manag Care. 2016;22(7):484-490

Individuals with diabetes have improved quality of care measures when they are insured. The results of both a previous National Health and Nutrition Examination Survey (NHANES) analysis and a study at federally qualified health centers (FQHCs) showed that the uninsured are more likely to have poor glycemic control than the insured.[1,2] The latter found that those with diabetes and insurance versus those without insurance were more likely to have had glycated hemoglobin (A1C) and cholesterol testing.[2]

Quality indicators by type of insurance are less definitive. In a Medical Expenditure Panel Survey (MEPS) study, adults with diabetes covered by private insurance and Medicaid reported no difference in receipt of A1C testing and eye or foot exams, but Medicaid patients were less likely to receive cholesterol testing.[3] In a similar analysis, publicly insured patients with diabetes were more likely to have received a foot exam compared with the privately insured.[4] A Behavioral Risk Factor Surveillance System study indicated no differences in most quality-of-care measures among patients with different types of insurance.[5] A study of FQHCs showed that diabetes quality indicators did not differ between those with Medicaid and the uninsured, but patients with private insurance were significantly more likely to meet 6 indicators.[2] Overall, research demonstrates that any insurance is associated with greater odds of meeting quality indicators in diabetes; however, how private insurance compares with government insurance for these outcomes is still uncertain.

Although the above studies have compared self-reported receipt of diabetes quality measures by insurance type, no study has—to our knowledge—evaluated validated A1C control, validated blood pressure measurement, eye and foot exams, and receipt of diabetes education in the same cohort using nationally representative data. In addition, inconsistent reports contrasting private and public insurance warrant further investigation. Because standard diabetes care is usually covered by Medicaid plans, perhaps there should be

no difference in quality measures between the groups. Piette et al indicated no difference in medication underuse between individuals with private insurance versus Medicaid,[6] and Rice et al found that individuals with employer-based insurance versus Medicaid are equally likely to be taking medications for their diabetes.[7]

The present study uses 2009-2012 NHANES data to determine if the prevalence of meeting diabetes quality indicators differs among the uninsured, individuals with private insurance, and those with Medicaid, both before and after adjusting for confounders.

Take-Away Points

Individuals with diabetes have improved chronic disease measures when they are insured, but there is a lack of consensus regarding how private versus public insurance performs for diabetes quality indicators. We show that:

- There is no significant difference between Medicaid and private insurance groups for any of the quality indicators measured.
- Medicaid appears to be sufficient to address most chronic care needs for diabetes.
- As healthcare coverage expands through the Affordable Care Act and more patients obtain public or private insurance, diabetes quality of care indicators are likely to improve.

METHODS

Study Design

A cross-sectional, secondary analysis of the 2009-2010 (n = 10,537) and 2011-2012 (n = 9756) NHANES (n = 20,293) was conducted. NHANES uses a complex, stratified, multistage probability sampling design to track the health and nutritional status of the US noninstitutionalized civilian population on an annual basis, and includes data from interviews, physical examinations, and biological sampling.

Participants

From 10,675 adult respondents, aged 18 to 64 years, we selected 777 subjects who reported that a doctor told them they had diabetes. The sample was reduced to the 642 respondents who self-reported insurance status as either no insurance, Medicaid, or private insurance.

Exposure Variable

Participants were asked, "Are you covered by health insurance or some other kind of healthcare plan?" If they responded affirmatively, they were asked to indicate type of insurance coverage, which was classified as Medicaid (n = 125) or private insurance (n = 324). Those that answered "no" were classified as no insurance (n = 193).

Outcome Variables

The following diabetes quality indicators were measured: mean A1C, A1C >9% (defined as uncontrolled), mean systolic blood pressure, mean diastolic blood pressure, blood pressure <140/90 mm Hg (defined as controlled), receipt of an eye exam in the last year, receipt of a foot exam in the last year, and ever meeting with a diabetes educator.

Glycated hemoglobin was assessed as part of the laboratory component and was examined as a continuous variable and as a binary variable defined as A1C >9%. An A1C >9% has been defined as poor control by the Healthcare Effectiveness Data and Information Set (HEDIS) and the National Diabetes Quality Improvement Alliance (NDQIA)[8,9] and has been used to indicate poor control in previous studies.[1,10] Although the A1C goal for most patients is ≤7%, goal values for patients vary based on demographics, comorbidity, and life expectancy.[11] Glycated hemoglobin >9% was determined to be an appropriate population measure of poor control that accounts for this variation.

Blood pressure was taken as part of the mobile examination component. Three consecutive blood pressure readings were obtained after participants rested quietly in a seated position for 5 minutes. Average systolic and diastolic blood pressures were calculated from all available measurements. If average systolic blood pressure was less than 140 mm Hg and average diastolic pressure was less than 90 mm Hg, participants were classified as having controlled blood pressure consistent with the American Diabetes Association (ADA) *Standards of Medical Care in Diabetes – 2015* and the Eighth Joint National Committee *2014 Evidence-based Guideline for the Management of High Blood Pressure in Adults*.[11,12]

Receipt of an eye exam was self-reported in response to a question asking the participant to report the last time they had their pupils dilated for an eye exam. If the participant reported receiving such an exam within the last year, then eye exam within the last year was coded as "yes." Respondents self-reported the number of times in the last year that a doctor checked their feet for sores. If at least once, foot exam was coded as "yes." Both of these measures are commonly accepted diabetes quality indicators as outlined by HEDIS, NDQIA, and the ADA.[8,9,11] Participants were also asked to self-report how long ago they saw a diabetes educator (nurse educator, dietitian, or nutritionist). Participants were classified as ever seeing a diabetes educator if they indicated any time frame.

Covariates

We controlled for several demographic, behavioral, and comorbidity-related variables based on theoretical and empirical evidence that each is related to insurance status and diabetes quality of care measures.

Demographic characteristics included self-reported age, gender, education (less than high school, high school graduate/General Educational Development test, more than high school), marital status (married/living with partner, or otherwise), race/ethnicity (white, non-Hispanic, or otherwise), and poverty level. Poverty level was calculated from the ratio of family income to poverty guidelines. Values were grouped as <100%, 100% to 200% or >200% of poverty level.

Current smoking status was assessed from the cigarette-use questionnaire. Current smokers were participants who indicated that they smoke cigarettes every day or some days. Insulin use was included to adjust for severity of diabetes, as has been done in previous studies.[5] Participants were asked if they were taking insulin at the time of the survey and were coded as no insulin use or current insulin use. Comorbid medical conditions were modeled as the number of self-reported diagnoses for the following chronic medical conditions: hypertension, cardiovascular disease (coronary heart disease, angina, or myocardial infarction), stroke, heart failure, or lung disease (emphysema or chronic bronchitis). The Patient Health Questionnaire-9 was administered to participants during the mobile examination component. Scores ranged from 0 to 27, with scores of 15 or more indicating major depressive disorder.[13]

Missing Data

All 642 eligible participants contributed information where valid. The rates of missing values for the 642 eligible participants were as follows: A1C control, 5.76%; blood pressure control, 5.45%; foot exam, 0.62%; eye exam, 0.78%; and diabetes education, 0.16%. The percentage missing for covariates were: age, race/ethnicity, gender, and number of chronic medical conditions, all 0%; education, 0.31%; marital status, 0.93%; poverty level, 11.53%; smoking status, 0.47%; and major depressive disorder, 12.3%. Among each multivariate outcome model, the rates of missing values were as follows: A1C control, 7.0%; blood pressure control, 6.7%; foot exam, 1.9%; eye exam, 2.0%; and diabetes education, 1.4%. Per NHANES analytic guidelines, if 10% or less of data are missing for a variable, analysis without further adjustments is acceptable. An "unknown" category was added for major depressive disorder and poverty level to eliminate potential bias due to nonresponse. Sample sizes for multivariable outcome models were: A1C control, n = 597; blood pressure control, n = 599; foot exam, n = 630; eye exam, n = 629; and diabetes education, n = 633.

Data Analysis

Data were weighted and analyzed using the complex survey methodology procedures in SAS version 9.4 (SAS Institute, Cary, North Carolina), making estimates representative of the US population of individuals with diabetes aged 18 to 64 years. The complex sampling scheme and subsequent analyses account for sampling weights, stratification, and primary sampling units.

Diabetes quality indicators and covariates were compared among those with no insurance, Medicaid, and private insurance by weighted prevalence estimates or means with 95% CIs. Chi-squared and 1-way ANOVAs were used to compare insurance groups by categorical and continuous variables, respectively, at $\alpha = 0.05$. Bivariate logistic regression models were used to assess the relationship between insurance status and each diabetes quality indicator. Adjusted odds ratios (ORs) for the relationship between insurance status and each indicator were calculated using multivariable logistic regression models, adding all other covariates to the model.

RESULTS

Table 1 shows weighted prevalence estimates in the bivariate relationships between insurance status and covariates. There were statistically significant differences between groups for all covariate measures except current insulin use ($P = .179$). Weighted prevalence estimates for outcome measures are also shown in Table 1. The uninsured had higher diastolic blood pressures than the Medicaid and privately insured groups (75.1 mm Hg, 70.7 mm Hg, and 70.0 mm Hg, respectively; $P = .030$). Medicaid patients had the highest receipt of foot exams in the last year (73.4%), followed by the privately insured (65.7%), and those with no insurance (44.3%; $P < .001$). A similar trend was seen for eye exams in the last year, with prevalence rates of 69.3%, 62.2%, and 32.6%, respectively, for Medicaid, privately insured, and uninsured patients ($P < .0001$). Mean A1C and systolic blood pressure were not different among groups, and no other statistically significant differences among the groups were found.

Table 2 shows unadjusted ORs for the outcome measures by insurance type, and Table 3 shows adjusted ORs for outcome measures and covariates, by insurance type, for diabetes quality measures. After adjustment for all reported covariates, those with private insurance had 2.73 times (95% CI, 1.24-6.03) the odds of controlled blood

Table 1. Weighted Prevalence Estimates (95% CI) of Covariates and Outcomes, Overall and by Insurance Status, for NHANES 2009-2012 Data, Participants Aged 18 to 64 Years With Diabetes (n = 642)

Variable, % (95% CI)	Overall (n = 642)	No Insurance (n = 193)	Medicaid (n = 125)	Private Insurance (n = 324)	*P*
Covariates					
Mean age	51.2 (49.-52.4)	48.4 (46.2-50.5)	50.1 (47.7-52.4)	52.5 (50.8-54.2)	.003
Gender (male)	50.3 (45.4-55.3)	49.7 (40.2-59.1)	28.5 (19.2-37.8)	55.5 (49.1-62.0)	<.0001
Education					<.0001
Less than high school	24.1 (18.3-29.9)	35.1 (23.8-46.3)	44.0 (32.4-56.9)	15.4 (9.8-20.9)	
High school grad/GED	26.1 (19.6-32.7)	25.0 (15.7-34.3)	21.7 (13.9-30.0)	27.5 (18.7-36.2)	
More than high school	49.7 (43.1-56.3)	39.9 (30.6-49.2)	33.4 (19.3-47.4)	57.1 (49.0-65.2)	
Marital status (married/partnered)	60.6 (56.0-65.2)	53.8 (43.5-64.2)	30.5 (18.9-42.1)	70.0 (63.7-76.4)	<.0001
Race (white, non-Hispanic)	55.0 (47.0-63.0)	35.7 (19.7-51.7)	35.3 (22.3-48.3)	66.7 (59.3-74.1)	<.0001
Poverty level					<.0001
0%-100%	19.2 (14.0-24.5)	34.2 (25.6-42.8)	58.4 (47.6-69.1)	4.8 (1.7-7.9)	
101%-200%	19.3 (14.5-24.0)	35.1 (23.8-46.4)	21.6 (13.7-29.5)	12.8 (8.1-17.5)	
>200%	54.3 (46.8-61.8)	20.3 (9.6-30.9)	11.3 (0.0-23.7)	76.8 (70.1-83.5)	
Unknown	7.2 (4.8-9.6)	10.4 (3.8-17.0)	8.8 (4.3-13.2)	5.6 (3.1-8.1)	
Current smoker	21.8 (18.3-25.4)	22.5 (14.7-30.2)	33.2 (23.6-42.8)	19.0 (13.8-24.2)	.038
Current insulin use	31.0 (26.8-35.3)	25.6 (14.8-36.5)	42.3 (31.2-53.5)	30.5 (23.3-37.7)	.179
Mean number of medical conditions	1.0 (0.9-1.1)	0.8 (0.7-1.0)	1.6 (1.4-1.8)	0.9 (0.8-1.0)	<.0001
Major depressive disorder					<.0001
No	85.3 (81.6-89.0)	82.1 (75.1-89.0)	64.5 (53.7-75.2)	91.3 (87.8-94.8)	
Yes	6.1 (3.6-8.7)	6.8 (0.5-13.2)	23.0 (12.4-33.6)	2.1 (0.7-3.4)	
Unknown	8.5 (6.2-10.8)	11.1 (6.3-15.9)	12.5 (6.8-18.1)	6.7 (3.6-9.7)	
Outcomes					
Mean A1C value	7.6 (7.4-7.8)	8.0 (7.5-8.5)	8.0 (7.3-8.7)	7.4 (7.1-7.6)	.106
A1C >9.0% (uncontrolled)	18.1 (14.4-21.7)	25.3 (16.7-33.9)	24.6 (9.4-39.9)	13.9 (7.9-19.9)	.103
Mean systolic blood pressure (mm Hg)	125.5 (123.4-127.6)	128.3 (124.5-132.1)	126.0 (122.5-129.6)	124.3 (121.9-126.7)	.138
Mean diastolic blood pressure (mm Hg)	71.3 (69.7-72.8)	75.1 (71.8-78.4)	70.7 (67.4-73.9)	70.0 (68.1-71.8)	.030
Blood pressure <140/90 mm Hg (controlled)	79.7 (74.4-84.9)	73.4 (62.8-84.0)	80.9 (72.7-89.1)	81.7 (75.6-87.8)	.183
Foot exam last 12 months	61.8 (55.0-68.5)	44.3 (35.0-53.5)	73.4 (62.6-84.2)	65.7 (56.4-75.0)	<.001
Eye exam last 12 months	56.3 (50.8-61.8)	32.6 (25.3-39.8)	69.3 (60.7-77.9)	62.2 (55.0-69.4)	<.0001
Diabetes educator (ever)	41.1 (36.0-46.2)	41.6 (31.3-51.8)	47.1 (36.5-57.7)	39.5 (32.1-46.)	.562

A1C indicates glycated hemoglobin; GED, General Educational Development test; NHANES, National Health and Nutrition Examination Survey.

pressure compared with the uninsured. Medicaid patients were significantly more likely to have had a foot exam (OR, 2.81; 95% CI, 1.28-6.14) and an eye exam (OR, 4.79; 95% CI, 2.89-7.95) in the last year compared with the uninsured. Privately insured patients were also more likely to have had a foot exam (OR, 2.59; 95% CI, 1.71-3.93) and an eye exam (OR, 2.96; 95% CI, 1.77-4.96) in the last year compared with the uninsured. There were no other statistically significant relationships. There was no significant difference between the Medicaid and private insurance groups for any of the quality indicators measured.

DISCUSSION

In a sample of 642 individuals with diabetes aged 18 to 64 years in the 2009-2010 and 2011-2012 NHANES, we found no significant association between insurance status and uncontrolled A1C. Privately insured individuals were more likely to have controlled blood pressure compared with the uninsured, and both Medicaid and privately insured individuals were more likely to have had a foot and eye exam in the last year compared with the uninsured. We found no difference in compliance with diabetes qual-

Table 2. Weighted Crude Odds Ratios (95% CI) for Relationship Between Insurance Status and Diabetes Outcomes, for NHANES 2009-2012 Data, Participants Aged 18 to 64 Years With Diabetes (n = 642)[a]

Outcome, OR (95% CI)	No Insurance (n = 193)	Medicaid (n = 125)	Private Insurance (n = 324)
A1C >9.0% (uncontrolled)	1.00	0.97 (0.36-2.63)	0.48 (0.25-0.91)[b]
Blood pressure control (<140/90 mm Hg)	1.00	1.54 (0.95-2.49)	1.62 (0.87-3.01)
Foot exam last 12 months	1.00	3.47 (1.70-7.08)[b]	2.41 (1.49-3.92)[b]
Eye exam last 12 months	1.00	4.67 (2.89-7.53)[b]	3.41 (2.26-5.14)[b]
Diabetes educator (ever)	1.00	1.25 (0.65-2.40)	0.92 (0.56-1.52)

A1C indicates glycated hemoglobin; NHANES, National Health and Nutrition Examination Survey; OR, odds ratio.
[a]*P* value comparing private insurance with Medicaid: A1C >9.0%, *P* = .221; blood pressure control, *P* = .872; foot exam, *P* = .290; eye exam, *P* = .171; diabetes educator, *P* = .256.
[b]*P* <.05.

ity indicators between the Medicaid and privately insured groups when comparing them directly.

Our results show consistencies and differences with previous studies. In an assessment of the 2007-2008 and 2009-2010 MEPS, Ali et al found adjusted prevalences of uncontrolled A1C to be 20.7% for the uninsured and 9.5% for the privately insured.[10] Our study showed the weighted prevalence estimates of uncontrolled A1C to be 25.3% for the uninsured and 13.9% for the privately insured, consistent with previous results. However, contrary to our results, Zhang et al found that the privately insured were significantly less likely to have uncontrolled A1C compared with the uninsured when controlling for confounders.[2] The measures of effect were similar between Zhang et al and our studies (Zhang et al: OR, 0.63; 95% CI, 0.42-1.00; this study: OR, 0.50; 95% CI, 0.24-1.03). Zhang et al defined uncontrolled A1C as >9.5% while we defined uncontrolled A1C as >9.0%, which might explain this difference.

No known study has compared blood pressure control by insurance type in patients with diabetes. This study indicates that the privately insured are more likely to have controlled blood pressure than the uninsured, but there was no significant difference between the privately insured and Medicaid groups. This finding, combined with the rigorous method used to obtain blood pressures in NHANES, provides novel evidence that private insurance is associated with greater likelihood that patients with diabetes achieve blood pressure control compared with the uninsured.

Most previous studies indicate that the rate of foot and eye exams is similar among holders of different types of insurance, although Richard et al found that publicly insured patients with diabetes were more likely to have foot exams performed compared with privately insured patients.[4] Our findings indicate that Medicaid and privately insured patients are more likely to receive both foot and eye exams compared with the uninsured, and that there is no difference between the Medicaid and privately insured groups. The difference in findings between studies may be related to use of different data sets (MEPS vs NHANES), differences in time periods (2005-2007 vs 2009-2010 and 2011-2012), and different inclusion criteria (aged 18 years or older vs 18-64 years). One previous study compared diabetes education by insurance type. Nelson et al reported no differences in ever meeting with a diabetes educator among uninsured, privately insured, and Medicaid patients,[5] and our results support this finding.

Based on weighted prevalence estimates, Medicaid patients were more likely to be female, less educated, single, of minority race/ethnicity, and living in poverty compared with their uninsured and privately insured counterparts. They also have higher rates of comorbid medical conditions. This trend is consistent with previous knowledge that Medicaid patients are a high-risk group with complex medical needs.

Limitations

Our study has several limitations. First, 3 of our 5 outcomes, as well as inclusion variables, were self-reported, are subject to recall bias, and might not accurately reflect care received or correct categorization. Further, 17.4% of patients with self-reported diabetes did not provide insurance type or had an insurance type that was not assessed in this study, which introduces bias secondary to nonresponse. Because this is a cross-sectional study, we cannot make causal claims about insurance status and diabetes quality measures. Despite efforts to control for covariates, uncontrolled variables could remain, although some unmeasured variables were likely controlled by proxy with measured covariates. Strengths of this study include national generalizability to patients with diabetes aged 18 to 64 years in the United States.

CONCLUSIONS

The proportion of individuals with diabetes who have health insurance has remained relatively stable over the past few decades, but the absolute number of those with diabetes has increased more than 3-fold, leading to an in-

Table 3. Weighted Adjusted Odds Ratios (95% CI) for Relationship Between Insurance Status and Diabetes Outcomes, for NHANES 2009-2012 Data, Participants Aged 18 to 64 Years With Diabetes (n = 642)[a]

	Outcome				
Variable, OR (95% CI)	A1C >9.0%	Blood Pressure <140/90 mm Hg	Foot Exam Last 12 Months	Eye Exam Last 12 Months	Diabetes Educator (ever)
Insurance status					
No insurance	1.00	1.00	1.00	1.00	1.00
Medicaid	0.58 (0.16-2.07)	1.54 (0.93-2.57)	2.81 (1.28-6.14)[b]	4.79 (2.89-7.95)[b]	1.33 (0.63-2.79)
Private	0.50 (0.24-1.03)	2.73 (1.24-6.03)[b]	2.59 (1.71-3.93)[b]	2.96 (1.77-4.96)[b]	1.02 (0.55-1.89)
Age	0.97 (0.94-1.00)	0.94 (0.91-0.97)[b]	1.01 (0.99-1.04)	1.01 (0.98-1.04)	0.97 (0.95-0.99)[b]
Gender (male)	1.37 (0.80-2.35)	0.42 (0.24-0.75)[b]	0.77 (0.48-1.22)	0.59 (0.33-1.06)	0.96 (0.61-1.51)
Education					
Less than high school	1.00	1.00	1.00	1.00	1.00
High school grad/GED	1.16 (0.49-2.77)	1.11 (0.54-2.26)	0.75 (0.38-1.50)	1.39 (0.68-2.82)	0.71 (0.42-1.21)
More than high school	0.70 (0.39-1.26)	1.23 (0.65-2.33)	1.84 (1.03-3.29)[b]	2.10 (1.27-3.47)[b]	1.08 (0.66-1.75)
Marital status (married/partnered)	0.75 (0.37-1.51)	0.83 (0.41-1.65)	1.17 (0.74-1.85)	0.90 (0.51-1.56)	0.93 (0.59-1.48)
Race (white, non-Hispanic)	0.38 (0.24-0.59)[b]	1.84 (1.02-3.32)[b]	0.86 (0.44-1.68)	0.80 (0.46-1.39)	0.76 (0.47-1.24)
Poverty level					
0%-100%	1.00	1.00	1.00	1.00	1.00
101%-200%	1.05 (0.51-2.17)	0.80 (0.39-1.63)	0.80 (0.40-1.62)	1.32 (0.88-1.98)	1.31 (0.78-2.20)
>200%	1.81 (0.77-4.28)	0.40 (0.19-0.84)[b]	0.71 (0.36-1.43)	1.42 (0.74-2.70)	1.27 (0.72-2.22)
Unknown	1.84 (0.67-5.04)	0.79 (0.28-2.25)	0.92 (0.34-2.51)	1.21 (0.56-2.62)	1.87 (1.02-3.43)[b]
Current smoker	1.19 (0.59-2.42)	1.85 (0.85-4.03)	1.02 (0.48-2.18)	0.60 (0.33-1.10)	0.66 (0.33-1.33)
Current insulin use	4.27 (2.13-8.54)[b]	0.91 (0.51-1.62)	2.28 (1.24-4.19)[b]	1.96 (1.01-3.78)[b]	1.97 (1.21-3.22)[b]
Medical conditions	1.21 (0.86-1.71)	0.77 (0.50-1.20)	1.30 (0.99-1.70)	1.08 (0.86-1.36)	1.09 (0.82-1.46)
Major depressive disorder					
No	1.00	1.00	1.00	1.00	1.00
Yes	2.29 (0.82-6.44)	0.47 (0.20-1.12)	0.71 (0.20-2.50)	1.10 (0.34-3.63)	0.59 (0.29-1.20)
Unknown	1.75 (0.67-4.55)	1.37 (0.58-3.24)	0.68 (0.27-1.73)	1.10 (0.56-2.17)	0.78 (0.45-1.38)

A1C indicates glycated hemoglobin; GED, General Educational Development test; NHANES, National Health and Nutrition Examination Survey; OR, odds ratio.
[a] *P* value comparing private insurance with Medicaid: A1C >9.0%, *P* = .858; blood pressure control, *P* = .204; foot exam, *P* = .814; eye exam, *P* = .172; diabetes educator, *P* = .539.
[b] *P* <.05.

creasing number of uninsured individuals with diabetes.[14] As more uninsured patients with diabetes become insured through Medicaid expansion and private insurance plans offered through the Affordable Care Act, evidence indicating which types of insurance coverage are associated with the best adherence to quality measures for diabetes is important. Patients with Medicaid have the same compliance with diabetes measures, compared with the privately insured, after controlling for confounders, including race and education. This finding suggests that key elements of Medicaid must be sufficient to achieve the studied diabetes quality indicators. If the source of the insurance plan is less important that the coverage itself, perhaps improving access to both public and private insurance through the Affordable Care Act is the best immediate step forward to improve diabetes quality indicators.

Future studies that compare plan design and coverage factors in both private and public insurance might clarify what components of an insurance plan are most important for patients to meet quality indicators in diabetes. Studies could also explore if other chronic disease measures perform equally well in private versus public insurance. As the emphasis on monitoring quality indicators for chronic diseases increases, placing focus on the multifactorial patient, provider, and coverage factors that affect compliance with these measures will be important to improve outcomes and better understand barriers to quality care.

Author Affiliations: Department of Family and Community Medicine, Saint Louis University School of Medicine (EDD, JS, JFS), St. Louis, MO.

Source of Funding: None.

Author Disclosures: The authors report no relationship or financial interest with any entity that would pose a conflict of interest with the subject matter of this article.

Authorship Information: Concept and design (EDD, JS, JFS); acquisition of data (EDD, JS); analysis and interpretation of data (EDD, JS, JFS); drafting of the manuscript (EDD, JS); critical revision of the manuscript for important intellectual content (JS, JFS); statistical analysis (JS); provision of patients or study materials (EDD, JS); administrative, technical, or logistic support (JFS).

Address correspondence to: Emily D. Doucette, MD, Department of Family and Community Medicine, Saint Louis University School of Medicine, 1402 South Grand Blvd, St. Louis, MO 63104. E-mail: edoucett@slu.edu.

REFERENCES

1. Zhang X, Bullard KM, Gregg EW. Access to health care and control of ABCs of diabetes. *Diabetes Care.* 2012;35(7):1566-1571. doi: 10.2337/dc12-0081.

2. Zhang JX, Huang ES, Drum ML, et al. Insurance status and quality of diabetes care in community health centers. *Am J Public Health.* 2009;99(4):742-747. doi: 10.2105/AJPH.2007.125534.

3. Hu R, Shi L, Rane S, Zhu J, Chen CC. Insurance, racial/ethnic, SES-related disparities in quality of care among US adults with diabetes. *J Immigr Min Health.* 2014;16(4):565-575. doi: 10.1007/s10903-013-9966-6.

4. Richard P, Alexandre PK, Lara A, Akamigbo AB. Racial and ethnic disparities in the quality of diabetes care in a nationally representative sample. *Prev Chronic Dis.* 2011;8(6):A142.

5. Nelson KM, Chapko MK, Reiber G, Boyko EJ. The association between health insurance coverage and diabetes care; data from the 2000 Behavioral Risk Factor Surveillance System. *Health Serv Res.* 2005;40(2):361-372.

6. Piette JD, Wagner TH, Potter MB, Schillinger D. Health insurance status, cost-related medication underuse, and outcomes among diabetes patients in three systems of care. *Med Care.* 2004;42(2):102-109.

7. Rice T, Lavarreda SA, Ponce NA, Brown ER. The impact of private and public health insurance on medication use for adults with chronic diseases. *Med Care Res Rev.* 2005;62(2):231-249.

8. Healthcare Effectiveness Data and Information Set diabetes mellitus measures, 2013. National Committee for Quality Assurance website. http://www.ncqa.org/Portals/0/HEDISQM/DM_2013_Measures_9.13.12.pdf. Accessed January 29, 2015.

9. Ahmann AJ. Guidelines and performance measures for diabetes. *Am J Manag Care.* 2007;13(suppl 2):S41-S46.

10. Ali MK, McKeever Bullard K, Imperatore G, Barker L, Gregg EW; CDC. Characteristics associated with poor glycemic control among adults with self-reported diagnosed diabetes—National Health and Nutrition Examination Survey, United States, 2007-2010. *MMWR Suppl.* 2012;61(2):32-37.

11. Cefalu WT. American Diabetes Association standards of medical care in diabetes - 2015. *Diabetes Care.* 2015;38(suppl 1):S1-S93.

12. James PA, Oparil S, Carter BL, et al. 2014 evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the Eighth Joint National Committee (JNC 8). *JAMA.* 2014;311(5):507-520. doi: 10.1001/jama.2013.284427.

13. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med.* 2001;16(9):606-613.

14. Ekperi LI, Greene S, Dehal A, Lòpez-De Fede A, Zhang J. Health insurance coverage among diabetic adults from three major ethnic groups in the United States. *Ethn Dis.* 2012;22(4):486-491. ■

www.ajmc.com Full text and PDF