The Influence of Health Insurance Stability on Racial/Ethnic Differences in Diabetes Control and Management

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Objective: This study examined whether health insurance stability was associated with improved type 2 diabetes mellitus (DM) control and reduced racial/ethnic health disparities.

Methods: We utilized electronic medical record data (2005-2013) from two large, urban academic health systems with a racially/ethnically diverse patient population to examine insurance coverage, and three DM outcomes (poor diabetes control, A1c ≥8.0%; very poor diabetes control A1c >9.0%; and poor BP control, ≥ 130/80 mm Hg) and one DM management outcome (A1c monitoring). We used generalized estimating equations adjusting for age, sex, comorbidities, site of care, education, and income. Additional analysis examined if insurance stability (stable public or private insurance over the six-month internal) moderates the impact of race/ethnicity on DM outcomes.

Results: Nearly 50% of non-Hispanic (NH) Whites had private insurance coverage, compared with 33.5% of NH Blacks, 31.5% of Asians, and 31.1% of Hispanics. Overall, and within most racial/ ethnic groups, insurance stability was associated with better glycemic control compared with those with insurance switches or always being uninsured, with uninsured NH Blacks having significantly worse BP control. More NH Black and Hispanic patients had poorly controlled (A1c≥8%) and very poorly controlled (A1c>9%) diabetes across all insurance stability types than NH Whites or Asians. The interaction between insurance instability and race/ethnic groups was statistically significant for A1c monitoring and BP control, but not for glycemic control.

Conclusion: Stable insurance coverage was associated with improved DM outcomes

Background

The rising prevalence of type 2 diabetes mellitus (DM) in the United States, particularly among racial/ethnic minorities, and the consequent health care and financial burden it places on the US health care system is of increasing concern.[1] By 2050, the Centers for Disease Control and Prevention estimates that one third of US adults will have DM, with racial and ethnic minorities bearing a disproportionate burden of the diabetes epidemic.[2] While glycemic control among those diagnosed with diabetes has improved over the years, some

studies suggest the disparities in diabetes control and outcomes between Whites and other racial/ethnic groups have either stayed the same or, in the case for Hispanics, widened.[3] Access to clinical care and insurance status, which are influenced by system-level policies, are aspects of social determinants of health that impact health outcomes and contribute to health disparities in the United States.[4]

A growing body of research suggests that insurance stability in general improves clinical care and practice around the management of diabetes[5-9]; however, most of the existing studies are cross-sectional and

therefore limited to examining current insurance coverage and diabetes outcomes instead of insurance changes over time. One such study examined trends in diabetes control by race/ethnicity and education from 1999 to 2006, but only looked at the effects of Medicare coverage and not changes in insurance status overall.[3] Another cross-sectional study found an association between insurance

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coverage, race, socioeconomic status and quality of care for diabetes; however, differences by race/ethnicity and socioeconomic status were not statistically significant across all multivariable analysis.[7] Increased health care access through stable health insurance may be a potential solution to improve poor diabetes outcomes in racially/ethnically diverse patients.[7] While insurance reforms – beginning at the state level in Massachusetts in 2006 and then expanding nationally with the Affordable Care Act in 2014—have increased rates of insurance coverage, they may increase instability or switches and

gaps in coverage, and thereby reduce access to care and the overall quality of an individual's care.[10-12]

Very few studies examine insurance stability explicitly as it relates to addressing racial/ethnic health disparities and DM specifically. We aimed to assess DM care outcomes and processes by health insurance stability status among a racially and ethnically diverse patient population. We hypothesized that stable health insurance coverage would improve both the processes and outcomes of DM care and help to reduce racial/ethnic disparities.

Methods

Study Population

We focused our analyses on patients with a diagnosis of type 2 DM receiving care in primary care practices (internal medicine and family medicine) . We utilized data from two large, urban academic health centers and six affiliated community health centers with racially/ethnically diverse patient populations. Both academic health centers provide disproportionate care to those with Medicaid and who are uninsured, and specifically serve populations who benefit from insurance reform and who were at risk of insurance instability. Inclusion criteria were having a type 2 DM diagnosis (ICD9 codes 249, 250, 250.x, 250.x0, 250.x2 on billing records or problem lists) and being aged 18-64 years. We excluded patients once they reached 65 years, due to Medicare eligibility and corresponding lack of risk for loss of insurance. Racial/ethnic groups in

the study included: non-Hispanic (NH) Whites, non-Hispanic (NH) Blacks, Asian/Pacific Islanders and Hispanics. Patients were excluded if their race/ethnicity was missing (n=2,335, 12.3%) or in the unspecified "other" (n=689, 3.46%) category.

Data

We utilized electronic medical record (EMR) and billing data from January 2005 through December 2013. Use of billing records ensured that we captured the payer and insurance type for each point of care. We divided each individual's longitudinal record of care into two six-month intervals per calendar year (January – June and July – December), which served as the unit of analysis.

Measures

Based on individual insurance coverage at each primary care visit, we categorized insurance stability status as four separate categories during each six month interval: 1) always private (employer based or individual coverage without subsidies); 2) always public (Medicaid, Medicare, or subsidized such as Commonwealth Care[13]); 3) insurance switch (uninsured to insured; switch between insurance categories; or insured to uninsured); or 4) always uninsured. Switches within the same category, such as one private insurance policy to another with a change in employment, were not considered an insurance switch. The insurance stability status categories were determined by comparing each primary care visit to the previous primary care visit, whether or not the visits were in the same interval. Individuals were included in the analytic

data only during those six-month intervals where they had a primary care visit. We selected six-month intervals as the unit of analysis to align with the standard of diabetes care and management (eg, for the study duration, guidelines for A1c or blood pressure monitoring was twice annually).[14]

We collected the following data for use as covariates in our analyses: the Charlson comorbidity index (CCI); median household income and percentage of residents with high school graduation in the patient's Census tract; sex; age; and site of care, stratified into three groupings (either one of two medical centers, or a community health center). The CCI, income, high school graduation rate, and age were time varying.

Study outcomes included both process and outcome diabetes management measures established by the National Committee for Quality Assurance (NCQA) during the relevant timeframe of the study.[15] The process measure was an indicator for having A1c checked within the six-month interval. Because a large proportion (96.3%) of intervals included a blood pressure measure, we did not examine blood pressure readings as a process measure.

The outcome measures for diabetes management included two dichotomous cutpoints for A1c control, poor diabetes control (A1c ≥8.0%) and very poor diabetes control (>9.0%), based on NCQA guidelines, and one dichotomous variable for blood pressure control, poor blood pressure control (≥ 130/80 mm Hg), based on NCQA guidelines.

Statistics

We used descriptive statistics by race/ethnicity to examine characteristics of the sample, including sociodemographic factors and insurance stability categories. We examined unadjusted prevalences and odds of diabetes and blood pressure control and A1c monitoring based on insurance stability status category, first overall and then stratifying by race/ethnicity, after adjusting for possible confounders. We examined whether insurance stability moderates the impact of race/ethnicity on DM outcomes by including an interaction term between race/ethnicity and insurance stability status in the logistic regression models. The patient-six-month interval was treated as the unit of analysis. We used generalized estimating equa-

Table 1. Demographic characteristics by race/ethnicity of patients with diabetes at 2 large urban health care systems, 2005-2013

Variable	Total patient sample	Non-Hispanic White	Hispanic	Black/African American	Asian/Asian Pacific Islander
Total sample[a]	14093	3954 (28.1)	924 (6.6)	7928 (56.3)	1287 (9.1)
Age, years, mean (SD) [b]	48.7 (10.5)	49.9 (10.1)	46.8 (11.0)	48.2 (10.6)	49.6 (10.4)
Sex					
Male	6135 (43.5)	2022 (51.1)	452 (48.9)	3114 (39.3)	547 (42.5)
Female	7958 (56.5)	1932 (48.9)	472 (51.1)	4814 (60.7)	740 (57.5)
Charlson Comorbidity Index, weighted[b,c]					
1	11268 (81.1)	2958 (76.8)	727 (80.1)	6496 (82.4)	1087 (87.0)
2+	2624 (18.9)	895 (23.2)	181 (19.9)	1385 (17.6)	163 (13.0)
Census tract high school graduate or higher, %, mean (SD)[b]	82.0 (10.5)	86.9 (10.1)	79.1 (11.0)	79.8 (9.6)	82.4 (11.3)
Census tract income, 2014 $, mean (SD) [b]	56849.3 (25538.2)	70635.6 (27749.3)	50792.6 (23196.8)	49765.9 (21029.4)	62537.0 (26767.4)
Language					
English	10589 (76.6)	3373 (89.2)	434 (47.4)	6368 (80.9)	414 (32.8)
Non-English	3241 (23.4)	407 (10.8)	482 (52.6)	1503 (19.1)	849 (67.2)
Location[b]					
Academic center 1	6792 (48.2)	1406 (35.5)	442 (47.8)	4686 (59.1)	258 (20.1)
Community health centers	4319 (30.6)	1117 (28.3)	277 (30.0)	2375 (30.0)	550 (42.7)
Academic center 2	2982 (21.2)	1431 (36.2)	205 (22.2)	867 (10.9)	479 (37.2)

Results are frequency (%) unless otherwise indicated.
a. Data presented at the patient level.
b. Variable based on data from first date of medical records.
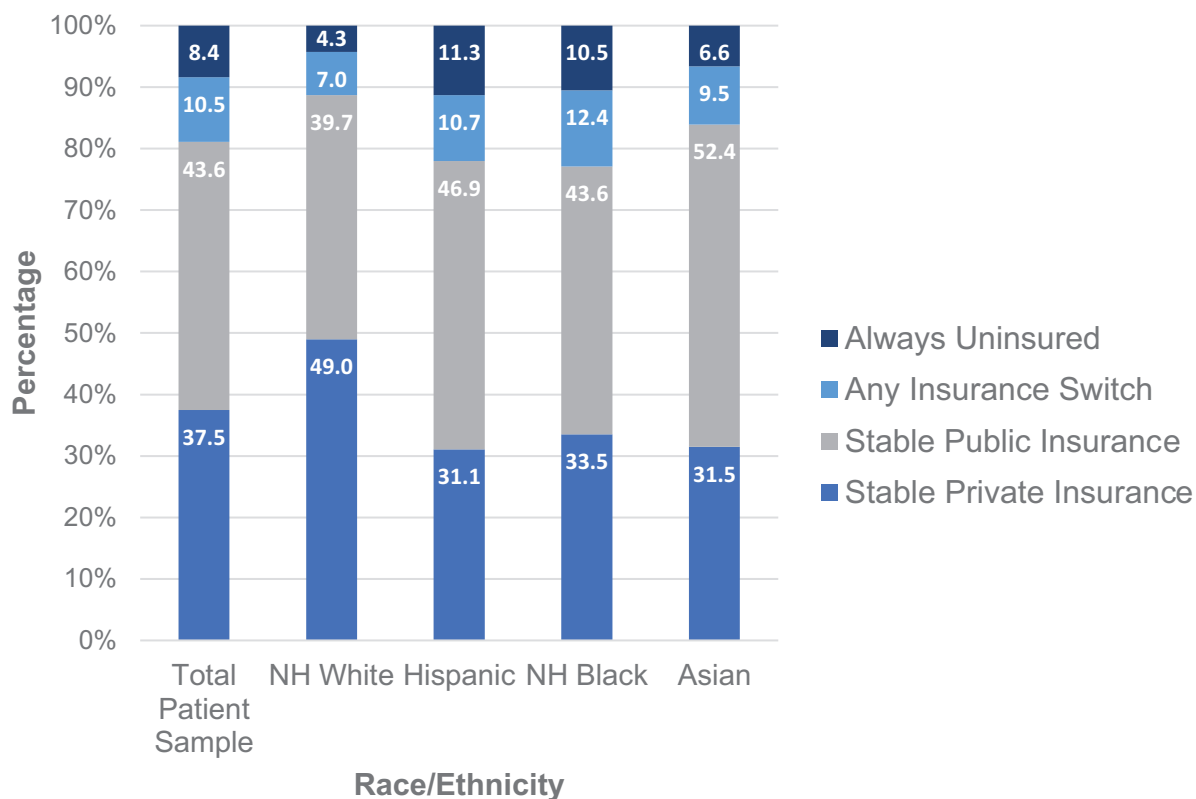c. Index range of 0 – 17 conditions.

Figure 1. Insurance status by race/ethnicity

tions (GEE) to account for correlated measurements from each patient.

RESULTS

Demographics of Study Sample

As shown in Table 1, 14,093 patients were included in the analytical sample, of which 56.5% were women, 56.3% were NH Black, 28.1% were NH White, 6.6% were Hispanic, and 9.1% were Asian. Mean age at the first visit within the dataset was 48.7 years. Mean census tract graduation rate was 86.9% for NH Whites, 82.4% for Asians, 79.8% for NH Blacks and 79.1% for His-

panic patients. Mean Census tract median income was $70,636 for NH Whites, $62,537 for Asians, $50,793 for Hispanics and $49,766 for NH Blacks. All patients had DM as a comorbidity for the CCI calculation; 23.2% of the NH White population had two or more comorbidities on the CCI, followed by 19.9% of Hispanic, 17.6% of NH Black and 13.0% Asian patients. The percentage of non-English speaking patients (based on reported language preference) was 23.4% for the entire study sample, 67.2% for Asian patients, 52.6% of the Hispanic patients, 19.1% of the NH Black patients, and 10.8% of the NH White patients.

Insurance Status by Race/Ethnicity

Figure 1 provides the insurance stability status of the total patient sample and by race/ethnicity. Most patients had either stable private insurance (37.5%) or stable public insurance (43.6%); with a similar percentage experiencing any insurance switch (10.5%) and being uninsured (8.4%) in the interval. Nearly half of NH White patients (49.0%) had stable private insurance, compared with 33.5% of NH Blacks, 31.5% of Asians, and 31.1% of Hispanics. 52.4% of Asians, 46.9% of Hispanics, 39.7% NH of Whites and 43.6% of NH Blacks had stable public in-

Table 2: Raw proportions for blood pressure and A1c process and outcome measures among patients with diabetes by race/ethnicity and insurance instability category from academic and community health centers, 2005-2013

Instability (6-Category) [a]	n, 6-month intervals	Total patient sample %, 6-month intervals	Non-Hispanic White[b] %, 6-month intervals	Hispanic[b] %, 6-month intervals	Black/African American[b] %, 6-month intervals	Asian/Asian Pacific Islander[b] %, 6-month intervals
Poor diabetes control, A1c ≥8.0%						
Overall	74,016	27.0	24.5	30.1	29.5	16.4
Stable private insurance	27,514	25.5	23.8	27.7	28.0	15.5
Stable public insurance	32,230	25.7	24.3	30.4	27.8	15.5
Any insurance switches	7,779	31.4	28.7	29.2	33.6	20.0
Always uninsured	6,493	34.5	27.9	36.0	36.9	22.4
Very poor diabetes control, >9.0%						
Overall	74,016	17.1	15.2	19.4	19.1	9.1
Stable private insurance	27,514	15.7	14.5	18.4	17.4	8.6
Stable public insurance	32,230	16.6	15.2	19.7	18.6	8.5
Any insurance switches	7,779	20.6	19.4	19.3	22.1	11.9
Always uninsured	6,493	21.1	16.7	20.9	22.9	12.0
A1c process (not monitored)						
Overall	90,111	23.5	27.8	24.3	21.3	23.6
Stable private insurance	33,444	23.3	27.7	25.6	20.4	21.1
Stable public insurance	39,498	24.4	28.2	23.9	22.8	24.1
Any insurance switches	9,514	22.8	29.4	22.7	20.4	27.1
Always uninsured	7,655	20.8	23.5	23.9	19.3	26.2
Poor BP control, ≥ 130/80 mm Hg						
Overall	87,567	55.5	52.8	49.1	60.4	37.6
Stable private insurance	32,073	56.0	54.8	49.7	60.2	38.3
Stable public insurance	38,672	53.6	49.9	47.8	59.2	37.0
Any insurance switches	9,306	57.9	55.0	53.4	61.6	38.8
Always uninsured	7,516	60.0	54.7	48.8	64.7	36.8

a. Data presented based on the 6-month interval, note that some patients may be moving in and out of insurance categories throughout the study period.

b. We performed a test of the differences in unadjusted outcome rates across insurance types within each race/ethnic group, treating Stable Private Insurance as the reference group, accounting only for clustering of observations at the patient level.

Stable private: Always privately insured; Stable public: Always publicly insured (Medicare, Medicaid and/or subsidized); Any insurance switches: includes gain (uninsured to insured), switch but not loss or gain (switch between private, Medicare, Medicaid, and subsidized categories), and insurance loss (insured to uninsured); Always uninsured: No insurance at any point within 6-month interval.

Total # of patients=12470 for the A1c process outcome: 3325 White, 803 Hispanic, 7195 Black,1147 Asian patients were included in analysis.

surance. 10.7% of Hispanics and 12.4% of NH Blacks experienced insurance switches and, 11.3% and 10.5%, respectively, were uninsured. Meanwhile, 4.3% of NH Whites and 6.6% of Asians were uninsured.

Diabetes-related Outcomes by Race/Ethnicity and Insurance Category

Table 2 provides the raw rates of A1c and blood pressure outcome and process measures by race/ethnicity and insurance stability category. Overall, and within most racial/ ethnic groups, those with stable private or public insurance had better A1c control and better BP control than those with insurance switches or always uninsured. In analyses adjusted for clustering, Hispanics and NH Blacks had the highest percentages of poor control (A1c ≥8.0%) and very poor control (A1c>9.0%) A1c readings

across all insurance stability types, compared with NH Whites, despite similar rates of A1c monitoring across all groups (all P significant, P<.001).

Table 3 provides the adjusted odds ratios of diabetes-related outcome and process measures by insurance stability category with stable private insurance as the reference group. For the total patient population, any switch in insurance and always being uninsured within a six-month inter-

Table 3. Adjusted[a] odds ratio of diabetes-related outcomes and process measures by insurance stability within 6-month interval for patients from academic and community health centers, 2005- 2013

Concurrent Insurance Stability Group[b]	n (6-month intervals)	Adjusted Odds Ratio (95% CI)				
		Total patient sample	Non-Hispanic White	Hispanic	Black/African American	Asian/Asian Pacific Islander
Poor diabetes control (A1c ≥8.0%)						
Stable private insurance	27514	Ref	Ref	Ref	Ref	Ref
Stable public insurance	32230	1.00 (.94, 1.07)	1.03 (.91 ,1.16)	1.12 (.84 ,1.49)	.98 (.90, 1.07)	1.01 (.80, 1.27)
Any insurance switches	7779	1.14 (1.06, 1.23)	1.05 (.89, 1.23)	1.12 (.82, 1.53)	1.16 (1.06, 1.27)	1.18 (.89, 1.58)
Always uninsured	6493	1.41 (1.28, 1.54)	1.22 (.98, 1.51)	1.46 (1.03, 2.08)	1.44 (1.29, 1.60)	1.48 (1.04, 2.11)
		Interaction race*insurance stability P=.67.				
Very poor diabetes control, >9.0%						
Stable private insurance	27514	Ref	Ref	Ref	Ref	Ref
Stable public insurance	32230	1.02 (0.95, 1.10)	1.00 (.87,1.14)	1.07 (.78, 1.47)	1.03 (.94, 1.14)	1.01 (.77, 1.31)
Any insurance switches	7779	1.16 (1.07, 1.26)	1.15 (.96 1.37)	.99 (.68 ,1.44)	1.18 (1.06, 1.30)	1.27 (.90, 1.78)
Always uninsured	6493	1.32 (1.19, 1.47)	1.14 (.89, 1.45)	1.18 (.79, 1.76)	1.38 (1.22, 1.55)	1.38 (.94, 2.03)
		Interaction race*insurance stability P=.85				
A1c not monitored						
Stable private insurance	33444	Ref	Ref	Ref	Ref	Ref
Stable public insurance	39498	.99 (.93, 1.05)	.88 (.78, .98)	.90 (.69, 1.17)	1.07 (.99, 1.17)	1.01 (.82, 1.26)
Any insurance switches	9514	.78 (.72, .83)	.76 (.65, .88)	.70 (.52, .94)	.77 (.70, .85)	1.04 (.82, 1.31)
Always uninsured	7655	.86 (.78 ,.94)	.78 (.65, .95)	.88 (.63, 1.22)	.86 (.77, .96)	1.17 (.86, 1.60)
		Interaction race*insurance stability P=.005				
Poor BP control, ≥ 130/80 mm Hg						
Stable private insurance	32073	Ref	Ref	Ref	Ref	Ref
Stable public insurance	38672	.89 (.85, 0.94)	.81 (.74, .89)	.85 (.69, 1.06)	.94 (.88, 1.01)	.90 (.76, 1.07)
Any insurance switches	9306	.99 (.93,1.05)	.95 (.83, 1.07)	1.09 (.84, 1.41)	1.03 (.95, 1.11)	.92 (.75, 1.12)
Always uninsured	7516	1.00 (.92, 1.07)	.86 (.72, 1.02)	.84 (.63, 1.13)	1.10 (1.00, 1.21)	.76 (.59, .98)
		Interaction race*insurance stability P=.01				

a. Adjusted for time, age, sex, comorbidities, site of care, education, income and race.

b. Data presented based on the 6-month interval, note that some patients may be moving in and out of insurance categories throughout the study period.

Stable private: Always privately insured; Stable public: Always publicly insured (Medicare, Medicaid and/or subsidized); Any insurance switches: includes gain (uninsured to insured), switch but not loss or gain (switch between private, Medicare, Medicaid, and subsidized categories), and insurance loss (insured to uninsured); Always uninsured: No insurance at any point within 6-month interval.

Total # of patients = 12470 for the A1c process outcome: 3325 White, 803 Hispanic, 7195 Black and 1147 Asian patients were included in the analysis.

val was associated with greater odds of poor (AOR 1.14, 95% CI 1.06, 1.23; AOR 1.41, 95% CI 1.28, 1.54) and very poor diabetes (AOR 1.16, 95% CI 1.07, 1.26; AOR 1.32, 95% CI 1.19, 1.26) control compared with having stable private insurance. These findings were statistically significant for NH Black patients (AOR 1.16, 95% CI 1.06, 1.27, AOR 1.44, 95% CI 1.29, 1.60, respectively). Always being uninsured within a six-

month interval was associated with a statistically significant increased odds of poor diabetes control compared with stable private insurance among Asians (AOR 1.48, 95% CI 1.04, 2.11) and Hispanics (AOR 1.46, 95% CI 1.03, 2.08). The interaction between insurance instability and racial/ethnic groups was not statistically significant for either of the poor A1c control outcomes. For the A1c process measure, any switch

in insurance or being uninsured was significantly associated with better A1c monitoring (lower odds of A1c not being monitored) compared to having stable private insurance for the total patient population.

There was a significant interaction between insurance instability and racial/ethnic groups for the outcomes of A1c monitoring and BP control. The interpretation of the interactions is difficult, as it appears that the ef-

fect of being uninsured on increasing the likelihood of A1c monitoring was strongest among NH Whites, whereas the effect of having switches on increasing the likelihood of monitoring was strongest in Hispanics. For BP control, stable public insurance was significantly associated with better BP control (lower odds of poor BP control) compared to stable private insurance for the total patient sample. This finding was statistically significant in NH Whites. NH Blacks who were always uninsured had higher odds of poor BP control compared to those with stable private insurance, while Asians who were uninsured had significantly better BP control compared to those with stable private insurance.

DISCUSSION

The purpose of this study was to explore whether insurance stability is associated with diabetes care outcomes and processes among a racially/ethnically diverse population receiving care at two urban health care systems. This analysis allows an explicit examination of health insurance stability as a lever to reduce racial/ethnic health disparities in diabetes care and management. Our findings suggest that insurance stability is associated with improved diabetes control as measured by A1c outcome measures for our patient population overall. Poor diabetes outcomes, as defined by A1c measurements, were more likely in patients who were always uninsured or who experienced changes in their insurance status, compared with patients who had stable private insurance. Our study did not demonstrate

that insurance stability reduced or eliminated ethnic/racial health disparities in diabetes outcome measures.

This study highlights differences in insurance stability by race and the negative impacts of being uninsured. In particular, Hispanic patients in our sample experienced the highest rates of not being insured, similar to national trends.[16] These national trends may be attributed to the influence of immigration status on access to clinical care, with fewer noncitizen immigrants having Medicaid or employer-based insurance, depending on the type of employment (ie, hourly wage jobs).[16] Similarly, NH Black patients also experienced high rates of being uninsured and having insurance switches. Types of employment, fluctuations in employment status within these groups, and differences in availability of employer sponsored health insurance as well as immigration status could be potential drivers in the differences observed in the types of insurance prevalent among each racial/ethnic group. Additional barriers exist for access and participation in employee-based insurance such as temporary employment, cost, and lack of agency to apply for benefits, which may be based in cultural beliefs and health literacy. For example, NH Whites had the highest prevalence of private insurance compared with other racial/ethnic groups in our patient sample---with Hispanics and Asians having the highest rates of stable public insurance status. Also noteworthy is the smaller number of uninsured in our study sample from health care systems providing care to underserved populations (~10%) compared with concurrent national

data, 19.3%-20.5% from 2005-2013 according to data from the Centers for Disease Control and Prevention.[17] This reflects the positive impact of Massachusetts' Medicaid expansion in 2006-07 on increasing the population with stable insurance coverage. It also underscores the Affordable Care Act and additional health care reform as an effective strategy to increase insurance access.[18,19]

This study also includes unexpected findings, with contradictory results for the relationship between

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insurance status and BP and glycemic control. For example, among Asians, being uninsured was associated with better BP control yet worse glycemic control. These findings among Asians may in part relate to small samples sizes. However, the findings also relate to the differences in the effectiveness of the standard of care and the com-

plexities of the treatment of hypertension and diabetes. For example, diabetes requires modification of a set of behaviors including exercise and diet as well as medication adherence, and therefore insurance alone may not be sufficient if there is no coverage for behavior management. These findings warrant further investigation.

The fact that poor diabetes management is still present in those with stable private and public insurance categories also highlights the need for more programs and systems (eg, insurance coverage for case management and behavioral interventions) to address DM care among those who have insurance. Once patients leave the clinical setting, societal context and other social factors also play a role in the engagement of behaviors (eg, diet and physical activity) and other factors (eg, stress) that contribute to disease management and progression.

This study provided a unique opportunity to link insurance coverage data with clinical outcomes to compare gaps and changes in insurance status by racial/ethnic groups. Specifically, data on insurance switches and gaps are not typically found in administrative databases of individual insurance providers and clinical outcomes such as A1c and blood pressure are not available in all-payer claims databases. Additionally, the study findings highlight the importance of stable public insurance (ie, Medicaid) as a safety net for vulnerable populations given the similar outcomes demonstrated for stable private (ie, employer-based coverage) and public insurance among all racial/ethnic groups, independent of income differences between the groups in the study.

Overall, this study aligns with recent literature on the influence of insurance reform on clinical outcomes. Results from a 2015 study demonstrated that Massachusetts Health reform was not found to be associated with lower racial and ethnic disparities in hospital admission rates.[20] A 2017 study examining the relationship between insurance switches and new physician and emergency department visits found insurance switches to be common and associated with increased physician visits and increased utilization of the emergency department temporarily among those with public insurance.[21] Another study looking at churning, or transitions in and out of Medicaid, found an association between insurance changes and disruptions in access and continuity of care, leaving low-income, working adults who are more susceptible to income and employment changes more vulnerable to disruptions in care.[22]

In our study, the association of insurance switches and poor (A1c ≥8.0%) and very poor diabetes (>9.0%) control among NH Black patients and the total patient population is noteworthy. While this insurance stability category combines any type of change in insurance status (switch between insurance types, insurance loss, and insurance gain), it emphasizes the burden to patients associated with insurance instability and changes. For example, a switch in insurance classification can signify changes in co-pays, new providers, new medications, and overall changes in coordination of care. These burdens can therefore introduce delays and other unseen costs in seeking services in populations that are already more vul-

nerable due to social circumstances.

A significant interaction was found for race/ethnicity and insurance stability category for BP control, suggesting a differential influence of insurance stability by race/ethnicity. There was an association between stable public insurance and better BP control among the total patient population and NH Whites compared with having stable private insurance. Among NH Blacks, always being uninsured was associated with higher odds of poor BP control and conversely, among Asians, always being uninsured was associated with better BP control.

A1c is a widely used and standard practice of care to monitor diabetes.[23] Our data suggest that disparities exist in the monitoring of A1c among different racial/ethnic groups.[24] Specifically, a significant interaction was found for race/ethnicity and insurance stability category for the A1c process measure, suggesting a differential influence of insurance stability by race/ethnicity. An unexpected study finding includes better A1c monitoring for patients experiencing any insurance switch or being uninsured for the NH White and NH Black patients and total patient population. One possible explanation for these findings is the increased likelihood for A1c testing in uninsured or newly insured patients who seeks medical care with new providers.

Study Limitations

Although this study adds to the research literature by examining health disparities, insurance stability, and DM outcomes using a large, diverse, patient sample, there are limitations

worth noting. The study is restricted in its applicability to patients who are receiving primary care and cannot be extrapolated to those patients who cease to seek care due to insurance loss, insurance switches, or any other circumstances not explored in this study. The study findings therefore may underestimate the influence of insurance loss and switches on diabetes outcomes and care.

Another limitation of this study is our inability to control for other social factors that influence access to care (ie, co-pays and deductibles, transportation, living conditions, built-environment, immigration status, etc.). This study assumes that those who are insured will seek care, however, other social circumstances may prevent patients from seeking care regularly and as recommended by their primary care physician. Some but not all studies demonstrate race, independent of insurance and socioeconomic status, as a significant predictor of diabetes and glycemic control, and social conditions as more impactful in shaping health overall.[25,26] A growing body of intervention research is exploring the influence of assessing for individual-level social factors and addressing social needs in order to improve clinical care and patient outcomes.[27-29] More research and innovation is needed in this area, however.

Conclusion

Overall, this study makes a significant contribution to the research literature by exploring how insurance stability status is associated with racial/ethnic health disparities

in diabetes care and management. While our study findings underscore the importance of insurance status stability in diabetes management, particularly for glycemic control, for the examined patient population overall, it does not support the notion that health insurance stability is a sufficient strategy to reduce racial/ethnic health disparities in diabetes outcomes. Further research needs to explore and address other social factors and determinants of health that impact diabetes management and control in order to eliminate existing disparities by race/ethnicity.

Conflict of Interest
No conflicts of interest to report.

Author Contributions
Research concept and design: Brown, Kressin, Terrin, Hanchate, LeClair, Freund; Acquisition of data: Kressin, Price, LeClair, Freund; Data analysis and interpretation: Brown, Kressin, Terrin, Hanchate, Suzukida, Kher, Price, Krzyszczyk, Byhoff, Freund; Manuscript draft: Brown, Kressin, Terrin, Hanchate, Suzukida, Kher, Price, Krzyszczyk, Byhoff, Freund; Statistical expertise: Terrin,

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