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Clinical Research Study

# Medicaid insured persons with diabetes have increased proportion of missed appointments and high HbA1c

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## ABSTRACT

**Objective:** This study was conducted to evaluate whether the type of insurance coverage is associated with missed appointments and to evaluate the effect of missed appointments on diabetes control.

**Methods:** All patients with diabetes mellitus (DM) managed at a major academic medical center between Jan 2015 and Dec 2020 were included in analysis. Association between insurance coverage and the proportion of missed appointments was evaluated with adjustments for demographic variables and social determinants of health. The relationship between proportion of missed appointments and glycemic control was also evaluated.

**Results:** The dataset included 30,633 patients, out of which 14,064 (46%) reported commercial insurance, 13,376 (44%) reported Medicare and 3,193 (10%) reported Medicaid coverage. Proportion of missed appointments was  $18.1 \pm 18.1\%$  among Medicaid covered patients,  $12.1 \pm 15.3\%$  among commercially insured and  $10.2 \pm 14.1\%$  among Medicare covered patients ( $p < 0.001$ ). Type of insurance was found to be a significant predictor of proportion of missed appointments after adjusting for age, race, language, marital status, smoking, BMI, HbA1c and type of diabetes ( $p < 0.001$ ) in series regression analysis. Proportion of missed appointments was associated with HbA1c with partial correlation coefficient  $+0.104$  ( $p < 0.005$ ) after adjusting for age, race, gender, type of insurance coverage, BMI and type of diabetes.

**Conclusions:** Medicaid covered patients with diabetes have higher proportion of missed clinic appointments and higher HbA1c. More research is needed to evaluate the root causes of inability to keep appointments in this population so that strategies for improved healthcare delivery can be designed.

## Introduction

Diabetes mellitus (DM) is a complex chronic disease affecting multiple aspects of human life. Inadequate control of diabetes leads to serious health consequences over time. According to the Centers for Disease Control and Prevention, >34 million people in the USA live with DM and the prevalence of diabetes is increasing over time.<sup>1</sup> Moreover, the prevalence of DM is higher among the disadvantaged communities like ethnic minorities and inner city populations.<sup>1</sup> Persons with diabetes often need frequent clinic visits for physical examination, laboratory tests, data review, counseling and adjustment of their medication regimen. Even with good control of diabetes, persons with DM need to see their healthcare providers every 3–6 months for monitoring glycemic control and annually to monitor for microvascular complications. Additional clinic visits may be necessary for diabetes education, medication adjustments and discussions for individualized treatment plans.

Previous studies have shown an association between the frequency of clinic visits and diabetes control.<sup>2,3</sup> Thus, a longer gap between visits is

associated with high HbA1c and higher blood pressure.<sup>4</sup> However, non-attendance rate for clinic visits is high among persons with diabetes.<sup>5</sup> Besides affecting adequate delivery of clinical care, missed appointments are associated with higher number of acute care visits, increased mortality, wasted healthcare resources and high financial costs.<sup>6,7</sup> Several psychosocioeconomic factors along with medical factors can affect a patient's ability to keep the clinic appointments.<sup>8–10</sup> Lack of insurance is an important factor for missed appointments. Expansion of Medicaid coverage after the affordable care act was associated with an improvement in access to diabetes care that was associated with improved diabetes control.<sup>11</sup> However, some studies have shown that expanded Medicaid coverage was not associated with an increase in primary care visits.<sup>12</sup> Thus, even among persons who have health insurance coverage (private or government sponsored), there may be differences in the ability to keep clinic appointments. Medicaid covered people are often marginalized groups in our society with multiple socioeconomic problems that may affect their access to outpatient clinic visits. While an association between Medicaid coverage and inadequate diabetes care has been shown,<sup>13</sup> the ability of Medicaid population to keep an appointment for diabetes management in a large academic healthcare system has not been studied. We hypothesized that Medicaid insurance will be

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associated with high rates of missed appointments for diabetes care. The primary objective of this analysis was to evaluate whether the type of insurance coverage is associated with missed appointments. Secondary exploratory analyses were performed to determine other factors affecting the proportion of missed appointments among the various types of insurance coverage.

## Methods

This was a retrospective study including patients with DM managed at a major academic center. Waiver of informed consent was approved by the Institutional Review Board. All patients aged >18 years with DM based on ICD-10 code (E08.00 to E13.999) and two or more completed clinic visits with either a primary care provider or an endocrinologist between Jan 2015 and Dec 2020 were included in data analysis. Data on the number of completed visits and missed appointments (no-show) were obtained from the appointment records. Canceled appointments, even within 24 h of appointment, were excluded. All appointments marked “completed” or “no-show” over the 6-year period were taken into account. Visits with physicians or non-physician advanced care providers were treated as equivalent for this study. Proportion of missed appointments was calculated as the percentage of completed visits plus “no-show” appointments.

Patient demographic data and laboratory data were obtained from electronic medical records in early 2021. The latest available values of all variables were used for data analysis. Type of diabetes was determined based on ICD-10 codes and/or the problem lists. We divided patients into three groups based on their healthcare insurance coverage at the time of last appointment: 1. Commercial insurance, 2. Medicare, and 3. Medicaid. Patients covered by worker’s compensation were included in the group 1, those covered by other Federal government programs including VA and Tricare in group 2, and those covered by other state or local government programs in group 3. Those eligible for both Medicaid and Medicare were included in group 2. Patients who were self-pay or had any other insurance status not fitting into one of the above categories were excluded.

## Statistical analysis

All data were extracted from medical records and de-identified. After excluding outliers, data were evaluated for normal distribution. The test of normality (Kolmogorov-Smirnov) determined that the primary outcome measure (Missed Visits proportion) did not follow a normal distribution ( $p < 0.010$ ). Log transformation was tried but it led to many negative values that is impractical for this variable. Therefore, groups were compared using non-parametric analyses of variance (Kruskal-Wallis test for continuous variables and chi squared tests of association for categorical variables). Because the patients in the Medicare group were significantly older and more likely to have type 2 DM while commercially insured and Medicaid groups were more similar, we also compared the commercially insured group to the Medicaid group using Wilcoxon test for continuous variables and chi square tests of association for categorical variables. Continuous data were summarized as means with standard deviations and categorical data as percentages. We evaluated predictors of missed appointments in a non-parametric series regression with proportion of missed appointments as a dependent variable and insurance coverage as the independent variable. All available variables were included in initial analysis. Age, BMI, race, preferred language, marital status, smoking status, diabetes classification, and HbA1c were included in the final model as covariates. To evaluate the relationship between proportion of missed appointments and glycemic control, a Spearman’s rank correlation test was performed including HbA1c as the dependent variable with proportion of missed appointments (on a continuous scale) as the independent variable accounting for age, BMI, gender, race, preferred language, marital status, smoking status, and diabetes classification as covariates. Statistical significance was determined by  $p < 0.05$ .

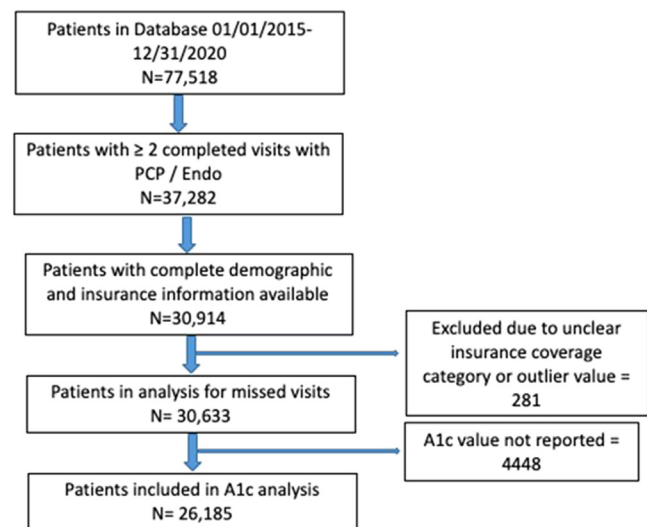


Fig. 1. Flow diagram of data aggregation.

We used SPSS 25 (IBM, New York), SAS v9.4 and Stata for statistical analysis.

## Results

Patient inclusion for data analysis is shown in Fig. 1. The final data analysis included 30,633 patients for evaluating the predictors of missed appointments out of which 14,064 (46%) reported commercial insurance, 13,376 (44%) reported Medicare and 3193 (10%) reported Medicaid coverage. The association of missed appointments with glycemic control was evaluated in 26,185 patients that had at least one HbA1c value available in records. There were 365,351 appointments, out of which 319,235 were completed and 46,116 (14.4%) were missed.

### Comparison of demographic and medical characteristics

Comparison between the three groups and between commercially insured group versus Medicaid insured group is shown in Table 1. Age ranged from 19 to 104 years. Medicare covered patients were older in age as compared to Medicaid and commercially insured patients. There were significant differences in gender, race, language, marital status, smoking, type of diabetes, HbA1c and BMI between the three groups. Medicaid covered group had a higher proportion of women, African Americans and Spanish speaking people. They were also more likely to be single, current smokers and to have a higher HbA1c.

Proportion of missed appointments was  $18.1 \pm 18.1\%$  in Medicaid covered patients,  $12.1 \pm 15.3\%$  in commercially insured and  $10.2 \pm 14.1\%$  in Medicare covered patients (Fig. 2). Other factors significantly associated with missed appointments included age, race, preferred language, marital status, smoking, BMI, HbA1c and type of diabetes.

In nonparametric series regression analysis, type of insurance was found to be a statistically significant predictor of proportion of missed appointments with covariates of age, race, preferred language, marital status, smoking, BMI, HbA1c and type of diabetes (Table 2).

### Correlation between HbA1c and proportion of missed visits

Spearman rank-order correlation test for the association between the proportion of missed appointments and HbA1c showed a significant association with coefficient of +0.131 ( $p < 0.001$ ). After adjusting for covariates (age, race, gender, type of insurance coverage, smoking, BMI, type of diabetes, and mean arterial blood pressure), the partial correlation coefficient was determined to be +0.104 with  $p < 0.001$  suggesting

**Table 1**  
Comparison of patient demographics and medical characteristics between different insurance groups.

	Commercial health insurance N = 14,064	Medicare N = 13,376	Medicaid N = 3193	P value*	P value**
Age (years)	55.2 ± 12.4	72.5 ± 10.8	55.3 ± 15.3	0.0001	0.0042
Gender					
Male	6834 (48.6%)	6529 (48.8%)	1279 (40.1%)	0.0001	<0.0001
Female	7230 (51.4%)	6847 (51.2%)	1914 (59.9%)		
Race					
African American	2697 (19.2%)	2527 (18.9%)	851 (26.7%)	0.0001	<0.0001
White	9724 (69.1%)	9988 (74.7%)	2148 (67.3%)		
Other	1643 (11.7%)	861 (6.4%)	194 (6.0%)		
Preferred language					
English	10,268 (73.0%)	8463 (63.3%)	1643 (51.5%)	0.0001	<0.0001
Spanish	3573 (25.4%)	4698 (35.1%)	1454 (45.5%)		
Other	223 (1.6%)	215 (1.6%)	96 (3.0%)		
Marital status					
Married	7690 (54.7%)	6264 (46.8%)	878 (27.5%)	0.0001	<0.0001
Single	5336 (37.9%)	6016 (45.0%)	2138 (67.0%)		
Other	1038 (7.4%)	1096 (8.2%)	177 (5.5%)		
Smoking					
Current	890 (6.3%)	670 (5.0%)	374 (11.7%)	0.0001	<0.0001
Former	3655 (26.0%)	5504 (41.2%)	896 (28.1%)		
Never	9490 (67.6%)	7182 (53.8%)	1916 (60.2%)		
Diabetes classification					
Type 1	2524 (17.9%)	607 (4.5%)	430 (13.5%)	0.0001	<0.0001
Type 2	10,975 (78.0%)	12,157 (90.9%)	2616 (81.9%)		
Other	565 (4.0%)	612 (4.6%)	147 (4.6%)		
BMI (kg/m <sup>2</sup> )	31.5 ± 7.0	29.3 ± 6.3	31.4 ± 8.0	0.0001	0.0450
HbA1c (%)	7.3 ± 1.8	6.9 ± 1.4	7.7 ± 2.1	0.0001	<0.0001
Number of all appointments	8.8 ± 8.6	12.4 ± 13.3	9.2 ± 10.4	0.0001	0.0002
Missed appointments (%)	12.1% ± 15.3%	10.2% ± 14.1%	18.1% ± 18.1%	0.0001	<0.0001

P Value\* - Comparison between the 3 groups.

P Value\*\* - Comparing Commercial to Medicaid group.

BMI: n = 27,998.

HbA1c: n = 26,185.

**Table 2**  
Non-parametric series regression identifying predictors of missed appointments (N = 24,093).

Parameter	Parameter estimate	Standard error	t-value	Prob >  t
Intercept	0.1078	0.0105	10.25	<0.0001
<sup>a</sup> Insurance status	0.0189	0.0015	12.33	<0.0001
Age	-0.0014	0.0001	-19.68	<0.0001
<sup>b</sup> Race	-0.0203	0.0012	-16.61	<0.0001
<sup>c</sup> Preferred language	0.0185	0.0011	17.26	<0.0001
<sup>d</sup> Marital status	0.0069	0.0010	6.90	<0.0001
Smoking	-0.0086	0.0015	-5.56	<0.0001
BMI	0.0008	0.0001	6.02	<0.0001
Type of diabetes	-0.0084	0.0025	-3.36	0.0008
HbA1c	0.0130	0.0006	23.57	<0.0001

<sup>a</sup> 1 = commercial, 2 = Medicare, 3 = Medicaid.

<sup>b</sup> 1 = Black/African American, 2 = White, 3 = Other.

<sup>c</sup> 1 = English, 2 = Spanish, 3 = Other.

<sup>d</sup> 1 = Married, 2 = Single, 3 = Other.

significant independent association between missed appointments and HbA1c.

**Discussion**

This study shows that among persons with diabetes who have some form of third-party healthcare coverage, those with Medicaid insurance have the highest rates of missing clinic appointments and they have higher HbA1c in comparison to other subgroups. Healthcare insurance remained an important independent predictor of the proportion of missed appointments after controlling for other sociodemographic factors. Moreover, a higher proportion of missed appointments was associated with inadequate glycemic control, even though the association was weak with a coefficient of +0.131. We included only the appointments with primary care providers and endocrinologists because these are the

most likely appointments to address diabetes as a problem. Our study shows that Medicaid insured patients are at high risk of underutilization of outpatient healthcare services for diabetes. These findings are likely to apply to other chronic medical conditions as well. Therefore, this group needs strategies to improve their access to outpatient medical care that may improve their clinical outcomes as well.

This is the largest study in an academic healthcare system showing that Medicaid coverage, in addition to multiple other sociodemographic factors, is associated with decreased utilization of outpatient diabetes care services. Our study highlights disparities in diabetes care based on insurance, gender, marital status, race, and primary language. It adds to existing data showing other social determinants of health like income, employment, education, food security, housing, and neighborhood to be associated with inadequate diabetes care.<sup>14</sup> Having insurance was shown to partially attenuate the effects of financial burden and improve

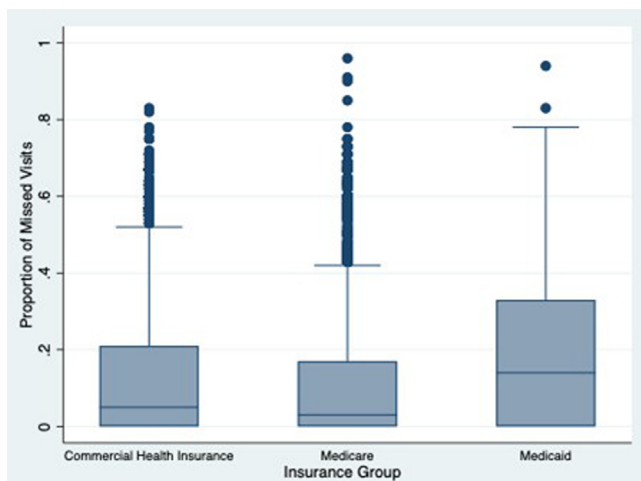


Fig. 2. Box plot of proportion of missed visits stratified by insurance coverage group.

access to diabetes care in a previous study.<sup>15</sup> Our study shows that social determinants of health remain an important factor in access to diabetes care despite providing subsidized government insurance to marginalized populations.

Previous studies have shown that inadequate insurance coverage is associated with underutilization of primary health care and increased rates of hospitalization.<sup>16</sup> Inadequate primary health care is also associated with inadequate glycemic control and higher risk of acute hyperglycemic crises in people with diabetes.<sup>17</sup> In a study evaluating diabetes related hospitalizations, Medicaid covered people were similar to the uninsured people for urgent admission to hospital.<sup>16</sup> Previous studies have also identified that there was no difference in quality of outpatient care between no-insurance and Medicaid-only groups.<sup>13</sup> Medicaid coverage varies from state to state, but the majority of these patients receive less assistance for out-of-pocket costs that may influence their decision to follow through with care for chronic conditions. A study comparing utilization of Medicaid health insurance to commercial health insurance found that Medicaid coverage cost was disproportionately comprised of emergency department visit expenditures as opposed to outpatient visits.<sup>18</sup> Thus, Medicaid covered people may have other factors such as impaired access to primary care centers, higher copayments, and lower health literacy that restrict their access to outpatient clinical care. There may also be difficulties with transportation, time-off from work, child-care or simply remembering to keep an appointment.<sup>19,20</sup> A previous study showed lack of access to transportation as one of the factors affecting diabetes care visits among Medicaid enrollees in rural areas.<sup>21</sup> However, our study was conducted in an urban setting and included patients who were treated at healthcare centers that were accessible by public transportation. Inadequate clinical care may also be associated with higher burden of comorbidities and complications of diabetes affecting their ability to use transportation and keep appointments. Unfortunately, our study cannot address all other factors that may interfere with Medicaid insured patients' ability to keep appointments.

Previous studies have been conducted to demonstrate the association between frequency of clinic appointments and diabetes control as represented by quantitative laboratory metrics such as HbA1c, blood pressure, and LDL-C.<sup>8</sup> Our study supports these previous data by showing that missed appointments are associated with high HbA1c.<sup>22,23</sup> However, we speculate that Medicaid insured population has factors other than insurance coverage alone that affect their ability to utilize healthcare services in an appropriate manner. Higher HbA1c in Medicaid insured patients is also likely to be multifactorial rather than missed appointments alone. The same factors that interfere with their ability to keep clinic appointments may also affect their ability to follow a healthy

lifestyle, monitor blood glucose and follow a medication regimen.<sup>24,25</sup> Previous studies have in fact shown less healthy lifestyle among Medicaid beneficiaries.<sup>26</sup> This may also be related to Medicaid population living in poor neighborhoods with lower access to shopping for healthy foods and exercise facilities among other social determinants contributing to health disparities.

This study has several limitations due to its retrospective design. The most important limitation is our inability to look further into the root causes of missed appointments. Factors, like the family income, comorbidities, transportation, employment status, time of appointment, and disability that can affect the ability of a patient to keep an appointment were not available in these data. In addition, we did not look at the previous insurance coverage but considered only the last insurance information in the patient record. This may have affected the composition of our groups but is unlikely to change the results of this study. There may also be some differences between appointments with physicians versus advanced practice non-physician providers. Again, we do not think these factors would affect the overall results of this study. Finally, the classification of diabetes based on ICD-10 codes in electronic records may not be very accurate.

In conclusion, Medicaid covered patients with diabetes have higher proportion of missed clinic appointments and higher HbA1c. Use of telehealth, extra clinic hours and home visits may be some of the interventions to improve access to diabetes care among the Medicaid covered population but need to be tested in systematic clinical trials. We think more research is needed to evaluate the root causes of inability to keep appointments in this population so that strategies for improved health-care delivery can be designed.

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