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Substance Use Disorders and Diabetes Care: Lessons from New York Health Homes

Sarah Forthal, MPH[1], **Sugy Choi, MS**[1,2], **Rajeev Yerneni, PhD, MBA**[1], **Zhongjie Zhang, MPH**[1], **David Siscovick, MD, MPH**[3], **Natalia Egorova, PhD, MPH**[4], **Todor Mijanovich, PhD**[5], **Victoria Mayer, MD, MS**[4,6], **Charles Neighbors, PhD, MBA**[1,7]

[1]Department of Data Science, Partnership to End Addiction*, New York, NY

[2]Department of Health Law, Policy and Management, Boston University School of Public Health, Boston, MA

[3]New York Academy of Medicine, New York, NY

[4]Department of Population Health Science and Policy, Icahn School of Medicine at Mount Sinai, New York, NY

[5]Department of Applied Statistics, Social Science, and Humanities, NYU Steinhardt School of Culture, Education and Human Development, New York, NY

[6]Division of General Internal Medicine, Department of Medicine, Icahn School of Medicine at Mount Sinai, New York, NY

[7]Department of Population Health, NYU Grossman School of Medicine, New York, NY

Abstract

Background—Individuals that have both diabetes and substance use disorder (SUD) are more likely to have adverse health outcomes and are less likely to receive high quality diabetes care, compared to patients without coexisting SUD. Care management programs for patients with chronic diseases, such as diabetes and SUD, have been associated with improvements in the process and outcomes of care.

Objectives—To assess the impact of having coexisting SUD on diabetes process of care metrics.

Research Design—Pre-/post-intervention triple difference analysis.

Subjects—Participants in the New York State Medicaid Health Home (NYS-HH) care management program who have diabetes and a propensity-matched comparison group of non-participants (N=37,260).

Correspondence to: Dr. Charles Neighbors, Department of Population Health, NYU Grossman School of Medicine, 180 Madison Avenue New York, New York 10016, charles.neighbors@nyulangone.org.

*Formerly Center on Addiction

Conflicts of Interest

There are no conflicts of interest.

Measures—Process of care metrics for patients with diabetes: an eye (retinal) exam, HbA1c test, medical attention (screening laboratory measurements) for nephropathy, and **receiving** all 3 in the past year.

Results—Before enrollment in NYS-HH, individuals with comorbid SUD had fewer claims for eye exams and HbA1c tests compared to those without comorbid SUD. Diabetes process of care improvements associated with NYS-HH enrollment were larger among those with comorbid SUD (eye exam: adjusted odds ratio [AOR]=1.08 (95% confidence interval [CI]: 1.01–1.15); HbA1c test: AOR=1.20 (95% CI: 1.11–1.29); medical attention for nephropathy: AOR=1.21 (95% CI: 1.12–1.31); all 3: AOR=1.09 (95% CI: 1.02–1.16)).

Conclusions—Individuals with both diabetes and SUD may benefit **moderately** more from care management than those without comorbid SUD. Individuals with both SUD and diabetes who are not enrolled in care management may be missing out on crucial diabetes care.

Keywords

Addiction; diabetes process of care; comorbidities; care management; difference-in-differences

INTRODUCTION

Substance use disorder (SUD) is highly prevalent among patients with diabetes, and tobacco, alcohol, and opioid use have each been independently associated with diabetes risk.[1] Patients that have SUD and diabetes are more likely to have adverse health outcomes such as diabetes-related complications, hospitalizations, and mortality, and are less likely to seek routine diabetes care, receive quality care, and adhere to care, compared to those without co-occurring SUD.[2–7]

Individuals with multiple chronic conditions (comorbidities) are likely to have significant health care needs but receive poorly coordinated and high cost care, resulting in worse health outcomes.[8] This is particularly serious if one of the conditions is an SUD.[6,9] Having an untreated SUD is associated with strain on bodily symptoms,[10,11] increased lifestyle risk factors,[12–14] poor treatment adherence,[15–17] and **high health care spending**.[18] **Individuals with co-occurring SUDs who seek care may not receive recommended chronic disease management or have symptoms attributed to their SUD that are, in fact, related to other conditions.**[19–21] Finally, the historical exclusion of behavioral health from primary care and other chronic disease specialists further complicates the coordination of care for individuals with SUD and another chronic disease.[22] For patients with diabetes, high quality care (yearly retinal exams, monitoring for signs of kidney disease, measurement of glycemic control) can help prevent complications such as blindness and progression to end-stage renal disease.[23]

Care management programs, in which beneficiaries receive access to a collaborative suite of services, activities, and providers, seek to improve quality of care, outcomes of care, and reduce costs through better coordination of care for individuals with complex and multiple chronic health issues. Care management has been associated with improved clinical chronic disease indicators, treatment adherence, and reduced hospital readmissions, particularly

among those with both a chronic disease and depression.[24] The New York State (NYS) Department of Health provides comprehensive care management to individuals with chronic conditions through its Medicaid Health Home (NYS-HH) program. NYS-HH represents a novel, integrated system-level approach to increasing access to care and quality of health outcomes for high cost clients with chronic conditions. The program prioritizes 'whole person' care **via care management**, **integrated networks of health care, housing, social service, and other community service providers, individually-tailored care plans developed collaboratively by care managers and patients**, and performance metrics that are used to manage overall health outcomes.[25] Individuals with **2 or more chronic conditions, including SUD and diabetes, or 1 single qualifying condition (HIV/AIDS or serious mental illness)** are eligible for NYS-HH. The effects of care management **on diabetes care** have not been evaluated among individuals with co-occurring SUD and diabetes.

In this study, we used pre-post controlled difference-in-difference-in-differences (DDD) estimation to assess the impact of having an SUD diagnosis on receipt of diabetes care among participants in NYS-HH. We hypothesized that participation in NYS-HH would increase receipt of recommended process of care metrics for patients with diabetes, and that those with SUD diagnoses would see greater increases in recommended care compared to those without SUD diagnoses. **To limit the influence of potential confounders, NYS-HH participants were matched to a comparison group of non-NYS-HH participants using propensity score methods.**

METHODS

Data and Study Population

We linked NYS-HH program administrative data for those who enrolled in NYS-HH between January 1, 2015 and December 31, 2016 to their NYS Medicaid claims for January 1, 2014 through December 31, 2017. All data were provided by the NYS Department of Health. **All study procedures were approved by the Institutional Review Board at the National Center on Addiction and Substance Abuse (#213).**

The **analytic sample** included NYS-HH participants who were newly enrolled in NYS-HH between January 1, 2015 and December 31, 2016 and a matched comparison group, **formed from the NYS Medicaid claims**. All participants had continuous Medicaid enrollment between January 1, 2014 and December 31, 2017, were between the ages of 18 and 75, and were identified as having diabetes.

Individuals were considered to have diabetes if they (1) had 2 outpatient claims or 1 inpatient claim with any **International Classification of Diseases diagnosis** code **(ICD-9-CM or ICD-10-CM)** from the Healthcare Effectiveness Data and Information Set (HEDIS) **2017** Diabetes Value Set on the same claim, or (2) received a prescription included in HEDIS Table CDC-A: Prescriptions to Identify Members With Diabetes.[26]

We created the matched comparison group of non HH-participants using propensity scores that accounted for attrition and varying health care utilization patterns over time.[27] For each

individual *i*, we calculated a monthly propensity score modeling the probability of NYS-HH enrollment within a county in NYS, enabling us to match on enrollment month *t*. Propensity scores were calculated based on person-level time-invariant demographic variables and time-varying variables related to chronic condition diagnoses and Medicaid utilization prior to the month of NYS-HH enrollment (see Supplementary Table 1 for a full list of matching variables). The propensity scores were then used to select **a comparison person** who **had not** enrolled in NYS-HH **over the study period (January 1, 2014 to December 31, 2017)** with the nearest propensity score in enrollment month *t*. **Because there were relatively few Medicaid enrollees who met NYS-HH eligibility criteria but did not enroll in NYS-HH,** matching was conducted **with replacement, meaning that some comparisons were matched with multiple NYS-HH participants.** We used the optimal matching algorithm and stratified by exact gender and county of residence.

New York State Health Homes

The NYS Department of Health began providing comprehensive care management through NYS-HHs in 2011, as authorized by the Patient Protection and Affordable Care Act (ACA) Section 2703. To be eligible, individuals must be enrolled in Medicaid and have 2 or more chronic conditions, including **SUD** and diabetes, or 1 single qualifying chronic condition (HIV/AIDS or serious mental illness).

Substance Use Disorder Status

Individuals were classified to have an SUD diagnoses if they had at least 1 Medicaid claim for any SUD **service** (identified using Medicaid diagnosis, procedure, rate, and diagnosis related group codes) at any time over the 3 years **prior to their HH enrollment dates**.

Diabetes Process of Care Metrics

The primary outcomes were receipt of an eye (retinal) exam, HbA1c test, or medical attention (screening using measures of renal function) for nephropathy. Each outcome was assessed for the measurement year in Medicaid claims using HEDIS 2017 criteria (Supplementary Table 2). A secondary outcome was the percentage of individuals who received all 3 indicators of the process of care for patients with diabetes.

Covariates

All models adjusted for demographic, clinical, and health care utilization variables that were hypothesized to be associated with both NYS-HH enrollment and receipt of diabetes care. These included most but not all of the variables used to create the propensity-matched comparison group. Age (years), gender (female, male), race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, other), and residence (New York City, other) were sourced from NYS-HH program administrative data. Comorbid diagnoses of asthma, coronary artery disease, bipolar disorder, and schizophrenia were identified by the presence of at least 2 outpatient or 1 inpatient Medicaid claim with the relevant ICD-9-CM or ICD-10-CM diagnosis code in the measurement year. HIV diagnosis was identified from a combination of ICD-9-CM or ICD-10-CM diagnosis codes, procedure codes, and National Drug Codes for antiretroviral treatments. Emergency department, inpatient, and outpatient visits (number

over past 12 months) were classified using procedure, rate, category of service, and diagnostic related grouping codes. Health care spending (USD over past 12 months) was calculated using New York State direct payments to Medicaid and claims reported by managed care organizations.

Data Analysis

We used a two-step approach to estimate the unadjusted 12 month pre-post effect of NYS-HH enrollment on the process of care metrics for patients with diabetes by SUD status. First, we calculated difference-in-differences (DID) effects which estimate the difference in pre-post NYS-HH enrollment effect by SUD status, separately for the NYS-HH and comparison groups. A more positive DID effect represents a greater increase (or a lesser decrease) in receipt of recommended process of care measures among those with SUD, compared to those without SUD. Then, we calculated DDD effects by subtracting the DID effect for the comparison group from the DID effect for the NYS-HH group. A large DDD effect suggests that receipt of the process of care measures is affected by the combination of NYS-HH status and SUD status, and provides evidence for the moderating effect of SUD status. Statistical significance was assessed using a logistic regression model for each of the process of care measures separately and combined.

DID effects were estimated by an interaction term between NYS-HH enrollment (yes/no) and time (pre/post HH enrollment). DDD effects were estimated by an interaction term between NYS-HH enrollment, time, and SUD status (yes/no).

Adjusted DID and DDD effects were estimated using logistic regression models that controlled for the **patient-level covariates listed above** and are presented as odds ratios for ease of interpretation.

We additionally conducted post-hoc sensitivity analyses to examine the potential effect of historically low diabetes care utilization on receipt of an eye exam, HbA1c test, or medical attention for nephropathy after NYS-HH enrollment. We reran the adjusted DID and DDD models with additional interactions for baseline diabetes outpatient utilization (any vs. none in the year prior to NYS-HH enrollment). An outpatient visit claim was considered to be diabetes-related if it had a primary diagnosis of diabetes plus a diabetes procedure or rate code. Thirty-nine percent of NYS-HH participants and 38% of controls had no diabetes outpatient utilization in the year prior to enrollment. The interactions were not significant for any diabetes care outcome. Complete results of these analyses are available upon request.

Data management was performed in SAS version 9.4 (Cary, NC) and models were run in Stata version 15 (College Station, TX).

RESULTS

Sample Characteristics

The final sample included 19,799 NYS-HH participants and 17,461 comparisons with diabetes. The groups were well-balanced on the matching variables, with the exception of HIV, which was more common in the comparison group (Supplementary Table 3). At

baseline (1 year before NYS-HH enrollment) nearly 40% of NYS-HH participants with diabetes also had SUD. Those with SUD were more likely to be male, have other comorbid diagnoses (particularly severe mental illnesses), high service utilization, and high Medicaid **spending** compared with those without SUD (Table 1). Those with SUD were also less likely to have received at least 1 eye exam (34.4% vs. 42.3% without SUD) or HbA1c test (72.9% vs. 80.3% without SUD) in the 12 months prior, but had about the same rates of medical attention for nephropathy as those without SUD (78.8% vs. 77.2%) (Table 1).

Diabetes Process of Care Metrics

Eye exam rates increased for all groups (NYS-HH participants with and without SUD, comparisons with and without SUD). The increase was larger among those with an SUD diagnosis (unadjusted DID=2.0%; $P = .071$) compared to those with no SUD diagnosis (unadjusted DID=1.0%; $P = .289$), but the difference was not statistically significant (unadjusted DDD=1.0%; $P = .082$) (Table 2). After adjusting for covariates, the increases in eye exam rates were not statistically significant for those with SUD (DID adjusted odds ratio [AOR]=1.09; 95% Confidence Interval [CI]=0.99–1.20) or without SUD (DID AOR=1.04; 95% CI=0.96–1.13). However, the increases among those with SUD were slightly larger than the increases among those without SUD (DDD AOR=1.08; 95% CI=1.01–1.15) (Table 3).

HbA1c testing increased for all groups. Individuals with SUD received significantly more HbA1c testing (unadjusted DID=3.7%; ***P* = < .001**) compared to individuals without SUD (unadjusted DID=2.3%; $P = .002$) in both the NYS-HH and comparison groups (unadjusted DDD=1.4%; $P < .001$) (Table 2). Adjusted models showed that both individuals with SUD (DID AOR=1.23; 95% CI=1.11–1.36) and without SUD (DID AOR=1.18; 95% CI=1.07–1.30) had significant increases in HbA1c testing. Increases were significantly larger for those with SUD (DDD AOR=1.20; 95% CI=1.11–1.29) (Table 3).

Medical attention for nephropathy increased for all groups, and did so significantly among those with SUD (unadjusted DID=2.9%; $P = .002$) and without SUD (unadjusted DID=2.8%; $P = .001$). The difference between the SUD and non-SUD groups was small but statistically significant (unadjusted DDD=0.1%; $P < .001$) (Table 2). Adjusted models found a significant increase in medical attention for nephropathy among those with SUD (DID AOR=1.21; 95% CI=1.08–1.35) and without SUD (DID AOR=1.18; 95% CI=1.08–1.30). The increase was statistically significantly larger among those with SUD (DDD AOR=1.21; 95% CI=1.12–1.31) (Table 3).

The percentage of individuals who received all 3 services increased for all groups. The increase was larger in those with SUD (unadjusted DID=2.4%; $P = 0.019$) compared to those without SUD (unadjusted DID=1.1%; $P = 0.237$), and the difference **was statistically significant** (DDD=1.3%; p=0.049). After adjusting, models showed that the increase was statistically significant among those with SUD (DID AOR=1.13; 95% CI=1.02–1.25) but not statistically significant among those without SUD (DID AOR=1.05; 95% CI=0.97–1.14). The increase was significantly higher among those with SUD (DDD AOR=1.09; 95% CI=1.02–1.16).

DISCUSSION

New York Medicaid-enrolled individuals with both diabetes and SUD benefited more from the NYS-HH care management program than those without comorbid SUD, though both groups saw **modest, statistically significant** increases in **HbA1c tests and medical attention for nephropathy**. After adjusting for several factors, NYS-HH-associated increases in eye exams, HbA1c tests, and medical attention for nephropathy were **moderately larger** for those with both diabetes and SUD. Individuals with both diabetes and SUD began with lower baseline eye exam and HbA1c test rates compared to individuals without comorbid SUD, which is consistent with previous studies.[5,7]

To our knowledge, this is the first study to assess the impacts of a care management program on a population with both diabetes and SUD. Past studies have examined care management in the context of other comorbidities. A recent review of studies evaluating care management for individuals with comorbid chronic diseases found mixed results for most programs on chronic disease-related and health care utilization measures.[24] However, evaluations that enrolled individuals with at least 1 chronic condition and comorbid depression consistently saw improvements in depression symptoms, and frequently in HbA1c test results.[24] **Similarly, a 2018 review of behavioral health homes (in which coordinated care is provided through specialty mental health programs) found overall increased rates of diabetic screening and monitoring among participants with comorbid diabetes and severe mental illness.[28] A more recent evaluation of Maryland's behavioral health program showed increased receipt of eye exams but not HbA1c or diabetic nephropathy testing among participants with comorbid diabetes and severe mental illness.[29] And, in a qualitative study of NYS-HH participants with diabetes, many emphasized the mental health referrals and support provided by care managers to be particularly helpful aspects of the program.[30] In the context of this literature, our findings suggest that care management's model of 'whole person' care may be beneficial for individuals with comorbid behavioral health issues; however, modest results suggest that there is still significant room for improvement.**

There are also other possible explanations for our results that should be investigated further. The relationship between comorbid SUD diagnosis and increase in process of diabetes care metrics could be mediated by an increase in overall primary and specialty care use associated with NYS-HH enrollment. NYS-HH has been linked to increased general outpatient visits among individuals with SUD in another study (Neighbors et al., unpublished data, 2020). Additionally, the SUD comorbid group began with lower eye exam and HbA1c testing rates, and the subsequent larger increase could be influenced by regression to the mean.

The modest effect size observed may be due to a variety of program implementation and structural issues. A 2014 survey of NYS-HH administrators identified the administrative challenges of integrating disparate services and financial concerns about the sustainability of the program to be significant barriers to success,[31] consistent with what has been reported in other care management systems.[28] Additionally, variation in quality of care coordination, referrals, and access to care across HHs and their associated clinics could impact observed

average effects. Finally, NYS-HH follow a 'generalist' model which enrolls participants with varied chronic conditions, rather than focusing on specific conditions such as diabetes or SUD. It is possible that, while increasing overall engagement with the healthcare system, this model limits the 'dose received' per condition.[28,31]

Our results bring up important considerations for healthcare administrators and policymakers. The most recent United States burden of disease reports rank diabetes as the 8th leading cause of years of life lost (YLLs), the 3rd leading cause of years lived with disability (YLDs), and the 4th leading cause of disability-adjusted life-years (DALYs).[32] Diabetes costs the US about $327 billion, nearly 10% of the US healthcare budget, and costs have increased yearly.[33,34] Similarly, SUDs are consistently identified as being within the top leading causes of YLLs, YLDs, DALYs, and costs due to health expenditure, crime, and lost work productivity in the United States.[32,35] NYS-HH and other care management programs are designed to increase access to treatment and reduce the costs of care for high-need populations, and should be considered in plans to address the growing burden of diabetes and SUD in the United States. **However, more research is needed to understand how to maximize the benefits of these programs.**

This study has limitations. First, **although we used a propensity-matched control group and adjusted for potential confounding factors,** there may be unmeasured comorbid conditions or complications, such as homelessness, that could affect receipt of diabetes care. **Unmeasured confounding is a common limitation of observational studies.** Second, we have examined the program effect 1 year after NYS-HH enrollment and do not know if this effect would continue past 1 year. **Third, for the sensitivity analysis, we defined diabetes-related outpatient visits using primary diagnoses. However, diabetes can be also addressed by physicians in the context of visits for other conditions, such as hypertension, obesity, renal disease, and coronary heart disease, where diabetes may not be listed as the primary reason for the visit.** Finally, the generalizability of our findings is limited to NYS Medicaid beneficiaries. However, other states with large Medicaid populations and state-wide care management programs may also find these results relevant.

The primary strength of this study was the large sample size and use of a propensity-matched comparison group, which allowed us to isolate the effect of NYS-HH from changes in care occurring over time or related to other Medicaid policies.

CONCLUSIONS

The NYS-HH care management program was associated with a **modest** increase in diabetes care. Individuals with both diabetes and SUD may benefit **moderately** more from care management than those without comorbid SUD. Care management administrators should take special care to recruit individuals with multiple chronic diseases, particularly SUD. Individuals with both SUD and diabetes who are not enrolled in care management may be missing out on crucial diabetes care.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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TABLE 1.

Baseline demographic and health care utilization characteristics for adults with diabetes enrolled in New York State Health Homes, with and without substance use disorder

Variable	Substance use disorder (N=7,733)	No substance use disorder (N=12,066)	P-value[a]
Gender (%)			
Male	49.8%	33.3%	<0.001
Race/ethnicity (%)			
White, non-Hispanic	32.3%	31.5%	0.234
Black, non-Hispanic	41.1%	38.0%	<0.001
Hispanic	13.4%	12.2%	0.013
Residence (%)			
NYC	60.0%	66.6%	<0.001
Comorbidities (%)			
Asthma	37.1%	31.1%	<0.001
Coronary Artery Disease	58.5%	52.0%	<0.001
Bipolar	18.7%	6.3%	<0.001
Schizophrenia	19.7%	8.5%	<0.001
HIV	37.2%	33.6%	<0.001
Age, mean (SD)	50.0 (9.9)	52.0 (10.5)	<0.001
Service utilization, mean (SD)[b]			
ED visits	3.5 (7.5)	1.7 (3.5)	<0.001
Hospital visits	1.5 (3.3)	0.5 (1.5)	<0.001
Outpatient visits[c]	38.4 (59.7)	19.3 (17.2)	<0.001
SUD outpatient visits	3.7 (15.3)	0.0 (0.0)	<0.001
Methadone visits	25.3 (71.5)	0.0 (0.0)	<0.001
Diabetes outpatient visits	3.8 (12.6)	3.8 (6.4)	0.731
Service utilization, any (%)[b]			
ED visits	71.0%	55.8%	<0.001
Hospital visits	47.0%	26.8%	<0.001
Outpatient visits[c]	97.7%	98.2%	0.011

Variable	Substance use disorder (N=7,733)	No substance use disorder (N=12,066)	P-value[a]
SUD outpatient visits	25.2%	0.0%	<0.001
Methadone visits	14.0%	0.0%	<0.001
Diabetes outpatient visits	55.4%	64.5%	<0.001
Diabetes care (%)[b]			
Eye exam	34.4%	42.3%	<0.001
HbA1c test	72.9%	80.3%	<0.001
Medical attention for nephropathy	78.8%	77.2%	0.007
All	25.2%	32.7%	<0.001
Medicaid **spending**, USD[b]			
Mean (SD)	50,122.0 (56,514.0)	35,333.6 (40,825.8)	<0.001
Median	33,084.1	22,407.6	

[a]For categorical variables: Pearson chi-square test with 1 degree of freedom; for continuous variables: independent two-sample t-test

[b]In the past 12 months

[c]Any outpatient visit, inclusive of SUD, methadone, and diabetes-related outpatient visits but exclusive of ED visits

HH=Health Homes; NYC=New York City; SUD=substance use disorder; HIV=human immunodeficiency virus; ED=emergency department

TABLE 2.

Unadjusted Difference-in-Difference-in-Differences Effect of Health Homes and Substance Use Disorder Diagnosis on Receipt of Comprehensive Diabetes Care

	With SUD diagnosis (N=15,409)			No SUD diagnosis (N=21,851)			
	Before HH[a]	After HH[b]	Difference	Before HH[a]	After HH[b]	Difference	DDD
Eye exam							
HH enrolled	34.4%	37.9%	3.5%	42.3%	46.6%	4.3%	
Comparison group	33.7%	35.2%	1.5%	43.0%	46.3%	3.3%	
Difference	0.7%	2.7%	**2.0%**	−0.7%	0.3%	**1.0%**	**1.0%**
HbA1c test							
HH enrolled	72.9%	77.5%	4.6%	80.3%	83.0%	2.7%	
Comparison group	73.7%	74.6%	0.9%	81.9%	82.3%	0.4%	
Difference	−0.8%	2.9%	**3.7%** ***	−1.6%	0.7%	**2.3%** **	**1.4%** ***
Medical attention for nephropathy							
HH enrolled	78.8%	81.9%	3.1%	77.2%	79.3%	2.1%	
Comparison group	77.1%	77.3%	0.2%	77.4%	76.7%	−0.7%	
Difference	1.7%	4.6%	**2.9%** **	−0.2%	2.6%	**2.8%** **	**0.1%** ***
All							
HH enrolled	25.2%	28.9%	3.7%	32.7%	36.8%	4.1%	
Comparison group	24.8%	26.1%	1.3%	32.8%	35.8%	3.0%	
Difference	0.4%	2.8%	**2.4%** *	−0.1%	1.0%	**1.1%**	**1.3%** *

*** $P < .001$;

** $P < .01$;

* $P < .05$

[a] 12 months before enrollment

[b] 12 months after enrollment

HH=Health Homes; HbA1c=Hemoglobin A1c; SUD=Substance Use Disorder; DDD=Difference-in-Difference-in-Differences Difference-in-Differences (DID) effects are the bolded values at the cross-section of rows and columns labeled “Difference”

TABLE 3.

Adjusted Difference-in-Difference-in-Differences Effect of Health Homes and Substance Use Disorder Diagnosis on Receipt of Comprehensive Diabetes Care

	Adjusted[a] Odds Ratio (95% Confidence Interval)		
	With SUD diagnosis (DID)	**No SUD diagnosis (DID)**	**Overall (DDD)**
Eye exam	1.09 (0.99, 1.20)	1.04 (0.96, 1.13)	1.08 (1.01, 1.15) *
HbA1c test	1.23 (1.11, 1.36) ***	1.18 (1.07, 1.30) **	1.20 (1.11, 1.29) ***
Medical attention for nephropathy	1.21 (1.08, 1.35) **	1.18 (1.08, 1.30) ***	1.21 (1.12, 1.31) ***
All	1.13 (1.02, 1.25) *	1.05 (0.97, 1.14)	1.09 (1.02, 1.16) *

*** $P < .001$;

** $P < .01$;

* $P < .05$

[a]All models were adjusted for age, gender, race/ethnicity, residence, comorbidities (HIV, asthma, CAD, bipolar, schizophrenia), and prior year utilization **(counts of emergency department visits, hospital visits, and outpatient visits; Medicaid spending)**

HbA1c=Hemoglobin A1C; SUD=Substance Use Disorder; DID=Difference-in-Differences; DDD=Difference-in-Difference-in-Differences