HHS Public Access

Author manuscript

J Subst Use Addict Treat. Author manuscript; available in PMC 2025 May 01.

Published in final edited form as:

J Subst Use Addict Treat. 2024 May ; 160: 209310. doi:10.1016/j.josat.2024.209310.

Barriers to retention in medications for opioid use disorder treatment in real-world practice

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Abstract

Background: Medications for Opioid Use Disorder (MOUD) are an effective method to treat persons with opioid use disorder (OUD). Longer treatment times are associated with better health outcomes, yet treatment retention rates remain low. This study aimed to assess patient characteristics and experiences associated with retention in treatment.

Methods: Data were from an observational cohort study of OUD treatments. Among persons receiving buprenorphine or methadone, log-binomial regression models assessed the relationship between patient characteristics and experiences and three retention outcomes: retention in any OUD treatment, retention in the index treatment (OUD treatment being administered at the time when patients were screened for study eligibility), and 6-month retention in the index treatment.

Results: Individuals being treated with methadone at the start of the study compared to those treated with buprenorphine were more likely to remain in their same index treatment at the 18-month follow-up (aPR = 1.35; 95 % CI = 1.11–1.65), and to have remained on their index treatment for 6-months or longer (aPR = 1.22; 95 % CI = 1.14–1.32), but were not significantly more likely to remain in any OUD treatment overall. Individuals residing five miles or less from treatment were more likely to have been retained in any OUD treatment (aPR = 1.06; 95 % CI = 1.00–1.12), to remain in their index treatment at the 18-month follow-up (aPR = 1.21; 95 % CI =

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Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

CRediT authorship contribution statement

Vanessa I. Villamil: Conceptualization, Formal analysis, Writing – original draft, Writing – review & editing. **Natasha Underwood:** Conceptualization, Writing – review & editing. **Laura J. Cremer:** Formal analysis, Writing – review & editing. **Cherie R. Rooks-Peck:** Conceptualization, Writing – review & editing. **Xinyi Jiang:** Formal analysis, Writing – review & editing. **Gery P. Guy:** Writing – review & editing.

Declaration of competing interest

The authors Vanessa I. Villamil, Natasha Underwood, Laura J. Cremer, Cherie R. Rooks-Peck, Xinyi Jiang, Gery P. Guy have no conflicts of interest to disclose.

1.08–1.36), and to have remained in their index treatment for 6 months or more (aPR = 1.08; 95 % CI = 1.02–1.13). Individuals without health insurance were less likely to be retained in any OUD treatment (aPR = 0.86; 95 % CI = 0.78–0.95).

Conclusion: The prevalence of retention in any OUD treatment was higher for individuals residing five miles or less from treatment. These findings expand on previous studies that have shown distance to and location of treatment sites can impact treatment access and retention. Lack of health insurance was also associated with lower retention in any OUD treatment in this study. Given the high burden associated with overdose deaths, it is important to understand and address barriers to retention in treatment.

Keywords

Medications for opioid use disorder; Treatment retention

1. Introduction

Overdose deaths continue to impact the United States, remaining a leading cause of injury-related death. In 2021, the number of deaths related to drug overdose surpassed 106,000, with most deaths involving synthetic opioids other than methadone (Spencer et al., 2022). Medications for opioid use disorder (MOUD) treatment are U.S. Food and Drug Administration-approved medications, such as methadone, buprenorphine, or naltrexone that can be used alone or in combination with counseling and behavioral therapies to treat opioid use disorder (OUD) (SAMHSA, 2023). MOUD treatment can help with cravings and symptoms of withdrawal from cessation of opioid use while allowing stabilization of brain functions and is associated with reductions in opioid use, overdose mortality, and criminal activity (WHO/UNODC/UNAIDS, 2004). Despite the availability and efficacy of these medications, only 22.1 % of people with OUD related to use of heroin or misuse of prescription pain relievers in 2021 received MOUD treatment within the past year (SAMHSA, 2022).

Although MOUD treatment has become more widely available in recent years, and the benefits of long-term retention are well known (Fiellin et al., 2014; Ma et al., 2019; Wakeman et al., 2020; Williams et al., 2020), utilization and retention in treatment remain low (Mauro et al., 2022; Meinhofer et al., 2019; Saloner et al., 2017). Individuals with substance use disorders must overcome many psychological, social, and economic barriers to obtain treatment and treatment is not always equitably accessible (Corry et al., 2022). Commonly reported barriers to accessing treatment include not having health care coverage or not being able to afford the cost of treatment, lack of treatment availability, negative treatment perceptions including medication side effects, lack of flexibility (e.g., daily visits for medications, strict regulations, lack of take-home doses) and social stigma (Hall et al., 2021).

Those individuals that access MOUD treatment are often not retained in treatment for long. However, longer treatment times are associated with better outcomes. When compared to individuals in treatment for 6–9 months, individuals retained in treatment for 15–18 months had significantly lower odds of emergency department visits and inpatient hospitalizations

(Williams et al., 2020). The National Quality Forum has endorsed a minimum of six months of MOUD treatment (National Quality Forum, 2017). Unfortunately, <45 % of individuals on MOUD treatment reach the recommended 6-month period (Meinhofer et al., 2019; Saloner et al., 2017).

While factors related to MOUD access are well documented, factors impacting retention in treatment are less understood. Previous studies have identified factors associated with increased odds of retention in MOUD treatment such as being older (Alford et al., 2011), female (Montalvo et al., 2019; Weinstein et al., 2017), and having a psychiatric disorder diagnosis (Bailey et al., 2021; Montalvo et al., 2019; Weinstein et al., 2017). One study also identified that higher doses of buprenorphine/naloxone or methadone were related to longer retention in treatment (Hser et al., 2014). A review assessing retention among adolescents and young adults identified inconsistent findings by age in previous studies, suggesting that medication type may be a moderator for the association between age and retention (Viera et al., 2020). A previous study assessing employment status found that patients that were employed had higher odds of treatment success, defined as treatment retention or buprenorphine taper after treatment adherence and absence of illicit drug use for at least 6 months (Alford et al., 2011). One study found no association between private insurance and treatment retention (Soeffing et al., 2009), while another study found that loss of insurance was strongly correlated with buprenorphine treatment disengagement in the privately insured population (Manhapra et al., 2018). Few studies have assessed logistical barriers such as distance from treatment and transportation type and retention in MOUD treatment. One study of substance use disorder treatment programs not specific to MOUD found an association between longer distance from outpatient treatment and decreased length of stay in treatment; however, this study did not assess treatment type (Beardsley et al., 2003). Another study found improved retention in outpatient treatment with methadone with the provision of transportation services, but not with transportation vouchers (Friedmann et al., 2001).

The purpose of this study is to further assess characteristics and treatment experiences that are associated with retention in treatment using a multistate study of individuals in MOUD treatments in real-world practice. This study assessed distance from treatment site, primary mode of transportation, employment status, health insurance status, and diagnosis of a mental health condition, as well as MOUD treatment type. Understanding the various factors that impact retention in treatment is critical for improving outcomes and preventing over-doses. Additionally, identifying patient barriers can help inform programs and policies to address disparities in overdose morbidity and mortality.

2. Methods

2.1. Data source

This study examined data from the Medications for Opioid Use Disorder (MOUD) Study: An 18-Month Longitudinal Study of Patients Treated for Opioid Use Disorder (Dever et al., 2023). The MOUD Study was an observational cohort study conducted between 2017 and 2021, and included 62 outpatient facilities across 16 U.S. states, offering four different types of OUD treatment including buprenorphine (e.g. Suboxone, Probuphine, generic),

methadone, naltrexone (e.g. Vivitrol, Revia, generic), and counseling without MOUD. The OUD treatment being administered at the time when patients were screened for study eligibility was defined as the index treatment; this analysis excluded individuals if their index treatment was naltrexone or counseling without medication due to the small sample size of these groups. Patient-level data were collected longitudinally using self-administered questionnaires; overview of the data collection instrument and associated items assessed are included in a separate publication (Dever et al., 2023). The MOUD Study excluded facilities administered by the U.S. Department of Veterans Affairs and facilities that served primarily court-ordered patients. Patients with OUD were eligible to participate if they were 18 years of age or older (19 years in Alabama) and were able to fill out the study questionnaires in English or Spanish. The study collected data from patients at baseline, 3-, 6-, 12-, and 18-month follow-up. The study still followed patients if they discontinued their index treatment or if they missed a follow-up questionnaire. A total of 1841 patients with OUD were receiving buprenorphine or methadone at baseline.

2.2. Measures

This study assessed three OUD treatment retention outcomes. All three outcomes were binary (Yes/No). The first outcome assessed was retention in any OUD treatment compared to those not in any OUD treatment at the 18-month follow-up. This outcome was included to assess overall retention in OUD treatment regardless of discontinuation of the index treatment. The second outcome assessed was retention in the index treatment compared to those that were no longer receiving their index treatment at the 18-month follow-up, including individuals that were receiving a different type of treatment or no longer receiving any treatment, in order to assess retention in the treatment patients were receiving when enrolled in the study. The third outcome assessed was 6-month retention in index treatment, compared to those retained in their index treatment for <6 months, as 6 months is the recommended minimum length of treatment. This analysis included only individuals that responded to the 18-month questionnaire to allow for comparison of individuals that discontinued treatment, changed their treatment type, or stayed in index treatment throughout the entirety of the study period. Change in dose of index treatment was not assessed in this analysis.

Exposures of interest included MOUD treatment type, distance from treatment facility, usual mode of transportation to appointments, employment status, health insurance status, and prior diagnoses of a mental illness. The study approximated patient's distance from the treatment facility using the distance from the treatment facility to the centroid of the zip code where they resided and recorded in miles. Distance was analyzed using a threshold of 5 miles, adapted from a previous study which reported that the effects of distance were not uniform (Beardsley et al., 2003). This analysis compared individuals that traveled >5 miles to those that traveled 5 miles or less to treatment.

2.3. Covariates

Demographic covariates assessed included age group, sex, race/ethnicity, level of education, and marital status as reported in the questionnaire.

Facility level covariates assessed included facility size, treatment focus (substance use, mental health and substance use, general health, other, undefined), ownership type (private for-profit, private non-profit, government owned, undefined), trauma intervention services and region as well as state policy related variables including, high State Targeted Response to the Opioid Crisis (STR)/State Opioid Response (SOR) dollars per month per capita, and summative ranking of state legislation to reduce prior authorization barriers to MOUD.

2.4. Statistical analysis

Descriptive statistics summarize overall patient demographic characteristics and experiences.

Bivariate log-binomial regressions assess the association between each demographic covariate and retention in treatment outcome. The study ran multivariable log-binomial regression models for each exposure of interest and outcome of interest while adjusting for the afore-mentioned demographic covariates. Poisson regression models with robust standard errors were chosen if log-binomial regression models did not converge (Knol et al., 2012). The study used directed acyclic graphs which convey directional causal associations (Tennant et al., 2021) between variables based on previous literature to select additional covariates to adjust for in each model; therefore models assessing usual mode of transportation as an exposure included distance to treatment as a potential confounder. Intra-cluster correlation (ICC) analysis assessed facility level clustering. Since approximately 12–17 % of the variability in the probability of outcomes can be attributed to the treatment facility (All p-values<0.05; data not shown), we applied generalized estimating equations (GEE) with an exchangeable correlation matrix to account for correlation within the treatment facilities. To reduce confounding by facility level covariates, multivariable log-binomial regression models were rerun controlling for treatment facility covariates. Results are presented as prevalence ratios (PRs), adjusted PRs (aPRs), and corresponding 95 % confidence intervals (CIs).

Variance inflation factors (VIF) assessed multicollinearity of the variables in the multivariable models and detected no multicollinearity. The study performed all data analyses in RStudio 2022.02.03 (Build 492) and SAS 9.4.

3. Results

3.1. Descriptive statistics

At the 18-month follow-up, 1054 (53.4 %) of the 1974 patients with OUD initially enrolled completed a self-administered questionnaire of which 987 had an index treatment of methadone or buprenorphine. Of those included in the sample 697 (70.6 %) reported still receiving their index treatment at the 18-month follow-up-496 index methadone maintenance therapy, and 201 index buprenorphine, 847 (85.8 %) were receiving any treatment, and 880 (89.2 %) were in their index treatment for 6-months or longer. Individuals included in the sample were primarily non-Hispanic White (70.9 %), between 35 and 44 years of age (32.9 %), and female (60.7 %). (Table 1).

3.2. Bivariate analysis

Table 2 displays the unadjusted PRs and 95 % CIs for the bivariate analysis of factors related to treatment retention. In the bivariate analysis individuals aged 25–34 years (PR = 0.91; 95 % CI = 0.85–0.97) compared to those aged 55 or older, and non-Hispanic Black persons (PR = 0.88; 95 % CI = 0.80–0.98) compared to non-Hispanic White persons were less likely to be retained in any OUD treatment at 18-month follow-up. Individuals aged 25–34 years (PR = 0.83; 95 % CI = 0.74–0.92) compared to those aged 55 or older, non-Hispanic Black persons (PR = 0.82; 95 % CI = 0.68–0.99) compared to non-Hispanic White persons, and that had a level of education of a high-school diploma (PR = 0.84; 95 % CI = 0.75–0.94) compared to not having a high-school diploma were less likely to be retained in their index treatment at the 18-month follow-up.

3.3. Multivariable regression models

Table 3 displays the adjusted prevalence ratios (aPRs) and 95 % CIs for the multivariable regression analyses of exposures and treatment retention controlling for covariates. In the multivariable models individuals with an index treatment of methadone (aPR = 1.05; 95 % CI = 1.00–1.11), and individuals residing five miles or less from treatment (aPR = 1.08; 95 % CI = 1.02–1.14) were more likely to be retained in any OUD treatment at 18-month follow-up compared to those receiving buprenorphine or residing more than five miles from treatment, respectively, while individuals that did not have health insurance were less likely to be retained (aPR = 0.86; 95 % CI = 0.77–0.95) compared to those who had health insurance. Individuals with an index treatment of methadone (aPR = 1.24; 95 % CI = 1.11–1.39), individuals residing five miles or less from treatment (aPR = 1.22; 95 % CI = 1.09–1.37), and individuals that usually drove a car to treatment (aPR = 1.11; 95 % CI = 1.00–1.24) were more likely to be retained in their index treatment at the 18-month follow-up than those who used transportation other than driving or public transportation or a taxi. Individuals that did not have health insurance were less likely to be retained in their index treatment at the 18-month follow-up (aPR = 0.86; 95 % CI = 0.77–0.95) compared to those who had health insurance. Individuals with an index treatment of methadone (aPR = 1.14; 95 % CI = 1.08–1.20) and individuals residing five miles or less from treatment (aPR = 1.08; 95 % CI = 1.03–1.13) were more likely to be retained in their index treatment for 6 months or longer.

Table 4 displays the aPRs and 95 % CIs for the multivariable log-binomial regression analyses of exposures and treatment retention controlling for covariates as well as treatment facility variables, to further account for the impact of facility level variables on the treatment retention outcomes. After adjusting for treatment facility variables, individuals with an index treatment of methadone were no longer more likely to be retained in any treatment at the 18-month follow-up; however, individuals residing five miles or less from treatment (aPR = 1.06; 95 % CI = 1.00–1.12) were more likely to be retained in any OUD treatment at 18-month follow-up and individuals that did not have health insurance were less likely to be retained (aPR = 0.86; 95 % CI = 0.78–0.95). Individuals with an index treatment of methadone (aPR = 1.35; 95 % CI 1.11–1.65) and individuals residing five miles or less from treatment (aPR = 1.21; 95 % CI = 1.08–1.36) were more likely to be retained in their index treatment at the 18-month follow-up. Individuals who usually drove a car to treatment

were no longer more likely to be retained in their index treatment at the 18-month follow-up and those who did not have health insurance were no longer less likely to be retained in their index treatment at the 18-month follow-up. Individuals with an index treatment of methadone (aPR = 1.22; 95 % CI = 1.14–1.32) and individuals residing five miles or less from treatment (aPR = 1.08; 95 % CI = 1.02–1.13) were more likely to be retained in their index treatment for 6 months or longer.

4. Discussion

This study assessed retention in MOUD treatment among individuals receiving buprenorphine or methadone among a large cohort of individuals from outpatient sites in various states across the nation. Our findings suggest that distance to treatment remains a barrier to retention in treatment as does lack of health insurance coverage. Additionally, this study adds to the existing knowledge of patient characteristics and experiences associated with retention in treatment.

While some studies have found retention in treatment by medication type and the relationship between dose and retention to be inconsistent (Viera et al., 2020; Zhang et al., 2022), our analysis found that individuals being treated with methadone were more likely to be retained in their index treatment for six months or more and at the 18-month follow-up when compared to those being treated with buprenorphine; however, treatment type was not associated with retention in any OUD treatment at the 18-month follow-up. Further study is needed to understand the relationship between treatment type and retention. Future studies may consider assessing the role of federal and state policies regarding MOUD treatment type and how they may impact retention.

Few studies have assessed potential barriers to retention in treatment such as distance from treatment site, transportation type, employment, and health insurance coverage. One previous study from Baltimore City in 2003 found that traveling >4 miles to treatment was associated with a shorter length of stay in treatment than individuals that traveled <1 mile (Beardsley et al., 2003). Similarly, our study found that individuals residing 5 miles or less from treatment were more likely to be retained in treatment than individuals residing further away. No association was found by transportation type after adjusting for facility level variables. In this study, employment was not significantly associated with retention in treatment. This is consistent with a past study that found no association in retention by employment status (Soeffing et al., 2009). Additionally, health insurance was associated with retention in treatment as is consistent with past studies that have identified loss of insurance coverage as one of the major impediments to buprenorphine treatment retention (Manhapra et al., 2018).

Diagnosis of a mental condition was not significantly associated with retention in treatment. Previous studies have demonstrated mixed or inconsistent results on the association between mental health conditions and retention in treatment. (Bailey et al., 2021; Biondi et al., 2022; Montalvo et al., 2019; Weinstein et al., 2017). It has been speculated that dual treatment for opioid use disorder and other comorbid psychiatric disorders may be beneficial (Montalvo

et al., 2019) however, our study did not distinguish between a current or past diagnosis and therefore benefits of dual treatment are not assessed in this analysis.

Consistent with some previous studies that found individuals who were older had increased odds of retention (Alford et al., 2011) our unadjusted analyses showed that younger individuals aged 25–34 years were less likely to be retained in treatment than individuals aged 55 years or older. Previous studies have demonstrated mixed or inconsistent results on the association between retention in treatment and sex. (Bailey et al., 2021; Biondi et al., 2022; Montalvo et al., 2019; Weinstein et al., 2017). Our analysis found no association with retention by sex. Non-Hispanic black patients were less likely to be retained in treatment at the 18-month follow-up. No similar findings were found in other racial and ethnic patient groups; previous authors assert that culturally relevant treatments can be beneficial for OUD treatment. More work is needed to fully examine what role, if any, age, sex, and race have in retention.

Additionally, this study assessed the association between education with retention in OUD treatment. Individuals with a high-school diploma or equivalent as their highest level of education were less likely to be retained in their index treatment at the 18-month follow up compared to individuals without a high school diploma in unadjusted analyses. A previous study that included education in their analysis found a similar association, with individuals having 12 years of education having decreased odds of retention for six months when compared to those with eight years or less of education (Krawczyk et al., 2021). However, it is possible that having less than a high school education could be associated with other factors such as younger age, mental illness, or living arrangements, so further assessment is needed to understand this association. No association was found by marital status in this analysis.

These findings highlight the need to provide adequate transportation support such as pick-up services particularly for individuals with longer distances to treatment as one previous study found improved retention in outpatient methadone maintenance treatment with the provision of transportation services, but not with transportation vouchers (Friedmann et al., 2001). These findings may also have implications for geographic placement of future treatment sites as treatment sites are not always equitably accessible in all communities (Corry et al., 2022). Additionally, increased use of telemedicine could decrease travel and has been shown to improve MOUD access and retention (Frost et al., 2022), although the effectiveness of telemedicine compared to face-to-face treatment needs further study (Chan et al., 2022).

4.1. Limitations

Several limitations of this study should be noted. First, this was a naturalistic observational longitudinal study using self-reported questionnaires and patients were followed even if they missed the 3- or 6-month follow-up questionnaire; therefore, there may be some issues with recall error and self-report bias. Second, as with most studies relying on questionnaires, nonresponse is a limitation particularly as this is a hard-to-reach population. Age, sex, race/ethnicity, education, distance from treatment, transportation type, employment, and mental illness diagnosis were all associated with loss to follow up, possibly leading to under or over estimation of these associations to retention. Additionally, nonresponse rates and loss to

follow up, as well as the exclusion of facilities primarily serving veterans or court-ordered individuals limit the generalizability of these findings.

4.2. Conclusion

The major strengths of this study are that it was a large nationwide study of outpatient MOUD treatment that used a large sample size of patients and sites in real-world practice. The results of this study suggest that shorter distances to treatment for patients and access to health insurance coverage might improve treatment retention. Additionally, we saw differences in retention in index treatment by treatment type at the start of the study. Future studies can further focus on the association between treatment type and retention in index treatment. These findings may have implications for geographic placement of future treatment sites as well as inform considerations regarding treatment choices and resources provided for patients with OUD.

Acknowledgements

Laura J. Dunlap, Mark J. Edlund, Jill A. Dever, John S. Richardson, Didier Turcios, Arnie Aldridge, Camille Gourdet, and the RTI International project team.

This project was supported in part by an appointment to the Research Participation Program at the Centers for Disease Control and Prevention administered by the Oak Ridge Institute for Science and Education through an interagency agreement between the US Department of Energy and the Centers for Disease Control and Prevention.

Role of funding source

This work was produced under contract number HHSD20002013M53964B with the Centers for Disease Control and Prevention and the U.S. Department of Health and Human Services between 2016 and 2021.

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Table 1

Patient characteristics of respondents at the 18-month follow-up[a] (n = 987).

Characteristics	Overall n (%)
Age group (years)	
18–24	28 (2.8 %)
25–34	292 (29.6 %)
35–44	325 (32.9 %)
45–54	201 (20.4 %)
55+	141 (14.3 %)
Sex	
Female	599 (60.7 %)
Male	388 (39.3 %)
Race/Ethnicity	
Non-Hispanic Black	91 (9.2 %)
Non-Hispanic White	700 (70.9 %)
Non-Hispanic Other or Mixed Race	58 (5.9 %)
Hispanic, any race	138 (14.0 %)
Education	
No high school diploma	147 (14.9 %)
High school diploma	280 (28.4 %)
Some college or technical training	560 (56.7 %)
Marital status	
Single, never married	474 (48.0 %)
Married or domestic partnership	230 (23.3 %)
Divorced or separated	213 (21.6 %)
Widowed	41 (4.2 %)
Other	28 (2.8 %)
Index treatment	
Methadone	659 (66.8 %)
Buprenorphine	328 (33.2 %)
Distance from treatment facility	
≤ 5 miles	389 (39.4 %)
> 5 miles	598 (60.6 %)
Usual mode of transportation to treatment	
Drove a car	505 (51.2 %)
Public transportation or a taxi	308 (31.2 %)
Other	174 (17.6 %)
Employed	
Yes	323 (32.7 %)
No	664 (67.3 %)
Health insurance	
Yes	837 (84.8 %)

Characteristics	Overall n (%)
No	150 (15.2 %)
Ever diagnosed with mental illness	
Yes	506 (51.3 %)
No	481 (48.7 %)
Retained in any OUD treatment	
Yes	847 (85.8 %)
No	140 (14.2 %)
Retained in index treatment	
Yes	697 (70.6 %)
No	290 (29.4 %)
Retained in index treatment for 6 months or more	
Yes	880 (89.2 %)
No	107 (10.8 %)

OUD = opioid use disorder; Index Treatment = OUD treatment being administered at the time when patients were screened for study eligibility.

[a]Excluding respondents with an index treatment of naltrexone or counseling without medication.

Table 2

Prevalence ratios for MOUD treatment retention at 18-month follow-up by demographic characteristics.

	Retention in any OUD treatment (n = 847) at the 18-month follow up	Retention in the index treatment (n = 290) at the 18-month follow up	Retention in the index treatment for 6 months or more (n = 880)
Characteristics	**PR (95 % CI)**	**PR (95 % CI)**	**PR (95 % CI)**
Age group (years)			
55+ (ref)			
18–24	0.82 (0.68, 1.00)	0.78 (0.61, 1.00)	0.95 (0.81, 1.11)
25–34	0.91 (0.85, 0.97)	0.83 (0.74, 0.92)	0.93 (0.87, 1.00)
35–44	0.99 (0.93, 1.06)	0.96 (0.86, 1.07)	0.98 (0.92, 1.03)
45–54	1.00 (0.93, 1.08)	1.04 (0.92, 1.17)	1.01 (0.95, 1.08)
Sex			
Male (ref)			
Female	1.03 (0.99, 1.08)	1.04 (0.96, 1.13)	1.01 (0.96, 1.07)
Race/Ethnicity			
Non-Hispanic White (ref)			
Non-Hispanic Black	0.88 (0.80, 0.98)	0.82 (0.68, 0.99)	0.94 (0.86, 1.03)
Non-Hispanic Other or Mixed Race	1.00 (0.92, 1.09)	1.01 (0.89, 1.14)	1.06 (0.99. 1.13)
Hispanic, any race	0.96 (0.89, 1.04)	0.99 (0.87, 1.12)	1.00 (0.94, 1.06)
Education			
No high school diploma (ref)			
High school diploma	1.01 (0.92. 1.09)	0.84 (0.75, 0.94)	0.95 (0.88, 1.01)
Some college or technical training	1.02 (0.96, 1.09)	0.94 (0.86, 1.03)	0.96 (0.92, 1.01)
Marital status			
Married or domestic partnership (ref)			
Single, never married	0.94 (0.89, 1.00)	0.93 (0.85, 1.02)	1.01 (0.96, 1.07)
Divorced or separated	1.00 (0.92, 1.08)	1.00 (0.87, 1.14)	1.02 (0.95, 1.09)
Widowed	0.96 (0.81, 1.14)	0.99 (0.79, 1.23)	1.08 (1.00, 1.16)
Other	0.93 (0.77, 1.12)	0.99 (0.80, 1.23)	1.02(0.90, 1.15)

PR = prevalence ratio; CI = confidence intervals; OUD = opioid use disorder; MOUD = medications for opioid use disorder; Index treatment = OUD treatment being administered at the time when patients were screened for study eligibility. Reference Group: age 55 or older; male; non-Hispanic White; no high school diploma; married or domestic partnership.

Table 3

Adjusted prevalence ratios[a] for MOUD treatment retention at 18-month follow-up by patient experiences.

	Retention in any OUD treatment (n = 847) at the 18-month follow up	Retention in the index treatment (n = 290) at the 18-month follow up	Retention in the index treatment for 6 months or more (n = 880)
Characteristics	**aPR (95 % CI)**	**aPR (95 % CI)[c]**	**aPR (95 % CI)[c]**
Index treatment			
Buprenorphine (ref)			
Methadone	1.05 (1.00, 1.11)	1.24 (1.11, 1.39)	1.14 (1.08, 1.20)
Distance from treatment facility			
>5 miles (ref)			
≤5 miles	1.08 (1.02, 1.14)[c]	1.22 (1.09. 1.37)	1.08 (1.03, 1.13)
Usual mode of transportation to treatment[b]			
Other (ref)			
Drove a car	1.02 (0.96, 1.09)[c]	1.11 (1.00, 1.24)	1.06 (0.99, 1.14)
Public transportation or a taxi	1.01 (0.94, 1.08)[c]	1.03 (0.93, 1.13)	1.01 (0.94, 1.08)
Employed			
No (ref)			
Yes	1.01 (0.96, 1.05)	1.04 (0.97, 1.11)	0.99 (0.95, 1.03)
Health insurance			
Yes (ref)			
No	0.86 (0.77, 0.95)	0.87 (0.76, 1.00)	0.95 (0.88, 1.03)
Ever diagnosed with mental condition			
No (ref)			
Yes	1.03 (0.98, 1.09)	0.96 (0.89, 1.04)	0.98 (0.92, 1.04)

aPR = adjusted prevalence ratio; CI = confidence intervals; OUD = opioid use disorder; MOUD = medications for opioid use disorder; Index treatment = OUD treatment being administered at the time when patients were screened for study eligibility.

[a] Separate models were used for each exposure and outcome adjusted for age group, sex, race/ethnicity, education, and marital status.

[b] Models additionally adjusted for distance from treatment facility.

[c] For this result Poisson regression models were chosen given convergence problems with log-binomial regression models.

Table 4

Adjusted prevalence ratios[a] for MOUD treatment retention at 18-month follow-up by patient experiences *controlling for treatment facility related variables.*

	Retention in any OUD treatment (n = 847) at the 18-month follow up	**Retention in the index treatment (n = 290) at the 18-month follow up**	**Retention in the index treatment for 6 months or more (n = 880)**
Characteristics	**aPR (95 % CI)[c]**	**aPR (95 % CI)[c]**	**aPR (95 % CI)[c]**
Index treatment			
Buprenorphine (ref)			
Methadone	1.07 (0.99, 1.15)	1.35 (1.11, 1.65)	1.22 (1.14, 1.32)
Distance from treatment facility			
>5 miles (ref)			
≤5 miles	1.06 (1.00, 1.12)	1.21 (1.08, 1.36)	1.08 (1.02, 1.13)
Usual mode of transportation to treatment[b]			
Other (ref)			
Drove a car	1.03 (0.96, 1.11)	1.11 (0.99, 1.23)	1.06 (0.99, 1.14)
Public transportation or a taxi	1.00 (0.93, 1.07)	1.03 (0.93, 1.13)	1.00 (0.93, 1.07)
Employed			
No (ref)			
Yes	1.02 (0.97, 1.09)	1.04 (0.97, 1.12)	0.99 (0.95, 1.03)
Health insurance			
Yes (ref)			
No	0.86 (0.78, 0.95)	0.88 (0.76, 1.03)	0.97 (0.89, 1.05)
Ever diagnosed with mental condition			
No (ref)			
Yes	1.01 (0.95, 1.07)	0.95 (0.88, 1.03)	0.98 (0.92, 1.04)

aPR = adjusted prevalence ratio; CI = confidence intervals; OUD = opioid use disorder; MOUD = medications for opioid use disorder; Index treatment = OUD treatment being administered at the time when patients were screened for study eligibility.

[a]Separate models were used for each exposure and outcome adjusted for age group, sex, race/ethnicity, education, and marital status and facility related variables including size, treatment focus, ownership type, trauma intervention services and region as well as state policy related variables including, high State Targeted Response to the Opioid Crisis (SOR)/State Opioid Response (STR) dollars per month per capita, and summative ranking of state legislation to reduce prior authorization barriers to MOUD.

[b]Models additionally adjusted for distance from treatment facility.

[c]For this result Poisson regression models were chosen given convergence problems with log-binomial regression models.