



Outpatient follow-up and use of medications for opioid use disorder after residential treatment among Medicaid enrollees in 10 states

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ABSTRACT

Background: Follow-up after residential treatment is considered best practice in supporting patients with opioid use disorder (OUD) in their recovery. Yet, little is known about rates of follow-up after discharge. The objective of this analysis was to measure rates of follow-up and use of medications for OUD (MOUD) after residential treatment among Medicaid enrollees in 10 states, and to understand the enrollee and episode characteristics that are associated with both outcomes.

Methods: Using a distributed research network to analyze Medicaid claims data, we estimated the likelihood of 4 outcomes occurring within 7 and 30 days post-discharge from residential treatment for OUD using multinomial logit regression: no follow-up or MOUD, follow-up visit only, MOUD only, or both follow-up and MOUD. We used meta-analysis techniques to pool state-specific estimates into global estimates.

Results: We identified 90,639 episodes of residential treatment for OUD for 69,017 enrollees from 2018 to 2019. We found that 62.5% and 46.9% of episodes did not receive any follow-up or MOUD at 7 days and 30 days, respectively. In adjusted analyses, co-occurring mental health conditions, longer lengths of stay, prior receipt of MOUD or behavioral health counseling, and a recent ED visit for OUD were associated with a greater likelihood of receiving follow-up treatment including MOUD after discharge.

Conclusions: Forty-seven percent of residential treatment episodes for Medicaid enrollees are not followed by an outpatient visit or MOUD, and thus are not following best practices.

Abbreviation: MODRN, Medicaid Outcomes Distributed Research Network.

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1. Introduction

1.1. Background

There were over 90,000 drug overdose deaths in the US in 2020, over 80% of which involved opioids (Centers for Disease Control and Prevention, 2022). Residential treatment for substance use disorder (SUD) includes 24 hour living support with available on-site clinical services provided by addiction treatment, mental health, and general medical personnel (American Society of Addiction Medicine, 2015). Over 269,000 residential treatment discharges were reported to the Substance Abuse and Mental Health Services Administration (SAMHSA) in 2019 (Substance Abuse and Mental Health Services Administration, 2021). From 2007–2019, the proportion of residential treatment episodes where opioids were the primary substance used steadily increased, and in 2019 accounted for just under 30% of all publicly-funded admissions nationwide (Substance Abuse and Mental Health Services Administration, 2021).

A systematic review of 23 studies published in 2019 concluded that moderate quality evidence supports residential treatment's ability to improve recovery in those with a SUD (de Andrade et al., 2019). Notably, the review authors identified post-discharge follow-up (i.e., outpatient treatment with any provider within a set number of days after a residential treatment episode, otherwise known as continuity of care post-discharge) as a significant predictor of recovery (de Andrade et al., 2019). Individuals who receive follow-up after residential treatment are more likely to remain abstinent within 1 year post-discharge relative to individuals who received standard care (DeMarce et al., 2008), and less likely to die within 2 years compared to those who did not receive follow-up treatment (Harris et al., 2015). Follow-up rates after discharge from residential treatment may vary considerably; one study in Washington state found that the percent of patients with a follow-up visit within 14 days ranged from 13% to 66% across 33 facilities (Acevedo et al., 2018). A study of residential rehabilitation treatment programs within the Veteran's Health Administration found a mean follow-up rate of 59% within 7 days and 80% within 30 days, but with notable variation across programs (Rubinsky et al., 2018). Little is known regarding what factors influence the likelihood of receiving follow-up (de Andrade et al., 2019), but studies have found lower follow-up rates among men and patients with mental health comorbidities (Carter et al., 2008), as well as patients living long distances from the residential treatment facility from which they were discharged (Garnick et al., 2020). While Medications for Opioid Use Disorder (MOUD) (i.e., buprenorphine, methadone, or naltrexone) are the standard of care for the treatment of opioid use disorder (OUD), their use within residential treatment facilities is low (Huhn et al., 2020). Thus, understanding patterns of outpatient follow-up and MOUD use after residential treatment is critical.

Medicaid provides public health insurance for low-income and disabled individuals, and is the single largest health insurer in the US, with over 88 million enrollees as of April 2022 (Kaiser Family Foundation, 2022). Medicaid covers a disproportionate number of people with behavioral health conditions, including 38% of persons with OUD (Kaiser Family Foundation, 2019). Medicaid is also the largest payer for OUD-related inpatient stays and emergency department visits (Agency for Healthcare Research and Quality, 2022). Yet, we are aware of only two studies that have focused on follow-up after residential treatment for individuals enrolled in Medicaid. The first (Reif et al., 2017) focused on hospital and residential detoxification stays in 10 states and found that two-thirds of enrollees did not have a follow-up visit within 14 days after discharge. However, this study is limited in that the data were from 2008 and excluded enrollees in Medicaid managed care (approximately 82% of the sample). The second study (Stein et al., 2009) found that less than half of enrollees received a follow-up visit 30 days after discharge, but the study was limited to data from 2004 to 2006 from one Medicaid managed care plan in one state, limiting the generalizability of its findings.

1.2. Present study

State Medicaid programs have substantial flexibility in how they choose which SUD treatment to cover and how to reimburse for services, with notable variation in rates of treatment for OUD (The Medicaid Outcomes Distributed Research Network, 2021). Significant policy shifts have occurred in Medicaid's financing of residential treatment stays since the 2000 s. The Affordable Care Act extended Medicaid coverage to millions of previously uninsured individuals, many of whom live with a SUD (Andrews et al., 2018). States have also expanded their coverage of residential treatment services through Medicaid waivers and other policy changes in response to the opioid crisis (Miles, 2019). In addition, OUD prevalence and overdose deaths have continued to rise, especially during the COVID-19 pandemic (Centers for Disease Control and Prevention, 2021b). Thus, understanding the quality of OUD treatment delivered to Medicaid enrollees is critical. The objective of this study is to measure rates of outpatient follow-up visits and use of MOUD after residential treatment among Medicaid enrollees in 10 states, and to understand the enrollee and episode characteristics that are associated with both outcomes.

2. Material and methods

2.1. Data sources

We obtained data from 10 states (Delaware, Kentucky, Maryland, Michigan, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia) participating in the Medicaid Outcomes Distributed Research Network (MODRN). These states capture 22.3% of the Medicaid population nationally (Kaiser Family Foundation, 2021) and include the five states ranking highest in overdose deaths in 2020 (West Virginia, Kentucky, Delaware, Ohio, and Tennessee) (Centers for Disease Control and Prevention, 2021a). University-based researchers in these 10 states obtained Medicaid claims, encounter, and enrollment data directly from their state's Medicaid agency. Individual-level Medicaid data were not permitted to be shared across states. Following previously validated approaches in distributed research networks (Toh et al., 2011), MODRN developed a common data model with uniform structure and data elements to which each participating university converted its Medicaid data. A data coordinating center distributed identical code for SAS software (SAS Institute Inc, 2021) to each university to apply to its state's Medicaid data (Zivin et al., 2022). (Note: the only exception to standardized SAS code was for the identification of residential treatment episodes as explained below). Each university then submitted aggregate results to the data coordinating center for statistical analyses and to summarize results. This approach enabled standardized Medicaid data analyses across states. We present deidentified state-level results per our data use agreements with participating state agencies.

2.2. Study population

There is no uniform method for identifying residential treatment episodes in Medicaid claims data. Thus, each university worked with state agency officials to identify which Current Procedural Terminology (CPT) codes they accept from providers billing for residential treatment for SUDs. As guidance, states were asked for the CPT codes used for the American Society of Addiction Medicine levels of care (American Society of Addiction Medicine, 2015) of 3.1 (clinically managed low intensity residential services), 3.3 (clinically managed population specific high intensity residential services), and 3.5 (clinically managed high intensity services) (a list of the CPT codes used are available in the Supplemental Materials).

We included residential treatment episodes occurring between February 1, 2018 and November 30, 2019, with a diagnosis of OUD (ICD-10 code of F11.xxx) on the claim, and that were for more than one day. Further, enrollees were required to be full-benefit (i.e.,

comprehensive coverage), non-dually eligible, Medicaid enrollees ages 12–64. Episodes were excluded if the enrollee was not continuously enrolled for at least 30 days before and after the episode, so that health care utilization prior to and after the episode could be observed. Finally, episodes were excluded if a subsequent inpatient or residential stay occurred within 30 days of discharge, except for residential treatment episodes beginning within 7 days of discharge of a preceding episode, which were merged into a single episode.

2.3. Outcomes

Our outcomes of interest were outpatient follow-up and any use of MOUD post-discharge. We used a modified version of the National Committee of Quality Assurance (NCQA) definition of an outpatient follow-up visit as specified in the Follow-Up After Hospitalization for Mental Illness measure (National Committee for Quality Assurance, 2021) in which we required a principal diagnosis of OUD on the claim. We identified post-discharge MOUD through pharmacy and professional claims for buprenorphine, injectable naltrexone, oral naltrexone, and methadone, as defined by the National Quality Forum (National Quality Forum, 2022). We identified both outcomes within 7 and 30 days of discharge, consistent with the NCQA measure discussed above. For MOUD, we included the day of discharge as enrollees might be discharged with a prescription, whereas we required follow-up to occur at least one day after discharge as we could not identify visits that occurred outside of the residential treatment facility on the day of discharge with certainty.

2.4. Covariates

All models adjusted for enrollee characteristics including age, sex, rurality, and Medicaid eligibility category (disabled, non-disabled) at the time of the residential stay. We included self-reported racial and ethnic identity as a binary variable (non-Hispanic White, and all other) as some states had small sample sizes of non-Hispanic White enrollees. We included indicators for whether the enrollee was diagnosed with a co-occurring mental health condition (mood, anxiety, or schizophrenia) or another SUD other than OUD (excluding tobacco use disorder). We also included measures of utilization that occurred in the 30 days prior to the beginning of the residential treatment episode, including any MOUD fill or claim, behavioral health counseling, acute care visit for opioid overdose, emergency department visit for OUD, and all-cause inpatient stays. MOUD may not be observed reliably in claims data across all states during a residential treatment episode as it may be part of a bundled payment to the facility; thus, we did not include such a variable in our model. We included a categorical variable that controlled for varying lengths of the residential treatment episode (less than 7 days, 7–30 days, more than 30 days). We used these categories as 30 days aligns with SAMHSA’s delineation between a short and long residential treatment stay, and because 7 days may capture very short stays that are systematically different from other residential treatment episodes. Finally, we included a binary indicator for whether the episode was the enrollee’s first residential treatment stay during the study period or a subsequent one.

2.5. Analyses

We used a multinomial logit regression model to estimate the likelihood of 4 mutually exclusive outcomes: No outpatient follow-up or MOUD, MOUD only, follow-up only, and both MOUD and follow-up. We estimated separate models for the outcomes at 7 days and at 30 days. We report marginal effects, which can be interpreted as the percentage point change in the probability of each outcome occurring.

As conducted in a previous study (The Medicaid Outcomes Distributed Research Network, 2021) our analysis was done in 2 stages. First, each of the 10 states estimated a multinomial logit model on their own

Table 1
Characteristics of Medicaid enrollee residential treatment episodes for OUD in 10 states (2018–2019).

Variable	Value	Number of Episodes (N = 90,639)	%
Age	12–20	1592	1.8
	21–34	49,658	54.8
	35–44	24,027	26.5
	45–54	10,986	12.1
	55–64	4376	4.8
Sex	Female	36,409	40.2
	Male	54,230	59.8
Race and Ethnicity	All Other Races and Ethnicities	22,979	25.4
	Non-Hispanic White	67,660	74.6
Medicaid Eligibility Type	Non-Disabled	81,665	90.1
	Disabled	8974	9.9
	Co-Occurring Mental Health or Substance Use Disorder	80,648	89.0
Co-Occurring Mental Health or Substance Use Disorder	Diagnosis	75,911	83.8
	Co-Occurring MH Diagnosis	75,911	83.8
Urbanicity	Urban	75,504	83.3
	Rural	15,135	16.7
Number of Residential Treatment Episodes During Study Period	1	68,259	75.3
	2 or more	22,380	24.7
Utilization in the 30 Days Prior to Residential Treatment	All-Cause Inpatient Discharge	11,123	12.3
	OUD-related ED visit	10,631	11.7
	Overdose	4365	4.8
	Any MOUD use	23,106	25.5
	Buprenorphine use	15,286	16.9
	Methadone use	5758	6.4
	Oral naltrexone use	1007	1.1
	IM naltrexone use	1795	2.0
	Behavioral Health Counseling	33,082	36.5
	Residential Treatment Length of Stay	< 7 days	26,506
7–30 days		48,990	54.0
> 30 days		15,143	16.7
7-Day Outcomes	None	56,672	62.5
	MOUD only	7095	7.8
	Outpatient Follow-up visit only	15,051	16.6
30-Day Outcomes	Both	11,821	13.0
	None	42,545	46.9
	MOUD only	7643	8.4
	Outpatient Follow-up visit only	15,217	16.8
	Both	25,234	27.8

Note: 69,017 enrollees and 90,639 episodes were included in the analysis. To be included, enrollees had to be continuously enrolled for 30 days before residential treatment admission and for 30 days after discharge. Episodes were merged if there were discharge and admission dates within 7 days of each other. Non-disabled enrollees include adults eligible for Medicaid through a category other than disability, including those eligible through Medicaid Expansion.

state’s data based on standardized code from the data coordinating center to produce the marginal effect estimates. Second, the data coordinating center conducted random effects meta-analyses to pool the estimates from each state into global estimates. We estimated global marginal effects by averaging the individual model estimates from states weighted by the inverse of their variances, accounting for differences in population size. We then calculated 95% confidence intervals for the global marginal effect estimates. We also provided 90% prediction intervals to describe the heterogeneity across states. While study conclusions were drawn based on confidence intervals, which capture the uncertainty in the global population of interest, prediction intervals provide description of additional uncertainty in the interested quantity for a new state population. Further details on this approach are presented in the peer-reviewed literature elsewhere (The Medicaid Outcomes Distributed Research Network, 2021). These analyses were done

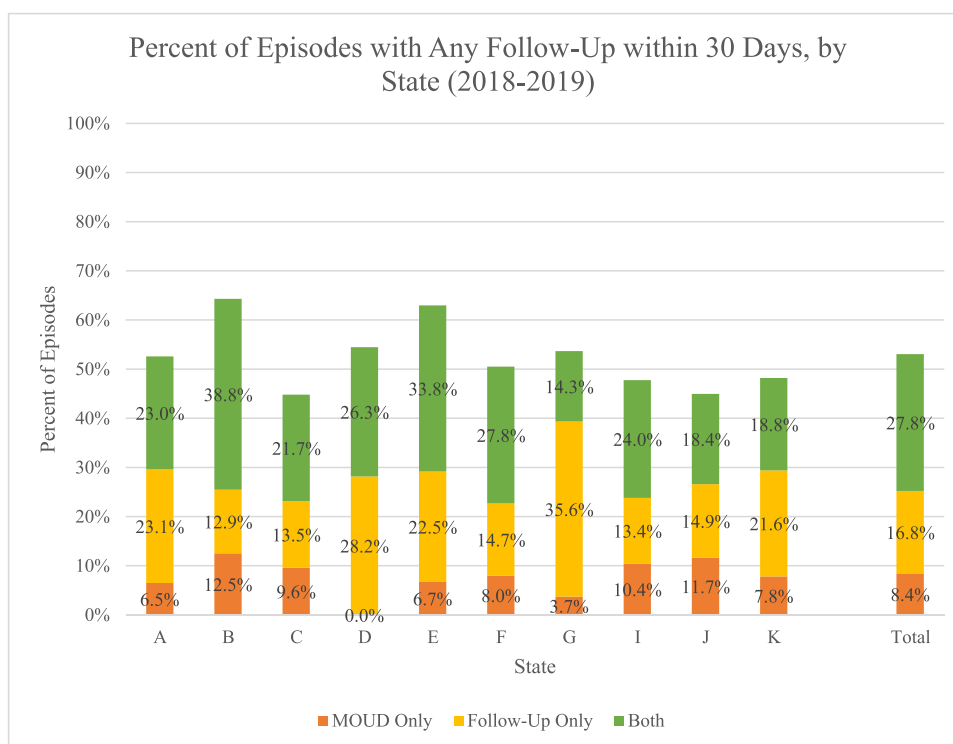


Fig. 1. Percent of Episodes with any follow-up within 30 days, by state between 2018 and 2019. This figure presents the percent of residential treatment episodes that included a MOUD fill, a follow-up visit, or both within 30 days of discharge, by state and in total across all states.

using R (4.1.1) and package metafor (3.0–2).

3. Results

3.1. Descriptive results

3.1.1. Characteristics of episodes

Across the 10 states, we identified 90,639 episodes of residential treatment for OUD for 69,017 enrollees during our study period. The number of episodes by state ranged from 213 to 37,880, with a mean of 9063.9 and a median of 6582.5. Most episodes were for enrollees who were between the ages of 21 and 34 (54.8%), male (59.8%), non-Hispanic White (74.6%), non-disabled (74.6%), who were diagnosed with co-occurring mental health (83.8%) and SUD conditions (89%), and living in urban areas (83.3%) (Table 1). Nearly one-quarter of our observations represented a repeated residential stay during the study period for the given enrollee. Hospital inpatient discharges within 30 days prior to the residential treatment episode occurred in 12.3% of our observations and was more frequent than OUD-related ED visits (11.7%), and overdoses (4.8%). More episodes were preceded by behavioral health counseling (36.5%) than MOUD (25.5%). Finally, 29.2% of residential treatment episodes were for less than 7 days, compared to 54% between 7 and 30 days, and 16.7% that were longer than 30 days.

3.1.2. Unadjusted outcomes of interest

Within 7 days of discharge from residential treatment, 13% of episodes had both an MOUD fill and a follow-up visit, 16.6% only had a follow-up visit, 7.8% only had a MOUD fill, and 62.5% did not receive either. Within 30 days, these numbers increased to 27.8% with both an MOUD fill and a follow-up visit, 16.8% with only a follow-up visit, and 8.4% with an MOUD fill, while the percent without any follow-up or MOUD decreased to 46.9%.

Fig. 1 presents variation in the 30-day outcome by state (a similar figure with results at 7 days is in the Supplemental Materials). Rates of

any follow-up or MOUD ranged from 44.8% to 64.3% by state. The percent of episodes followed by both MOUD and a follow-up visit ranged from 14.3% to 38.8%, compared to 12.9–35.6% that had a follow-up visit only, 0–12.5% that received only MOUD, and 35.7–55.2% that did not receive either follow-up or MOUD. This indicates that one state had no episodes where an enrollee had a MOUD fill without a follow up visit.

In Table 2 we present the 4 outcomes at 30-days stratified by episode and enrollee characteristics (results at 7 days are presented in the Supplemental Materials). Episodes for enrollees ages 12–20 had the highest proportion with no follow-up or MOUD (63.2%). Regarding length of stay, a higher percentage of residential treatment stays of less than 7 days had no follow up or MOUD (58.8%) compared to stays between 7 and 30 days (43.2%) or longer than 30 days (38.3%). Episodes with MOUD in the 30 days prior to admission had the highest proportion with both follow-up and MOUD in the 30-days after discharge (52.9%). In contrast, less than 20% of episodes without MOUD in the 30 days before admission had a follow-up visit, MOUD, or both in the 30 days after residential treatment, and 55.2% had neither. Approximately equal percentages of episodes with any behavioral health counseling in the 30 days prior to admission to residential treatment had both (37.1%) or neither (37.2%) MOUD or follow-up in the 30 days after discharge.

In Fig. 2, we present state-level rates of MOUD and behavioral health counseling use in the 30 days before the residential treatment episode. These rates varied substantially, from 7.6% to 45.9% for MOUD, and from 6.5% to 52.7% for counseling. The difference between MOUD and counseling use within states varied widely as well, from a 27.4 percentage point gap in State J, to nearly equal rates in states B, I and K, albeit at different levels.

3.2. Multinomial logit regression results

Fig. 3 presents results from our meta-analysis of the multinomial regression models for outcomes at 30 days. Results were generally similar at 7 days (available in the Supplemental Materials). After

Table 2
 Characteristics of episodes by 30-day follow-up or MOUD in 10 states (2018–2019).

Variable	Value	Row N	Row Percentages (%)			
			None	MOUD Only	Follow-Up Visit Only	Both
Age	12–20	1592	63.2	5.4	17.0	14.4
	21–34	49,658	46.6	8.3	17.9	27.1
	35–44	24,027	45.0	8.6	16.0	30.4
	45–54	10,986	47.6	8.9	14.1	29.3
	55–64	4376	53.3	8.8	14.8	23.1
Sex	Female	36,409	44.2	8.6	17.5	29.6
	Male	54,230	48.8	8.3	16.3	26.6
Race and Ethnicity	All other race and ethnicity	22,979	50.6	8.2	15.1	26.0
	Non-Hispanic White	67,660	45.7	8.5	17.4	28.5
	Non-Disabled	81,665	46.7	8.4	17.2	27.7
Medicaid Eligibility Type	Disabled	8974	49.2	8.8	13.3	28.7
	Co-Occurring SUD	No	9991	52.6	6.8	17.5
Co-Occurring SUD	Yes	80,648	46.2	8.6	16.7	28.4
	Co-Occurring Mental Health Condition	No	14,728	56.0	6.7	16.9
Urbanicity	Yes	75,911	45.2	8.8	16.8	29.3
	Urban	75,504	46.3	8.7	16.1	28.9
30 Days Prior: Inpatient Discharge	Rural	15,135	50.1	7.1	20.2	22.6
	No	79,516	47.4	8.4	16.7	27.5
30 Days Prior: OUD-Related ED Visit	Yes	11,123	43.6	8.6	17.3	30.4
	No	80,008	47.5	8.3	16.9	27.4
30 Days Prior: Overdose	Yes	10,631	42.9	9.6	16.3	31.2
	No	86,274	47.2	8.4	16.7	27.7
30 Days Prior: Any MOUD	Yes	4365	41.7	9.1	18.1	31.1
	No	67,533	55.2	6.7	18.8	19.3
30 Days Prior: Behavioral Health Counseling Residential Treatment Length of Stay	Yes	23,106	22.9	13.4	10.8	52.9
	No	57,557	52.5	8.3	16.6	22.5
Number of Episodes in Study Period	Yes	33,082	37.2	8.6	17.1	37.1
	LOS: < 7 days	26,506	58.8	8.3	10.4	22.4
	LOS: 7–30 days	48,990	43.2	8.7	18.7	29.4
Number of Episodes in Study Period	LOS: > 30 days	15,143	38.3	7.7	21.6	32.3
	1	68,259	47.6	8.2	17.3	26.9
Number of Episodes in Study Period	2 or more	22,380	44.8	9.2	15.3	30.7

Note: 69,017 enrollees and 90,639 episodes were included in the analysis. To be included, enrollees had to be continuously enrolled for 30 days before residential treatment admission and for 30 days after discharge. Episodes were merged if there were discharge and admission dates within 7 days of each other. Non-disabled enrollees include adults eligible for Medicaid through a category other than disability, including those eligible through Medicaid Expansion.

controlling for relevant covariates, we found that length of residential stay and having any MOUD fill in the 30 days prior to residential treatment were the strongest predictors of receiving MOUD and follow-up after discharge. For example, episodes with a length of stay of 7–30 days were 5 percentage points more likely to receive MOUD and follow-up relative to episodes with a length of stay of less than 7 days. Episodes with MOUD prior to admission were 23.9 percentage points more likely to receive both MOUD and follow-up after discharge compared to episodes with no MOUD in the 30 days prior to admission. Holding all other variables at the reference value, this results in a change in the probability of receiving both MOUD and follow up from 11% to 34.9% (predicted probabilities are available in the [Supplemental Materials](#)).

Enrollee characteristics associated with a higher likelihood of not receiving MOUD or follow-up after discharge included non-White race and ethnicity (3 percentage points (95% CI: 1.4, 4.6)), living in a rural area (2.7 percentage points (95% CI: 0.3, 5.1)), being age 12–20 (10 percentage points (95% CI: 6.9, 13.2)), and male (2.7 percentage points (95% CI: 0.9, 4.6)). Receiving MOUD before admission was not associated with receiving only follow-up after discharge; however, receiving counseling before admission was (2.8 percentage points (95% CI: 0.04, 5.6)). In contrast, receiving MOUD before admission was predictive of receiving only MOUD after admission (7.2 percentage points (95% CI: 4.3, 10.1)), while receiving counseling before admission was not. Having an inpatient stay or an overdose in the 30 days prior to admission to residential treatment were not associated with any of the 4 outcomes after controlling for relevant covariates.

4. Discussion

4.1. Overview

Our objective was to measure rates of follow-up visits and use of MOUD after residential treatment, and to understand enrollee- and episode-level factors associated with the likelihood of these outcomes. We found that rates of follow-up and/or MOUD after discharge were 53.1% at 30 days, with variation among states ranging from 45% to 64%. We also found disparities in follow-up by race and ethnicity as well as urbanicity. Length of stay, prior MOUD use, prior behavioral health counseling, and enrollee age, gender, comorbidities, and urban residence were associated with the likelihood of receiving follow-up and MOUD. Our multi-state analysis is unique, and given the variation in enrollee characteristics and Medicaid policy encompassed by these 10 states, our findings may generalize to other state Medicaid programs; however, it is difficult to assess if the observed range of follow-up rates in our study encompasses that of all states. Further, our findings may not generalize well to other populations who may have greater financial and non-financial resources than Medicaid enrollees for their behavioral healthcare.

4.2. Implications

Our findings have several implications for health systems and policymakers. We observed a substantial proportion of episodes without follow-up or MOUD, which is inconsistent with treatment guidelines ([National Committee for Quality Assurance, 2021](#)). Our findings are consistent with others on residential treatment showing highly variable follow-up rates and a large proportion of patients not continuing care within 30 days after discharge ([Acevedo et al., 2018](#); [Rubinsky et al., 2018](#)). However, it is difficult to benchmark these findings as so little has been reported on follow-up after residential treatment at a state or multi-state level in Medicaid or other payers. While follow-up is viewed as an important contributor to recovery, it is not reported in SAMHSA’s Treatment Episodes Data Set (TEDS). Adding follow up metrics could inform efforts to improve these rates in the future.

While our analysis cannot determine the reasons for a lack of follow-up, improved coordination or warm handoffs between residential and outpatient providers may improve these rates. One randomized control trial found that outreach within 2 weeks by the facility improved long-term rates of follow-up ([Deane et al., 2019](#)). In contrast, a study of over 32,000 residential treatment discharges found that financial incentives and electronic reminders for facilities had a negligible impact on improving their rates of follow-up ([Lee et al., 2018](#)). Thus, opportunities to improve follow-up rates exist for providers caring for publicly insured patients needing longitudinal SUD care; however, managed care plans contracted to administer Medicaid benefits may need to carefully evaluate the best approaches to facilitate and incentivize follow-up care. Recent interviews with state Medicaid officials in these states have found a number of initiatives focused on coordination for Medicaid

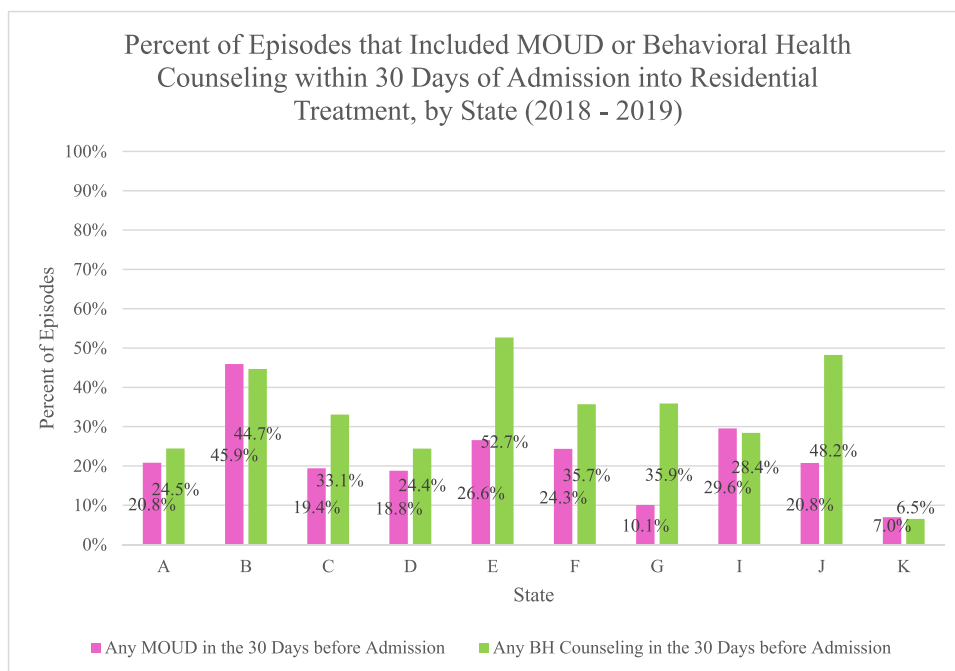


Fig. 2. Percent of episodes that included MOUD or behavioral health counseling within 30 days of admission into residential treatment, by state between 2018 and 2019.

enrollees (Cole et al., 2021).

Further, variation in the volume of residential treatment episodes and in our outcomes of interest across states was notable. Most of the states included in this analysis have adopted policies that require providers to use the ASAM criteria to determine the needed level of care (Cole et al., 2021), and yet the use of residential treatment by Medicaid enrollees differed considerably by volume, ranging from 213 to 37,880 episodes in a two-year period. Future research should aim to elucidate reasons for this variation, and policymakers should seek to learn from other states as to how increasing rates of treatment after residential treatment discharge might be achievable.

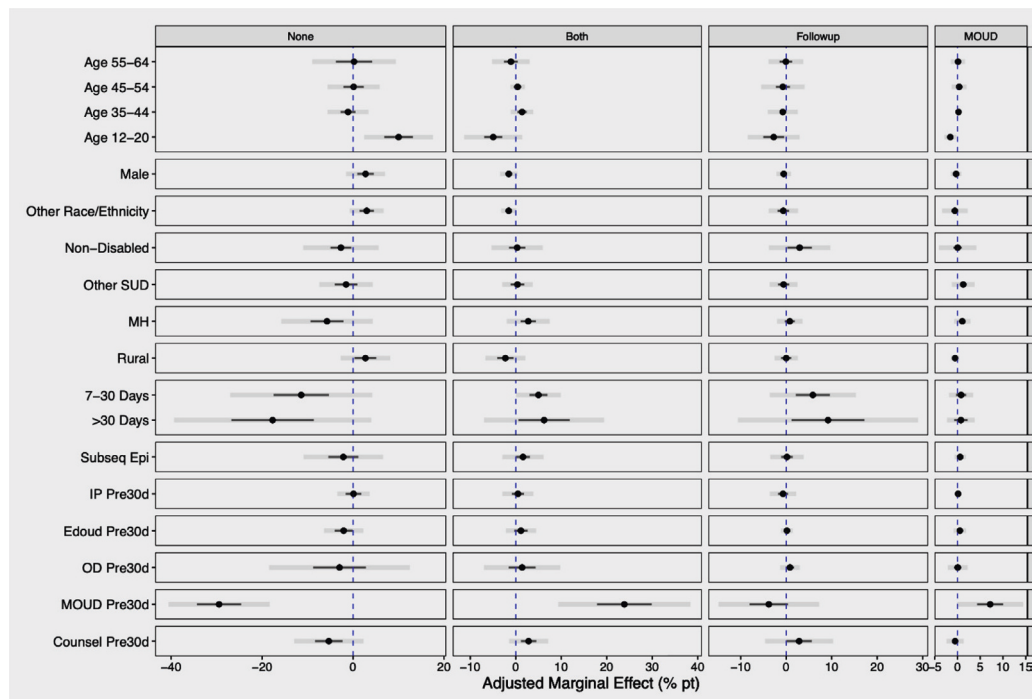
While the association between MOUD use in the 30 days before admission and receiving both MOUD and a follow-up visit after discharge is not surprising, the magnitude of the association is. Enrollees with prior MOUD use were 23.9 percentage points more likely to receive both MOUD and a follow-up visit than their counterparts without prior MOUD use. This is notable in the abstinence-focused context in which many residential treatment programs have operated (Goodnough, 2018). Previous work has found that some states included in our study recently required MOUD to be offered in residential treatment facilities or for the facility to coordinate it (Cole et al., 2021). While we were unable to identify MOUD during residential treatment episodes, our findings clearly indicate that engagement in treatment before residential treatment is related to continuing treatment in the 30 days afterwards. This is highly relevant given the varying rates of MOUD and behavioral health counseling prior to residential treatment that we observed across the states in our sample. This finding could be used by providers or managed care plans to identify enrollees that are the least likely to receive follow-up or MOUD post-discharge.

Our analyses found large racial/ethnic and urban/rural disparities in follow-up and MOUD. Non-White and Hispanic enrollees, as well as rural enrollees were significantly less likely to receive MOUD or follow-up relative to non-Hispanic White enrollees. Rural enrollees may have worse geographic access to MOUD prescribers (Andrilla et al., 2019; Cole et al., 2019; Joudrey et al., 2019; Sigmon, 2014), and racial and ethnic disparities in access to and use of MOUD have been well-documented (Essien et al., 2020; Finlay et al., 2021; Krawczyk et al., 2017; Schiff et al., 2020; Stahler et al., 2021). Further, other

research has found that Black patients are significantly less likely to receive MOUD during a residential treatment stay even after adjusting for relevant covariates (Stahler et al., 2021). Our study adds to the literature by documenting these disparities after discharge from residential treatment in multiple states, although small sample sizes in some states precluded a more complete analysis of racial and ethnic disparities that would stratify Black, Hispanic, Asian, Native American, and other racial and ethnic minorities.

4.3. Limitations

Our analysis is subject to some limitations. There is no validated approach to defining residential treatment in Medicaid claims. While our measures were derived from specific guidance given by state Medicaid agencies, there may be some measurement error in rates of residential treatment or in comparability between states (e.g., whether detoxification was included in the episode or not, which we did not identify separately). Conversely, our analysis is the first to study residential treatment in multiple states with such an approach that verifies specifications for identifying these episodes with state agency officials, which likely enhances our ability to address any unique state-specific caveats that broad, nationally-applied measures may be unable to. Second, follow-up and MOUD after residential treatment may be affected by the treatment received during the episode. As noted earlier, we were unable to measure some potentially relevant residential treatment episode characteristics, namely the provision of MOUD, or any coordination activities undertaken by the residential treatment provider that may facilitate post-discharge treatment. Studies have shown that most residential treatment facilities do not offer MOUD (Beetham et al., 2020; Huhn et al., 2020), and little is known related to how MOUD treatment initiation during such an episode, or type of MOUD (i.e., buprenorphine, methadone or naltrexone) affects follow-up and may be an area for future research. Further, coordination and seamless transition from detoxification and residential treatment for OUD is often impaired by confidentiality concerns. The U.S., Code of Federal Regulations (CFR) Title 42 Part 2, requires patients to provide written consent to transfer records from SUD treatment settings to any specific health care provider (Substance Abuse and Mental Health Services



Variable	None	Both	Follow-Up Only	MOUD Only
Age 55-64	0.2 (-3.8, 4.2)	-1.1 (-2.6, 0.4)	-0.1 (-1.5, 1.3)	0.1 (-0.6, 0.8)
Age 45-54	0.1 (-2.1, 2.4)	0.4 (-0.4, 1.2)	-0.7 (-2.3, 0.8)	0.4 (-0.3, 1.1)
Age 35-44	-1.1 (-2.7, 0.5)	1.4 (0.4, 2.4)	-0.8 (-1.5, -0.02)	0.2 (0.03, 0.4)
Age 12-20	10 (6.9, 13.2)	-5 (-6.9, -3)	-2.7 (-5, -0.4)	-1.6 (-2.2, -1)
Male	2.7 (0.9, 4.6)	-1.5 (-2.3, -0.8)	-0.5 (-1.3, 0.2)	-0.3 (-0.8, 0.1)
All other race/ethnicity	3 (1.4, 4.6)	-1.6 (-2.3, -0.8)	-0.6 (-1.9, 0.6)	-0.6 (-1.3, 0.2)
Non-Disabled	-2.7 (-5, -0.4)	0.3 (-1.5, 2.1)	3 (0.3, 5.7)	0.0 (-0.9, 1)
Co-SUD Diagnosis	-1.5 (-4, 1)	0.4 (-1.1, 1.9)	-0.6 (-1.8, 0.7)	1.3 (0.5, 2)
Co-Mental Health Diagnosis	-5.7 (-9.4, -2.1)	2.7 (1.1, 4.4)	0.8 (-0.3, 1.9)	1.1 (0.3, 1.8)
Rural	2.7 (0.3, 5.1)	-2.3 (-4.1, -0.5)	0 (-1.1, 1.1)	-0.5 (-0.9, -0.2)
LOS: 7 - 30 Days	-11.4 (-17.5, -5.3)	5 (3, 7)	5.9 (2.1, 9.6)	0.8 (-0.3, 1.9)
LOS: > 30 Days	-17.7 (-26.8, -8.6)	6.2 (0.6, 11.9)	9.2 (1.2, 17.2)	0.7 (-0.7, 2.2)
Subsequent Episode	-2.1 (-5.4, 1.2)	1.6 (0.1, 3.1)	0.2 (-1.1, 1.4)	0.6 (0, 1.2)
Previous 30 Days: Inpatient Stay	0.1 (-1.6, 1.8)	0.5 (-0.9, 1.8)	-0.7 (-1.8, 0.4)	0.1 (-0.2, 0.5)
Previous 30 Days: ED OUD Visit	-2.1 (-4.1, -0.1)	1.1 (-0.3, 2.6)	0.16 (-0.3, 0.7)	0.5 (-0.1, 1.1)
Previous 30 Days: Overdose	-3 (-8.8, 2.8)	1.4 (-1.6, 4.4)	0.8 (-0.1, 1.7)	0.1 (-0.8, 0.8)
Previous 30 Days: MOUD	-29.5 (-34.3, -24.6)	23.9 (17.9, 29.9)	-3.8 (-8.1, 0.4)	7.2 (4.3, 10.1)
Previous 30 Days: Counseling	-5.3 (-8.4, -2.3)	2.8 (1.1, 4.5)	2.8 (0.04, 5.6)	-0.5 (-1.1, 0.1)

Fig. 3. Meta-Analysis Forest Plots and Marginal Effects Estimating Outcomes at 30-Days Post-Discharge from Residential Treatment. Note: Point estimates of adjusted marginal effects are presented in each table cell, with 95% confidence intervals in parentheses. Estimates can be interpreted as the percentage point change in the likelihood of the given outcome occurring. In the forest plots, 95% CIs are represented by the black lines, and the 90% prediction intervals are represented by the gray shaded bars. Other Race and Ethnicity includes all enrollees who are not non-Hispanic White. Non-disabled eligibility includes individuals enrolled through Medicaid expansion as well as other enrollees who are not disabled. LOS refers to the length of stay in days of the residential treatment episode. Subsequent episodes indicates whether the given episode was preceded by another residential treatment episode earlier in the study period. Previous 30 days refers to the 30 days before the first day of the residential treatment episode.

Administration, 2022). In practice, this is rarely done since written disclosure may be required at each instance—impairing or impeding potential coordination of care (Manuel et al., 2013; Wakeman and Friedmann, 2017). For example, one qualitative study that assessed the perceived impact of 42 CFR Part 2 on access to addiction treatment for Medicaid enrollees in Oregon found that respondents (including local and state agencies, as well as providers) reported the regulations to be a barrier to communication and information sharing, and ultimately a barrier to care coordination (McCarty et al., 2017). Third, our measure of follow-up visits was restricted to claims with OUD in the primary diagnosis field. It is possible that enrollees received treatment adjacent to their OUD (e.g., anxiety disorder, other SUD) within the 7- and 30-day period that was not included in our analysis. Fourth, we did not control for distances to the nearest OUD treatment program, MOUD prescriber, or discharging residential treatment facility, all of which could be related to follow-up but were beyond the scope of this analysis. Finally, our study period ended in 2019, and thus it is unknown how well our findings apply to time periods during the COVID-19 pandemic.

5. Conclusions

Many episodes of residential treatment for OUD among Medicaid enrollees are not followed by a timely outpatient visit or receipt of MOUD. The absence of either service for almost half of enrollees runs counter to the evidence that outpatient treatment engagement post-discharge is most likely to support recovery. In addition, variation by state both in the volume of residential treatment episodes and rates of follow-up are considerable. Further research on both findings would support policymakers and providers in facilitating the best treatment for Medicaid enrollees with OUD. Finally, racial and ethnic, as well as urban/rural disparities, in rates of follow-up should be a focus of stakeholders in not only improving outcomes but also in achieving health equity.

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CRedit authorship contribution statement

Evan Cole contributed to the concept and design, acquisition, analysis, and interpretation of data, critical revision of the manuscript, and drafting of the manuscript, Lindsay Allen contributed to the concept and design, acquisition, analysis, and interpretation of data, and critical revision of the manuscript, Anna Austin contributed to the acquisition, analysis, and interpretation of data and critical revision of the manuscript, Andrew Barnes contributed to the acquisition, analysis, and interpretation of data and critical revision of the manuscript, Chung-Choi H. Chang contributed to the statistical analysis and administrative, technical, or material support, Sarah Clark contributed to the acquisition, analysis, and interpretation of data and critical revision of the manuscript, Dushka Crane contributed to the acquisition, analysis, and interpretation of data and critical revision of the manuscript, Peter Cunningham contributed to the acquisition, analysis, and interpretation of data and critical revision of the manuscript, Carrie Fry contributed to the acquisition, analysis, and interpretation of data and critical revision of the manuscript, Adam Gordon contributed to the critical revision of the manuscript and administrative, technical, or material support, Lindsey Hammerslag contributed to the acquisition, analysis, and interpretation of data and critical revision of the manuscript, David Idala contributed to the acquisition, analysis, and interpretation of data and critical revision of the manuscript, Susan Kennedy contributed to obtaining funding and administrative, technical, or material support, Joo Yeon Kim contributed to the acquisition, analysis, and interpretation of data, statistical analysis, and critical revision of the manuscript,

Sunita Krishnan contributed to obtaining funding and administrative, technical, or material support, Paul Lanier contributed to the acquisition, analysis, and interpretation of data and critical revision of the manuscript, Shyama Mahakalanda contributed to the acquisition, analysis, and interpretation of data and administrative, technical, or material support, Rachel Mauk contributed to the acquisition, analysis, and interpretation of data and administrative, technical, or material support, Mary Joan McDuffie contributed to the acquisition, analysis, and interpretation of data and critical revision of the manuscript, Shamis Mohamoud contributed to the acquisition, analysis, and interpretation of data and critical revision of the manuscript, Jeff Talbert contributed to the acquisition, analysis, and interpretation of data and critical revision of the manuscript, Lu Tang contributed to the acquisition, analysis, and interpretation of data, statistical analysis, and critical revision of the manuscript, Kara Zivin contributed to the acquisition, analysis, and interpretation of data, obtained funding, and administrative, technical, or material support, Julie Donohue contributed to the concept and design, acquisition, analysis, and interpretation of data, critical revision of the manuscript, obtained funding, and supervision of study activities.

Author disclosures

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Conflict of interest statement

No conflict declared.

Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.drugalcdep.2022.109670.

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