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Follow-up after ED visits for opioid use disorder: Do they reduce future overdoses?

The Medicaid Outcomes Distributed Research Network[1]

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ABSTRACT

Introduction: Follow-up visits within 7 days of an emergency department (ED) visit related to opioid use disorder (OUD) is a key measure of treatment quality, but we know little about its protective effect on future opioid-related overdoses. The objective this paper is to examine the rate of 7-day follow-up after an OUD-related ED visit and the association with future overdoses.

Methods: Retrospective analysis of Medicaid enrollees in 11 states that had an OUD-related ED visit from 2016 through 2018. Each state used Cox proportional hazard models to estimate the association between having a follow-up visit within 7 days of an OUD-related ED visit, and an overdose within 6 months of the ED visit. State analyses were pooled to generate global estimates using random effects meta-analysis.

Results: Among 114,945 Medicaid enrollees with an OUD-related ED visit, 15.7% had a follow-up visit within 7 days. State-specific rates varied from 7.2% to 22.4% across the 11 states. Compared to those with no follow-up visit, enrollees with a follow-up visit were more likely to be female, non-Hispanic White, less likely to have had an overdose or other substance use disorder at the time of the ED visit, and much more likely to have been receiving MOUD treatment prior to the ED visit. Global estimates based on multivariate analysis showed that having a 7-day follow-up visit was associated with a lower likelihood of overdose within 6 months of the index ED visit (HR = 0.91, CI = 0.84, 0.99). However, states had considerable heterogeneity in this association, with only two states having statistically significant results.

Conclusions: Among Medicaid enrollees with OUD, having a follow-up visit 7 days after an ED visit is protective against fatal or nonfatal overdose within 6 months, although the association varies considerably across states. Although the association with future overdoses was relatively modest, both practitioners and policymakers should seek to increase the number of Medicaid enrollees with OUD who receive follow-up care within 7 days after an ED visit.

1. Introduction

Hospital emergency departments (EDs) are major sources of care for people with opioid use disorder (OUD). As the prevalence of OUD surged from 2010 to 2017, the rate of OUD-related ED visits doubled to 249 visits per 100,000 people (Agency for Healthcare Research and Quality, 2021). Overall, Medicaid enrollees with OUD are three times as likely to have all-cause ED visits compared to enrollees with no OUD (Barnes et al., 2020).

OUD-related ED visits are opportunities to intervene and connect patients to treatment providers following the ED visit (Schmidt et al., 2016; National Institute on Drug Abuse, 2018). A key indicator of treatment quality for OUD and other substance use disorders, developed by the National Committee on Quality Assurance (NCQA) and adopted by the Center for Medicare and Medicaid Services (CMS) as an adult core measure, is the percent of alcohol and other drug use–related ED visits for which the patient received follow-up care within 7 days of the visit (Center for Medicare and Medicaid Services, 2021; National Committee for Quality Assurance, 2022a).

Nevertheless, low rates of 7-day follow-up visits have been reported, ranging from 7% to 13% percent across Medicaid, Medicare, and commercial insurance enrollees (National Committee for Quality Assurance, 2022a). Even after discharge from an acute inpatient stay, 60% received some type of follow-up treatment, but only 17% received any medications for opioid use disorder (MOUD) treatment (Ali & Mutter, 2016).

However, despite its widespread adoption as a measure of quality and timeliness of care, we know little as to whether 7-day follow-up visits are protective against future overdoses. A study in Ontario examined rates of all-cause mortality one year following an OUD-related ED visit (Leece et al., 2020). The results indicated that having any health

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services use within a week of the ED visit was not protective for opioid-related death (relative to having no follow-up health services use). Other studies have examined patient and ED treatment characteristics that are associated with having follow-up care after the ED visit, but have not assessed the effects of having follow-up care on overdoses or other opioid-related outcomes (Cao et al., 2020; Naeger et al., 2016).

Using Medicaid claims data from 11 states, we assessed whether having a follow-up visit for OUD within 7 days of an OUD-related ED visit is associated with a reduction in opioid-related overdoses treated in hospital settings up to six months following the ED visit. The primary hypothesis that we tested was that having a follow-up visit within 7 days of an OUD-related ED visit would be associated with lower risk of overdoses. We also assessed the rate of follow-up care among Medicaid enrollees with OUD-related ED visits and the extent of variation in 7-day follow-up across both member characteristics and different state Medicaid programs. By using the NCQA definition of 7-day follow-up, the results of this study will provide evidence on the usefulness of the measure for assessing quality of OUD treatment, and can suggest actionable guidance on OUD treatment quality to state Medicaid programs and CMS.

2. Methods

2.1. Data sources

The Medicaid Outcomes Distributed Research Network (MODRN) has been previously described (Donohue & Medicaid Outcomes Distributed Research Network, 2021). In brief, we obtained data from 11 states (DE, KY, MD, ME, MI, NC, OH, PA, VA, WV, WI) participating in the MODRN. These states account for 16.3 million (22%) Medicaid enrollees and include 6 of the 10 states with the highest overdose death rates, according to the Center for Disease Control and Prevention (2021). Universities in these 11 states obtained claims and enrollment data on a census of enrollees directly from their state's Medicaid agency. Each university received an exempt determination from their site-specific IRB for this study. To preserve the privacy and security of sensitive Medicaid data, MODRN developed analytic tools centrally and each university applied those tools to their state's Medicaid data using a common data model with uniform structure and data elements. MODRN's data coordinating center distributed standardized statistical software code to each university, which returned aggregate results for statistical analyses. This approach enabled standardized analyses of Medicaid data across multiple states, enhancing generalizability of results without sharing individual-level data.

2.2. Study population

We identified full-benefit Medicaid enrollees aged 18–64 years (and not dually eligible for Medicare) in each of the 11 states who had an ED visit between January 1, 2016, and June 30, 2018, with a diagnosis of OUD in any position (primary or otherwise) on the claim (ICD-10 codes F11.xxx). This definition includes OUD-related overdoses. A total of 439,911 enrollees had an OUD-related ED visit between 2016 and 2018. For this analysis, we excluded members meeting one or more of the following criteria: (1) not continuously enrolled in Medicaid for at least 90 days prior to and for at least 7 days following the index ED visit; (2) with use of hospice services or benefits during the study period; (3) with an inpatient admission occurring within 7 days of the index visit; (4) with an overdose occurring within 7 days of the index ED visit; and (5) missing ZIP code information. For enrollees who had multiple ED visits that met the inclusion criteria during the study period, we included only the first eligible ED visit as the index visit. After these exclusions, the final sample for the analysis included 114,945 Medicaid enrollees with an index ED visit. Appendix Table 1 shows how the study sample was derived based on the exclusion criteria.

2.3. Outcomes

Our main outcome variable was whether the enrollee had an opioid-related (fatal or nonfatal) overdose treated in a health care setting within 6 months (180 days) following the index ED visit. We identified overdoses using previously validated methods based on ICD-10 codes for overdoses and poisonings related to OUD (Green et al., 2017).

2.4. Exposure

Our main exposure variable was whether the enrollee had a Medicaid-billed follow-up visit with a principal diagnosis of OUD with any practitioner within 7 days after the index ED visit, including the date of the ED visit, as defined by NCQA (we note that this differs from the denominator for the NCQA measure, which includes not only OUD-related but also other SUD-related ED visits) (National Committee for Quality Assurance, 2022a). Follow-up visits included (but were not restricted to) observation visits, telehealth visits, and online assessments. As the data preceded the COVID-19 pandemic, we had too few telehealth and online visits to observe differences in the effects of these visit types on outcomes. We compared enrollees with a follow-up visit to enrollees who had no follow-up visit within 7 days of an OUD-related ED visit.

2.5. Covariates

We adjusted multivariable analyses for the following covariates, all identified using Medicaid claims and enrollment data: age at index ED visit; gender; race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, other); Medicaid eligibility group in the year of the index ED visit (pregnant women, children [for enrollees in the 18–20 years of age group]); disabled adults, nondisabled adults, or expansion adults (see Appendix Table 2); and urban/rural residence as defined by the 2010 Rural-Urban Commuting Area (RUCA) Codes based on ZIP code of the enrollee's residence in the year of the index ED visit (United States Department of Agriculture & Economic Research Service, 2021).

We also adjusted multivariable analyses for several clinical characteristics measured using diagnosis codes on the index ED claim that could be correlated with future overdoses, including binary indicators for: whether the index ED visit was related to an overdose; whether patient had a diagnosis of other substance use disorders or mental health conditions; and medical complications of injection drug use, such as intracranial and intraspinal abscess, osteomyelitis, endocarditis, soft skin tissue infections, and viral hepatitis B (HBV) or C (HCV) infections. Appendix 3 lists the ICD-10 codes that we used to identify these conditions on the index ED visit claim, if found in any position.

To adjust for differences in engagement with treatment and general health care use prior to the index ED visit, we also included health services use and selected diagnoses in the 90 days prior to the index ED visit, including the number of inpatient admissions (all cause); the number of outpatient claims (all cause); and separate indicators for whether there was a diagnosis in the 90 days prior to the index visit for HBV, HCV, HIV, anxiety disorder, mood disorder, schizophrenic and other psychotic disorders, and any non-tobacco substance use disorders as covariates in multivariable analyses. We include the ICD-10 codes that we used to identify specific diagnoses for the index ED visit or in the 90 days prior to the visit in Appendix 3.

2.6. Analysis

We used a two-stage procedure to conduct the analysis. In the first stage, we conducted state-level descriptive statistics and estimated hazard of overdose up to 6 months following the index ED visit, using a common data model and standardized code for the analysis. The study team summarized into Excel tables both descriptive and regression results and sent them to MODRN's data coordinating center at the

University of Pittsburgh. We estimated hazard ratios (HR) using the Cox proportional hazards model for Medicaid enrollees in each state separately. Censoring events included death, disenrollment from Medicaid (defined as a gap in enrollment of 60 days or longer), and no overdose by the end of the 180-day follow-up period. The primary objective of the analysis was to assess the hazard of an overdose for enrollees who had a 7-day follow-up visit, compared to those who did not have a 7-day follow-up visit. We tested the proportional hazard assumption by visualizing the scaled Schoenfeld residuals of the main exposure, 7-day follow-up after an OUD-related ED visit, over time. The plot did not show a strong trend along the time variable, indicating no strong evidence of violation of the proportional hazard assumption (findings not shown).

In the second stage of the analysis, we combined the state-level modeling results, using the same methods described in a previous paper based on the MODRN that are commonly applied in distributed research networks (Donohue & Medicaid Outcomes Distributed Research Network, 2021). We used random-effect meta-analysis to obtain global estimates while accounting for heterogeneity across states. Using the Hartung-Knapp-Sidik-Jonkman method, we estimated between-state variances due to potential heterogeneity across states to construct valid confidence intervals (IntHout et al., 2014). We used between-state variability and the Cochran Q statistic to measure and test the statistical significance of between-state heterogeneity in our estimates. We report 2-sided *P* values associated with the significance of the mean (i.e., global) effects across states and their corresponding 95% confidence intervals (CIs), using a significance threshold of 0.05. To convey underlying heterogeneity across states and complement information provided by the 95% CIs, which describes the variability of the global estimate for the overall population represented by the 11 states' samples, we calculated 90% prediction intervals to denote the range within which hazard ratios would fall for 90% of states if a different set of states were drawn (see Donohue & Medicaid Outcomes Distributed Research Network, 2021 for description of how the prediction intervals are computed). We report the hazard ratio for both the global estimate of the effect of 7-day follow-up, as well as the state-specific hazard ratios for this measure.

3. Results

Variation in 7-day follow-up by state. Among the 114,945 Medicaid members who had an index OUD-related ED visit, 15.7% had a follow-up visit within 7 days. The percent with a follow-up visit varied considerably by state, ranging from a low of 7.2% to 22.4% (Fig. 1).

Characteristics of members who had a follow-up visit within 7 days. Table 1 shows the characteristics of the study sample with and without a 7-day follow-up visit. Chi-square tests determined whether differences between those with a 7 day follow-up and those without a 7 day follow-up are statistically significant. We discuss only differences with a *p* value of <0.01 in the text.

Compared to those with no follow-up visit, enrollees with a follow-up visit were more likely to be female (54.6%), and more likely to be non-Hispanic White (79.2%) and less likely to be other racial/ethnic groups. Those with a follow-up visit were more likely to be eligible for Medicaid as pregnant women (10.5%) and less likely to be eligible as disabled adults (14.6%). About half in both groups were enrolled in Medicaid expansion. No statistically significant differences occurred in the percentage living in rural versus urban areas, with about four-fifths in both groups living in urban areas.

Only a small percentage of OUD-related ED visits in the sample had an overdose diagnosis (8.3%). Those with a 7-day follow-up visit were less likely to have had an overdose (5.3%) compared to those with no 7 day follow-up (8.9%). Those with a follow-up visit were also less likely to have another substance use disorder (20.2%) coded on the index ED visit compared to those with no follow-up visit (24.5%).

For diagnoses and treatment in the 90 days prior to the index ED visit, those with a 7-day follow-up visit were more likely to be receiving MOUD treatment in the 90 days prior to the ED visit (53.4%) compared to those with no 7 day follow-up (21.6%). Those with a 7-day follow-up visit were somewhat less likely to have an overdose within 6 months of the index ED visit (7.9%) compared to those who did not have a follow-up visit (9.2%).

Appendix Table 4 shows characteristics of the full study sample, and the minimum and maximum values for each characteristic among the 11 states.

Adjusted association between 7-day follow-up and overdose. Table 2 shows the results of the random effects meta-analyses. Consistent with the unadjusted results, having a follow-up visit within 7-days of an OUD-related ED visit was associated with a lower likelihood of overdose within 6 months (HR = 0.91, 95% CI = 0.84, 0.99) with a 90% prediction interval of 0.74–1.12.

Fig. 2 shows substantial heterogeneity in the association between 7-day follow-up and the hazard of subsequent overdose across the 11 states. The hazard ratios varied from 0.70 (95% CI = 0.46, 1.07) in state D to 1.36 (95% CI = 0.69, 2.69) in state G. However, at the state-level, the hazard ratios were statistically significant only in state B (HR = 0.80, 95% CI = 0.67, 0.96) and state F (HR = 0.88, 95% CI = 0.78, 1.00), indicating that these states drove the global estimate in pooled meta-

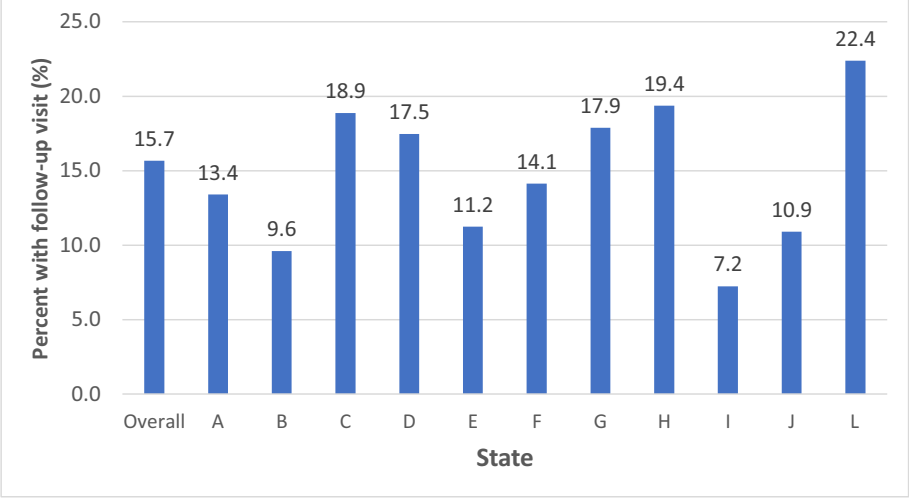

Fig. 1. Percent with 7-day follow-up after OUD-Related ED Visit, by State.

Table 1
Characteristics of study cohort by 7 day follow-up status pooling data across 11 states.

	Percent of people in study cohort	No 7-day follow-up visit	Had 7-day follow-up visit	*p*-value
Total N	114,945	96,936	18,009	
Average age	36.7	36.9	35.5	
Gender**		%	%	<0.0001
Female	50.7	49.9	54.6	
Male	49.3	50.1	45.4	
Race/ethnicity				<0.0001
Non-Hispanic white	74.6	73.8	79.2	
Non-Hispanic black	14.3	14.9	10.8	
Hispanic	3.2	3.2	3.3	
Others	7.9	8.1	6.8	
Eligibility				<0.0001
Pregnant women	7.0	6.3	10.5	
Children	2.0	2.1	1.5	
Disabled adults	19.3	20.2	14.6	
Non-disabled adults	21.6	21.3	23.1	
Expansion adults	50.2	50.1	50.4	
Living area				0.4042
Urban	79.7	79.6	79.9	
Rural	20.3	20.4	20.1	
Other diagnoses on index ED visit				
Overdose				<0.0001
No	91.7	91.1	94.7	
Yes	8.3	8.9	5.3	
Other substance use				<0.0001
No	76.2	75.5	79.8	
Yes	23.8	24.5	20.2	
Mental health condition				0.0423
No	75.5	75.7	74.9	
Yes	24.5	24.3	25.1	
Medical complications of injection drug use				0.3070
No	87.6	87.6	87.9	
Yes	12.4	12.4	12.1	
Diagnoses and treatment in 90 days prior to ED visit				
HCV				<0.0001
No	89.6	90.1	87.1	
Yes	10.4	9.9	12.9	
HIV				0.1894
No	99.0	99.0	99.1	
Yes	1.0	1.0	0.9	
Anxiety disorder				<0.0001
No	70.8	71.2	68.3	
Yes	29.2	28.8	31.7	
Mood disorder				<0.0001
No	68.1	68.8	64.7	
Yes	31.9	31.2	35.3	
Schizophrenic and other psychotic disorders				<0.0001
No	94.6	94.5	95.4	
Yes	5.4	5.5	4.6	
Other substance use disorders				<0.0001
No	69.7	70.6	65.1	
Yes	30.3	29.4	34.9	
Any pre-index MOUD				<0.0001
No	73.5	78.4	46.6	
Yes	26.5	21.6	53.4	
Outcomes after index ED visit				
Overdose within 6 months of index ED visit				<0.0001
No	91.0	90.8	92.1	
Yes	9.0	9.2	7.9	
Death within 180 days of ED visit				<0.0001
No	98.6	98.5	99.1	
Yes	1.4	1.5	0.9	

Note: *p*-values from Chi-square bivariate tests comparing the unadjusted differences in the distribution of member characteristics by receipt of a 7-day follow-up visit or not.

Table 2
Adjusted hazard of overdose at 6 months.

Var	Hazard ratio	95% confidence intervals	p value	90% prediction interval
Follow-up within 7 days	0.91	0.84–0.99	0.033	0.74–1.12
Age at index 5-yr inc	0.94	0.92–0.96	0.000	0.88–1.00
Sex-male	1.16	1.1–1.22	0.000	1.03–1.31
Race/ethnicity – White (reference)				
Race/ethnicity-Hispanic	1.00	0.66–1.52	0.998	0.34–2.94
Race/ethnicity-Black	0.92	0.64–1.32	0.605	0.32–2.66
Race/ethnicity-Others	1.01	0.88–1.16	0.897	0.75–1.36
Elig cat – nondisabled adults (reference)				
Elig. cat.-Children	1.21	1.00–1.47	0.052	0.76–1.93
Elig. cat.-Dis. Adults	1.30	1.11–1.52	0.005	0.87–1.93
Elig. cat.-Exp. Adults	1.24	1.06–1.46	0.015	0.88–1.75
Elig. cat.-Preg. Women	0.79	0.63–0.98	0.036	0.46–1.33
Rural	0.55	0.48–0.64	0.000	0.39–0.77
Other diagnoses at index ED				
Overdose	2.56	2.22–2.97	0.000	1.71–3.87
Other substance use	1.08	0.98–1.18	0.108	0.86–1.36
Mental health conditions	0.99	0.89–1.10	0.853	0.77–1.27
Comp injection drug use	1.12	1.03–1.23	0.017	0.92–1.37
Diagnoses and utilization in 90 days before index ED				
Number of inpatient admissions	1.18	0.95–1.46	0.120	0.63–2.21
Number of outpatient claims	0.99	0.97–1.00	0.031	0.95–1.02
Number of outpatient professional claims	0.99	0.98–1.00	0.007	0.97–1.01
Any HCV diagnosis	1.39	1.18–1.63	0.001	0.90–2.15
Any HIV diagnosis	1.17	0.96–1.43	0.113	0.74–1.84
Any anxiety disorder diagnosis	0.99	0.95–1.04	0.764	0.89–1.11
Any mood disorder diagnosis	1.11	1.01–1.22	0.029	0.86–1.45
Any Schizo/other psychotic disorders	0.98	0.86–1.12	0.766	0.72–1.35
Any other substance use disorders	1.34	1.21–1.49	0.000	1.01–1.76
Any MOUD treatment	0.98	0.92–1.03	0.358	0.89–1.08

Hazard ratios and 95% Confidence Intervals for the hazard ratios are global effects estimated from random effects metal analysis. 90% prediction intervals denote the range within which hazard ratios would fall for 90% of states if a different set of states were drawn. The prediction interval estimates the between-state variability of the true hazard ratio of the state populations.

analyses that weight states by the inverse of their variances, a measure correlated with population size.

Older age, being a pregnant woman (relative to other nondisabled adults), and rural residence were associated with a decreased likelihood of an overdose within 6 months of the index ED visit (Table 2). Being male and eligible for Medicaid due to a disability or expansion (relative to nonexpansion adults) was associated with a greater likelihood of an overdose. Having an overdose diagnosis present on the index ED visit (HR = 2.56, 95% CI = 2.22, 2.97; 90% prediction interval, 1.71, 3.87) and complications of injection drug use at the time of the index ED visit were associated with a greater likelihood of subsequent overdose (HR = 1.12, 95% CI = 1.03, 1.23; 90% prediction interval, 0.92, 1.37).

A number of conditions and health services utilization in the 90 days prior to the ED visit were also associated with overdose. Greater use of outpatient services prior to the ED visit was associated with lower likelihood of overdose (HR = 0.99, 95% CI = 0.97, 1.00; 90% prediction interval, 0.97, 1.01) as were outpatient-related professional claims (HR = 0.99, 95% CI = 0.98, 1.00; prediction interval 0.97, 1.01). However,

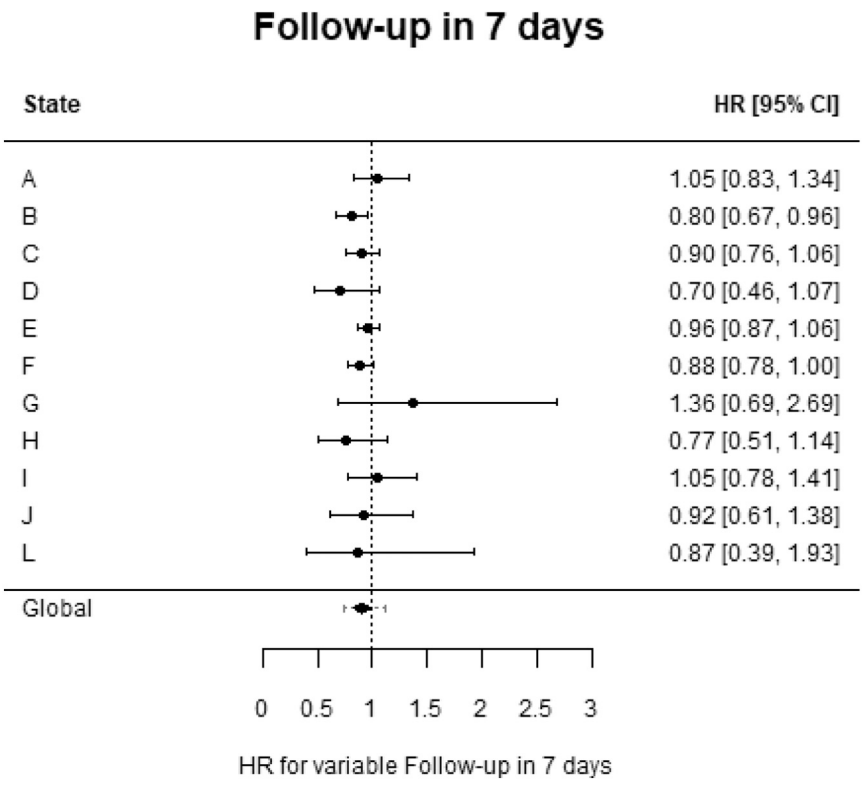

Fig. 2. State-specific hazard ratios for the effect of 7-day follow-up on overdose at 6 months.

comorbid diagnoses were associated with higher likelihood of overdoses, including HCV diagnoses, mood disorders, and other SUD. Although receiving MOUD treatment in the 90 days prior to the ED visit was associated with lower likelihood of overdose, the effects were not statistically significant.

4. Discussion

Timely follow-up after an OUD-related ED visit is encouraged by providers and many Medicaid programs to engage patients with treatment and prevent future overdoses. The rate of follow-up within 7 days of an OUD-related ED visit is a key indicator of quality of SUD treatment that has been adopted by NCQA, CMS, and other government agencies and organizations. It is important to note that these recommendations are based on any OUD diagnosis at the ED and not just ED visits for overdoses, which included 8.3% of our sample of OUD-related ED visits. Similar to previous studies (National Committee for Quality Assurance, 2022a), we found that the rate of 7-day follow-up is low among Medicaid populations—only about 1 in 6 Medicaid enrollees with an OUD-related ED visit had a follow-up visit for their OUD within 7 days. The very low rate of follow-up overall indicates a large gap and missed opportunity for timely initiation or continuity of treatment for OUD. By comparison, the rate of 7-day follow-up for mental illness–related ED visits is much higher (40% for Medicaid members) (National Committee for Quality Assurance, 2022b). Rates of 7-day follow-up vary widely across the 11 states included in this study—from a low of 7% to a high of 22%. In addition, non-Hispanic White members, those whose index ED visit was not due to overdose, and those receiving MOUD treatment prior to the ED visit were more likely to have a 7-day follow-up, suggesting follow-up is less likely among racial/ethnic minorities and those at potentially higher risk for a future overdose. Some providers may serve a disproportionate number of patients with characteristics that make them less likely to receive follow-up care, putting them at a disadvantage when this measure is used to assess quality of care.

Nevertheless, the implications of lacking a 7-day follow-up visit are somewhat more ambiguous. Results from the meta-analysis pooling estimates across 11 states indicated that having a 7-day follow-up is associated with lower likelihood of an overdose; however, the effect was relatively modest and varied considerably across states. In fact, the global results—while statistically significant at the 0.05 level—were driven primarily by two states. The hazard ratios for other states were not statistically significant, and in several cases were above 1.0 (indicating greater likelihood of overdoses associated with having follow-up visits).

The study did not seek to explain the variation in 7-day follow-up rates across states, or the variation in the effect on overdoses. Medicaid benefits for SUD treatment and other policies vary across states, although an in-depth analysis of state Medicaid policies in the MODRN states show substantial convergence on the use of ASAM placement guidelines and policies on access to MOUD (Cole et al., 2021). However, states vary substantially in other ways that could affect the rate of follow-up, such as the level of demand for treatment services, treatment infrastructure and capacity, as well as state and local initiatives to promote linkages and “warm handoffs” between EDs and outpatient providers.

Relatedly, differences may exist across states in how patients with different levels of OUD severity utilize the ED, which may be reflected in the study sample. Although the analysis of 6-month overdose rates controlled for a variety of health and health care utilization measures in the 90 days before the ED visit, other unmeasured differences across states could influence how patients with OUD present at the ED. Also, differences across states may exist in how often hospitals admit patients from the ED (which this study sample excluded), and how often patients either decline to be transported to the hospital or leave against medical advice.

The inconsistent effect of 7-day follow-up across states may reflect in part the breadth of the measure—based on the NCQA definition—which includes any type of contact with a practitioner where OUD was the principal diagnosis. The effect on overdoses may vary depending on more nuanced characteristics of the follow-up visit. For example,

initiating MOUD treatment at the follow-up visit may be more effective for preventing overdoses than assessments only or treatment approaches that rely entirely on counseling and abstinence, especially when MOUD is received for longer rather than shorter periods (Samples et al., 2020; Williams et al., 2020). The NCQA definition does not specifically require MOUD to be in the follow-up measure because it was designed to include alcohol and other substance use disorders (SUDs for which medication may or may not be appropriate), although NCQA has signaled interest in modifying its measure for OUD to include MOUD in the numerator (National Committee for Quality Assurance, 2021).

Providers and policymakers have increasingly focused on initiating MOUD treatment in the ED—such as through "ED-Bridge" programs—rather than waiting for a follow-up visit with a treatment provider. In general, research shows that more aggressive approaches to initiating MOUD treatment in the ED increased treatment engagement and decreased opioid use in the short-term (D'Onofrio et al., 2015; D'Onofrio et al., 2017; Englander et al., 2019; Liebschutz et al., 2014; Martin et al., 2020; Shanahan et al., 2010; Wakeman et al., 2017). Attempts to establish "ED-Bridge" programs statewide exist in California and Pennsylvania (AcademyHealth/ Milbank Memorial Fund, 2021; Herring, 2018).

We should note that this study has some limitations. First, knowing whether OUD was the chief complaint associated with the ED visit is difficult with claims data, as the coding of such conditions is not consistent across providers and possibly across states and is subject to error (Howell et al., 2021). Therefore, we had some uncertainty as to whether clinicians in the ED were responding primarily to an OUD diagnosis or some other condition, which could attenuate the correlation with 7-day follow-up for OUD. Also, the results of this study are based on retrospective data rather than data from natural experiments or randomized controlled trials. Although the analysis controlled extensively for demographic and clinical confounders that may be related both with having a 7-day follow-up visit and with subsequent overdose, some caution should be used in making causal inferences. In terms of the meta-analytic method used, the large heterogeneity across states could possibly indicate the existence of unmeasured/unadjusted confounders at the beneficiary or state level.

Also, although other studies have used our measure of overdoses (Green et al., 2017), the measure is based on claims data and, therefore, will exclude any overdoses that did not involve a health care provider who billed for Medicaid (McLeod et al., 2021; Slavova et al., 2020; Zozula et al., 2021). This limitation could explain, in part, why Medicaid enrollees in rural areas were much less likely to have an overdose compared to those in metro areas, as some enrollees in rural areas live farther away from hospitals and other health care providers. This measurement error could possibly differ by states, which could partly explain the variation across states in the effects of 7-day follow-up on overdoses.

This is the first study, to our knowledge, to examine the association between 7-day follow-up and overdoses for Medicaid populations. The low rate of follow-up care among Medicaid enrollees should be of concern to policymakers and providers, especially to the extent that enrollees encounter barriers to care such as lack of availability of providers, waiting lists, transportation, stigma, or lack of willingness to seek treatment. Models of care delivery that include initiation of MOUD treatment in EDs along with greater coordination with referral sources hold great promise for improving the rate of follow-up care if brought to scale across communities and states. Although the results show that 7-day follow-up is associated with lower overdose rates, a measure that includes treatment type and duration may be an even stronger predictor of clinical- and policy-relevant outcomes, and, therefore, an even more compelling measure of OUD treatment quality.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jsat.2022.108807.

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