NEW RESEARCH SUBSTANCE USE

Medications for Opioid Use Disorder Among Transition Age Youth Compared to Adults 26 or Older in Rural Settings

José M. Flores, MD, PhD, Emily Kan, PhD, Larissa J. Mooney, MD, Huyen Pham, PhD, Yuhui Zhu, PhD, Kate Wolitzky-Taylor, PhD, Yih-Ing Hser, PhD

Objective: Transition age youth (TAY), aged 18 to 25 years, face barriers to medication treatment for opioid use disorder (MOUD), resulting in lower retention. We evaluated OUD prevalence and MOUD receipt comparing TAY to adults aged 26 or older residing in rural settings.

Method: Electronic health records (October 2019 to January 2021) for 36,762 patients across 6 primary care clinics involved in a large feasibility trial in US rural communities were analyzed. All clinics implemented a standardized intervention. Mixed effects logistic/linear regression estimated the odds of OUD diagnosis among all patients, and, among those with OUD, the odds of receiving MOUD and days prescribed MOUD during the 15-month study period, comparing age categories (TAY aged 18-25 years vs adults 26 years or older). Covariates included gender, race, ethnicity, mental health comorbidities, and insurance status.

Results: OUD prevalence was 2.82% among TAY (n = 3,122) and 3.24% among adults aged 26 or older (n = 33,208). After adjusting for covariates and clustering, TAY had significantly lower odds of OUD diagnosis compared to adults 26 years or older (odds ratio = 0.58, 95% CI 0.45-0.73). There were no significant differences in MOUD receipt between age groups. Compared to adults aged 26 or older, TAY with OUD had significantly fewer MOUD days during the study, −43.81 days (−76.85 to −10.77).

Conclusion: Although no differences were observed in MOUD prescription receipt between TAY and adults aged 26 or older, TAY with OUD had fewer total days prescribed MOUD, indicating lower retention. Further research generalizable to rural communities is needed to assess retention among rural TAY with OUD.

Plain language summary: This study used data from the electronic health records of 6 rural primary care clinics across three states to compare the diagnostic rates of opioid use disorder (OUD) and the prescription of medications for opioid use disorder (MOUD) between 3,122 transition age youths (aged 18-25) and 33,208 adults aged 26 or older. The study found that the rates of OUD were lower in youths under age 25 compared to adults 26 or older. However, among participants diagnosed with OUD, youths under age 25 received 43 to 63 fewer days of prescribed MOUD compared to adults 26 years or older. These findings indicate possible inconsistencies in care such as lower retention or lower adherence affecting transition age youths compared to adults 26 or older. These findings highlight the need for age-appropriate interventions to improve treatment among youths with opioid use disorder in rural settings.

Clinical trial registration information: Rural MOUD Telemedicine in Primary Care Phase 1 (Feasibility); https://clinicaltrials.gov/; NCT04418453.

Key words: transition age youth; opioid use in rural settings; medications of opioid use disorder; opioid use disorder; retention

JAACAP Open 2024;2(4):231-238.

The opioid epidemic continues to exert a profound impact across age groups with individuals residing in rural areas of the United States facing unique barriers to care. The prevalence of opioid use disorder (OUD) in young adults aged 18-25 years was 0.9% in 2020 and increased to 1.3% in 2021, whereas the prevalence for adults aged 26 or older was 1.1% in 2020 and increased to 2.2% in 2021.[1,2] Importantly, over the past 2 decades, the opioid-related overdose death rate has dramatically increased among young adults. Between 2001 and 2016, the proportion of deaths attributable to opioids increased from 2.9% to 12.4% for young people aged 15-24 and from 4.2% to 20.0% among adults aged 25 to 34 years.[3] Unfortunately, there remains a critical gap in research and evidence-based interventions to address the specific needs of young people from rural areas.

Despite guidelines recommending the use of medications for opioid use disorder (MOUD) among adolescents and young adults with OUD,[4,5] only a minority of youth who need treatment receive MOUD. In one study, only 26.9% of young adults aged 18-25 years with OUD received timely MOUD.[6] In another large, nationally representative sample, only 13.5% of young adults with OUD received MOUD in 2008, increasing to 21.8% in 2017.[7] In contrast, among patients in specialty opioid treatment, older adults have higher odds of ever being treated with MOUD

compared to younger adults aged 18-25 years.[8] In addition, multiple studies have shown that younger age is significantly associated with lower retention in substance use treatment programs compared to that in older adults, including programs focusing on buprenorphine[9,10] and methadone.[11,12] Retention and other inconsistencies in care in MOUD are important clinical outcomes, as longer duration of MOUD treatment is associated with reduced risk of opioid relapse and overdose.[13] However, prior studies have not examined how younger age may affect retention in rural settings.

Studies conducted in rural communities underscore the severity of the opioid crisis among rural adolescents and young adults. Research has shown that rural adolescents have 35% higher odds of past-year prescription opioid use compared to their urban counterparts.[14] In addition, studies in New England show alarming trends among young people who use opioids in rural areas, with 23.8% of rural people who used opioids to get high or who injected opioids initiating opioid use at ages 10 to 13, 28.6% at ages 14 to 17, and 38.1% at ages 18 to 25 years. Importantly, this study also indicated that more than half of those who used opioids by injection (67.2%) had injection initiation between 10 and 25 years of age,[15] raising significant concerns about the opioid use trajectory of young adults in rural settings. Moreover, states with large rural areas, such as Kentucky, Tennessee, and Georgia, experienced a 200% increase in hepatitis C (HCV) cases among young people from 2006 to 2012.[16] Increases in HIV and HCV were largely attributed to increases in drug injection, and underscore the toll and consequences of opioid use among young adults and the need for a comprehensive understanding of the factors driving these trends.

Residents from rural communities encounter major challenges in access to and availability of MOUD and mental health services. A recent study shows the persistence of stark rural–urban differences in unmet mental health need, with rural nonadjacent county residents in need of mental health services having 73% fewer ambulatory and specialty mental health visits compared to urban counterparts.[17] High rates of opioid use and unmet mental health needs have vast implications for young people who use opioids, as mental health comorbidities often precede or worsen opioid use.[18] A recent systematic review showed a relative lack of medication treatment facilities and mental health services/providers, and, even when this gap decreased over time, smaller improvements were seen in rural communities.[19] In addition, patients seeking treatment for OUD in rural settings confront travel, cost, and time constraints,[20] factors that may be even more difficult to overcome for young adults compared to older adults. Indeed, further research is needed to better understand whether residing in a rural community may exacerbate the poor treatment retention among young adults, highlighting a population that may not only be at greater risk for initiation of opioid use and development of OUD, but also encounter barriers to receiving and staying in treatment.

The present study evaluated the prevalence of opioid use disorder (OUD) and rates of prescription of MOUD between transition age youths (TAY) aged 18 to 25 years and adults aged 26 years or older in rural settings. In addition, differences in MOUD treatment adherence, retention, and inconsistent care were examined by comparing the total number of days prescribed MOUD between the 2 age groups. We hypothesized that, compared to adults aged 26 or older, TAY would have a lower prevalence of OUD. Among those with OUD, we expected that TAY would be less likely to receive MOUD and would have fewer days prescribed MOUD than adults aged 26 or older. The findings of the present study hold significant implications for public health interventions.

METHOD

The current study involved a secondary analysis of electronic health record (EHR) data from a large prospective, single-arm, multisite study conducted by the National Drug Abuse Treatment Clinical Trials Network (CTN-0102). The primary aim of the parent study was to assess the feasibility of implementing a care coordination model between primary care and external telemedicine providers to expand MOUD access for patients with OUD in rural settings. Briefly, the study recruited rural primary care clinics with varying levels of MOUD capacity based on the number of buprenorphine-prescribing clinicians (0 or 1, 2 or 3, or more than 3). The intervention involved 3 main components: (1) establishing a telemedicine referral process within a service delivery plan; (2) identifying and documenting eligible OUD patients in a patient registry; and (3) providing continuum of care MOUD, including patient referrals for telemedicine-based MOUD. This intervention phase coincided with the onset of the Coronavirus disease 2019 (COVID-19) pandemic, leading all clinics in the study to transition to telehealth services. A detailed description of the study design and the intervention can be found in Hser *et al.*[21] The original study sample comprised 36,762 patient records, with patients ranging in age from 18 to 80 years, who had visited 1 of 6 rural primary care sites in 3 states (Maine, Washington, and Idaho) at least once during the period from October 2019 to January 2021. Ethical approval for the study procedures and data use was obtained from a single Institutional Review Board (sIRB) – BRANY. The study is registered at Clinicaltrials.gov (NCT04418453).

The EHR data collected as part of the parent study were obtained over a span of 15 months. Three dependent

variables represented the outcomes of interest of the study: 1 variable analyzed in the total sample, and 2 variables analyzed only among participants diagnosed with OUD. The dependent variable for analyses using the total sample was OUD diagnosis, ascertained based on diagnosis codes from the *International Classification of Diseases, 10th Revision, Clinical Modification* (*ICD-10-CM*) or Systematized Nomenclature of Medicine Clinical Terms (SNOMED) codes, associated with opioid dependence or abuse in the EHR during the 15-month observational period. The 2 dependent variables analyzed only among participants with OUD were as follows: (1) MOUD prescription, represented as an indicator variable (yes or no) describing whether each patient was prescribed MOUD during the 15-month observation period; and (2) the total number of days prescribed MOUD, calculated as the total number of nonoverlapping days during which MOUD was prescribed to each patient, including prescriptions provided by clinic providers or external telemedicine providers.

The independent variable was age, determined at the first visit in the EHR, categorized into 2 groups: TAY (aged 18-25 years) or older adults (aged 26 years or older). Demographic variables were used as adjustment covariates included sex/gender (categorized as male or female), race (categorized as White, Black or African American, Other) and ethnicity (categorized as Latinx, Non-Latinx), insurance status (categorized as Medicaid, Medicare, private insurance, or other), and presence of mental health comorbidities (whether or not any of the following diagnoses were present: major depressive disorder, bipolar disorder, or anxiety and related disorders including generalized anxiety disorder, panic disorder, social anxiety disorder, post-traumatic stress disorder, and obsessive-compulsive disorder) (Table S1 through Table S6, available online).

Finally, even though all clinics were observed for 15 months, individual participants entered the study at different times during the study period; thus, in contrast to clinic-level variables, any given participant in the sample had a unique time under observation during which the outcomes of interest could be observed (termed "exposure time under observation"). For analyses of individual level variables such as age, the individual length of follow-up affects the likelihood of experiencing the outcomes. Therefore, to adjust for the difference in individual follow-up times, we defined 2 covariates estimating the exposure time under observation: (1) number of days from the date of first visit to the end of the study period, or (2) number of days from the date of OUD diagnosis to the end of the study period. Sensitivity analyses using either of these exposure time covariates were performed for all analyses.

Data management and statistical analyses were performed using STATA/BE v16 (StataCorp). Continuous variables are presented as mean (SD). Categorical variables are reported as the number (proportion) of participants in each category. To compare means between groups, p values for continuous variables were derived using analyses of variance. The p values for categorical variables were determined using Pearson χ^2 tests. Mixed effects logistic regression was used to estimate the odds ratio (OR) of receiving MOUD during the 15-month study period comparing TAY vs adults aged 26 and older. Mixed effects linear regression models were used to estimate differences in the total days prescribed MOUD between TAY and adults aged 26 or older. Clustering of patients within clinics was accounted for by incorporating a random intercept for clinical site.

RESULTS

The EHR data included a total of 36,762 patients, with 3,122 in the 18- to 25-year age group (TAY) and 33,208 classified as adults aged 26 years or older. There were significant differences in demographic variables between the 2 age groups (Table 1). The demographic composition of TAY vs adults 26 years or older, respectively, was as follows: female participants (60% vs 53%, $p < .001$), Latinx participants (2.3% vs 1.2%), White participants (89.0% vs 93.3%, $p < .001$), and participants with a mental health comorbidity diagnosis (30.2% vs 24.9%, $p < .001$). In terms of insurance coverage, the TAY group had a higher proportion of individuals who were uninsured (10.5% vs 8%), were covered under Medicaid (38.2% vs 17.0%), or had private insurance (47.9% vs 44.3%), whereas adults aged 26 years or older had higher proportions covered by Medicare (27.9% vs 1.5%, $p < .001$).

Table 2 presents the analysis of outcomes of the study. The observed prevalence of OUD among TAY was 2.82% and 3.24% among adults aged 26 years or older. Among individuals diagnosed with OUD, 72.73% of TAY received MOUD, whereas 65.52% of adults aged 26 or older received MOUD. The average count of prescribed MOUD days during the 15-month study period was 173 days among TAY and 230 days among adults aged 26 or older.

As shown in Table 2, using mixed effects logistic regression to adjust for the clustering of patients within clinics, for covariates, and for exposure time since first visit to the end of 15-month study period, the odds of OUD diagnosis in the entire sample were significantly lower among TAY in comparison to adults aged 26 or older (OR = 0.58; 95% CI = 0.45-0.74). Among participants diagnosed with OUD, 3 distinct mixed effects logistic regression models revealed no statistically significant differences in the odds of being prescribed MOUD during the

TABLE 1 Demographic Characteristics Between Transition Age Youth (TAY) (Aged 18-25 Years) and Adults Aged 26 Years or Older

	TAY (18-25 y) (n = 3,122)	Adults ≥26 y (n = 33,208)	p
Sex, n (%)			<.001
Male	1,244 (39.8)	15,451 (46.5)	
Female	1,878 (60.2)	17,753 (53.5)	
Race/ethnicity, n (%)			<.001
Black/African American	29 (0.9)	94 (0.3)	
White	2,780 (89.0)	30,985 (93.3)	
Other	92 (2.9)	580 (1.7)	
Ethnicity, n (%)			<.001
Non-Latinx	2,439 (78.1)	25,246 (76.0)	
Latinx	73 (2.3)	396 (1.2)	
Mental health comorbidity, n (%)			
No diagnoses	1,860 (59.6)	22,847 (68.8)	<.001
At least 1 diagnosis	944 (30.2)	8,285 (24.9)	
Insurance, n (%)			<.001
None	327 (10.5)	2,650 (8.0)	
Medicaid	1,194 (38.2)	5,644 (17.0)	
Medicare	47 (1.5)	9,252 (27.9)	
Private	1,495 (47.9)	14,712 (44.3)	
Other (VA, Tricare, etc)	57 (1.8)	924 (2.8)	

Note: Other race includes categories that were different between clinical sites and could not be aggregated into 1 category in the complete sample dataset. Other races/ethnicities may include Asian, Alaskan Native or Pacific Islander, unspecified, declined to answer, and unknown. Mental health comorbidity indicates whether the electronic health record includes a diagnosis of major depressive disorder, bipolar disorder, or anxiety and related disorder. Percentages may not add to 100% due to missing data. VA = Veteran Affairs.

study period between TAY and adults aged 26 or older (adjusting for patient clustering resulted in an OR of only 1.22 (95% CI = 0.73-2.03); adjusting for clustering, covariates, and exposure time from the first visit to the 15-month endpoint resulted in an OR of 1.05 (95% CI = 0.61-1.81); and adjusting for clustering, covariates, and exposure time since OUD diagnosis to the 15-month endpoint led to an OR of 1.28 (95% CI = 0.72-2.30).

Similar models were used to investigate the variation in days prescribed MOUD between TAY and adults aged 26 years or older. The findings showed significantly lower total number of days prescribed MOUD among TAY compared to adults aged 26 or older. We conducted sensitivity analyses in 3 steps. First, adjusting only for clustering within clinics and not adjusting for covariates or exposure time showed an unadjusted difference of −63.26 days (95% CI = −100.81 to −25.71). Second, adjustment for clustering, covariates, and exposure time from first visit to the 15-month endpoint resulted in a difference of −49.67 days (95% CI = −84.02 to −15.33). Finally, adjustment for clustering, covariates, and exposure time from OUD diagnosis to the end of the observation period revealed a significant difference of −43.81 days (95% CI = −76.01 to −10.77).

DISCUSSION

The present study compared TAY to adults aged 26 or older to investigate the prevalence of OUD in a large sample of rural participants, and, among participants diagnosed with OUD, the likelihood of being prescribed MOUD and the differences in the number of days prescribed MOUD between the 2 age groups. These findings provide insights into the prevalence of OUD and treatment patterns among young adults compared to adults over age 26 years in rural settings.

First, in line with prior literature and our hypotheses, results demonstrated that OUD prevalence was lower among TAY compared to adults aged 26 or older, which is consistent with the findings of the National Survey on Drug Use and Health (NSDUH) during the last 2 annual administrations (2020 and 2021), since the survey began to use *DSM-5* criteria.[1,2] Notably, OUD prevalence in this study within rural communities was higher for both age groups compared to those in national surveys. For instance, according the 2021 NSDUH, the prevalence of opioid use disorder (meeting *DSM-5* criteria for heroin use disorder or prescription pain reliever use disorder or both) was 1.3% for young adults aged 18 to 25 years and 2.2% for adults aged 26 or older (compared to 2.82% among TAY and 3.24% among adults aged 26 or older in this study).[2] The higher OUD prevalence that we observed may be due to the present sample participating in a study assessing a care coordination model designed to expand MOUD access for patients with substance use disorders in rural settings. Consistent with studies involving non-rural populations, these findings highlight the emergence of OUD in young people and emphasize the need for early interventions to reduce opioid use and progression to opioid use disorder in rural settings.

Among participants diagnosed with OUD, 72.73% of TAY and 64.52% of adults aged 26 years or older were prescribed MOUD during the study. Thus, contrary to our hypotheses, we found that the likelihood of receiving MOUD in rural clinics did not significantly differ between TAY and adults 26 years or older. One study involving youth engaged in primary care across urban, suburban, and rural settings in 6 health systems representing 6 states reported that 32% of patients aged 18-21 years received MOUD. The

TABLE 2 Opioid Use Disorder (OUD) Prevalence, Medications for Opioid Use Disorder (MOUD) Prescription, and Mixed Effects Model Results

	TAY (18-25 y) (n = 3,122)	**Adults (≥26 y) (n = 33,208)**
Descriptive statistics		
OUD prevalence (%), total sample (N = 36,762)	2.82% (n = 88)	3.24% (n = 1,076)
Percentage receiving MOUD (%) among those diagnosed with OUD (n = 1,167)	72.73% (n = 64)	65.52% (n = 705)
Days prescribed MOUD among those diagnosed with OUD, mean (SD)	173.06 (149.69)	230.42 (150.58)
Exposure time under observation from first visit to end of study period, days, mean (SD)	291.43 (134.05)	325.76 (129.12)
Exposure time under observation from OUD diagnosis to end of the study period, days, mean (SD)	317.43 (146.23)	340.34 (134.71)
Mixed effects regression models		
Odds ratio of OUD diagnosis in the total sample (95% CI)		Ref.
Model 1	0.84 (0.67 to 1.05)	
Model 2	**0.58 (0.45 to 0.73)**	
Odds ratio of receiving MOUD among those diagnosed with OUD (95% CI)		Ref.
Model 1	1.22 (0.73 to 2.03)	
Model 2	1.05 (0.61 to 1.81)	
Model 3	1.28 (0.72 to 2.30)	
Difference in days prescribed MOUD among those diagnosed with OUD (95% CI)		Ref.
Model 1	**−63.26 (−100.81 to −25.71)**	
Model 2	**−49.67 (−84.02 to −15.33)**	
Model 3	**−43.81 (−76.84 to −10.77)**	

Note: MOUD receipt and days prescribed MOUD comparing TAY to adults aged 26 years or older. Model 1 is an unadjusted estimate, accounting for clustering only within clinics. Model 2 is adjusted for clustering within clinics, covariates (sex, race, ethnicity, insurance, diagnosis of mental health comorbidity), and exposure time from first clinic visit to end of the 15-month period. Model 3 is adjusted for clustering within clinics, covariates (sex, race/ethnicity, insurance, diagnosis of mental health comorbidity), and exposure time from date of OUD diagnosis to the end of 15-month period (Model 3 is possible for outcomes only among patients diagnosed with OUD, since OUD diagnosis date is necessary for computation of exposure time. Ref. = reference; TAY = transition age youth (aged 18-25 years). Data in bold font denotes statistically significant findings (p < 0.001).

percentage rose to 39% among individuals aged 22 to 25 years.[22] Similarly, a recent analysis of 2021 NSDUH data representative of the general US population showed that among adults 18 years or older with past-year OUD, only 35.6% received MOUD; however, analyses between age groups showed that the odds of past-year receipt of MOUD were not statistically different when adults aged 26 to 34 years and adults aged 35 or older were compared to young adults aged 18-25.[23] Therefore, in contrast with prior studies, rates of MOUD prescription are higher in the current sample. This observed difference in treatment rates compared to treatment as usual in the general community and compared to studies using national data can likely be attributed to the involvement of clinical staff in research, resulting in additional resources to provide MOUD access for patients at rural sites participating in the feasibility trial. However, although these rates are influenced by the targeted intervention of our study, they also reflect the pre-intervention priorities and practices of the participating clinics, which were already focusing on MOUD access. Nonetheless, almost one-third of patients (TAY or adults aged 26 years or older) did not receive MOUD. These findings suggest that there are similar rates of unmet need among both age groups in rural settings, and that additional effort should be made to provide patients with MOUD.

Despite similar rates of MOUD receipt between age groups, however, TAY had significantly fewer days prescribed MOUD relative to adults 26 years or older. After adjustment for exposure time from first visit or from OUD diagnosis to the end of study period, TAY had significantly lower days prescribed MOUD (49 fewer days or 43 fewer days prescribed MOUD, respectively). These differences might therefore be indicative of inconsistencies in care such as lower MOUD adherence or MOUD retention among TAY compared to adults aged 26 or older, or lower duration of MOUD prescription by clinicians for young adults relative to older adults.

This observation aligns with a recent literature review indicating that retention has consistently been associated with increasing age.[24] The literature review recommended interventions at individual, interpersonal, and institutional levels, including screening and referral to treatment to address factors that could be associated with lower retention, such as concurrent drug use, physical health problems, psychiatric comorbidities, or family stress and conflict, while ensuring that young participants had adequate MOUD dosing. In addition, access to MOUD at pharmacies is hindered by multiple barriers including financial, regulatory, geographic, and logistical challenges[25] as well as by pharmacy staff and medication shortages,[26] which have been further exacerbated by the COVID-19 pandemic, especially in rural communities.[27] Such limitations in access to MOUD at the pharmacy may impact TAY patients to a larger degree, particularly in rural communities. Improving retention and other inconsistencies in care among TAY is a critical priority, as research has shown that young adults aged 18 to 25 years are more likely to return to use compared to adults aged 26 or older, regardless of the type of MOUD received.[28]

This study has several limitations. First, the data come from clinical sites that were part of a single-arm feasibility study to expand access to MOUD in rural settings, with participation likely related to having higher rates of patients with OUD. Therefore, given the nature of the study design, all clinical sites received the intervention seeking to expand access to MOUD by improving their capacity to identify OUD and to provide access to telehealth-based MOUD services through an external vendor. Participation in the trial was likely coupled with other factors such as higher level of contact with providers or study staff compared to people receiving treatment as usual in the community. However, it is important to note that high rates of OUD and MOUD existed prior to the intervention and at the beginning of the trial, suggesting that participation in the intervention did not necessarily inflate these rates. Thus, this clinical trial setting and the selection of clinics with high rates of OUD and MOUD limit the generalizability of the findings, as the clinics may not be representative of health care available in the general rural population. Furthermore, it is worth noting that the onset of the COVID-19 pandemic coincided with the study intervention period, when most clinics expanded their own internal telehealth capabilities regardless of their participation in the study; in fact, the vast majority of MOUD was not provided through the study telehealth vendor, further indicating that MOUD rates cannot be attributable solely to the intervention. Second, data from electronic health records are susceptible to inaccurate recording of diagnoses and differences among clinical sites. Third, comparative analyses using individual level variables such as age may be affected by differences in exposure or follow-up time under observation. To overcome this limitation, we compared 3 models: (1) without adjusting for exposure time; (2) adjusting for the length of time since the first clinic visit of the study; or 3) adjusting for exposure time since the date of OUD diagnosis until the end of study. However, these calculations and subanalyses provide only an estimate of individual exposure time, and associations may still be confounded despite statistical adjustments, as data beyond the 15-month study period were not collected. Fourth, the EHR data did not allow us to distinguish between sex and gender identity. We have used sex-based classifications with this limitation in mind, and future studies should consider methodologies that can accurately capture distinctions between sex and gender identity. Fifth the EHR data had a limited set of variables, and other important factors that may account for differences in MOUD prescription and total number of days prescribed MOUD beyond age have not been adjusted for. For example, the provision of MOUD may be affected by individual-level sociodemographic factors (education, socioeconomic status, incarceration, or houselessness history) and higher-level factors (county-level poverty, community-level availability of mental health treatment). The limited number of variables prevented analyses that are critical to understand the reasons why there may be differences in days prescribed MOUD between age groups.

Despite these limitations, this study also has multiple strengths. The study represents a large unique sample of rural primary care clinical sites representing 3 states across 2 regions, increasing the generalizability of the findings. Comparative age analyses studying differences between rural youth vs older adults are extremely scarce in the literature, so this study adds to a critical gap in knowledge.

In conclusion, this study highlights rural specific findings that underscore the persistent need for developmentally appropriate interventions to improve MOUD initiation, retention, and consistency of care for young adults in rural communities. Future research should focus on replication of these analyses in general rural populations to improve generalizability and to identify interventions to improve retention, adherence, and MOUD prescription with strategies specifically adaptable to serve the needs of young people from rural communities.

CRediT authorship contribution statement

José M. Flores: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization. **Emily Kan:** Writing – review & editing, Writing – original draft, Formal analysis, Data curation,

Conceptualization. **Larissa J. Mooney:** Writing – review & editing, Writing – original draft, Supervision, Methodology. **Huyen Pham:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Yuhui Zhu:** Writing – review & editing, Writing – original draft, Methodology, Data curation, Conceptualization. **Kate Wolitzky-Taylor:** Writing – review & editing, Writing – original draft, Conceptualization. **Yih-Ing Hser:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Formal analysis, Conceptualization.

This article is part of a special series devoted to the subject of substance use, featuring topics relevant to child and adolescent behavioral health, including genetics, neuroscience, epidemiology, measurement, prevention, and treatment. This special series is edited by Guest Editor Kevin M. Gray, MD, *JAACAP Open* Deputy Editor Kara S. Bagot, MD, *JAACAP* Deputy Editor Mary Fristad, PhD, ABPP, *JAACAP* and *JAACAP Open* Associate Editor Robert R. Althoff, MD, PhD, *JAACAP Open* Editor Manpreet K. Singh, MD, MS, and Editor-in-Chief Douglas K. Novins, MD.

Accepted February 21, 2024.

Drs. Flores, Kan, Mooney, Pham, Zhu, Wolitzky-Taylor, and Hser are with the University of California, Los Angeles, California. Dr. Mooney is also with the VA Greater Los Angeles Healthcare System, Los Angeles, California

Research reported in this publication was supported by the National Institute on Drug Abuse of the National Institutes of Health under Award Number UG1DA049435. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. This work was also partly supported from the United States Department of Human Services through the American Academy of Addiction Psychiatry / National Institute of Drug Abuse Clinical Trials Network Mentor Facilitated Training Award (contract #75N95020C00028RFP). Dr. Flores is supported by training grant T32MH073517.

The research was performed with permission from Single Institutional Review Board (sIRB) — BRANY.

The authors have reported the use of AI or AI-assisted technologies. During the preparation of this work the authors used services offered by Chat Generative Pre-trained Transformer (Chat GPT), a language model-based chatbot developed by OpenAI, in order to improve the language, clarity, and readability of the article. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

Drs. Flores, Pham, Zhu, and Hser served as the statistical experts for this research.

Disclosure: Dr. Mooney has received research support from Aelis Farma. Drs. Flores, Kan, Pham, Zhu, Wolitzky-Taylor, and Hser have reported no biomedical financial interests or potential conflicts of interest.

Correspondence to José M. Flores, MD, PhD, 760 Westwood Avenue, Suite c8-193, Los Angeles, CA 90025; e-mail: josemflores@mednet.ucla.edu

https://doi.org/10.1016/j.jaacop.2024.02.001

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