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Co-occurring substance use disorders among patients with opioid use disorder in rural primary care clinics

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Abstract

Background: Co-occurring substance use disorders (SUDs) among individuals with opioid use disorder (OUD) are associated with additional impairment, overdose, and death. This study examined characteristics of patients who have OUD with and without co-occurring SUDs in rural primary care clinics.

Methods: Secondary analysis used electronic health record (EHR) data from six rural primary care clinics, including demographics, diagnoses, encounters, and prescriptions of medication for OUD (MOUD), as well as EHR data from an external telemedicine vendor that provided MOUD to some clinic patients. The study population included all adult patients who had a visit to the participating clinics from October 2019 to January 2021.

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Declaration of competing interest

Authors disclosing relevant financial interests, activities, relationships, and affiliations are: A.J.S. receives royalties as a section editor for UpToDate, received travel support from Alkermes, Inc. and consultant fees from Indivior, Inc. L.J.M. receives research support from Aelis Pharma. All other authors report no financial or other possible conflicts of interest.

Clinical trial registration

The study was registered at Clinicaltrials.gov (NCT04418453).

CRediT authorship contribution statement

All authors contributed to and approved the final manuscript.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.josat.2023.209269.

Results: We identified 1164 patients with OUD; 72.6 % had OUD only, 11.5 % had OUD and stimulant use disorder (OUD + StUD), and 15.9 % had OUD and other non-stimulant substance use disorder (OUD + Other). The OUD + StUD group had the highest rates of hepatitis C virus (25.4 % for OUD + StUD, 17.8 % for OUD + Other, and 7.5 % for OUD Only; $p < 0.001$) and the highest rates of mental health disorders (78.4 %, 69.7 %, and 59.9 %, respectively; $p < 0.001$). Compared to the OUD Only group, patients in the OUD + StUD and OUD + Other groups were more likely to receive telehealth services provided by clinic staff, in-clinic behavioral health services, and in-clinic MOUD. The OUD + StUD group had the highest proportion of referrals to the external telemedicine vendor.

Conclusions: More than 27 % of patients with OUD in rural primary care clinics had other co-occurring SUDs, and these patients received more healthcare services than those with OUD only. Future studies should examine variations in outcomes associated with these other services among patients with OUD and co-occurring SUDs.

Keywords

Opioid use disorder; Substance use disorders; Comorbidity; Health service; Rural; Primary care clinic

1. Introduction

The opioid crisis continues to be a public health concern in the U.S., with nearly 80,000 overdose deaths involving opioids reported in 2022 (CDC, 2023). The majority of opioid-involved overdose deaths involve other substances, notably stimulants such as cocaine or methamphetamine (Kariisa et al., 2021). Recent epidemiological studies have shown a high prevalence of co-occurring substance use disorders (SUDs; 26 %–57 %) among individuals with opioid use disorder (OUD) (Hassan & Le Foll, 2019; Xu et al., 2022). Co-occurring SUDs are associated with additional impairment, relapse following a treatment regimen, overdose, and death (Bhalla et al., 2017; Hassan & Le Foll, 2019; Smart et al., 2023).

Rural areas have been disproportionately impacted by the opioid crisis, especially during the COVID-19 pandemic (Jenkins et al., 2022). Rural areas have limited healthcare resources in general and face particular challenges in access to medication for OUD (MOUD) (Andrilla & Patterson, 2022), including lack of transportation and high levels of substance use-related stigma (Ezell et al., 2021). The gap between the need for and the actual receipt of MOUD among rural populations remains large. On the one hand, several studies have shown that veterans or Medicaid enrollees with OUD and co-occurring SUDs have lower odds of receiving MOUD or treatment continuity than those with OUD only (Lin et al., 2021; O'Brien et al., 2020). On the other hand, a recent study found that Medicaid enrollees with OUD and other psychoactive SUD were significantly more likely to receive MOUD treatment (Smart et al., 2023). Importantly, little is known about whether individuals with OUD and co-occurring SUDs differ from those with OUD only in types of services and treatment in rural areas. To fill this knowledge gap, the current study assessed rates of comorbid SUDs and clinical correlates alongside health utilization patterns among patients with OUD in rural primary care clinics.

Using electronic health record (EHR) data from six rural primary care clinics, this study examined rates of co-occurring SUDs among patients with OUD. We compared those with and without co-occurring SUDs in terms of socio-demographics, other health conditions, and receipt of healthcare services to increase our knowledge of co-occurring SUDs among patients with OUD who live in rural areas.

2. Methods

2.1. Study design and population

We conducted a secondary analysis of electronic health record (EHR) data collected during a feasibility study that aimed to expand access to MOUD in rural areas by implementing a care coordination model with referral of MOUD to an external telemedicine vendor (Hser et al., 2023). Funded by the National Drug Abuse Treatment Clinical Trials Network (NIDA CTN), the feasibility study (CTN-0102) was a prospective, single-arm study conducted in six rural sites in three states (Maine, Washington, and Idaho). We used the Health Resources & Services Administration's (HRSA's) rural definition to define rural communities, and we confirmed the locations of these clinic sites by using the "Am I Rural?" tool (Rural Health Information Hub, 2022). We conducted the care coordination intervention linking the external telemedicine vendor with the rural primary care clinics from approximately July 2020 to January 2021 during the early period of the COVID-19 pandemic. A nationwide telemedicine company specializing in virtual SUD treatment was the study's external telemedicine vendor. Each participating clinic had a designated care coordinator to identify patients with OUD and track their telemedicine referral status. Clinic clinicians and care coordinators worked with these patients to determine whether to refer them to the external telemedicine vendor for MOUD based on clinic's current workflow and patients' needs. Clinics and the telemedicine vendor billed and recorded their respective services separately to maintain budgetary independence.

The study population included all patients 18 years and older who had a clinic visit in one of the six sites (including seven rural primary care clinics; we handled two small geographically proximate rural clinics as a single site) from 9 months before the intervention start to the end of the intervention (October 2019 to January 2021, for a total period of approximately 15 months). We extracted EHR data during the 15-month observational period and used it for the current analyses. The clinic EHR data included demographics, diagnoses, encounters, prescriptions for MOUD, and laboratory tests. Some clinics had additional data about referrals and urine drug screening. In addition to clinic EHR data, this study includes EHR data from the external telemedicine vendor that provided MOUD and behavioral health services to some patients of the participating clinics. The study's single Institutional Review Board (sIRB) approved all procedures. The study was registered at Clinicaltrials.gov (NCT04418453).

2.2. Measures

2.2.1 Patients with OUD: adult patients with at least one opioid diagnosis code (e.g., opioid dependence and abuse) according to International Classification of Diseases, 10th revision,

Clinical Modification (ICD-10) or SNOMED diagnostic code (see Appendix) during the 15-month observational period.

2.2.2 Patients with OUD + Stimulant Use Disorder (StUD): adult patients with ICD-10 or SNOMED diagnosis codes for stimulant use disorders (e.g., cocaine, methamphetamine, see Appendix) in addition to OUD, and could be with or without other SUDs during the 15-month observational period.

2.2.3 Patients with OUD + other SUD (Other): adult patients with ICD-10 or SNOMED diagnosis codes for other non-stimulant use disorders (i.e., alcohol, cannabis) in addition to OUD during the 15-month observational period. We did not consider all other SUDs because tobacco use disorder is often managed separately from illicit substance or alcohol use, and the prevalence of other SUDs are low (<3 %).

2.2.4 Demographic characteristics reported in EHR data included age at the first encounter during the study period, gender (male, female), race and ethnicity [non-Hispanic White (hereafter, White), non-Hispanic Black (hereafter, Black), Hispanic or Latino, Other], health insurance (None, Medicaid, Medicare, Other).

2.2.5 We identified co-occurring health conditions by using analogous methods based on diagnosis codes during the study period. These comorbidities included hepatitis C virus (HCV), human immunodeficiency virus (HIV), mental health disorders, and chronic pain.

2.2.6 Health service utilization included encounters and MOUD. We used keyword searching from EHR data to identify behavioral health and telehealth services based on encounters' descriptions of each clinic. Receipt of any MOUD was indicated if an individual had at least one prescription record for buprenorphine or naltrexone from the clinic or the external telemedicine vendor during the study period.

2.3. Statistical analysis

We classified the study sample into three mutually exclusive groups for our analysis: 1) individuals with OUD and without other SUDs except tobacco use disorder (OUD Only), 2) individuals with OUD and at least stimulant use disorder (OUD + StUD), and 3) individuals with OUD and other non-stimulant use disorders (OUD + Other). We conducted Chi-square analyses to evaluate overall differences among the three groups in demographic characteristics, co-occurring health conditions, and health service utilization. We also applied Bonferroni correction for pairwise comparisons. We considered two-tailed tests with a p-value <0.05 statistically significant except for the Bonferroni correction ($\alpha = 0.05/3$) where we conducted pairwise comparisons. The study conducted all statistical analyses using SAS 9.4 version (SAS Institute, Cary, NC).

3. Results

3.1. Socio-demographic characteristics

Among 36,762 primary care patients, we identified 1164 patients with OUD (3.2 %) during the study period; 72.6 % of the 1164 had OUD only, 11.5 % had OUD and stimulant use

disorder (OUD + StUD), and 15.9 % had OUD and another non-stimulant SUD (OUD + Other). Among those in the OUD + StUD group, 33.6 % had a cocaine use disorder diagnosis, and 73.1 % had a methamphetamine use disorder diagnosis; 6.7 % had both. Table 1 provides demographic information. The OUD Only group was the oldest, and the OUD +Other group had the highest proportion of uninsured patients. There were no significant race and ethnicity differences across groups as >90 % of the sample were White.

3.2. Characteristics related to co-occurring conditions

As shown in Table 2, we found that the OUD + StUD group had the highest rates of HCV and mental health disorders. In the OUD + StUD group, 27.6 % also had alcohol use disorder (AUD), and 29.1 % had cannabis use disorder (CUD). Among the OUD + Other group, 62.2 % had AUD, and 51.1 % had CUD. The OUD Only group had the lowest proportion of tobacco use disorder.

3.3. Utilization of healthcare services

As displayed in Table 3, compared to the OUD Only group, patients in the OUD + StUD and OUD + Other groups were more likely to receive telehealth services provided by clinic staff, in-clinic behavioral health services, and prescriptions for MOUD from clinic. In addition, patients in the OUD + StUD group had the highest proportion of referrals to the external telemedicine vendor.

4. Discussion

This study examined clinical characteristics among individuals with OUD and other co-occurring SUDs in rural primary care clinics. Among individuals with OUD, a substantial proportion had co-occurring SUDs (27.4 %). This finding is consistent with previous studies, which ranged from 20 % to 30 % (Delcher et al., 2022; Jones & McCance-Katz, 2019; Xu et al., 2022).

This study found that co-occurring SUDs were associated with younger age and being uninsured. A previous study of adult primary care patients reported similar results showing that participants who were male, younger, less educated, and unemployed had increased odds of multiple SUDs compared to one SUD (John et al., 2018). Although not unique to rural areas, barriers to care are more challenging in rural communities as many individuals in rural regions face fewer healthcare providers, difficulties obtaining insurance because of cost and ineligibility for public programs, and long distance to healthcare facilities (Burman et al., 2006; Dickson-Gomez et al., 2022; Gong et al., 2019). Addressing these barriers and providing evidence-based interventions or services for these demographic subgroups (e.g., youth, uninsured) at high risk of multiple SUDs should be considered.

Our study also found that individuals with OUD involving StUD or other SUDs had higher rates of HCV and mental health disorders than those with OUD only. This finding is consistent with Hassan & Le Foll's study (Hassan & Le Foll, 2019), reporting that individuals with SUDs involving multiple substances were more likely to have other mental disorders than those with OUD only. Comorbid SUDs and mental health conditions have been shown to be associated with greater SUD severity and worse treatment outcomes (Lin

et al., 2019; Litz & Leslie, 2017). In our study, HCV infection was the more common infectious disease (11.2 %) related to injection drug use or sexual transmission compared with HIV (0 %), raising concerns about the prevalence of unsafe practices of injection drug use in rural settings. The prevalence of HCV infection among the OUD + StUD group was two times higher than those among OUD only group. A previous study (Glick et al., 2018) has shown that sharing injection equipment was relatively common among people who inject stimulants, and individuals who reported injecting stimulants with opioids are more likely to inject drugs daily or more than once a day compared to those who reported injecting stimulants with other drugs. Understanding the association of co-occurring SUDs and health problems such as HCV infection can help inform treatment or other intervention options needed for this population.

Approximately two-thirds of individuals with OUD in the study sample received at least some MOUD services, and one-third received behavioral health services during the 15-month observation period. Nearly half of these patients received telehealth services for any of their medical conditions, which is consistent with the results of American Medical Association's, 2022 digital health research survey. That survey found that telehealth visits in clinical practice in the U.S. have increased in recent years, from 14 % of visits in 2016 to 80 % in 2022 (American Medical Association, 2022). During our study period, rural primary care clinics were adapting to COVID-19 and developing in-clinic telemedicine services as needed (Hser et al., 2023). The high use of telehealth services in these rural primary clinics suggests that technology-based applications could be leveraged to provide greater opportunities for individuals with OUD in rural settings to receive treatment delivered virtually.

As mentioned previously, Lin and colleagues conducted a retrospective national cohort study of veterans (VA) diagnosed with OUD and found that having comorbid SUDs is associated with a higher likelihood of visits to an SUD clinic, but a lower likelihood of buprenorphine treatment (Lin et al., 2021). Using IBM MarketScan Multi-State Medicaid Database, O'Brien et al. found Medicaid enrollees with OUD and another SUD diagnosis were more likely to receive intensive services, but less likely to use MOUD (O'Brien et al., 2020). In contrast, Smart et al. recently found that Medicaid enrollees with OUD and other psychoactive SUD were more likely to receive MOUD treatment within one year of OUD diagnosis compared with those with OUD only (Smart et al., 2023). In our study, compared to those with OUD only, patients with comorbid SUDs were more likely to use many and varied healthcare services, including behavioral health services, telehealth visits, prescriptions for MOUD, and referrals to an external telemedicine vendor. Differential findings across studies could be explained by variations in treatment settings and time. We conducted our study in rural primary care clinics that have a documented interest in offering OUD treatment by participating in a study aiming for expanding MOUD. These rural primary care clinicians could have been more inclined to provide MOUD in the context of clinical challenges or instability related to polysubstance use. Nevertheless, future research should focus on understanding factors and mechanisms underlying clinic care services across diverse settings.

This study has several limitations. First, data are based on a feasibility trial with a limited number of clinics that varied in MOUD capacity and buprenorphine prescriber accessibility, and thus, results may have limited generalizability. More importantly, the study was conducted at the beginning of the COVID-19 pandemic, when clinics shifted priorities and adopted telehealth services as needed, so COVID-19 may highly impact findings. Additionally, this study relied on EHR-based diagnosis codes (e.g., ICD-10 codes) for OUD and other disorders, which are known to have some misclassification errors. Current or recent use of substances could not be determined from EHR data. Further, we did not consider all substance use disorders (e.g., sedative-hypnotic use disorder). The prevalences of these other SUDs are low, e.g., sedative and hallucinogen use disorders are 3 % and 0 %, respectively, which should have minimum impact on the group classification and results. Finally, the study population being >90 % White limited our ability to examine potential ethnic and racial differences. Nevertheless, the high proportion of non-Hispanic Whites is consistent with U.S. Census county-level data for northern states, which ranged from 73.6 % to 95.8 %.

5. Conclusions

Our study has shown a high prevalence of co-occurring SUDs among rural patients with OUD. These patients have more health problems (e. g., mental health, HCV), and use more and varied healthcare services than those with OUD only. Future studies should examine variations in outcomes associated with these other services among patients with OUD and co-occurring SUDs.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

American Medical Association. (2022). Physicians' motivations and key requirements for adopting digital health adoption and attitudinal shifts from 2016 to 2022. Retrieved from https://www.ama-assn.org/system/files/ama-digital-health-study.pdf.

Andrilla CHA, & Patterson DG (2022). Tracking the geographic distribution and growth of clinicians with a DEA waiver to prescribe buprenorphine to treat opioid use disorder. The Journal of Rural Health, 38(1), 87–92. 10.1111/jrh.12569 [PubMed: 33733547]

Bhalla IP, Stefanovics EA, & Rosenheck RA (2017). Clinical epidemiology of single versus multiple substance use disorders: Polysubstance use disorder. Medical Care, 55(Suppl 9 Suppl 2), S24–S32. 10.1097/MLR.0000000000000731 [PubMed: 28806363]

Burman ME, Mawhorter S, & Vanden Heede F (2006). Multiple perspectives on being uninsured and barriers to health coverage in a rural western state. Journal of Health Care for the Poor and Underserved, 17(3), 625–640. 10.1353/hpu.2006.0102 [PubMed: 16960326]

CDC. (2023). Provisional data shows U.S. drug overdose deaths top 100,000 in 2022. Retrieved from https://blogs.cdc.gov/nchs/2023/05/18/7365/.

Delcher C, Harris DR, Anthony N, Stoops WW, Thompson K, & Quesinberry D (2022). Substance use disorders and social determinants of health from electronic medical records obtained during Kentucky's "triple wave". Pharmacology Biochemistry and Behavior, 221, Article 173495. 10.1016/j.pbb.2022.173495 [PubMed: 36427682]

Dickson-Gomez J, Weeks M, Green D, Boutouis S, Galletly C, & Christenson E (2022). Insurance barriers to substance use disorder treatment after passage of mental health and addiction parity laws and the affordable care act: A qualitative analysis. Drug and Alcohol Dependence Reports, 3, Article 100051. 10.1016/j.dadr.2022.100051 [PubMed: 36845978]

Ezell JM, Walters S, Friedman SR, Bolinski R, Jenkins WD, Schneider J, … Pho MT (2021). Stigmatize the use, not the user? Attitudes on opioid use, drug injection, treatment, and overdose prevention in rural communities. Social Science & Medicine, 268, Article 113470. 10.1016/j.socscimed.2020.113470 [PubMed: 33253992]

Glick SN, Burt R, Kummer K, Tinsley J, Banta-Green CJ, & Golden MR (2018). Increasing methamphetamine injection among non-MSM who inject drugs in King County, Washington. Drug and Alcohol Dependence, 182, 86–92. 10.1016/j.drugalcdep.2017.10.011 [PubMed: 29175463]

Gong G, Phillips SG, Hudson C, Curti D, & Philips BU (2019). Higher US rural mortality rates linked to socioeconomic status, physician shortages, and lack of health insurance. Health Affairs (Project Hope), 38(12), 2003–2010. 10.1377/hlthaff.2019.00722 [PubMed: 31794316]

Hassan AN, & Le Foll B (2019). Polydrug use disorders in individuals with opioid use disorder. Drug and Alcohol Dependence, 198, 28–33. 10.1016/j.drugalcdep.2019.01.031 [PubMed: 30877954]

Hser YI, Mooney LJ, Baldwin L-M, Ober A, Marsh LA, Sherman S, … Saxon AJ (2023). Care coordination between rural primary care and telemedicine to expand medication treatment for opioid use disorder: Results from a single-arm, multisite feasibility study. The Journal of Rural Health, 39(4), 780–788. 10.1111/jrh.12760 [PubMed: 37074350]

Jenkins RA, Whitney BM, Nance RM, Allen TM, Cooper HLF, Feinberg J, … the Rural Opioid Initiative. (2022). The rural opioid initiative consortium description: Providing evidence to understand the fourth wave of the opioid crisis. Addiction Science & Clinical Practice, 17(1), 38. 10.1186/s13722-022-00322-5 [PubMed: 35883197]

John WS, Zhu H, Mannelli P, Schwartz RP, Subramaniam GA, & Wu L-T (2018). Prevalence, patterns, and correlates of multiple substance use disorders among adult primary care patients. Drug and Alcohol Dependence, 187, 79–87. 10.1016/j.drugalcdep.2018.01.035 [PubMed: 29635217]

Jones CM, & McCance-Katz EF (2019). Co-occurring substance use and mental disorders among adults with opioid use disorder. Drug and Alcohol Dependence, 197, 78–82. 10.1016/j.drugalcdep.2018.12.030 [PubMed: 30784952]

Kariisa M, Seth P, Scholl L, Wilson N, & Davis NL (2021). Drug overdose deaths involving cocaine and psychostimulants with abuse potential among racial and ethnic groups – United States, 2004–2019. Drug and Alcohol Dependence, 227, Article 109001. 10.1016/j.drugalcdep.2021.109001 [PubMed: 34492555]

Lin LA, Bohnert ASB, Blow FC, Gordon AJ, Ignacio RV, Kim HM, & Ilgen MA (2021). Polysubstance use and association with opioid use disorder treatment in the US Veterans Health Administration. Addiction (Abingdon, England), 116(1), 96–104. 10.1111/add.15116 [PubMed: 32428386]

Lin LA, Casteel D, Shigekawa E, Weyrich MS, Roby DH, & McMenamin SB (2019). Telemedicine-delivered treatment interventions for substance use disorders: A systematic review. Journal of Substance Abuse Treatment, 101, 38–49. 10.1016/J.JSAT.2019.03.007 [PubMed: 31006553]

Litz M, & Leslie D (2017). The impact of mental health comorbidities on adherence to buprenorphine: A claims based analysis. The American Journal on Addictions, 26(8), 859–863. 10.1111/ajad.12644 [PubMed: 29143483]

O'Brien P, Henke RM, Schaefer MB, Lin J, & Creedon TB (2020). Utilization of treatment by Medicaid enrollees with opioid use disorder and co-occurring substance use disorders. Drug and Alcohol Dependence, 217, Article 108261. 10.1016/j.drugalcdep.2020.108261 [PubMed: 32979735]

Rural Health Information Hub. (2022). Am I rural? Tool. Retrieved from https://www.ruralhealthinfo.org/am-i-rural (Accessed July 15, 2019).

Smart R, Kim JY, Kennedy S, Tang L, Allen L, Crane D, … Donohue J (2023). Association of polysubstance use disorder with treatment quality among Medicaid beneficiaries with opioid use disorder. Journal of Substance Abuse Treatment, 144, Article 108921. 10.1016/j.jsat.2022.108921 [PubMed: 36327615]

Xu KY, Mintz CM, Presnall N, Bierut LJ, & Grucza RA (2022). Comparative effectiveness associated with buprenorphine and naltrexone in opioid use disorder and cooccurring polysubstance use. JAMA Network Open, 5(5), Article e2211363. 10.1001/jamanetworkopen.2022.11363 [PubMed: 35536575]

Table 1

Demographics of patients with opioid use disorder in rural primary care clinics ($N = 1164$).

	OUD only[a]	OUD + StUD[b]	OUD + other[c]	Total
N (%)	845 (72.6)	134 (11.5)	185 (15.9)	1164
Categorical age, n (%) ***[ab,ac]				
18–30 years	183 (21.7)	48 (35.8)	46 (24.9)	277 (23.8)
31–64 years	578 (68.4)	85 (63.4)	138 (74.6)	801 (68.8)
65 years and older	84 (9.9)	1 (0.8)	1 (0.5)	86 (7.4)
Female, n (%)	400 (47.3)	50 (37.3)	78 (42.2)	528 (45.4)
Race/ethnicity, n (%)				
White	752 (92.4)	119 (92.3)	168 (96.6)	1029 (93.0)
Black	5 (0.6)	0 (0)	0 (0)	5 (0.5)
Hispanic or Latino	18 (2.2)	4 (3.1)	1 (0.6)	23 (2.1)
Other	39 (4.8)	6 (4.7)	5 (2.9)	50 (4.5)
Health insurance, n (%) ***[ab,ac,bc]				
None	75 (8.9)	14 (10.5)	50 (27.0)	139 (12.0)
Medicaid	439 (52.0)	102 (76.1)	99 (53.5)	640 (55.0)
Medicare	126 (14.9)	6 (4.5)	12 (6.5)	144 (12.4)
Commercial or other	204 (24.2)	12 (9.0)	24 (13.0)	240 (20.6)

Notes: SD: standard deviation.

*$p < 0.05$,

**$p < 0.01$,

***$p < 0.001$ for significant omnibus tests; superscripted letters indicate specific pair(s) of groups that cause the difference (Bonferroni corrected $p < \alpha = 0.05/3$ as significant different).

Table 2

Rates of co-occurring health conditions among patients with opioid use disorder in rural primary care clinics.

	OUD only[a] (*n* = 845)	OUD + StUD[b] (*n* = 134)	OUD + other[c] (*n* = 185)	Total (*n* = 1164)
Health conditions, n (%)				
HCV ^{***ab,ac}	63 (7.5)	34 (25.4)	33 (17.8)	130 (11.2)
HIV	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Mental health disorders ^{***ab,ac}	506 (59.9)	105 (78.4)	129 (69.7)	740 (63.6)
Chronic pain	394 (46.6)	62 (46.3)	74 (40.0)	530 (45.5)
Other substance use disorders, n (%)				
Alcohol use disorder ^{***ab,ac,bc}	0£	37 (27.6)	115 (62.2)	152 (13.1)
Cannabis use disorder ^{***ab,ac,bc}	0£	39 (29.1)	102 (51.1)	141 (12.1)
Tobacco use disorder ^{***ab,ac}	229 (27.1)	83 (61.9)	120 (64.9)	432 (37.1)

Notes: $p < 0.05$,

** $p < 0.01$,

*** $p < 0.001$ for significant omnibus tests; superscripted letters indicate specific pair(s) of groups that cause the difference (Bonferroni corrected $p < \alpha = 0.05/3$ as significant different).

£:OUD only excluded all other SUDs (stimulant, cannabis, alcohol use disorders) except tobacco use disorder.

Table 3

Health service utilization among patients with opioid use disorder in rural primary care clinics from October 2019 to January 2021.

	OUD only[a] (n = 845)	OUD + StUD[b] (n = 134)	OUD + other[c] (n = 185)	Total (n = 1164)
Health service, n (%)				
Patients receiving TH from clinic ***ab,ac	319 (37.8)	89 (66.4)	128(69.2)	536 (46.1)
Patients receiving BH from clinic ***ab,ac	151 (17.9)	76 (56.7)	128 (69.2)	355 (30.5)
Patients referred to TH vendor **ab,bc	44 (5.2)	17 (12.7)	7 (3.8)	68 (5.8)
Patients with medications for OUD				
From either clinic or TH vendor ***ab,ac	505 (59.8)	117 (87.3)	147 (79.5)	769 (66.1)
From clinic ***ab,ac	497 (58.8)	117 (87.3)	147 (79.5)	761 (65.4)
From TH vendor	15 (1.8)	4 (3.0)	1 (0.5)	20 (1.7)

Notes: TH: telehealth service; BH: behavioral health service.

* $p < 0.05$,

** $p < 0.01$,

*** $p < 0.001$ for significant omnibus tests; superscripted letters indicate specific pair(s) of groups that cause the difference (Bonferroni corrected $p < \alpha = 0.05/3$ as significant different).