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Opioid Agonist Therapy During Hospitalization Within the Veterans Health Administration: a Pragmatic Retrospective Cohort Analysis

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Running Title

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Abstract

Background: Hospitalization of patients with opioid use disorder (OUD) is increasing, yet little is known about opioid agonist therapy (OAT: methadone and buprenorphine) administration during admission.

Objective: Describe and examine patient-and hospital-level characteristics associated with OAT receipt during hospitalization in the Veterans Health Administration (VHA).

Participants: 12,407 unique patients, ≥ 18 years old, with an OUD-related ICD-10 diagnosis within 12 months prior to or during index hospitalization in fiscal year 2017 from 109 VHA hospitals in the continental United States.

Main Measure: OAT received during hospitalization.

Key Results: Few admissions received OAT (n = 1,914; 15%) and when provided it was most often for withdrawal management (n = 834; 7%). Among patients not on OAT prior to admission who survived hospitalization (n = 10,969), 2.0% (n = 203) were newly initiated on OAT with linkage to care after hospital discharge. Hospitals varied in the frequency of OAT delivery (range 0% to 43% of qualified admissions). Patients with pre-admission OAT (Adjusted Odds Ratio [AOR] = 15.30; 95% CI [13.2, 17.7]), acute OUD diagnosis (AOR = 2.3; 95% CI [1.99, 2.66]), and male gender (AOR 1.52; 95% CI [1.16, 2.01]) had increased odds of OAT receipt. Patients who received non-OAT opioids (AOR 0.53; 95 CI [0.46, 0.61]) or surgical procedures (AOR 0.75; 95 CI [0.57, 0.99]) had decreased odds of OAT receipt. Large (AOR = 2.0; 95% CI [1.39, 3.00]) and medium-sized (AOR = 1.9; 95% CI [1.33, 2.70]) hospitals were more likely to provide OAT.

Conclusions: In a sample of VHA inpatient medical admissions, OAT delivery was infrequent, varied across the health system, and was associated with specific patient and hospital characteristics. Policy and educational interventions should promote hospital-based OAT delivery.

Introduction

Surging opioid-related hospitalizations challenge the acute care delivery system in the United States (U.S.).[1] Opioid-related hospitalizations are associated with increased readmissions[2] and 12% of patients admitted with an OUD-related condition leave the hospital against medical advice.[3] OUD-related admissions disproportionately burden public payers[3,4] and cost more than non-opioid-related admissions.[3,5] Opioid agonist therapy (OAT)—buprenorphine or methadone[6]—are provided infrequently and variably during hospitalization[7] or upon discharge.[8] Underutilization occurs although OAT delivery during hospitalization is feasible[9,10] and OAT receipt is associated with decreased illicit opioid use upon discharge,[9] reduced 30 and 90-day readmissions, [11] and increased post-hospital substance use disorder (SUD) treatment engagement.[11,12]

Veterans are particularly vulnerable as they are twice as likely to die from accidental opioid overdose than non-veterans.[13] OUD diagnoses within the Veterans Health Administration (VHA) have increased by nearly two-fold between 2004 (n = 30,093)[14] and 2017 (n = 54,078).[15] The VHA's initiatives to increase OAT access[16] include a system-wide requirement that all VHA facilities provide access to OAT[16] and follow national OUD treatment guidelines.[17] In fiscal year 2017, 41% (n = 22,179) of VHA patients with OUD received an OUD-related pharmacotherapy.[15] At the facility-level, OUD-related pharmacotherapy delivery ranged from 2% to 76% across the VHA system.[15] To date, little is known about inpatient practice for this patient population. This multi-hospital retrospective study examines variation in OAT delivery and receipt for hospitalized VHA patients with OUD.

Methods

Study Design and Cohort

A retrospective sample of unique acute medical and surgical inpatient admissions from fiscal year 2017 was extracted from the VHA Corporate Data Warehouse, a database containing national VHA patient electronic health record data. Eligible individuals were aged 18 or older with a primary or secondary OUD ICD-10 diagnosis from any source (inpatient, outpatient, and community care paid for by VHA) in the year preceding index hospitalization or during index hospitalization in fiscal year 2017. Facilities were restricted to "acute care hospitals" with at least 500 acute bed days of care delivered during the study period and at least 25 index admissions. Patients were excluded if they did not have a primary or secondary admission code, if they had an Elixhauser cancer flag,[18] and if they had a hospital length of stay (LOS) within the 99th percentile (median 82 days, range 51 to 1,652 days). The 99% percentile LOS cutoff was chosen to capture those admitted with OUD-related infections warranting 4 to 6 weeks of inpatient antibiotics and to exclude chronic hospitalization. See Figure 1. The Veterans Affairs Portland Health Care System Institutional Review Board approved this study (# 4045).

Study Variables

Variable selection and construction were informed by the existing literature, data availability, and prior qualitative research.[19,20] Study variables included patient demographics (age, gender, race, ethnicity), patient diagnoses present on admission (co-occurring mental health and SUD diagnoses), admission characteristics (intensive care unit [ICU] or surgical services received), and admission-related diagnoses (OUD-related infection, OUD-related diagnoses). Hospital characteristics included admission volume, acute OUD diagnosis volume

(the percentage of admissions with an acute OUD diagnosis during hospitalization), hospital geographic location, and hospital size.

Pharmacotherapy variables were coded for three time periods: 1) 30 days pre-admission; 2) during admission; and 3) 30 days post-admission. Non-OAT pharmacotherapy included benzodiazepines, non-OAT opioids (e.g., oxycodone), naltrexone, naloxone, inpatient use of first-line opioid withdrawal adjuvant (clonidine), and second-line withdrawal adjuvants (baclofen, gabapentin/pregabalin, tizanidine). See Appendix Table 1 for additional details. Admission OAT was categorized by four OAT delivery scenarios (OAT continued, OAT initiated with linkage to care, OAT for withdrawal, and OAT sustained), see Table 1. Categories and calculations involving post-admission care excluded patients who died during admission.

Statistical Analysis

RStudio[21-27] was used for descriptive statistics and bivariate analyses. Multilevel logistic regression modeling used Stata[28] with an alpha value of 0.05. The dependent variable (level 1) was any OAT received (yes/no) during hospitalization, and covariates were level 1 (patient) and level 2 (hospital) continuous, binary, or categorical variables. See Appendix Table 2 for model covariates. Covariate inclusion was based on literature review, study aims, and model fit. Comparative model fit for nested models used the log-likelihood ratio test, the Akaike Information Criterion, and the Bayesian Information Criterion. Regression coefficients, standard errors, adjusted odds ratios (AOR) with 95% confidence intervals, and the intraclass correlation coefficient (ICC) were reported. A sensitivity analysis examined whether a narrower OAT administration definition during hospitalization changed study findings.

Results

Patient Characteristics. The study cohort included 12,407 unique patients with index hospitalizations from 109 VHA acute care hospitals in the continental U.S. Most patients were male (n = 11,543; 93%), white (n = 8,880; 72%) or Black (n = 2,706; 22%), and non-Hispanic or Latino (n = 11,476; 93%) with a median age of 61 years (range 21 to 90). Over half of patients (n = 8,094; 65%) had at least one co-occurring mental health diagnosis and nearly half had at least one co-occurring SUD diagnosis (n = 6,024; 49%).

Admission-Related Characteristics. The median length of hospital stay was 5 days (range 1 to 50 days). Nearly 20% of patients (n = 2,303) received ICU services and 6% (n = 779) received surgical services. OUD-related infection or primary or secondary OUD-related diagnoses occurred in 20% of admissions (n = 2,491) and 1% of patients died during admission (n = 119).

Pre-and-Post-Pharmacotherapy. Approximately one in ten patients received OAT in the 30 days prior to admission (n = 1,325; 11.5%) and in the 30 days post hospital discharge (n = 1,420; 11.6%). Thirty percent of patients (n = 3,766) had an opioid prescription filled in the 30 days before admission and 35% (n = 4,250) filled an opioid prescription in the 30 days after discharge.

Admission Pharmacotherapy. The majority of patients did not receive OAT during admission (n = 10,493; 85%). In the 15% of admissions with OAT (n = 1,914), methadone was more common (n = 1,049; 55%) than buprenorphine (n = 639; 33%). A small number of patients (n = 136; 7.1%) received more than one type of OAT and 4.7% (n = 90) had non-specific administration. For patients on OAT prior to admission (n = 1,325), 65% (n = 867) had their OAT

continued during admission and 35% (n = 458) had their OAT discontinued during admission—regardless of receipt post-admission.

Related to withdrawal management, 9% of patients received the VHA's recommended first line adjuvant for opioid withdrawal—clonidine—and 39% (n = 1,089) received a second-line adjuvant (baclofen, gabapentin/pregabalin, or tizanidine).[29] Over half of patients (55%; n = 6,765) received at least one non-OAT opioid (e.g., oxycodone) during admission.

Hospital OAT by Delivery Scenario. When hospital OAT was delivered for patients not on pre-admission OAT it was most often provided as withdrawal management (n = 834; 44%) and infrequently initiated during hospitalization with linkage to care upon discharge (n = 203; 11%). For patients on pre-admission OAT, it was most often delivered as a sustained medication (n = 722; 38%)—OAT received before, during, and after admission—and less often continued during admission, but with subsequent discontinuation after discharge (n = 140; 8%). See Table 2 for additional details on patient and admission-related characteristics and pharmacotherapy.

System-Wide OAT Delivery. Across the 109 VHA hospitals, the median OAT delivery frequency during admission was 11% (SD: 0.10; range 0% to 43%). The data had a non-normal distribution skewed towards less OAT delivery, see Figure 2. The frequency of OAT delivery scenario in each hospital varied. For example, two hospitals did not provide any OAT, and nearly half of hospitals (48%, n = 52) did not have a single admission in which OAT was initiated with linkage to care (range 0 to 16 admissions). Measures of variation (ICC) are reported in Appendix Table 3.

Hospital and Patient-Level Associations with OAT Receipt

Patient-Level Covariates. In the fully specified model, 13 covariates were associated with hospital OAT receipt. Six covariates increased the odds of receiving OAT during hospitalization: pre-admission OAT receipt (AOR 15.3; 95% CI [13.2, 17.7]); an OUD diagnosis or OUD-related infection during admission (AOR 2.30; 95% CI [1.99, 2.66]); male gender (AOR 1.52; 95% CI [1.16, 2.01]); receipt of adjuvant medication for opioid withdrawal during admission (AOR 1.52; 95% CI [1.32, 1.75]); an opioid withdrawal diagnosis (AOR 1.47; 95% CI [1.12, 1.92]); and an increased length of hospital stay (AOR 1.04; 95% CI [1.03, 1.05]). Seven covariates were associated with decreased odds of OAT receipt: the receipt of pre-admission naltrexone (AOR 0.26; 95% CI [0.12, 0.56]); an unintentional overdose diagnosis (AOR: 0.29; 95% CI [0.16, 0.52]); the receipt of admission naltrexone (AOR 0.31; 95% CI [0.14, 0.66]); pre-admission non-OAT opioid receipt (AOR 0.49; 95% CI [0.41, 0.58]); non-OAT opioid receipt during admission (AOR 0.53; 95 CI [0.46, 0.61]); surgical service receipt during admission (AOR 0.75; 95 CI [0.57, 0.99]); and having a co-occurring SUD diagnosis (AOR: 0.77; 95% CI [0.67, 0.88]). See Appendix Table 4.

Hospital-Level Covariates. Four hospital-level covariates were associated with hospital OAT receipt. Patients admitted to large (AOR 2.04; 95% CI [1.39, 3.00]) and medium-sized hospitals (AOR 1.90; 95% CI [1.33, 2.70]) had increased odds of OAT receipt compared with small hospitals. Patients admitted to hospitals located in the northeast (AOR 1.80; 95% CI [1.30, 2.49]) and west (AOR 1.62; 95% CI [1.19, 2.22]) had increased odds of OAT receipt compared with those in the south. See Table 3 for the fully-specified model output.

Sensitivity Analysis. A pre-specified sensitivity analysis examined if a narrower OAT definition would change study findings; specifically, removing non-FDA approved formulations of OAT for the treatment of OUD (e.g., injectable methadone) from the admission OAT variable. In this sensitivity analysis surgical service received during admission was no longer statistically significant. No other differences were observed in statistical significance or the directionality of the relationships between covariates and the primary outcome. See Appendix Table 5.

Discussion

This retrospective cohort analysis of 12,407 VHA hospitalized individuals with a past year or admission-related ICD-10 OUD diagnosis suggests that hospital OAT receipt was rare. This study is the first to examine hospital OAT delivery across multiple hospitals. A limited research base has examined hospital OAT delivery. A ten-year (2004 to 2014) retrospective chart review of patients with intravenous drug use associated infective endocarditis—from a single Massachusetts hospital—observed that only 11% of OUD admissions received OAT.[7] Our national study confirms and expands upon these findings. Only 15% of patients in our study received any OAT during admission (n = 1,914) and the vast majority (91%) of patients not on OAT prior to admission did not receive any OAT during hospitalization (n = 10,035).

Further, only 203 patients in our cohort were initiated on OAT and subsequently linked to care—a nationally recommend best-practice.[6,30] Instead most patients (80%) were provided opioid withdrawal management, representing a missed opportunity to continue OUD treatment beyond hospitalization. Moreover, hospital admission interrupted ongoing outpatient OUD treatment. Over a third of patients had their outpatient OAT discontinued during admission. Contemporary guidance strongly recommends continuing outpatient OAT during admission,

232 including for patients who are undergoing surgical procedures.[6,31] It is possible that evolving
233 practice recommendations were not reflected in our sample. Anesthesiologists may
234 recommend buprenorphine discontinuation prior to surgery. However, only 6% of our cohort
235 received surgery and only 12% of those patients were on OAT prior to admission; thus, it is
236 unlikely that this is driving observed findings. Moreover, OAT discontinuation during admission
237 may reflect challenges related to care transitions.[20]

238 Previous research in the VHA describes system wide-variation in OUD-related
239 pharmacotherapy delivery, which ranged from 2% to 76% of qualified patients per facility.[15]
240 That analysis, however, did not examine variation specifically for hospital admissions. Our study
241 aligns with and builds upon these prior findings. We observed OAT delivery frequency per
242 hospital ranging from 0% to 43% of qualified admissions.

243 Prior VHA research suggests that specific patient characteristics are positively associated
244 with OAT receipt including male gender, age 56 years or older, and those without a co-
245 occurring mental health diagnosis.[32] Gender disparities in SUD treatment and engagement have
246 been described in other care delivery settings.[33] Our study builds upon these findings,
247 suggesting that women-identified patients may be less likely to receive OAT during
248 hospitalization. Associations from this study also suggest that outpatient OAT preceding
249 hospitalization influences subsequent hospital OAT delivery, highlighting the importance of OAT
250 engagement prior to admission. Further, specific care received during admission decreased OAT
251 receipt; for example, patients who received non-OAT opioids or surgical procedures were less
252 likely to receive OAT during hospitalization. These two clinical scenarios should not influence
253 hospital OAT administration. Finally, immutable hospital characteristics (e.g., size and location)

influenced OAT delivery, and may reflect unmeasurable internal hospital attributes (e.g., resources or culture).[20] These findings could also reflect the contribution of elements outside the hospital, for example, local beliefs about addiction and availability of community-based treatment resources.[20]

Study Limitations

This is an observational, unmatched, retrospective cohort study; thus, causal relationships cannot be established. There are limitations to the generalizability of study findings because of the cohort (Veterans, older, white, mostly men) and the health system setting (VHA); however, given that the VHA is an integrated health system that has prioritized OAT delivery, it is possible that VHA OAT delivery outperforms non-VHA hospitals. We elected to include patients with an OUD diagnosis in the prior year, not just patients with an admission diagnosis; thus, for 80% of patients OUD was not the primary reason for hospitalization. The pragmatic study sample selection may be seen as a limitation, but we believe reflects the realities of acute care delivery for patients hospitalized with complications related to OUD and other chronic illnesses. Patients in our cohort may have been misclassified with an OUD diagnosis and thus were not valid OAT candidates. The challenges of using diagnosis-based denominators for cross-facility comparisons are discussed elsewhere.[34] Conversely, OUD is also underdiagnosed and eligible patients may have been inadvertently excluded. Further, our study only includes VHA pharmacotherapy data; thus, it is possible that patients received OAT after discharge at a non-VHA facility. However, this is unlikely to significantly influence our results because there were only six cases with post-admission non-VHA OAT receipt in the original data extraction. Another study limitation was our inability to discern why OAT was not delivered

(e.g., patients may have declined OAT). Finally, the study data are from 2017, a specific moment in time that does not capture potential changes in practice over time.

Implications for Practice, Research, and Policy

The findings from this study may motivate practice improvement, future research, and inform policy to increase hospital-based OAT delivery in the midst of the opioid-related overdose crisis.

***Practice Improvement*.** National authorities recommend OAT continuation or initiation in the hospital[6] and a National Academies of Science, Engineering, & Medicine consensus report concluded that: "Withholding or failing to have available all classes of FDA-approved medication for the treatment of opioid use disorder in any care or criminal justice setting is denying appropriate medical treatment"(p.3).[30] Further, hospitalization is a reachable moment for treatment initiation and engagement.[35,36] Unfortunately, our study suggests that hospital OAT delivery frequency may be far from optimal. Current practice is not only a missed opportunity for treatment engagement, but may also cause harm by disrupting life-saving care.

A recent systematic review suggests that the provision of addiction-related services for hospitalized patients with OUD improves patient, provider, and health care outcomes.[37] Interventions to improve OAT delivery may include an organizational intervention—the addiction consult service (ACS), which provides clinical, educational, and policy-based addiction services and programming in the hospital.[38] ACSs, however, are unlikely to be available or feasible across all hospitals. Further, it is likely that many hospital providers have limited addiction training[39] and are less confident in providing OAT and delivering other OUD-related services. To address this issue, the VHA and other national hospital authorities could publish

specific guidance promoting evidence-based addictions hospital care[40] or create educational campaigns encouraging hospital-based OAT delivery. These initiatives would likely need to address provider knowledge gaps and addiction-related stigma,[20,41] describe pathways to OAT after discharge, and identify policies impeding care inside and outside the hospital-setting.[20]

Future Research. Research should explore barriers to OAT initiation during hospitalization at the VHA, and reasons for practice variation at patient, hospital, and system levels. Given the VHA's prioritization of OUD treatment, it is possible that the VHA may be outperforming non-VHA hospitals. Future research may confirm this impression. Policymakers and researchers need to consider data access issues. One of the primary challenges to studying hospital OAT delivery is the widespread use of diagnosis-related groupings (DRG) in hospital billing. DRG allows hospitals to bill payers through a bundled payment algorithm to account for illness acuity.[42] Study replication using Medicaid claims data, for example, is not feasible because most admission-related medications are not captured in the bundled claims data.

Policy Interventions. The VHA has already mandated national standards to enhance services for patients with OUD. Additional policy interventions outside the VHA may be warranted. Policies requiring all hospitals to offer OAT could be leveraged through hospital-related accrediting bodies (e.g., the Joint Commission). At present, there are no accreditation requirements related to hospital care for persons with OUD and SUDs. It is within the authority of the Joint Commission to require reporting and performance measurement for OAT and to mandate addiction-related technologies for hospital accreditation (e.g., presence of addiction physicians or ACS). Another approach is local legislation. In August 2018, the Massachusetts legislature passed House Bill 4866, *Prevention and Access to Appropriate Care and Treatment of*

Addiction,[43]which requires Massachusetts' emergency departments to offer OAT for patients with an opioid overdose and to link them to outpatient services.[43] Similar policies could be created for inpatient service delivery. Finally, there is interest in reforming restrictive federal OAT policies, specifically, to abolish buprenorphine x-waiver requirements.[44]

Conclusions

In a retrospective, unmatched pragmatic VHA patient cohort, hospital OAT delivery varied widely, was infrequently delivered, and was most commonly administered as a continued outpatient medication or for withdrawal management. These findings are the first multisite description of hospital OAT delivery and reveal characteristics that require further exploration to understand how to increase OAT access to patients hospitalized with OUD.

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Conflicts of Interest

Dr. Lovejoy reports grants from VA Health Services Research & Development during the conduct of the study and grants from National Institutes of Health outside the submitted work.

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Table and Figure Legends

Table 1. Hospital OAT Delivery by Scenario

Table 2. Patient, Admission, and Hospital Characteristics

Table 3. Multilevel Logistic Regression Model: Hospital OAT Delivery

Figure 1. Study Sample Selection

Figure 2. Hospital OAT Delivery Relative Frequency Histogram

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Table 1. Hospital OAT Delivery by Scenario

Variable	Pharmacotherapy
Any OAT Received	Any OAT received during admission
OAT Continuation	OAT received during pre-admission and admission, but not post-admission
OAT Initiation & Linkage to Care	OAT received during admission and post-admission, but not pre-admission
OAT Sustained	OAT received pre-admission, during admission and post-admission
OAT Withdrawal	OAT received during admission, but not pre or post-admission

Table Notes. *OAT = opioid agonist therapy; Pre-Admission OAT: VHA OTP visit or Healthcare Common Procedure Coding System (HCPCS) codes (H0033; J0574; J0575; J0571; S0109)* ***or*** *outpatient buprenorphine filled prescriptions: buprenorphine film buccal; buprenorphine sublingual tablet; buprenorphine/naloxone film sublingual; buprenorphine/naloxone sublingual tablet; Admission OAT: VHA OTP visit* ***or*** *HCPCS codes (H0033; J0571; S0109)* ***or*** *any formulation of buprenorphine or methadone administered: buprenorphine sublingual tablet; buprenorphine/naloxone sublingual film; buprenorphine/naloxone sublingual tablet; buprenorphine injection; buprenorphine patch; methadone injection; methadone solution concentrate; methadone solution oral; methadone tablet; methadone tablet effervescent; and methadone unknown formulation; Post-admission OAT: VHA OTP visit* ***or*** *HCPCS codes (H0033; J0574; J0575; J0571; S0109)* ***or*** *outpatient buprenorphine filled prescriptions: buprenorphine film buccal; buprenorphine sublingual tablet; buprenorphine/naloxone film sublingual; and buprenorphine/naloxone sublingual tablet.*

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Table 2. Patient, Admission, and Hospital Characteristics

Variable	Frequency % Count
Patient Characteristics (n = 12,407)	
Age	Median 61; Mean 58.5 Range 21 to 90
Gender	
Male	93.0% (11,543)
Female	6.8% (864)
Race	
American Indian or Alaska Native	1.2% (147)
Asian	<1% (43)
Black or African American	21.8% (2,706)
Native Hawaiian or Pacific Islander	< 1% (106)
White	71.6% (8,880)
Unknown/Declined to Answer	4.2% (525)
Ethnicity	
Hispanic or Latino	4.8% (595)
Non-Hispanic or Latino	92.5% (11,476)
Unknown	2.7% (336)
Co-Occurring Mental Health Diagnosis	65.2% (8,094)
Co-Occurring Substance Use Disorder Diagnosis	48.6% (6,024)
Co-Occurring Mental Health and Substance Use Disorder Diagnoses	41.0% (5,091)
Admission-Related Characteristics (n = 12,407)	
Length of Stay	Median, 5; Mean 6.6 Range 1 to 50
Admission Source	
Outpatient Treatment	49.1% (6,095)
Other Direct Admission	45.3% (5,616)
Other	4.9% (696)
Services Received	
ICU Services	18.6% (2,303)
Surgical Services	6.3% (779)
Acute OUD Infection Diagnosis	5.5% (691)
OUD-Related Diagnosis Primary and/or Secondary	14.9% (1,848)
OUD-Related Diagnosis and/or Acute OUD Infection	20.1% (2,491)
Pre-Admission Pharmacotherapy (n = 12,407)	
No OAT Received	89.3% (11,082)
Pre-Admission OAT[a]	10.7% (1,325)
Buprenorphine Only[b]	5.0% (625)
Non-Specific Administration[c]	4.7% (577)
>1 Type of OAT Received[d]	<1% (112)
Methadone Only[e]	<1% (11)
Non-OAT Opioid Prescription Filled	30.4% (3,766)
Naltrexone Received or Prescription Filled	2.0% (244)
Naloxone Prescription Filled	3.8% (477)
Admission Pharmacotherapy (n = 12,407)	
No OAT Received	84.6% (10,493)
Admission OAT[a]	15.4% (1,914)
Methadone Only[e]	8.5% (1,049)
Buprenorphine Only[b]	5.2% (639)
>1 Type of OAT Received[d]	1.1% (136)

Non-Specific Administration Only[c]	<1% (90)
Any Withdrawal Adjuvants	44.4% (5,502)
First-Line Adjuvant—Clonidine	8.8% (1,089)
Second-Line Adjuvant—Baclofen, Gabapentin/Pregabalin, or Tizanidine	39.3% (4,882)
Both Adjuvants	3.4% (469)
Non-OAT Opioid Received	54.5% (6,765)
Naltrexone Received	1.4% (168)
Post-Admission Pharmacotherapy[f] (n = 12, 288)	
No OAT Received	88.4% (10,868)
Post-Admission OAT[a]	11.6% (1,420)
Buprenorphine Only[b]	5.2% (633)
Non-Specific Administration Only[c]	5.1% (628)
>1 Type of OAT Received[d]	1.2% (142)
Methadone Only[e]	<1% (17)
Non-OAT Opioid Prescription Filled	34.6% (4,250)
Naltrexone Received or Prescription Filled	2.8% (341)
Naloxone Prescription Filled	6.2% (765)
Hospital OAT Delivery by Scenario[f] (n = 12, 288)	
OAT for Withdrawal Management	6.8% (834)
OAT Sustained	5.9% (722)
OAT Initiated with Linkage to Care	1.7% (203)
OAT Continued	1.2% (140)
Secondary Outcomes	
Left Hospital Against Medical Advice[f]	5.7% (701)
In-Hospital Mortality	1.0% (119)
Pre-OAT Received	<1% (6)
Pre-OAT Not Received	1.0% (113)
Death within 30 Days of Discharge[f]	<1% (110)
Emergency Department Visit within 30 Days of Discharge[f]	27.9% (3,434)
Hospital Readmission within 30 Days of Discharge[f]	13.3% (1,630)
Hospital Characteristics (n = 109)	
Hospital Size	
Small: 1 to 49 beds	25.7% (28)
Medium: 50 to 99 beds	33.0% (36)
Large: ≥100 beds	41.3% (45)
Hospital Region	
Midwest	22.9% (25)
Northeast	16.5% (18)
South	39.4% (43)
West	21.1% (23)
Admission Volume	Median 98; Mean 114 Range 26 to 430; IQR 97
Acute OUD Relative Volume	Median 32% Range 13% to 83%

Table Notes. *ICU = intensive care unit; OUD = opioid use disorder; OAT = opioid agonist therapy; IQR = interquartile range; [a]Includes each of the 4 sub-categories in this table; [b]Includes buprenorphine prescription fills and the Healthcare Common Procedure Coding System (HCPCS) codes J0574, J0575, J0571; [c]Includes an OTP stop code visit **or** the non-specific OAT administration HCPCS code H0033; [d]Includes any patients who received more than one type of OAT during the pre-period; [e]Includes the methadone specific HCPCS code S0109; [f]Percentage and count excludes 119 inpatient deaths (n = 12, 288); If a medication was used more than once in a study period, it was only counted once.*

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Table 3. Multilevel Logistic Regression Model: Hospital OAT Delivery

Parameters	*B*	*SE*	*AOR*	*95% CI*	
Intercept	**-2.78*** **	**0.00**	**0.04**	**0.03**	**0.13**
Patient-Level Covariates					
Age	0.00	0.08	1.00	1.00	1.01
Gender: Male (ref. Female)	**0.42****	**0.18**	**1.52**	**1.16**	**2.01**
Race: Non-white (ref. White)	-0.05	0.14	0.95	0.82	1.11
Race: Unknown (ref. White)	-0.18	0.21	0.84	0.59	1.19
Ethnicity: Hispanic (ref. Non-Hispanic)	0.02	0.07	1.02	0.77	1.34
Ethnicity: Unknown (ref. Non-Hispanic)	0.17	0.07	1.2-	0.80	1.81
Acute OUD Diagnosis/Infection	**0.83*** **	**0.07**	**2.30**	**1.99**	**2.66**
Co-Occurring Substance Use Disorder Diagnosis	**-0.26*** **	**0.30**	**0.77**	**0.67**	**0.88**
Co-Occurring Mental Health Diagnosis	-0.04	0.14	0.97	0.84	1.11
Unintentional Overdose Diagnosis During Admission	**-1.24*** **	**0.00**	**0.29**	**0.16**	**0.52**
Opioid Withdrawal Diagnosis During Admission	**0.38****	**0.08**	**1.47**	**1.12**	**1.92**
Hospital Length of Stay	**0.04*** **	**0.14**	**1.04**	**1.03**	**1.05**
ICU Services Received During Admission	-0.13	0.14	0.88	0.74	1.03
Surgical Services Received During Admission	**-0.29***	**0.08**	**0.75**	**0.57**	**0.99**
Pre-Admission OAT Received	**2.73*** **	**0.12**	**15.3**	**13.1**	**17.7**
Pre-Admission Non-OAT Opioid Prescription Filled	**-0.72*** **	**0.38**	**0.49**	**0.41**	**0.58**
Pre-Admission Benzodiazepine Prescription Filled	0.03	0.08	1.03	0.81	1.32
Pre-Admission Naltrexone Received or Prescription Filled	**-1.33*** **	**0.00**	**0.26**	**0.12**	**0.56**
Pre-Admission Gabapentin/Pregabalin Prescription Filled	-0.12	0.14	0.89	0.77	1.04
Admission Source: Other (ref. Outpatient)	-0.13	0.07	0.88	0.66	1.16
Admission Source: Direct (ref. Outpatient)	-0.01	0.07	0.99	0.85	1.15
During Admission Non-OAT Opioid Received	**-0.64*** **	**0.07**	**0.53**	**0.46**	**0.61**
During Admission Adjuvant Received	**0.42*** **	**0.39**	**1.52**	**1.32**	**1.75**
During Admission Benzodiazepine Received	-0.08	0.08	0.92	0.80	1.06
During Admission Naltrexone Received	**-1.17****	**0.09**	**0.31**	**0.14**	**0.66**
Hospital-Level Covariates					
Acute OUD Diagnoses Volume[a]	**-0.02****	**0.01**	**0.98**	**0.97**	**0.99**
Hospital Size: Medium (ref. Small)	**0.64*** **	**0.18**	**1.90**	**1.33**	**2.70**
Hospital Size: Large (ref. Small)	**0.71*** **	**0.20**	**2.04**	**1.39**	**3.00**
Census Region: Midwest (ref. South)	0.24	0.16	1.27	0.93	1.72
Census Region: Northeast (ref. South)	**0.59*** **	**0.17**	**1.80**	**1.30**	**2.49**
Census Region: West (ref. South)	**0.48****	**0.16**	**1.62**	**1.19**	**2.22**
Admission Volume	0.00	0.00	1.00	1.00	1.00

Table Notes. *Bold indicates statistical significance; p < 0.05*; p < 0.01**; p < 0.001***; [a]This relatively small effect size likely has little practical relevance, thus, was omitted from the manuscript text.*

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Appendices

Appendix Table 1: Study Variable Definition

Appendix Table 2: Model Covariates

Appendix Table 3: Testing for Variation in Hospital OAT Delivery Across the VHA

Appendix Table 4: Logistic Regression Models Testing for Multilevel Characteristic Associations with Hospital OAT Delivery

Appendix Table 5: Sensitivity Analysis: OAT Definition

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Appendix Table 1: Study Variable Definitions

Variable	Definition
Patient Demographics	
OUD ICD-10 Codes Queried	F11.10, F11.11, F11.120 F11.121, F11.122, F11.129, F11.14, F11.150, F11.151, F11.159, F11.181, F11.182, F11.188, F11.19, F11.20, F11.220, F11.21, F11.221, F11.222, F11.229, F11.23, F11.24, F11.250, F11.251, F11.259, F11.281, F11.282, F11.288, F11.29, F11.90, F11.920, F11.921, F11.922, F11.929. F11.93, F11.94, F11.950, F11.951, F11.959, F11.981, F11.982, F11.988, F11.99, T40.0X1A, T40.0X1D, T40.0X1S, T40.0X4A, T40.0X4D, T40.0X4S, T40.0X5A, T40.0X5D, T40.0X5S, T40.1X1A, T40.1X1D, T40.1X1S, T40.1X4A, T40.1X4D, T40.1X4S, T40.2X1A, T40.2X1D, T40.2X1S, T40.2X4A, T40.2X4D, T40.2X4S, T40.2X5A, T40.2X5D, T40.2X5S, T40.3X1A, T40.3X1D, T40.3X1S, T40.3X4A, T40.3X4D, T40.3X4S, T40.3X5A, T40.3X5D, T40.3X5S, T40.4X1A, T40.4X1D, T40.4X1S, T40.4X4A, T40.4X4D, T40.4X4S, T40.4X5A, T40.4X5D, T40.4X5S, T40.601A, T40.601D, T40.601S, T40.604A, T40.604D, T40.604S, T40.605A, T40.605D, T40.605S, T40.691A, T40.691D, T40.691S, T40.694A, T40.694D, T40.694S,T40.695A,T40.695D, T40.695S
Age	Age in years present on admission.
Co-Occurring Mental Health Diagnosis[1]	Conditions were identified within 365 days prior to the index hospitalization admission date: 1) Adjustment Disorder Other; 2) Anxiety Disorder; 3) Mood Disorder; 4) Non-Mood Psychotic disorder; 5) PTSD; 6) Self-Harm. Could include more than one. *Codes available upon request.*
Co-Occurring Substance Use Disorder Diagnosis[1]	Conditions were identified within 365 days prior to the index hospitalization admission date: 1) Alcohol Use Disorder; 2) Cannabis Use Disorder; 3) Cocaine Use Disorder; 4) Hallucinogen Use Disorder; 5) Nicotine Dependence; 6) Other Psychoactive Use Disorders; 7) Other Stimulant Related Disorders; 8) Other Substance Use Disorder; 9) Sedative Hypnotic Disorders. Could include more than one. *Codes available upon request.*
Gender	Male or Female.
Ethnicity	1) Not Hispanic or Latino; 2) Hispanic or Latino; 3) Unknown.
OUD-Related Diagnosis[2]	Primary or secondary ICD-10 OUD admission diagnosis codes. *Codes available upon request.*
OUD-Related Infections[2]	Primary or secondary ICD-10 OUD admission diagnosis codes: 1) Endocarditis; 2) Candida Endocarditis; 3) Osteomyelitis; 4) Bacteremia; 5) Discitis; 6) Septic Arthritis; 7) Brain Abscess; 8) Joint Infection; 9) Necrotizing Fasciitis; 10) Empyema; and 11) Lung Abscess. *Codes available upon request.*
OUD-Related Diagnosis **or** Infection	Combined variable: OUD-Related Diagnosis **or** OUD-Related Infection Diagnosis.
Primary Diagnosis[2]	The primary ICD-10 admission diagnosis code for index hospitalization.
Race	1) American Indian or Alaska Native; 2) Asian; 3) Black or African American; 4) White; 5) Native Hawaiian or Other Pacific Islander; 6) Unknown/Decline to Answer.
Secondary Diagnosis[2]	The secondary ICD-10 admission diagnosis code for index hospitalization.
Admission Source	Point of admission for the index hospitalization: 1) Outpatient Treatment; 2) Other Direct Admission; 3) Other.
Intensive Care Unit Service	Use of intensive care unit services during index hospitalization.
Length of Stay	Length of time (days) of the index hospitalization.
Surgical Service	Use of surgical services during index hospitalization.
Pharmacotherapy	
Pre-Admission	

Benzodiazepine	Prescription filled for any benzodiazepine.
Gabapentin/Pregabalin	Prescription filled for gabapentin **and**/**or** pregabalin.
Naloxone	Prescription filled for naloxone.
Naltrexone	Prescription filled or HCPCS code for naltrexone.
Opioid	Prescription filled for any non-OAT opioids, not including methadone or buprenorphine.
Admission[3]	
Benzodiazepine	Administration of benzodiazepine.
Gabapentin/Pregabalin	Administration of gabapentin **and**/**or** pregabalin.
Naltrexone	Administration of naltrexone.
Opioid	Administration of any non-OAT opioid, did not include methadone or buprenorphine formulations for pain.
First-Line Withdrawal Adjuvant	Administration of clonidine.
Second-Line Withdrawal Adjuvant[4]	Administration of any second-line adjuvant: baclofen **or** gabapentin **or** pregabalin **or** tizanidine. Could include more than one.
Any Withdrawal Adjuvants	Administration of any of the adjuvants: baclofen **or** clonidine **or** gabapentin **or** pregabalin **or** tizanidine. Could include more than one.
Both Adjuvants	Administration of both first-line and second-line withdrawal adjuvants.
Post-Admission	
Benzodiazepine	Prescription filled for any benzodiazepine.
Gabapentin/Pregabalin	Prescription filled for gabapentin **and**/**or** pregabalin.
Naloxone	Prescription filled for naloxone.
Naltrexone	Prescription filled or HCPCS code for naltrexone.
Secondary Outcomes	
In-Hospital Mortality	Death during index admission
Left Against Medical Advice	Leaving against medical advice during admission, collapsed VHA internal codes.
Death	Death within the post-admission time period.
Emergency Department Visit	VHA emergency department visit within the post-admission time period.
Hospital Readmission	VHA acute medical admission within the post-admission time period.
Hospital Characteristics	
Acute OUD Diagnosis Volume	The proportion of index admissions in a facility with an acute OUD diagnosis (OUD-infection or OUD diagnosis).
Admission Volume	The number of admissions in a facility.
Hospital Region	U.S. Census categories: 1) Northeast; 2) Midwest; 3) South; 4) West.
Hospital Size	1) Small: 1 to 49 beds; 2) Medium: 50 to 99 beds; 3) Large: ≥ 100.

Table Notes. *[1]Present on admission = identified within prior 365 days; [2]Occurred during admission; [3]During admission < 1% of pharmaceutical data points were prescribed; [4]Second line adjuvants are medications recommended for use by VHA Opioid Taper Tool; HCPCS = Healthcare Common Procedure Coding System is a specific procedure billing code for medication administration.*

Appendix Table 2: Model Covariates

Level 1: Patient and Admission Characteristics	Level 2: Hospital Characteristics
Demographics	1. Admission Volume (*continuous*)
1. Age (*continuous*)	2. Acute OUD Diagnoses Relative Volume (*continuous*)
2. Male (*ref. Female*)	3. Hospital Size: Medium (*ref. Small*)
3. Race: Non-white (*ref. White*)	4. Hospital Size: Large (*ref. Small*)
4. Race: Unknown (*ref. White*)	5. Census Region: Midwest (*ref. South*)
5. Ethnicity: Hispanic (*ref. Non-Hispanic*)	6. Census Region: Northeast (*ref. South*)
6. Ethnicity: Unknown (*ref. Non-Hispanic*)	7. Census Region: West (*ref. South*)
7. Acute OUD Diagnosis/Infection (*yes/no*)	
8. Co-occurring Substance Use Disorder Diagnosis (*yes/no*)	
9. Co-occurring Mental Health Diagnosis (*yes/no*)	
Admission	
10. Unintentional Overdose Diagnosis (*yes/no*)	
11. Opioid Withdrawal Diagnosis (*yes/no*)	
12. Length of Stay (*continuous*)	
13. ICU Services Received *(yes/no*)	
14. Surgical Services Received (*yes/no*)	
15. Admission Source: Other (*ref. Outpatient*)	
16. Admission Source: Direct (*ref. Outpatient*)	
17. Opioid Received (*yes/no*)	
18. Adjuvant Received (*yes/no*)	
19. Benzodiazepine Received (*yes/no*)	
20. Naltrexone Received (*yes/no*)	
Pre-Admission	
21. OAT Received or Prescription Filled (*yes/no*)	
22. Non-OAT Opioid Prescription Filled (*yes/no*)	
23. Benzodiazepine Prescription Filled (*yes/no*)	
24. Naltrexone Received or Prescription Filled (*yes/no*)	
25. Gabapentin/Pregabalin Prescription Filled (*yes/no*)	

Appendix Table 3: Testing for Variation in Hospital OAT Delivery Across the VHA

	Model 1: Without Covariates			*Model 2: Patient Covariates*			*Model 3: Patient and Hospital Covariates*		
	B	***SE***	***95% CI***	***B***	***SE***	***95% CI***	***B***	***SE***	***95% CI***
Constant	0.52	0.09	0.37, 0.72	0.38	0.07	0.26, 0.56	0.02	0.05	0.13, 0.34
ICC	0.14	0.02	0.10, 0.18	0.10	0.18	0.07, 0.14	0.06	0.13	0.04, 0.09

Appendix Table 4: Logistic Regression Models Testing for Multilevel Characteristic Associations with Hospital OAT Delivery

	Model 2: Patient Covariates					*Model 3: Patient/Hospital Covariates*				
	B	***SE***	***OR***	***95% CI***		***B***	***SE***	***OR***	***95% CI***	
Intercept	**-2.79*** **	**0.22**	**0.06**	0.04	0.09	**-2.78*** **	**0.00**	**0.04**	**0.03**	**0.13**
Patient-Level Covariates										
Age	0.00	0.00	1.00	1.00	1.01	0.00	0.08	1.00	1.00	1.01
Gender: Male (ref. Female)	**0.42** **	**0.14**	**1.52**	**1.15**	**2.00**	**0.42** **	**0.18**	**1.52**	**1.16**	**2.01**
Race: Non-white (ref. White)	-0.07	0.08	0.94	0.80	1.09	-0.05	0.14	0.95	0.82	1.11
Race: Unknown (ref. White)	-0.17	0.18	0.85	0.60	1.20	-0.18	0.21	0.84	0.59	1.19
Ethnicity: Hispanic (ref. Non-Hispanic)	0.06	0.14	1.06	0.80	1.41	0.02	0.07	1.02	0.77	1.34
Ethnicity: Unknown (ref. Non-Hispanic)	0.18	0.21	1.20	0.79	1.80	0.17	0.07	1.2-	0.80	1.81
Acute OUD Diagnosis/Infection	**0.83*** **	**0.07**	**2.30**	**1.99**	**2.67**	**0.83*** **	**0.07**	**2.30**	**1.99**	**2.66**
Co-Occurring SUD Diagnosis	**-0.26*** **	**0.07**	**0.77**	**0.67**	**0.88**	**-0.26*** **	**0.30**	**0.77**	**0.67**	**0.88**
Co-Occurring Mental Health Diagnosis	-0.04	0.07	0.96	0.84	1.11	-0.04	0.14	0.97	0.84	1.11
Unintentional Overdose Diagnosis During Admission	**-1.24*** **	**0.30**	**0.29**	**0.16**	**0.52**	**-1.24*** **	**0.00**	**0.29**	**0.16**	**0.52**
Opioid Withdrawal Diagnosis During Admission	**0.38** **	**0.14**	**1.46**	**1.12**	**1.91**	**0.38** **	**0.08**	**1.47**	**1.12**	**1.92**
Length of Stay	**0.04*** **	**0.00**	**1.04**	**1.04**	**1.05**	**0.04*** **	**0.14**	**1.04**	**1.03**	**1.05**
ICU Services Received During Admission	-0.12	0.08	0.88	0.75	1.04	-0.13	0.14	0.88	0.74	1.03
Surgical Services Received During Admission	-0.27	0.14	0.76	0.58	1.00	**-0.29***	**0.08**	**0.75**	**0.57**	**0.99**
Pre-Admission OAT Received	**2.73*** **	**0.08**	**15.3**	**13.2**	**17.8**	**2.73*** **	**0.12**	**15.3**	**13.1**	**17.7**
Pre-Admission Non-OAT Opioid Prescription Filled	**-0.72*** **	**0.09**	**0.49**	**0.41**	**0.58**	**-0.72*** **	**0.38**	**0.49**	**0.41**	**0.58**
Pre-Admission Benzodiazepine Prescription Filled	0.04	0.12	1.04	0.81	1.32	0.03	0.08	1.03	0.81	1.32
Pre-Admission Naltrexone Received or Filled	**-1.31** **	**0.38**	**0.27**	**0.13**	**0.57**	**-1.33*** **	**0.00**	**0.26**	**0.12**	**0.56**
Pre-Admission Gabapentin/Pregabalin Prescription Filled	-0.12	0.08	0.89	0.76	1.03	-0.12	0.14	0.89	0.77	1.04
Admission Source: Other (ref. Outpatient)	-0.16	0.14	0.85	0.64	1.12	-0.13	0.07	0.88	0.66	1.16
Admission Source: Direct (ref. Outpatient)	-0.01	0.08	0.99	0.85	1.16	-0.01	0.07	0.99	0.85	1.15
During Admission Non-OAT Opioid Received	**-0.63*** **	**0.07**	**0.53**	**0.46**	**0.61**	**-0.64*** **	**0.07**	**0.53**	**0.46**	**0.61**
During Admission Adjuvant Received	**0.42*** **	**0.07**	**1.53**	**1.33**	**1.76**	**0.42*** **	**0.39**	**1.52**	**1.32**	**1.75**
During Admission Benzodiazepine Received	-0.11	0.07	0.90	0.78	1.04	-0.08	0.08	0.92	0.80	1.06
During Admission Naltrexone Received	**-1.19** **	**0.39**	**0.30**	**0.14**	**0.65**	**-1.17** **	**0.09**	**0.31**	**0.14**	**0.66**
Hospital-Level Covariates										
Acute OUD Diagnoses Volume	--	--	--	--	--	**-0.02** **	**0.01**	**0.98**	**0.97**	**0.99**
Hospital Size: Medium (ref. Small)	--	--	--	--	--	**0.64*** **	**0.18**	**1.90**	**1.33**	**2.70**
Hospital Size: Large (ref. Small)	--	--	--	--	--	**0.71*** **	**0.20**	**2.04**	**1.39**	**3.00**
Census Region: Midwest (ref. South)	--	--	--	--	--	0.24	0.16	1.27	0.93	1.72
Census Region: Northeast (ref. South)	--	--	--	--	--	**0.59*** **	**0.17**	**1.80**	**1.30**	**2.49**
Census Region: West (ref. South)	--	--	--	--	--	**0.48** **	**0.16**	**1.62**	**1.19**	**2.22**
Admission Volume	--	--	--	--	--	0.00	0.00	1.00	1.00	1.00

Table Notes**. Bold indicates statistical significance; p < 0.05*; p < 0.01**; p < 0.001*

Appendix Table 5: Sensitivity Analysis: OAT Definition

The multilevel model was run using a narrower OAT definition for admission delivery which excluded any non-FDA approved versions of OAT (i.e., injectable formulations of methadone and buprenorphine).

Model 1: The Variance Component Model. There were no differences observed for the narrower OAT definition. The coefficient was the same and in the same direction.

Model 2: The Intermediate Model with Level 1 Covariates. There were no differences in the intermediate model with regards to covariate direction or statistically significant associations, except for the surgical variable, which was statistically significant in the model presented in the manuscript with the broader OAT definition.

Model 3: The Full Model with Level 1 and Level 2 Covariates. There were no differences in the final model with regards to covariate direction or statistically significant associations, except for the surgical services received variable, which was statistically significant in the model presented in the manuscript with the broader OAT definition.

Model 3: Narrower OAT Definition

	OR	SE	Z	P	95% CI	
Intercept	0.06	0.0234484	-7.2	0.0000	0.03	0.13
Age	1.00	0.002539	0.12	0.9060	1.00	1.01
Gender: Male (ref. Female)	1.50	0.2121659	2.89	0.0040	1.14	1.98
Race: Non-white (ref. White)	0.95	0.0738042	-0.71	0.4770	0.81	1.10
Race: Unknown (ref. White)	0.84	0.149254	-0.98	0.3260	0.59	1.19
Ethnicity: Hispanic	0.98	0.1419715	-0.11	0.9120	0.74	1.31
Ethnicity: Unknown	1.20	0.24997	0.88	0.3780	0.80	1.81
Acute OUD Diagnosis/Infection	2.30	0.1720454	11.12	0.0000	1.99	2.66
Co-Occurring Substance Use Disorder Diagnosis	0.78	0.0543631	-3.59	0.0000	0.68	0.89
Co-Occurring Mental Health Diagnosis	0.95	0.0677582	-0.67	0.5050	0.83	1.10
Unintentional Overdose Diagnosis During Admission	0.27	0.0836167	-4.23	0.0000	0.15	0.50
Opioid Withdrawal Diagnosis During Admission	1.51	0.206946	3	0.0030	1.15	1.97
Hospital Length of Stay	1.04	0.0045775	9.69	0.0000	1.03	1.05
ICU Services Received During Admission	0.89	0.0745036	-1.4	0.1610	0.75	1.05
Surgical Services Received During Admission	***0.77***	***0.1058284***	***-1.93***	***0.0540***	**0.58**	**1.00**
Admission Source: Other (ref. Outpatient)	0.88	0.1260072	-0.89	0.3740	0.67	1.17
Admission Source: Direct (ref. Outpatient)	0.98	0.0771065	-0.22	0.8260	0.84	1.15
During Admission Non-OAT Opioid Received	0.54	0.0376208	-8.84	0.0000	0.47	0.62
During Admission Adjuvant Received	1.51	0.1087461	5.79	0.0000	1.32	1.74
During Admission Benzodiazepine Received	0.91	0.06681	-1.29	0.1980	0.79	1.05
During Admission Naltrexone Received	0.31	0.1215771	-2.99	0.0030	0.15	0.67
Pre-Admission OAT Received	15.04	1.143896	35.64	0.0000	12.96	17.46
Pre-Admission Non-OAT Opioid Prescription Filled	0.48	0.0418063	-8.41	0.0000	0.41	0.57
Pre-Admission Benzodiazepine Prescription Filled	0.99	0.1243564	-0.1	0.9180	0.77	1.26
Pre-Admission Naltrexone Received or Prescription Filled	0.27	0.1035082	-3.41	0.0010	0.13	0.57
Pre-Admission Gabapentin/Pregabalin Prescription Filled	0.89	0.0687118	-1.46	0.1440	0.77	1.04
Acute OUD Diagnoses Volume	0.98	0.0069802	-2.49	0.0130	0.97	1.00
Hospital Size Medium (ref. Small)	1.90	0.3410116	3.53	0.0000	1.33	2.69
Hospital Size Large (ref. Small)	1.91	0.3767839	3.26	0.0010	1.29	2.81
Census Region Midwest (ref. South)	1.23	0.1970601	1.47	0.1420	0.93	1.71
Census Region Northeast (ref. South)	1.60	0.2682119	2.81	0.0050	1.15	2.22
Census Region West (ref. South)	1.63	0.2603606	3.04	0.0020	1.19	2.23
Admission Volume	1.00	0.0010102	-1.03	0.3010	1.00	1.00

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