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Assessing factors associated with discharge from opioid agonist therapy due to incarceration in the United States

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Abstract

The following study investigates factors associated with discharge from OAT due to incarceration in a sample of 64,331 discharges in the United States. Multinomial regression investigated the association between demographic factors, prior arrest, referral source (i.e criminal justice agency) intravenous drug use, types of drug used, length of prior treatment and discharge due to incarceration compared to completing treatment or discharge due to other reasons. African Americans, Latinx, and Native Americans were at greater risk of discharge due to incarceration compared to whites. Referral to OAT from criminal justice agencies and self-referral was associated with increased risk of discharge from OAT due to incarceration compared to referral from a health care provider. Substance use of heroin, benzodiazepines, synthetic opioids, cocaine and non-prescription use of methadone were associated with discharge due to incarceration. Risk of discharge due to incarceration was higher for patients who reported intravenous drug use and who reported a co-morbid psychiatric problem. These findings enrich a nascent body of literature on mechanisms associated with attrition from OAT due to incarceration and emphasize the need for programs to divert people with OUD from incarceration to increase engagement and retention in OAT.

Keywords

Opioid Agonist Therapy; attrition; incarceration

Introduction

Burgeoning availability of prescription drugs coupled with expanding illicit markets for heroin and synthetic opioids in the United States resulted in the greatest rates of opioid use and opioid-related overdose death rates in the country's history. From 1999 to 2016, rates of drug related overdose increased from 6.1 to 16.3 per 100,000.¹ Opioid-related overdose deaths accounted for more than two thirds (66.4%, 44,249 deaths) of all overdose deaths (63,632) in 2016 in the United States.² The largest increase in opioid-related overdose deaths was due to synthetic opioids which increased by 88% from 2015 to 2016. During the same period, rates of overdose due to heroin increased by nearly 20% and 500% from 2010 to 2016.² In 2017, nearly 1 million (948,000) people used heroin in the past year, of which nearly one-quarter used prescription opioids prior to transitioning to heroin.² Although overall rates of prescribing opioids declined gradually since 2011, use of illicit opioids continues to increase with approximately 11.1 million people reporting misusing opioids and nearly 2 million being diagnosed with an opioid use disorder (OUD) in 2015.² Rapid growth of OUD and misuse of opioids catalyzed a critical need for a continuum of evidence-based interventions that prevent opioid use, misuse and overdose deaths and promote long-term recovery.

Medication assisted therapies for opioid use disorders (OUD) are defined as the provision of medications approved by the United States Food and Drug Administration to treat substance use problems involving opioid drugs.³ The term Opioid Agonist Therapy for opioid use disorders (OAT-OUD) refers to the provision of two pharmacological interventions to reduce cravings and diminish euphoria consisting of 1) buprenorphine (Suboxone®) or 2) methadone.^{3,4} which remain the two most popular pharmacological interventions to treat OUD in the United States.^{5,6}

Opioid agonist therapy is widely regarded as among the most effective methods of treating opioid use disorders (OUD) particularly when paired with behavioral substance use interventions.^{3,4,7} A wealth of prior literature emphasizes the benefits of buprenorphine and methadone to reduce relapse, drug use, fatal and non-fatal overdose, injection drug behaviors as well as increase antiretroviral therapy (ART) adherence, HIV viral suppression and decrease recidivism and hospitalizations.⁸⁻¹³ The national opioid response strategy endorsed by the White House and CDC emphasizes the critical importance of increasing availability of and retention in MAT.¹⁴

Non-completion of MAT due to incarceration

A growing number of studies suggest that the criminal justice policy approach criminalizing drug use in the United States failed to reduce substance use in local communities.¹⁵⁻¹⁸ Prior studies suggest that criminalizing drug use results in interruptions in access to services, and increased risk of relapse and overdose upon release into the community.¹⁹⁻²¹ Several studies point to arrest for possession and distribution of drugs as the primary reason for incarceration of people with substance use disorders which is a major driver of racial and ethnic disparities in criminal justice involvement.²²⁻²⁴ In addition to drug-related offenses, people with OUD are at greater risk of being arrested for property related crimes that are

often directly driven by ongoing engagement in substance use.^{25,26} Involvement with the criminal justice system due to prior drug-related offenses (drug possession, use and property crimes to sustain drug use) results in greater risk of receiving sanctions involving custody in the criminal justice system resulting in greater risk of interruptions from treatment due to incarceration and detention.

The criminalization of illicit opioid use introduces numerous barriers to accessing OAT and increases the risk of overdose among people with OUD.²⁷ Criminalization of illicit opioid use results in disproportionate surveillance, arrest, and incarceration of people with OUD.^{28,29} Following arrest, correctional settings in the United States seldom provide OAT, forcing inmates to undergo involuntary detoxification into precipitated withdrawal-fatal under extreme circumstances.^{30–32} Under these conditions, detention and incarceration of people with OUD vastly decreases tolerance upon release into the community. Risk of relapse, overdose fatality, and HIV infection increases dramatically during the period immediately following incarceration for people with OUD.³³ Reducing interruptions to treatment and attrition among people on OAT due to incarceration of people with OUD is critical to ensuring positive treatment outcomes for people with OUD and preventing overdose.³⁴

Non-completion of MAT due to other reasons

Several organizational-level factors increase the likelihood of attrition from OAT programs including rigid clinic rules, stigma, restrictive times of medication dispensation, and requirements to attend treatment multiple times a week to receive treatment.^{35–37} Zhang et al.³⁸ found a significant association between duration of treatment and retention in OAT. Clients referred from occupational health services from employers and criminal justice organizations are most likely to successfully complete treatment and conversely, patients who are self-referred or referred from health care providers are least likely to complete treatment.^{38,39}

Racial and ethnic disparities in attrition from MAT

Prior literature suggests racial and ethnic minorities disproportionately face barriers to engaging and being retained in OAT. Racial disparities exist in the relationship between referral source and treatment completion. Sahker et al.³⁹ found whites were more likely to successfully complete treatment when referred by a criminal justice agency. African Americans were more likely to complete treatment when referred by an employer. Guerrero et al.⁴⁰ found significant disparities whereby African Americans and Latinx patients were least likely to successfully complete treatment. Mennis & Stahler⁴¹ examined racial and ethnic differences in substance use disorder treatment completion rates and found Latinx were 70% as likely to successfully complete treatment compared to other groups. Severe racial and ethnic disparities in attrition persist in all types of substance use disorder treatments with African Americans experiencing greatest rates of attrition from substance use disorder treatment interventions across drug types (i.e heroin, methamphetamines, cocaine) and settings of treatment (i.e residential, outpatient).^{41–44}

Sociodemographic factors

Prior literature suggests sociodemographic factors associated with increased likelihood of successfully completing substance use disorder treatment consist of education, employment race (White), female sex, and age.^{43,45} Moreover, people who have prior psychiatric comorbidities experience numerous barriers to engaging in substance use disorder treatment including greater rates of criminal justice involvement, greater mental health treatment needs, poverty and food insecurity compared to the general population.^{46–49} Extant literature on retention and completion of treatment suggests that types of substances used including heroin, cocaine, or methamphetamines, paired with substance use behaviors such as daily drug use and using more than one substance at intake are associated with increased risk of attrition from substance use disorder treatment.^{45,50}

Several significant gaps in extant literature provide fruitful avenues of empirical inquiry into factors that are associated with discharge due to incarceration and other reasons from OAT in the United States. To our knowledge, no studies to date have examined factors that heighten risk of attrition due to incarceration in OAT programs despite the disproportionate involvement of people with OUD, particularly minorities in the criminal justice system. Such research is vital to elucidate the pathways by which the criminal justice system acts as a driver of observed health disparities among minority groups in the United States. The majority of existing literature focuses on residential, outpatient, and/or inpatient treatment settings and either exclude discharges from treatments involving OAT or control for OAT treatment in study models. Another gap is that few studies examine attrition from treatment due to incarceration and exclude discharges from treatment due to incarceration entirely. No prior studies have investigated factors that are correlated with treatment attrition from OAT specifically due to incarceration. Moreover, no studies to date compare factors associated with discharge due to incarceration to the factors that are associated with discharge due to other reasons.

It is critical that studies examine and compare factors associated with discharge due to incarceration and other reasons to identify public health strategies of increasing retention and successful treatment completion in OAT in the United States. Prior literature suggests that psychosocial interventions address the common underlying factors that increase risk of recidivism, relapse and ultimately disengagement from substance use treatment.^{51,52} Moreover, addressing substance use and underlying psychosocial needs could reduce risk of engaging in drug-related crimes consisting of possession and distribution as well as property crimes of theft, burglary, larceny and other offenses.

To address gaps in the literature, this study aims to elucidate the association between demographic and socioeconomic characteristics, prior arrest, source of referral (i.e substance use disorder treatment provider & criminal justice agency), prior substance use disorder treatment (i.e length of prior treatment & prior treatment history), substance use factors (i.e current Intravenous drug use, type of drugs used, number of substances) and reasons for discharge including 1) incarceration or 2) other reasons (i.e. breaking clinic rules) compared to successfully completing treatment. Additionally, the following study compares factors associated with discharge due to incarceration to factors associated with discharge due to other factors.

Methods and materials

Data source

Data for this study comes from the Substance Abuse and Mental Health Services Administration (SAMHSA), U.S Department of Health and Human Services (HHS) Treatment Episodes Dataset – Discharges, 2015 (TEDS-D).⁵³ The TEDS-D data reporting system is part of a series of yearly datasets that began for admissions in 1992 and discharges in 2000. Data collected includes demographic, clinical, substance use treatment and substance use characteristics for more than 1.4 million discharges from substance use disorder treatment programs in the United States. The TEDS dataset is managed under the purview of the Center for Behavioral Health Statistics and Quality (CBHSQ). This study used the public release file of the TEDS-D dataset from 2015 which encompasses a substantial proportion of all discharges from substance use disorder treatment programs in the United States. The TEDS-D data consists of data reported to state administrative data systems and include substance use disorder programs that receive state and/or federal block grant funding.

Data for this study includes discharges from treatment settings where the use of opioid medications were part of the client's treatment plan (buprenorphine or methadone). The following study refers to Opioid Agonist Therapy for opioid use disorders as OAT-OD which reflects if the patient participated in an Opioid Treatment Program at the time of discharge. In the United States OAT, refers to pharmacological approaches to treating OUD that involves the provision of methadone or buprenorphine.³ According to SAMSHA's definition, participation in an opioid treatment program (OTP) is indicated if either methadone or buprenorphine are mentioned in the treatment plan at the time of discharge. For this study, discharges were included if the service setting identified at discharge included ambulatory intensive and non-intensive outpatient treatment settings. After restricting the sample of discharges to outpatient substance use disorder treatment settings consisting of OAT and missing data, a final sample remained consisting of 64,331 treatment discharges in 43 states in 2015.

Measures

Dependent variable

Non-completion of MAT.: Reasons for non-completion were measured as a nominal categorical variable consisted of the following categories: 0) completed treatment/transferred to different facility and did not complete treatment due to 1) incarceration (includes jail, prison, and house confinement) and 2) other reasons (noncompliance or violation of rules, laws, or procedures).

Independent variables

Demographics.: Variables included respondent age, sex, race/ethnicity, educational attainment, employment status, and living arrangements. Age was collected as categorical variables indicating age categories of 18–24, 25–29, 30–49 and 50+. Sex consisted of whether or not the admission was for a female (1) or male (0). Categories for race/ethnicity included white, African American, Native American, Asian and Other/>1 race and Hispanic

ethnicity. Categories for variables for education were less than a high school degree or diploma, high school diploma/GED, and college or more.

Socioeconomic factors.: Employment status was categorized as employed full time, part time, or unemployed and not in labor force. Place of living was categorized as homeless, dependent living or independent living.

Criminal justice involvement.: Criminal justice involvement was categorized as 1) no arrest, 2) one arrest, 2) and two or more arrests in the 30 days prior to admission.

Prior OAT treatment history.: Length of OAT was categorized as less than 30 days, 30–89 days, 90–179 days, 180–364 days and greater than 1 year for the entire duration of treatment. The source of referral for treatment included indicator variables of 1) family or self-referral, 2) alcohol or drug use treatment or other health care provider court or 3) criminal justice system (Any police official, judge, prosecutor, probation officer, or other person affiliated with a federal, state, or county judicial system, referral by a court for DWI/ DUI, clients referred in lieu of or for deferred prosecution, or during pretrial release, or before or after official adjudication) and 4) other (i.e schools, community or religious organization, social service providers or self-help group). Prior treatment history includes previous substance use disorder treatment episodes of one or more than one prior treatment episodes (1) or no prior treatment (0).

Substance use history.: Dichotomous variables of substance use type indicated at admission (Primary, secondary, tertiary) included 1) heroin, 2) non-prescription methadone, 3) synthetic and other opiates, 4) cocaine, 5) methamphetamines, and 6) benzodiazepines. An interval variable measured the number of substances reported at admission that ranged from 1–4. A variable was created indicating the number of substances used (1, 2, 3+). A dichotomous variable measured daily use (1) of any reported substances at admission. A dichotomous variable measured intravenous drug use as the route of administration for any of the drugs used prior to admission.

Co-morbid psychiatric condition.: A binary indicator variable was created measuring if the client had a psychiatric condition.

Statistical analyses

Descriptive analyses consisted of overall proportions and counts %(n) of independent variables and results were stratified by whether or not the discharge from OAT consisted of completion of treatment or non-completion due to either incarceration/detention or other reasons. Bivariate analyses comparing treatment noncompletion due to incarceration and other reasons used chisquare tests and are presented in Appendix 1.⁵⁴ This study performed two multinomial regression models.⁵⁵ The first used a multinomial model to estimate the association between independent variables and the categorical outcome variable of 1) discharge due to incarceration and 2) discharge due to other reasons compared to 0) completing treatment as the base category. The second model compared 1) discharge due to incarceration and 2) discharge due to treatment completion to 0) discharge due to other

reasons as the base category. The second model enabled comparison between factors associated with discharge due to incarceration with discharge due to other reasons. We included fixed effects to control for unmeasured confounding at the state-level.⁵⁶ Analysis using variance inflation ratio indicated no multicollinearity between variables included in the model.

Results

Descriptive results

Descriptive statistics of discharge due to incarceration and other reasons as well as sociodemographic, substance use treatment and substance use characteristics are presented in Table 1. Overall 14.40% (9,263) of the discharges consisted of treatment completion, 6.79% (4,365) did not complete treatment due to incarceration and more than three quarters (78.82%, 50,703) did not complete treatment due to other reasons. Results from bivariate analyses of statistical differences between the three categories of the dependent variable 0) completion of treatment, 1) discharge due to incarceration, and 2) other reasons are presented in Appendix 1.

Demographics—Out of all discharges from OAT 12.54% were patients between the ages of 18–24 years old (8,066), 49.06% between 30–49 years old (31,553) and 19.69% were 25–29 (12,664) and 18.73% were more than 50 years old (12,048). Nearly 40% (39.50%, 25,409) of all discharges from OAT were women. Overall, 68.65% percent of discharges were white (44,166), 13.50% black (8,684), 2.02% (1,302) Native American, .62% (400) Asian, and 15.20% (9,779) other/>1 race. Nearly, a fifth of all the discharges from MAT were Latinx ethnicity (19.47%, 12,525).

Socioeconomic characteristics—Out of all of the discharges from OAT, 29.84% (19,196) included patients with less than a high school education, 45.91% (29,535) reported a high school diploma, and 24.25% (15,600) reported college or more. Unemployment accounted for 35.56% (22,879) of the discharges of patients. Regarding living arrangements, 8.03% (5,165) of the discharges were of patients were homeless, 13.78% (8,863) resided in dependent living and 78.19% (50,303) resided in independent living.

Criminal justice involvement—At least one arrest in the 30 days prior to admission into treatment accounted for 4.48% (2,879) of all discharges from OAT and less than one percent (.77%, 497) of discharges from OAT had 2 or more arrests in the 30 days prior to admission.

Substance use disorder treatment—The length of treatment episode for 22.87% of discharges lasted fewer than 30 days, (14,710), 22.04% lasted 30–89 days (14,181) and 17.54% (11,281) lasted 90–179, 16.20% (10,424) lasted 180–364 days, and 21.35% lasted more than a year (13,735). More than three quarters of all the discharges consisted of patients reporting more than one prior treatment episodes (77.18%, 49,649).

Referral to treatment—Referrals to treatment from individual or self-referral sources accounted for 70.64% (45,443) of all discharges followed by substance use disorder or other treatment providers which accounted for 16.45% (10,583) of discharges and, criminal justice

agencies (i.e court, probation, DUI/DWI courts) which accounted for 6.60% (4,062) and other sources (6.31%, 4,062).

Substance use—Discharges of patients who reported using heroin in the past 30 days prior to admission included 81.05% (52,141) of treatment discharges. Synthetic opioids and other opiates were reported by 28.68% (18,450) discharges and 21.97% (14,133) reported cocaine use. In the 30 days prior to admission, 7.26% (4,672) of discharges included patients who reported methamphetamines, 6.44% (4,144) used benzodiazepines and 2.07% (1,333) used methadone (non-prescription). Nearly half of the discharges were of patients reporting daily drug use at admission (48.22%, $n = 31,020$) and 55.89% reported intravenous drug use ($n = 33,955$). Nearly 40% of the discharges were of patients reporting one or more substance at admission (39.29%, $n = 25,277$), 36.69% ($n = 23,669$) used more than used 2 substances and 23.92% (15,385) used three or more substances.

Comorbid psychiatric condition—More than a third of the discharges consisted of patients who reported at least one co-occurring psychiatric condition at the time of admission (36.91%, 23,747).

Appendix 1 provides findings from bivariate chi-squared tests of significant differences of demographic, socioeconomic, substance use and criminal justice factors and reasons for discharge from OAT in the United States.

Multivariable results

Results from multinomial fixed effects analyses predicting discharge from outpatient treatment involving provision of OAT due to incarceration and other reasons are presented in Table 2. Variables in the model included age, race, education, employment status, living arrangements, criminal justice involvement, length of treatment, number of prior treatment episodes, referral sources, prior treatment history, substances used at admission, daily drug use at admission, number of substances used at admission, current IV drug use and comorbid psychiatric conditions.

Demographics

Discharge due to incarceration vs. completion.: Compared to older patients (>50 years), discharges of patients ages 18–24 ($RRR = 1.28$, $CI_{95} = 1.09, 1.50$, $p = .002$), 25–29 ($RRR = 1.61$, $CI_{95} = 1.39, 1.85$, $p < .001$), 30–49 ($RRR = 1.63$, $CI_{95} = 1.45, 1.84$, $p < .001$) was associated with greater relative risk of discharge due to incarceration. Female sex was associated with a lower risk of discharge due to incarceration ($RRR = .54$, $CI_{95} = .50, .59$). Compared to discharges of white patients, the risk of discharge due to incarceration was highest among African Americans ($RRR = 1.73$, $CI_{95} = 1.50, 1.98$, $p < .001$), Native Americans ($RRR = 1.57$, $CI_{95} = 1.19, 2.08$) and other/more than 1 race ($RRR = 1.23$, $CI_{95} = 1.05, 1.44$, $p = .009$). Discharges of Latinx populations more likely to be discharged due to incarceration compared to discharges of non-Latinx populations ($RRR = 1.39$, $CI_{95} = 1.21, 1.61$).

Discharge due to other reasons vs completion.: Discharges of patients ages 18–24 was associated with lower relative risk (RRR=.85, CI₉₅=.77, .93, $p<.001$) of discharge due to other reasons compared to discharges of patients 50 years or older. Female sex was associated with lower risk of discharge due to other reasons (RRR=.92, CI₉₅=.88, .92, $p=.002$). Risk of discharge due to other reasons was also higher among African-Americans (RRR = 1.52, CI₉₅= 1.38, 1.66, $p<.001$), Hispanics (RRR = 1.36, CI₉₅= 1.27, 1.47, $p<.001$) and Native Americans (RRR = 1.36, CI₉₅= 1.12, 1.65, $p<.001$) compared to discharges of white patients.

Discharge due to incarceration vs. discharge due to other reasons.: With the base category of discharges due to other reasons, discharges of patients ages 18–24 (RRR = 1.53, CI₉₅= 1.33, 1.75, $p<.001$), 25–29, (RRR = 1.67, CI₉₅= 1.48, 1.89, $p<.001$) and 30–49 (RRR = 1.60, CI₉₅= 1.45, 1.78, $p<.001$) was associated with greater risk of incarceration compared to patients 50 years or older. Female sex was associated with lower risk of discharge due to incarceration compared to other reasons (RRR=.58, CI₉₅=.54, .63, $p<.001$). Compared to whites, discharges of African-Americans was associated with increased risk of discharge due to incarceration (RRR = 1.12, CI₉₅= 1.00, 1.25 $p=.042$).

Socioeconomic factors

Discharge due to incarceration vs. completion.: Discharges of patients with less than a high school education (RRR = 1.57, CI₉₅= 1.41, 1.75, $p<.001$) and a high school diploma (RRR = 1.29, CI₉₅= 1.17, 1.42, $p<.001$) were associated with increased risk of discharge due to incarceration compared to college or more. Unemployment was associated with increased risk of discharge due to incarceration (RRR = 1.36, CI₉₅= 1.26, 1.48, $p<.001$) compared to discharges of patients who were employed. The risk of discharge due to incarceration was higher among discharges of patients in OAT who were homeless (RRR = 1.55, CI₉₅= 1.33, 1.80, $p<.001$) at admission compared to discharges of patients who were housed in independent housing.

Discharge due to other reasons vs. completion.: Less than high school education (RRR = 1.42, CI₉₅= 1.33, 1.53, $p<.001$) and a high school diploma (RRR = 1.17, CI₉₅= 1.10, 1.24, $p<.001$) was associated with increased risk of discharge due to other reasons compared to college or more. Unemployment was associated with increased risk of discharge due to other reasons (RRR = 1.10, CI₉₅= 1.04, 1.16) compared to discharges of patients who were employed. The risk of discharge due to other reasons (RRR = 1.30, CI₉₅= 1.17, 1.45, $p<.001$) was higher among patients in OAT who were homeless and lower among patients in dependent housing (RRR = .74, CI₉₅=.68, .79, $p<.001$) compared to patients who were housed in independent housing.

Discharge due to incarceration vs. discharge due to other reasons.: With discharge due to other reasons as the base category, discharge of patients with less than a high school diploma (RRR = 1.10, CI₉₅= 1.01, 1.21, $p=.022$) and a high school diploma (1.10 CI₉₅= 1.01, 1.20, $p=.036$) was associated with increased risk of incarceration compared to discharges of patients with some college or more education. The risk of discharge due to incarceration for patients who were unemployed (RRR = 1.24, CI₉₅= 1.16, 1.33, $p<.001$) was significantly

greater than the risk of discharge due to incarceration for patients who were employed (RRR = 1.24, CI₉₅ = 1.16, 1.33, $p < .001$). Homelessness (RRR = 1.18, CI₉₅ = 1.06, 1.32, $p = .003$), and dependent living arrangements (RRR = 1.36, CI₉₅ = 1.24, 1.50, $p < .001$) were associated with increased risk of discharge due to incarceration.

Criminal justice involvement

Discharge due to incarceration.: The risk of discharge due to incarceration for patients who reported one arrest in the past 30 days at admission was more than 2.5 times that of participants who reported no arrests (RRR = 2.15, CI₉₅ = 1.84, 2.52, $p < .001$).

Discharge due to other vs. reasons.: The risk of discharge due to other reasons for participants who reported more than one arrest in the past 30 days was significantly lower (RRR = .70, CI₉₅ = .54, .91, $p < .001$) than discharges of patients with no arrests.

Discharge due to incarceration vs. discharge due to other reasons.: The risk of discharge due to incarceration was significantly higher for patients with one (RRR = 1.98, CI₉₅ = 1.77, 2.22, $p < .001$) and more than one (RRR = 1.73, CI₉₅ = 1.27, 2.33, $p < .001$) prior incarceration.

Substance use disorder treatment

Discharge due to incarceration vs. completion.: The risk of discharge due to incarceration was significantly higher among patients in MAT for fewer than 30 days (RRR = 1.68, CI₉₅ = 1.48, 1.92, $p < .001$) and 30–90 days (RRR = 1.81, CI₉₅ = 1.61, 2.04, $p < .001$) compared to length of treatment of more than a year. Referral from a criminal justice agency (RRR = 1.48, CI₉₅ = 1.27, 1.72, $p < .001$) and self/family (RRR = 1.76, CI₉₅ = 1.56, 1.97, $p < .001$) was associated with greater risk of discharge due to incarceration, compared to receiving a referral to treatment from a substance use provider or other health care provider.

Discharge due to other reasons vs. completion.: The risk of discharge due to other reasons was significantly higher for discharges from treatment of less than 30 (RRR = 3.37, CI₉₅ = 3.10, 3.66, $p < .001$), 30–89 (RRR = 2.39, CI₉₅ = 2.22, 2.88, $p < .001$), 90–180, (RRR = 1.39, CI₉₅ = 1.30, 1.50, 3.66, $p < .001$) and 181–364 days (RRR = 1.16, CI₉₅ = 1.08, 1.25, $p < .001$) compared to more than a year. Self-referral was associated with greater relative risk of treatment discharge due other reasons (RRR = 1.47, CI₉₅ = 1.38, 1.58, $p < .001$), compared to receiving a referral to treatment from a substance use provider or other health care provider. Referral from criminal justice agencies (RRR = .45, CI₉₅ = .41, .50, $p < .001$) and other referral sources (RRR = .83, CI₉₅ = .74, .92) was associated with lower relative risk of discharge due to other reasons.

Discharge due to incarceration vs. discharge due to other reasons.: The risk of discharge due to incarceration was more than three times higher for referrals from criminal justice referral sources (RRR = 3.27, CI₉₅ = 2.87, 3.73) compared to referrals from substance use and other health care providers. Referral from self/family (RRR = 1.19, CI₉₅ = 1.08, 1.32, $p < .001$) and others (RRR = 1.30, CI₉₅ = 1.11, 1.52, $p < .001$) were associated with increased risk of discharge due to other reasons. Compared to duration of treatment lasting longer than a year, treatment episodes lasting fewer than 30 days (RRR = .50, CI₉₅ = .45, .56, $p < .001$) and

30–89 days ($RRR = .76$, $CI_{95} = .69, .84$, $p < .001$) were associated with lower risk of discharge due to incarceration. More than 1 prior treatment episode was associated with increased risk of discharge due to incarceration ($RRR = 1.31$, $CI_{95} = 1.20, 1.43$, $p < .001$).

Substance use

Discharge due to incarceration vs. treatment completion.: The risk of treatment discharge due to incarceration among patients who used heroin ($RRR = 2.09$, $CI_{95} = 1.77, 2.46$, $p < .001$) or methamphetamine ($RRR = 2.04$, $CI_{95} = 1.68, 2.47$, $p < .001$) at admission was more than twice the risk for discharges where heroin or methamphetamines were not indicated. Non-prescription use of methadone ($RRR = 1.47$, $CI_{95} = 1.12, 1.93$, $p = .005$), synthetic and other opiates ($RRR = 1.23$, $CI_{95} = 1.07, 1.53$, $p = .004$), cocaine ($RRR = 1.55$, $CI_{95} = 1.35, 1.77$, $p < .001$) and benzodiazepines ($RRR = 1.28$, $CI_{95} = 1.07, 1.53$, $p = .006$) were associated with discharge due to incarceration than discharges of patients who did not use methadone, synthetic and other opiates, cocaine, and benzodiazepines. Daily drug use of any substance at admission was associated with discharge due to incarceration ($RRR = 1.59$, $CI_{95} = 1.41, 1.74$, $p < .001$). Use of two ($RRR = .78$, $CI_{95} = .69, .89$, $p < .001$) and three or more ($RRR = .55$, $CI_{95} = .45, .68$, $p < .001$) at admission were associated with lower relative risk of discharge due to incarceration compared to discharges of patients who used only one substance. Daily drug use of any substance at admission was associated with discharge due to incarceration ($RRR = 1.59$, $CI_{95} = 1.41, 1.74$, $p < .001$). Injection drug use was associated with greater risk of discharge due to incarceration ($RRR = 1.27$, $CI_{95} = 1.16, 1.39$, $p < .001$).

Discharge due to other reasons vs. completion.: The risk of discharge due to other reasons were associated with increased odds of heroin ($RRR = 1.51$, $CI_{95} = 1.37, 1.67$, $p < .001$), synthetic and other opiates ($RRR = 1.28$, $CI_{95} = 1.17, 1.39$, $p < .001$), cocaine ($RRR = 1.30$, $CI_{95} = 1.19, 1.42$, $p < .001$), and methamphetamines ($RRR = 1.51$, $CI_{95} = 1.37, 1.66$, $p < .001$) than discharges of patients who did not use heroin, synthetic opiates, cocaine and methamphetamines. Daily drug use of any substance at admission was associated discharge due to other reasons ($RRR = 1.63$, $CI_{95} = 1.53, 1.73$, $p < .001$). Use of two ($RRR = .84$, $CI_{95} = .78, .91$, $p < .001$) and three or more drugs ($RRR = .70$, $CI_{95} = .62, .79$, $p < .001$) at admission were associated with lower relative risk of discharge due to incarceration compared to discharges of patients who used only one substance.

Discharge due to incarceration vs. discharge due to other reasons.: Discharges of patients reporting use of heroin ($RRR = 1.38$, $CI_{95} = 1.19, 1.60$, $p < .001$), cocaine ($RRR = 1.19$, $CI_{95} = 1.06, 1.34$, $p = .003$) and benzodiazepines ($RRR = 1.17$, $CI_{95} = 1.01, 1.36$, $p = .044$) were associated with increased risk of discharge due to incarceration. Patients who reported use of 3 or more substances at admission ($RRR = .79$, $CI_{95} = .66, .95$, $p = .011$) were less likely to be discharged due to incarceration compared to discharges of patients who used one substance at admission. Intravenous drug use was significantly associated with increased risk of discharge due to incarceration ($RRR = 1.21$, $CI_{95} = 1.12, 1.30$, $p < .001$).

Co-morbid psychiatric conditions

Discharge due to incarceration vs. completion.: The relative risk of discharge due to incarceration ($RRR = 1.09$, $CI_{95} = 1.00, 1.18$, $p = .043$) was significantly higher among

discharges of patients who indicated a co-morbid psychiatric problem at admission to OAT compared to discharges of patients without a co-morbid psychiatric problem.

Discharges due to other reasons vs. completion.: The relative risk of discharge due to other reasons was significantly higher among discharges of patients who indicated a co-morbid psychiatric problem (RRR = 1.09, CI₉₅= 1.03, 1.16, p<.001) upon admission into OAT.

Discussion

This study elucidated significant associations between several key risk factors of dropping out of OAT due to incarceration and other reasons (i.e breaking clinic rules). This study addressed a significant gap in understanding of the psychosocial factors that are associated with specific reasons for not completing treatment. Prior studies group all reasons for discharge into a single category of unsuccessful completion of treatment which is compared to successful completion of treatment in multivariable models. Findings from this study suggest that criminal justice involvement might be a driver of racial and ethnic inequalities in rates of attrition. Patients who did not complete treatment due to incarceration were more likely to be younger, male as well as African American and Hispanic. Disproportionate arrest and incarceration of African American, Hispanic and other minorities may be a contributing factor to wide-spread racial and ethnic inequalities in treatment attrition from OAT programs in the United States with sequelae that include overdose and infectious disease transmission. Factors associated with discharge due to incarceration compared to successful completion of treatment included younger populations, racial and ethnic minorities, with less education, homeless and prior criminal justice involvement. Moreover, participants who were in treatment for shorter periods of time, used drugs daily, current intravenous drug use and comorbid psychiatric conditions had a greater relative risk of discharge due to incarceration compared to discharges due to successful completion of treatment after adjusting for several potential confounders.

The collateral effects of racialized drug laws and the criminalization of drug use including arrest, detention and incarceration may interrupt engagement with OAT programs resulting in discharges due to incarceration. Findings from this study support extant literature pointing to incarceration as a major barrier to successful retention and engagement of African American and Hispanic patients in OAT programs in the United States (Springer et al., 2015). The finding that only 14.40% of discharges were treatment completions calls for future research examining potential areas of inadequacy of current treatment systems to inform interventions to improve retention and successful treatment.

Multinomial regression analysis enabled comparison between factors associated with discharge due to incarceration and discharge due to other reasons. Factors associated with discharges due to incarceration were different than factors associated with discharges for other reasons (i.e., not following clinic rules). We observed an association between referral to OAT from criminal justice agencies and increased odds of non-completion of OAT due to incarceration and a lower odds of non-completion due to other reasons (i.e., breaking clinic rules) compared to referrals from health care providers. Referrals from criminal justice

agencies may include patients who are already entrenched in the criminal justice system and subject to re-arrest and incarceration due to parole or probation violations. Extant literature suggests that prior involvement in the criminal justice system greatly increases risk of future involvement consisting of repeated incarcerations. People with OUD referred by the criminal justice system may also face greater monitoring by community corrections and surveillance by police and other law enforcement agencies resulting in greater rates of discharge due to incarceration. Moreover, people referred by the criminal justice system might face severe consequences for not following up in treatment or failing drug tests resulting in discharge due to incarceration.

The type of substances used at admission increased risk of attrition from OAT with the greatest risk of discharge due to incarceration and other reasons for use of heroin and methamphetamines. The number of substances used at admission were negatively associated with a lower risk of discharge due to incarceration or other reasons compared to treatment completion. Current intravenous drug use was associated with attrition due to incarceration but not attrition due to other reasons. The criminalization of syringe possession, as well as heroin could result in a greater likelihood of discharge due to incarceration for people with OUD who inject drugs compared to people with OUD who do not inject drugs.

Several limitations of this study give rise to fruitful avenues of future empirical inquiry. First the data is restricted to discharges from OAT and does not include admissions where patients were retained on treatment. Findings from this study must be interpreted as discharges due to incarceration and other reasons compared to successful completion of treatment rather than a sample of all participants in MAT. Fixed effects analyses adjusted for shared variance of discharges nested within states and therefore this study does not examine statistical associations between factors at the state-level and non-completion due to incarceration. Future multi-level analyses are needed to extend findings from this study to an analytic framework that estimates associations between state-level factors and attrition from OAT due to incarceration and other reasons. Additionally, the data is cross-sectional and thus all of the parameter estimates embody correlations between variables rather than causation. The data consists of discharges rather than individuals and therefore it is possible that multiple discharges occurred of the same participants. Patients who cycle in and out of treatment may account for much of the associations observed in this study. An important area of future research includes identifying how multiple discharges from the same patient may influence risk of recidivism due to incarceration compared to successful completion of treatment.

Another important limitation of the following study is the focus on the medicalization of drug use through the provision of MAT-OUD without including the provision of other interventions beyond the medical model of substance use treatment. The reliance of this study on the medicalization of substance use treatment without considering the receipt of other psychosocial interventions may exclude other important factors that increase risk of discharge due to incarceration, breaking clinic rules and other factors. Another limitation of this study is that it did not investigate relapse and ongoing drug use following discharge from treatment due to incarceration, breaking clinic rules and other reasons. Unmet psychosocial needs such as transportation, vocational and educational training that address underlying causes of substance use may play a significant role in preventing relapse in the

long term for people with opioid use disorders following discharge from substance use treatment. Findings from this study call for future longitudinal research into the unmet treatment needs of people with OUD particularly patients who are involved in the criminal justice system which prior literature suggests are disproportionately at risk of relapse and recidivism.

Limitations notwithstanding, this study gives rise to several implications for the delivery of OAT particularly for people with OUD who are involved in the criminal justice system. Most immediately, access to OAT in correctional settings embodies a clear public health imperative supported by obligations of correctional institutions under the U.S constitution with the American with Disabilities Act (Boston Globe, 2018). The National Institute of Drug Abuse prioritizes increasing retention and engagement in OAT as integral to the national response to the opioid epidemic and attenuating rates of opioid overdose deaths in the United States. Addressing the role of the criminal justice system in racial and ethnic disparities in attrition from OAT must be a priority of the national response to the opioid epidemic. People with OUD are disproportionately involved in the criminal justice system introducing barriers to accessing OAT for specific populations particularly racial and ethnic minorities who are disproportionately arrested and incarcerated compared to white populations. Decriminalizing possession of small amounts of opioids and other drugs would remove a major reason for interrupting access to OAT and a major driver of relapse and opioid overdose among people who use drugs. The decriminalization of possession of small amounts of opioids could open additional financial and human resources to devote to treatment and prevention of OUD to address underlying structural drivers of addiction in the United States.

Drug courts could also play an important role in attenuating rates of attrition due to incarceration by providing post-arrest treatment in lieu of incarceration for people with opioid use disorders who are arrested for drug crime related to drug use. Unfortunately, most drug courts do not provide access to OAT with a study by Krawczyk et al.⁴⁶ identifying just 1 in 20 justice referred adults receiving Methadone or Buprenorphine. Additionally, reducing draconian consequences for failing to comply with requirements of probation, the courts and other criminal justice referral agencies could reduce discharge due to incarceration compared to completion of treatment. Future empirical inquiry should weigh the merits of decriminalizing possession of small amounts of drugs to reduce gaps in treatment due to arrest and incarceration of people with OUD. This study makes a significant contribution to understanding factors that lead to attrition from OAT due to incarceration in the United States.

In addition to the criminal justice system we identified several factors related to substance use disorder treatment and illicit drug use that were significantly associated with discharges from treatment due to incarceration and other reasons. The longer patients were retained in treatment, the less the likelihood of discharge due to incarceration and other reasons (i.e breaking clinic rules). The risk of OAT non-completion due to other reasons among patients in treatment for <30 days was more than 3 times the risk among patients in treatment for a year or longer. Patients in OAT with shorter duration of treatment may have more active substance use disorders consisting of triggers and stronger cravings for drug use thus

increasing risk of relapse and discharge from treatment due to other reasons such as noncompliance with clinic rules.

Findings from this study have implications for future substance use treatment services research that aim to address the pitfalls of systems that fail to integrate important psychosocial factors into treatment and exclude participants from treatment due to incarceration. Future research must investigate the merits of implementing policies in substance use treatment programs that require providers to keep treatment plans open rather than immediately discharging patients during periods of incarceration. This may be of particular benefit to people with OUD who cannot afford to immediately post bail or afford legal representation when involved in the criminal justice system and thus face longer periods of custody and detention in jails which may increase risk of discharge due to incarceration.

Findings from this study are congruent with existing literature emphasizing the need to integrate treatment systems for OUD in criminal justice system with community-based interventions.^{52,57–59} Future research is needed that investigates interventions that link secure jail and prison settings to treatment provided in the community. Moreover, findings from this study suggests that policies and practices criminalizing drug use through arrest and incarceration for drug possession may interfere with the delivery of evidence-based substance use treatment interventions in the United States. An important avenue of future empirical inquiry involves research into replacing arrest of people with OUD for drug possession with options for treatment on outcomes of retention and successful completion of substance use treatment for people with OUD in the United States.

Future research is necessary using multidisciplinary and multiagency approaches that builds upon this study and existing innovative interventions. The Hub and Spoke models used in Vermont and Nurse-Coordinated office-based models in Massachusetts offer promising evidence-based multidisciplinary approaches that embrace multiple agencies and social systems as critical in attenuating relapse and disengagement from substance abuse treatment among people with OUD in the United States.^{5,60–62} Greater research is necessary that applies multi-disciplinary and systems approaches to coordinate criminal justice practitioners consisting of probation, courts, and correctional officers with health professionals including psychiatrists, social workers, substance abuse counselors and case managers to address the complex needs of people with OUD who are involved in the criminal justice system.

Future research must investigate if providing additional treatment resources including peer navigation and additional recovery and support services could attenuate risk of discharge due to incarceration. Prior treatment episodes were associated with discharge due to incarceration and other reasons. Patients with prior treatment may indicate a population with greater substance use disorder treatment needs as well as more barriers to engaging in substance use disorder treatment including inconsistent health insurance, poor access to transportation and other factors. Interventions that involve peer navigators who link people with OUD who are involved in the criminal justice system to OAT and follows their progress

closely are a promising method of addressing high rates of discharge due to incarceration among patients in OAT programs.

Findings from this study are consistent with prior literature emphasizing that the lack of including psychosocial factors by health care providers may result in a rigid treatment delivery system excluding the most vulnerable populations particularly African American and Latinx groups, less educated, folks with co-occurring psychiatric problems, and populations disproportionately impacted by trauma.^{63–66} Moreover, populations with more social attachments may be less vulnerable to attrition from treatment compared to populations with greater social bonds to family, work and educational institutions. Future research must investigate if greater flexibility in care delivery systems to address underlying factors that increase risk of relapse in individualized treatment systems results in greater retention and successful completion of treatment.

Findings from this paper underscore the importance of future research into psychosocial interventions focused on recovery in promoting engagement and retention in substance use interventions for people with OUD. This includes psychosocial interventions focused on employment, education, social skills and peer groups to enhance the quality of life of people with OUD and promote retention and eventual completion of treatment. These directions of future inquiry are congruent with prior literature suggesting that ‘wrap-around’ psychosocial interventions that address social, economic, housing and medical needs in addition to substance use treatment reduces risk of recidivism and relapse.^{67–69} Future research is needed that investigates if providing psychosocial interventions that reduce recidivism and risk of relapse may reduce attrition from substance use treatment facilities due to incarceration in the United States.

Increasing retention and engagement in OAT involves redressing other structural and systemic barriers to accessing OAT that disproportionately face racial and ethnic minorities. Findings from this study suggest that the criminal justice system contributes to racial and ethnic inequalities in retention and engagement in OAT in the United States. Addressing the role of the criminal justice system in racial and ethnic disparities in attrition from OAT must be a priority of the national response to the opioid epidemic.

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Appendix

Appendix 1.

Descriptive statistics and bivariate tests between independent variables and treatment noncompletion for incarceration and other reasons (64331)

	Overall	Completed/ transferred %n	Incarceration %(n)	Chi- Sq.	Non- completion Other reasons %(n)	Chi- Sq.
Overall	%(n)	14.40(9263)	6.79(4365)		78.82(50703)	
Socio-demographics						
Age						
18–24	12.54 (8066)	14.58 (1351)	12.19 (532)	<.001	12.19 (6183)	<.001
25–29	19.69 (12664)	21.32 (1975)	21.15 (923)	.810	19.26 (9766)	.010
30–49	49.06 (31553)	48.59 (4501)	53.70 (2344)	<.001	48.73 (24708)	.805
50+	18.73 (12048)	15.50 (1436)	12.97 (566)	<.001	19.81 (10046)	<.001
Women	39.50 (25409)	44.31 (4104)	27.12 (1184)	<.001	39.68 (20121)	<.001
Race						
White	68.65 (44166)	80.36 (7444)	65.38 (2854)	<.001	66.80 (33868)	<.001
Black	13.50 (8684)	8.58 (795)	13.29 (580)	<.001	14.42 (7309)	<.001
Native American	2.02 (1302)	1.44 (133)	2.25 (98)	<.001	2.11 (1071)	<.001
Asian	.62 (400)	.57 (53)	.39 (17)	.164	.65 (330)	.382
Other/>1 race	15.20 (9779)	9.05 (838) <.001	16.02 (8125)	<.001		
Hispanic	19.47 (12525)	13.00 (1204)	22.96 (1002)	<.001	20.35 (10319)	<.001
Education						
Less than high school education	29.84 (19196)	23.77 (2202)	32.32 (1407)	<.001	30.74 (15587)	<.001
High school diploma	45.91 (29535)	48.04 (4450)	47.01 (2052)	.261	45.43 (23033)	<.001
College or more	24.25 (15600)	28.19 (2611)	20.76 (906)	<.001	23.83 (12083)	<.001
Unemployed	35.56 (22879)	35.46 (3285)	42.38 (1850)	<.001	35.00 (17744)	.386
Living arrangements						
Homeless	8.03 (5165)	4.66 (432)	9.46 (413)	<.001	8.52 (4320)	<.001
Dependent living	13.78 (8863)	14.57 (1350)	15.42 (673)	.196	13.49 (6840)	.005
Independent living	78.19 (50303)	80.76 (7481)	75.12 (3279)	<.001	77.99 (39543)	<.001
Criminal justice involvement						

	Overall	Completed/ transferred %n	Incarceration %(n)	Chi- Sq.	Non- completion Other reasons %(n)	Chi- Sq.
One	4.48 (2879)	4.04 (374)	9.58 (418)	<.001	4.12 (2087)	.726
>1	.77 (497)	1.17 (108)	1.26 (55)	.637	.66 (334)	<.001
Source of referral						
Individual	70.64 (45443)	62.14 (5756)	69.00 (3012)	<.001	72.33 (36675)	<.001
Other	6.31 (4062)	7.48 (693)	5.75 (251)	.142	6.15 (3118)	.025
Court/Criminal Justice/ Referral/DUI/DWI	6.60 (4243)	12.27 (1137)	13.04 (569)	<.001	5.00 (2537)	<.001
Substance abuse treatment or other healthcare provider	16.45 (10583)	18.10 (1677)	12.21 (533)	<.001	16.51 (8373)	<.001
Length of treatment						
<30 days	22.87 (14710)	13.03 (1207)	15.49 (676)	<.001	25.30 (12827)	<.001
30–90 days	22.04 (14181)	17.51 (1622)	23.02 (1005)	<.001	22.79 (11554)	<.001
90–180 days	17.54 (11281)	20.34 (1884)	21.17 (924)	.264	16.71 (8473)	<.001
180–364 days	16.20 (10424)	19.94 (1847)	19.24 (840)	.341	15.26 (7737)	<.001
>Year	21.35 (13735)	29.18 (2703)	21.08 (920)	<.001	19.94 (10112)	<.001
Prior treatment history						
>1 prior treatment episodes	77.18 (49649)	74.17 (6870)	83.92 (3663)	<.001	77.15 (39116)	<.001
Substance use						
At admission						
Heroin	81.05 (52141)	69.32 (6421)	88.18 (3849)	<.001	82.58 (41871)	<.001
Methadone (non- prescription)	2.07 (1333)	3.47 (321)	1.97 (86)	<.001	1.83 (926)	<.001
Synthetic and other opiates	28.68 (18450)	38.51 (3567)	22.20 (969)	<.001	27.44 (13914)	<.001
Cocaine	21.97 (14133)	19.63 (1818)	27.42 (1197)	<.001	21.93 (11118)	<.001
Methamphetamines	7.26 (4672)	4.73 (438)	7.40 (323)	<.001	7.71 (3911)	<.001
Benzodiazepines	6.44 (4144)	7.27 (673)	7.06 (308)	<.001	6.24 (3163)	.659
Daily drug use at admission	48.22 (31020)	34.51 (3197)	49.64 (2167)	<.001	50.60 (25656)	<.001
Number of substances at admission						
1	39.29 (25277)	39.80 (3687)	34.98 (1527)	<.001	39.57 (20063)	.672

	Overall	Completed/ transferred %n	Incarceration %(n)	Chi- Sq.	Non- completion Other reasons %(n)	Chi- Sq.
2	36.79 (23669)	35.76 (3312)	38.85 (1696)	<.001	36.80 (18661)	.182
3	23.92 (15385)	24.44 (2264)	1142 (2616)	<.001	23.63 (11979)	.092
Current IV drug use	55.89 (35955)	50.37 (4666)	63.16 (2757)	<.001	56.27 (28532)	<.001
Comorbid psychiatric condition	36.91 (23747)	39.81 (3688)	38.83 (1695)	.274	36.22 (18364)	<.001

*
 $p < .05$,

**
 $p < .01$,

 $p < .001$.

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Table 1.

Descriptive statistics of independent variables and discharge due to incarceration and other reasons (64331).

	Overall
Reason for discharge	% (n)
Completed/transferred	14.40 (9263)
Incarceration	6.79 (4365)
Other reasons	78.82 (50703)
Demographics	
Age	
18–24	12.54 (8066)
25–29	19.69 (12664)
30–49	49.06 (31553)
50+	18.73 (12048)
Women	39.50 (25409)
Race	
White	68.65 (44166)
Black	13.50 (8684)
Native American	2.02 (1302)
Asian	.62 (400)
Other/>1 race	15.20 (9779)
Latinx	19.47 (12525)
Socioeconomic factors	
Education	
Less than high school education	29.84 (19196)
High school diploma	45.91 (29535)
College or more	24.25 (15600)
Unemployed	35.56 (22879)
Living arrangements	
Homeless	8.03 (5165)
Dependent living	13.78 (8863)
Independent living	78.19 (50303)
Criminal justice involvement	
One	4.48 (2879)
>1	.77 (497)
Substance use treatment	
Length of treatment	
<30 days	22.87 (14710)
30–90 days	22.04 (14181)
90–180 days	17.54 (11281)
180–364 days	16.20 (10424)
>Year	21.35 (13735)
Source of referral	

	Overall
Individual	70.64 (45443)
Other	6.31 (4062)
Court/Criminal Justice/Referral/DUI/DWI	6.60 (4243)
Substance abuse treatment or other healthcare provider	16.45 (10583)
Prior treatment history	
>1 prior treatment episodes	77.18 (49649)
Substance use	
At admission	
Heroin	81.05 (52141)
Methadone (non-prescription)	2.07 (1333)
Synthetic and other opiates	28.68 (18450)
Cocaine	21.97 (14133)
Methamphetamines	7.26 (4672)
Benzodiazepines	6.44 (4144)
Daily drug use at admission	48.22 (31020)
Number of substances at admission	
1	39.29 (25277)
2	36.79 (23669)
3	23.92 (15385)
Current IV drug use	55.89 (35955)
Comorbid psychiatric condition	36.91 (23747)

Table 2.

Multinomial regression of factors associated with attrition from treatment due to incarceration and other reasons compared to treatment completion or transferred to another facility.

	Model 1			Model 2		
	Incarceration vs. completion	Other reasons vs. completion	Incarceration vs. other reasons	RRR	p-value	RRR
Demographic characteristic						
Age (less than 30)						
18–24	1.28 (1.09, 1.50) **	.84 (.76, .92) ***	1.53 (1.33, 1.75) ***		<.001	
25–29	1.61 (1.39, 1.85) ***	.96 (.88, 1.05)	1.67 (1.48, 1.89) ***		.360	
30–49	1.63 (1.45, 1.84) ***	1.02 (.95, 1.09)	1.60 (1.45, 1.78) ***		.638	
Sex						
Female	.54 (.50, .59) ***	.93 (.88, .97)	.58 (.54, .63) ***		.002	
Race						
Black	1.73 (1.50, 1.98) ***	1.54 (1.40, 1.69) ***	1.12 (1.00, 1.25) *		<.001	
Native American	1.57 (1.19, 2.08) **	1.38 (1.13, 1.69) ***	1.14 (.91, 1.42)		.247	
Asian	.79 (.45, 1.39)	1.07 (.79, 1.44)	.74 (.45, 1.23)		.715	
Other race/>1 race	1.23 (1.05, 1.44) **	1.16 (1.04, 1.29) **	1.06 (.93, 1.21)		.008	
Ethnicity						
Latino	1.39 (1.21, 1.61) ***	1.27 (1.16, 1.39) ***	1.10 (.97, 1.23)		<.001	
Socioeconomic factors						
Education						
Less than high school education	1.57 (1.41, 1.75) ***	1.42 (1.33, 1.53) ***	1.10 (1.01, 1.21) *		<.001	
High school diploma	1.29 (1.17, 1.42) ***	1.17 (1.10, 1.24) ***	1.10 (1.01, 1.20) *		<.001	
Unemployed	1.36 (1.26, 1.48)	1.10 (1.04, 1.16) **	1.24 (1.16, 1.33) ***		<.001	
Living arrangements						
Homeless	1.55 (1.33, 1.80) ***	1.30 (1.17, 1.45) ***	1.18 (1.06, 1.32) **		<.001	
Dependent living	1.01 (.90, 1.12)	.74 (.68, .79) ***	1.36 (1.24, 1.50) ***		.918	
Criminal justice involvement						
One	2.15 (1.84, 2.52) ***	1.09 (.96, 1.23)	1.98 (1.77, 2.22) ***		.170	

	Model 1			Model 2		
	Incarceration vs. completion	Other reasons vs. completion	Incarceration vs. other reasons	Other reasons vs. completion	Incarceration vs. other reasons	p-value
>1	RRR	p-value	RRR	p-value	RRR	p-value
Source of referral	1.20 (.85, 1.71)	.299	.70 (.54, .91)***	.007	1.73 (1.27, 2.33)***	<.001
Individual	1.76 (1.56, 1.97)***	<.001	1.47 (1.38, 1.58)***	<.001	1.19 (1.08, 1.32)***	<.001
Other	1.08 (.89, 1.29)	.422	.83 (.74, .92)**	<.001	1.30 (1.11, 1.52)***	<.001
Court/Criminal justice referral	1.48 (1.27, 1.72)***	<.001	.45 (.41, .50)***	<.001	3.27 (2.87, 3.73)***	<.001
Substance abuse treatment						
Length of treatment						
<30 days	1.68 (1.48, 1.92)***	<.001	3.37 (3.10, 3.66)***	<.001	.50 (.45, .56)***	<.001
30–90 days	1.81 (1.61, 2.04)***	<.001	2.39 (2.22, 2.28)***	<.001	.76 (.69, .84)***	<.001
90–180 days	1.34 (1.19, 1.51)	.173	1.39 (1.30, 1.50)***	<.001	.96 (.87, 1.06)	.456
180–364 days	1.21 (1.08, 1.53)*	.002	1.16 (1.08, 1.25)***	<.001	1.04 (.94, 1.15)	.431
Prior treatment history						
>1 prior treatment episodes	1.42 (1.29, 1.57)***	<.001	1.09 (1.02, 1.14)*	.006	1.31 (1.20, 1.43)***	<.001
Substance use						
Substance use at admission						
Heroin	2.09 (1.77, 2.46)***	<.001	1.51 (1.37, 1.67)***	<.001	1.38 (1.19, 1.60)***	<.001
Methadone (non-prescription)	1.47 (1.12, 1.93)**	.005	1.17 (.99, 1.36)	.053	1.26 (.99, 1.61)	.063
Synthetic and other opiates	1.23 (1.07, 1.53)**	.004	1.28 (1.17, 1.39)***	<.001	.98 (.86, 1.10)	.685
Cocaine	1.55 (1.35, 1.77)***	<.001	1.30 (1.19, 1.42)***	<.001	1.19 (1.06, 1.34)**	.003
Methamphetamines	2.04 (1.68, 2.47)***	<.001	1.51 (1.37, 1.66)***	<.001	1.34 (1.14, 1.58)	<.001
Benzodiazepines	1.28 (1.07, 1.53)**	.006	1.10 (.98, 1.23)	.094	1.17 (1.01, 1.36)*	.046
Cannabis	1.27 (1.10, 1.45)***	<.001	1.18 (1.08, 1.25)***	<.001	1.07 (.95, 1.20)	.266
Daily drug use at admission	1.59 (1.41, 1.74)***	<.001	1.63 (1.53, 1.72)***	<.001	.97 (.90, 1.04)	.215
Number of substances at admission						
2	.78 (.69, .89)***	<.001	.84 (.78, .91)***	<.001	.93 (.83, 1.04)	.431
3	.55 (.45, .68)***	<.001	.70 (.62, .79)***	<.001	.79 (.66, .95)*	.012

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	Model 1			Model 2		
	Incarceration vs. completion		Other reasons vs. completion	Incarceration vs. other reasons		
	RRR	p-value	RRR	RRR	p-value	p-value
Current IV drug use	1.27 (1.16, 1.39)***	<.001	1.05 (.99, 1.12)	1.21 (1.12, 1.30)***	<.001	<.001
Comorbid psychiatric condition	1.09 (.99, 1.18)*	.093	1.09 (1.03, 1.16)***	.99 (.91, 1.06)	.723	.723

*
p < .05,
**
p < .01,

p < .001.