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## The association of psychiatric comorbidity with treatment completion among clients admitted to substance use treatment programs in a U.S. national sample

Noa Krawczyk<sup>a,\*</sup>, Kenneth A. Feder<sup>a</sup>, Brendan Saloner<sup>a</sup>, Rosa M. Crum<sup>a,b,c</sup>, Marc Kealhofer<sup>b</sup>, and Ramin Mojtabai<sup>a,c</sup>

<sup>a</sup>Department of Mental Health, Johns Hopkins Bloomberg School of Public Health, 624 North Broadway, Baltimore, MD 21205, USA

<sup>b</sup>Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, 615 N Wolfe St., Baltimore, MD 21205, USA

<sup>c</sup>Department of Psychiatry and Behavioral Sciences, Johns Hopkins University School of Medicine, 1800 Orleans St., Baltimore, MD 21287, USA

### Abstract

**Background**—Psychiatric disorders are highly comorbid with substance use disorders and play an important role in their course and recovery. However, the impact of comorbidity on treatment outcomes has not been examined in a U.S. national sample. This study explores the impact of psychiatric comorbidity on treatment completion among individuals admitted to publicly funded substance use treatment facilities across the United States.

**Methods**—Using data on first-time treatment episodes in the U.S. from the Treatment Episode Dataset-Discharges (TEDS-D) for the years 2009–2011, logistic regression was used to assess the association between psychiatric comorbidity and treatment non-completion, and Cox proportional hazards regression was used to assess the association between comorbidity and rate of attrition. Analyses were performed for all substances together and then stratified by primary substance of abuse (alcohol, cannabis, stimulants, or opioids).

**Results**—Of 856,385 client treatment episodes included in our analysis, 28% had a psychiatric comorbidity and 38% did not complete treatment. After adjusting for socio-demographic and treatment characteristics, clients with psychiatric comorbidity had higher odds of not completing treatment relative to those without comorbidity [OR = 1.28 (1.27–1.29)], and had an earlier time to attrition [HR = 1.14 (1.13–1.15)]. Psychiatric comorbidity was most strongly associated with

\*Corresponding author at: Department of Mental Health, Johns Hopkins Bloomberg School of Public Health, 624 N Broadway, Room 888, Baltimore, MD 21205, USA. noa.krawczyk@jhu.edu, noakra@jhu.edu (N. Krawczyk).

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treatment non-completion and rate of attrition in those admitted primarily for alcohol [OR = 1.37 (1.34–1.39); HR = 1.19 (1.17–1.21), respectively].

**Conclusions**—Individuals with psychiatric comorbidities receiving treatment for substance use disorders face unique challenges that impact their ability to complete treatment. The findings call for further efforts to integrate treatment for psychiatric comorbidities in substance use treatment settings.

### Keywords

Substance use treatment; Comorbidity; Treatment retention; Mental health integration; Drug treatment; Alcohol treatment

## 1. Introduction

The successful retention of individuals who suffer from substance use disorders (SUDs) in treatment and long-term recovery remains a persistent challenge. Indeed, many authors have pointed to the need to improve the quality and effectiveness of existing treatment programs and systems to address the varied needs of patients (Pating et al., 2012; Watkins et al., 2015; Saloner and Sharfstein, 2016). A particularly relevant factor in addressing the needs of this patient population is the high prevalence of comorbid psychiatric conditions.

Epidemiological studies have repeatedly pointed to comorbidities between substance use disorders and mood, anxiety, and personality disorders, in particular (Lai et al., 2015). Comorbidity of substance use and mental health disorders have also been found to be highly prevalent among treatment-seeking populations, (McGovern et al., 2006) with adults more often experiencing co-occurring internalizing disorders and adolescents more often experiencing externalizing disorders (Chan et al., 2008).

Individuals with SUDs who have psychiatric comorbidities not only experience barriers that impact access to care (Mojtabai et al., 2014), but also have more difficulty integrating into existing treatment and recovery programs (Torrens et al., 2012; Urbanoski et al., 2007). Clients with co-occurring psychiatric comorbidities are likely to experience more severe clinical, social, and legal problems than the general population, and may thus require more specialized care than what is typically available in substance use treatment programs (Cacciola et al., 2001; McGovern et al., 2006; Torrens et al., 2012). Studies that explore the relationship between psychiatric comorbidity and treatment outcomes among drug and alcohol users often find that psychiatric disorders are associated with lower treatment retention and poorer outcomes (Bradizza et al., 2006; Compton et al., 2003; Ouimette et al., 1999). Similar findings have been reported for substance using adolescents with comorbid psychiatric disorders (Tomlinson et al., 2004). Nevertheless, the impact of psychiatric comorbidity on substance use outcomes is not always consistent and may vary by sex, the type and severity of comorbidity, substance use type, and treatment setting (Choi et al., 2015; Compton et al., 2003; Mertens and Weisner, 2000; Polcin et al., 2015). Past research on the association of psychiatric comorbidities with substance use treatment outcomes has been mainly limited to small samples and select treatment programs. Studies have yet to examine these associations at a national level in the United States and explore variations in this association by the type of substance of use. Greater understanding of the impact of

psychiatric comorbidities on treatment completion in the U.S. as a whole, and variations in these associations may have implications for national policies and design of services.

The current study addresses this need by exploring differences in treatment completion patterns among individuals with and without psychiatric problems using three years of U.S. national data on substance use treatment episodes from the Treatment Episode Dataset (TEDS). The study further examines whether comorbidity has a differential effect on treatment completion for different classes of substances, specifically alcohol, cannabis, stimulants, and opioids.

## 2. Material and methods

### 2.1. Source of data

Data on treatment episodes were obtained for the years 2009, 2010, and 2011 from the Treatment Episode Dataset-Discharges (TEDS-D), a database of substance use treatment episodes in the United States. The TEDS is managed by the Substance Abuse and Mental Health Services Administration (SAMHSA) and includes information regarding admissions and discharges from treatment programs that receive public funding throughout the 50 U.S. States, the District of Columbia and Puerto Rico. This dataset includes information from the large majority of programs that provide treatment for substance use in the United States, but does not include data from settings that are entirely dependent on private revenue or, in most cases, treatment occurring in hospitals or correctional settings (SAMHSA, Center for Behavioral Health Statistics and Quality, 2016).

We limited our analyses to records from the TEDS in which clients had no prior treatment episodes so that each record represents a unique episode for a client. Furthermore, we removed all detoxification treatment episodes from the analysis as they are shorter and serve the purpose of stabilizing, not treating patients for substance use disorders. This approach is consistent with other studies that have removed detoxification episodes when evaluating factors associated with treatment completion in the TEDS (Saloner et al., 2014; Sahker et al., 2015). For the sake of completeness, sensitivity analyses were conducted including detoxification episodes and this had no effect on results of the analyses (results not shown). Analyses were also limited to those who presented to treatment primarily for problems related to alcohol, cannabis, stimulants and opioids; treatments for other substances made up only 2% of treatment episodes and were excluded. Finally, we excluded eight states that did not report the psychiatric comorbidity variable to TEDS: Connecticut, Georgia, Minnesota, Oregon, Texas, Vermont, Virginia, and Nevada, and a ninth state as an extreme outlier, Michigan, which only reported 0.31% treatment episodes as having a psychiatric comorbidity.

### 2.2. Measures

Our primary outcome of interest was treatment non-completion, which we defined as a binary variable of having a treatment episode marked with a discharge reason of “left against professional advice,” “terminated by facility,” or “incarcerated.” Treatment episodes in the reference category were those with discharge reasons marked as “treatment completed,” or

“transferred to another treatment program or facility.” The 5% of the clients who died during treatment or who did not have a defined reason for discharge were excluded. Our primary independent variable was having a comorbid psychiatric problem, which was defined by an indicator in the TEDS as “having a psychiatric problem in addition to an alcohol or drug use problem.” The assessment of comorbidity in the TEDS is based on clinical diagnoses, screening results, claims information, or self-report (TEDS State Instruction Manual: SAMHSA, Center for Behavioral Health Statistics and Quality, 2014). Depending on the state, specific guidelines to be used at each facility are determined either at the state or facility level, and information on specific states can be accessed from the TEDS central base (Crosswalk: SAMHSA, Center for Behavioral Health Statistics and Quality, 2016).

To attempt to isolate the impact of having a psychiatric problem on the odds of non-completion, we adjusted for several potentially confounding socio-demographic and treatment characteristics including age group, sex, race/ethnicity, educational attainment, marital status, employment status, number of substances of abuse reported at admission, source of referral (self/individual, criminal justice, health/substance use provider, community organization, school/employer), and primary drug of abuse (alcohol, cannabis, stimulants, opioids). To control for different treatment settings and types of programs we also adjusted for type of treatment facility that included either non-intensive outpatient (ambulatory services for individual, family or group treatment, or pharmacological therapies), intensive outpatient (ambulatory services for two or more hours per day on three or more days per week, partial hospitalization), hospital residential (24-h medical care in a hospital facility in conjunction with substance use treatment services), short-term residential (30-days or less of non-acute care in a setting with treatment services for substance use), and long-term residential (more than 30 days of non-acute care in a setting with treatment services for substance use and including transitional living/halfway houses). Due to the variation in treatment conditions as well as the classification of comorbidity within different states, we also included state fixed effects using dummy variables for each state in which the episode took place.

### 2.3. Data analysis

A total of 856,385 treatment episodes with information on all independent and dependent variables of interest were included in the complete case analyses. First, we compared individuals with and without psychiatric comorbidity in our sample by examining which characteristics had a greater than 5 percentage point risk difference, which is consistent with thresholds that other authors have used to assess clinically meaningful risk differences in the large TEDS datasets (Marie et al., 2015; Sahker et al., 2015). Statistical significant differences were assessed using chi-square tests. To control for confounding by variables that were associated with psychiatric comorbidity in our sample and that also have been identified in the literature as associated with treatment completion, we used multiple logistic regression to examine the association between psychiatric comorbidity and odds of non-completion, adjusting for state and all demographic and treatment characteristics described above. We also conducted a sensitivity analysis to test whether this association differed between high-comorbidity reporting states and low-comorbidity reporting states by

stratifying states based on reporting high or low prevalence of psychiatric comorbidity based on the median prevalence of comorbidity across states (28.8%).

Next, we used Cox proportional hazards regression to assess the association between psychiatric comorbidity and time to treatment attrition among those who did not complete treatment. Cox proportional hazards models are used to analyze time-to-event data. These models estimate the relative increase or decrease in the rate of event associated with risk factors. Exponentiated Cox regression coefficients are interpreted as hazard ratios –in this study, the time-specific rate ratio of treatment attrition among individuals with comorbidity relative to those without comorbidity. We used a log plot of survival to assure the proportional hazards assumption was met and the Breslow method to handle tied failure times (Breslow, 1974).

Analyses were performed first using all substances and then completed separately for alcohol, cannabis, crack/cocaine, methamphetamine/other stimulants, heroin and other opiates. Heroin and other opiate treatment episodes were further stratified by whether medication assisted treatment (MAT) was included in the client's treatment plan, in response to prior research showing that MAT is effective for persons both with and without psychiatric comorbidity (Maremmani et al., 2000). Due to some missing data on variables of interest that were excluded by using the complete-case analysis (see Appendix Table I for details on missing variables) we performed additional sensitivity analyses on the logistic and Cox regressions by imputing all missing data on independent variables using Multiple Imputation by Chained Equations (White et al., 2011). Lastly, to explore whether specific reasons for non-completion differed based on comorbidity status, a supplemental analysis examined relative risk of non-completion by specific discharge reason using multinomial logistic regression. This analysis was conducted for all substances and then stratified by each substance as outlined above. All analyses were conducted using STATA version 14 (StataCorp, 2014).

### 3. Results

#### 3.1. Sample characteristics

Of the clients whose treatment episodes were included in the complete case analysis, 28% were registered as having a psychiatric problem in addition to a substance use problem. The prevalence of psychiatric comorbidity in individual states ranged between 8% and 62%, indicating substantial reporting and coding variation depending on the state. Overall, 38% of the sample did not complete treatment. Frequency of reasons for non-completion included leaving against professional advice (72%), being terminated by the facility (23%), and being incarcerated (5%). Among those in the reference category, clients either fully completed their treatment regimen (71%) or were transferred to continue treatment at another institution or facility (29%). The prevalence of the outcome of treatment non-completion among people without psychiatric comorbidity was 36%, compared to 42% among people with psychiatric comorbidity. Among individuals without psychiatric comorbidity, the median length of treatment was 90 days, which was greater than the median length of treatment of 60 days among people with psychiatric comorbidity. However, median length of treatment did not differ by psychiatric comorbidity status among those who did not complete

treatment (both groups had a median of 60 treatment days) or among those in the reference category (both groups had a median of 90 treatment days).

The frequency distribution of socio-demographic and substance use characteristics of the clients by report of psychiatric comorbidity is presented in Table 1 (state variables are not shown). Clients with a psychiatric problem differed by more than 5 percentage points from those without a psychiatric problem in that they were more often female, white, less likely to be employed, more likely to report using at least three substances at treatment admission, more likely to be referred by an individual or a health/substance use provider, less likely to be referred by the criminal justice system, and less likely to be in non-intensive outpatient care.

### 3.2. Associations with treatment attrition

Table 2 presents the results of the logistic and Cox regression analyses by psychiatric comorbidity, for all substances and stratified by primary substance for which clients sought treatment. After adjusting for socio-demographic and treatment characteristics, clients in treatment for any substance who had psychiatric comorbidity had a higher odds of not completing treatment (OR = 1.28 (1.27–1.29), and also an earlier time to attrition (HR = 1.14 (1.13–1.15)) than their counterparts without psychiatric comorbidity. Stratifying by primary substance of abuse revealed that these associations were strongest for clients who were primarily seeking treatment for alcohol use [OR = 1.37 (1.34–1.39); HR = 1.19 (1.17–1.21)]. The association was positive but somewhat weaker for cannabis [OR = 1.24 (1.22–1.27); HR = 1.11 (1.10–1.13)], as well as for stimulants [OR = 1.21 (1.17–1.25); HR = 1.12 (1.10–1.15)], with no significant differences observed when stimulant users were stratified by crack/cocaine and methamphetamine/other stimulant use. Among individuals in treatment for opioids without MAT, the association was weaker but remained statistically significant [OR = 1.14 (1.10–1.17); HR = 1.06 (1.04–1.08)], with no significant differences observed when stratified by heroin and other opiate users. The only treatment episodes in which there was no association between comorbidity and odds of non-completion and a very weak association for hazard of treatment attrition were for those in treatment for opioids that utilized medication-assisted treatment [OR = 1.00 (0.93–1.08); HR = 1.06 (1.02–1.10)], with no differences observed between heroin and other opiate use.

Because of prior literature indicating differences by sex for psychiatric and substance use comorbidity (Grant et al., 2004; Husky et al., 2008; Ross, 1995), we further tested a comorbidity-by-sex interaction term to assess whether there was a differential association between psychiatric comorbidity and treatment completion among men and women. No appreciable sex differences were observed (results not shown). In the supplemental analysis using multinomial logistic regression, we found that persons with psychiatric comorbidity were more likely not to complete treatment because they were more likely to either become incarcerated, or leave against professional advice. This was true for clients in treatment for all substances with the exception of those in treatment for opioids on MAT, who were somewhat less likely to leave for any of the reasons as compared to those without comorbidity. Findings are presented in Appendix Table II. Sensitivity analyses of the logistic and Cox regressions using multiply imputed data are presented in Appendix Table III. Using

multiply imputed data did not change the direction or magnitude of the associations. In testing whether the association between comorbidity and treatment non-completion differed based on state prevalence, a significant association was observed between psychiatric comorbidity and treatment non-completion across both high comorbidity reporting states (OR = 1.24 (1.22–1.26)) and low comorbidity reporting states (OR = 1.32 (1.30–1.33)).

#### 4. Discussion

In this study based on data from substance use treatment facilities across the United States, we observed a modest but significant association between psychiatric comorbidity and treatment non-completion. This remained true after controlling for a multitude of potential demographic and treatment-related confounders. Clients with psychiatric comorbidity also had an earlier time to treatment attrition with shorter lengths of treatment. As staying in treatment for longer has been associated with better post-treatment outcomes (Conners et al., 2006; Greenfield et al., 2004; Morandi et al., 2016), it is concerning that clients who have comorbid psychiatric problems, and who may need greater support, are being lost faster from treatment. Our results also suggest that the probability of treatment non-completion and the specific reasons for treatment non-completion varied according to the primary substance use disorders for which the clients received treatment. Such differences may be expected given the distinct characteristics of different SUDs and the differential interactions that substances can have with comorbid psychiatric disorders (Todd et al., 2002). This finding highlights the need to distinguish between the types of substances involved when assessing treatment outcomes in epidemiologic studies as well as the importance of considering the heterogeneous needs of patients with different types of co-occurring disorders when designing programs to address these conditions.

We found the strongest association between psychiatric comorbidity and treatment attrition among clients who were primarily in treatment for alcohol use. This is consistent with previous studies conducted with individuals in treatment for alcohol use disorders, in which comorbidities –including anxiety, major depression and antisocial personality disorder – were major risk factors for relapse to alcohol use and other negative outcomes (Bobo et al., 1998; Bradizza et al., 2006; Driessen et al., 2001; Kranzler et al., 1996). The impact of comorbidity was still strong, although somewhat less pronounced, for individuals admitted for cannabis use treatment. Although cannabis use has been linked to the presence of several types of comorbid psychiatric disorders (Hasin et al., 2016), the impact of such comorbidity on substance use treatment outcomes has not been fully explored. The impact of psychiatric comorbidity was somewhat less pronounced for those in treatment primarily for stimulant use, regardless of being admitted primarily for cocaine/crack or for methamphetamine and other stimulants. Nonetheless, we found higher odds of treatment non-completion and earlier time to attrition, consistent with other studies that have found psychiatric comorbidity to increase risk of treatment attrition and other negative outcomes among clients with stimulant use disorders (Glasner-Edwards et al., 2009; Glasner-Edwards et al., 2010; Gonzalez-Saiz et al., 2014; Levin et al., 2004).

The impact of psychiatric comorbidity on treatment outcomes for opioid use are particularly relevant, considering the substantial rise in opioid use disorders and opioid-related overdose

deaths in the U.S., and the urgent calls for the expansion of effective treatment systems for opioid use disorders (Jones et al., 2015; Rudd et al., 2016; Saloner and Sharfstein, 2016). Interestingly, while there was a small association of psychiatric comorbidity with treatment non-completion among individuals in opioid use treatment programs that did not utilize MAT, we found that among clients admitted primarily for opioid use disorders that utilize MAT, there was no association of comorbidity with treatment non-completion or time to attrition, regardless of being primarily admitted for heroin or other opiates. This corroborates other studies that have shown that MAT may be as effective a treatment for clients with opioid use disorders regardless of the presence of psychiatric comorbidity (Maremmani et al., 2008; Pani et al., 2011), even though the integrated presence of psychiatric care may still lead to better treatment retention and mental health outcomes (King et al., 2014). MAT has been increasingly recommended in the treatment of opioid use disorders, and our findings lend further support to its use (Connery, 2015; Jerry and Collins, 2013). It is noteworthy that the prevalence of MAT among those in treatment for opioid use disorder was only 23%, underscoring the need for further expansion of access to this treatment option.

The findings from the current analyses of national-level data in the U.S. corroborate previous research indicating that individuals with comorbid psychiatric problems may be at higher risk of not completing recommended treatment regimens (Bradizza et al., 2006; Compton et al., 2003; Tomlinson et al., 2004; Urbanoski et al., 2007). Patients with co-occurring disorders experience a plethora of obstacles that may make them less likely to complete treatment, ranging from greater severity and longer chronicity of mental and substance use disorders (Kessler, 2004), to experiencing higher rates and severity of other medical conditions (De Hert et al., 2015). Patients with co-occurring disorders also experience greater social adversities, which also challenges their ability to succeed in required treatment regimens (Torrens et al., 2012). Lack of training among providers in treating patients with co-occurring disorders and stigma may further lower quality of care and jeopardize the success of treatment (Todd et al., 2002).

Evidence demonstrates that due to these conditions, clients with co-occurring disorders benefit from programs that have greater levels of integration of substance use and mental health services (Drake et al., 2004; Torrens et al., 2012). Yet, integrating substance use and mental health care remains a challenge due to the historical separation of systems of care, funding streams, and treatment ideologies that have limited coordination between services and providers (Mason et al., 2016). Despite the recent expansion of training materials, such as SAMHSA's Substance Abuse Treatment for Persons with Co-occurring Disorders, Treatment Improvement Protocols (TIPs) (Substance Abuse and Mental Health Services Agency, 2016), only a minority of substance use treatment facilities offer comprehensive mental health care services that meet the needs of their clients (Mauro et al., 2016; Mojtabai, 2004).

Our findings additionally highlight the inconsistent measurement of psychiatric comorbidity within substance use treatment facilities: Several states in the TEDS database did not report comorbidity at all and there was wide variation in comorbidity rates among those states that did report this variable, indicating differences in screening methods to determine the presence of psychiatric comorbidity. Other studies have also found low rates of screening for



psychiatric comorbidity in substance use treatment programs: a recent analysis found that while approximately 88% of facilities that participated in the 2012 National Survey of Substance Abuse Treatment Services reported having clients with co-occurring mental health and substance use disorders, as many as 29% do not have screening procedures for psychiatric disorders (Mauro et al., 2016). Requiring more thorough mental health screening and assessment in substance use facilities is fundamental both for record keeping and for the design of appropriate clinical interventions to address the needs of patients.

The current study has several limitations. First, the 28% comorbidity rate found in this sample overall is lower than what has been reported in other studies of clients admitted to treatment for substance use (Chan et al., 2008; McGovern et al., 2006). This may be accounted for in part by the fact that clients with no prior treatment episodes had lower rates of comorbidity than those with prior treatment episodes who were excluded from the analysis (results not shown). Thus, the generalizability of the results may be limited to those with no prior treatment episodes. In addition, variation in the prevalence of psychiatry comorbidity across states suggests variations in ascertainment methods, and this measure likely captures individuals with more severe psychiatric symptoms. Nevertheless, it is noteworthy that the association between psychiatric comorbidity and treatment non-completion was observed in both high and low comorbidity reporting states, supporting the validity of the results. Third, we were unable to control for variation at the level of individual facilities. The TEDS includes treatment episodes from heterogeneous types of treatment facilities across the United States, each with its own requirements and length of treatment. Although we attempted to control for facility and geographic variability by adjusting for state of residence, type of treatment facility, and length of treatment by calculating time-specific hazard ratios for attrition, there may be residual confounding by characteristics that are specific to individual facilities. Lastly, information on specific type of psychiatric comorbidity, as well as duration of substance use and severity of both substance and psychiatric symptoms, was not available in the TEDS, and therefore could not be included in our analyses as potential confounders. However, we did attempt to address severity of substance use by holding constant the number of substances used at the time of admission and by only analyzing first-time treatment episodes.

## 5. Conclusion

This research is relevant in highlighting the need for appropriate and integrated care to address the needs of patients with co-occurring mental health and substance use disorders. Treatment services need to include methods to properly diagnose and address the unique needs of patients with mental disorders, while also providing resources to improve retention in care and ultimately treatment success in this group of clients. Recent healthcare reforms have motivated the integration of substance use, mental health and primary care services and improvement of training for providers to address multiple client needs (Huskamp and Iglehart, 2016). It is important that we continue prioritizing the integration of care and monitoring trends in outcomes as initiatives are implemented in the coming years.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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## Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.drugalcdep.2017.02.006>.

**Table 1**

Sociodemographic and substance use characteristics of study population (N = 856,385).

	Psychiatric Comorbidity (28.21%)	No Psychiatric Comorbidity (71.79%)	Total
Age, years (%)			
12–17	14.11	12.73	13.98
18–24	21.85	25.74	24.79
25–34	27.35	27.71	27.66
35–44	18.35	16.89	17.28
45–54	14.03	12.67	13.05
55+	4.31	4.25	4.25
Sex (%)			
Male	<b>56.26</b>	72.50	67.73
Female	<b>43.74</b>	27.50	32.27
Race/Ethnicity (%)			
Non-Hispanic White	<b>69.18</b>	57.73	61.20
Non-Hispanic Black/African American	<b>17.01</b>	25.41	23.20
Hispanic	9.30	12.08	10.94
Am. Indian/Alaska Nat.	1.99	1.60	1.68
Asian/Hawaiian/Pac. Is.	0.79	1.58	1.31
Non-Hispanic	0.74	0.40	0.52
Non-Hispanic Other	1.00	1.21	1.15
Education Level (%)			
Primary or less	9.60	8.48	8.67
Some high school	30.03	31.52	31.09
High School	35.80	38.26	37.85
Some college	19.06	17.18	17.64
College and above	5.51	4.56	4.74
Marital Status (%)			
Unmarried	84.79	83.96	84.33
Married	15.21	16.04	15.67
Employment Status (%)			
Currently Employed	<b>22.88</b>	34.06	30.57
Currently Not Employed	<b>77.12</b>	65.94	69.43
Homeless Status (%)			
Not Homeless	92.73	95.15	94.47
Currently Homeless	7.27	4.85	5.53
Number of Substances Reported at intake (%)			
1	<b>39.71</b>	51.62	48.41
2	33.55	31.52	32.07
3	<b>26.75</b>	16.86	19.52
Mode of Referral to Treatment (%)			
Self/Individual	<b>27.67</b>	20.31	22.52

	Psychiatric Comorbidity (28.21%)	No Psychiatric Comorbidity (71.79%)	Total
Criminal Justice	<b>36.19</b>	55.71	49.64
Health/Subst. use provider	<b>18.77</b>	8.08	11.74
Community organization	15.40	12.66	13.27
School/Employer	1.98	3.23	2.82
Treatment Facility Type (%)			
Non-Intensive outpatient	<b>64.94</b>	71.18	69.50
Intensive outpatient	16.02	13.35	14.07
Hospital residential	0.63	0.11	0.25
Short-term residential	12.26	10.20	10.76
Long-term residential	6.15	5.15	5.42
Primary Substance for which admitted (%)			
Alcohol	39.41	43.12	42.13
Cannabis	29.83	32.13	31.46
Stimulants	13.99	11.31	11.89
Opioids (receiving non- MAT)	13.74	10.81	11.69
Opioids (receiving MAT)	3.03	2.63	2.83

**Note:** Differences greater than 5% points are considered clinically significant and marked by bold lettering. All characteristics differed across groups at  $p < 0.001$

**Table 2**

Results of multivariable logistic and Cox regression models for the association of psychiatric comorbidity with odds and hazard ratios for treatment non-completion by specific substances and type of opioid treatment.

	Odds Ratio	95% Confidence Interval	Hazard Ratio	95% Confidence Interval
All Substances (N = 856,385)	1.28 *	1.27–1.29	1.14 *	1.13–1.15
Alcohol (N = 360,301)	1.37 *	1.34–1.39	1.19 *	1.17–1.21
Cannabis (N = 269,619)	1.24 *	1.22–1.27	1.11 *	1.10–1.13
Stimulants (N = 103,344)	1.21 *	1.17–1.25	1.12 *	1.10–1.15
Crack/Cocaine (N = 61,235)	1.22 *	1.18–1.27	1.11 *	1.08–1.14
Methamphetamine/other stimulants (N = 42,109)	1.18 *	1.13–1.24	1.14 *	1.10–1.18
Opioids, non-MAT (N = 99,646)	1.14 *	1.10–1.17	1.06 *	1.04–1.08
Heroin (N = 36,240)	1.12 *	1.07–1.18	1.06 **	1.02–1.10
Other opiates (N = 63,406)	1.16 *	1.11–1.20	1.06 *	1.03–1.09
Opioids, MAT (N = 23,475)	1.00	0.93–1.07	1.06 **	1.02–1.10
Heroin (N = 12,483)	1.02	0.92–1.14	1.07 **	1.02–1.13
Other opiates (N = 10,988)	0.99	0.89–1.10	1.04	0.98–1.11

Notes: Logistic and Cox regression models are adjusted for age, sex, race/ethnicity, education, employment, homelessness, marital status, substance type, referral source, type of treatment facility, state and number of substances of abuse reported at admission.

MAT = Medication Assisted Treatment, in which the use of Methadone or Buprenorphine is part of client's treatment plan.

\* Denotes statistical significance at the  $p < 0.001$  level.

\*\* Denotes statistical significance at the  $p < 0.05$  level.