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Risk Factors for Overdose in Treatment-Seeking Youth with Substance Use Disorders

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Abstract

Objective—Overdoses (OD) are among the leading causes of death in youth with substance use disorders (SUDs). We aimed to identify the prevalence of OD and characteristics associated with a history of OD in youth presenting for SUD outpatient care.

Methods—Systematic retrospective medical record review of consecutive psychiatric and SUD evaluations for patients age 16 to 26 years at entry into an outpatient SUD treatment program for youth. Unintentional OD was defined as substance use without intention of self-harm that was associated with a significant impairment in level of consciousness. Intentional OD was defined as ingestion of a substance that was reported as a suicide attempt. T-tests, Pearson's chi-square, and Fisher's exact tests were performed to evaluate characteristics associated with a history of OD.

Results—We examined the medical records of 200 patients (157 males and 43 females) with mean age 20.2 (\pm) 2.8 years. At intake 58 patients (29%) had a history of OD and 62% of those patients had a history of unintentional OD only (n=36). Youth with 2 SUDs were 3 times more likely to have a history of OD compared to youth with 1 SUD (all $p < 0.05$). Compared to those without a history of OD those with an OD were more likely to be female and have lifetime

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histories of: alcohol, cocaine, amphetamine, anxiety, depressive, and/or eating disorders (all $p < 0.05$).

Conclusion—High rates of OD exist in treatment-seeking youth with SUD. OD was associated with more SUD and psychiatric co-morbidity.

Keywords

substance use disorder; overdose; youth; psychiatric

INTRODUCTION

There has been a substantial increase in non-fatal and fatal overdoses (OD) in the United States over the past fifteen years.^{1,2} In 2014 there were approximately 1.5 times more drug OD deaths in the United States than deaths from motor vehicle accidents.² Similar to general population trends, poisoning deaths among adolescents increased by 91% between 2000 and 2009.³ Most ODs occur in individuals with substance use disorders (SUDs) and over half of individuals medically hospitalized in 2010 for an unintentional alcohol or drug poisoning had a SUD.⁴

A growing literature has identified risk factors associated with OD in adults including nonmedical use of prescription opioids and heroin,^{3,5–8} benzodiazepine use,^{6,8} and history of OD.^{9,10} Psychiatric risk factors associated with OD in substance users include depression¹¹ and increased impulsivity.¹² Likewise, a history of a suicide attempt has also been associated with history of OD in substance users^{5,13,14} although many of the studies that examined this relationship did not evaluate for differences related to the intentionality of the OD.^{5,12,13}

To our knowledge, only one previous study has focused specifically on risk factors associated with a history of OD in youth with substance misuse. Silva and colleagues found 24% of 596 urban youth 16 to 25 years of age with a history of nonmedical use of prescription opioids and/or tranquilizers had a lifetime history of OD involving prescription medication.¹⁵ Substance specific factors associated with an increased risk for OD included histories of being prescribed a tranquilizer, intranasal opioid use, injecting tranquilizers, and past 90 day injection drug use. Psychiatric symptoms and disorders were not assessed in this study; however, patients with a history of psychiatric hospitalization were at increased risk for OD. While informative, this community study of youth with prescription medication misuse may not generalize to SUD treatment-seeking youth, and psychiatric disorders were not systematically assessed.

Given the high rates of OD in young people, an increased knowledge of risk factors for OD in youth with SUD is critical to help focus screening and guide interventions directed at preventing OD. The main aims of this study were to examine the prevalence of OD and characterize substance and psychiatric risk factors associated with a history of OD among treatment-seeking youth with SUDs. Secondly, we aimed to distinguish differences in the characteristics and correlates between unintentional and intentional OD in this sample. We hypothesized that more severe SUD would be associated with a history of OD. We also

hypothesized that individuals with a history of a mood disorder and/or a psychiatric disorder associated with impulsivity, such as attention deficit hyperactivity disorder (ADHD), would be more likely to have a history of OD compared to those without those respective disorders.

METHODS

We conducted a systematic retrospective medical chart review of consecutive intake assessments between January 2012 and June 2013 completed at the Addiction Recovery Management Service (ARMS), an outpatient SUD treatment program in a major northeast metropolitan medical center for youth 14 to 26 years of age.¹⁶ Patients seen in the ARMS program had a semi-structured assessment for SUD and psychiatric disorders including self-report of addiction severity (the Leeds Dependence Questionnaire (LDQ))¹⁷ that were documented in standardized templates. The intake assessment was completed by a multidisciplinary team including masters-level social workers, psychologists, and psychiatrists with additional credentialing in Addiction Care. All cases were reviewed by the clinical and medical directors who were both trained in child psychology and psychiatry with additional training and certification in addiction. For patients with more than one intake assessment during this time period, only the first initial intake assessment was included. Inclusion criteria included youth 16 to 26 years of age¹⁸ at intake assessment who had a diagnosis of SUD (substance abuse or dependence, DSM-IV-TR criteria). Patient records were excluded if they did not meet criteria for SUD, were outside the inclusion age range, or had an incomplete record. Permission to conduct this study was obtained from the Partners Human Research Committee Institutional Review Board, which approved the study as providing adequate protection for human subjects.

Data extracted from patients' clinical records included demographics, characteristics of their substance use, lifetime SUD diagnoses, SUD treatment history, lifetime diagnoses of psychiatric disorders, psychiatric treatment history, OD history, and the type of substance ingested in the OD. Consistent with prior work,^{9,19,20} unintentional OD was defined as substance use without intention of self-harm that was associated with significant impairment in level of consciousness. Intentional OD was defined as ingestion of any substance with the deliberate intention of self-harm²¹ that was reported as a suicide attempt.

Statistical Analyses

Comparisons were made between patients with no history of OD and histories of OD, unintentional OD, and intentional OD. In the event of missing data, subjects were excluded only from those analyses of outcomes for which they were missing. Patients with a history of both unintentional and intentional OD were included in the intentional OD group for purposes of analysis. We analyzed continuous outcomes using Student's independent t-tests for parametric data and Wilcoxon rank-sum tests for nonparametric data. Binary outcomes were analyzed using Pearson's chi-square tests or Fisher's exact tests if any cell had an expected value less than five. In the event of zero cells, we added 0.5 to all cells to calculate the odds ratio. We also performed stepwise logistic regression (backwards selection, $p = 0.05$ for removal) starting with models that included all significant outcomes from the bivariate analyses to identify the best predictors of OD. All tests were two-tailed and performed at the

0.05 alpha level using Stata® (Version 14). All data are presented as percentages, absolute numbers, or mean \pm standard deviation (SD) unless otherwise described.

RESULTS

The medical records for 243 consecutive initial intake assessments were examined. Forty-three records were excluded because they were outside the inclusionary age range (n=21), a prior initial evaluation had already occurred outside the study timeframe (n=12), had an incomplete medical record (n=6), or did not meet criteria for a SUD (n=4). The full data set was available for 151 out of 200 patients. Among the patients with missing information, 69.4% (n=34) were only missing one data point.

Rates of OD

The lifetime prevalence of OD involving any substance was 29% (n=58). Among patients with a history of OD, 62% (n=36) had an unintentional OD only, 31% (n=18) had an intentional OD only, and 7% (n=4) had both unintentional and intentional OD. Among those with a history of OD, 41% (n=24) had a history of more than one OD.

Demographics

We tested for demographic differences between patients with no history of OD and those with histories of OD, unintentional OD, and intentional OD (Table 1). Compared to patients without OD those with a history of OD and intentional OD were more likely to be female (both $p < 0.001$). There was no significant difference in sex between patients with no history of OD and history of unintentional OD ($p > 0.05$). Furthermore, there were no significant differences between groups in race or mean age at initial evaluation.

In examining demographic differences between the unintentional and intentional OD groups, those with a history of intentional OD were more likely to be female ($p = 0.009$). There were no differences between the unintentional and intentional OD groups in race or age at initial evaluation ($p > 0.05$). There was a non-significant trend that patients with history of intentional OD had their first OD at a younger age compared to those with a history of unintentional OD (17.3 ± 3.1 years vs. 19.0 ± 2.8 years, $p = 0.06$). Age of first OD was unknown for 2 of the patients with intentional OD and 10 patients with unintentional OD.

Substances Ingested in OD

We evaluated for differences in the substances ingested in reported ODs between the unintentional and intentional groups (Table 2). Alcohol and cocaine were significantly more likely to be involved in unintentional ODs compared to intentional ODs (both $p < 0.05$). Over the counter and prescription medications were significantly more likely to be involved in intentional OD compared to unintentional OD (both $p < 0.05$).

OD risk relative to number of SUD diagnoses

We evaluated the risk for OD relative to the number of SUD diagnoses. Patients with 2 or more SUDs were approximately 3 times more likely to have a history of OD compared to patients with 1 SUD (2 SUDs: 37% vs. 15%; OR=3.19; 95% CI: 1.40, 7.25; $p = 0.005$; 3

SUDs: 37% vs. 15%; OR=3.21; CI: 1.20, 8.57; p=0.02; 4 SUDs: 37% vs. 15%; OR=3.28; CI: 1.28, 8.38; p=0.01).

SUD and Psychiatric Characteristics Associated with OD

We examined if there were specific SUD and psychiatric characteristics linked to OD (Table 3). We found that a history of OD was associated with more severe addiction and higher rates of psychopathology. Those with a history of OD had more severe SUD as measured by the LDQ compared to those without a history of OD (11.0 ± 7.9 vs. 8.6 ± 6.9 ; $z=1.98$; $p=0.05$). Information for the LDQ was not available for 3 patients. Those with a history of OD versus those without were more likely to have an alcohol, cocaine, or amphetamine use disorder (all $p < 0.01$). Those with a history of OD were also more likely to have histories of intravenous drug use, SUD-related medication assisted treatment, and blackouts compared to those without a history of OD (all $p < 0.05$). Those with a history of OD also had higher rates of depressive, anxiety, and eating disorders (all $p < 0.05$), and were more likely to have histories of self-injurious behavior, suicide attempt, psychiatric hospitalization, and emotional, physical, or sexual abuse (all $p < 0.05$) compared to those without OD.

Results from our stepwise logistic regression identified histories of alcohol use disorder, eating disorder, blackouts, intravenous drug use, and psychiatric hospitalization as the best predictors of having a history of OD (all $p < 0.05$). Youth with these characteristics were 2 to 5 times more likely to have a history of OD.

Unintentional Versus Intentional OD

Examining only those patients with a history of OD we tested for differences in SUD and psychiatric characteristics associated with unintentional versus intentional OD. While there were no differences in SUD variables between those with unintentional and intentional OD (all $p > 0.05$) those with an intentional OD had more severe psychopathology. Patients with an intentional OD compared to those with an unintentional OD were more likely to have a history of self-injurious behavior (73% vs. 25%; OR=8.00; 95% CI: 2.40, 26.7; $p < 0.001$) and prior inpatient treatment (82% vs. 36%; OR=7.96; 95% CI: 2.22, 28.6; $p < 0.001$).

DISCUSSION

In a systematic retrospective review of consecutive intakes from an outpatient SUD treatment program we found that 29% of youth aged 16 to 26 years of age had a history of OD. Our data supports the hypothesis that OD is associated with more severe SUD and psychopathology. OD risk was directly related to the number of SUD diagnoses. Our findings of specific drug and psychopathology-related risk factors partially support our hypothesis— whereas alcohol, cocaine, and amphetamine use disorders were associated with OD there were no meaningful associations found with opioid or benzodiazepine use disorders. Similarly, while depressive, anxiety, and eating disorders were associated with OD, no associations were observed with ADHD or other impulse-related psychopathology. Individuals with intentional OD had more severe psychopathology than those with unintentional OD. These data suggest the need to carefully screen for OD and associated risk factors during intake assessment for SUD.

The prevalence of lifetime history of OD in our sample (29%) was reminiscent of the prevalence of lifetime history of OD in two other studies with similar mean sample ages (21 and 21.5 years of age).^{15,22} The marginal differences in prevalence may have been related to the study population sampled. Silva and colleagues¹⁵ may have found a lower prevalence of OD (23%) since they only queried youth about OD due to prescription opioids and/or tranquilizers. It is less likely that our inclusion of intentional OD as part of the assessment of prevalence of OD contributed to differences in prevalence with the Silva and colleagues sample since they did not assess intentionality when querying youth about their OD history. Mills and colleagues²² may have found a higher prevalence of OD (41%) since all participants were presenting for treatment for heroin dependence and the majority had a history of intravenous use. Independent of these differences, overall our retrospective analysis and the broader literature suggest OD is a common phenomenon among treatment-seeking youth. More research is needed to assess the incidence and mitigation of OD risk in youth longitudinally.

The three-fold increased risk for OD associated with patients who have more than one SUD is noteworthy and suggests that the number of SUD diagnoses may be a marker of SUD severity that is meaningful in the assessment of OD risk. Our results support findings by Bohnert and colleagues¹³ who found that adults seeking treatment for the use of 2 or more substances had an increased risk for a history of OD and a history of having both an OD and a suicide attempt. More research is needed to clarify if the increased risk for OD associated with more than one SUD is related to polysubstance use or SUD severity.

In general, we found that youth with alcohol, cocaine, or amphetamine use disorders as well as those with more severe SUD were at increased risk for OD. Alcohol and cocaine have been identified as risk factors for OD in several studies. Among patients with intravenous substance use, alcohol use,^{6,9,23} binge drinking,^{24,25} cocaine use,⁹ and intravenous use of cocaine^{6,19,24} were associated with increased risk for OD. Interestingly, the risk for OD associated with amphetamine use has been less commonly examined but regular use of amphetamines has been previously identified as a risk factor for OD in patients seeking SUD treatment.^{26,27}

The association found between depressive disorders and a history of OD and in particular, intentional OD in youth, is consistent with previous literature in adults linking elevated risk for OD with major depression.¹¹ Our findings of an association between anxiety disorders and a history of OD and intentional OD are similar to work by Maloney and colleagues¹² with adults with opioid use disorders. They found that anxiety disorders were linked with a history of suicide attempt but not with unintentional OD.¹² Maloney and colleagues also reported an association between impulsivity and unintentional OD which was a finding hypothesized but not found in our current study. Our findings may have differed because we did not evaluate symptoms of impulsivity at initial evaluation and only assessed for a lifetime history of impulsivity related psychopathology. Our findings coupled with the existing literature support the importance of assessing for depressive and anxiety disorders when assessing OD risk.

Although limited by small sample size, our findings linking eating disorders with all types of OD and the identification of eating disorder as the most significant predictor of OD is a novel but not surprising finding. SUDs commonly co-occur with eating disorders²⁸ with one report highlighting drug-related OD to be the most common method of suicide attempt among a sample of women referred for outpatient eating disorder treatment.²⁹ If replicated, it would be helpful to identify the mechanism linking OD and eating disorders in youth.

We found intriguing differences between those with intentional and unintentional ODs. Youth with a history of intentional OD had more severe psychopathology and a younger age of first OD than those with unintentional OD. Interestingly, there were no significant differences in SUD diagnoses or SUD characteristics between the groups. These findings are similar to work by Best and colleagues, who in a sample of adults receiving methadone maintenance, reported no difference in heroin use among those with and without intentional OD.³⁰ Those with intentional OD, however, endorsed greater symptoms of psychopathology, increased depressive symptoms, relative to those with unintentional OD.³⁰

Although not an *a priori hypothesis* we did examine for sex differences and found females were more likely to have a history of OD and more intentionality associated with the OD compared to males. Our findings are similar to others⁶ who found women were at increased risk to have a history of OD. In contrast, Pabayo and colleagues²⁴ did not find a difference in the prevalence of OD between adult men and women, but did find that women but not men with several sources of social support were significantly less likely to have a history of OD at baseline and through follow up. More work is needed to examine sex differences in risk for OD with particular attention to intentionality and age.

There are several methodological limitations of our study which are important to consider when making any generalizations from the findings. Our data were derived retrospectively in a systematic review of consecutive medical records. Our data were also derived from treatment-seeking youth and may not generalize to youth not seeking treatment. We describe a heterogeneous sample and some of the cell sizes were small limiting our power. Since our sample was mostly Caucasian the findings may not generalize to other ethnic groups.

Despite these limitations, our findings from treatment-seeking youth with SUD suggest that OD is common and begins relatively early. Youth with more lifetime SUD diagnoses and psychopathology are at increased risk for OD. Amid the opioid epidemic clinicians who work with youth need to assess for other substances such as alcohol and stimulants that were found to be associated with increased risk for OD. Similarly, it seems parsimonious to assess for psychiatric risk factors when determining OD risk in SUD youth. Future studies should also examine the effect of treatment longitudinally in mitigating the risk for subsequent OD.

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References

1. Unick GJ, Rosenblum D, Mars S, Ciccarone D. Intertwined epidemics: national demographic trends in hospitalizations for heroin- and opioid-related overdoses, 1993-2009. *PLoS One*. 2013; 8(2):e54496. [PubMed: 23405084]
2. Rudd RA, Aleshire N, Zibbell JE, Gladden RM. Increases in Drug and Opioid Overdose Deaths—United States, 2000-2014. *MMWR Morb Mortal Wkly Rep*. 2016; 64(50-51):1378–1382. [PubMed: 26720857]
3. Gilchrist J, Ballesteros MF, Parker EM. Vital Signs: Unintentional Injury Deaths Among Persons Aged 0-19 Years — United States, 2000-2009 U.S. Department of Health and Human Services: Centers for Disease Control and Prevention; 2012
4. Yoon YH, Chen CM, Yi HY. Unintentional alcohol and drug poisoning in association with substance use disorders and mood and anxiety disorders: results from the 2010 Nationwide Inpatient Sample. *Inj Prev*. 2014; 20(1):21–28. [PubMed: 23710064]
5. Hakansson A, Schlyter F, Berglund M. Factors associated with history of non-fatal overdose among opioid users in the Swedish criminal justice system. *Drug Alcohol Depend*. 2008; 94(1-3):48–55. [PubMed: 18082338]
6. Kerr T, Fairbairn N, Tyndall M, et al. Predictors of non-fatal overdose among a cohort of polysubstance-using injection drug users. *Drug Alcohol Depend*. 2007; 87(1):39–45. [PubMed: 16959438]
7. Warner M, Chen LH, Makuc DM, Anderson RN, Minino AM. Drug poisoning deaths in the United States, 1980-2008. *NCHS Data Brief*. 2011; (81):1–8.
8. Jones CM, McAninch JK. Emergency Department Visits and Overdose Deaths From Combined Use of Opioids and Benzodiazepines. *Am J Prev Med*. 2015; 49(4):493–501. [PubMed: 26143953]
9. Coffin PO, Tracy M, Bucciarelli A, Ompad D, Vlahov D, Galea S. Identifying injection drug users at risk of nonfatal overdose. *Acad Emerg Med*. 2007; 14(7):616–623. [PubMed: 17554010]
10. Darke S, Marel C, Mills KL, et al. Patterns and correlates of non-fatal heroin overdose at 11-year follow-up: findings from the Australian Treatment Outcome Study. *Drug Alcohol Depend*. 2014; 144:148–152. [PubMed: 25278146]
11. Bartoli F, Carra G, Brambilla G, et al. Association between depression and non-fatal overdoses among drug users: a systematic review and meta-analysis. *Drug Alcohol Depend*. 2014; 134:12–21. [PubMed: 24210424]
12. Maloney E, Degenhardt L, Darke S, Nelson EC. Are non-fatal opioid overdoses misclassified suicide attempts? Comparing the associated correlates. *Addict Behav*. 2009; 34(9):723–729. [PubMed: 19447563]
13. Bohnert AS, Roeder KM, Ilgen MA. Suicide attempts and overdoses among adults entering addictions treatment: comparing correlates in a U.S. National Study. *Drug Alcohol Depend*. 2011; 119(1-2):106–112. [PubMed: 21715108]
14. Bradvik L, Frank A, Hulenvik P, Medvedeo A, Berglund M. Heroin addicts reporting previous heroin overdoses also report suicide attempts. *Suicide Life Threat Behav*. 2007; 37(4):475–481. [PubMed: 17896887]

15. Silva K, Schragger SM, Kecojevic A, Lankenau SE. Factors associated with history of non-fatal overdose among young nonmedical users of prescription drugs. *Drug Alcohol Depend.* 2013; 128(1-2):104–110. [PubMed: 22974490]
16. Wilens TE, McKowen J, Kane M. Transitional-aged youth and substance use: teenaged addicts come of age. *Contemporary Pediatrics.* 2013
17. Raistrick D, Bradshaw J, Tober G, Weiner J, Allison J, Healey C. Development of the Leeds Dependence Questionnaire (LDQ): a questionnaire to measure alcohol and opiate dependence in the context of a treatment evaluation package. *Addiction.* 1994; 89(5):563–572. [PubMed: 8044122]
18. Wilens TE, Rosenbaum JF. Transitional aged youth: a new frontier in child and adolescent psychiatry. *J Am Acad Child Adolesc Psychiatry.* 2013; 52(9):887–890. [PubMed: 23972688]
19. Jenkins LM, Banta-Green CJ, Maynard C, et al. Risk factors for nonfatal overdose at Seattle-area syringe exchanges. *J Urban Health.* 2011; 88(1):118–128. [PubMed: 21246299]
20. Grau LE, Green TC, Torban M, et al. Psychosocial and contextual correlates of opioid overdose risk among drug users in St. Petersburg, Russia. *Harm Reduct J.* 2009; 6:17. [PubMed: 19630963]
21. Griffin E, Corcoran P, Cassidy L, O'Carroll A, Perry IJ, Bonner B. Characteristics of hospital-treated intentional drug overdose in Ireland and Northern Ireland. *BMJ Open.* 2014; 4(7):e005557.
22. Mills KL, Teesson M, Darke S, Ross J, Lynskey M. Young people with heroin dependence: findings from the Australian Treatment Outcome Study (ATOS). *J Subst Abuse Treat.* 2004; 27(1): 67–73. [PubMed: 15223096]
23. Bazazi AR, Zelenev A, Fu JJ, Yee I, Kamarulzaman A, Altice FL. High prevalence of non-fatal overdose among people who inject drugs in Malaysia: Correlates of overdose and implications for overdose prevention from a cross-sectional study. *Int J Drug Policy.* 2015; 26(7):675–681. [PubMed: 25532449]
24. Pabayo R, Alcantara C, Kawachi I, Wood E, Kerr T. The role of depression and social support in non-fatal drug overdose among a cohort of injection drug users in a Canadian setting. *Drug Alcohol Depend.* 2013; 132(3):603–609. [PubMed: 23647731]
25. Seal KH, Kral AH, Gee L, et al. Predictors and prevention of nonfatal overdose among street-recruited injection heroin users in the San Francisco Bay Area, 1998-1999. *Am J Public Health.* 2001; 91(11):1842–1846. [PubMed: 11684613]
26. Rossow I, Lauritzen G. Balancing on the edge of death: suicide attempts and life-threatening overdoses among drug addicts. *Addiction.* 1999; 94(2):209–219. [PubMed: 10396789]
27. Gossop M, Stewart D, Treacy S, Marsden J. A prospective study of mortality among drug misusers during a 4-year period after seeking treatment. *Addiction.* 2002; 97(1):39–47. [PubMed: 11895269]
28. The National Center on Addiction and Substance Abuse CASAC Conference New York, NY: 2003 Food For Thought: Substance Abuse and Eating Disorders.
29. Corcos M, Taieb O, Benoit-Lamy S, Paterniti S, Jeammet P, Flament MF. Suicide attempts in women with bulimia nervosa: frequency and characteristics. *Acta Psychiatr Scand.* 2002; 106(5): 381–386. [PubMed: 12366473]
30. Best D, Gossop M, Man L, Finch E, Greenwood J, Strang J. Accidental and deliberate overdose among opiate addicts in methadone maintenance treatment: are deliberate overdoses systematically different? *Drug Alcohol Rev.* 2000; 19:213–216.

Table 1

Demographic characteristics of subjects with no history of overdose (OD) and history of OD including both unintentional OD and intentional OD

	No Overdose (OD) n=142	Any OD n=58	Unintentional OD n=36	Intentional OD n=22
Age at Initial Evaluation, mean \pm SD, years	20.0 \pm 2.7	20.7 \pm 2.9	20.6 \pm 2.9	20.7 \pm 2.9
Female Gender, n (%)	21 (15)	22 (38)*	9 (25)	13 (59)*
Caucasian, n (%) ⁺⁺	126/138 (91)	51/56 (91)	31/34 (91)	20 (91)

* p<0.05 when compared to subjects with no history of OD

⁺⁺ full data set not available for race

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Table 2

Substances ingested in all reported overdoses (OD) (n=92)

	Unintentional OD (n=55)	Intentional OD (n=37)	Test Statistic	P-Value
	n (%)	n (%)		
Alcohol	28 (51)	7 (19)	$\chi^2 = 9.60$	0.002
Opioids	15 (27)	6 (16)	$\chi^2 = 1.54$	0.22
Cocaine	7 (13)	0	Fisher's exact	0.03
Benzodiazepines	6 (11)	6 (16)	$\chi^2 = 0.55$	0.46
Over the counter medication	2 (4)	13 (35)	$\chi^2 = 16.1$	<0.0001
Prescription medication *	1 (2)	10 (27)	Fisher's exact	0.0004
Other	2 (4)	0	Fisher's exact	0.51
Unknown	5 (9)	6 (16)	$\chi^2 = 1.07$	0.30

* Does not include prescription opioids or benzodiazepines

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Table 3

Odds ratios (OR) and 95% Confidence Intervals (CI) depicting the bivariate associations of substance use disorder (SUD) and psychiatric characteristics between subjects with a history of (h/o) any overdose (OD), unintentional OD, and intentional OD, compared to patients with no h/o OD.

Variable	Any OD (n=58)	Unintentional OD (n=36)	Intentional OD (n=22)
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Lifetime SUD Diagnosis			
Alcohol	3.06 (1.49, 6.26)**	2.39 (1.05, 5.45)*	5.05 (1.42, 17.8)**
Cannabis	0.60 (0.31, 1.13)	0.49 (0.23, 1.04)	0.84 (0.32, 2.21)
Opioid	1.22 (0.65, 2.28)	1.38 (0.66, 2.90)	0.99 (0.39, 2.52)
Cocaine	2.75 (1.25, 6.02)**	2.24 (0.75, 6.23)	3.64 (1.09, 11.4)*
Benzodiazepine	1.99 (0.79, 5.02)	2.16 (0.61, 6.83)	1.70 (0.28, 7.17)
Amphetamine	2.87 (1.24, 6.64)**	2.81 (0.92, 8.17)*	2.89 (0.72, 10.1)
SUD Characteristics (h/o)			
Abstinence	2.88 (0.82, 10.19)	5.73 (0.85, 247)	1.44 (0.30, 13.9)
Intravenous drug use	2.26 (1.06, 4.83)*	2.85 (1.21, 6.72)**	1.44 (0.32, 5.05)
Inpatient detoxification	1.62 (0.80, 3.24)	1.71 (0.76, 3.89)	1.46 (0.43, 4.37)
Medication Assisted Treatment	2.40 (1.11, 5.18)*	1.97 (0.78, 4.98)	3.18 (0.96, 9.78)
Withdrawal symptoms	1.48 (0.77, 2.86)	1.47 (0.68, 3.20)	1.50 (0.55, 4.11)
Blackouts	3.22 (1.46, 7.13)**	3.79 (1.38, 10.4)**	2.52 (0.80, 7.96)
Lifetime Psychiatric Diagnosis			
Attention Deficit Hyperactivity	0.79 (0.43, 1.47)	0.86 (0.41, 1.80)	0.69 (0.28, 1.70)
Anxiety	2.11 (1.11, 4.00)*	1.82 (0.85, 3.87)	2.74 (1.01, 7.41)*
Depressive	2.38 (1.28, 4.44)**	1.88 (0.90, 3.92)	3.60 (1.38, 9.39)**
Bipolar	1.46 (0.58, 3.70)	1.14 (0.26, 3.97)	2.02 (0.44, 7.44)
Mood (not otherwise specified)	1.01 (0.39, 2.58)	1.18 (0.32, 3.70)	0.74 (0.08, 3.51)
Psychosis	0.34 (0.01, 2.74)	0.25 (0.01, 4.44)	0.92 (0.02, 7.77)
Eating	5.65 (1.66, 22.2)**	5.41 (1.28, 24.0)**	5.98 (1.08, 30.7)*
Psychiatric Characteristics (h/o)			
Self-Injurious Behavior	2.50 (1.31, 4.79)**	1.10 (0.47, 2.57)	8.81 (3.19, 24.3)***
Suicide Attempt	11.3 (4.66, 27.5)***	0.49 (0.01, 3.90)	712 (39.9, 12,773)***
Psychiatric Medication	2.28 (0.89, 5.84)	1.32 (0.5, 3.47)	12.0 (0.71, 204)
Mental Health Treatment	2.08 (0.68, 6.42)	1.23 (0.37, 5.34)	7.11 (0.41, 121)
Psychiatric Hospitalization	3.14 (1.66, 5.93)**	1.55 (0.71, 3.36)	12.3 (3.92, 38.7)***
Abuse (emotional, physical, and/or sexual)	2.36 (1.21, 4.57)**	1.60 (0.70, 3.62)	4.18 (1.65, 10.6)***

* p<0.05;

** p 0.01;

*** p 0.001

Sample sizes for variables with missing information: abstinence (185), withdrawal symptoms (184), blackouts (192), suicide attempt (199), psychiatric medication (197), abuse (196).

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