Lifetime non-fatal overdose experiences among at-risk adolescents and young adults in the emergency department with past-year opioid use in the USA

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ABSTRACT

Background Adolescents and young adults with risk factors for opioid misuse and opioid use disorder are at elevated risk for overdose. We examined prior non-fatal overdose experiences among at-risk adolescents/young adults to inform prevention efforts.

Methods Adolescents/young adults (ages 16–30) in two US emergency departments self-reporting past year opioid misuse or opioid use plus a misuse risk factor completed a baseline survey as part of an ongoing randomised controlled trial. We describe baseline factors associated with (a) overall non-fatal overdose experiences and (b) groups based on substance(s) used during the worst overdose experience.

Results Among 771 participants (27.9% male), 40.7% reported a non-fatal overdose experience. Compared with those without a prior overdose experience, those with prior overdose experience(s) were less likely to be heterosexual, and more likely to report a prior suicide attempt and greater peer substance misuse. Regarding the worst overdose experience, substance(s) included: 36.6% alcohol only, 28.0% alcohol and cannabis, 22.6% alcohol with other substance(s) and 12.7% other substance(s) only (eg, opioids). Compared with the alcohol only group, the alcohol and cannabis group were younger and less likely to be heterosexual; the alcohol with other substance(s) group were older and had greater peer substance misuse; and the other substance(s) only group were more likely to be male, receive public assistance, screen positive for anxiety and less likely to be heterosexual.

Conclusions Among at-risk adolescents/young adults, findings support the need for tailored overdose prevention efforts based on substance(s) used, with consideration of sexuality, mental health and peer substance use.

Trial registration number NCT04550715.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Adolescents and young adults have lifetime non-fatal overdose experience rates of 24%–48%, increasing risk for future overdoses and/or the development of substance use disorders.

WHAT THIS STUDY ADDS

⇒ Adolescent and young adult overdose experiences were primarily related to alcohol use, although polysubstance use was also involved, with age, sexuality and mental health factors associated with a higher likelihood of an overdose experience.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Scalable substance use prevention approaches, with consideration of age, sexuality and mental health, are needed to reduce risk for consequences, including fatal overdoses.

INTRODUCTION

Overdose prevention is a public health priority in the USA where there has been a 28.5% increase in overdose deaths in 2021 from 2020.[1] Most US overdose deaths (~70%) involve opioids (ie, prescription opioids, heroin, illegally manufactured fentanyl).[2 3] However, other substances are often involved, with up to 80% of overdose deaths involving polysubstance use (more than one substance),[4] particularly alcohol.[5 6] Substance use often begins in adolescence and reaches peak prevalence during young adulthood, a key developmental transition into independence when adolescents and young adults are also developing their social relationships, and related aspects such as sexual identities.[7 8] Although overdose prevention efforts, such as behavioural and medication treatments for substance use disorders (SUDs) and provision of naloxone are critical, there remains a critical need for prevention efforts.[9] Substance use interventions initiated during the adolescent and young adult developmental period may help prevent negative consequences, including non-fatal overdoses and escalation of SUDs.

To inform these interventions, there is a need to understand characteristics of non-fatal overdose experiences among adolescents and young adults. For every overdose death, there are many more non-fatal overdose experiences, with a 2019 systematic review noting lifetime non-fatal overdose experience rates of 24%–48% among adolescents and young adults, though severity of substance use and reported symptoms varied in reviewed articles.[10] Further limitations of previous work include a lack of detail regarding the characteristics (ie, symptoms, disposition) and substances involved in the worst overdose experience, as well as a broader array of associated risk and protective factors (eg,

peer substance use).[10 11] Prior overdose prevention interventions for adults have focused on identifying signs and symptoms of non-fatal overdoses,[12] and understanding how adolescents and young adults experience these events (eg, symptoms, intentionality) could aid in developing interventions tailored for this population.

Here, we conducted secondary analyses of baseline data collected as part of a randomised control trial (RCT) to examine characteristics of self-reported lifetime non-fatal overdose experiences among adolescents and young adults (ages 16–30) recruited in a US emergency department (ED) setting who screened at-risk for opioid misuse/opioid use disorder (OUD). In addition to providing descriptive information to characterise prior non-fatal overdose experiences among this sample, we examined correlates of overdose experiences using a social-ecological lens of risk and protective factors (eg, sociodemographics, substance use, mental health and social influences).[7] Based on work focused on factors associated with opioid use and/or overdose among young people,[7 8 10 13 14] we hypothesised that those with overdose experiences would be disproportionally of a non-heterosexual identity, have greater social and individual risk factors (ie, familial and peer substance use, mental health indicators) and have fewer protective factors (ie, social support).

METHODS

Study design and setting:

This paper presents baseline data (January 2021–December 2022) from an ongoing RCT testing opioid prevention interventions among ED patients (see published protocol in Bonar *et al*[15] and online supplemental appendix 1). With IRB approval (IRB #HUM00177625; ClinicalTrials.gov registration NCT04550715), adolescents and young adults presenting for care in two academic EDs in Ann Arbor, Michigan, USA (one paediatric and one adult) were recruited for the RCT either in-person during the ED visit or, initially due to COVID-19 restrictions, remotely after the visit.

Participant recruitment

Patients were eligible for screening regardless of chief complaint, except for those presenting with acute sexual assault or suicidality (given receipt of behavioural services); additional exclusions were non-English speaking, current pregnancy or cancer diagnosis/treatment. After providing assent (ages 16–17) and/or consent (parent of minor or adult) either during the ED visit or remotely after the visit, participants self-administered a ~5 min computerised screening survey for RCT eligibility, which included past 12-month opioid misuse (prescription or illicit) or prescription opioid use plus a risk factor (ie, past 3-month use of cannabis or illicit drugs, other prescription drug misuse, binge drinking; past 2-week depression or suicidal ideation or past-year suicide attempt) selected per a scoping review.[7] Those reporting injection drug use or screening as high risk for an OUD (ie, NIDA-Modified ASSIST V2 score of 27+[16–19]) were excluded and offered referral to services. After providing RCT assent/consent, enrolled participants self-administered a computerised baseline survey either during the ED visit or remotely after the visit (initially US$40 compensation; raised to US$50 in October 2022) and received a resource brochure and a medication disposal bag. Here, we focus on baseline data collected among those enrolled in the RCT.

Patient/public involvement

Patients and/or the public were not involved in the specific analysis reported in this paper. However, participants did provide the data examined in the study, and their data were deidentified and stored on secure IRB-approved servers only accessible to members of the study team to ensure privacy.[15]

Measures

Given funding was part of the US National Institute of Health's (NIH) Helping to End Addiction Long-term (HEAL) Prevention Cooperative (HPC), some measures were modified for standard use across HPC sites (if modified, noted as 'HPC').[20]

Helping to End Addiction Long-term® Initiative

Sociodemographics

Age, biological sex, sexual identity, race, ethnicity and receipt of public assistance (yes/no) were measured using HPC items and prior work.[21–23] Race/ethnicity was collapsed to indicate whether the respondent was non-Hispanic white (vs other). Sexual identity was categorised as 'heterosexual identity' versus 'other sexual identity' (eg, gay/lesbian, bisexual, asexual, questioning or other identity) for analysis.

Lifetime non-fatal overdose experiences

Based on prior work,[24] we queried overall overdose experiences with the item, 'How many times have you taken more drugs, alcohol and/or medications than your body could handle?', which was designed to be inclusive (eg, high sensitivity), as adolescents and young adults may not identify some non-fatal experiences as an 'overdose' and other definitions are not inclusive of polysubstance use, including alcohol use,[24] despite the role of other substances and alcohol in overdoses.[4] The primary dependent variable was any overdose experience dichotomised as'yes/no' for analysis (non-zero responses coded as 'yes').

Lifetime worst Ooverdose experience

Participants with any prior overdose experiences completed additional questions about their 'worst experience when they felt the sickest from taking too much drugs, alcohol or medications/pills[24]': (a) Substances they took (eg, alcohol; cannabis; prescription opioids, sedatives or stimulants; illicit drugs); (b) Symptoms experienced, categorised based on clinical judgement and previous literature[24] as follows: high-risk alterations in mental status (eg, no memory of event), high-risk physical symptoms (eg, difficulty breathing), low-risk alterations in mental status (eg, hallucinations), low-risk physical symptoms (eg, vomiting); (c) disposition, included someone calling 911, going to the ED, admitted to the hospital or waking up without help and (d) Intent categorised as: (1) on purpose; I wanted to die (ie, suicide attempt), (2) on purpose; I did not care about the risks (ie, ambivalent intent), (3) accidentally; I did not know what the effect would be; (4) accidentally; I lost track of the amount; (5) accidentally; I combined alcohol and/or other drugs or (6) unsure; 'accidental' responses were combined.[24]

The secondary dependent variable focused on substance use groups reported during the worst overdose experience, created per prior work[24 25]: alcohol only, alcohol and cannabis only, alcohol in combination with other substances (eg, cannabis could be included in this category if used with another substance (eg, alcohol, cannabis and opioid)), and other substance(s) only (eg, single substance alone or combination, excluding alcohol).

Table 1 Total sample characteristics and unadjusted comparisons of sociodemographic, social and mental health factors among those with and without lifetime non-fatal overdose experiences (N=771), 2021–2022, USA

	Total N=771 N%/M (SD)	No non-fatal overdose experience n=457 (59.3%) n%/M (SD)	Prior non-fatal overdose experience n=314 (40.7%) n%/M (SD)	Unadjusted OR (95% CI)
Sociodemographics				
Age	23.7 (3.6)	23.8 (3.6)	23.6 (3.6)	0.98 (0.94 to 1.02)
Male sex (vs female)	215 (27.9%)	130 (28.5%)	85 (27.1%)	0.93 (0.68 to 1.29)
Heterosexual identity (vs other sexual identity)	505 (65.5%)	317 (69.4%)	188 (59.9%)	0.66 (0.49 to 0.89)
White, non-Hispanic (vs other race/ethnicity)	496 (64.3%)	284 (62.1%)	212 (67.5%)	1.27 (0.94 to 1.71)
Receives public assistance (vs none)	214 (27.8%)	132 (28.9%)	82 (26.1%)	0.87 (0.63 to 1.20)
Social factors				
History of familial substance misuse** (vs none)	456 (59.1%)	250 (54.7%)	206 (65.6%)	1.58 (1.17 to 2.13)
Peer substance misuse score***†	4.7 (3.4)	4.1 (3.2)	5.6 (3.5)	1.14 (1.09 to 1.19)
Social support score‡	7.7 (2.4)	7.8 (2.4)	7.7 (2.3)	0.98 (0.92 to 1.04)
Mental health factors				
Positive depression screen* (vs negative)§	351 (45.5%)	191 (41.8%)	160 (51.0%)	1.45 (1.08 to 1.93)
Positive anxiety screen** (vs negative)¶	301 (39.0%)	159 (34.8%)	142 (45.2%)	1.55 (1.15 to 2.08)
Suicide attempt (lifetime)*** (vs none)	83 (10.8%)	34 (7.4%)	49 (15.6%)	2.30 (1.45 to 3.66)

*p<0.05.
**p<0.01.
***p<0.001.
†Higher M score (range 0–24) indicates more peer substance misuse.
‡Higher M score (range 1–10) indicates more peer and/or family social support.
§PHQ-8 with score >10 positive for at least moderate depression risk in the past 2 weeks.
¶GAD-7 with score >10 positive for at least moderate anxiety disorder risk in the past 2 weeks.
GAD-7, Generalised Anxiety Disorder-7; M, mean; OR, odds ratio; PHQ-8, Patient Health Questionnaire-8.

Social factors

Familial substance misuse was assessed (ie, 'Have any of your blood-related relatives had a significant drinking or drug use problem that did or should have led to treatment?'); response choices included eight people, with any 'yes' reported as positive and dichotomised as 'yes/no' for analysis (HPC item). Peer substance misuse included eight items examining the number of friends that use each substance at least once a month, and once a week, separately (ie, 5 or more drinks in a sitting, cannabis use, misuse of prescription opioids, heroin use), which were summed with higher scores (0–24) indicating greater peer substance misuse.[26] We assessed past month social support ((ie, how supportive and helpful were people important to you (friends/family) using a 1–10 ruler with anchors 'not at all' to 'extremely') via a single item.[8]

Mental health factors

The Patient Health Questionnaire-8[27] and Generalised Anxiety Disorder-7[28] screened for past 2-week depression and anxiety symptoms. Each tool was dichotomised to indicate a positive (>10) or negative screen (<10) for either depression or anxiety. A single item adapted from the Columbia-Suicide Severity Rating Scale behaviour scale[29 30] assessed a lifetime history of suicide attempt (yes/no).

Analysis

Data were analysed with SAS V.9.4. First, we calculated descriptive information and unadjusted bivariate associations (eg, χ^2) between participants with and without an overdose experience in relation to demographics, social factors and mental health factors. Then, we used a logistic regression analysis to examine overall overdose experience history in relation to demographics, social factors and mental health factors, chosen based on prior work.[7] Due to collinearity with anxiety screening, depression screening was excluded from adjusted analyses.

Second, among those with a prior overdose experience, we described characteristics of the worst overdose experience, including substances used, disposition and intent. Also, we divided the sample of those with an overdose experience (n=314) based on substance(s) used during worst experience: alcohol only, alcohol and cannabis only, alcohol with other substances and other substance(s) only. Then, we compared these groups using unadjusted, bivariate analyses based on demographics, social factors and mental health factors (eg, ANOVA, χ^2). Finally, we conducted multinomial logistic regression analyses for the substance use groups (with alcohol only as the reference group). Due to collinearity with anxiety screening, depression screening was excluded from adjusted analyses.

Table 2 Logistic regression examining factors associated with prior lifetime non-fatal overdose experiences (N=771), 2021–2022, USA

	Adjusted OR (95% CI)
Sociodemographics	
Age	1.00 (0.96–1.05)
Male sex (vs female)	0.99 (0.70 to 1.40)
Heterosexual identity* (vs other sexual identity)	0.72 (0.53 to 0.99)
White, non-Hispanic (vs other race/ethnicity)	1.12 (0.81 to 1.55)
Receives public assistance (vs none)	0.82 (0.58 to 1.16)
Social factors	
History of familial substance misuse (vs none)	1.27 (0.93 to 1.75)
†Peer substance misuse score***	1.14 (1.09 to 1.19)
‡Social support score	1.03 (0.96 to 1.10)
Mental health factors	
§Positive anxiety screen (vs negative)	1.35 (0.97 to 1.88)
Suicide attempt (lifetime)** (vs none)	2.02 (1.22 to 3.33)

*p<0.05.
**p<0.01.
***p<0.001.
†Higher M score (range 0–24) indicates more peer substance misuse.
‡Higher M score (range 1–10) indicates more peer and/or family social support.
§GAD-7 with score >10 positive for at least moderate anxiety disorder risk in the past 2 weeks.
GAD-7, Generalised Anxiety Disorder-7; OR, Odds Ratio.

RESULTS

Characteristics of study participants

Among 5129 screened, 1104 (21.5%) were eligible, with 771 (69.8% of eligible) completing the baseline survey and randomised into the RCT. The mean age was 23.7 years (SD=3.6), 27.9% were male, 65.5% identified as heterosexual, 64.3% non-Hispanic white and 27.8% receiving public assistance (table 1).

Overall overdose experiences: prevalence and risk/protective factors

Notably, 314 participants (40.7%) reported a lifetime non-fatal overdose experience (M=3.3 (range 1–10+), SD=1.8). Although there were no significant bivariate differences based on overall overdose experiences for most sociodemographic characteristics or social support (see table 1), those reporting any prior overdose experiences were less likely than those not reporting overdose experiences to identify as heterosexual, and were more likely to report familial substance use, a lifetime suicide attempt, greater peer substance misuse and to screen positive for depression and anxiety disorders.

In the logistic regression model (table 2), those reporting overdose experiences were less likely to identify as heterosexual, have greater peer substance use and were more likely to report a lifetime suicide attempt than those without an overdose experience.

Worst overdose experience: substance use groups and characteristics

Regarding the worst overdose experience, 87.2% involved alcohol, either alone or in combination with another substance (table 3), with the sample grouped into these categories: 36.6% alcohol only, 28.0% alcohol and cannabis, 22.6% alcohol with other substance(s) and 12.7% other substance(s) only. Specifically, substances used prior to the worst experience for the alcohol and other substances group included: 64.8% cannabis, 47.9% prescription opioids, 46.5% other illicit drugs, 46.5% prescription sedatives, 31.0% hallucinogens, 26.8% cocaine,

Table 3 Characteristics of worst overdose experience symptoms by overdose substance group (n=314), 2021–2022, USA

Symptoms	Alcohol only n=115 (36.6%) n (%)	Alcohol and cannabis n=88 (28.0%) n (%)	Alcohol and other substances n=71 (22.6%) n (%)	Other substances (no alcohol) n=40 (12.7%) n (%)
High risk: alteration in mental status				
Awake, but no memory of what happened***	65 (56.5%)	57 (64.7%)	52 (73.2%)	13 (32.5%)
Lost consciousness*	32 (27.8%)	25 (28.4%)	35 (49.2%)	14 (35.0%)
Could not be woken up	12 (10.4%)	8 (9.0%)	16 (22.5%)	7 (17.5%)
High risk: physical symptoms				
Collapsed*	10 (8.6%)	8 (9.0%)	16 (22.5%)	9 (22.5%)
Skin turned blue or pale*	5 (4.3%)	8 (9.0%)	9 (12.6%)	8 (20.0%)
Difficulty breathing***	7 (6.0%)	10 (11.3%)	17 (23.9%)	12 (30.0%)
Had convulsions*	0 (0.0%)	4 (4.5%)	5 (7.0%)	3 (7.5%)
Had a heart attack	0 (0.0%)	0 (0.0%)	2 (2.8%)	2 (1.5%)
Low risk: alteration in mental status				
Had hallucinations***	5 (4.3%)	15 (17.0%)	26 (36.6%)	10 (25.0%)
Low risk: physical symptoms				
Vomiting/nausea*	111 (96.5%)	86 (97.7%)	69 (97.1%)	35 (87.5%)
Heart beating fast/slow***	18 (15.6%)	35 (39.7%)	43 (60.6%)	20 (50.0%)
Was shaking***	21 (18.2%)	18 (20.5%)	38 (53.5%)	22 (55.0%)
Had a fever/felt too cold***	11 (9.5%)	12 (13.6%)	23 (32.3%)	10 (25.0%)

*p<0.05.
**p<0.01.
***p<0.001.

Table 4 Sample characteristics and unadjusted comparisons of sociodemographic, social and mental health factors comparisons among those with lifetime non-fatal overdose experiences based on substance(s) used in the worst experience (n=314), 2021–2022, USA

	Alcohol only n=115 (36.6%) n (%)	Alcohol and cannabis n=88 (28.0%) n (%)	Alcohol and other substances n=71 (22.6%) n (%)	Other substances (no alcohol) n=40 (12.7%) n (%)
Sociodemographics				
Age***	23.7 (3.7)	22.4 (3.1)	24.9 (3.9)	23.5 (3.1)
Male sex (vs female)	30 (26.1%)	23 (26.1%)	16 (22.5%)	16 (40.0%)
Heterosexual identity* (vs other sexual identity)	79 (68.7%)	46 (52.3%)	45 (63.4%)	18 (45.0%)
White, non-Hispanic (vs other race/ethnicity)	80 (69.6%)	61 (69.3%)	41 (57.8%)	30 (75.0%)
Receives public assistance** (vs none)	20 (17.4%)	21 (23.9%)	24 (33.8%)	17 (42.5%)
Social factors				
History of familial substance misuse (vs none)	72 (62.6%)	59 (67.1%)	50 (70.4%)	25 (62.5%)
†Peer substance misuse score**	5.0 (3.1)	5.7 (3.1)	6.9 (4.2)	4.9 (3.6)
†Social support score*	7.9 (2.3)	8.0 (2.0)	6.9 (2.7)	7.5 (2.3)
Mental health factors				
§Positive depression screen** (vs negative)	47 (40.9%)	42 (47.7%)	44 (62.0%)	27 (67.5%)
¶Positive anxiety screen* (vs negative)	42 (36.5%)	38 (43.2%)	38 (53.5%)	24 (60.0%)
Suicide attempt (lifetime) (vs none)	14 (12.2%)	14 (15.9%)	11 (15.5%)	10 (25.0%)

*p<0.05.
**p<0.01.
***p<0.001.
†Higher M score (range 0–24) indicates more peer substance misus.
†Higher M score (range 1–10) indicates more peer and/or family social support.
§PHQ-8 with score ≥10 positive for at least moderate depression risk in the past 2 weeks.
¶GAD-7 with score >10 positive for at least moderate anxiety disorder risk in the past 2 weeks.
GAD-7, Generalised Anxiety Disorder-7; PHQ-8, Patient Health Questionnaire-8.

25.4% prescription stimulants, 9.9% heroin, 7.0% methamphetamine, 2.8% unknown drug and 1.4% over-the-counter medicine. The other substance(s) group reported: 37.5% cannabis, 30.0% prescription sedatives, 22.5% other illicit drugs, 17.5% prescription opioids, 15.0% hallucinogens, 10.0% prescription stimulants, 5.0% methamphetamine, 5.0% cocaine, 5.0% over-the-counter medicine, 2.5% heroin, 2.5% unknown drug and 2.5% other prescription medication.

For the worst overdose experience, the most common symptom across substance use groups was 'vomiting/nausea' (95.9%) (table 3). During this experience, those reporting alcohol only, alcohol and cannabis only, and alcohol with other substance(s) had higher rates of symptoms reflecting clinically high-risk alterations in mental status such as 'awake, but no memory of what happened' (p<0.001). Those reporting alcohol with other substance(s) and other substance(s) only, reported symptoms clinically reflecting high-risk alterations in physical status, such as 'difficulty breathing' (p<0.001) and 'collapsed' (p<0.05). Finally, clinically lower-risk symptoms that significantly differed by group included hallucinations, heart beating fast/slow, shaking and had a fever/felt too cold (see table 3); those reporting alcohol with other substances or other substance(s) only, reported the greatest symptoms.

Regarding disposition following the worst overdose experience, substance use groups were significantly related to someone calling 911 (p<0.05), going to the ED (p<0.05), hospital admission (p<0.01) and waking up without help (p<0.01). The alcohol with other substance(s) and other substance(s) only groups reported the highest rates of calling 911 (18.3% and 12.5%, respectively), going to the ED (28.1% and 37.5%, respectively) and hospital admissions (19.7% and 27.5%, respectively). In contrast, these rates were lower for the alcohol only and alcohol and cannabis only groups: called 911 (9.5% and 3.4%, respectively), going to the ED (18.2% and 10.2%, respectively), and hospital admission (6.9% and 6.8%, respectively). Further, waking up without help was highest with alcohol with other substance(s) (36.6%) relative to alcohol only (19.1%), alcohol and cannabis groups (22.7%), and other substance(s) only (17.5%) groups.

During the worst overdose experience, 70.1% indicated unintentional intent, 21.3% ambivalent intent, and 4.8% a suicide attempt, which was associated with substance use groups (p<0.001). Specifically, among the following sample proportions, unintentional intent was: 71.3% alcohol only; 81.8% alcohol and cannabis only; 57.8% alcohol with other substance(s); and 60.0% other substance(s) only. Ambivalent intent was: 23.5% alcohol only, 17.1% alcohol and cannabis only, 31.0% alcohol with other substance(s) group and 7.5% other substance(s) only. Suicide attempt was: 1.7% alcohol only, 0% alcohol and cannabis only, 4.2% alcohol with other substance(s) and 25.0% other substance(s) only group.

Worst overdose experiences: substance use groups and risk/protective factors

For the worst overdose experience, substance use groups were significantly related to age, heterosexual identity, public assistance, peer substance use, social support, positive depression screen and positive anxiety screen (table 4). For example, those reporting alcohol use with other substance(s) were oldest, had the greatest peer substance use and lowest social support relative to other groups. In contrast, the other substance(s) only group reported the lowest rates of heterosexual identity and highest rates of public assistance and positive screens for depression and anxiety disorders.

In multinomial regression analyses (reference group: alcohol only; table 5), significant results showed that the alcohol and cannabis group were younger and less likely to identify as heterosexual; the alcohol with other substance(s) group was more likely to be older and report greater peer substance misuse; and the other substance(s) only group were more likely to be male, receive public assistance and screen positive for anxiety disorder and less likely to identify as heterosexual.

DISCUSSION

We examined at-risk adolescents and young adults in the USA who have already engaged in opioid use and/or misuse, finding that 40.7% reported a non-fatal overdose experience (with

Table 5 Multinomial logistic regression examining factors associated with substance use groups during worst experience among those with lifetime non-fatal overdose experiences (n=314), 2021–2022, USA

	Alcohol and cannabis (n=88) AOR (95% CI)	Alcohol and other substances (n=71) AOR (95% CI)	Other substances (no alcohol) (n=40) AOR (95% CI)
Sociodemographics			
Age	0.89 (0.82 to 0.98)*	1.13 (1.03 to 1.24)*	0.95 (0.85 to 1.07)
Male sex (vs female)	1.08 (0.55 to 2.10)	0.72 (0.33 to 1.56)	3.40 (1.40 to 8.26)**
Heterosexual identity (vs other sexual identity)	0.49 (0.26 to 0.91)	0.68 (0.33 to 1.37)	0.28 (0.12 to 0.66)**
White, non-Hispanic (vs other race/ethnicity)	1.24 (0.63 to 2.46)	0.66 (0.33 to 1.29)	1.46 (0.60 to 3.57)
Receive public assistance (vs none)	1.96 (0.93 to 4.10)	1.96 (0.90 to 4.28)	4.59 (1.90 to 11.09)***
Social factors			
History of familial substance misuse (vs none)	1.18 (0.63 to 2.20)	1.02 (0.51 to 2.04)	0.76 (0.34 to 1.70)
†Peer substance misuse score	1.07 (0.98 to 1.18)	1.20 (1.09 to 1.33)***	1.00 (0.88 to 1.12)
‡Social support score	1.08 (0.94 to 1.25)	0.89 (0.78 to 1.03)	0.96 (0.81 to 1.14)
Mental health factors			
§Positive anxiety screen (vs negative)	1.35 (0.70 to 2.59)	1.69 (0.84 to 3.40)	2.72 (1.14 to 6.52)*
Suicide attempt (lifetime) (vs none)	0.93 (0.37 to 2.29)	0.99 (0.36 to 2.71)	1.03 (0.36 to 2.99)

Alcohol only is the reference group.
*p<0.05.
**p<0.01.
***p<0.001.
†Higher M score (range 0–24) indicates more peer substance misuse.
‡Higher M score (range 1–10) indicates more peer and/or family social support.
§GAD-7 with score >10 positive for at least moderate anxiety disorder risk in the past 2 weeks.
AOR, adjusted odds ratio; GAD-7, Generalised Anxiety Disorder-7.

varied substances), consistent with a prior review.[10] Hypotheses that those with overdose experiences would be disproportionally of a non-heterosexual identity, have greater social/individual risk factors and have fewer protective factors, were supported.

Our measure of non-fatal overdose experiences was based on previous work with adults aged 18+[24] and designed to be sensitive to understand a broad array of risky experiences. Most overdose experiences involved alcohol use, either alone or in combination with another substance, which is particularly concerning given these ED patients have a history of opioid use. These data are consistent with recent national trends, in which 39.3% of substance-related ED visits were due to alcohol, and alcohol was commonly involved in drug-related ED visits (eg, cannabis, cocaine).[25] Such use is concerning as those reporting alcohol use alone or in combination with other substances reported higher rates of high-risk alterations in mental status (eg, awake but no memory of what happened) during their worst overdose experience, while those reporting only other substance(s) during their worst overdose experience had higher rates of concerning physical symptoms (eg, difficulty breathing). Further, those using alcohol with other substances, or other substance(s) only, were more likely to report someone called 911, going to the ED, or a hospital admission following their worst experience. Taken together, these symptoms and substance use behaviours increase the risk for severe health outcomes, including potential fatality and other consequences (eg, impaired driving).[31 32] Harm reduction approaches, such as eliciting protective behavioural strategies to limit amount of use (eg, opioids and sedatives/benzodiazepines, with/without alcohol) may prevent negative sequelae among adolescents and young adults, particularly for those with alcohol and/or polysubstance use.

Intentionality of overdose experiences is another important consideration. National data from 2021 show suicide is the second leading cause of death among young adults.[33] Although only 4.8% of our sample indicated their worst overdose experience was a suicide attempt (ie, wanted to die), those using only other substance(s) had the highest rate of reporting a suicide attempt during their worst overdose experience (25.0%). Further, 21.3% indicated ambivalent intent (ie, on purpose and did not care about risks), with the highest rate in the alcohol and other substances group (31.0%). It may be that national rates of suicide are an underestimate given the ambivalent intent associated with non-fatal overdose experiences.[11 24] Considering mental health concerns were related to overdose experiences (ie, suicide attempts, depression, anxiety), as well as for specific subgroups for the worst experiences (ie, other substance(s) only group more likely to screen positive for anxiety disorder), early interventions for adolescents and young adults with substance use should attend to suicide risk and mental health symptoms and provide referrals (eg, crisis lines, support groups, treatment).

Further, age was associated with different substance use overdose groups, with younger participants more likely to use alcohol with cannabis in their worst experience while older participants used alcohol with other substances. Additionally, those who reported heterosexual identities versus all others had lower odds of overdose experiences in general, as well as lower odds of using alcohol with cannabis or other substances only during their worst overdose experience. Established literature has identified more substance use in lesbian, gay or bisexual communities compared with heterosexual peers, including among adolescents and young adults,[34 35] potentially as a coping mechanism for disparities related to marginalisation.[13 36] Considering the overlap of substance use escalation and sexual identity development during adolescence and young adulthood, interventions for this population should be tailored based on these factors.

As millions of adolescents and young adults visit EDs yearly,[37] EDs can be an important location for identifying at-risk individuals and initiating behavioural interventions. Expanding prior ED interventions[38 39] to include opioid use prevention[12] and increasing focus on adolescents and young adults and those

who report polysubstance use, may be effective at preventing escalation of substance use and fatal/non-fatal overdoses. In addition to incorporating harm reduction and addressing mental health, given that peer substance misuse increases the risk for developing a SUD[40] and was higher among those with a prior overdose experience and in the alcohol with other substance(s) group, interventions should incorporate a focus on enhancing prosocial connections.

Limitations require consideration. This manuscript reports baseline data gathered as part of an RCT among an English-speaking population in academic ED settings; thus, replication is recommended in diverse samples. Data regarding overdose experiences were limited to self-report, although validity is enhanced with computerised assessment, confidentiality assurances and standard questions. Our definition of non-fatal overdose experiences was purposefully designed to be sensitive and broad to capture the range of potential overdose experiences to better inform prevention efforts, and thus, this construct reflects a range of risk severity for fatal overdose. Finally, although cross-sectional data precludes causal interpretations, these findings inform overdose prevention approaches.

CONCLUSION

In summary, among adolescents and young adults presenting to the ED with past-year opioid misuse or opioid use with a substance use/mental health risk factor, prior non-fatal overdose experiences were common. These experiences were primarily related to alcohol use, although polysubstance use was also involved (especially cannabis). Scalable substance use prevention approaches, with consideration of age, sexuality and mental health, are needed to reduce risk for consequences, including fatal and non-fatal overdoses.

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