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Symptom Profiles and Characteristics of Acute Methamphetamine Toxicity: Implications for Emergency Recognition and Response

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Abstract

Background: The increasing prevalence of methamphetamine-associated “overdoses” in the surveillance literature necessitates a better understanding of self-reported symptoms associated with acute methamphetamine toxicity events. This study describes and compares the prevalence, self-reported symptoms, and behavioral correlates of acute methamphetamine toxicity, opioid overdose, and mixed drug overdose events.

Methods: We surveyed 420 people who use drugs in Nevada and New Mexico. Participants reported on their experiences of acute methamphetamine toxicity, opioid overdose, and mixed drug overdose events, including symptoms and healthcare utilization. We conducted descriptive analyses and compared demographics, drug use behaviors, and health indicators across groups experiencing different types of events.

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Results: Of 217 participants reporting any event, 24% experienced only methamphetamine toxicity, 35% only opioid overdose, 5% only mixed drug overdose, and 36% multiple types. Methamphetamine toxicity events were characterized by anxiety (43%), heart pounding (34%), and rapid heart rate (33%), while opioid overdoses primarily involved loss of consciousness (86%). The methamphetamine-only group reported significantly lower prevalence of recent use of various substances and less frequent naloxone availability.

Conclusions: Acute methamphetamine toxicity events present distinctly from opioid overdoses, with implications for emergency recognition and response. Lower naloxone availability among people who use methamphetamine is concerning given the prevalence of polydrug use. These findings underscore the need for targeted interventions addressing methamphetamine-related harm reduction efforts.

Keywords

Methamphetamine; Overdose; Toxicity; Opioids; Harm reduction

1.0 Background:

US surveillance data indicate increases in drug overdose deaths involving methamphetamine.¹ Deaths involving psychostimulants other than cocaine (largely methamphetamine) increased 180% nationally, between 2015 and 2019.² The increase in methamphetamine use and related deaths and emergency hospitalizations has focused attention on the experience of methamphetamine “overdose”. Qualitative studies have determined that “overdose” may be an imprecise term for describing the experience of taking too much methamphetamine, which people who use drugs refer to as “overamping”.^{3,4} In fact, when asked directly if they had ever experienced a “methamphetamine overdose,” respondents in a study in the Western US denied having had such an experience, though they did describe a host of other negative, unwanted, and medically concerning acute effects of consuming too much methamphetamine including physical (e.g., rapid heart rate, uncontrollable movements) and psychological symptoms (e.g., paranoia, anxiety, hallucinations)³ that ranged from expected drug effects to unexpected and worrisome. Given this diversity in the types and acuity of symptoms associated with taking too much methamphetamine,⁵ there are challenges in defining the experience of a non-fatal methamphetamine “overdose,” which has important implications for recognition in pre-hospital settings.

In contrast, identifying and measuring non-fatal *opioid* overdose is relatively straightforward, because the symptoms are less variable and more easily recognized (i.e., depressed respiration, loss of consciousness, and cyanosis).⁶ Therefore, training laypeople, in addition to emergency clinical personnel, to recognize and respond to opioid overdose has become commonplace. The first step of opioid overdose response - “recognition” - typically asks if a person has “became unconscious,” “stopped breathing,” or “had difficulty breathing” as a result of taking opioids.⁷⁻⁹ If such symptoms are identified, the response steps (call 911, provide rescue breathing, administer rescue medication, provide follow-up care and support) follow logically from the primary symptom – depressed respiration. In contrast, identifying the experience of “overamping,” or symptoms of acute

methamphetamine toxicity, is newer and more complex, thereby complicating recognition and response.

Harm reduction, pre-hospital, and clinical interventions designed to address non-fatal acute methamphetamine toxicity require that the phenomenon of interest is described accurately, and in all its complexity. To advance this goal, here we describe the prevalence and symptoms of acute methamphetamine toxicity, using a quantitative survey measure developed based on qualitative data³ about the symptoms of acute methamphetamine toxicity. Then, we compare the symptoms, demographic profiles, and substance use behavior/risk factors among people who experienced acute methamphetamine toxicity, opioid only overdose, and overdose including a mixture of opioids and methamphetamine. Implications for harm reduction, pre-hospital, and clinical interventions are discussed.

2.0 Methods:

2.1 Recruitment

The AMPED 2.0 study was conducted from September 2022 to August 2023 at four sites in Reno and Las Vegas, Nevada; and Española and Albuquerque, New Mexico. We recruited using a combination of incentivized snowball sampling, word of mouth, and street- and agency-based outreach. Eligibility criteria included: being over 18 years old and reporting non-medical drug use in the past three months (excluding alcohol, tobacco, or cannabis use). Eligibility screening was conducted using a computer assisted screener programmed in Research Electronic Data Capture (REDCap), which included “red herring” questions to mask eligibility criteria. Those who participated in the incentivized snowball sampling as seeds (n=79) were trained on eligibility criteria and given coupons to recruit up to three people who might be eligible for the study. They received a \$10 incentive for each eligible person they referred. A total of 241 participants (57.4% of the final sample) were recruited through snowball sampling. In total, we screened 570 people, of whom 545 (95.6%) were eligible. Of those, 420 (77%) provided informed consent and completed a baseline interview.

2.2 Data collection

Eligible participants completed an informed consent process with data collectors, according to an IRB approved protocol. Participants were compensated \$40 and a 30- to 90-minute survey was administered by study staff in research field sites or other private/semi-private locations where conversations could not be overheard (e.g., public libraries, research van, or office of a community-based organizations).

2.3 Ethical approval

This study was reviewed and approved through a single Institutional Review Board agreement, with the University of Nevada, Reno as the IRB of record.

2.4 Measures

2.4.1 Acute methamphetamine toxicity: We measured acute methamphetamine toxicity events using the question: “*Have you ever experienced effects that made you feel like you needed medical attention when using methamphetamine?*” Then, symptoms

experienced at the most recent event were assessed with a question that allowed people to endorse up to 15 symptoms that were derived from our previous qualitative work³: anxiety, difficulty breathing or not breathing, hallucinations, heart attack, heart pounding, hyperventilation, loss of consciousness (blacked out), paranoia, rapid heart rate (heart racing) seizure, slowed heart rate, stroke, strong desire to sleep, unable to motivate yourself to move/get up), other (specify). Next, we asked about the number of events experienced in the past 3 months, and whether they went to the ED or got emergency medical care from EMS after the event.

2.4.2 Opioid and Drug Mixture Overdoses: We used the same set of questions to measure opioid overdose and drug mixture overdose, after providing the following definitions: “*When I say opioid overdose, I am talking about times when you took so much of an opioid (e.g., heroin, oxycodone, or methadone), that you lost consciousness and something had to be done if you were going to be brought back to consciousness.*” Drug mixture overdose was defined as, “*Combining an opioid with stimulants, like mixing heroin and cocaine together into a speedball or mixing heroin and methamphetamine into a goofball. This could also be taking an opioid and another drug together at the same time but by different routes, such as shooting heroin and taking a prescription stimulant pill. Times you took so much that you lost consciousness and something had to be done if you were going to be brought back to consciousness.*” The same set of symptoms was assessed for all three event types to allow comparisons.

2.4.3 Other measures: We measured past 3-month (recent) substance use, using the Alcohol, Smoking, and Substance-use Involved Screening Test (ASSIST).¹⁰ To assess simultaneous polydrug use, we asked participants if they had deliberately taken methamphetamine with other drugs and, if yes, which drugs (alcohol, benzodiazepines, cocaine, fentanyl, heroin, prescription amphetamines, prescription opioids, other/specify). Responses yielded a significant amount of variation in terms of the types of drugs combined with methamphetamine, so we combined simultaneous polydrug use into two categories for analysis: combining methamphetamine with a stimulant (i.e., cocaine or prescription amphetamines) or combining methamphetamine with a depressant (i.e., alcohol, benzodiazepines, fentanyl, heroin, prescription opioids, other depressants). The survey also measured experiences of stigma measured with the Substance Use Stigma Mechanisms Scale (SU-SMS),¹¹ mental and physical health, service utilization, risk and protective behaviors, overdose history, levels of social support, stressful life events, and sociodemographic characteristics (e.g., age, gender, sexual orientation, race, Hispanic/Latino ethnicity, housing and employment status).

3.0 Analysis

We used descriptive statistics to summarize the prevalence of each type of overdose or toxicity event (i.e., methamphetamine toxicity, opioid overdose, and mixed drug overdose). Then, we described the frequency of symptoms experienced at the most recent event, stratified by type of event. Finally, we compared demographics and drug use behavior across three groups: (1) those who only ever experienced opioid overdoses, (2) those who only ever experienced methamphetamine toxicity, and (3) those who only ever experienced

drug mixture overdoses and those who experienced multiple types of overdoses/toxicity events. Because of small cell sizes in the drug mixture only group, and after comparing the participants in this group to those who experienced multiple types and determining that they are sufficiently similar, we collapsed these two categories to enable us to make statistical comparisons. We did not collapse race, despite small cell sizes, in the interest of documenting the racial diversity in the sample. This made a statistical comparison by race impossible. Because this analysis focused on the methamphetamine-only events, we used that as the reference point for comparisons. Statistical comparisons were made using Chi-square test or Fischer's exact test for proportions, and Wilcoxon rank sum test for medians. All analyses were conducted in R.

4.0 Results

4.1 Prevalence of overdose/toxicity events

Just over half the sample (217/420; 52%) reported ever experiencing an episode of opioid overdose, mixed drug overdose, or acute methamphetamine toxicity. The prevalence of events by type is shown in Table 1. Of the 217, 138 (63%) reported experiencing only one type of event: 76/217 (35%) had only experienced opioid overdoses, 51/217 (24%) had only experienced acute methamphetamine toxicity, and 11/217 (5%) had only experienced mixed drug overdoses. The remainder (n=79; 36%) reported experiencing multiple kinds of events.

Of those who had ever experienced only opioid overdoses, 26% (20/76) had experienced one in the past 3 months, and the median number of events was 1 (1st Quartile [Q1], 3rd Quartile [Q3]: 1, 2; Table 1). Of those who had ever experienced only methamphetamine toxicity events, 80% (41/51) had experienced a recent event (past 3 months), and the median number of events was 2 (Q1, Q3: 1, 4). Experiences of mixed drug and multiple types were less frequent.

4.2 Symptoms reported at most recent overdose or toxicity event

Figure 1 illustrates the prevalence of symptoms experienced during overdose or toxicity events, stratified by event type. There were 106 people who described at least one methamphetamine-only toxicity event in their lifetime. The five most prevalent symptoms reported at a methamphetamine toxicity event were: anxiety (43%), heart pounding (34%), rapid heart rate (33%), difficulty breathing (31%), and paranoia (31%).

There were 145 respondents who described at least one opioid-only overdose event in their lifetime (Figure). The five most prevalent symptoms experienced at the most recent opioid overdose event were: loss of consciousness (86%), difficulty breathing (19%), strong desire to sleep (12%), slowed heart rate (6%), and hallucinations (5%).

Finally, 127 respondents described experiencing at least one drug mixture overdose that involved opioids and stimulants in their lifetime (Figure). Symptoms experienced at the most recent event mostly resemble opioid overdoses, but also included stimulant-associated symptoms. The five most prevalent symptoms reported at the most recent event included: loss of consciousness (83%), difficulty breathing (17%), anxiety (12%), strong desire to sleep (10%), heart pounding (9%).

We asked whether the most recent event resulted in receiving care from EMS or the emergency department. Participants reported receiving emergency medical care in 13% of the methamphetamine only events, 8% of the opioid only events, and 10% of the drug mixture events (data not shown).

4.3 Demographic and drug use comparisons

Demographic and drug use behaviors are reported in Table 2. Because of the small number of people who reported only drug mixture events, we collapsed the drug mixture and multiple types groups for statistical comparisons. The median age of the 217 people was 39 years (Q1, Q3: 34, 47.5) with no differences across groups. Gender (approximately 50% male, with few gender minorities) and sexual orientation (>80% heterosexual) did not differ significantly across groups. The majority of the sample (84%) reported white race, with meaningful variation across other categories (e.g., 8% American Indian, 4% Black/African American, 7% multiracial, 6% other race.) We observed a higher proportion of Hispanic/Latino people in the opioid-only group compared to the other two.

Over two thirds of the sample reported being homeless in the past three months (Table 2) and one-third to almost one half reported being worried about losing their housing. One quarter or fewer reported current employment. Just under 20% of the sample reported recent incarceration.

4.4 Drug use and risk behavior comparisons

Median age at initiation of drug use ranged from 15 for alcohol to 35 for fentanyl, with no statistically significant differences across groups (Table 2). The median age at which people in this sample reported starting methamphetamine use was 23 years old (Q1, Q3: 17, 32.5) and they had been using prescription amphetamines since they were 22 years old (Q1, Q3: 17, 29).

In terms of types of drugs use in the past 3 months, the methamphetamine-only toxicity group reported significantly lower prevalence of past three-month use of benzodiazepines, fentanyl, heroin, and prescription opioids compared to the other groups. The methamphetamine-only toxicity group also reported significantly lower prevalence of methamphetamine co-use with depressants compared to the other groups. The opioid only group reported significantly lower prevalence of methamphetamine use. Seventy one percent of the sample reported past 3-month injection drug use, with no statistically significant differences across groups. Forty-six percent of the sample reported that they usually/always have naloxone available when using drugs, with the lowest prevalence (21%) in the methamphetamine toxicity only group.

4.5 Health care/health status indicators

In terms of stimulant-related health concerns, no statistically significant differences were observed between groups. Nearly one-third of the sample reported high blood pressure, 18% had ever been prescribed heart medications, 12% had been diagnosed with a heart condition, and 5% had been diagnosed with lung disease. The median number of visits to a health care provider in the past three months was zero.

Just under one-quarter of the sample reported being in any kind of substance use disorder treatment. The prevalence of taking medications for opioid use disorder was lowest in the methamphetamine only toxicity group, compared to the others.

5.0 Discussion

This study provides important insights into the self-reported symptoms described by people who experienced acute methamphetamine toxicity, comparing these events with opioid overdoses and mixed drug overdoses. Our findings have implications for harm reduction, pre-hospital, and clinical interventions. Most importantly, while the demographic profiles of individuals experiencing different types of drug-related events are similar, the symptoms experienced during an episode of acute methamphetamine toxicity differ markedly from the symptoms experienced during an opioid overdose. Compared to opioid-involved events, which are characterized by depressed respiration and loss of consciousness, acute methamphetamine toxicity presents with distinct symptom clusters involving cardiovascular and psychiatric symptoms, clinically referred to as a sympathomimetic toxidrome.¹² Interestingly, mixed drug overdoses involving both opioids and stimulants primarily resembled opioid overdoses in their symptom profile, suggesting that the opioid component may dominate the clinical presentation in these cases. Therefore, care should be taken when describing acute non-fatal drug-related medical events to specifically define the type of event (i.e., opioid overdose vs. acute methamphetamine toxicity or “overamping”).

This diversity in symptom presentation for methamphetamine toxicity poses challenges for potential lay and emergency responders in recognizing and appropriately responding to these events. Qualitative data suggest that people who use drugs often deny the possibility of experiencing a methamphetamine “overdose” and some may lack a clear understanding of how to manage a potentially harmful methamphetamine-related event, making it difficult for them to identify when intervention is necessary.^{3,4} Clinical evaluation and diagnosis is largely based on patient history and physical examination,¹² which relies on the clinician’s ability to ask the correct questions to obtain an accurate history and symptom profile. Asking about specific symptoms most frequently reported in acute methamphetamine toxicity events may inform more rapid and accurate diagnosis.

Our findings underscore the need for clear, evidence-based recommendations for responding to acute methamphetamine toxicity that can be easily understood and implemented by emergency responders and laypeople alike. Clinical recommendations for management of acute methamphetamine toxicity prioritize airway, breathing, and respiration; providing a calm safe environment; and offering medications such as benzodiazepines or antipsychotics to reduce toxicity symptoms including tachycardia, hypertension, agitation, seizures, and psychosis.^{12,13} Practice-based experience in overdose prevention centers¹⁴ suggests additional recommendations for non-clinicians responding to suspected methamphetamine toxicity, including: 1: Recognizing signs of distress: anxiety, rapid heart rate, difficulty breathing, paranoia. 2: Providing a calm, safe environment to reduce stimulation and anxiety. 3: Encouraging the person to sit or lie down to prevent falls if dizziness occurs. 4: Offering cool water to prevent dehydration. 5: Monitoring breathing and consciousness. 6: Escalating to emergency services if symptoms worsen or persist, especially if the

person experiences chest pain, symptoms of stroke, severe difficulty breathing, or loses consciousness. Messaging for laypeople should emphasize that while these steps can be helpful, professional medical evaluation may also be warranted in cases of suspected acute methamphetamine toxicity, given the potential for serious cardiopulmonary and cerebrovascular complications.

A concerning finding from our study is the significantly lower prevalence of naloxone availability among those who experienced methamphetamine toxicity only, compared to other groups. This disparity is worrying given the high prevalence of polydrug use and the potential for unexpected opioid exposure, even among primary methamphetamine users.¹⁵ The lower naloxone availability among people using methamphetamine may reflect a perception that they are not at risk for opioid overdose. However, given the unpredictability of the drug supply and the high prevalence of polydrug use, ensuring widespread naloxone access across all groups of people who use drugs remains crucial. Public health interventions should aim to increase naloxone distribution and education among people who use methamphetamine, emphasizing the importance of having this life-saving medication on hand regardless of one's primary drug of choice.

Several limitations should be considered when interpreting the results of this study. First, the cross-sectional nature of our design precludes the establishment of causal relationships and the convenience sampling and geographical focus of our study on four sites in Nevada and New Mexico may limit the generalizability of our findings to other regions with different drug use patterns. Second, while our sample size of 420 participants allowed for meaningful analyses, a larger sample might have provided greater statistical power, particularly for subgroup comparisons. Future research should aim to address these limitations through longitudinal designs, larger sample sizes, and more diverse geographical representation to further validate and expand upon our findings.

In terms of measurement limitations, our self-report measures were subjective, by design, and because they were derived from formative work describing participants' *experience* of taking too much methamphetamine, some symptoms may not align with clinical diagnostic indicators. For example, the symptom "loss of consciousness (blacked out)" may represent two distinct clinical phenomena. But from the participant experience they are described similarly and therefore assessed using the same item. Similarly, some symptoms associated with methamphetamine use (but not necessarily acute toxicity) are not included, such as hyperactivity. The rationale for not including hyperactivity in the measure is that participants in our formative work did not identify that as an indicator of needing medical attention for an acute event. Finally, our measurement of acute methamphetamine toxicity did not account for unintentional exposure to opioids in methamphetamine (presumably through adulteration of methamphetamine). Given data from other studies indicating that the prevalence of unanticipated fentanyl in methamphetamine is <10%¹⁵ and that participants in this study had a remarkably low prevalence of unanticipated fentanyl exposure¹⁶ we do not believe this to be a major limitation of this study.

6.0 Conclusion

In conclusion, this study contributes valuable insights to the growing body of literature on a rising concern in public health: non-fatal acute methamphetamine toxicity. Our findings underscore the unique challenges in identifying and responding to acute methamphetamine toxicity in a pre-hospital environment and highlight the urgent need for targeted interventions. As methamphetamine use continues to increase across the United States and become more prevalent in areas that, heretofore, have had relatively low prevalence, it is crucial that we develop and implement comprehensive public education campaigns to raise awareness about the signs and symptoms of methamphetamine toxicity. These efforts should aim to empower people who use drugs, laypeople, and emergency responders with the knowledge and skills to recognize and respond appropriately to these events. Especially because people who use drugs experience significant barriers to accessing routine health care, acute emergency medical events can represent a unique moment for engagement, if thoughtful treatment and compassionate care are provided.

Our results emphasize the critical need for evidence-based interventions to prevent, reduce, and treat methamphetamine toxicity. This may include the development of novel harm reduction strategies specifically tailored to methamphetamine use, as well as the expansion of treatment options for methamphetamine use disorder. By addressing these needs, we can work towards mitigating the health impacts of methamphetamine use and improving outcomes for affected individuals and communities. Collaborative efforts among people who use drugs, researchers, harm reduction workers, healthcare providers, policymakers, and community organizations will be essential in translating these findings into effective public health strategies and clinical practices.

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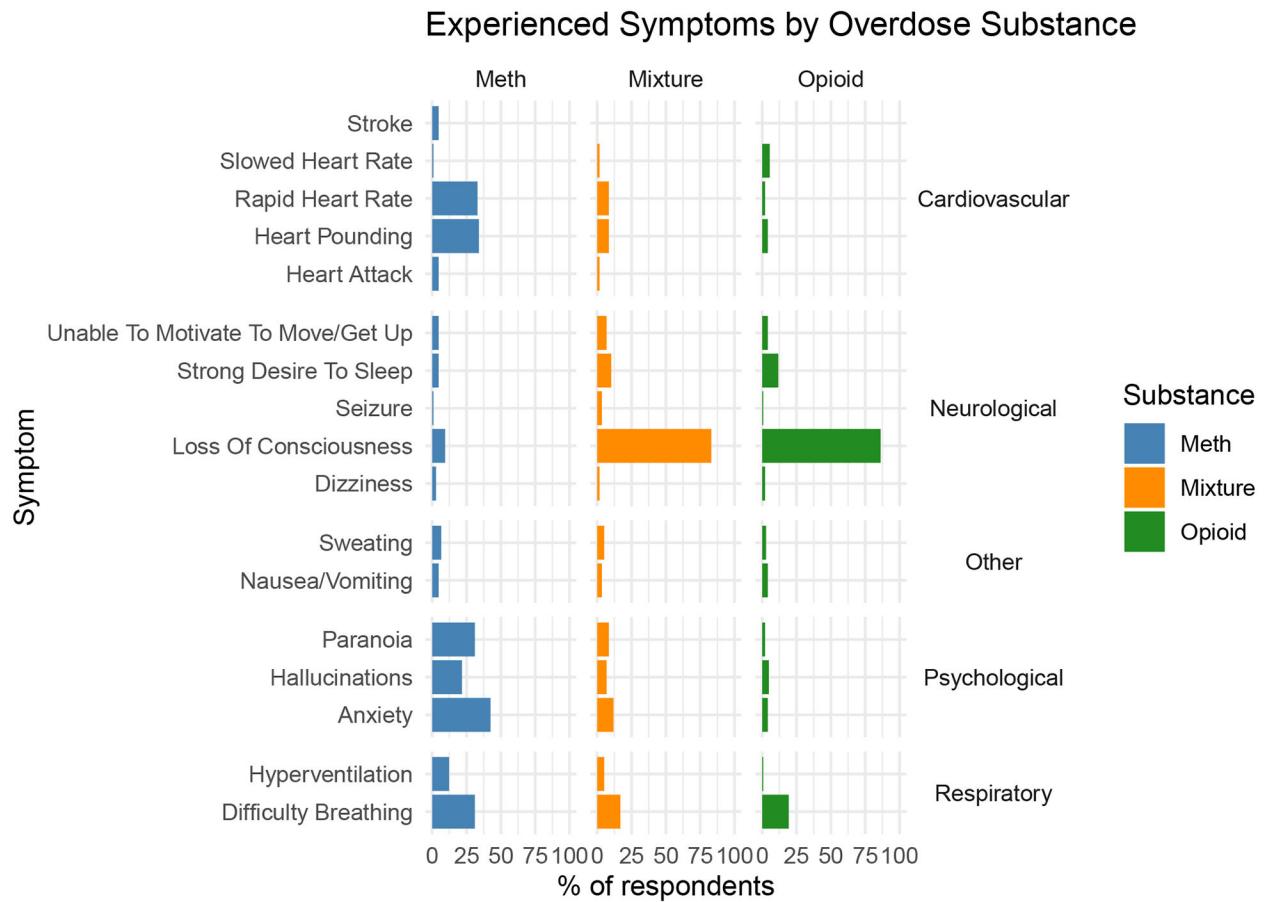
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**Figure:**

Prevalence of symptoms reported at most recent overdose or toxicity event in the past 3 months among 106 respondents, stratified by type of drug.

Table 1.

Prevalence of overdose/toxicity events among 217 AMPED 2.0 participants.

	Only experienced one type of event (N=138; 63%)			Experienced multiple types of events (n=79)
	Opioid overdose only	Methamphetamine toxicity only	Opioid + stimulant mixture only	
Ever experienced (n, %)	76 (35%)	51 (24%)	11 (5%)	79 (36%)
Experienced in past 3 months * (n, %)	20 (26%)	41 (80%)	2 (18%)	15 (19%)
Median number of events in past 3 months (IQR ^)	1 (1, 2)	2 (1,4)	1 (1,1)	4 (3,7)

* denominator is those who ever experienced this type of event

^ IQR – Interquartile Range

Table 2.

Demographic and substance use characteristics of people reporting of overdose/toxicity events among 217 AMPED 2.0 participants.

	Opioid overdose only (n=76)	Methamphetamine toxicity only (n=51)	Multiple types of events (n=90)	Total (N=217)	p-value
Demographics					
Age, Median (IQR [^])	39 (33, 44)	39 (34, 51)	38 (34, 46)	39 (34, 47.5)	0.26
Gender identity (n, %)					
Male	46 (60.5%)	25 (49.0%)	49 (54.4%)	120 (55.3%)	0.64
Female	30 (39.5%)	23 (45.1%)	39 (43.3%)	92 (42.4%)	
Transmasculine, Transfeminine, Genderqueer/nonbinary	0 (0.0%)	3 (5.9%)	2 (2.2%)	5 (2.3%)	
Sexual orientation (n, %)					0.72
Heterosexual	65 (85.5%)	41 (80.4%)	70 (77.8%)	176 (81.1%)	
Not heterosexual (Gay, Bisexual, or other)	11 (14.5%)	10 (19.6%)	19 (22.2%)	40 (18.9%)	
Race					n/a *
Black or African American	0 (0.0%)	7 (13.7%)	2 (2.2%)	9 (4.1%)	
Asian or Native Hawaiian or Pacific Islander	0 (0.0%)	1 (2.0%)	2 (2.2%)	3 (1.4%)	
American Indian or Alaska Native	4 (5.3%)	3 (5.9%)	10 (11.1%)	17 (7.8%)	
White	64 (84.2%)	41 (80.4%)	76 (84.4%)	181 (83.4%)	
Multiracial	7 (9.2%)	4 (7.8%)	4 (4.4%)	15 (6.9%)	
Other race	6 (7.9%)	3 (5.9%)	3 (3.3%)	12 (5.5%)	
Hispanic/Latino	52 (68.4%)	20 (39.2%)	43 (47.8%)	115 (53%)	0.002
Homeless past 3 months	52 (68.4%)	35 (68.6%)	67 (74.4%)	154 (71.0%)	0.56
Worried about losing housing past 3 months	26 (34.2%)	25 (49.0%)	37 (41.1%)	88 (40.6%)	0.27
Currently employed	12 (15.8%)	13 (25.5%)	11 (12.2%)	36 (16.6%)	0.17
Incarcerated past 3 months	15 (19.7%)	8 (15.7%)	18 (20%)	41 (18.9%)	0.94
Substance use behavior					
Median Age of First Use(IQR [^])					
Alcohol	14 (13, 19)	16 (13, 18)	15 (13, 17)	15 (13, 18)	0.61
Benzodiazepines	22.5 (17.5, 32)	21 (16, 25.5)	21.5 (17, 25)	22 (17, 27)	0.35
Fentanyl	36 (27, 42)	35 (32, 44)	35.5 (29, 41.5)	36 (29, 42)	0.73
Cocaine	19 (15, 23)	20 (16, 25)	19.5 (17, 26)	20 (16, 24)	0.36
Heroin	24 (20, 30)	26 (23, 34)	23 (19, 31)	25 (19, 31)	0.30
Methamphetamine	23 (17, 34.5)	21 (17, 31)	23 (17, 31)	23 (17, 32.5)	0.79
Prescription amphetamines	22 (17, 28)	22.5 (16.5, 26.5)	22 (17, 31)	22 (17, 29)	0.67
Prescription opioids	20 (17, 25)	24 (18, 29)	20.5 (17, 26)	21 (17, 27)	0.60
Past 3 month use of					

	Opioid overdose only (n=76)	Methamphetamine toxicity only (n=51)	Multiple types of events (n=90)	Total (N=217)	p-value
Alcohol	33 (43.4%)	30 (58.8%)	50 (55.6%)	113 (52.1%)	0.16
Benzodiazepines	19 (25.0%)	4 (7.8%)	26 (28.9%)	49 (22.6%)	0.01
Dispensary cannabis	41 (53.9%)	36 (70.6%)	61 (67.8%)	138 (63.6%)	0.15
Street cannabis	45 (59.2%)	33 (64.7%)	69 (76.7%)	147 (67.7%)	0.05
Crack/cocaine	36 (47.4%)	17 (33.3%)	51 (56.7%)	104 (47.9%)	0.06
Fentanyl	58 (76.3%)	16 (31.4%)	72 (80.0%)	146 (67.3%)	<0.0001
Hallucinogens	13 (17.1%)	12 (23.5%)	14 (15.6%)	39 (18.0%)	0.48
Heroin	46 (60.5%)	13 (25.5%)	60 (66.7%)	119 (54.8%)	<0.0001
Inhalants	3 (3.9%)	3 (5.9%)	4 (4.4%)	10 (4.6%)	0.87
Methamphetamine	71 (93.4%)	50 (98.0%)	90 (100.0%)	211 (97.2%)	0.03
Prescription amphetamines	7 (9.2%)	4 (7.8%)	9 (10.0%)	20 (9.2%)	0.91
Prescription opioids	22 (28.9%)	6 (11.8%)	30 (33.3%)	58 (26.7%)	0.02
Sedatives	10 (13.2%)	6 (11.8%)	19 (21.1%)	35 (16.1%)	0.58
Methamphetamine co-use with depressants	50 (65.8%)	25 (49.0%)	75 (83.3%)	150 (69.1%)	<0.0001
Methamphetamine co-use with other stimulants	9 (11.8%)	8 (15.7%)	23 (25.6%)	40 (18.4%)	0.06
Used drugs by injection, past 3 months	57 (75.0%)	30 (58.8%)	68 (75.6%)	155 (71.4%)	0.07
Always have naloxone available when using drugs	41 (57.75%)	8 (20.51%)	42 (46.67%)	91 (45.5%)	0.0008
Health care/health status					
Lung disease diagnosis	3 (3.9%)	2 (3.9%)	6 (6.7%)	11 (5.1%)	0.67
Heart condition diagnosis	8 (10.5%)	9 (17.6%)	10 (11.1%)	27 (12.4%)	0.43
High blood pressure diagnosis	23 (30.3%)	18 (35.3%)	27 (30.0%)	68 (31.3%)	0.78
Stroke	0 (0.0%)	2 (3.9%)	1 (1.1%)	3 (1.4%)	n/a
Ever prescribed medications for heart disease	11 (14.5%)	12 (23.5%)	16 (17.8%)	39 (18.0%)	0.43
Currently in SUD treatment	24 (31.6%)	8 (15.7%)	21 (23.3%)	53 (24.4%)	0.09
Currently on MOUD	19 (25.0%)	3 (5.9%)	14 (15.6%)	36 (16.6%)	0.02
Median number of visits to a healthcare provider in the past 3 months	0 (0, 1)	1 (0, 2)	1 (0, 2)	0 (0, 2)	0.40
Substance Use Stigma Mechanisms scores Range: 1–5) (Median, IQR [^]) (					
Enacted Stigma Subscore: Family Members	3.7 (2.7, 4)	3.7 (2.7, 4.3)	4 (3.3, 4.3)	4 (3, 4)	0.02
Enacted Stigma Subscore: Health Care Workers	2.3 (1.3, 3.5)	2 (1.3, 4)	3.3 (2, 4)	3 (1.7, 4)	0.0003
Internalized Stigma Subscore	3 (2.2, 4)	3.3 (2.3, 3.8)	3.2 (2.5, 4)	3.2 (2.3, 4)	0.72

* Due to small cell sizes we did not perform statistical testing

[^] IQR - Interquartile Range