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# Patients presenting to the ED with nonfatal drug overdose: Self-reported history of overdose and naloxone use

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ABSTRACT

*Background:* In the context of polysubstance use and fentanyl detection in non-opioid drugs supplies (e.g., cocaine, methamphetamine), it is important to re-evaluate and expand our understanding of which populations are at high risk for fatal drug overdoses. The primary objective of this pilot study was to gather data from the ED to characterize the population presenting with drug overdose, including demographics, drug use patterns and comorbidities, to inform upstream overdose prevention efforts.
*Methods:* A consecutive sample of ED patients undergoing treatment for non-fatal overdose were prospectively recruited for study participation at the time of ED visit. Participants reported history of substance use over the past six months, recent and lifetime overdose, and naloxone receipt and administration history.
*Results:* A total of 76 eligible participants were enrolled over the course of seven months. Participants reported high rates of opioid (56%), stimulant (56%), and cannabis use (59%). Self-reported polysubstance use, defined as self-reported use of more than one substance, was 83%. Of enrolled participants, 64% reported at least one overdose and 39% reported three or more lifetime overdoses prior to their index overdose ED visit. Participants with no self-reported intentional opioid use ($n = 32$) in the past six months had fentanyl positive urine drug screen 84% of the time versus 89% in the overall study population ($n = 74$). Participants who did not report opioid use in the past six months were less likely to possess (34% vs. 55%) or to know how to acquire (50% vs. 74%) naloxone compared to participants with self-reported history of opioid use.
*Conclusion:* This study demonstrated high rates of fentanyl exposure on toxicology testing at time of overdose across all participants including study participants without self-reported intentional opioid use. Data gathered in the ED at time of overdose can be used to inform upstream naloxone distribution and public health initiatives.


## 1. Introduction

The United States overdose crisis continues at epidemic rates, driven by fentanyl and fentanyl analogs. In 2021, fentanyl was involved in 77% of drug overdose fatalities in Rhode Island [1], and it has largely replaced heroin in the local, illicit opioid drug supply [2]. Recently, fentanyl has been detected in non-opioid drug samples, including cocaine and methamphetamine, both locally and across the country [3-6]. In turn, nonfatal and fatal overdoses from fentanyl exposure are being reported in populations using stimulants without intentional fentanyl use [7-11].

Studies have consistently shown that laypersons are both willing to administer naloxone and capable of reversing overdoses at high rates when equipped with it [12,13]. This is particularly true for community members who are in regular contact with people who intentionally use opioids, given their higher likelihood of witnessing an overdose [14]. With widespread polysubstance use and reported presence of opioids in the stimulant supply [15,16], there now exists a potential gap in naloxone awareness and distribution for people who are unintentionally exposed to opioids or do not regularly use opioids. It is important to understand which populations, as defined by characteristics such as drug use history and comorbidities, including psychiatric illness, are at risk for fatal opioid overdose to better inform harm reduction outreach and community naloxone distribution. There has been a substantial investment in overdose prevention strategies across the United States, but these can only be effective if public health authorities understand the population they are seeking to serve.

While there are potential biases in collecting data in the ED post-overdose due to stigma, hospital setting, and enrollment criteria, the

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ED is an important health care touchpoint for patients who present with non-fatal overdose because they are extremely high risk for recurrent overdose and short-term mortality [17]. Data gathered in the ED on non-fatal overdose visits can be used as a feedback loop to inform community public health initiatives and prioritize upstream prevention efforts. The primary objective of this pilot study was to gather data from the ED to characterize which populations are at heightened risk of overdose, including demographics, drug use patterns and comorbidities, to inform public health initiatives aimed at reducing overdose risk.

## 2. Methods

This study presents secondary analysis of an ED comprehensive drug overdose toxicology testing study. Research assistants screened a consecutive sample of ED patients daily (7 am – 11 pm) at two hospitals within a single health system from February 1, 2022 to September 1, 2022.

Potential participants were identified prospectively using chief complaints in the ED electronic health records (e.g., overdose, drug use, unresponsive) and direct referral from emergency department care teams. Eligible patients were: (1) English-speaking; (2) age ≥ 18 years; (3) presenting to the ED for an unintentional drug overdose; and (4) willing to be contacted after the ED visit. Unintentional drug overdose was defined as witness-report, self-report, or ED provider diagnosis of unintentional drug overdose. Only overdoses from non-prescribed substances were included. Patients were excluded if: (1) unable to provide informed consent, clinically unstable, and/or in police custody/incarcerated; (2) those who endorsed active or recent suicidal ideation; and (3) those without a reliable means to contact them (e.g., working phone number, functioning email). A small number of study phones were available for participants without a reliable contact. Sufficient phones were available to meet the needs of our enrolled patients.

Baseline demographic information, self-reported past six-month substance use, past-year and lifetime overdose(s), and naloxone receipt and administration history were recorded at the time of the ED visit and are presented here. Comprehensive toxicology testing was performed in blood and urine as well as a standard hospital urine drug screen (UDS) that contained an immunoassay test for fentanyl. Data on comprehensive toxicology testing results and communication after the ED is presented in other manuscripts [18].

Descriptive statistics were used to characterize patterns of self-reported substance use and overdose history. Self-reported overdose history and naloxone practices were stratified by self-reported drug use history. This study was approved by the Institutional Review Board at the study sites. For context, the two EDs where study recruitment was conducted have robust and standardized post-overdose service offerings. All patients presenting to the ED with an unintentional drug overdose are offered take home naloxone. Additionally, peer specialist or social work support, substance use treatment linkage, and, if appropriate, medications for opioid use disorder treatment in the ED are offered.

## 3. Results

A total of 76 eligible participants with an ED visit for a non-fatal overdose were enrolled over the course of seven months. The study consort diagram is presented in Fig. 1. Self-reported demographic details are outlined in Table 1. Psychiatric illness was self-reported by 50 out of 76 study participants (66%). Of these 50 study participants, 43 (86%) reported more than one psychiatric illness and 33 (66%) reported more than two psychiatric illnesses.

Self-reported substance use history, including frequency of use and route of administration, is presented in Table 2. Self-reported polysubstance use, defined as use of more than one substance in the past six months, was 83% ($n = 75$). Cannabis use was the most common substance reported (59%). Of individuals who reported cannabis use,

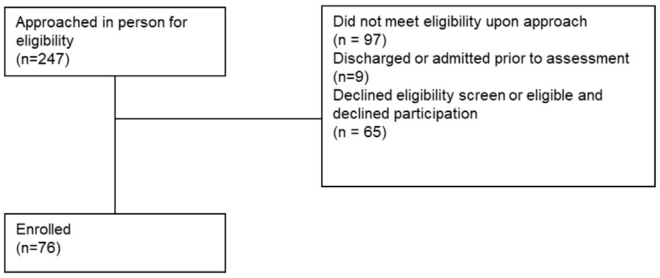


**Fig. 1.** Consort diagram showing number of patients approached for eligibility, excluded from the study, and enrolled in the study.

**Table 1**
Self-reported demographics of 76 participants with an emergency department visit for non-fatal drug overdose, February to September 2022

| Age | Years | |
|---|---|---|
| Median (IQR) | 38 (27–49) | |
| Characteristic | Count | Percent |
| Ethnicity | | |
| Not Hispanic/Latinx | 58 | 76% |
| Hispanic/Latinx | 18 | 24% |
| Gender | | |
| Man | 50 | 66% |
| Woman | 25 | 33% |
| Non-Binary or Genderqueer | 1 | 1% |
| Race | | |
| White (Caucasian) | 46 | 61% |
| Black/African American | 14 | 18% |
| Other | 10 | 13% |
| Multiple Races | 6 | 8% |
| Education | | |
| High School | 48 | 63% |
| Some High School | 17 | 22% |
| Bachelor's Degree | 5 | 7% |
| Trade School | 5 | 7% |
| Decline to answer | 1 | 1% |
| Employment | | |
| Full-Time | 24 | 32% |
| Unemployed Looking for Work | 17 | 22% |
| Part-Time | 14 | 18% |
| Disabled | 12 | 16% |
| Unemployed Not Looking for Work | 5 | 7% |
| Retired | 3 | 4% |
| Decline to answer | 1 | 1% |
| Housing | | |
| Apartment | 31 | 41% |
| Friend or Family's Place | 15 | 20% |
| House | 13 | 17% |
| Unsheltered, Outside, Tent | 12 | 16% |
| Shelter | 3 | 4% |
| Other | 2 | 3% |
| Income | | |
| Less Than $25 k | 32 | 42% |
| $25 k – $50 k | 18 | 24% |
| $50 k – $100 k | 8 | 11% |
| $100 k – $200 k | 3 | 4% |
| Decline to answer | 15 | 20% |
| Marital Status | | |
| Single | 49 | 64% |
| Married | 11 | 14% |
| Divorced | 10 | 13% |
| Unmarried Living with a Partner | 4 | 5% |
| Other | 2 | 3% |
| Self-reported Psychiatric History* | | |
| Anxiety Disorder | 36 | 47% |
| Depression | 36 | 47% |
| Post-Traumatic Stress Disorder | 23 | 30% |
| Bipolar Disorder | 19 | 25% |
| Attention Deficit Hyperactivity Disorder | 18 | 24% |
| Obsessive Compulsive Disorder | 10 | 13% |
| Schizophrenia or Schizoaffective Disorder | 7 | 9% |
| Other | 3 | 4% |
| No self-reported psychiatric illness | 26 | 34% |

* Participants could report more than one psychiatric illness.

**Table 2**
Self-reported participant drug use stratified by frequency of use and route of administration for the six months preceding an emergency department visit for a non-fatal overdose ($n = 75$)

*Self-reported participant drug use stratified by frequency of use for the six months preceding an emergency department visit for a non-fatal overdose ($n = 75$).*

| Substance | Total Percent Reporting Use (n) | Daily | Every Other Day | Weekly | Every Other Week | Monthly | Once Every 3 Months | Once Every 6 Months |
|---|---|---|---|---|---|---|---|---|
| Opioid | 56% (42) | 12 | 5 | 6 | 3 | 1 | 3 | 12 |
| Stimulant | 56% (42) | 18 | 6 | 3 | 3 | 2 | 3 | 7 |
| Cannabis | 59% (44) | 23 | 7 | 6 | 2 | 3 | 3 | 0 |
| Alcohol | 40% (30) | 4 | 10 | 12 | 1 | 1 | 1 | 1 |
| Benzodiazepine/Barbiturate | 23% (17) | 13 | 0 | 2 | 2 | 0 | 0 | 0 |
| Hallucinogen/Dissociative | 19% (14) | 5 | 2 | 2 | 1 | 1 | 2 | 1 |
| Other | 1% (1) | 0 | 0 | 0 | 1 | 0 | 0 | 0 |

*Self-reported participant drug use stratified by route of administration for the six months preceding an emergency department visit for a non-fatal overdose ($n = 75$). Participants were able to select more than one route of administration. Excludes one study participant due to incomplete self-reported use data.*

| Substance | Total Percent Reporting Use (n) | Ingested | Injected | Smoked | Snorted |
|---|---|---|---|---|---|
| Opioid | 56% (42) | 24 | 18 | 10 | 24 |
| Stimulant | 56% (42) | 7 | 11 | 29 | 19 |
| Cannabis | 59% (44) | 11 | 0 | 41 | 0 |
| Alcohol[1] | 40% (30) | 29 | 0 | 0 | 0 |
| Benzodiazepine/Barbiturate | 23% (17) | 27 | 0 | 0 | 0 |
| Hallucinogen/Dissociative | 19% (8) | 9 | 1 | 1 | 1 |

[1] Route of administration for alcohol missing for one participant.

over half (23/44) reported daily use. In individuals with self-reported opioid use, the most frequent reported routes of administration were ingestion and inhalation. 19% of study participants reported hallucinogen or dissociative use. Substances reported included ecstasy/MDMA/molly, LSD, psilocybin, and dextromethorphan.

Table 3 details self-reported overdose history and witnessed overdose history, including fatal and non-fatal overdoses. The majority (67%) of study participants had previously experienced an overdose, with 39% of individuals reporting three or more lifetime overdoses. Most participants (66%) had previously witnessed a non-fatal overdose; 36% of participants reported witnessing a fatal overdose in the past.

Self-reported opioid use in the past six months and self-reported lifetime overdose history are stratified by fentanyl-positive UDS and naloxone practices in Table 4. 22 participants had self-reported stimulant use with no self-reported intentional opioid use in the past six months. Of these 22 participants, 12 (55%) reported witnessing a non-fatal overdose in their life, while 4 (18%) reported witnessing a fatal overdose. Among this group, 8 of 22 (36%) reported currently having naloxone and 3 of 22 (14%) reported administering naloxone to someone in the past. 8 participants had self-reported benzodiazepine use with no self-reported intentional opioid use in the past six months. Of these 8 participants, 7 (88%) reported witnessing a non-fatal overdose in their life, while 3 (38%) reported witnessing a fatal overdose. Among this group, 5 of 8 (63%) reported currently having naloxone and 4 of 8 (50%) reported administering naloxone to someone in the past.

**Table 3**
Self-reported personal overdose and witnessed overdose history from participants recruited from the emergency department at time of non-fatal drug overdose ($n = 76$)

| Overdose history | n | Percentage |
|---|---|---|
| Previous overdose (excluding enrollment overdose) | | |
| Yes | 51 | 67% |
| No | 24 | 32% |
| Decline to answer | 1 | 1% |
| Number lifetime overdoses | | |
| One | 24 | 32% |
| Two | 19 | 25% |
| Three or more | 30 | 39% |
| Decline to answer | 3 | 4% |
| Number overdoses past year | | |
| One | 47 | 62% |
| Two | 14 | 18% |
| Three or more | 10 | 13% |
| Decline to answer | 5 | 7% |
| Witnessed non-fatal overdose lifetime | | |
| Yes | 50 | 66% |
| No | 25 | 33% |
| Decline to answer | 1 | 1% |
| Witnessed a non-fatal overdose in the past 6 months | | |
| Yes | 19 | 25% |
| No | 53 | 70% |
| Decline to answer | 4 | 5% |
| Witnessed a fatal overdose | | |
| Yes | 27 | 36% |
| No | 47 | 62% |
| Decline to answer | 2 | 3% |
| Witnessed a fatal overdose in the past 6 months | | |
| Yes | 10 | 13% |
| No | 64 | 84% |
| Decline to answer | 2 | 3% |

A standard hospital UDS with a fentanyl immunoassay was performed in 75 of 76 participants. Fentanyl exposure was documented on urine drug screen immunoassay in 67 (89%) study participants at the time of their ED visit. Participants with no self-reported intentional opioid use in the past six months ($n = 32$) had fentanyl-positive UDS 84% of the time. Participants with any self-reported opioid use in the past six months ($n = 42$) had fentanyl-positive UDS 93% of the time.

## 4. Discussion

This pilot study demonstrates that data collected in the ED characterizing populations that experience non-fatal overdose can be used to inform upstream public health efforts. For example, these data suggest the need to expand naloxone distribution and education efforts to populations that do not report opioid use, which includes populations using non-prescribed benzodiazepines and stimulants. In this study there were notable rates of fentanyl exposure in study participants without self-reported opioid use. Whether this is due to unintentional exposure or limitations of self-reported data, such as fear of judgment, cannot be definitively determined. Regardless, this finding points to a potential gap in naloxone distribution and education among people who use drugs. This finding fits with national and local reports of fentanyl in the non-opioid drug supply and highlights the concern that opioid naïve patients are at higher risk for opioid overdose in cases of fentanyl exposure because of lack of tolerance [15,19].

The vast majority of participants in our study had documented fentanyl exposure at the time of ED visit for overdose. Unfortunately, this finding is not unexpected. In Rhode Island, fentanyl and fentanyl analogs have been the main driver of drug overdose death for years. From 2019 to 2021, fentanyl and/or fentanyl analogs contributed to cause of death in 86% ($n = 834$) of drug overdose fatalities [20]. Today the US

**Table 4**
Self-reported opioid use and UDS results over the past six months ($n = 74$) and self-reported lifetime overdose(s) and UDS results ($n = 75$) stratified by opioid use history, fentanyl positive UDS, and naloxone experience

*Self-reported opioid use over the last six months stratified by fentanyl positive UDS and naloxone practices ($n = 74$). Excludes one study participant due to incomplete self-reported use data and another study participant due to lack of UDS data.*

| Self-Reported Opioid Use Over the Past Six Months (=74) | Number of Participants Reporting | Fentanyl Positive UDS | Do you know how to acquire naloxone? | Do you currently have naloxone? | Have you ever administered naloxone to another person during an overdose? |
|---|---|---|---|---|---|
| Daily or Every Other Day | 17 | 16 | 15 | 11 | 11 |
| Weekly or Every Other Week | 9 | 8 | 6 | 3 | 3 |
| Monthly or Less | 16 | 15 | 10 | 9 | 5 |
| No Self Report of Use | 32 | 27 | 16 | 11 | 5 |
| Total | 74 | 66 | 47 | 34 | 24 |

*Self-reported lifetime overdose stratified by fentanyl positive UDS and naloxone practices ($n = 75$). Excludes one study participant due to lack of UDS data.*

| Self-Reported Lifetime Overdose(s) (n = 75) | Participants Reporting Opioid Use | Fentanyl Positive UDS | Do you know how to acquire naloxone? | Do you currently have naloxone? | Have you ever administered naloxone to another person during an overdose? |
|---|---|---|---|---|---|
| 3 or More Lifetime Overdoses | 24 | 22 | 22 | 15 | 16 |
| Two Lifetime Overdoses | 18 | 17 | 12 | 10 | 6 |
| One Lifetime Overdose | 30 | 26 | 11 | 8 | 2 |
| DK/R | 3 | 2 | 2 | 1 | – |
| Total | 75 | 67 | 47 | 34 | 24 |

drug supply is dominated by fentanyl and fentanyl analogs frequently cut with adulterants, e.g., xylazine [21]. This study reports high rates of fentanyl exposure at the time of an ED visit for overdose in populations both with and without self-reported opioid use and documents high rates of self-reported polysubstance use. This finding aligns with rising rates of polysubstance exposure described in overdose [22-24]. Naloxone is effective in the treatment of opioid overdose from fentanyl and fentanyl analogs [25-27]. However, for naloxone to work there needs to be someone present to administer it.

Research shows that those who primarily use stimulants are less likely to have received naloxone training or possess naloxone. A study published in 2021 showed that those with a history of cocaine use (without history of opioid use) were significantly less likely to have received naloxone training, to be aware of fentanyl in the drug supply, and to carry naloxone [28], while an exploratory study by Reed et al. suggested that patients using stimulants only (no regular opioid use) were confused "about what [opioid] overdoses look like and how to respond" to a witnessed overdose [29]. Another study published by Schneider et al. analyzed a population of 420 people with injection drug use and showed that there was a significantly lower rate of take-home naloxone in the stimulant-only group compared to groups that reported polysubstance use with opioids or opioid use only [30].

In this study participants who reported prior overdoses had better knowledge of where to acquire naloxone and how to administer it. This finding speaks to the effectiveness of naloxone efforts in Rhode Island [31,32]. Rhode Island has a robust naloxone distribution network with documented year over year increases in naloxone distribution for the past ten years. For example, over the first nine months of 2022, >40,000 naloxone units were distributed, a >7000 unit increase over 2021 [33]. Naloxone kits are available free via community partners and state contracted organizations including mail order and delivery options for access. In 2023 naloxone became available without a prescription, potentially further reducing barriers to naloxone access [34,35].

Focusing on substance use disorder alone is not enough to address the ongoing opioid overdose epidemic. In this study, the co-occurrence of substance use and self-reported psychiatric illness was 66%. The association between psychiatric illness and substance use disorder has been well established. SAMSHA's 2021 National Survey on Drug Use and Health reported that approximately 17.9 million of the 44 million adults (18+) in the United States with a substance use disorder also had a co-occurring mental health disorder [36], while a study published in 2017 by Han et al. found that 37.9% of U.S. adults with a substance use disorder also had another mental illness. Han et al. also reported that 52.5% of the population with co-occurring SUD and another mental illness received neither mental health care nor substance use treatment, and only 9.1% received treatment for both [37]. While other studies have also found high levels of psychiatric comorbidities, the data in this study is self-reported and may not be generalizable. Regardless, it is evident that there is need for greater access to affordable mental healthcare and substance use treatment to effectively combat the ongoing overdose crisis.

## 5. Limitations

This study presents self-reported data. The accuracy of self-reported drug use data in ED overdose studies can be challenged by stigma in healthcare and the trauma related to the recent overdose. Disclosing substance use may be complicated by numerous factors including social desirability bias, fear of discrimination, or legal concerns, which may result in underreporting of substance use [38-41]. Moreover, ED-based studies for overdose may be susceptible to additional biases. To be enrolled in this study, participants had to experience an unintentional drug overdose, be transported to the ED, and have capacity to consent to study participation. Given these required inclusion criteria, data reported may not be generalizable to overdose populations who do not seek health care evaluation, refuse EMS transport, or even to the overall ED population that experiences overdose. This study was limited to English-speaking patients. Further work needs to evaluate the generalizability of ED studies on substance use to broader populations. The small sample size of this study did not allow for race, ethnicity, or gender comparisons across overdose and drug use data. Future work could pair the quantitative data from this study or more expansive studies with qualitative interviews to elucidate specific resistance or barriers to naloxone and other harm reduction supplies among patients who do not intentionally use opioids. Subsequent studies may also include questions about drug use settings (e.g., bars, clubs, etc.) to help focus public health campaigns.

## 6. Conclusion

This study demonstrated high rates of fentanyl exposure on toxicology testing at time of overdose across all participants, including study participants without self-reported intentional opioid use. Data gathered in the ED at time of overdose can inform upstream naloxone distribution and public health initiatives.

## CRediT authorship contribution statement

**Francesco S. Pappalardo:** Writing – original draft, Visualization, Validation, Investigation, Formal analysis. **Maxwell Krieger:** Writing – review & editing, Data curation. **Carolyn Park:** Writing – review & editing, Data curation. **Francesca L. Beaudoin:** Writing – review & editing, Conceptualization. **Rachel S. Wightman:** Writing – original draft, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization.

## Declaration of competing interest

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