

BRIEF REPORT

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Xylazine awareness and attitudes among people who use drugs in Ohio, 2023–2024

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Abstract

Background The prevalence of xylazine, a non-opioid tranquilizer not for human consumption, in illicitly manufactured fentanyl is increasing in the United States. However, little is known about xylazine awareness and attitudes among people who use drugs.

Methods A cross-sectional survey of people who use drugs in Ohio was conducted from November 2023 – May 2024 to identify xylazine awareness and attitudes in rural and urban counties across the state. Study participants were recruited from naloxone distribution sites, including health departments, syringe service programs, and community-based organizations.

Results Among 630 people who use drugs in Ohio, more than one-half (53.5%) were unaware of xylazine being in “street drugs,” regardless of urbanicity. Among individuals who were aware of xylazine, most (73.0%) indicated they did not want to use the drug and try to avoid it. In addition, 75.8% of this group felt it was “very” or “extremely” important to know if xylazine was in their drugs.

Discussion This research found that many people who use drugs in Ohio are unaware of xylazine and its risks. An important finding of this study is that most individuals who had heard of xylazine did not want to use it and were concerned about knowing whether xylazine was in their drugs.

Keywords Xylazine, Fentanyl, Overdose, Ohio, Drug testing

Background

Xylazine, also called “tranq” or “tranq dope,” is a non-opioid veterinary tranquilizer. Although not approved by the United States (US) Food and Drug Administration for human use, xylazine is increasingly being identified as an adulterant in illicitly manufactured fentanyl and heroin,

and occasionally in other drugs such as cocaine and methamphetamine in the US [1, 2]. Xylazine overdose has no known antidote and can cause central nervous system and respiratory depression, hypotension, and bradycardia in humans [3, 4]. This has led to concern that xylazine could worsen the cardiorespiratory depressive effects and lethality of opioids when the drugs are combined, but its impact on overdose risk and symptoms is still being explored [2, 5–9]. The sedating effects of xylazine, which can last for hours, may also put individuals at greater risk for victimization or injury from assault or exposure to the elements [10]. In addition to its sedating properties, xylazine can also cause severe skin ulcers in humans, regardless of route of use (e.g., injection, smoking, snorting) [2, 11].

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The US Drug Enforcement Administration has identified fentanyl containing xylazine in 48 states, with 23% of powder fentanyl and 7% of fentanyl pills seized containing xylazine [12]. Among 21 US jurisdictions, including Ohio, reporting data to the Centers for Disease Control and Prevention's State Unintentional Drug Overdose Reporting System, the monthly percentage of overdose deaths involving illicitly manufactured fentanyl that also had xylazine detected increased 276% from 2.9% in January 2019 to 10.9% in June 2022 [13]. The age-adjusted rate of drug overdoses involving xylazine increased 35-fold from 2018 to 2021, from 0.03 to 1.06 per 100,000 population [14]. This is likely an underestimate because many jurisdictions do not routinely screen for the drug and vital statistics data do not have codes specific for xylazine [15, 16]. The drug most commonly co-involved with xylazine-associated deaths is fentanyl, which has been identified in 97–99% of these fatalities [13, 14]. Ohio has one of the highest rates of xylazine seizures reported among US states [17]. Ohio drug seizure data from March 29 – November 28, 2023 found 10.5% of all drugs seized contained xylazine, and 37.3% of drugs containing fentanyl also contained xylazine [18].

Despite its increasing prevalence in the unregulated drug supply, little is known about xylazine awareness and attitudes among people who use drugs (PWUD), particularly outside the Northeastern region of the US. This cross-sectional study describes xylazine awareness and attitudes among PWUD in Ohio who are enrolled in a larger study investigating harm reduction strategies for drug overdose prevention [19].

Methods

Study recruitment and enrollment were conducted in accordance with the published study protocol for a larger study investigating fentanyl test strips as an overdose harm reduction strategy [19]. Study participants were recruited from naloxone distribution sites across the state of Ohio, including health departments, syringe service programs, and a variety of community-based organizations. Each study recruitment site was designated as rural or urban according to the county it was located in using a list published by the US Health Resources and Services Administration's Federal Office of Rural Health Policy [20]. Recruitment was conducted in-person by trained research staff who visited each participating site on multiple occasions to approach potential study participants and invite them to enroll in the study.

To capture data on xylazine awareness and attitudes among PWUD, 672 individuals enrolling in the previously described study between November 14, 2023 - May 30, 2024, were asked several questions about their xylazine awareness and attitudes as part of baseline data collection. Inclusion criteria for the study were: (1) age 18

years or older; (2) visitor to a participating naloxone distribution site in Ohio; (3) self-reported use of illicit drugs or any drugs purchased on the street within the past 6 months; (4) a phone number or email address to allow for follow-up contact; and (5) able to participate in study activities in English. Questionnaires were administered in-person using electronic tablet or paper following the completion of informed consent procedures. Participants were paid \$25 for completion of the baseline questionnaire that included the xylazine-related questions as well as other questions relevant to the original fentanyl test strip study. Although the original randomized controlled trial included a fentanyl test strip intervention for participants enrolled in counties randomized to the intervention study arm, all data for the current study were collected prior to intervention delivery and the intervention did not include any information related to xylazine. Participants in the current xylazine study included individuals who were enrolled in both the intervention and non-intervention arms of the original study and no distinctions are made here with regard to randomization.

Xylazine awareness was compared by demographic characteristics, history of drug overdose, and drug(s) of regular use using chi-square, Fisher's exact, or Wilcoxon-Mann-Whitney tests, as applicable, with statistical significance determined at $\alpha=0.05$. Significant findings were further examined separately, using generalized estimating equations estimation method for modified Poisson regression. We chose this approach rather than logistic regression because odds ratios from logistic regression will overestimate the risk or prevalence ratios when the event (xylazine awareness) is not rare [21–24]. Each model was adjusted for age, sex, and race. Prevalence ratios and 95% confidence intervals are reported. All analyses were conducted using SAS version 9.4 (SAS Institute Inc). This study was reviewed and approved by the Institutional Review Board at the authors' institution.

Results

Among 630 study participants who responded to the supplemental xylazine questions (93.8% response rate), 46.5% indicated that they were aware of xylazine being present in "street drugs" (Table 1). Xylazine awareness was more common among those who were younger, White, or had a lifetime history of overdose (all $P<0.0001$). No statistically significant difference was found in xylazine awareness among individuals in rural versus urban counties ($P=0.3515$). However, variability in xylazine awareness was observed across counties, differentiated by rural and urban classifications. In rural counties with recruitment of more than 10 participants, the prevalence of xylazine awareness ranged from 33.3% in Ross County to 63.3% in Guernsey County. Similarly, in urban counties with recruitment of more than 10 participants, awareness

Table 1 Participants characteristics by xylazine awareness among people who use drugs — Ohio, 2023–2024

Characteristic	Overall No. (%)	Xylazine awareness ^a		P-value ^b	PR ^c (95% CI)
		Yes No. (%)	No No. (%)		
Total	630 (100.0)	293 (46.5)	337 (53.5)	—	—
Age, yrs					
Mean (std dev)	43.0 (11.2)	40.7 (10.1)	45.0 (11.7)	< 0.0001	0.99 (0.98–0.99)
Median (range)	42 (19–77)	40 (19–74)	45 (19–77)	—	
Sex					
Female	249 (39.6)	122 (41.8)	127 (37.7)	0.3247	Ref
Male	372 (59.1)	168 (57.5)	204 (60.5)		0.98 (0.83–1.16)
Other ^d	8 (1.3)	2 (0.7)	6 (1.8)		0.62 (0.20–1.98)
Missing ^e	1	1	0	—	—
Race					
Black or African American	152 (24.5)	46 (15.9)	106 (31.9)	< 0.0001	0.70 (0.54–0.91)
White, European American, or Middle Eastern	404 (65.1)	213 (73.7)	191 (57.5)		Ref
Other ^f	65 (10.5)	30 (10.4)	35 (10.5)		0.89 (0.67–1.16)
Missing ^e	9	4	5	—	—
Ethnicity					
Hispanic or Latino	28 (4.5)	14 (4.8)	14 (4.2)	0.7167	—
Not Hispanic or Latino	600 (95.5)	279 (95.2)	321 (95.8)		
Missing ^e	2	0	2	—	—
Education					
Did not finish high school	195 (31.0)	89 (30.4)	106 (31.5)	0.6612	—
Finished high school	255 (40.5)	124 (42.3)	131 (38.9)		
Additional schooling beyond high school	180 (28.6)	80 (27.3)	100 (29.7)		
Currently employed					
Yes	105 (16.7)	52 (17.8)	53 (15.7)	0.4973	—
No	525 (83.3)	241 (82.3)	284 (84.3)		
Currently experiencing homelessness					
Yes	251 (39.8)	123 (42.0)	128 (38.0)	0.3067	—
No	379 (60.2)	170 (58.0)	209 (62.0)		
Recruitment county					
Rural ^g	135 (21.4)	58 (19.8)	77 (22.9)	0.3515	—
Urban ^h	495 (78.6)	235 (80.2)	260 (77.2)		
Lifetime history of overdose					
Yes	343 (54.5)	191 (65.4)	152 (45.1)	< 0.0001	1.44 (1.20–1.74)
No	286 (45.5)	101 (34.6)	185 (54.9)		Ref
Missing ^e	1	1	0	—	—
Overdose in the past six months (if lifetime = Yes)					
Yes	113 (32.9)	56 (29.3)	57 (37.5)	0.1093	—
No	230 (67.1)	135 (70.7)	95 (62.5)		
Worried about overdosing in future					

Table 1 (continued)

Characteristic	Overall No. (%)	Xylazine awareness ^a		P-value ^b	PR ^c (95% CI)
		Yes No. (%)	No No. (%)		
Yes	306 (48.8)	152 (52.2)	154 (45.8)	0.1098	—
No	321 (51.2)	139 (47.8)	182 (54.2)		
Missing ^e	3	2	1	—	

Abbreviations: PR=Prevalence ratio; CI=Confidence interval; Ref=Reference

Bold indicates statistical significance

^aRespondents were asked, “Before today, had you ever heard of xylazine being present in street drugs? (Xylazine is also known as tranq, tranq dope, Philly dope, sleep cut, or zombie drug.)” Missing responses were excluded from analyses

^bP-values calculated from Chi-square, Fisher’s exact, or Wilcoxon-Mann-Whitney tests

^cSignificant result from Chi-square test for drug overdose by xylazine awareness was examined further using Generalized Estimating Equations (GEE) estimation method for modified Poisson regression, controlling for age, sex, and race

^dIncludes intersex, transgender female, & transgender male

^eMissing values were omitted from the denominator when calculating percentages

^fIncludes Asian, Native American, Indigenous, or Alaska Native, Native Hawaiian or Other Pacific Islander, Two or more races, and Other

^gIncludes Guernsey, Knox, Logan, Marion, Muskingum, Ross, and Washington counties

^hIncludes Butler, Cuyahoga, Franklin, Hamilton, Lucas, Mahoning, Miami, Montgomery, Portage, and Union counties

ranged from 40.3% in Franklin County to 75.7% in Butler County. Participants reporting a history of overdose in a lifetime were 44% more likely to be aware of xylazine, compared to those who did not report any overdose in their lifetime.

Cocaine (42.9%), fentanyl (40.6%), methamphetamine/amphetamine (38.1%), and heroin (27%) were the most frequent regularly used illicit drugs among study participants (Table 2). Xylazine awareness was higher among individuals who reported regularly using fentanyl (PR=1.67, 95% CI: 1.40–1.98) or heroin (PR=1.34, 95% CI: 1.14–1.58), compared to those who did not report regular use of those drugs.

Participants age was a significant factor for xylazine awareness in all regression models except for the model in which fentanyl was the drug regularly used. With each year increase in age of a participant, the prevalence of xylazine awareness decreased by 1–2%. Black or African American participants reported lower prevalence (ranging 27–33%) of xylazine awareness compared to White, European American, or Middle Eastern participants. No significant difference in xylazine awareness was observed between “other” race and White, European American, or Middle Eastern participants.

When asked about their attitudes related to xylazine use, among individuals who indicated they were aware of xylazine at the time of the survey, most (73.0%) indicated “I do not want to use xylazine and try to avoid it” (Table 3). In addition, 75.8% of these participants felt it was “very” or “extremely” important to know if xylazine was in their drugs.

Discussion

This survey of PWUD in a Midwestern US state provides an important and timely contribution to discussions about xylazine in the unregulated drug supply. Despite the prevalence of xylazine in Ohio and frequent news coverage and government alerts about the issue, this research indicates many PWUD are unaware of this emerging threat. The findings of this study also indicate many PWUD in Ohio are concerned about the presence of xylazine in their drugs and want to avoid exposure to it. This is consistent with the results of other recent studies in the US and supports the need for greater access to reliable tools, such as xylazine test strips or access to community-based drug checking services, that allow individuals to test their drugs for adulterants before using them [25, 26]. Identifying the presence of xylazine in drugs before use is important, because naloxone will not reverse the effects of xylazine [12, 27]. (However, naloxone should still be given in response to suspected xylazine overdoses because opioids are often involved in these incidents [3]). While xylazine test strips are commercially available for consumer use, research is needed to understand the feasibility, acceptability, and impact of utilizing these tools as a harm reduction strategy, as well as what other types of interventions may be effective for preventing xylazine-related harms. These efforts should include active participation by PWUD and people with lived experience of drug use and should provide opportunities for them to contribute their knowledge and experiences to the work.

Xylazine is not currently scheduled under the Controlled Substances Act, and therefore, is not subject to the authority of the US Drug Enforcement Administration. However, the US Food and Drug Administration does have authority over xylazine under the Federal

Table 2 Participants drug profile by xylazine awareness among people who use drugs — Ohio, 2023–2024

Characteristic	Overall No. (%)	Xylazine awareness ^a		P-value ^b	PR ^c (95% CI)
		Yes No. (%)	No No. (%)		
Total	630 (100.0)	293 (46.5)	337 (53.5)	—	—
Drug(s) regularly used (not mutually exclusive)					
Marijuana	304 (48.3)	120 (39.5)	184 (60.5)	0.0006	0.77 (0.64–0.91)
Cocaine	270 (42.9)	117 (43.3)	153 (56.7)	0.1665	—
Fentanyl	256 (40.6)	165 (64.5)	91 (35.6)	< 0.0001	1.67 (1.40–1.98)
Meth/Methamphetamine/Amphetamine	240 (38.1)	134 (55.8)	106 (44.2)	0.0002	1.17 (0.99–1.39)
Heroin	170 (27.0)	101 (59.4)	69 (40.6)	< 0.0001	1.34 (1.14–1.58)
Alcohol	160 (25.4)	51 (31.9)	109 (68.1)	< 0.0001	0.67 (0.52–0.85)
Prescription pills that are not from a doctor or pharmacy	84 (13.3)	38 (45.2)	46 (54.8)	0.8021	—
MDMA/Ecstasy/GHB	26 (4.1)	13 (50.0)	13 (50.0)	0.7154	—
K2/SPICE	16 (2.5)	9 (56.3)	7 (43.8)	0.4287	—
Ketamine/PCP/DXM	10 (1.6)	8 (80.0)	2 (20.0)	0.0509	—
Other ^e	27 (4.3)	14 (51.9)	13 (48.2)	0.5693	—
Unknown	8 (1.3)	4 (50.0)	4 (50.0)	1.0000	—
Prefer not to answer	29 (4.6)	12 (41.4)	17 (58.6)	0.5708	—
Polydrug use^f					
Yes	453 (75.0)	219 (48.3)	234 (51.7)	0.2586	—
No	151 (25.0)	65 (43.1)	86 (57)	—	—
Missing ^d	26	9	17	—	—
Number of drugs indicated^g					
Mean (std dev)	2.5 (1.5)	2.6 (1.6)	2.4 (1.4)	0.0348	—
Median (min-max)	2 (0–10)	2 (0–10)	2 (0–9)	—	—

Abbreviations: PR=Prevalence ratio; CI=Confidence interval; Ref=Reference

Bold indicates statistical significance

^aRespondents were asked, “Before today, had you ever heard of xylazine being present in street drugs? (Xylazine is also known as tranq, tranq dope, Philly dope, sleep cut, or zombie drug.)” Missing responses were excluded from analyses

^bP-values calculated from Chi-square, Fisher’s exact, or Wilcoxon-Mann-Whitney tests

^cSignificant results from Chi-square or Fisher’s exact tests for drug(s) of regular use characteristics by xylazine awareness were examined further using Generalized Estimating Equations (GEE) estimation method for modified Poisson regression separately, controlling for age, sex, and race

^dMissing values were omitted from the denominator when calculating percentages

^eIncludes hash, suboxone, tobacco products, methadone, etc

^fTwo or more drugs selected (Heroin, Fentanyl, Marijuana, Meth/Methamphetamine/Amphetamine, Cocaine, Prescription pills that are not from a doctor or pharmacy, MDMA/Ecstasy/GHB, Ketamine/PCP/DXM, K2/SPICE, Alcohol, or Other)

^gNumber of drug selected (Heroin, Fentanyl, Marijuana, Meth/Methamphetamine/Amphetamine, Cocaine, Prescription pills that are not from a doctor or pharmacy, MDMA/Ecstasy/GHB, Ketamine/PCP/DXM, K2/SPICE, Alcohol, or Other)

Food, Drug, and Cosmetic Act. Xylazine is legitimately used for veterinary sedation and analgesic purposes, but the US Food and Drug Administration restricts its import for non-approved uses and collaborates with US Customs and Border Protection to interdict illicit shipments. The US Congress and the US Drug Enforcement Administration have the authority to schedule xylazine as a controlled substance (several bills are currently under consideration in the 118th Congress), and some states have decided to do so on their own [28, 29]. In March 2023, Ohio Governor Mike DeWine signed an executive order to direct the State of Ohio Board of Pharmacy to classify xylazine as a Schedule III controlled substance, making the state one of the first in the US to do so [30]. Despite this progress, there are currently no coordinated efforts at the state level in Ohio regarding xylazine

education or xylazine test strip distribution in communities. The state’s Project DAWN (Deaths Avoided with Naloxone) program, which offers no-cost naloxone, fentanyl test strips, and corresponding educational materials for distribution by more than 200 partner sites across the state, does not provide xylazine test strips or educational materials at this time. The current study’s findings regarding the lack of xylazine awareness among participants in both rural and urban counties highlights the need for greater universal community education. There are some limitations to this study. Study participants were recruited from a single state and the cross-sectional nature of the study was unable to capture whether participants’ knowledge and attitudes about xylazine evolved over time. Survey responses were self-reported by study participants and are subject to recall and social

Table 3 Xylazine attitudes among people who use drugs and have xylazine awareness— Ohio, 2023–2024

Characteristic	Xylazine awareness ^a , Yes No. (%)
Total	293 (100.0)
How do you feel about using xylazine?	
I would rather use xylazine than other drugs	13 (4.4)
I use xylazine when it is available, but it isn't my 1st choice	16 (5.5)
I don't try to use xylazine, but I'm not worried about it being in my drugs	42 (14.3)
I do not want to use xylazine and try to avoid it	214 (73.0)
Other ^b	8 (2.7)
How important is it to know if xylazine is in your drugs?	
Not important at all	19 (6.5)
Slightly important	20 (6.8)
Moderately important	32 (10.9)
Very important	92 (31.4)
Extremely important	130 (44.4)

^aRespondents were asked, "Before today, had you ever heard of xylazine being present in street drugs? (Xylazine is also known as tranq, tranq dope, Philly dope, sleep cut, or zombie drug.)" Missing responses were excluded from analyses

^bIncluded responses "don't know," "NA," "Not sure," etc

desirability bias. The survey is also limited by lack of input from PWUD and people with lived experience of drug use in its development and the fact that it did not utilize a validated survey instrument. Because study participants were enrolled from naloxone distribution sites, such health departments, this population may be better informed about emerging drugs and drug-related risks than other PWUD in the community. In addition, some counties contributed only a few participants to the study. There are also some questions raised by the study findings that we are not able to answer with the available data, such as the impact of recency of past overdose on xylazine awareness and differences in xylazine awareness by substances used. We hope future research will be able to further explore these interesting findings. Despite these limitations, this study contributes important information about xylazine awareness and attitudes among PWUD in a Midwestern US state.

Conclusions

The increasing prevalence of xylazine in the unregulated drug supply has introduced new dangers for PWUD and additional challenges for public health workers. This study found that many PWUD in Ohio are unaware of xylazine and its risks. Among individuals who had heard of xylazine, the majority did not want to use it and indicated concern about knowing whether xylazine was in their drugs. Greater education about xylazine and its risks and improved access to reliable drug testing tools are needed.

Abbreviations

PWUD people who use drugs
 US United States of America

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Author contributions

NLM conceptualized and designed the study, interpreted data findings, and created the initial manuscript draft. SB contributed to the study design, carried out the data coding and analysis, interpreted data findings, and critically reviewed and revised the manuscript. ASM contributed to the study design, interpreted data findings, and critically reviewed and revised the manuscript. HH interpreted data findings and critically reviewed and revised the manuscript. GAS contributed to study design, interpreted data findings, and critically reviewed and revised the manuscript. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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Data availability

The data that support the findings of this study may be available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

The Nationwide Children's Hospital Institutional Review Board has given ethical approval for this study (STUDY00001919). Informed consent was obtained from all study participants according to our IRB-approved study protocol.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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