

Drug Overdose Deaths Involving Xylazine: United States, 2018–2021

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Abstract

Objectives—This study presents trends in drug overdose death rates involving xylazine from 2018 through 2021, overall and by sex. Rates of drug overdose deaths involving xylazine are also presented by age group and race and Hispanic origin from 2020 through 2021, and by the U.S. Department of Health and Human Services public health regions in 2021. Co-involvement for the most frequent drugs involved with xylazine in 2018 through 2021 is also reported.

Methods—Using an established methodology for examining death certificate literal text, drug overdose deaths involving xylazine for deaths occurring in the United States for U.S. residents were identified. Drug overdose deaths were limited to those with *International Classification of Diseases, 10th Revision* underlying cause-of-death codes X40–X44, X60–X64, X85, or Y10–Y14.

Results—The age-adjusted rate of drug overdose deaths involving xylazine increased from 0.03 per 100,000 standard population in 2018 to 1.06 in 2021. Rates for males were at least twice the rates for females for each year between 2018 and 2021. Between 2020 and 2021, rates increased across all age groups

and reportable race and Hispanic-origin categories. In 2020, rates were highest among those aged 25–34 and 35–44, while in 2021, rates were highest among those aged 35–44. In 2020 and 2021, rates were highest among Black or African-American non-Hispanic people (0.68 and 1.82, respectively). However, the largest increase in rates occurred among Hispanic or Latino people compared with other groups, tripling from 0.21 in 2020 to 0.64 in 2021. In 2021, the highest rate of drug overdose deaths involving xylazine occurred in Region 3 (which includes Delaware, the District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia), followed by other regions along the East Coast. Fentanyl was the most frequently co-occurring drug mentioned on xylazine death records between 2018 and 2021.

Keywords: drug involved • mortality surveillance • poisoning • National Vital Statistics System

Introduction

Xylazine, a drug approved for veterinary medicinal use for sedation, anesthesia, muscle relaxation, and analgesia (pain relief), has received recent attention due to its increasing involvement in drug overdose deaths

in the United States (1–5). Typically, deaths in the United States are coded to the *International Classification of Diseases, 10th Revision* (ICD–10) to classify underlying and multiple causes of death in the National Vital Statistics System (NVSS) (6). However, one limitation of the ICD–10 classification system is that, with a few exceptions, ICD–10 codes do not reflect specific drugs but, rather, broader categories. For example, the ICD–10 code for poisoning by antiepileptic and sedative-hypnotic drugs (T42.7) includes deaths involving xylazine and levetiracetam. Consequently, a literal text analysis of death certificate records can help ensure adequate monitoring and surveillance of xylazine involvement.

Over the past decade, the National Center for Health Statistics has developed a method that searches the literal text of death certificates to identify mentions of specific drugs and other substances involved in the deaths (7). Death certificate literal text is the written information provided by the medical certifier, usually a medical examiner or coroner for drug overdose deaths, that describes the causes, manner, and circumstances contributing to the death (8). Using this method to search the literal text, this report describes xylazine involvement in drug overdose deaths from 2018 through 2021,



and reports rates by demographic and regional characteristics for selected years during this period.

Data Source and Methods

Data source and study population

The study population included decedents who resided and died in the United States and had an underlying cause of death of drug overdose as identified by the following ICD–10 codes: X40–X44 (unintentional), X60–X64 (suicide), X85 (homicide), and Y10–Y14 (undetermined intent). For drug overdose deaths during 2018–2021, 87.4%–92.1% were unintentional, 4.1%–7.2% were suicides, 3.6%–5.2% were of undetermined intent, and less than 1.0% were homicides. Population estimates used for computing rates for 2018 through 2020 are yearly July 1 postcensal estimates based on the April 1, 2010, census. The population estimates used to calculate death rates for 2021 are July 1, 2021, postcensal estimates based on the Blended Base produced by the U.S. Census Bureau (9,10).

NVSS death certificate records are held in a dynamic database and are considered provisional until the data have been processed, reviewed, verified, and released by the National Center for Health Statistics as a final data set. For this analysis, a file containing literal text and other mortality information for 2018–2021 was retrieved from the database on May 24, 2023. Because the dynamic database may continue to receive updates to death certificate data after the closeout of data, death counts may differ from other published sources.

Drugs involved in deaths were extracted from the death certificate literal text: the causes of death from Part I, significant conditions contributing to the death from Part II, and a description of how the injury occurred. Drug overdose deaths involving xylazine, as well as the three most frequent drugs co-involved with

these deaths by year, were identified from these text fields using the method described below.

Identifying drug overdose deaths involving xylazine

Specific drugs can be identified when the drug or substance is mentioned in the literal text of the death certificate. The drugs or substances mentioned in literal text fields are assumed to be involved in the death unless contextual information indicates otherwise. The methodology for searching literal text information to characterize drugs involved in deaths is briefly described below, and in detail in previous reports (2–4,7).

The Drugs Mentioned with Involvement methodology was used to identify mentions of xylazine—and the three most frequent drugs co-involved with xylazine—by using search terms, including generic names, brand names, common usage or street names, abbreviations, metabolites, misspellings, and other variations (7). Each search term is mapped to a “principal variant,” the label assigned to a drug, a drug class, or exposure not otherwise specified. Principal variants are linked to a “unique ingredient identifier,” which describes the substance’s molecular structure or descriptive information as generated by the Global Substance Registration System maintained by the U.S. Food and Drug Administration. Based on the analysis of the literal text, search terms “ROMPUN,” “XYLAZINE,” “XYLACINE,” “XYLAZYNE,” “XYLAZIN,” and “ZYLAZINE” were all mapped to the principal variant “XYLAZINE.”

“Referent drug groups” serve as the unit of analysis for reporting drug overdose deaths of specific drugs. A referent drug group is a category made up of any number of principal variants grouped together to reflect a broader drug category. For the case of drug overdose deaths involving xylazine, the principal variant and referent group are the same (“XYLAZINE”). However, the principal variant can be

more narrowly focused for other drugs, such as drug overdose deaths involving fentanyl. For example, the referent drug group “fentanyl” includes more than one principal variant, such as fentanyl analogs (“CARFENTANIL”), precursors (“DEPROPIONYLFENTANYL”), and metabolites (“NORFENTANYL”) of fentanyl.

Data analysis

Age-adjusted death rates were calculated using the direct method, adjusted to the 2000 standard population, and include all ages (6), using R statistical software version 4.0.3 (11). Any differences between rates presented in this report are statistically significant (p values less than 0.05).

Trends in age-adjusted death rates from 2018 through 2021 were evaluated using z tests (between years) and the National Cancer Institute’s Joinpoint Regression Program (12). Because the number of deaths involving xylazine before 2018 was too small to produce reliable estimates, the study period of 2018 through 2021 was selected. Joinpoint software fitted weighted least-squares regression models to the rates on the log-transformed scale. Allowing one observed time point at each end and two for the middle line segments, the grid search algorithm searched for a maximum of two joinpoints at an overall alpha level of $p < 0.05$ (10). Pairwise comparisons of rates to detect differences within demographic groups and regions were conducted using a z test statistic at the 0.05 level of significance (13).

Age-adjusted rates of drug overdose deaths by race and Hispanic origin for 2020 and 2021 were reported using categories based on the Office of Management and Budget’s 1997 standards for federal statistical and administrative reporting (14). All race categories are single race, meaning that only one race was reported on the death certificate. Only race and Hispanic-origin groups with statistically reliable estimates were reported.

These groups include Black or African American non-Hispanic (subsequently, Black); White non-Hispanic (subsequently, White); Hispanic or Latino; and more than one race, non-Hispanic. Non-Hispanic decedents where more than one race was reported were grouped into “More than one race, non-Hispanic.” Data shown for the Hispanic population include people of any race. Misclassification of Hispanic people on death certificates has been estimated to be about 3% (15). At this time, the extent of this misclassification has not been evaluated for all causes of death (including drug overdose deaths); as a result, rates are not adjusted for misclassification.

Geographic patterns in overdose deaths involving xylazine in 2021 are presented using the 10 U.S. Department of Health and Human Services public health regions (16). The regions, excluding U.S. territories, are:

- Region 1: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont
- Region 2: New Jersey and New York
- Region 3: Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia
- Region 4: Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee
- Region 5: Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin
- Region 6: Arkansas, Louisiana, New Mexico, Oklahoma, and Texas
- Region 7: Iowa, Kansas, Missouri, and Nebraska
- Region 8: Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming
- Region 9: Arizona, California, Hawaii, and Nevada
- Region 10: Alaska, Idaho, Oregon, and Washington.

Rates for Regions 8–10 did not meet the reliability criteria of 20 deaths or more and as a result are not reported

separately, but deaths in these regions were reported as part of the overall rates (6).

Results

Age-adjusted rate of drug overdose deaths involving xylazine, by sex: United States, 2018–2021

In 2021, the age-adjusted rate of drug overdose deaths involving xylazine was 35 times higher than the 2018 rate, increasing from 0.03 per 100,000 standard population to 1.06 (Table 1, Figure 1). The number of drug overdose deaths involving xylazine was 102 in 2018, 627 in 2019, 1,499 in 2020, and 3,468 in 2021 (Table 1). Among males, the rate of drug overdose deaths involving xylazine increased from 0.05 in 2018 to 1.55 in 2021. Among females, the rate increased from 0.01 in 2018 to 0.57 in 2021. Rates of drug overdose deaths involving xylazine for males were at least double the rates for females over the 2018–2021 period.

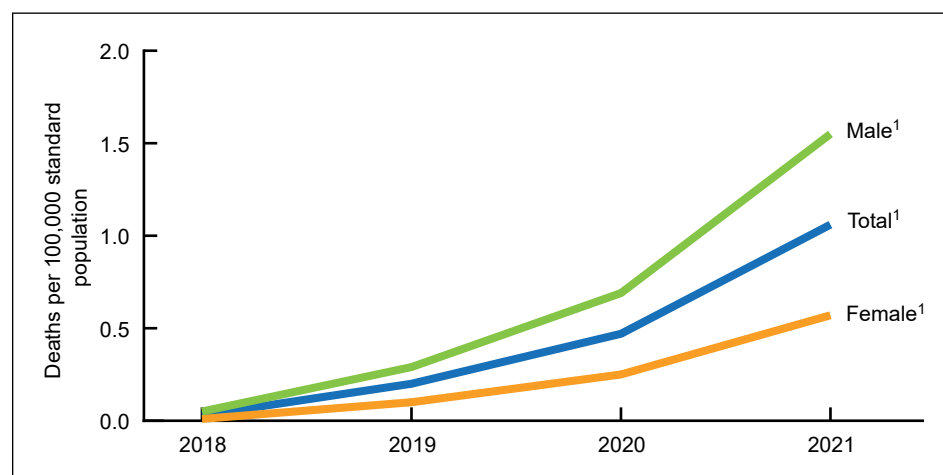
Rate of drug overdose deaths involving xylazine, by age group: United States, 2020–2021

Rates of drug overdose deaths involving xylazine increased from 2020 to 2021 across all age groups. In 2020, the rate of drug overdose deaths involving xylazine was highest for those aged 25–34 (1.00 per 100,000) and 35–44 (0.98), and lowest among those aged 0–24 (0.08) and 65 and over (0.09) (Table 2, Figure 2). In 2021, rates were highest among those aged 35–44 (2.24); the rate of drug overdose deaths involving xylazine was lowest among those aged 0–24 (0.16).

Age-adjusted rate of drug overdose deaths involving xylazine, by race and Hispanic origin: United States, 2020–2021

For all reportable race and Hispanic-origin groups, rates increased from 2020 to 2021. Rates were highest among Black people, where the age-adjusted rate of drug overdose deaths involving xylazine increased from

Figure 1. Age-adjusted rate of drug overdose deaths involving xylazine, by sex: United States, 2018–2021

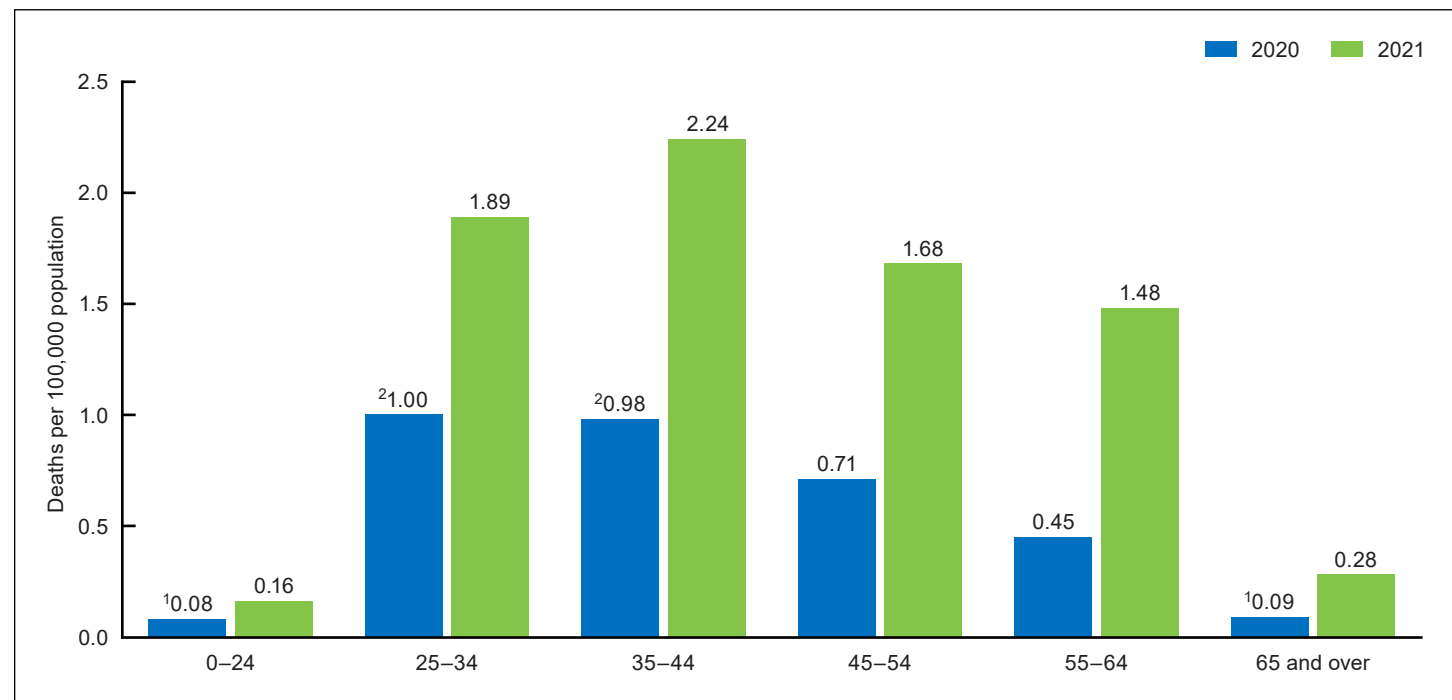


¹Increasing trend from 2018 through 2021 ($p < 0.05$).

NOTES: Drug overdose deaths are identified using *International Classification of Diseases, 10th Revision* underlying cause-of-death codes X40–X44, X60–X64, X85, and Y10–Y14. Deaths may involve other drugs in addition to the referent (listed) drug. Age-adjusted death rates were calculated using the direct method and adjusted to the 2000 U.S. standard population. When comparing rates across years, note that trends may be influenced by improvements in drug reporting. The reporting of at least one specific drug or drug class in the literal text, as identified by multiple cause-of-death codes T36–T50.8, improved from 92.0% of drug overdose deaths in 2018 to 95.2% in 2021.

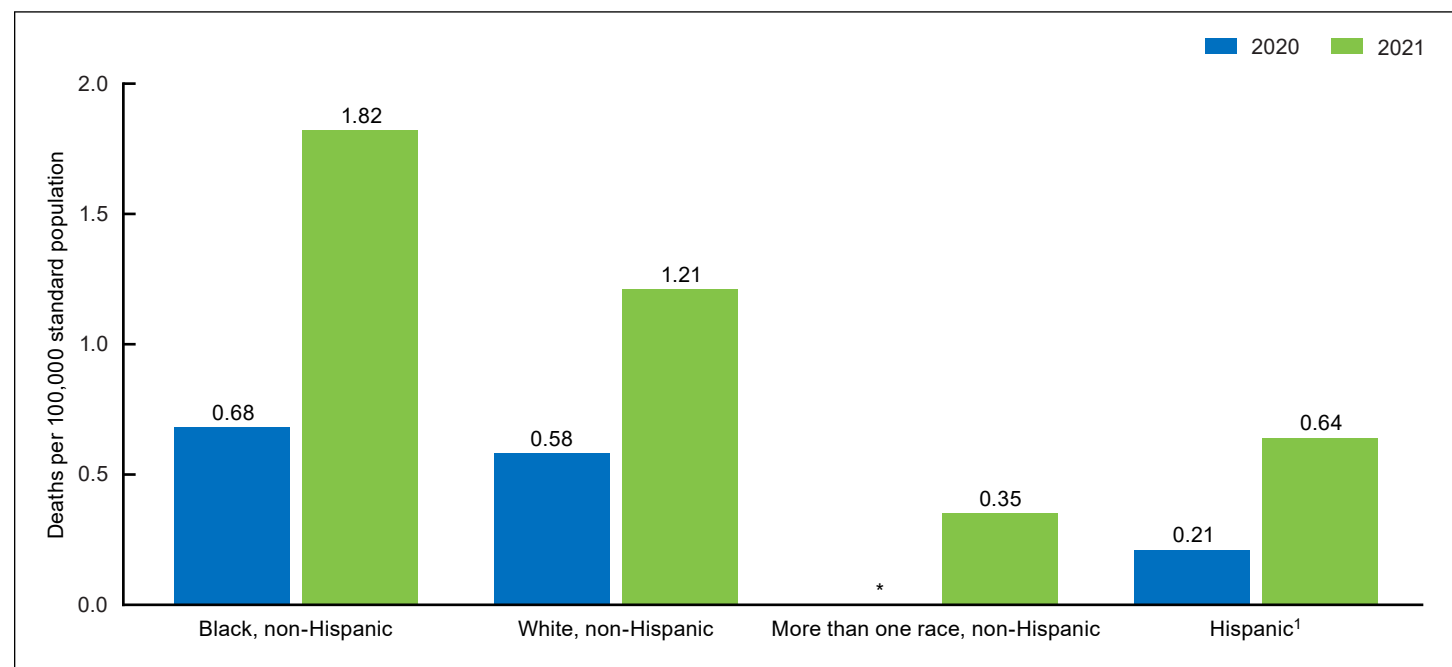
SOURCE: National Center for Health Statistics, death certificate literal text from the National Vital Statistics System as of May 24, 2023.

Figure 2. Rate of drug overdose deaths involving xylazine, by age group: United States, 2020–2021



¹Significantly lower than all other age groups ($p < 0.05$) for 2020.
²Significantly higher than all other age groups ($p < 0.05$) for 2020.
 NOTES: Drug overdose deaths are identified using *International Classification of Diseases, 10th Revision* underlying cause-of-death codes X40–X44, X60–X64, X85, and Y10–Y14. Deaths may involve other drugs in addition to the referent (listed) drug. When comparing rates across years, note that trends may be influenced by improvements in drug reporting. The reporting of at least one specific drug or drug class in the literal text, as identified by multiple cause-of-death codes T36–T50.8, improved from 94.4% of drug overdose deaths in 2020 to 95.2% in 2021. Differences in rates between 2020 and 2021 were significant for all groups ($p < 0.05$). In 2021, differences in rates were significant between all groups ($p < 0.05$).
 SOURCE: National Center for Health Statistics, death certificate literal text from the National Vital Statistics System as of May 24, 2023.

Figure 3. Age-adjusted rate of drug overdose deaths involving xylazine, by race and Hispanic origin: United States, 2020–2021



* Rate does not meet the National Center for Health Statistics reliability criteria of 20 deaths or more and as a result is not reported.
¹People of Hispanic origin may be of any race.
 NOTES: Drug overdose deaths are identified using *International Classification of Diseases, 10th Revision* underlying cause-of-death codes X40–X44, X60–X64, X85, and Y10–Y14. Deaths may involve other drugs in addition to the referent (listed) drug. Age-adjusted death rates were calculated using the direct method and adjusted to the 2000 U.S. standard population. When comparing rates across years, note that trends may be influenced by improvements in drug reporting. The reporting of at least one specific drug or drug class in the literal text, as identified by multiple cause-of-death codes T36–T50.8, improved from 94.4% of drug overdose deaths in 2020 to 95.2% in 2021. Difference in rates between 2020 and 2021 and within a given year for all groups was significant ($p < 0.05$). Asian non-Hispanic, Native Hawaiian or Other Pacific Islander non-Hispanic, and American Indian or Alaska Native non-Hispanic people are not reported because the 2020 and 2021 rates do not meet the reliability criteria of 20 deaths or more (see <https://www.cdc.gov/nchs/data/nvsr/nvsr70-08-508.pdf>).
 SOURCE: National Center for Health Statistics, death certificate literal text from the National Vital Statistics System as of May 24, 2023.

0.68 per 100,000 standard population in 2020 to 1.82 in 2021 (Table 2, Figure 3). Rates were second highest among White people, where the rate increased from 0.58 in 2020 to 1.21 in 2021. Among Hispanic people, the rate increased from 0.21 in 2020 to 0.64 in 2021. Among non-Hispanic people of more than one race, the rate was not reportable in 2020 but was 0.35 in 2021, which was the lowest rate.

Age-adjusted rate of drug overdose deaths involving xylazine by region, 2021

In 2021, the rate of drug overdose deaths involving xylazine was highest in Region 3 at 4.05 per 100,000 standard population, followed by Region 1 at 2.62 and Region 2 at 2.44 (Table 3, Figure 4). The rate of drug overdose deaths involving xylazine was lowest

in Region 6 at 0.15, followed by Region 7 (0.33), Region 4 (0.79), and Region 5 (0.92). Rates for Regions 8–10 did not meet the reliability criteria of 20 deaths or more and, as a result, are not reported (6).

Most frequent concomitant drugs co-involved in drug overdose deaths involving xylazine: United States, 2018–2021

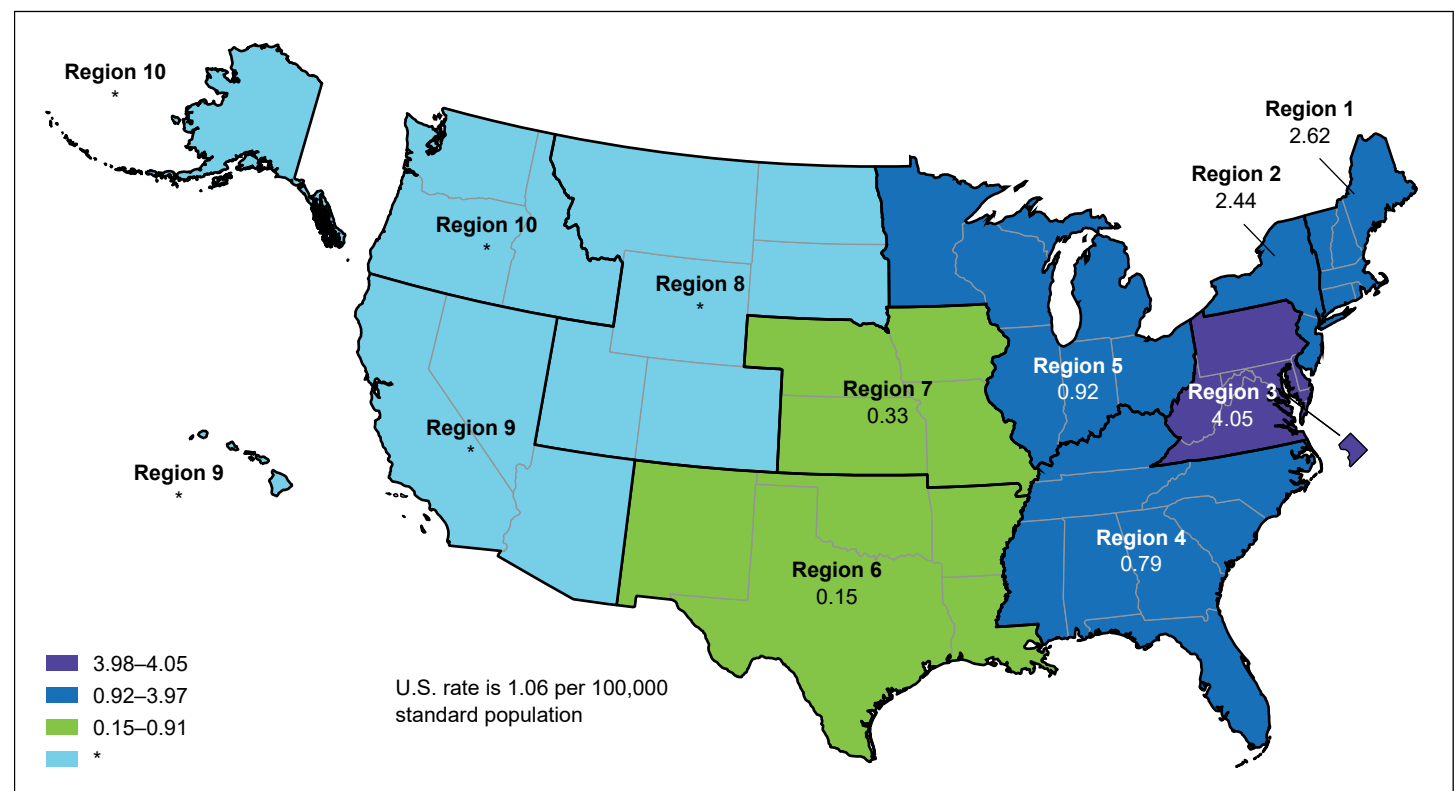
Throughout 2018–2021, almost all drug overdose deaths involving xylazine mentioned fentanyl in addition to other drugs (Table). Between 97.1% and 99.4% of drug overdose deaths involving xylazine in this time period also mentioned fentanyl, which was the most frequent co-involved drug. The second most frequent co-involved drug was cocaine, whose co-involvement

varied over time: 40.2% of deaths in 2018, 30.9% in 2019, 32.6% in 2020, and 35.1% in 2021. The third most frequent co-involved drug with xylazine in 2018 and 2019 was heroin (29.4% and 24.1%, respectively). In 2020 and 2021, the third most frequent drug mentioned was methamphetamine (15.5% and 18.8%, respectively).

Discussion

This study highlights the increase in drug overdose deaths involving xylazine since 2018. The number of drug overdose deaths involving xylazine was 102 deaths in 2018, 627 in 2019, 1,499 in 2020, and 3,468 in 2021. Overall, the age-adjusted rate of drug overdose deaths involving xylazine increased 35 times, from 0.03 per 100,000 standard population in 2018 to 1.06 in 2021. The increases in rates were observed among both males and females, although the rate for males was

Figure 4. Age-adjusted rate of drug overdose deaths involving xylazine, by region: United States, 2021



* Rate does not meet the National Center for Health Statistics reliability criteria of 20 deaths or more and as a result is not reported.
 NOTES: Drug overdose deaths are identified using *International Classification of Diseases, 10th Revision* underlying cause-of-death codes X40–X44, X60–X64, X85, and Y10–Y14. Deaths may involve other drugs in addition to the referent (listed) drug. Age-adjusted death rates were calculated using the direct method and adjusted to the 2000 U.S. standard population. Regions are the U.S. Department of Health and Human Services public health regions: Region 1 (CT, MA, ME, NH, RI, and VT), Region 2 (NJ and NY), Region 3 (DC, DE, MD, PA, VA, and WV), Region 4 (AL, FL, GA, KY, MS, NC, SC, and TN), Region 5 (IL, IN, MI, MN, OH, and WI), Region 6 (AR, LA, NM, OK, and TX), Region 7 (IA, KS, MO, and NE), Region 8 (CO, MT, ND, SD, UT, and WY), Region 9 (AZ, CA, HI, and NV), and Region 10 (AK, ID, OR, and WA). Except for Regions 1 and 2, differences in rates between all regions were significant ($p < 0.05$).
 SOURCE: National Center for Health Statistics, death certificate literal text from the National Vital Statistics System as of May 24, 2023.

Table. Most frequent concomitant drugs for drug overdose deaths involving xylazine: United States, 2018–2021

Year	Referent drug	Number of drug overdose deaths involving referent drug	Most frequent concomitant drug		Second most frequent concomitant drug		Third most frequent concomitant drug	
			Concomitant drug	Number and percent of deaths involving both drugs	Concomitant drug	Number and percent of deaths involving both drugs	Concomitant drug	Number and percent of deaths involving both drugs
2021.....	Xylazine	3,468	Fentanyl	3,437 (99.1)	Cocaine	1,216 (35.1)	Methamphetamine	652 (18.8)
2020.....	Xylazine	1,499	Fentanyl	1,490 (99.4)	Cocaine	489 (32.6)	Methamphetamine	232 (15.5)
2019.....	Xylazine	627	Fentanyl	621 (99.0)	Cocaine	194 (30.9)	Heroin	151 (24.1)
2018.....	Xylazine	102	Fentanyl	99 (97.1)	Cocaine	41 (40.2)	Heroin	30 (29.4)

NOTES: Drug overdose deaths are identified using *International Classification of Diseases, 10th Revision* underlying cause-of-death codes X40–X44, X60–X64, X85, and Y10–Y14. Deaths may involve other drugs in addition to xylazine. Age-adjusted death rates were calculated using the direct method and adjusted to the 2000 U.S. standard population. When comparing rates across years, note that trends may be influenced by improvements in drug reporting. The reporting of at least one specific drug or drug class in the literal text, as identified by multiple cause-of-death codes T36–T50.8, improved from 92.0% of drug overdose deaths in 2018 to 95.2% in 2021.

SOURCE: National Center for Health Statistics, death certificate literal text from the National Vital Statistics System as of May 24, 2023.

more than double the rate for females each year. Rates for all age groups increased between 2020 and 2021, where rates were highest among those aged 25–34 and 35–44 in 2020 and among those aged 35–44 in 2021. By race and Hispanic-origin, rates were highest among Black people, followed by White people and then Hispanic people. The greatest increase was observed among Hispanic people, where the rate tripled from 0.21 in 2020 to 0.64 in 2021. Black people had the second largest increase, where the rate nearly tripled from 0.68 per 100,000 in 2020 to 1.82 in 2021, followed by White people, whose rates more than doubled (from 0.58 in 2020 to 1.21 in 2021). However, note that death rates involving xylazine were low for all years, which may magnify the relative changes over time. Geographically, the highest rate of drug overdose deaths involving xylazine occurred in Region 3 (Delaware, the District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia), followed by other regions along the East Coast (Regions 1, 2, 4, and 5). From 2018 through 2021, more than 97% of drug overdose deaths involving xylazine also mentioned fentanyl, which was the most frequent drug co-involved in those deaths. Notably, co-involvement of methamphetamine with drug overdose deaths involving xylazine increased over the period, and methamphetamine surpassed heroin as the third most frequent drug co-involved in overdose deaths for 2020 and 2021.

Overall, drug overdose deaths have risen over the period, increasing from 20.7 per 100,000 in 2018 to 32.4 in 2021 (17). This report provides the first national estimates using NVSS data on the rates of drug overdose deaths involving xylazine in the United States, while supporting other studies describing xylazine involvement. Of note, a recent study using the State Unintentional Drug Overdose Reporting System—a system that collects postmortem toxicology results as well as reports from coroners and medical examiners from up to 47 states and the District of Columbia—examined xylazine detection in illicitly manufactured fentanyl-involved drug overdose deaths of unintentional and undetermined intent (2). Despite the use of different data systems (NVSS and the State Unintentional Drug Overdose Reporting System) and differing methodological approaches, both this report and the recent study similarly identified co-involvement of fentanyl in more than 99% of xylazine-related deaths, as well as co-involvement with cocaine in nearly one-third of xylazine-related deaths (2).

Methods based on death certificate literal text depend on the quality and completeness of the information provided, which may vary by jurisdiction due to differences in reporting practices in the medicolegal death investigation systems across the United States (18–20). For example, at autopsy, toxicological laboratory tests may be performed to determine the types of legal and illegal

drugs present. The substances tested for and circumstances in which the tests are performed vary by jurisdiction. Increased attention on fatal poisonings, such as for those associated with emerging substances like xylazine, may have led to changes in reporting practices over time such as increasing the level of substance-specific detail included on death certificates (18–20). Additionally, regional differences in the quality and completeness of death investigation and reporting must be considered when reviewing these findings. Another limitation of this study is the potential underreporting of the involvement of xylazine for some jurisdictions in certain U.S. Department of Health and Human Services regions, which should be considered when interpreting regional differences observed in this report. Underreporting of deaths may have also impacted the reporting of age-adjusted rates of drug overdose deaths involving xylazine for Regions 8–10, which did not meet the reliability criteria of 20 deaths or more and, as a result, were not reported.

Variations in the way drug overdose deaths are reported on death certificates, including the level of detail on the specific drugs involved, can impact comparability. During 2018 through 2021, the reporting of at least one specific drug mentioned in drug overdose deaths improved from 92.0% in 2018 to 95.2% in 2021 (21). This and other improvements in specificity could affect the magnitude and distribution of

deaths due to specific drugs. However, previous research that adjusted for improved reporting practices found similar patterns between the observed and adjusted rates, and as a result reported solely the observed rates (4). Similarly, this report provides the observed rates only. These factors should be considered when interpreting the trends in drug overdose death rates over the study period.

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Table 1. Age-adjusted rate of drug overdose deaths involving xylazine, by year and sex: United States, 2018–2021
[Rates are per 100,000 standard population]

Year	Total		Female		Male	
	Number	Rate	Number	Rate	Number	Rate
2018.....	102	0.03	24	0.01	78	0.05
2019.....	627	0.20	163	0.10	464	0.29
2020.....	1,499	0.47	392	0.25	1,107	0.69
2021.....	3,468	1.06	938	0.57	2,530	1.55

NOTES: Drug overdose deaths are identified using *International Classification of Diseases, 10th Revision* underlying cause-of-death codes X40–X44, X60–X64, X85, and Y10–Y14. Deaths may involve other drugs in addition to xylazine. Age-adjusted death rates were calculated using the direct method and adjusted to the 2000 U.S. standard population. When comparing rates across years, note that trends may be influenced by improvements in drug reporting. The reporting of at least one specific drug or drug class in the literal text, as identified by multiple cause-of-death codes T36–T50.8, improved from 92.0% of drug overdose deaths in 2018 to 95.2% in 2021.

SOURCE: National Center for Health Statistics, death certificate literal text from the National Vital Statistics System as of May 24, 2023.

Table 2. Number and rate of drug overdose deaths involving xylazine, by age and race and Hispanic origin: United States, 2020–2021
[Rates are per 100,000 population]

Characteristic	2020		2021	
	Number	Rate	Number	Rate
Age group (years)				
0–24.....	84	0.08	163	0.16
25–34.....	459	1.00	858	1.89
35–44.....	421	0.98	974	2.24
45–54.....	293	0.71	683	1.68
55–64.....	192	0.45	634	1.48
65 and over.....	50	0.09	156	0.28
Race and Hispanic origin				
Black, non-Hispanic.....	290	0.68	806	1.82
White, non-Hispanic.....	1,054	0.58	2,211	1.21
More than one race, non-Hispanic.....	12	*	21	0.35
Hispanic ¹	125	0.21	384	0.64

* Rate does not meet the National Center for Health Statistics reliability criteria of 20 deaths or more and as a result is not reported.

¹People of Hispanic origin may be of any race.

NOTES: Drug overdose deaths are identified using *International Classification of Diseases, 10th Revision* underlying cause-of-death codes X40–X44, X60–X64, X85, and Y10–Y14. Deaths may involve other drugs in addition to xylazine. Age-adjusted death rates by race and Hispanic origin are per 100,000 standard population and were calculated using the direct method and adjusted to the 2000 U.S. standard population. Asian non-Hispanic, Native Hawaiian or Other Pacific Islander non-Hispanic, and American Indian or Alaska Native non-Hispanic people are not reported because the 2020 and 2021 rates do not meet the National Center for Health Statistics reliability criteria of 20 deaths or more.

SOURCE: National Center for Health Statistics, death certificate literal text from the National Vital Statistics System as of May 24, 2023.

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Table 3. Age-adjusted rate of drug overdose deaths involving xylazine, by region:
United States, 2021

[Rates are per 100,000 standard population]

Region	Number	Rate
Region 1	387	2.62
Region 2	732	2.44
Region 3	1,246	4.05
Region 4	493	0.79
Region 5	476	0.92
Region 6	63	0.15
Region 7	43	0.33
Region 8	---	*
Region 9	19	*
Region 10	---	*

--- Data not available because counts between 1–9 are suppressed according to National Center for Health Statistics data confidentiality standards.
 * Rate does not meet the National Center for Health Statistics reliability criteria of 20 deaths or more and as a result are not reported.

NOTES: Drug overdose deaths are identified using *International Classification of Diseases, 10th Revision* underlying cause-of-death codes X40–X44, X60–X64, X85, and Y10–Y14. Deaths may involve other drugs in addition to xylazine. Age-adjusted death rates were calculated using the direct method and adjusted to the U.S. 2000 standard population. Regions are the U.S. Department of Health and Human Services public health regions: Region 1 (CT, MA, ME, NH, RI, and VT), Region 2 (NJ and NY), Region 3 (DC, DE, MD, PA, VA, and WV), Region 4 (AL, FL, GA, KY, MS, NC, SC, and TN), Region 5 (IL, IN, MI, MN, OH, and WI), Region 6 (AR, LA, NM, OK, and TX), Region 7 (IA, KS, MO, and NE), Region 8 (CO, MT, ND, SD, UT, and WY), Region 9 (AZ, CA, HI, and NV), and Region 10 (AK, ID, OR, and WA).

SOURCE: National Center for Health Statistics, death certificate literal text data from the National Vital Statistics System as of May 24, 2023.

Technical Notes

Nature and source of data

Literar text data from the National Vital Statistics System

Mortality data from the National Vital Statistics System are held in a dynamic database and considered provisional until the data have been processed, reviewed, verified, and released to the public as a final, static data set. Jurisdictions may continue to send updated death certificate information after the data year is considered final; these updates are not reflected in annual final mortality data files and official summary reports. Because the final data set does not include literal text data, the data used in this report come from the live National Vital Statistics System database. As noted, this dynamic database may include updates to death certificate data received after the closeout of the data year, and death counts may differ from other published sources.

Census population data

The population estimates used for computing rates are yearly July 1 postcensal estimates based on the April 1, 2010, census (years 2018 through 2020) and on the Blended Base (year 2021) produced by the U.S. Census Bureau in lieu of the April 1, 2020, decennial population count. The Blended Base consists of the blend of vintage 2020 postcensal population estimates, 2020 demographic analysis estimates, and data from the 2020 Census PL 94–171 Redistricting File (see <https://www2.census.gov/programs-surveys/popest/technical-documentation/methodology/2020-2021/methods-statement-v2021.pdf>). These estimates are available on CDC WONDER from: <https://wonder.cdc.gov/single-race-population.html>.

Cause-of-death classification

Causes of death were classified according to World Health Organization regulations, which specify that member

countries classify and code causes of death according to the current revision of the *International Classification of Diseases* (ICD). ICD provides the basic guidance used in nearly all countries to code and classify causes of death. Effective with deaths occurring in 1999, the United States began using the 10th Revision of this classification (ICD–10) (22).

In this report, cause-of-death statistics are based solely on the underlying cause of death. The underlying cause is defined by the World Health Organization as “the disease or injury which initiated the train of morbid events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury.” The underlying cause is selected from the conditions entered by the medical certifier in the cause-of-death section of the death certificate. When more than one cause or condition is entered by the medical certifier, the underlying cause is determined by the sequence of conditions on the certificate, provisions of ICD, and associated selection rules and modifications. Drug overdose deaths were identified using ICD–10 underlying cause-of-death codes X40–X44 (unintentional), X60–X64 (suicide), X85 (homicide), and Y10–Y14 (undetermined intent).

Considerations for the drugs mentioned with involvement methodology

The methods to identify specific drugs involved in the death (referred to as the drugs mentioned with involvement methodology) are routinely enhanced to better search the literal text from death certificates (7). The list of search terms found in the literal text used to identify drug overdose deaths involving xylazine were “ROMPUN,” “XYLAZINE,” “XYLACINE,” “XYLAZYNE,” “XYLAZIN,” and “ZYLAZINE.”

Two limitations were observed in the categorization of specific drugs reported. First, determination of the source of the drugs or whether the drug was illicitly manufactured cannot be

determined from the literal text. Second, drug-specific counts are subject to change as additional search terms for drugs are identified. As such, findings from this report may differ from other issued reports using final or provisional mortality data.

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