

Xylazine in Texas wastewater

Eleni Woldearegay MD, Abbie Evans MD

First detection of xylazine in Texas wastewater and its association with fentanyl use.

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SUMMARY

This preprint investigates the presence as well as the prevalence of xylazine in wastewater samples in El Paso, Texas and its correlation with fentanyl use over a 14-month period (June 2023 to July 2024) by using wastewater epidemiology (WBE).

Xylazine is a veterinary sedative increasingly detected in illicit drug supplies. This study marks the first reported detection of xylazine in Texas wastewater and highlights its heterogeneous distribution across sewer sheds.

INTRODUCTION AND BACKGROUND

The introduction addresses public health threats posed by xylazine within the U.S. broader—an area that is currently experiencing an opioid crisis. Xylazine is often intermixed with fentanyl, which increases overdose risks that cannot be reversed by the use of naloxone. The authors highlight the limitations of traditional surveillance methods that are often associated with delayed reporting and underdetection in toxicology screens, and highlight the use of WBE as a timely, non-invasive alternative. The authors' focus on El Paso is justified by the rising rates of overdose and its proximity to drug trafficking routes, a claim supported by regional US Drug Enforcement Administration (DEA) reports.

Corresponding author: Eleni Woldearegay
Contact Information: Eleni.Woldearegay@ttuhsc.edu
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However, the introduction could be strengthened by briefly discussing the pharmacological properties and adverse outcomes of xylazine to clarify its clinical impact for readers.

METHODS

STUDY DESIGN AND SAMPLING

The study uses a prospective observational design in which 124 raw wastewater samples were collected from four wastewater treatment plants (WWTPs). In El Paso, these plants serve approximately 751,982 residents. The 24-hour composite samples were collected consistently from June 2023 to July 2024 assuring temporal coverage. The methods described in the study, including sample collection, storage, and transportation, are clearly stipulated assuring reproducibility of the methods used. Further explanation for the surge of cases in the month of February could be further explored.

ANALYTICAL TECHNIQUES

Xylazine and norfentanyl (a fentanyl metabolite) were quantified using liquid chromatography-tandem mass spectrometry with a limit of detection of 0.1 ng/L for xylazine. The concentration of xylazine in each sample was quantified using two methods: a calibration curve and an internal deuterated xylazine (xylazine-d6). Norfentanyl quantification was performed using a standard reference (Cayman Chemical) for building a standard calibration curve following the same procedure.

The use of deuterated xylazine (xylazine-d6) as an internal standard and a calibration curve method ensured analytical precision, as evidenced by a high coefficient of determination ($R^2 = 0.996$). The authors provide detailed protocols for quantification, sample preparation, including solid-phase extraction and filtration, which align with WBE standards.

CALCULATIONS AND STATISTICAL ANALYSIS

Mass loads and per capita consumption rates were calculated using wastewater flow volumes and population data, although human excretion rates for xylazine were estimated based on rat studies (70%). The Welch two-sample t-test was used to compare norfentanyl loads across sewer sheds. The statistical approach is reasonable, but the reliance on animal-based excretion data introduces uncertainty as it confounds data on human excretion of xylazine.

DATA SOURCES

Mortality data from the National Forensic Laboratory Information System (NFLIS) were used to show xylazine trends, which add to the external validity of the study. However, a lack of local clinical data limits making direct correlation with health outcomes. There is potential inference of xylazine excretion rates from rats onto humans, and there is also a potential confounding of data from veterinary sources. In addition, there is a lack of clarification of the impact of flow variability on concentration estimates in wastewater.

RESULTS

The preprint describes detection of Xylazine in three of four WWTPs, with the highest prevalence in the Haskell R. Street (HS) sewer shed (29% positive detection rate). Concentrations ranged from 0.1 to 1.44 ng/L, and no xylazine was detected in the Roberto Bustamante (RB) WWTP, suggesting spatial heterogeneity.

The study reports that all xylazine-positive samples also tested positive for norfentanyl. Sewer sheds with higher xylazine detection (HS and Fred Hervey) had significantly higher norfentanyl loads and there is robust statistical association between xylazine and fentanyl consumption at the community level.

The study makes an important integration of national trends and local findings by discussing NFLIS data showing a nine-fold increase in xylazine-related deaths in Texas from 2019 to 2023, as well as pointing out a doubling overdose death rate in El Paso from 11 to 22 percent between the years 2018 and 2023 with over

50 % of dates attributed to fentanyl. However, the lack of local overdose rates on xylazine limits direct attribution of deaths from xylazine in the study area. The authors do not consider population mobility in their analysis as the study area is a border city with high daily crossings.

DISCUSSION

The discussion effectively emphasizes the detection of xylazine in Texas wastewater and its implications for public health. It gives particular emphasis on the association between xylazine and fentanyl use and a compelling overdose risk.

The authors note the DEA's reports of rising concern of xylazine and documentation of drug seizures in the southern region of the United States, which highlights the authors' results in contrast to national trends. However, there is limited insight into what local policy regulations are on xylazine control, and there is minimal discussion of possible interventions beyond surveillance findings by further exploring regulatory or reduction strategies in communities.

CONCLUSION

The study provides critical evidence of xylazine's emergence in El Paso, highlighting its association with fentanyl use and the value of WBE in tracking illicit drug trends. The findings are particularly relevant for border regions facing escalating overdose rates. The authors recommend continued WBE surveillance and targeted interventions, which are appropriate given the data.

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From: Department of Internal Medicine, Texas Tech University Health Sciences Center, Lubbock, TX, USA (EW, AE)

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