THE RELATIONSHIP BETWEEN

HIDTA PMP DRUG SEIZURES
&
OVERDOSE DEATHS

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ABSTRACT

Background: The National Emerging Threats Initiative (NETI) is a polydrug national, intelligence, and best practices sharing initiative that coordinates emerging drug threat strategies in HIDTA designated areas and the remaining United States. In line with NETI's overarching mission, this paper aims to determine whether a statistical relationship exists between overdose deaths associated with specific drugs of abuse and law enforcement seizures of those same drugs. The focus is on providing information on emerging threats and generating practical systemic approaches to address the supply of illegal drugs and resulting collateral issues.

Methods: This observational study uses Pearson correlation coefficients to assess the relationship between overdose deaths for specific drugs and analogous substances found in the illicit drug market. Tests for normality and linearity and a post hoc analysis of statistical power were also conducted.

Findings: Statistically significant correlations with high effect sizes were found between seizures and deaths for cocaine, methamphetamines, heroin, fentanyl, and benzodiazepines. A Post hoc power analysis for each correlation suggests that despite the small sample size, we can be confident in the strength of these correlations, except for the association between heroin seizures and deaths where power expectations were not met. The relationship between prescription opioid seizures and deaths was not significant.

Conclusion: The findings of this paper provide essential evidence that changes in overdose deaths closely match changes in the illicit drug market. Overall, this result suggests that emerging illicit drug trends are an important indicator of likely future overdose death patterns and are worthy of scrutiny by federal and state public health and criminal justice policymakers.

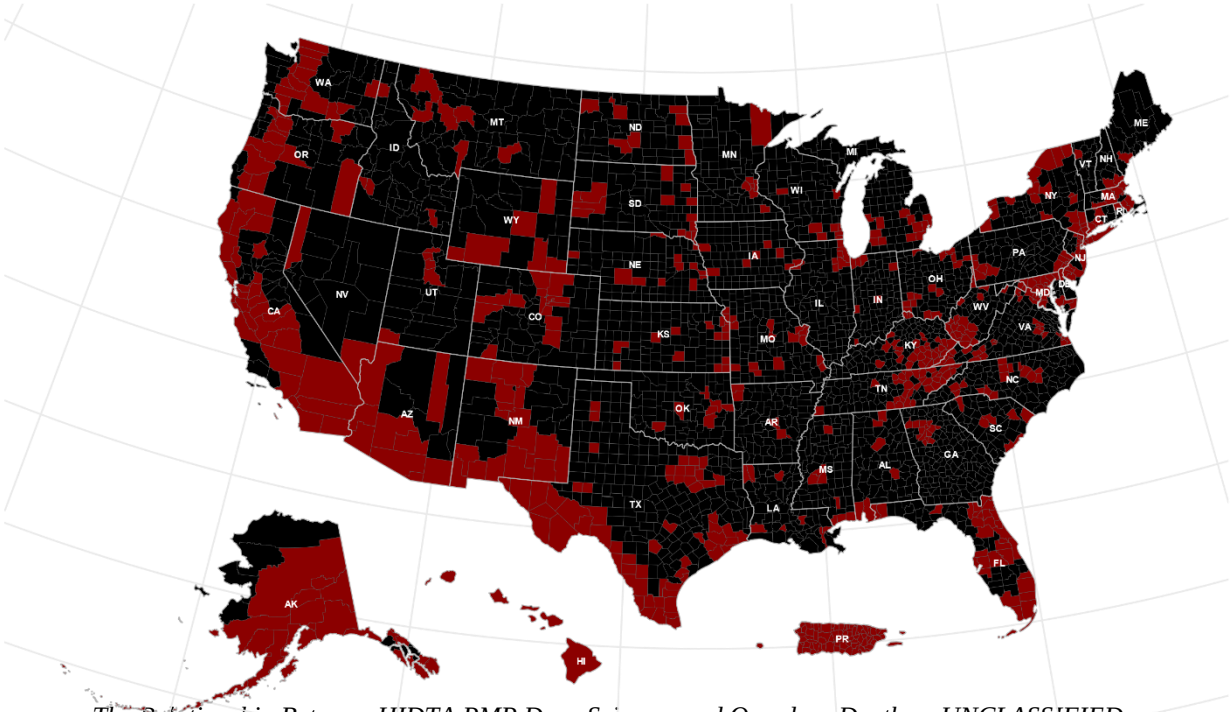
INTRODUCTION

The High Intensity Drug Trafficking Area (HIDTA) program, created by Congress in 1988, assists federal, state, and local law enforcement agencies operating in the areas identified as critical drug-trafficking regions of the United States.

Today's illicit drug landscape is more complex than ever before, rapidly evolving due to shifts in drug use patterns, supply-side catalysts, and a proliferation of new drug variants. To understand the trajectory of these complexities and develop strategies to mitigate the resulting increased harm experienced in our Nation's communities, the Office of National Drug Control Policy (ONDCP) High Intensity Drug Trafficking Areas (HIDTA) Program funds the National Emerging Threats Initiative (NETI). NETI is a polydrug national trends, intelligence, and best practices-sharing initiative that addresses all aspects of the illegal drug supply, including the diversion of legal drugs. NETI supports a coordinated HIDTA strategy for emerging drug-related threats.

Previous work by NETI and other researchers suggests that the composition of illicit drug seizures may be an important indicator of overdose deaths.[1],[2] This paper aims to determine whether a statistical relationship exists between overdose deaths associated with specific drugs of abuse and law enforcement seizures of those same drugs.

Location of High Intensity Drug Trafficking Task Forces



METHODOLOGY

U.S. Overdose deaths were obtained from the CDC[3] for cocaine, psychostimulants with abuse potential (a proxy measure for methamphetamines), heroin, fentanyl, prescription opioids, and prescription benzodiazepines by year from 2010 through 2021.

Drug seizures for cocaine, methamphetamines, heroin, and fentanyl were measured in kilograms. Seizures for prescription opioids and benzodiazepines were measured in doses. All seizures were abstracted from the High Intensity Drug Trafficking Area Performance Management Process database.[4]

The Pearson correlation coefficient[5] was used to determine the association between seizures and overdose deaths. Correlation coefficients expressed as (r) range between -1.0 (a perfect inverse correlation) and 1.0 (a perfect positive correlation). Correlations at or below .3 are considered to have a negligible effect size. While correlations above .3 and below .5 are believed to have a moderate effect size. Correlations above .5 are deemed to have a significant effect size.

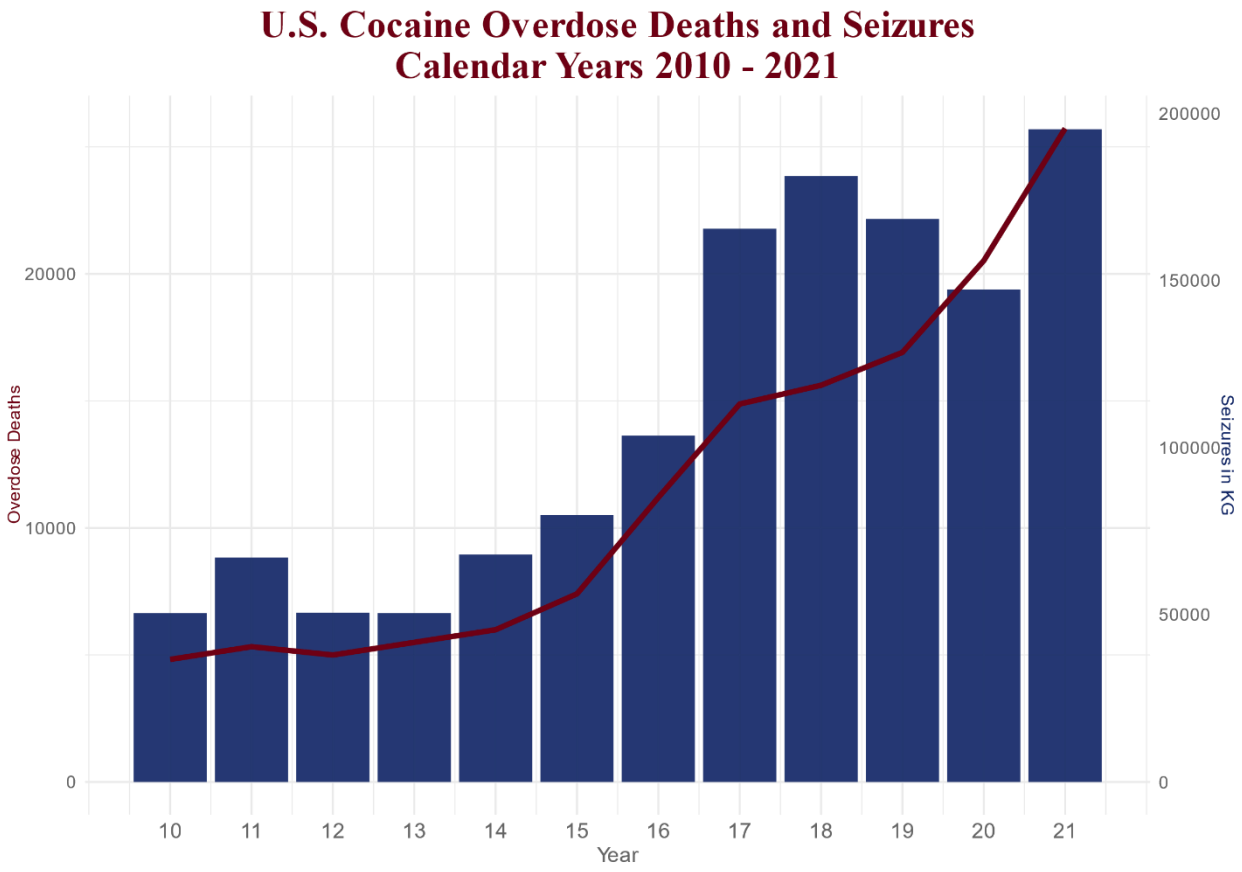
To compute Pearson Correlations, variables must be 1) paired, 2) measured on a continuous scale,3) normally distributed, and 4) without significant outliers. In addition, the calculated relationship between variables should be linear. Since these correlations were based on small sample sizes, NETI also conducted a post hoc power analysis to ensure no Type II errors were made when concluding that the findings were statistically significant.[6]

FINDINGS

Cocaine Deaths and Seizures

A Pearson product-moment correlation coefficient was calculated for U.S. cocaine overdose deaths recorded between 2010 and 2021 and U.S. law enforcement seizures of cocaine abstracted from the HIDTA PMP database for the same period. The results of a Shapiro-Wilk test[7] for both variables confirmed normality. Visual inspection of a scatter plot for the two variables demonstrated a linear relationship between cocaine deaths and cocaine seizures.

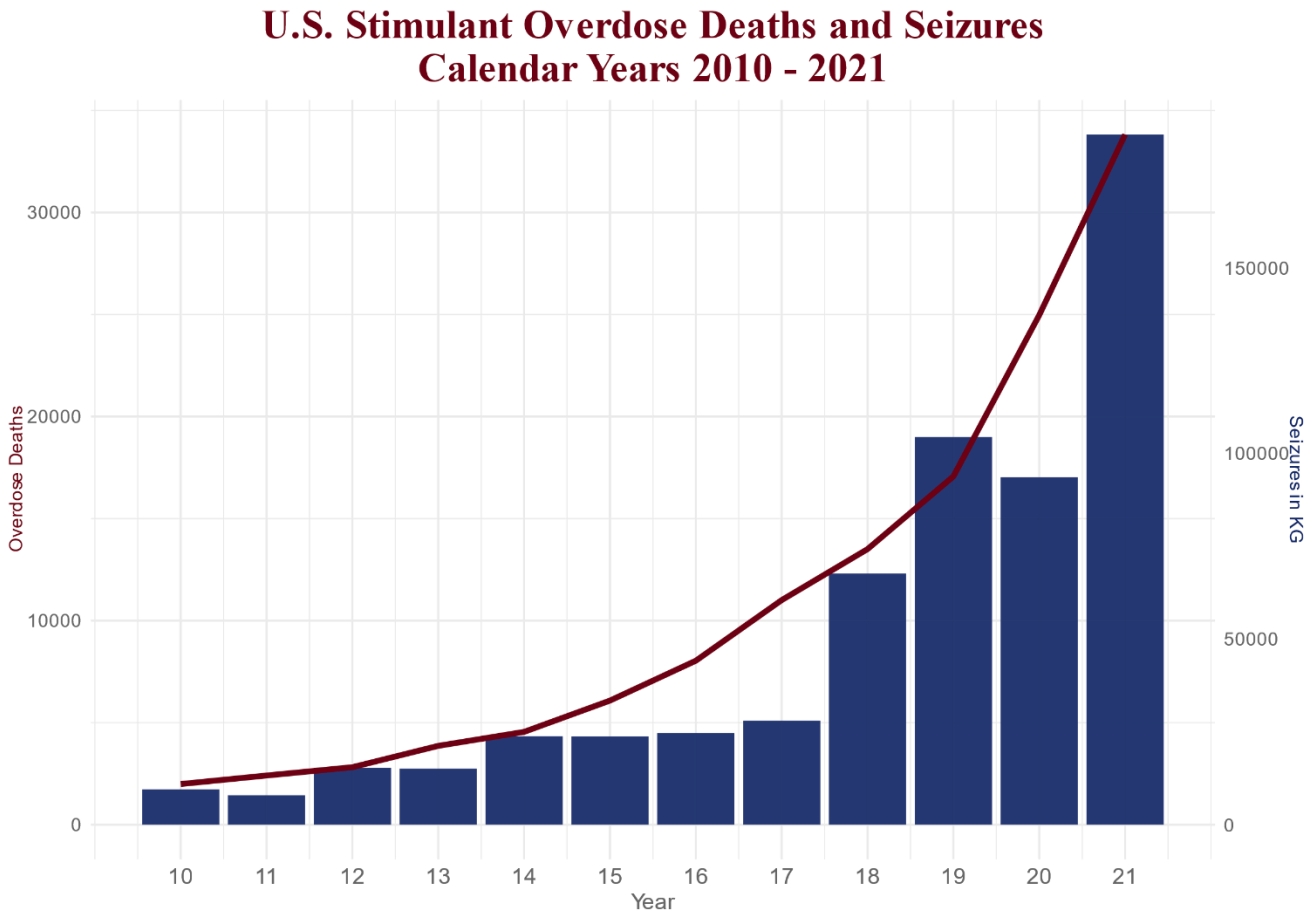
The result of the Pearson correlation (r (10) = .93, $p < .001$) was statistically significant with a large effect size. The power analysis shows that a type II error for this test is unlikely.



Psychostimulant Deaths and Methamphetamine Seizures

A Pearson product-moment correlation coefficient was calculated for U.S. psychostimulant overdose deaths recorded between 2010 and 2021 and U.S. law enforcement seizures of methamphetamines abstracted from the HIDTA PMP database for the same period. The results of a Shapiro-Wilk test for both variables confirmed normality. Visual inspection of a scatter plot for the two variables demonstrated a linear relationship between psychostimulant deaths and methamphetamine seizures.

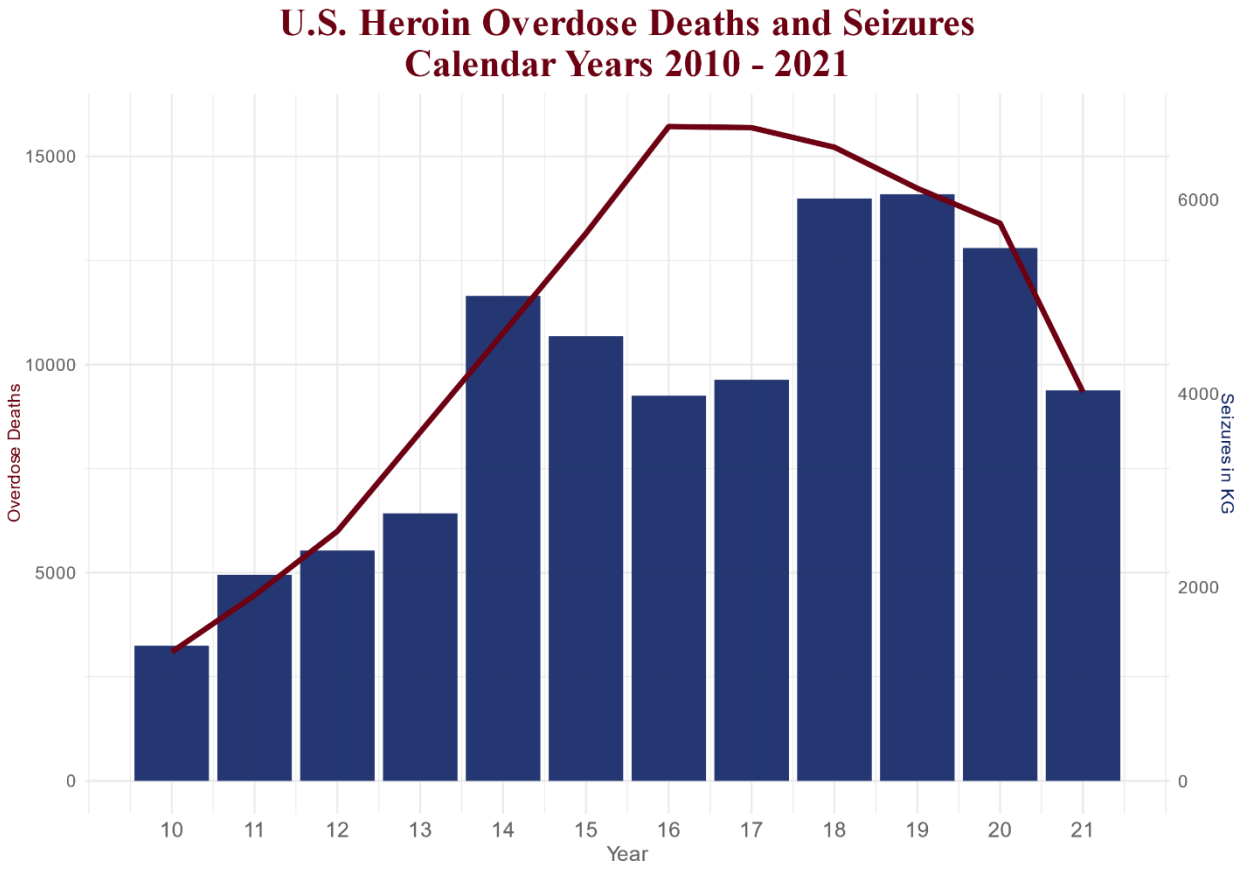
The result of the Pearson correlation (r (10) = .94, $p < .001$) was significant with a large effect size. The power analysis suggests that a type II error for this test is unlikely.



Heroin Deaths and Seizures

A Pearson product-moment correlation coefficient was calculated for U.S. heroin overdose deaths recorded between 2010 and 2021 and U.S. law enforcement seizures of heroin abstracted from the HIDTA PMP database for the same period. The results of a Shapiro-Wilk test for both variables confirmed normality. Visual inspection of a scatter plot for the two variables demonstrated the relationship between heroin deaths and heroin seizures was linear.

The result of the Pearson correlation (r (10) = .65, $p < .05$) was significant with a large effect size. The power analysis suggests that a type II error for this test is possible; therefore, the results of this correlation must be evaluated with caution.

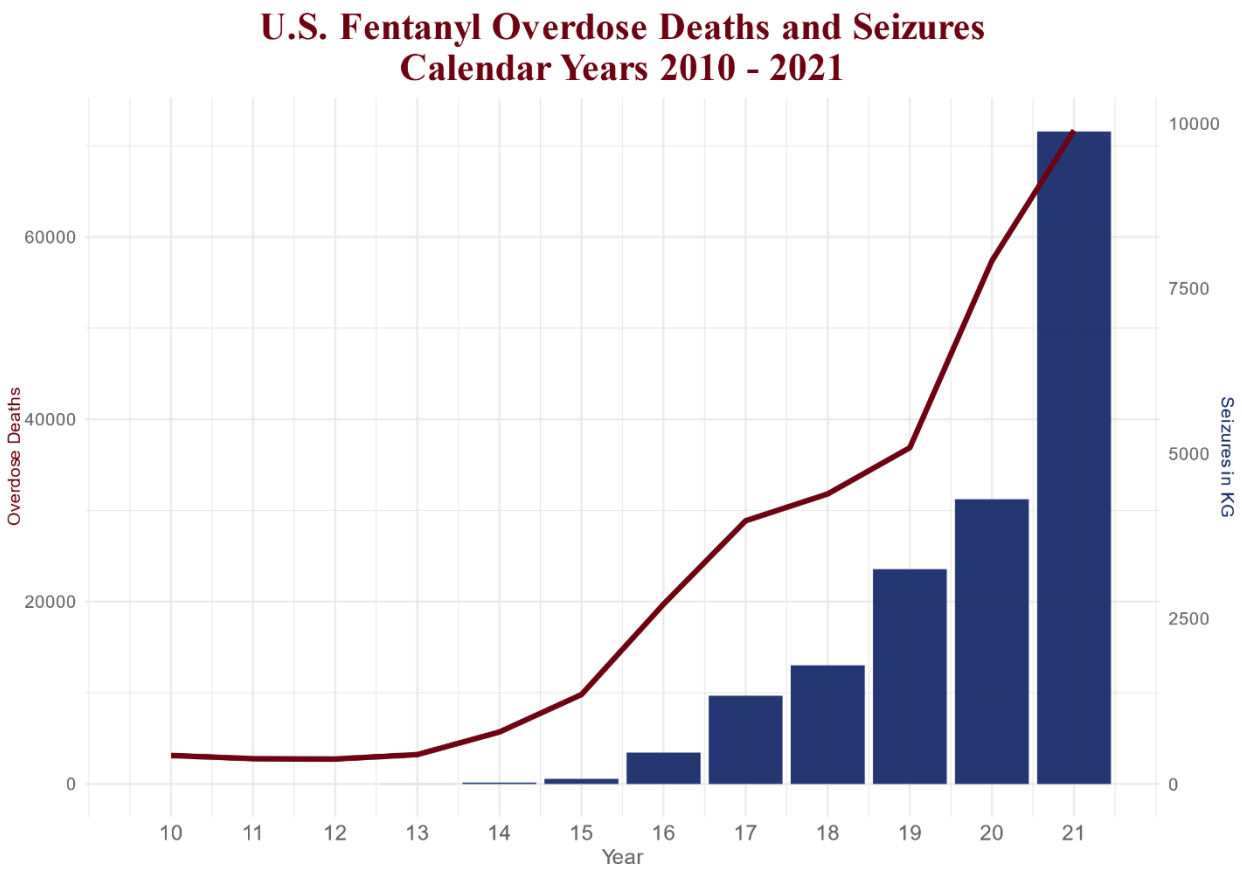


Fentanyl Deaths and Seizures

A Pearson product-moment correlation coefficient was calculated for U.S. fentanyl overdose deaths recorded between 2010 and 2021 and U.S. law enforcement seizures of fentanyl abstracted from the HIDTA PMP database for the same period. The results of a Shapiro-Wilk test for both variables confirmed normality for seizures but determined that fentanyl deaths were not normally distributed.

Further investigation of the data using the package ggdensity[8] in R[9] revealed that the distribution was positively skewed. A log transformation was applied to the death data, and a follow-up Shapiro-Wilk test confirmed normality. Visual inspection of a scatter plot for the two variables demonstrated a linear relationship between fentanyl deaths and fentanyl seizures.

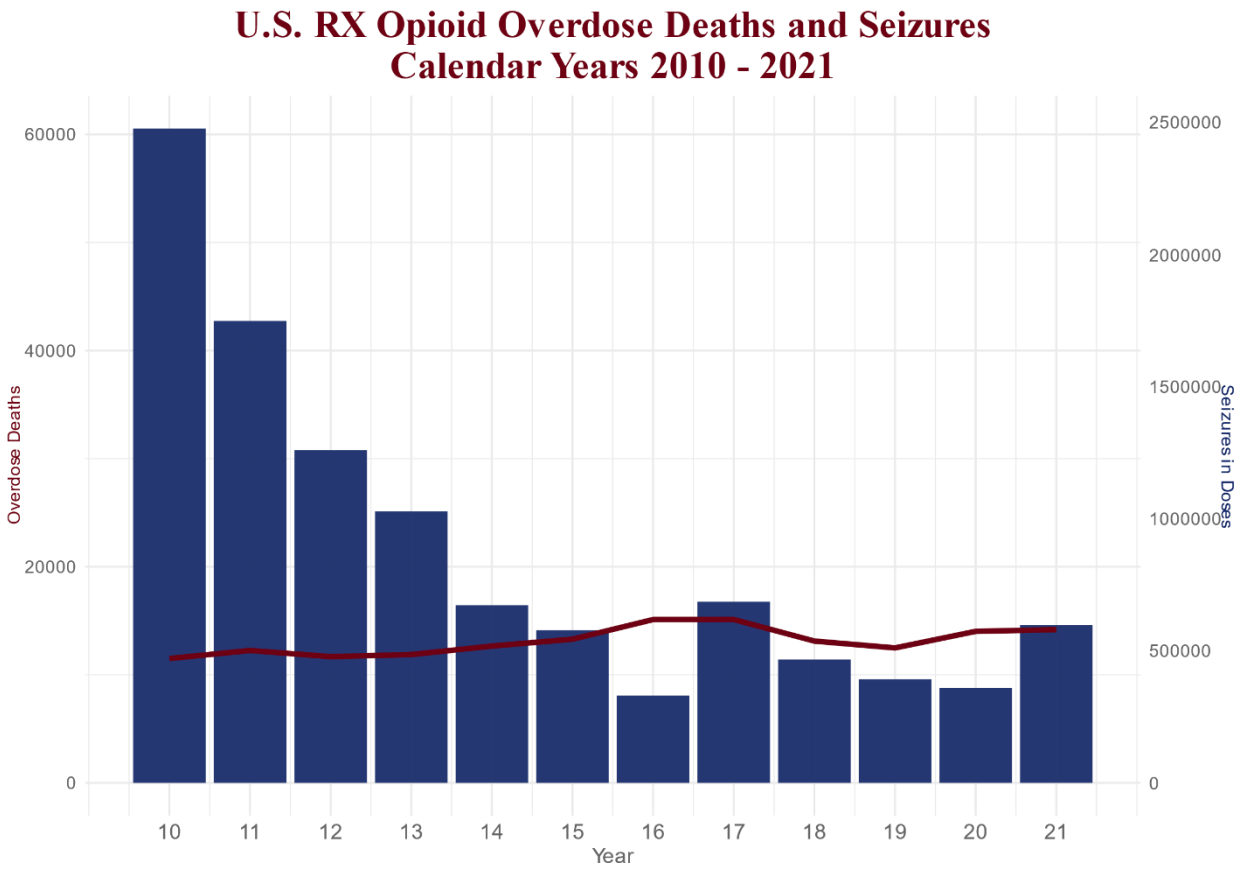
The result of the Pearson correlation (r (10) = .98, $p < .001$) was significant with a large effect size. The power analysis suggests that a type II error for this test is unlikely.



Prescription Opioid Deaths and Seizures

A Pearson product-moment correlation coefficient was calculated for U.S. prescription opioid overdose deaths recorded between 2010 and 2021 and U.S. law enforcement seizures of prescription opioids abstracted from the HIDTA PMP database for the same period. The results of a Shapiro-Wilk test for both variables confirmed normality. Visual inspection of a scatter plot for the two variables demonstrated the relationship between prescription opioids and deaths and seizures was linear.

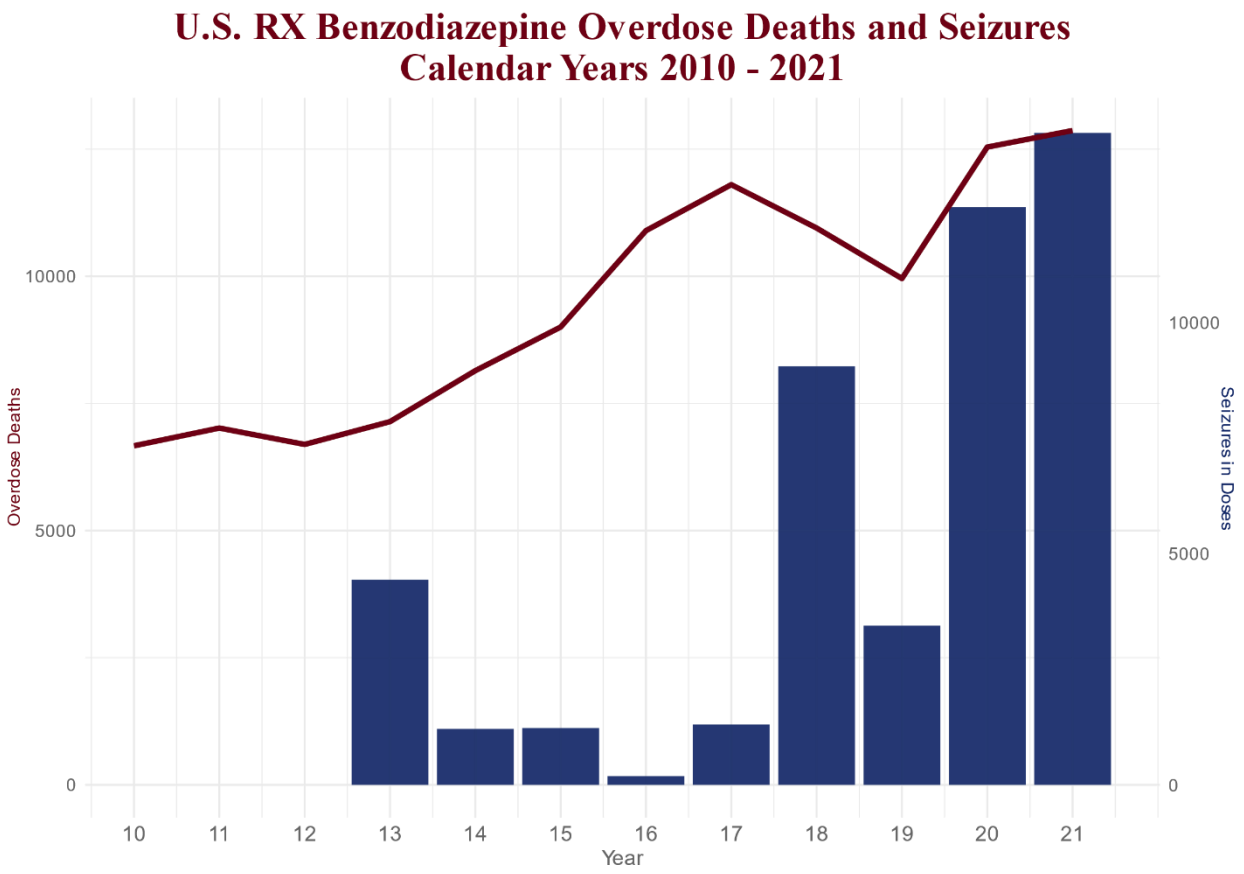
The result of the Pearson correlation (r (10) = -.27, $p < .05$) was not significant. While not significant, it is interesting to note that seizures of prescription opioids declined dramatically over the period while deaths attributable to this class of drug increased slightly. Additional research is required to understand this finding better.



Prescription Benzodiazepine Deaths and Seizures

A Pearson product-moment correlation coefficient was calculated for U.S. benzodiazepine-related overdose deaths recorded between 2010 and 2021 and U.S. law enforcement seizures of benzodiazepines abstracted from the HIDTA PMP database for the same period. The results of a Shapiro-Wilk test for both variables confirmed normality. Visual inspection of a scatter plot for the two variables demonstrated the relationship between benzodiazepine deaths and benzodiazepine seizures was linear.

The results of the Pearson correlation (r (7) = .76, $p < .05$) were significant with a large effect size. The power analysis results suggest that a type II error for this test is unlikely.



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