

Drug Toxicity as the Leading Cause of Homeless Deaths in Toronto*

Insights from 2017-2023 Data

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This study examines the primary causes of homeless deaths in Toronto using the data from Open Data Toronto, covering the period from 2017 to 2023. The findings reveal that seasonal variations in homeless deaths are minimal, with drug toxicity emerging as the leading cause. Surprisingly, the surge in homeless deaths during the COVID-19 pandemic was also driven by an increase in drug use rather than virus itself. Understanding the trends and factors contributing to homeless deaths is critical for guiding public health interventions and improving support services for these vulnerable populations, particularly in addressing the drug overdoses.

1 Introduction

In 2022, the median age of death for homeless individuals was significantly lower than that of the general population—55 years for males and 42 years for females, compared to 79 and 84 years, respectively (Toronto Public Health 2023b). This sharp contrast highlights the urgent need to understand the causes and develop effective strategies to reduce mortality within this vulnerable group.

This study examines the factors contributing to the deaths of homeless individuals, including seasonal changes, diseases, and drug use, using data from the “Deaths of People Experiencing Homelessness” dataset (2017–2023) from Open Data Toronto. It also seeks to clarify the misconception that COVID-19 was the primary cause of increased deaths during the pandemic, emphasizing drug toxicity as the leading factor. While many feared that the virus would drive a rise in deaths, the actual increase was largely due to heightened drug use.

Drug toxicity was the primary cause of death between 2017 and 2023, accounting for about 58% of known causes. During the pandemic, deaths related to drug use surged, and the

*Code and data are available at: <https://github.com/Jiaqi-Xing/Homeless-death>

underlying reasons for this will be explored later. These findings emphasize the critical need to address substance abuse in homeless populations, particularly during periods of increased isolation and reduced access to social services.

The remainder of this paper is structured as follows: Section 2.1 provides an overview of the raw data set. (ser-variables?) introduces variables in the cleaned data, and these variables will be used in the visualization. Section 2.3 presents visualizations of data with explanation of findings from them. Finally, ?@sec-discussion examines the possible reasons of surge in drug-caused deaths during epidemic, limitations and next steps.

2 Data

2.1 Introduction to the Dataset

This paper uses the “Deaths of People Experiencing Homelessness” dataset(Toronto Public Health 2023a) from Open Data Toronto, covering January 2017 to December 2023. The data is collected by Toronto Public Health (TPH) in collaboration with the Shelter, Support, and Housing Administration (SSHA) and various health service agencies. After homeless people share the information they know about death, these agencies report death information to TPH, with some data verified by the Office of the Chief Coroner of Ontario (OCCO) to ensure accuracy. The dataset consists of three sets: deaths by month, deaths by cause, and deaths by demographics. The first two sets are used in this paper.

There is another dataset called “Shelter Resident Deaths”(Toronto Shelter & Support Services 2024) available on the Open Data Toronto Portal. Although this dataset tracks homeless deaths over a longer period of time, from 2017 to the present, it focuses solely on demographic information and does not provide valid data on causes of death. Therefore, it was not used for this study, as it does not contribute to our analysis of the primary causes of death.

2.2 Variables in the cleaned Dataset

1. **Cause of Death:** The recorded cause of death for homeless individuals from 2017 to 2023 provides insight into the leading contributors to mortality. Its sample space includes nine known causes of death: “accident”, “cancer”, “cardiovascular disease”, “COVID-19”, “drug toxicity”, “homicide”, “infection”, “pneumonia”, and “suicide”; “Unknown” cause for unreported or pending cases; and “other”, which refers to causes of death that can’t be disclosed due to the protection of privacy.
2. **Total Number of Deaths by Cause:** This variable captures the total count of deaths attributed to each specific cause, allowing for comparisons between different mortality factors.

3. **Month of Death:** Records the month in which the death occurred. This variable spans from January to December.
4. **Year of Death:** Records the year in which the death occurred. This data spans from 2017 to 2023. It is used to analyze year-over-year changes in homeless death trends.
5. **Yearly total deaths:** This variable records the total number of homeless deaths per year from 2017 to 2023.
6. **Yearly drug toxicity deaths:** This variable records the total number of homeless deaths due to drug toxicity per year from 2017 to 2023.
7. **Yearly unknown deaths:** This variable records the total number of unknown homeless deaths per year from 2017 to 2023.
8. **Season:** The “season” variable was constructed by deriving the season from the “month of death” variable to examine whether seasonal factors impact mortality rates. The seasons are classified as follows:
 - **Spring:** March, April, May
 - **Summer:** June, July, August
 - **Fall:** September, October, November
 - **Winter:** December, January, February
9. **Total Number of Deaths by Season:** This variable records the total number of deaths in each season, allowing for the identification of any potential seasonal variations in mortality rates.

2.3 Results

The visualizations of the cleaned data are presented in this section.

The statistical programming language R (R Core Team 2023) was used to obtain, clean, and visualize the data. The raw data was downloaded from the opendatatoronto package (Gelfand 2022). The tidyverse (Wickham et al. 2019), readr (Wickham, Hester, and Bryan 2024), dplyr (Wickham et al. 2023), lubridate (Grolemund and Wickham 2011), and janitor (Firke 2023) packages were employed for data cleaning, while ggplot2 (Wickham 2016) was used for data visualization.

2.3.1 Seasonal effect on homeless deaths

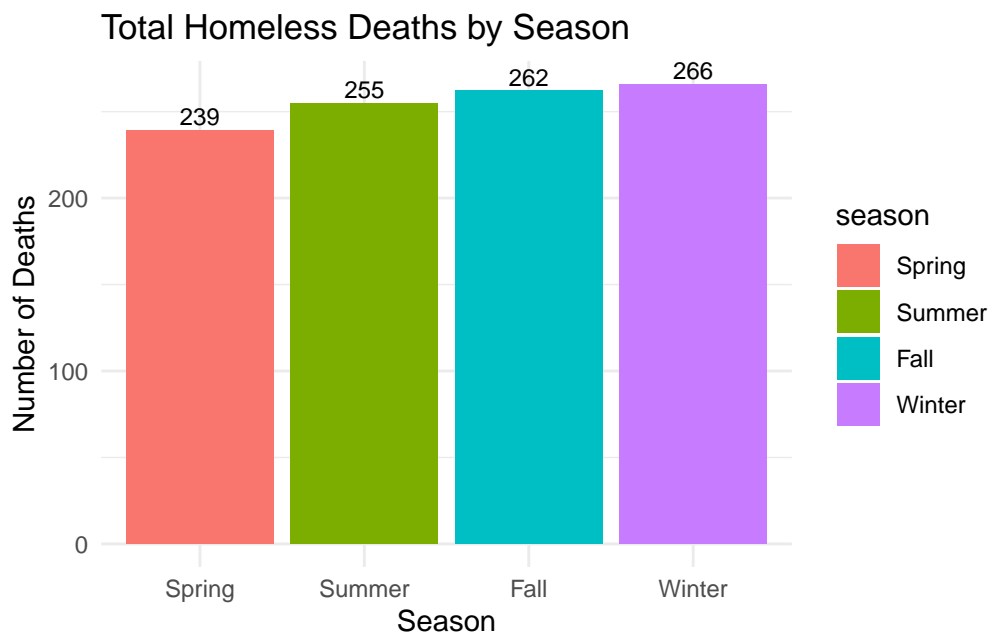


Figure 1: Total number of homeless deaths by season from 2017 to 2023

Figure 1 displays the total number of homeless deaths by season between 2017 and 2023. There is some variation in deaths across the seasons, though the differences are not substantial. Winter has the highest number of deaths at 266, followed closely by Fall (262) and Summer (255), with Spring having the lowest number of deaths at 239.

The difference of 27 deaths between Spring (the lowest) and Winter (the highest) suggests that the season may play a role, as the freezing winter months in Toronto are fertile for the homeless people who lack of stable shelter and heating. However, this small difference over six

years does not not drastic enough to suggest that the season is the primary cause of death. Therefore, we need a deeper look into other causes contributing to homeless deaths.

2.3.2 Distribution of known homeless causes of death

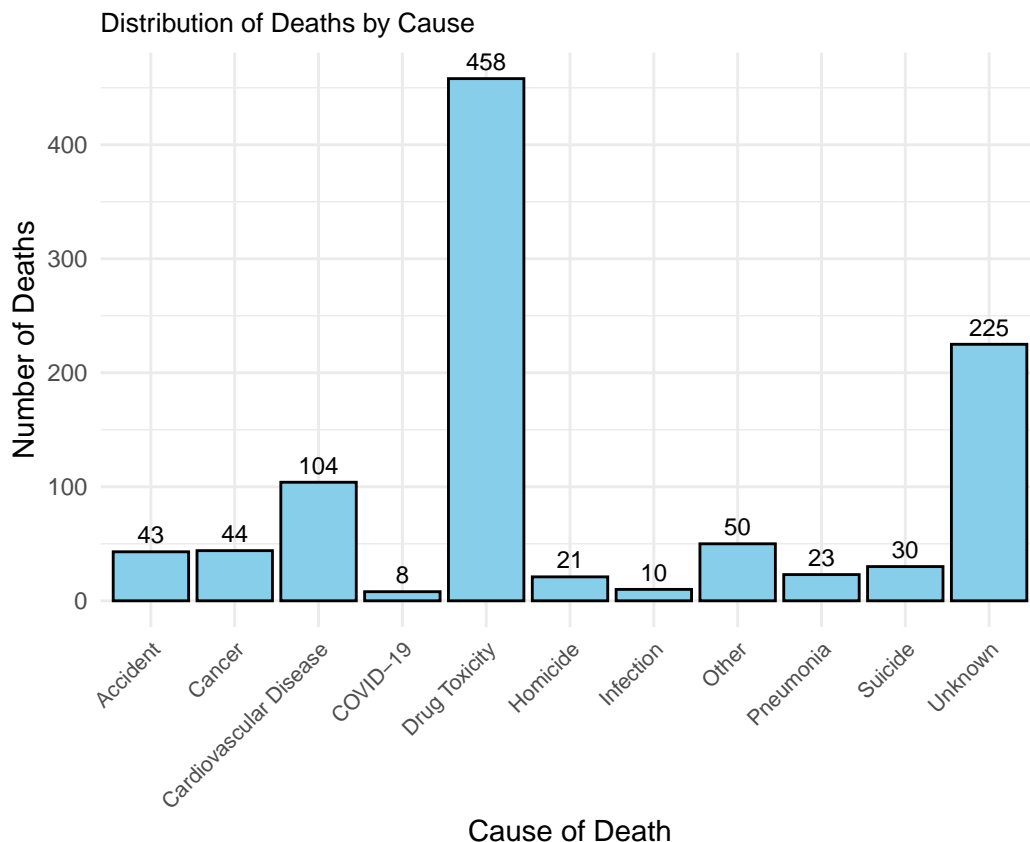


Figure 2: Distribution of known homeless causes of death(2017-2023)

Figure 2 illustrates the distribution of homeless deaths by cause between 2017 and 2023. The data shows a clear disparity, with Drug Toxicity leading by a significant margin, accounting for 458 deaths, far surpassing all other causes. This underscores the critical impact of substance use on the homeless population. Other notable causes include Cardiovascular Disease (104 deaths), Accident (43 deaths), and Cancer (44 deaths).

The low number of COVID-19-related deaths (8 deaths) and the high number of deaths marked as “Unknown” (225 deaths) are particularly striking. This raises concerns about potential underreporting of COVID-19 as a cause of death, leading to doubts that the virus’s impact on the homeless population may have been underestimated. This discrepancy also questions the earlier assertion that the surge in homeless deaths during the pandemic was driven primarily

by drug overdoses rather than the virus itself. This concern will be addressed and clarified in the next section.

2.3.3 Deaths over time

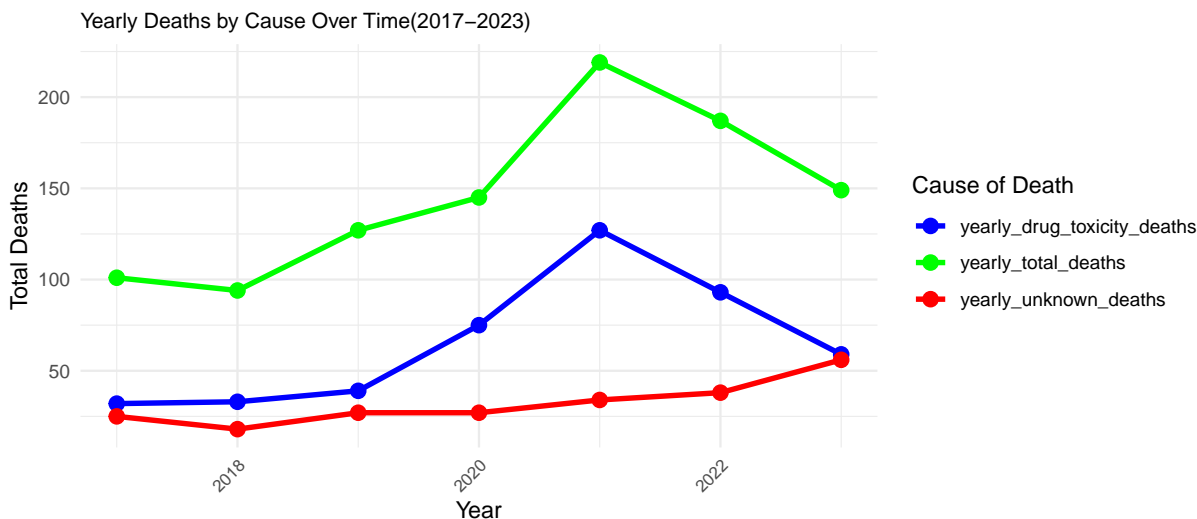


Figure 3: Trends in Homeless Deaths:Drug Toxicity, Unknown Causes, Total Deaths

Figure 3 shows the yearly trends in homeless deaths from 2017 to 2023, comparing deaths due to Drug Toxicity, Unknown Causes, and the Total Deaths.

The green line (total deaths) and the blue line (deaths due to drug toxicity) follow a similar trend throughout the period. Both rise significantly from 2019, peak in 2021, and then decline. This close correlation suggests that drug toxicity has been a primary driver of the overall mortality trend in the homeless population, especially for the death peak in 2021.

In contrast, the red line (deaths due to unknown causes) shows a different pattern. It keep increasing, and even faster after the pandemic period. This divergence from the total deaths and drug toxicity trends implies that the rise in unknown causes is not simply due to unreported COVID-19 cases, as might be suspected. If COVID-19 deaths had been underreported in this category, we would expect a similar spike in 2020-2021 as seen in the total and drug-related deaths.

Overall, this graph alleviates concerns about COVID-19 deaths being overlooked and demonstrates that drug use was the leading cause of death, driving the surge in mortality during the pandemic.

3 Discussion

3.1 possible reasons of surge in drug-caused deaths during epidemic

Two factors likely contributed to the increase in deaths due to drug poisoning during the COVID-19 pandemic.

First, avoidance of hospital-based care during the peak of the pandemic due to social distancing measures and fears of contracting COVID-19. Studies show that emergency department (ED) visits dropped by 40%–60% during the first wave of the pandemic, and there were higher rates of patients refusing transportation to the ED for drug overdoses (Michael Liu 2022). This makes people lose the best opportunity to receive treatment after over doses, leading to an increase in the number of deaths.

Another contributing factor is the increased toxicity of the unregulated drug supply during the pandemic. As regular drug supply chains were disrupted, users turned to more dangerous alternatives, including synthetic opioids like fentanyl and novel benzodiazepines. These substances are more potent and often lead to more severe overdoses. (Michael Liu 2022)

In summary, a combination of reduced access to emergency care and the worsening quality of drugs likely drove the surge in drug poisoning deaths during the pandemic.

3.2 Limitations and next steps

One of the main limitations of the data used in this analysis is the unknown causes of deaths account for a large proportion of data. The increasing trend of unknown causes of death raises concerns about the accuracy of reporting. In 2023, the number of deaths attributed to unknown causes is even nearly equal to deaths from drug toxicity, the primary cause of deaths so far. This highlights the need for further investigation into these causes. Future research should focus on identifying these unknown factors, as they may point to risks affecting the homeless population that are not yet recognized.

Although the number of people who died due to drugs has dropped after the epidemic and is back to normal levels, it is still higher than other factors. Addressing overdoses among the homeless requires a multi-faceted approach. First, expanding access to addiction treatment, harm reduction services, safe injection sites, and outreach programs can help reduce fatal overdoses. It's also important to disrupt the supply of dangerous drugs like fentanyl through publishing stronger law enforcement to monitor them, and provide safer alternatives. Public health efforts should focus on educating people about the harm of synthetic opioids. Collaboration between healthcare providers, communities, and policymakers is key to reducing overdose deaths.

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