Time Trends in Deaths of Shelter Residents in Toronto*

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The number of deaths among shelter residents in Toronto is a good index assessing the living conditions and health risks faced by homeless populations. We visualized the data to examine time trends, pandemic impacts, and gender differences in shelter deaths. Our findings suggest seasonal difference and strong COVID-19 impact on death increment. This analysis draws the attention of policymakers and encourages further statistical examination to reach significant conclusions.

*Code and data are available at: https://github.com/RohanAlexander/starter_folder.

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1 Introduction

Walking through the streets of Toronto these days, it's hard not to see the stark realities that homeless people feel every day. From the makeshift tent cities in park corners to the weary figures lining up for a meal outside the food bank, the plight of the city's homeless population is visible and poignant. At times, I wonder why do so many people sleep outside of shelters or not try to use the resources that the government have provided them. It is amid these daily scenes, the challenges they face that an amalgamation of health risks, safety concerns, and social neglect portrays a broader picture of deeply rooted social issues that demand our attention.

In examining these social issues, the living conditions and health risks faced by homeless populations have long been and will continue to be the main concern. Toronto's shelter system, according to the latest report from Trillium, has the capacity to house around 10,000 individuals at any given time. This number highlights the seriousness of the city's homelessness challenge and reflects ongoing efforts to meet the basic needs of this vulnerable group The Trillium (2024). However, despite these provisions, conditions for homeless individuals remain deeply challenging. Data from Fred Victor reveals that the daily shelter occupancy rate consistently hovers at approximately 98%, indicating not only a pressing demand but a significant strain on overall shelter resources and management Fred Victor (2024). Furthermore, behind this high occupancy rate lies a deeply concerning mortality rate among the homeless. On average, three homeless people die each week in or near shelters, a rate significantly higher than that of the general population. This alarming statistic underscores the heightened health risks faced by this group and poses a critical challenge to urban society's commitment to public welfare. There are even further additional statistics from Toronto's database that reinforce the gravity of the situation, demonstrating that homeless individuals experience not only a higher incidence of illness but also an unusually elevated rate of unnatural deaths City of Toronto (2024).

In response, what has the government done? Well, the Toronto government has committed to enhancing its emergency response protocols within shelters, demonstrating a proactive commitment to safeguarding the health of this population. These measures are without question crucial components of efforts to create a more inclusive and resilient city. However, is merely augmenting emergency responses sufficient? I think that there is a need to examine the patterns and underlying causes of medical emergencies in shelters, what truly happens inside these "safe havens" for homeless individuals and why some of them even refuse to go there at all. If we truly succeed in this, we could finally begin to properly optimize emergency response strategies to prevent these tragic outcomes.

This paper aims to analyze the temporal patterns of deaths within Toronto's shelter system and to investigate the factors that may influence mortality rates. The specific objectives are to examine the time trends in shelter death rates since 2007, identify periods of higher and lower mortality rates, assess the impact of external events such as COVID-19 on shelter deaths, and explore gender differences in shelter mortality. Through this analysis, I hope to provide

data-driven recommendations that can help inform and propose more targeted, timely policies toward the homeless population that may prove to be the first step in addressing the homeless problem in Toronto. The remainder of the paper will be structured as follows: Methodologies employed in gathering and analyzing the data Section 2, present the findings and their implications Section 3, and finally discuss the broader context and recommendations for future policy development Section 4.

2 Data and methods

2.1 Data Collection and Publication

The data on shelter resident deaths in Toronto has been collected by the City's Shelter and Support Services Division since 2007 City of Toronto (2024). When a resident or recent resident passes away, shelter operators are required to notify the City within 24 hours and submit a detailed report in PDF format within 30 days. This process helps the City monitor emerging issues within the shelter system and respond appropriately.

The dataset is publicly available through Toronto Public Health's "Deaths of People Experiencing Homelessness" dashboard and is updated annually. The most recent update was released on September 19, 2024.

2.2 Data Source

The dataset used in this study was obtained from Open Data Toronto. The raw dataset comprises the following key fields:

- **Year** and **Month**: The calendar year and month when the data for shelter resident deaths is reported.
- **Total decedents** : The total number of shelter residents who passed away during the reported month and year.
- **Male** , **Female** and **Transgender/Non-binary/Two-Spirit**: Detailed number of shelter residents who died in the reported month and year by genders.

2.3 Software and Packages

We used R 4.3 for analysis and followed a public template R Core Team (2023)Alexander (2023). and a collection of R packages were used in this study:

- tidyverse Wickham et al. (2019)

- here Müller (2020)
- lubridate Grolemund & Wickham (2011)
- ggplot2 Wickham (2016)
- scales Wickham, Pedersen, & Seidel (2023)
- knitr Xie (2024)

2.4 Data Management

Data cleaning steps are described in the Appendix. A sample of the cleaned data is presented in Table 1. Among all variables, Year, Total_Death, Male, and Female are coded as integers, Month is coded as abbreviations in character format, and Time is coded in date format. After data cleaning, there are no missing values remaining in the dataset.

Table 1: Sample of Monthly Death Data

Year	Month	Total_Death	Male	Female	Time
2007	Jan	0	0	0	2007-01-01
2007	Feb	3	3	0	2007-02-01
2007	Mar	3	2	1	2007-03-01
2007	Apr	1	1	0	2007-04-01
2007	May	2	2	0	2007-05-01
2007	Jun	3	3	0	2007-06-01

3 Analysis

3.1 Data Overview

Figure 1 shows the overall trend of deaths in Toronto shelters. The numbers of monthly deaths fluctuate over time and increases slightly before the COVID-19 period. There is an outbreak of death during COVID period. After COVID-19, the numbers of death dropped down but the still showed an overall increase.

3.2 COVID-19 Impact

We defined the COVID-19 period as spanning from January 2020 to May 2023 and used histogram to show the distribution of numbers of monthly deaths for both the COVID-19 and non-COVID periods, as shown in Figure 2. The numbers of monthly deaths during the COVID-19 period ranged from 0 to 18 and most values are between 5 to 15. The typical number of

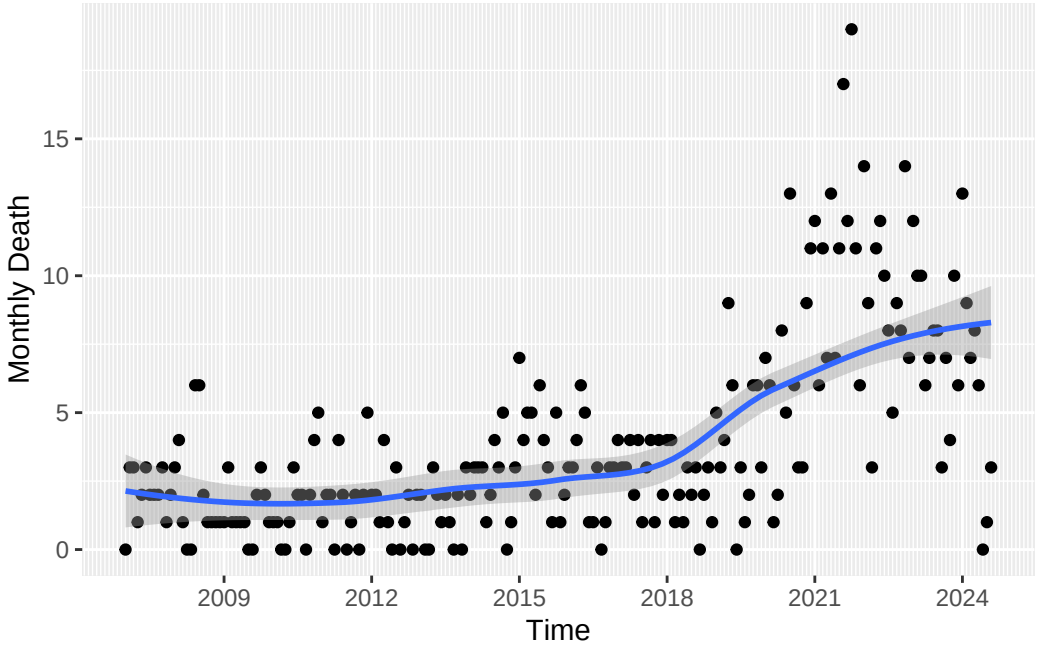

Figure 1: Monthly Death in Toronto Shelters Since 2007

monthly deaths in non-COVID period was around 3. Visually COVID-19 resulted in a three-fold increase in monthly death.

3.3 Season Impact

We also explored the seasonal impact on the number of deaths. Figure 3 presents boxplots of deaths by season. Visually, the fall season showed a slightly lower mean number of deaths. The average number of deaths is similar for spring, summer, and winter, with winter showing the highest lower bound of the interquartile range. There are some outliers with extremely high death counts, likely caused by COVID-19.

3.4 Gender Impact

Figure 4 shows that the total number of deaths among males is significantly higher than that among females since 2007. However, we cannot conclude that males are at a higher risk than females, as we do not have detailed information on the total number of male and female residents in Toronto shelters. Further analysis will be required once additional data is collected.

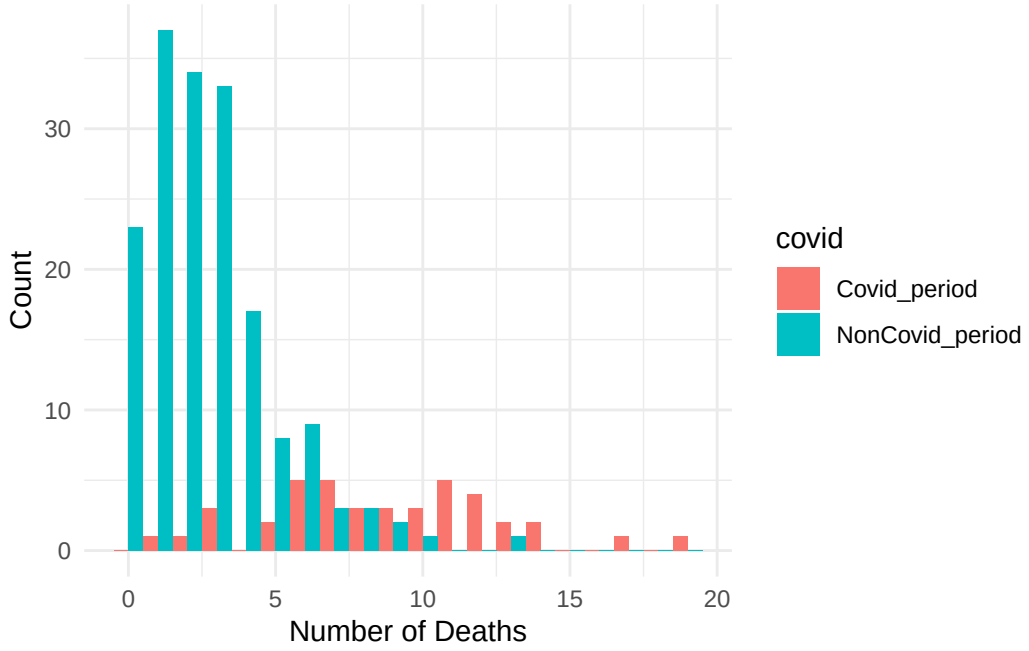

Figure 2: Histogram of Monthly Deaths in Toronto Shelters for Covid and Non-Covid Periods

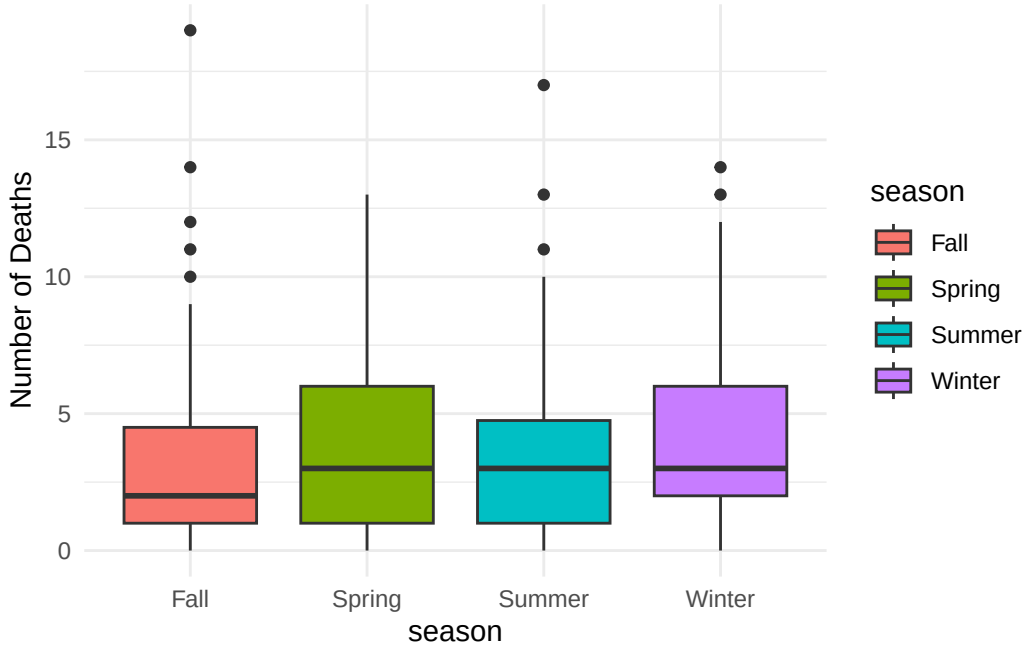

Figure 3: Boxplots of Monthly Deaths in Toronto Shelters by Seasons

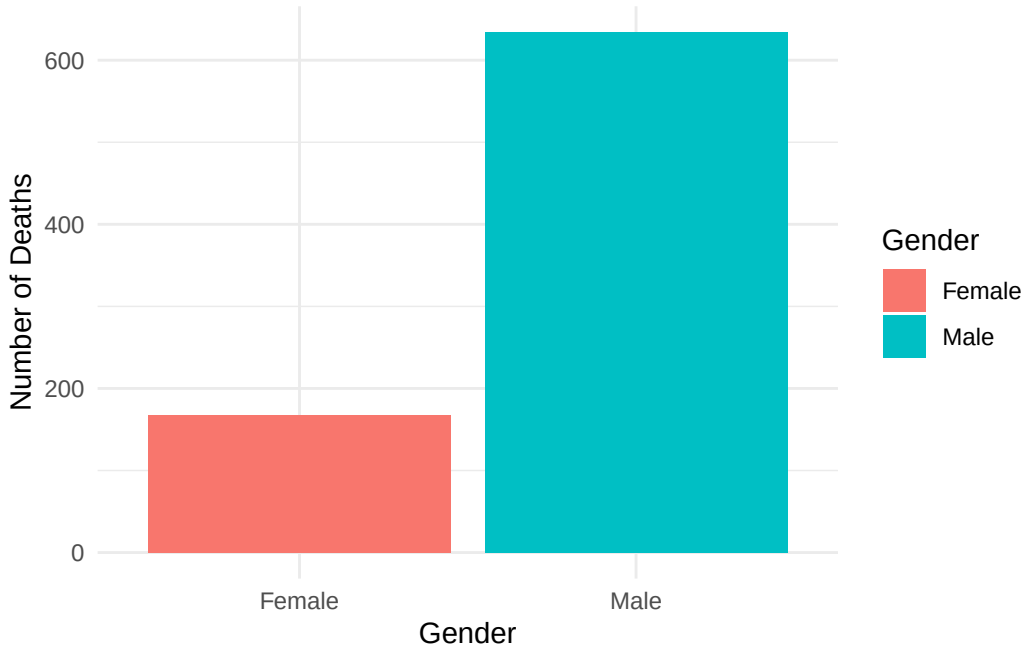

Figure 4: Barplots of Monthly Deaths in Toronto Shelters by Gender

4 Discussion

4.1 Summary of Findings

In this paper, we analyzed data on the number of shelter deaths in the Toronto area. From our analysis, we identified the following key points: 1. The number of deaths in Toronto shelters has increased slightly each year since 2007, despite the impact of COVID-19; 2. COVID-19 significantly increased the number of deaths by three times; 3. Seasonal impacts exist but are not visually significant regarding the number of deaths; 4. The majority of deaths in shelters are among males.

4.2 Strength and Limitations

We analyzed variations in the number of deaths from different perspectives. We used plots to visualize temporal trends, which may provide some statistical support for policymakers.

However, we did not employ statistical methods to test whether various impacts are significant. Since we did not use modeling, we cannot provide statistical meaningful conclusions. We need to incorporate statistical modeling in future research. Additionally, we need to collect further data; for example, when exploring the gender effect, we did not have the total number

of sheltered males and females, so we cannot calculate the death rate and cannot draw a clear conclusion.

4.3 Conclusion and Support to Policy Making

We identified potential timely trends in deaths, such as seasonal impacts and pandemic effects. However, we lack statistical modeling, so we are unable to make statistically significant conclusions. On a positive note, we have provided policymakers with some visual results that may help attract more attention and interest in further analyzing this data.

Appendix

Data Cleaning Steps

Raw data from Open Data Toronto were prepared, so we did not need to perform many cleaning steps. A few cleaning steps are as follows:

- Recode missing values for genders other than male or female.
- Standardize column names.
- After realizing that there were too many missing values for other genders (over 90%), we dropped that variable.
- Create a new Time variable to represent the first day of each recorded month in date format.

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