# How Toronto's homeless death toll over the years shows the dangers of addiction's epidemic?*

**Data analysis of homeless deaths in Toronto from 2017 to 2023**

Shipeng Zhang

January 22, 2024

Homelessness is a well-known problem in Toronto, and this article takes an in-depth look at the tragic reality of homelessness in Toronto. Focuses on the devastating impact of drug addiction by analyzing homeless death toll data from 2017 to 2023. Our top findings reveal a worrying rise in addiction-related homeless deaths over the years. By examining causes of death, age groups and gender, we provide a comprehensive overview revealing the dangers faced by this vulnerable group.

## 1 Introduction

Toronto is currently experiencing an escalating drug poisoning crisis, with challenges posed by the Covid-19 pandemic further exacerbating the public health dilemma. This article explores the details behind this crisis through a comprehensive analysis of homeless deaths from 2017 to 2023.

Drug addiction has a profound impact on the homeless community. Our result reveal the rapid spread of drug poisoning in Toronto. This article takes an depth look at the proportion of deaths caused by drug poisoning and sheds light on the impact of the COVID-19 pandemic on the drug poisoning crisis.

To examine the impact of the COVID-19 pandemic on the drug poisoning crisis, this article is divided into the following sections: data, results, discussion, and conclusion. In the data section, I discuss the nature of the spreadsheets obtained through the City of Toronto's Open-DataToronto (Toronto Public Health 2023) and the steps I took to clean and analyze the data. The Results section displays the trends discovered during the analysis, and the Discussion

*Code and data are available at: https://github.com/zero616/Homeless_Death_Analysis.

section evaluates the trends and provides insights. Finally, the conclusion summarizes the main findings of this paper.

## 2 Data

The dataset used in this analysis was obtained from the City of Toronto's OpenDataToronto Library (Gelfand 2022), adhering to ethical guidelines and ensuring personal anonymity. It includes important information such as year of death, cause of death, age group, gender and number of people. To maintain transparency and reproducibility, all analyzes were performed using the R programming language and visualized with ggplot2 (Wickham 2016) and tables created with knit (Xie 2023).

Table 1 provides a summary of the dataset outlining the key variables under consideration: time to death, cause of death, sex and age group. The time of death started in 2017 and ended in 2023, and the age groups were divided into <20, 20-39, 40-59, 60+.

Table 1: Sample Table for Toronto Homeless Death

| Year of Death | Cause of Death | Age Group | Gender | Count |
|---|---|---|---|---|
| 2017 | Accident | 40-59 | Male | 2 |
| 2017 | Accident | 60+ | Male | 3 |
| 2017 | Cancer | 60+ | Female | 1 |
| 2017 | Cancer | 40-59 | Female | 2 |
| 2017 | Cancer | 40-59 | Male | 2 |
| 2017 | Cancer | 60+ | Male | 4 |

```
total_count_age_data <- toronto_homeless_death %>%
  group_by(Age_group, Cause_of_death) %>%
  summarise(total_count_age = sum(Count), .groups = 'drop')
sample_total_count_by_age_data <- head(total_count_age_data, 6)
knitr::kable(sample_total_count_by_age_data,'markdown',col.names = c("Age Group", "Cause of D

                      caption = "Sample Table for total death number of causes of death by Ag
```

Table 2: Sample Table for total death number of causes of death by Age Group

| Age Group | Cause of Death | Total Count |
|---|---|---|
| 20-39 | Accident | 11 |
| 20-39 | Cancer | 1 |
| 20-39 | Cardiovascular Disease | 4 |

| Age Group | Cause of Death | Total Count |
|---|---|---|
| 20-39 | Drug Toxicity | 179 |
| 20-39 | Homicide | 5 |
| 20-39 | Other | 7 |

```
total_count_data <- toronto_homeless_death %>%
  group_by(Year.of.death, Cause_of_death) %>%
  summarise(total_count = sum(Count), .groups = 'drop')
sample_total_count_by_year_data <- head(total_count_data, 6)
knitr::kable(sample_total_count_by_year_data,'markdown',col.names = c("Year of Death", "Cause

                        caption = "Sample Table for total death number of causes of death by Ag
```

Table 3: Sample Table for total death number of causes of death by Age Group

| Year of Death | Cause of Death | Total Count |
|---|---|---|
| 2017 | Accident | 5 |
| 2017 | Cancer | 9 |
| 2017 | Cardiovascular Disease | 13 |
| 2017 | Drug Toxicity | 31 |
| 2017 | Homicide | 1 |
| 2017 | Other | 8 |

Figure 1 shows the distribution of causes of death among homeless people, stratified by age group. This figure provides an impactful sketch of the leading causes of death among homeless people.

# 3 Model

The goal of our modelling strategy is twofold. Firstly,...

Here we briefly describe the Bayesian analysis model used to investigate... Background details and diagnostics are included in Appendix B.

## 3.1 Model set-up

Define $y_i$ as the number of seconds that the plane remained aloft. Then $\beta_i$ is the wing width and $\gamma_i$ is the wing length, both measured in millimeters.

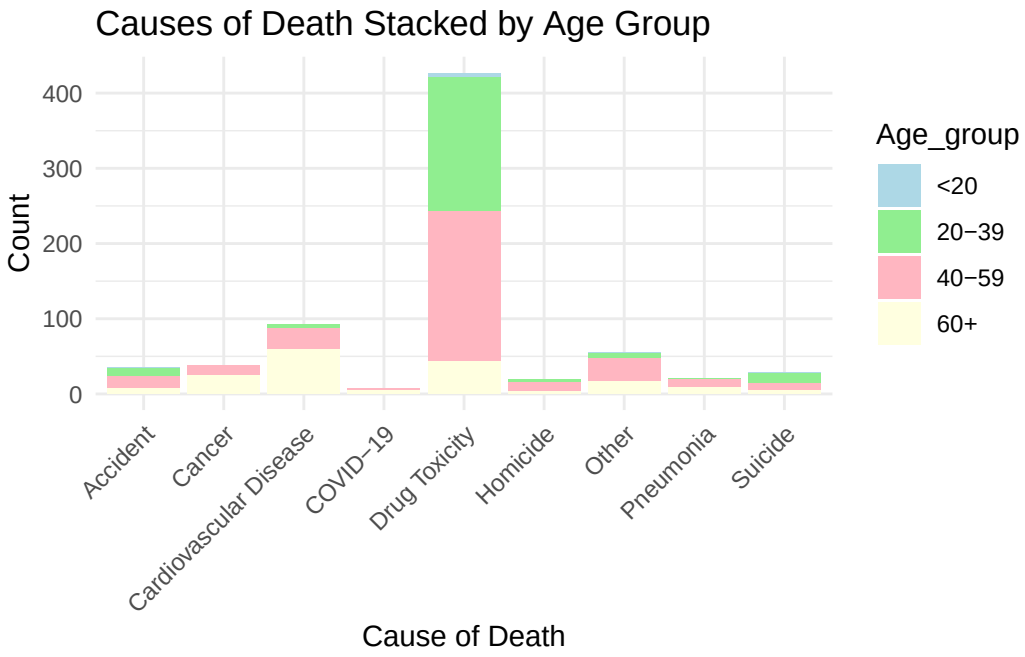


Figure 1: Causes of death analysis by abe

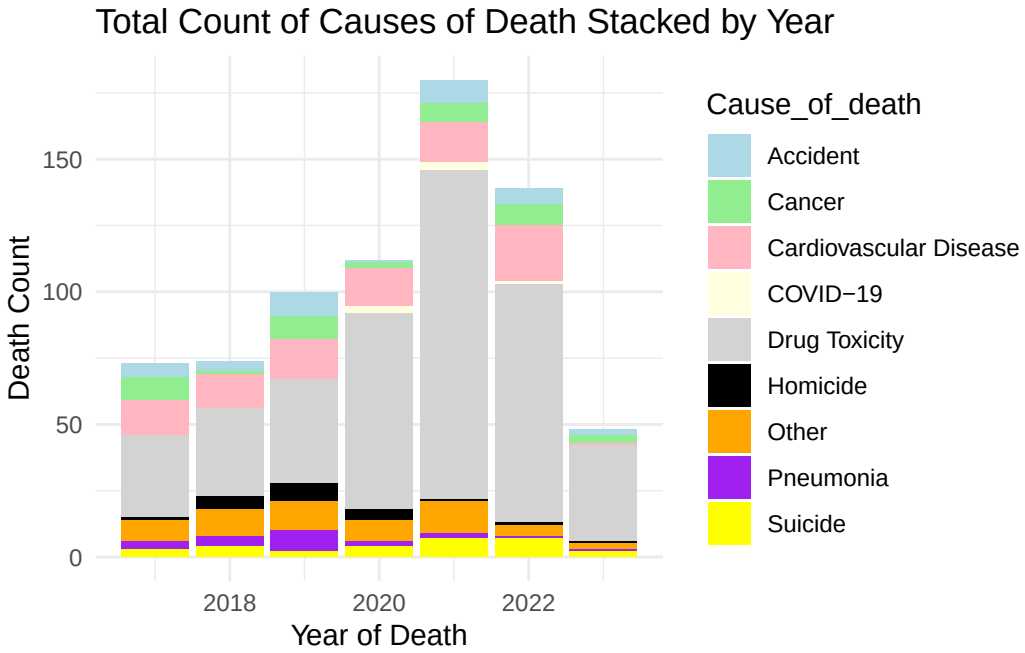


Figure 2: Causes of death analysis by year

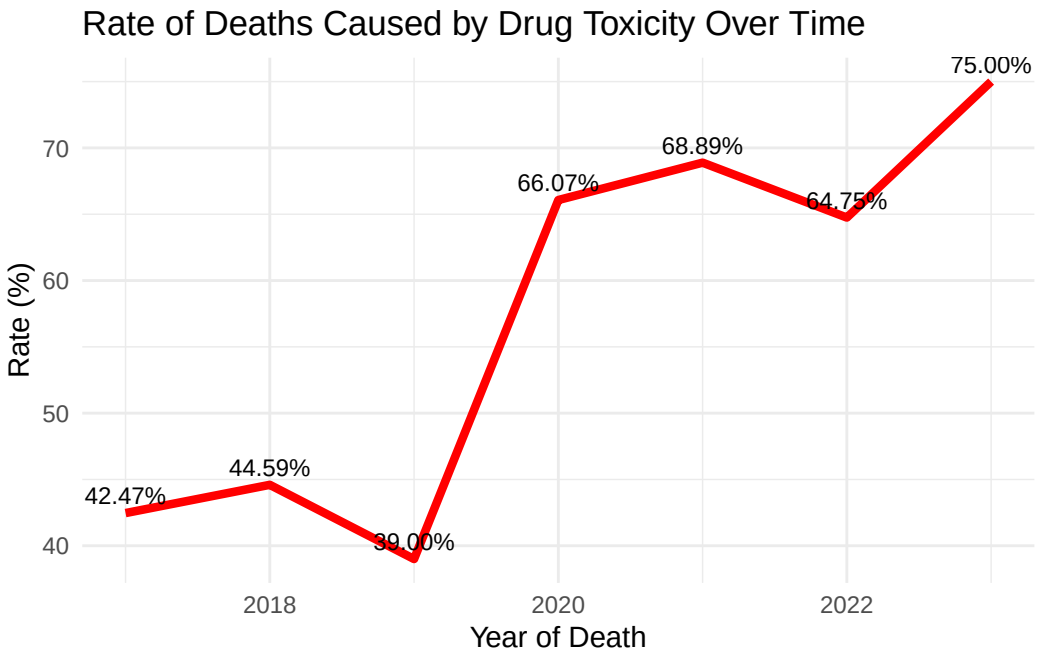


Figure 3: Rate of death Caused by Drug Toxicity Over Time

$$y_i|\mu_i, \sigma \sim \text{Normal}(\mu_i, \sigma) \tag{1}$$
$$\mu_i = \alpha + \beta_i + \gamma_i \tag{2}$$
$$\alpha \sim \text{Normal}(0, 2.5) \tag{3}$$
$$\beta \sim \text{Normal}(0, 2.5) \tag{4}$$
$$\gamma \sim \text{Normal}(0, 2.5) \tag{5}$$
$$\sigma \sim \text{Exponential}(1) \tag{6}$$

We run the model in R (R Core Team 2022) using the `rstanarm` package of Goodrich et al. (2022). We use the default priors from `rstanarm`.

### 3.1.1 Model justification

We expect a positive relationship between the size of the wings and time spent aloft. In particular...

We can use maths by including latex between dollar signs, for instance $\theta$.

# 4 Results

Our results are summarized in **?@tbl-modelresults**. #| echo: false #| eval: true #| warning: false #| message: false

library(rstanarm)

first_model <- readRDS(file = here::here("outputs/models/first_model.rds"))

#| echo: false #| eval: true #| label: tbl-modelresults #| tbl-cap: "Explanatory models of flight time based on wing width and wing length" #| warning: false

modelsummary::modelsummary( list( "First model" = first_model ), statistic = "mad", fmt = 2 )

# 5 Discussion

## 5.1 First discussion point

If my paper were 10 pages, then should be be at least 2.5 pages. The discussion is a chance to show off what you know and what you learnt from all this.

## 5.2 Second discussion point

## 5.3 Third discussion point

## 5.4 Weaknesses and next steps

Weaknesses and next steps should also be included.

# Appendix

# A Additional data details

# B Model details

## B.1 Posterior predictive check

In **?@fig-ppcheckandposteriorvsprior-1** we implement a posterior predictive check. This shows…

In **?@fig-ppcheckandposteriorvsprior-2** we compare the posterior with the prior. This shows… #| eval: true #| echo: false #| message: false #| warning: false #| label: fig-ppcheckandposteriorvsprior #| layout-ncol: 2 #| fig-cap: "Examining how the model fits, and is affected by, the data" #| fig-subcap: ["Posterior prediction check", "Comparing the posterior with the prior"]

pp_check(first_model) + theme_classic() + theme(legend.position = "bottom")

posterior_vs_prior(first_model) + theme_minimal() + scale_color_brewer(palette = "Set1") + theme(legend.position = "bottom") + coord_flip()

## B.2 Diagnostics

**?@fig-stanareyouokay-1** is a trace plot. It shows… This suggests…

**?@fig-stanareyouokay-2** is a Rhat plot. It shows… This suggests… #| echo: false #| eval: true #| message: false #| warning: false #| label: fig-stanareyouokay #| fig-cap: "Checking the convergence of the MCMC algorithm" #| fig-subcap: ["Trace plot", "Rhat plot"] #| layout-ncol: 2

plot(first_model, "trace")

plot(first_model, "rhat")

## References

Goodrich, Ben, Jonah Gabry, Imad Ali, and Sam Brilleman. 2022. "Rstanarm: Bayesian Applied Regression Modeling via Stan." https://mc-stan.org/rstanarm/.

R Core Team. 2022. *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing. https://www.R-project.org/.