Return to Homeless Shelters and Mortality: A Correlation Analysis*

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April 18, 2024

This paper investigates the relationship between returns to homeless shelters and mortality among those experiencing homelessness in Toronto. Using datasets from Open Data Toronto, I analyzed patterns of returns to shelters alongside occurrences of death among homeless individuals on a monthly basis. The findings reveal a correlation between returns to shelter patterns, and an decreased risk of mortality in those months. Understanding these correlations showcases the dynamics between shelter access, flaws in shelter operation, and mortality risks faced by those experiencing homelessness in Toronto, and helps illuminate these issues, raise awareness, and to prompt reflection on potential avenues for assisting these individuals.

1 Introduction

In Toronto, homelessness remains a persistent social issue with significant implications for public health and social welfare (Ireland 2023). Amidst efforts to address homelessness, understanding the dynamics between shelter usage patterns and mortality risks among individuals experiencing homelessness is crucial. This paper looks into this relationship, aiming to analyze the underlying factors that contribute to mortality within this vulnerable population.

Using data sets sourced from Open Data Toronto (Gelfand 2022), this study examines the interplay between homeless shelter usage trends, particularly returns to homeless shelters per month, and monthly mortality among individuals experiencing homelessness in Toronto. By analyzing patterns of shelter occupancy, transitions, and occurrences of death on a monthly basis, I aim to highlight the connections between shelter access, economic instability, and mortality risks faced by those without stable housing. Additionally, I will employ a poisson

*Code and data are available at: https://github.com/Maroosh-Gillani/homeless_mortality.

regression model to further explore the relationships between shelter return patterns and mortality outcomes, providing statistical insights into this dynamic. The estimand of interest in this analysis is the effect of returns to homeless shelters per month on the monthly mortality rate among individuals experiencing homelessness. By estimating this parameter, I aim to quantify the impact of shelter usage patterns on mortality risks within this vulnerable population.

The findings of this study reveal a notable correlation between the pattern of returning to shelters, and a decreased risk of mortality during certain months. This contributes to the understanding of challenges faced by individuals experiencing homelessness and emphasizes the importance of targeted interventions to address mortality risks within this population.

By discussing these issues and raising awareness of the interconnected factors influencing homelessness and mortality, this paper aims to encourage reflection on potential ways to support individuals experiencing homelessness in Toronto. Through this exploration, I aim to underscore the significance of addressing the underlying causes of homelessness and advocating for approaches to safeguard the well-being and dignity of all members of society.

The structure of the paper is as follows: Sections 2 and 3 covers details surrounding the utilized data, and how it was measured. Section 4 expands upon the choice of model for this analysis. Section 5 visualizes the data, and finally, Section 6 discusses the implications surrounding the visualizations, and the broader homelessness issue in Toronto.

2 Data

This paper uses data sets from OpenDataToronto (Gelfand 2022), which provides access to freely available digital data from the city of Toronto. In particular, the "Deaths of People Experiencing Homelessness" and "Toronto Shelter System Flow" data sets are being utilized for the purposes of analyzing the number of people returning to homeless shelters, and the number of homeless people who passed away over the time period of 2018 to 2022.

The "Deaths of People Experiencing Homelessness" is very simple, and consists of the year and months (starting January 2018), a unique id for each month, and the count of homeless persons who passed away in that month in Toronto. All columns in this dataset are numeric, with the exception of 'Month of death', which consists of characters. For this analysis, I have utilized the columns of 'Year of death', 'Month of death', and 'Count' only.

The "Toronto Shelter System Flow" is a more complex dataset, consisting of many columns such as 'date(mmm-yy)', and 'population_group', which contain characters, and details regarding the population relevant to homeless shelters in Toronto, such as 'returned_from_housing' or 'became_inactive', which are numeric in nature.

There were no similar data sets to my knowledge. Furthermore, the two data sets used in this paper are ideal as they are coming directly from the city of Toronto, and the organizations

and agencies dealing with homeless shelters and recording the deaths of homeless individuals. As such, alternate data sets do not need to be considered.

The data sets were cleaned to reformat the date into 'mm/yyyy' format. This allowed for me to extract and merge the relevant information from both data sets easily into one table. This aided in utilizing and having access to the necessary information only when making graphs and models for analysis purposes.

The most important variables are 'Month/Year', 'Deaths', and 'Returns to Homeless Shelters'. 'Month/Year' is the independent variable for both Figure 1 and Figure 2. 'Deaths' is the dependent variable for Figure 1, while 'Returns to Homeless Shelters' is the dependent variable for Figure 2. All of these variables were also key for the Poisson regression model utilized in this analysis, and more details can be seen in the Model section.

All data collection, analysis, modeling and visualization was done using R (R Core Team 2023), with the aid of the RStudio IDE (RStudio Team 2020) to streamline the process. In particular, the following packages were utilized: tidyverse (Wickham et al. 2019), ggplot2 (Wickham 2016), here (Müller 2020), knitr (Xie 2023), arrow (Richardson et al. 2024), dplyr (Wickham et al. 2023), and haven (Wickham, Miller, and Smith 2023).

3 Measurement

The "Deaths of People Experiencing Homelessness" data set is maintained by the Toronto Public Health, particularly in regards to data collection, reporting and analysis (Gelfand 2022). It is refreshed semi-annually. Their information is supplied to them by agencies such as the SSHA, alongside other social service agencies relevant to homelessness.

On the other hand, the "Toronto Shelter System Flow" gets its data from an information management system that is used to operate shelter related services that are funded by the City of Toronto, and it is updated on a monthly basis (Gelfand 2022).

4 Model

4.1 Model justification

To model the relationship between the number of homeless deaths and the number of homeless individuals returning to shelters on a monthly basis, a Poisson regression model was utilized. Such a model is suitable for this purpose because the number of deaths, as well as the number of people returning to shelters, are both instances of count data. The outcome variable here represents the counts of events occurring within a fixed interval.

4.2 Model set-up

The model is specified as follows:

$$log(ExpectedNumberofHomelessDeaths) = \beta_0 + \beta 1(NumberofIndividualsReturningtoShelters)$$

Here, β_0 represents the intercept, or the expected log count of homeless deaths when the number of people returning to shelters is 0.

β_1 represents the coefficient for the predictor variable, indicating the change in the expected log count of homeless deaths for each unit increase in the number of individuals returning to homeless shelters.

5 Results

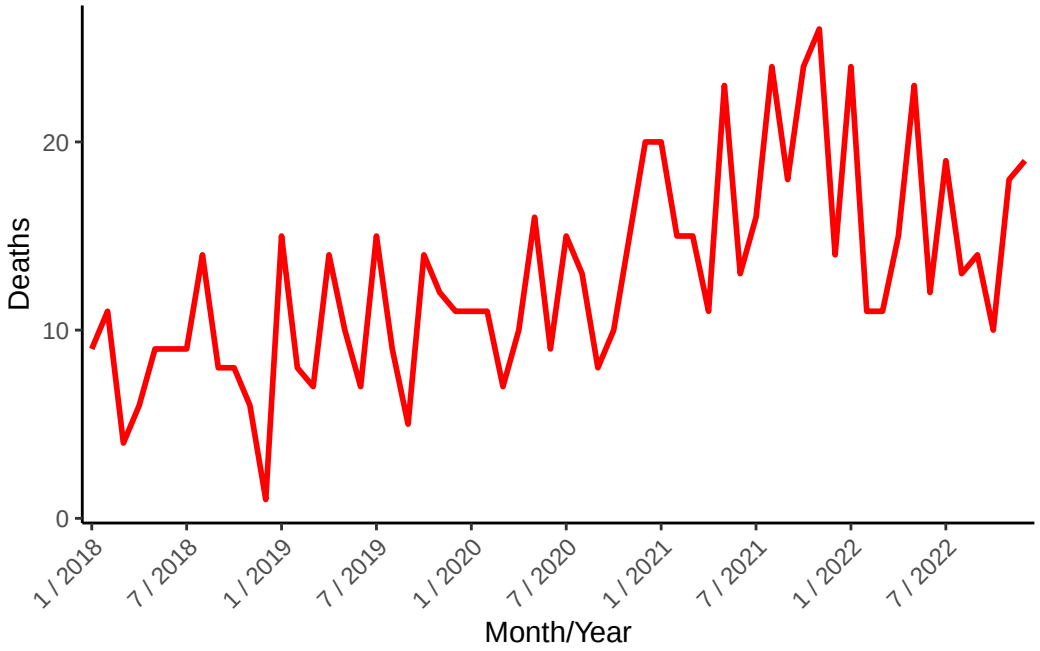

Figure 1: Deaths of Homeless Individuals in Toronto per month (2018 - 2022)

Figure 1 shows that deaths among homeless people in Toronto, while fluctuating significantly over the months, are following a general trend of growth. Each year, the deaths have a consistent peak around winter time, especially near the month of January. The highest number of homeless deaths in Toronto seem to have occurred in the November of 2021, while the lowest amount of deaths recorded are in December of 2018.

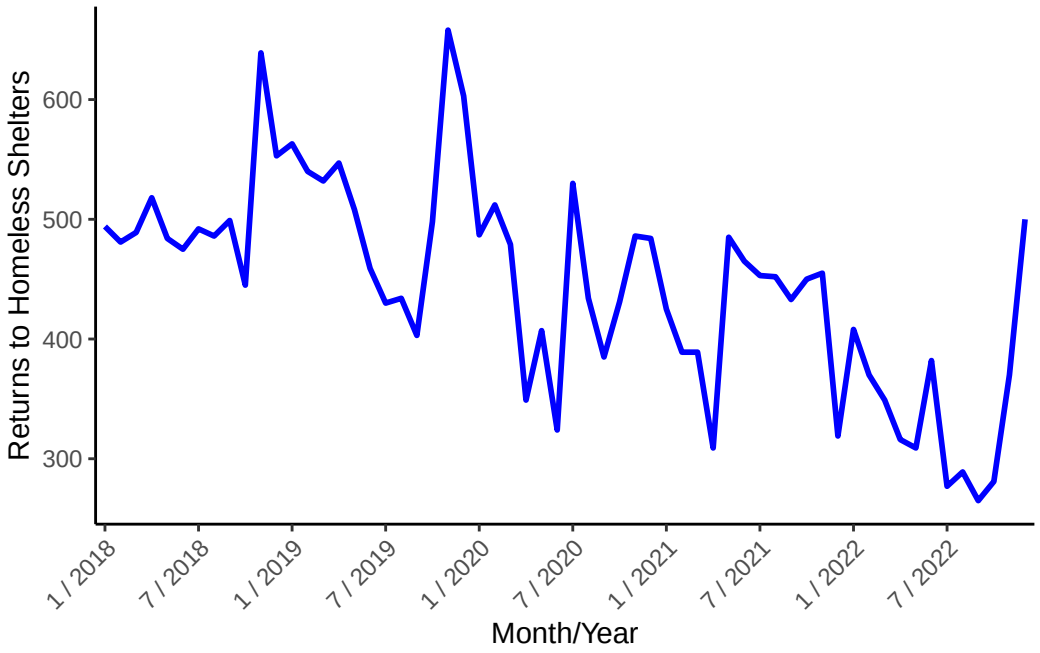

Figure 2: Number of Individuals Returning to Homeless Shelters per Month (2018 - 2022)

Figure 2, while also fluctuating significantly, seems to follow a negative pattern for returns of homeless people to shelters. The returns are at their peak in November of 2019. In contrast, September of 2022 saw the least amount of Toronto's homeless population return to a shelter.

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	3.0368482	0.1827703	16.615656	0.0000000
Returned.to.shelter	-0.0010889	0.0004107	-2.651166	0.0080215

Figure 3: Summary of the Results from The Poisson Regression Model

Figure 3 shows the results from the Poisson regression conducted on the cleaned dataset. The aim of this model was to investigate the relationship between the number of homeless deaths and the number of individuals returning to homeless shelters. In particular, "Returned to shelter" was used as the sole predictor variable for monthly homeless deaths.

Firstly, the intercept represents the estimated log count of homeless deaths when the predictor variable is 0. Here, it can be seen that it is 3.0368 (with SE = 0.1828, z = 16.6157 and p = 0), which represents the base level of homeless deaths when no individuals are returning to shelters.

The estimated coefficient for Returned to shelter is approximately -0.0011 (with SE = 0.0004, z = -2.6511, and p = 0.0080). This represents the estimated change in the log count of homeless deaths in relation with a one unit increase in the number of individuals returning to homeless shelters per month. Since the coefficient is negative, the average increase of people returning to homeless shelters can be associated with a decrease in the number of homeless death.

6 Discussion

Upon examining both Figure 1 and Figure 2, it is apparent that both graphs are moving in opposite directions over the same period of time. The data shows that homeless deaths seem to be rising, while the amount of homeless people returning to shelters seems to be in decline. This implies an inverse relationship between the two variables, indicating that when more homeless people returned to shelters, the mortality within this population was a lot lower. This observation is further supported by the Poisson regression model run on this same data, which posits that for each homeless person that returns to a shelter, the average number of deaths in the homeless population decreases, as illustrated in Figure 3.

These findings suggest that homeless shelters indeed play a role in reducing mortality in the homeless population of Toronto. However, the declining trend of returns to shelters prompts the question of why this might be the case. A deeper look shows that the issue is not as straightforward as it initially seems. Lavoie (2023) highlights that both 2021 and 2022 consecutively saw over 100 deaths among homeless shelter users in Toronto. This implies that homeless people in Toronto are at risk of death regardless of having access to shelter services. Another implication could be that the services and resources provided by these shelters are inadequate to ensure homeless survival, which could be why the homeless population in Toronto has progressively chosen to return to shelters less with the passage of time.

This is further supported by Crowe (2023), who discusses the inhumane practices of Toronto's shelters. Hundreds of shelter seekers were forced to sleep on sidewalks in front of Toronto's referral center. In fact, in place of the city, frontline workers took the mantle of providing relief through necessities such as food, water and blankets to these individuals. In addition, church groups had to provide shelter to many of the shelter seekers in places of worship. Thus, it seems like the city of Toronto and its shelters are either ill equipped, or refuse to handle large number of homeless shelter seekers. This implies that the declining returns to shelters is not solely a consequence of refusal to access shelters on the homeless populations part, but rather a shortcoming of the current infrastructure in place, which is likely unable to support the demand.

Crowe (2023) also brings up more unethical practices such as multiple shelters having a lack of doors on washroom and shower stalls, withholding information regarding disease outbreaks in shelters, and refusing to meet basic needs in favor cost cutting, such as replacing bath towels with paper towels. All of these factors could also contribute to making shelters less appealing for homeless people, which could also be a factor impacting why returns to shelters has seen a negative trend in Toronto.

So while it seems that homeless shelters do have a positive impact on the mortality rates among homeless populations in Toronto, it comes at the cost of enduring unpleasant conditions, including scenarios that bring up the trade-off between survival and dignity. In addition, even if homeless people want access to shelters, many are unable to access them due to poor infrastructure in referring these individuals to appropriate centers. This means that at the

very least, significant reform is needed at a fundamental level for how homeless shelters are operated in Toronto. Some obvious changes include improving the shelter referral system such that it does not allow hundreds of individuals to be forced to live on sidewalks for extended durations. Another change is to improve conditions and treatment of homeless people within shelters. Figure 3 is clear in showing that homeless shelters reduce mortality, and making shelters more appealing to utilize can help in a significant way.

A more ambitious solution would be to address the homelessness issue itself, and work towards eliminating homelessness at its root. Ritcher (2022) proposes multiple ways to combat homelessness in Canada, which include ideas such as the government implementing caps on rapidly increasing rent prices, fixing the National Housing Strategy by elevating the amount of affordable housing units being built, or by providing additional rent support to people at increased risks of becoming homeless.

It must be noted that a significant limitation in this analysis is that the cause of death is not provided in the utilized data sets. Thus, it is a difficult to say how many deaths within homeless individuals can directly be affected by resources available at homeless shelters. Having access to more information surrounding causes of death, and other details such as location of death can help in providing a more robust analysis on factors contributing to Toronto's homeless mortality in relation to shelter usage.

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