Unveiling Vulnerabilities*

An Analysis of Causes of Death Across Age Groups and Genders Within Toronto's Homelessness Population

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This paper aims to explore the relationship between male homelessness and mortality rates across age groups, focusing on causes of death related to homelessness in Toronto from the years 2017- 2023. The hypothesis suggests that younger homeless males (<20 and 20-39) may have higher mortality rates due to harsh living conditions, limited healthcare access, and increased vulnerability. The results indicate that while male homeless mortality rates are generally higher than reported female death tolls, the most affected age demographic is the 40-59 age range rather than the hypothesized age group.

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*Code and data are available at: https://github.com/fazim07/deaths_gender

1 Introduction

Homelessness is typically thought of as an individual who is completely unhoused or resides in public spaces. Four categories are commonly used to describe homelessness to various degrees. Chronic homelessness is a pattern in which an individual has had or is facing homelessness in a continuous pattern. Often, these victims are older and struggle with complex health issues, i.e., diabetes, mental illness, or addiction. Episodic homelessness refers to an individual who has experienced 3-4 periods of homelessness within a year (Canada 2023). Typically seen in younger cohorts, these individuals often fall prey to addiction or have mental health issues. This specific category is critical as episodic homelessness can transform into chronic if left unprovoked (Homes 2024). Transitional homelessness refers to individuals who become homeless due to a major life event that affects their financial, familial, or social situation. Considered the most common form of homelessness, particularly since the pandemic, it is typically found in younger working individuals and can lead them to seek shelters for temporary housing (Homes 2024). Lastly, hidden homelessness refers to individuals who are 'couch-surfing' with friends or family. This type is typically undocumented and unreported, hence not much data is collected from it. Individuals facing this particular type have no guarantee that they may find housing and are not registered under any shelters (Homes 2024).

Some of the key factors that result in homelessness are financial challenges, results from abuse or intimate partner violence, health issues which cannot be sustained within a household, and finally addiction or substance abuse (Canada (2023)). Although many underlying factors contribute to an individual becoming or facing homelessness, it's important to keep an open and empathetic mind when dealing with the data collected to understand these trends. Research has shown that women make up 27.3% of the homeless population. Several factors contribute to the higher likelihood of women experiencing homelessness compared to men. These factors include unstable employment, which raises the risk of income fluctuations or job loss, as well as the added responsibility of care giving, such as caring for children and dependents, intimate partner violence and other forms of abuse (Stephen Gaetz (2013)). However, there is no study explaining the reason to the high volume of male victims in homelessness populations.

This paper aims to identify the correlation between gender and age within the homeless population in Toronto from the year 2017 - 2023, specifically examining how age and gender intersect in terms of homelessness experiences and demographic characteristics. In examining the data set concerning causes of death, including homelessness as a potential factor, the hypothesis suggested is that there is a notable relationship between male homelessness and mortality rates across different age groups. Specifically, the anticipation that younger age groups (<20 and 20-39) among homeless males may exhibit higher mortality rates compared to older age groups

(40-59 and 60+), potentially due to factors such as exposure to harsh living conditions, limited access to healthcare, and increased vulnerability to external threats.

The Introduction sets the stage by providing essential background information on homelessness in Toronto and outlining the research objectives. Moving into the Data section, the methodology for data collection, including gender, age, and homelessness status assessment. The Results section presents findings on the correlation between gender and age within Toronto's homeless population, using visual aids to depict trends and significant patterns. Finally, the Discussion section interprets these results in the context of the research questions, compares them with existing literature, addresses methodological limitations and biases, and suggests potential areas for future research to further expand understanding in this domain.

The graphs and tables in this paper were made with (R Core Team 2023) using R studio. The creation of these graphs and tables was made with `ggplot` (Wickham 2016), `tiddyverse` (Wickham et al. 2019), The analysis and cleaning of the data were conducted with and `dyplr` (Wickham et al. 2023), `janitor` (Firke 2023) and `readr` (Wickham, Hester, and Bryan 2024) packages.

2 Data

The data was collected from Open Data Toronto, specifically from the data set called "Deaths of People Experiencing Homelessness," which is a subset known as "Homeless deaths by cause." Toronto Public Health (TPH) conducted this data collection initiative to track the deaths of people experiencing homelessness more accurately and understand their causes. TPH oversees the data collection, analysis, and reporting, while the Shelter, Support and Housing Administration (SSHA) and various health and social service agencies that support the homeless population share information with TPH. The Office of the Chief Coroner of Ontario (OCCO) also verifies some of the data. In this context, homelessness is defined as "the situation of an individual or family without stable, permanent, appropriate housing, or the immediate prospect, means, and ability to acquire it (Health 2023).

2.1 Data Source

The original data set contained six variables, for this paper, five of the six variables were selected. The first variable, *id* contains an id number which is associated with the following variables, *cause of death*, *age group*, *year of death*, and *gender*. There are a total of 253 entries. The *cause of death* variable is listened from 12 categories. These categories include homicide, accident, cardiovascular disease, cancer, COVID-19, drug toxicity, pneumonia, suicide, others and unknown. There are no notices nor indications on what the category other and unknown classifies as. *Year of death*, covers the years from 2017 to 2023. Lastly, the gender variable houses, three categories, male, female, and unknown Table 2. Once again, the *unknown* has not been classified. We can observe by the table that Male homeless victims have highest

Table 1: Summary of clean data

Year	Cause of Death	Age Group	Gender	Death Toll
2017	Accident	40-59	Male	2
2017	Accident	60+	Male	3
2017	Cancer	40-59	Female	2
2017	Cancer	40-59	Male	2
2017	Cancer	60+	Female	1
2017	Cancer	60+	Male	4
2017	Cardiovascular Disease	20-39	Male	2

Table 2: Homelessness gender total death tolls

Gender	Death Tolls
Female	210
Male	749
Unknown	3

death tolls sitting at 749, while female victims come in second with 210, followed by unknown individuals who are accounted for as 3 The *age group* variable is a set of four age ranges, <20 years old, 20-39 years of age, 40-59 years of age and 60+ years of age Table 3. We can see that there are 9 deaths reported for the age gorup under 20, followed by the 20-39 age range, then the 60+ age range and finally, the 40-59 age range having the highest death tolls among each demograph.

2.2 Variables of Intrest & Cleaning

To clean the data, five of the six variables were chosen as the *id* variable was not required for this paper. From there the *age group* category had unknown variables. To avoid any issues with the gender death analysis, the unknown variables were omitted from the clean data set. This brings the clean data set to 233 entries as opposed to the original 253, Table 1 shows a snap shot of the clean data sets. The decision to omit unknown values in the age group category is particularly important when analyzing how gender correlates with different causes of death across specific age groups. Including unknown values could introduce uncertainty and skew the findings, making it challenging to draw accurate conclusions about any relationships or trends observed between gender, age, and causes of death among the homeless population.

Therefore, by focusing on known age group data, the analysis can provide more insightful and reliable insights into how gender may influence mortality rates or patterns of causes of death within different age brackets among the homeless population in Toronto.

Table 3: Age Groups and their total death tolls

Age Group	Death Tolls
<20	9
20-39	251
40-59	420
60+	282

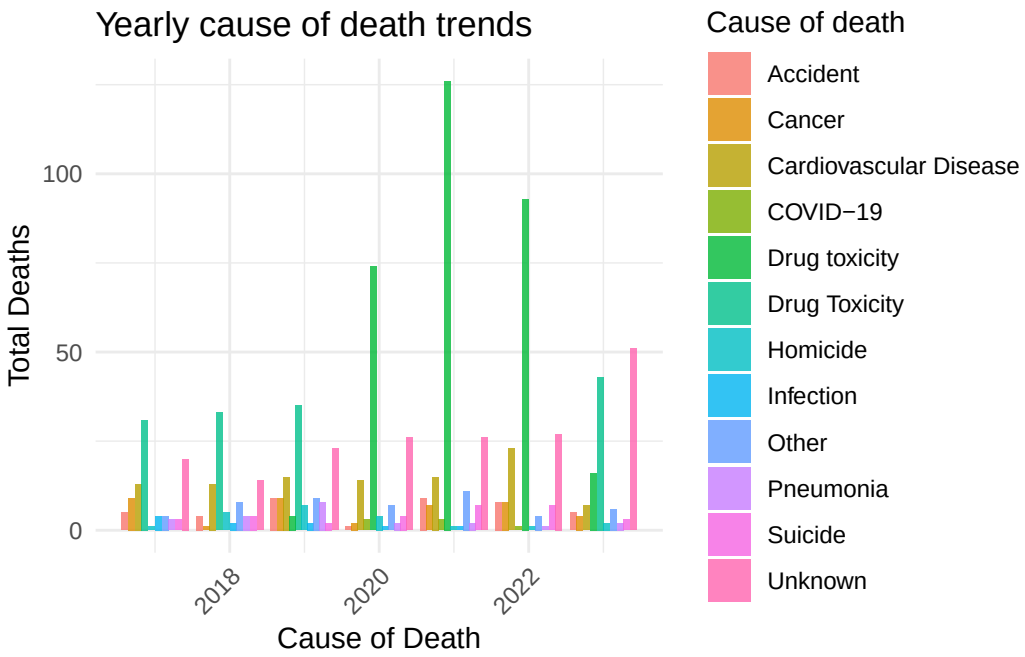


Figure 1: Cause of death by year trends form 2017 - 2023

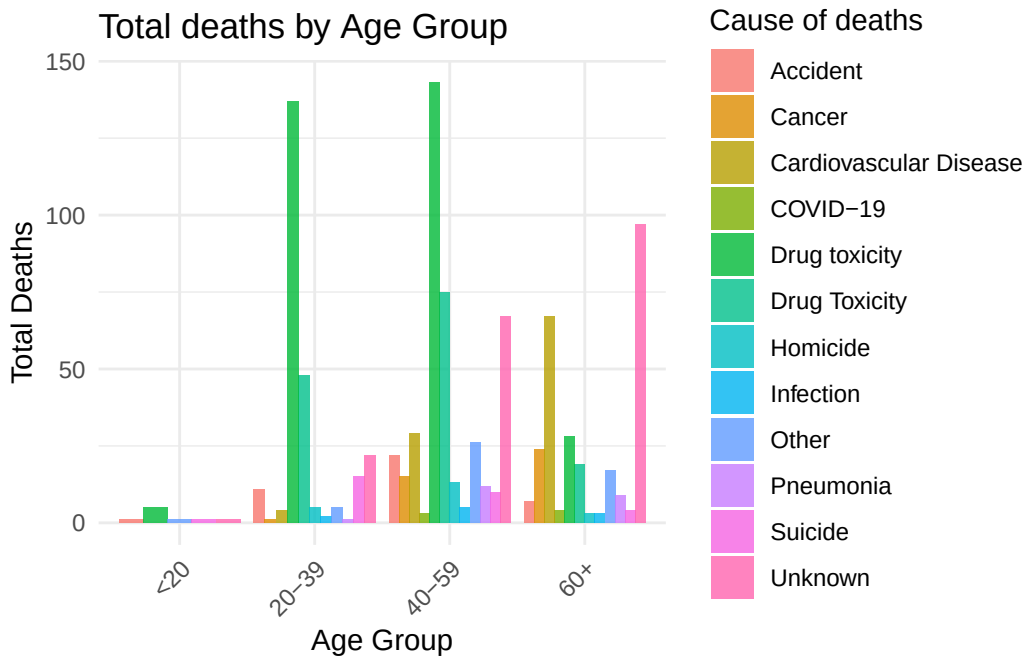
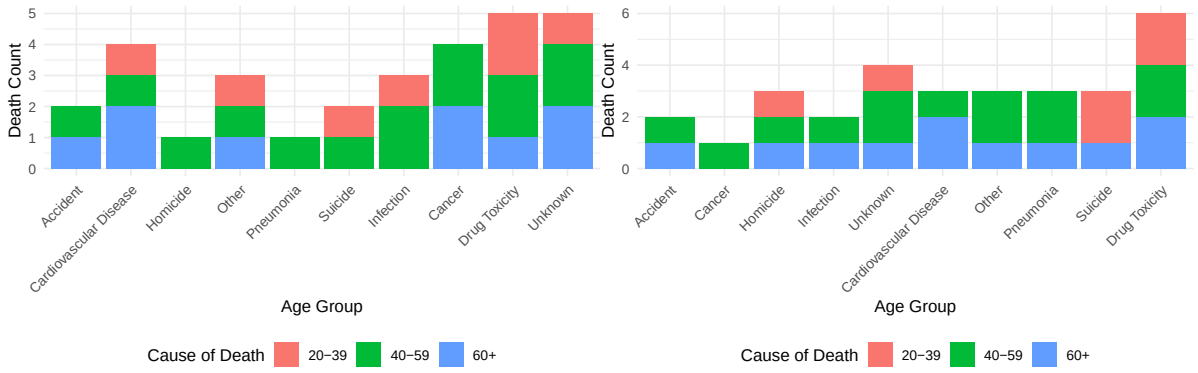


Figure 2: Total cause of death by age group

3 Results

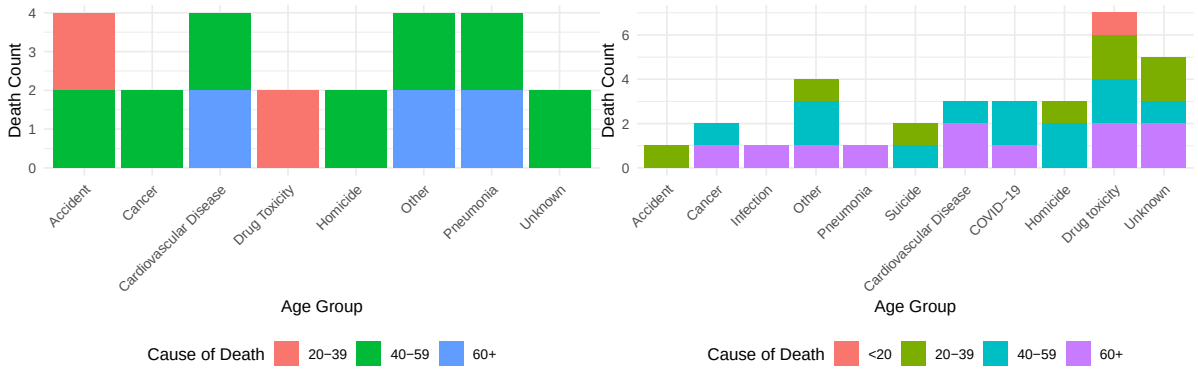
3.1 Yearly Death Analysis

Analyzing the data from the figure Figure 1, we can observe trends in the yearly death toll among the homeless population from 2017 to 2023. When sorting by the cause of death, we find that drug toxicity stands out as the most prevalent cause of death during this period. From 2017 until the beginning of 2023, drug toxicity consistently accounted for the highest number of reported deaths among the homeless. In 2021, we see a notable peak in reported drug-related deaths, with 123 cases recorded. This spike underscores the severity of substance abuse issues within the homeless community during that year. Following drug toxicity as a leading cause of death, we find that unknown causes emerge as the second most common reason for mortality. The data shows that in 2023, there was a significant increase in reported deaths with unknown causes, reaching a peak of 51 cases. This rise in unknown causes of death raises questions about the accuracy and completeness of reporting or may indicate underlying health issues or circumstances that require further investigation. Overall, these insights highlight critical areas for intervention and support within homeless populations, particularly addressing substance abuse and improving data collection and reporting mechanisms to better understand and address mortality trends.



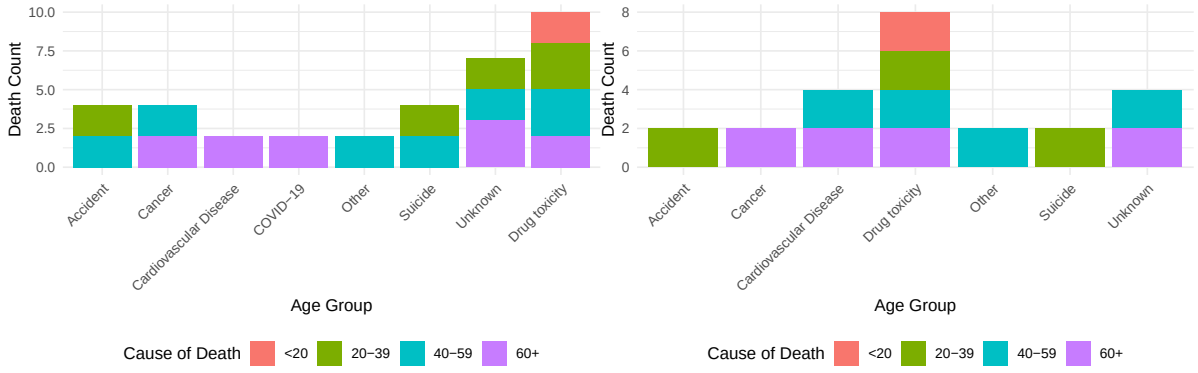
(a) Total Deaths by Age in 2017

(b) Total Deaths by Age in 2018



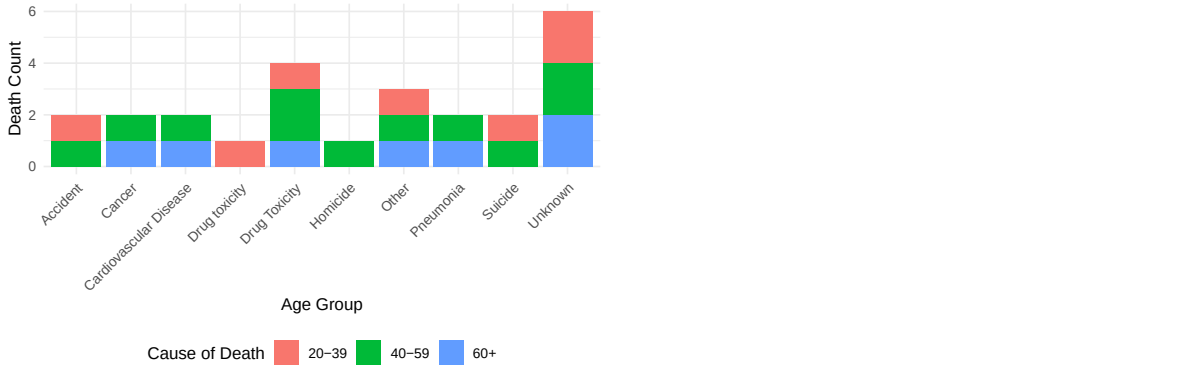
(c) Total Deaths by Age in 2019

(d) Total Deaths by Age in 2020



(e) Total Deaths by Age in 2021

(f) Total Deaths by Age in 2022



(g) Total Deaths by Age in 2023

Figure 3: Total deaths by age group from 2017-2023

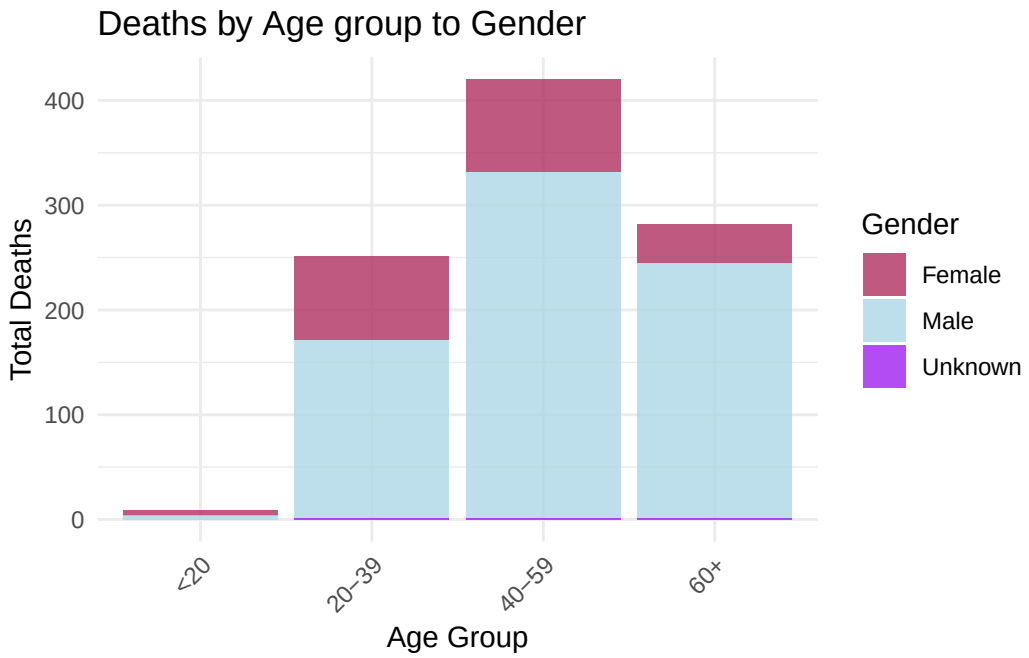
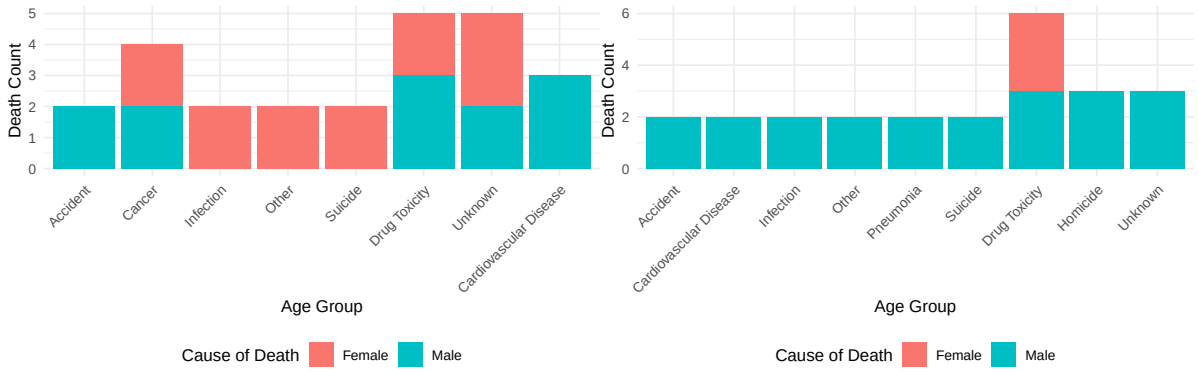


Figure 4: Looking at the death toll trends of age groups and gender

3.2 Age Groups and Cause of Death

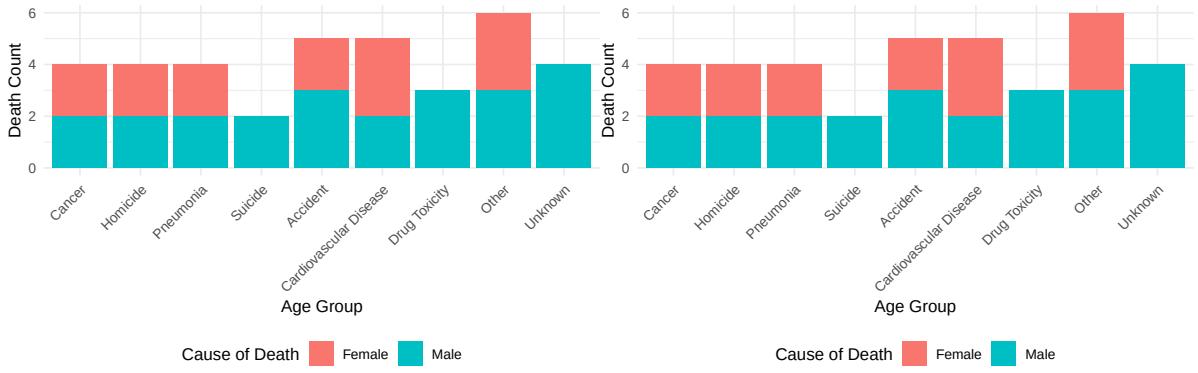
When analyzing the overall death trends over the years based on age groups Figure 2, a distinct pattern emerges, particularly regarding the age demographics of 20-39 and 40-59, which exhibit the highest death tolls. The primary cause attributed to these deaths is drug toxicity, indicating a significant challenge within these age brackets. Specifically, the 20-39 age group had a death toll of 137, while the 40-59 age group recorded a death toll of 143, highlighting the critical impact of substance abuse and related health risks in these younger to middle-aged homeless individuals. Moreover, projecting this trend forward, we observe that the second-highest cause of death among the 60+ age group is classified as unknown (Figure 2). This finding underscores the complexity of factors contributing to mortality in older homeless individuals, pointing to potential gaps in understanding and addressing the specific health issues or circumstances leading to these unknown causes of death.

When examining the figures provided in Figure 3, a clear picture emerges regarding the prevalent causes of death among various age demographics over the years. One notable trend is the consistent reporting of the highest death tolls among the 40-59 age demographic across different years. In particular, the data reveals that in 2019 Figure 3 (c), this age group experienced the highest number of deaths in seven out of the nine cause-of-death categories considered. This finding underscores the significant impact of mortality within the 40-59 age range and suggests a need for targeted interventions and health strategies to address the specific challenges faced by individuals in this demographic. Further analysis of these trends can offer



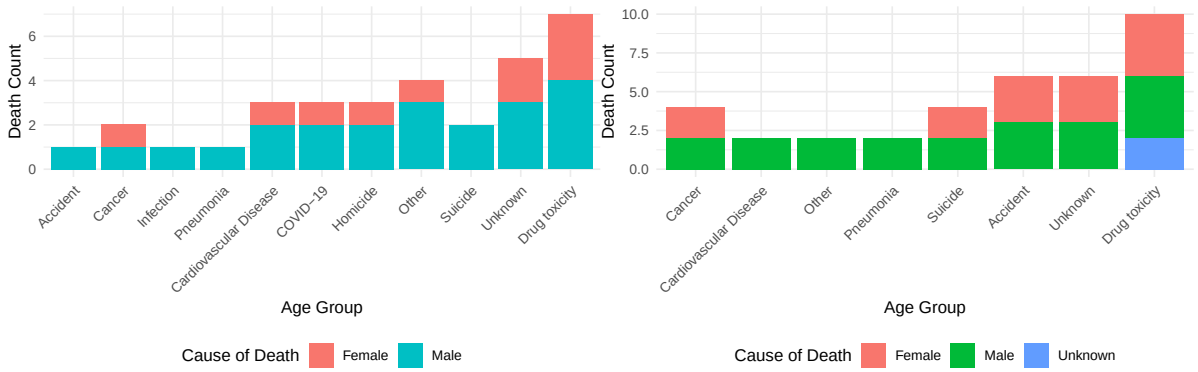
(a) Total Deaths by Gender in 2017

(b) Total Deaths by Gender in 2018



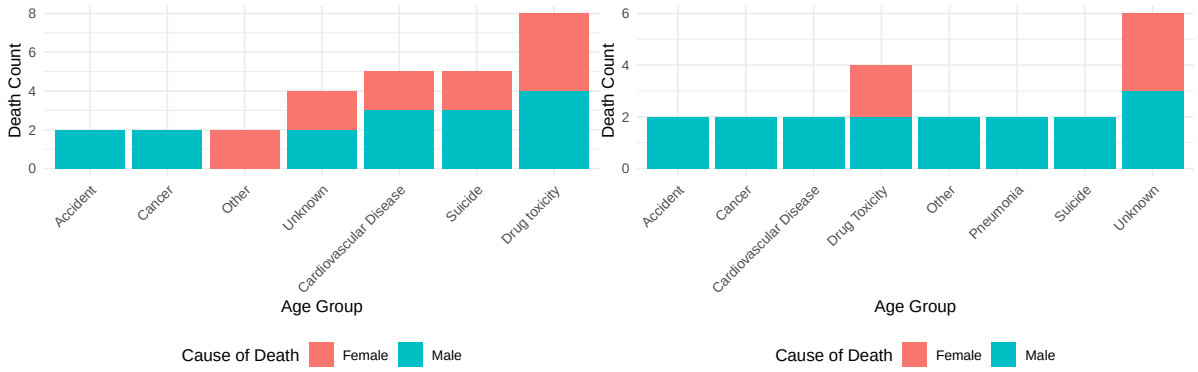
(c) Total Deaths by Gender in 2019

(d) Total Deaths by Gender in 2020



(e) Total Deaths by Gender in 2021

(f) Total Deaths by Gender in 2022



(g) Total Deaths by Gender in 2023

(h) Total Deaths by Gender in 2017

Figure 5: Total Deaths by Gender from 2017-2023

valuable insights into the dynamics of mortality rates among different age groups, guiding efforts to improve healthcare access, address underlying health issues, and enhance support systems for vulnerable populations, including those experiencing homelessness.

These insights prompt further exploration into the underlying factors driving mortality rates across different age groups within the homeless population, emphasizing the need for targeted interventions and support strategies tailored to address the diverse and evolving health challenges faced by individuals experiencing homelessness.

3.3 Gender and Cause of Death

In the gender distribution depicted in Figure 4, male victims are predominant across all age demographics. Specifically, the 20-39 age group recorded 170 reported male deaths compared to 80 reported female deaths, resulting in a male-to-female ratio of approximately 4:5 within this age demographic. Moving to the 40-59 age group, the data shows 331 male deaths and 88 female deaths, translating to a male-to-female death ratio of approximately 2:1. This indicates a higher proportion of male deaths relative to females within this age range. The most significant skew in gender distribution is observed in the 60+ age demographic, where there were 244 male deaths compared to 37 female deaths. This disparity yields a male-to-female death ratio of approximately 7:1, representing the highest skew among all the age demographics analyzed.

When analyzing the figures provided in Figure 5 from a gender perspective, a prominent pattern emerges highlighting the dominance of male deaths across various age demographics over the years. One striking trend is the consistent reporting of the highest death tolls among the 40-59 age demographic, primarily driven by male fatalities, which persist across different years. This emphasizes the substantial impact of mortality among males within the 40-59 age range, indicating the urgent need for targeted interventions and health strategies.

These results emphasize the urgent need for targeted interventions and health strategies, particularly in addressing substance abuse issues and understanding the gender-specific dynamics of mortality within the homeless population.

4 Discussion

This paper aims to delve into the relationship between gender and age within Toronto's homeless population with a specific focus on mortality rates and causes of death. The central hypothesis posits that male homelessness is significantly correlated with higher mortality rates across different age groups. The anticipation of elevated mortality rates among younger homeless males, especially those below 20 and between 20 to 39, stems from the recognition of harsh living conditions, limited healthcare accessibility, and increased vulnerability to external risks among this demographic.

4.1 Male-Female Cause of Death Trends

The analysis of gender-specific cause-of-death trends among Toronto's homeless population from 2017 to 2023 reveals notable patterns. Across various age groups, males consistently exhibit higher mortality rates compared to females. This trend is particularly pronounced in the 20-39 and 40-59 age brackets, where male deaths significantly outnumber female deaths. The data underscores the disproportionate impact of homelessness on male individuals within these age demographics. One possible explanation for this disparity could be the differential exposure to risk factors and vulnerabilities among male and female homeless individuals. Factors such as substance abuse, violence, and lack of access to adequate health care may contribute to higher mortality rates among males. Additionally, societal norms and systemic challenges may disproportionately affect males in terms of seeking and receiving support services. The reasoning behind such a high volume of men being reported as homeless is unclear and should be studied moving forward to understand how homelessness affects this demographic so harshly. Based on the results and findings, it can be assumed that most of these reported deaths among homeless individuals are due to episodic and chronic homelessness. Although that particular information is not provided, it should be a consideration for understanding how often the population flows fluctuate.

The findings highlight the importance of addressing gender-specific health disparities within homeless populations. Policymakers should make note and create targeted interventions focusing on addressing substance abuse, improving access to healthcare, and providing comprehensive support services tailored to the needs of male individuals. This in turn can play a crucial role in mitigating mortality rates and improving overall well-being to mitigate the growing homeless population.

4.2 Male Age-Specific Cause of Death Trends

The analysis of male age-specific cause of death trends within Toronto's homeless population from 2017 to 2023 reveals nuanced patterns that warrant discussion. Across different age brackets, certain causes of death emerge as prominent contributors to mortality rates among male homeless individuals. In all reported cases, drug toxicity takes the top spot, with an unknown cause of death ranking second. Although the exact nature of this cause is unknown, further studies should be conducted to dissect and identify the underlying issue.

In the younger age groups, particularly those below 20 and between 20 to 39, drug toxicity stands out as a leading cause of death. This finding aligns with broader trends indicating the prevalence of substance abuse issues among homeless individuals, especially among males in their early adulthood. The impact of harsh living conditions, limited healthcare accessibility, and heightened vulnerability to external risks likely exacerbates the risk of drug-related fatalities in these demographics. With easy access to unregulated drugs and substances, it's apparent that these deaths result from overdoses. Moving to the 40-59 age group, while drug toxicity remains a significant cause of death, other factors such as chronic health conditions and

external injuries also contribute substantially to mortality rates among males. The interplay of long-term health challenges, environmental hazards, and socioeconomic factors underscores the complexity of mortality risks faced by middle-aged male homeless individuals. In the 60+ age demographic, unknown causes of death emerge as a notable concern among male homeless individuals. This finding raises questions about the accuracy and completeness of reporting, as well as the potential presence of undiagnosed or untreated health conditions among older homeless males. The lack of visibility into the specific causes of death in this age group highlights a gap in understanding the health needs and challenges of elderly homeless individuals.

The main hypothesis of this study suggests a significant connection between male homelessness and mortality rates, focusing particularly on the 20-39 age group. Initial analysis affirmed a notable impact on male homeless individuals compared to females. However, the hypothesis fails to account for variations within gender and age subsets. For instance, younger homeless males aged 20-39 may face increased mortality risks due to substance abuse, whereas older homeless males may encounter different mortality patterns related to chronic health conditions and age-related vulnerabilities. To enhance future research, a more nuanced approach is required, considering factors like substance use patterns, healthcare accessibility, social support networks, and environmental exposures. Integrating these factors will lead to a more comprehensive understanding of mortality risks among homeless populations and inform targeted interventions.

5 Weaknesses & Next Steps

When considering weaknesses and potential biases in research on the correlation between gender and age within the homeless population in Toronto, several aspects should be addressed to understand what factors may have skewed the data projections during this paper's analysis. There was limited data available regarding age and gender breakdowns, and even with the available data, there were a few entries that were unknown for the age category. I opted to exclude those values to focus on the existing and available values within the dataset. This decision could have skewed the data and constrained the accuracy of the findings. As mentioned previously, there is an underlying stigma surrounding homelessness, which alone can influence individuals who are reluctant to disclose information, particularly those facing hidden homelessness. Lastly, within the gender values, there are three variables: male, female, and unknown. This unknown entry possibly refers to those individuals who have an LGBTQ+ identity and can overlook important nuances in the experiences of homeless individuals. Addressing these weaknesses and biases through rigorous study design, comprehensive data collection methods, ethical considerations, and thoughtful analysis can enhance the reliability and validity of research findings in this area."

Future studies in this area should aim to investigate the intersectionality of gender, race, ethnicity LGBTQ+ identity, disability status and mental illness to understand the long-term effects of homelessness within these demographics. Findings from this research can help understand

how policymakers and organizations can help alleviate the growing numbers of homelessness victims and pave the way for research methodologies and intervention strategies aimed at addressing homelessness in a broader sense. Another future study can be aimed at exploring the long-term impacts of homelessness on an individual's physical and mental health, as well as their ability to reintegrate into stable housing and employment situations whether they face chronic or episodic homelessness. Understanding the nuanced challenges faced by homeless individuals, including the effects on physical and mental health, reintegration into stable housing and employment, and the cyclical nature of homelessness, is essential for creating effective and sustainable solutions. By prioritizing research and intervention strategies that consider the multifaceted aspects of homelessness, we can work towards a more inclusive and supportive approach that fosters long-term stability and well-being for vulnerable populations.

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