

Navigating Toronto’s Homelessness Landscape: A Comprehensive Data Analysis of Trends, Compositional Shifts, and Projections for the City’s Homeless Population Dynamics (2018-2023)

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Against the backdrop of economic challenges and the ramifications of the pandemic, this analysis offers an intricate exploration of Toronto’s shelter system from 2018 to 2023. Unveiling nuanced shifts in the homeless population’s composition across single adults, families, genders, and age groups, the study scrutinizes population dynamics. It elucidates fluctuations in the actively homeless count and discerns patterns of return to homelessness. Notably, predictive modeling forecasts a concerning surge in homelessness, underscoring the urgency for proactive strategies. These findings illuminating the pressing need for expanded shelter infrastructure to meet the escalating challenges ahead.

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1 Introduction ¹

Undoubtedly, homeless individuals in Toronto have been facing serious challenges in accessing nighttime accommodation in recent years. As early as 2020, the general manager of the city's shelter, support, and housing administration openly stated that an average of 72 people were being turned away from shelters due to overcrowding every day, a number that only continued to rise. ¹ By the winter of 2022, this figure had surged to a staggering 168 people. ² For residents living in Toronto, this reality is starkly apparent - despite shelter occupancy rates exceeding 98%, a significant number of individuals still resort to sleeping on the streets or in parks, a reality witnessed firsthand by residents and students alike.

Despite significant efforts to address homelessness, there remains a notable gap in our understanding of the changing trend in the composition of the homeless community in Toronto. While the overall number of homeless individuals is documented, the specific demographic shifts within this population, such as variations in age groups and gender distribution, have not been comprehensively explored. Understanding these trends is essential for developing targeted interventions and resource allocation strategies to effectively address the diverse needs of the homeless population in Toronto.

To do this, we seek to conduct an in-depth analysis and study of Toronto's homeless population, aiming to understand the recent trends in this community, including changes in overall numbers and demographic composition. Leveraging data obtained from the Toronto Open Database, we aim to delve into the complexity and evolving trends of Toronto's homeless community. We analyze the status and demographic composition of Toronto's homeless population from 2018 to 2023, focusing on changes in status, such as the number of homeless individuals transitioning between housing and shelters, and long-term use of the shelter system, as well as demographic characteristics including gender, age, and identity.

To address this gap, we present a series of structured analyses of our findings. We begin by examining the annual counts of transitions of homeless individuals between housing, shelters, and other status within the Toronto shelter system from 2018 to 2023. Following this, we delve into the composition of homeless population groups and the trend of age distribution within the homeless population. Similarly, the trend of gender composition across different population groups in the homeless community was also analyzed. Finally, we present the predictions from our linear model for future trends in the number of homeless individuals in Toronto.

Our analysis reveals several key findings. Firstly, the linear model we built suggests a steady increase in the number of homeless individuals in Toronto, indicating the need for expansion of the shelter system to accommodate more people. Additionally, our examination of the data through various figures provides insights into the nuanced dynamics of homelessness in the city. These figures include trends in the annual counts of homeless individuals transitioning within the Toronto shelter system, trends in the composition of homeless population groups and age

¹Please check <https://github.com/kqlqkqlqF/Toronto-Shelter-System-Flow-between-2018-and-2023-with-Further-Predictions.git> for more information.

distribution, and trends in gender composition across different population groups within the shelter system.

Understanding the trends and dynamics of homelessness in Toronto is of paramount importance, given its implications for public policy and social welfare. By shedding light on the challenges faced by the homeless population and providing evidence-based insights, our study aims to inform and guide policymakers and stakeholders in their efforts to address homelessness in the city.

2 Data ²

The data for this analysis was collected from the shared Toronto Open Database (Shelter 2018-2023). This study utilizes and analyzes the dataset titled “About Toronto Shelter System Flow”. The dataset contains a wealth of information on the movement of homeless individuals in Toronto shelters from January 2018 to January 2024, including gender, age, quantity, and group affiliation (such as refugees). Additionally, the dataset provides information on the number of people leaving and entering shelters. It is released by the Toronto Shelter, Support, and Housing Administration, updated monthly, and has a high level of credibility. Moreover, the dataset has received full marks for freshness, metadata, accessibility, completeness, and usability on the Opendatatoronto website. Therefore, we consider the content of this dataset to be highly credible and utilize it as the primary data source for this paper. However, due to the limited data available for January 2024, we did not include this portion in the data analysis, as the smaller dataset size for 2024 may lead to unexpected analysis results.

Upon entering shelters, individuals utilizing shelter services are required to provide their name, age, gender, and group affiliation, which are recorded in the database. It is important to note that this dataset only records homeless individuals using overnight shelter services and does not include those utilizing other welfare policies, such as receiving free food or vaccinations. In the data, homeless individuals are divided into five age groups: under 16, 16 to 24, 25 to 44, 45 to 64, and over 65. Gender is categorized as male, female, and non-binary. Group affiliation includes chronic, refugees, families, youth, single adult, non-refugee, and indigenous. It is noteworthy that the indigenous group was only included in the statistics starting from January 2022, as the authors of the dataset stated their intention to collect more detailed data, hence adding the subdivision. Here, Chronic refers to homeless individuals who have continuously used shelter services for more than 180 days. Additionally, by dividing the specific group’s number of a given month by the total number of people using shelter services overnight, the dataset also records the percentage of each group in the overall population. Regarding the documentation of homeless transitions, the dataset provides six data points: new identified, return from housing, return to shelter, moved to housing, became inactive, and actively homeless. Newly Identified refers to people who entered the shelter system for the

²Rstudio (R Core Team 2022) was used for producing the code and this paper. A series of R packages were used: (Kassambara 2023). (Xie 2023), (Zhu 2021), (Firke 2023), and (Wickham et al. 2019).

first time; Returned from Permanent Housing refers to people who previously used the shelter system, then moved to permanent housing, and have now returned; Returned to Shelter refers to people who were previously using the shelter system, then did not use the system for 3 months or longer, and have now returned; Moved to Permanent Housing refers to people who were using the shelter system and have moved to permanent housing; Became Inactive refers to people who last accessed shelter services three months ago; Actively Homeless refers to people who have used shelter services at least one time in the past three months and have not moved to permanent housing.

Due to the clarity of the data itself, our data cleaning process primarily focused on converting the raw data dates into the yyyy-mm-dd format, without making extensive changes to the overall dataset. Following the completion of general data cleaning, we performed separate data cleaning for each chart to ensure code were organized and minimize the amount of code in the final QMD file. For the first chart, intended to reveal Trends in the Annual Counts of Homeless Individuals Transitioning within the Toronto Shelter System between 2018 and 2023, we retained only a portion of the data for the six transition status categories from monthly data and aggregated data within the same year for ease of subsequent chart generation. For the second chart, aimed at revealing Trends in Composition of Homeless Population Groups and Age Distribution within the Toronto Shelter System between 2018 and 2023, we removed all data except for age and group affiliation. Similarly, for the third chart, which aimed to reveal Trends in Gender Composition of Homeless Population Across Different Population Groups within the Toronto Shelter System between 2018 and 2023, we retained only gender and group affiliation data. The final linear model utilized the overall dataset after data cleaning, and no additional cleaning was performed. It is important to note that we excluded data from January 2024 in all chart data to avoid errors.

3 Result

Section 1 aimed to find the seasonal patterns of shelter occupancy rate, and the major age group occupied the shelter. To get this information, I eResultxtracted the dataset from the Opendatatoronto website and processed the data. First, I only preserved columns with date information and the number of people who moved into the shelter with their age groups recorded. The level of age group was categorized into 5 levels: under 16, between 16 and 24, between 25 and 44, between 45 and 64, and above 65. Second, to find the seasonal patterns, I summarized the number of people who moved into shelters each month and took the average to obtain a new data set with the month and respective average amount of people who moved into shelters in that month.

Using this cleaned data set, I produced (Figure 1) and (Figure 2) for visualizing the trend of people moving in shelters with the change of month.

Warning: Using `size` aesthetic for lines was deprecated in ggplot2 3.4.0.

Year	From Housing	To Shelter	Newly Identified	To Housing	Inactive	Actively
2018	776	6055	14442	8135	10420	110052
2019	873	6175	13124	8293	11037	117078
2020	891	5308	7617	6094	9302	99777
2021	989	5024	8297	3409	8690	99580
2022	940	4116	9795	4385	8738	117222
2023	688	3197	10183	5927	7507	125274

Figure 1: Number of Homeless Individuals Transitioning between Housing, Shelters, and Other Status Within the Toronto Shelter System between 2018 and 2023

i Please use ``linewidth`` instead.

In (Figure 1), the categories 1-5 present in legend were as follows: Under 16 (1), between 16 and 24 (2), between 25 and 44 (3), between 45 and 64 (4), and above 65(5).

According to (Figure 1) and (Figure 2), on the age group aspect, we can see that people age was between 25 and 44 occupied the most places in the shelter, while the age group between 45 and 64 is the second, and age group above 65 occupied the least. The age group under 16 and between 16 and 24 occupied the shelter with a very close amount, while the age group under 16 occupied a little bit more. On the season aspect, we can see that there’s no large fluctuation in shelter occupation rates throughout all months. There was a small increase in December, but the overall level remained stable.

In section 2, we focus on investigating the number of people moving in/out of the shelters. So, we did second round of data cleaning and visualizing. Similar to what we did in section 1, we removed all other columns and preserved columns containing information about the date, number of people returning from housing, return to shelters, and move to housing. We summarized the number of people who moved in/out of the shelter for each year and took the average to show the trend. “People return from housing” means that the person has stayed in the shelter before and was recorded as moved to permanent housing, now returned to the shelter from housing. “Return to shelters” was the class of people who stayed in the shelter before and hadn’t been using the shelter for at least 3 months, and returned to shelters. Finally, “move to house” indicates people used the shelter and registered as moving to permanent housing.

We constructed (**?@fig-tab-two**) to show the cleaned data, and also constructed three figures: (Figure 3), (Figure 4), and (**?@fig-fou**) for visualizing the number of people return from housing, return to shelters, and move to house each year respectively.

According to (Figure 3), we can see that the average amount of people returned to shelters from housing shows a decreasing trend from 2018 to 2023. In (Figure 4), similar to (Figure 3), the average number of people returning to shelter also shows a decreasing trend from the year

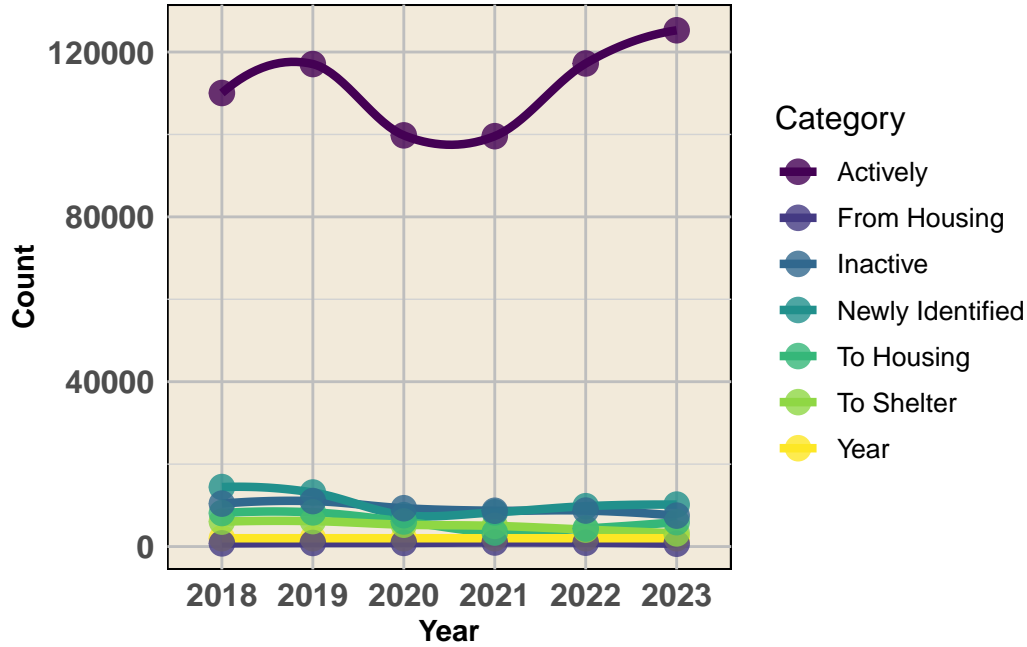


Figure 2: Trends in the Annual Counts of Homeless Individuals Transitioning within the Toronto Shelter System between 2018 and 2023

2018 to 2023. However, the trend in (Figure 3) goes up in the first 3 years and went down, while the data in (Figure 4) shows a more steadily decreasing trend. Combining the results we got from these two graphs, we can conclude that the overall number of people returned to shelter (including return from housing or other places) shows a decreasing trend from 2018 to 2023.

Moreover, (?@fig-fou) shows the trend of an average number of homeless moved out from shelters to permanent housing. Although the best-fit line was showing a decreasing trend, we can see that the actual trend was increasing from 2018 to 2019, and then significantly decreased between 2019 and 2021, and started to recover after that. However, although the average number of people moving to a house is increasing from 2021 to 2023, it is still much lower comparing the average value in 2018.

Summarizing the information provided by the data, we can conclude that the average number of people who returned to shelter or moved out to housing has shown a decreasing trend between 2018 and 2023.

In section 3, we aim to find the big picture of homeless population in Toronto. We are focusing on two columns mainly: the number of homeless who became inactive and actively homeless. A homeless becomes inactive if they haven't returned to the shelter for at least three months, and an actively homeless means they came to the shelter at least once per three months. These

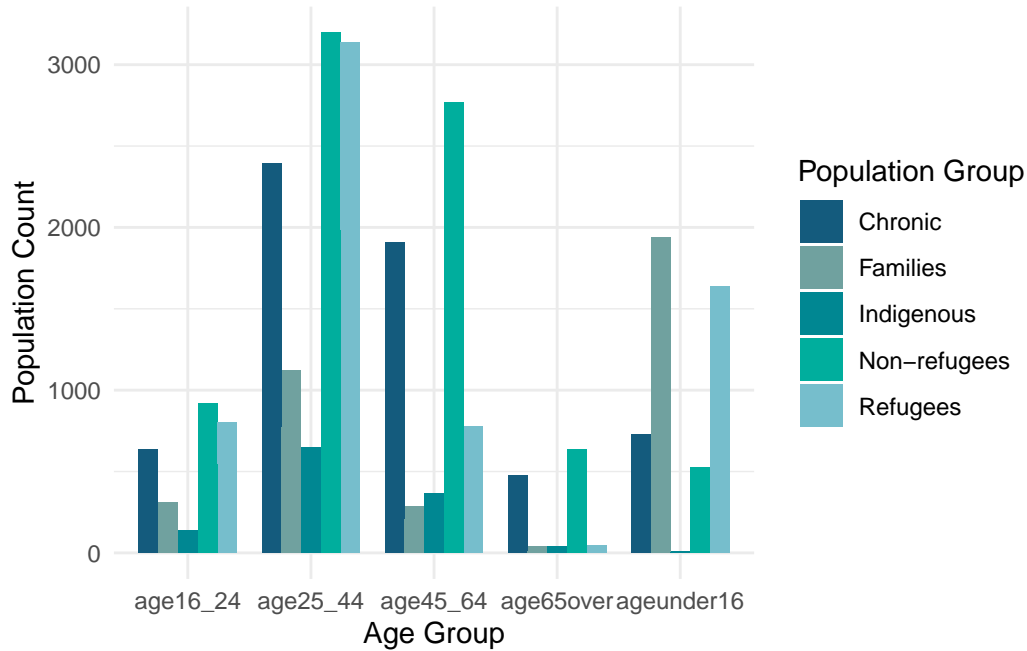


Figure 3: Trends in Composition of Homeless Population Groups and Age Distribution within the Toronto Shelter System between 2018 and 2023

two data indicate the overall flow of actively homeless communities in Toronto, while “became inactive” records how many homeless left the community, and “actively homeless” records the overall population size. To visualize these changes, and show the group composition in the homeless group, we created (?@fig-fiv) and (?@fig-six), where different groups of people were represented with different colors.

In (?@fig-fiv), we can see that the overall trend for the number of homeless who became inactivate has decreased between 2018 and 2023. However, the trend of some population groups did not follow the overall decreasing trend. The trend of several homeless people with chronic became inactivate has increased between 2018 and 2023, which means more and more chronic homeless people left the homeless community, while the other populations, including families, indigenous, non-refugees, single adults, and youth have shown a decreasing trend or remains relatively unchanged.

In (?@fig-six), the overall trend for the number of actively homeless increased between 2018 and 2023. Chronic, single adult, and refugee population groups contribute the most to the overall increasing trend, while indigenous and youth population groups were kept at a stable level. However, the family population group that was actively homeless became less between 2018 to 2023, which suggests there are fewer homeless families in the homeless community.

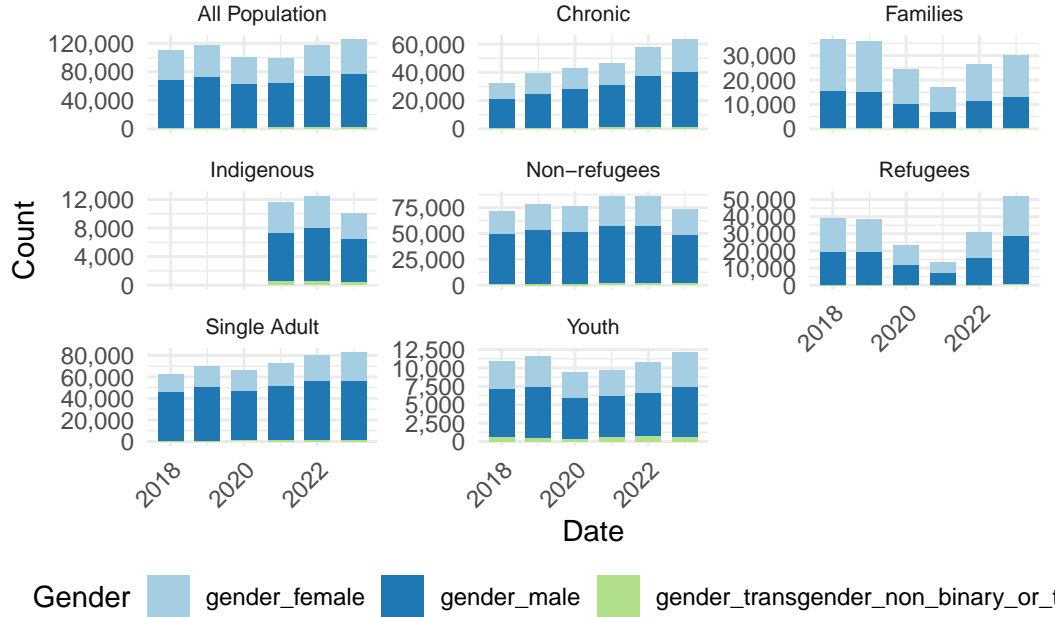


Figure 4: Trends in Gender Composition of Homeless Population Across Different Population Groups within the Toronto Shelter System between 2018 and 2023

4 Discussion

In the first section, we came up with the conclusion that there's no significant difference in the occupied rate of shelter in different seasons, and the main population of the homeless group consisted of people aged between 25 and 64, while people aged between 25 and 44 occupied the most. This conclusion seems reasonable since as we mentioned before, the occupancy rate of shelters in Toronto is already over 98% (Gilbert 2022), but there are still more than 9000 people who need to sleep outside. So, in a situation in which the shelters are full and cannot accept all of the homeless, the shelter will be fully occupied every day. As a result, the season and weather factors won't affect the occupancy rate of shelters largely.

In the second section, we found that the average number of people returning to shelters between 2018 and 2023 has decreased. Although the number of people returning to shelter decreased may suggest a good phenomenon, this also suggests a possibility that some of them died because of the pandemic so they cannot return. This idea came up with the result in the third section, in which we find that more people with chronic became inactive during these five years while all of the other population groups held a stable trend or decreasing trend. Considering people with chronic are more vulnerable to the COVID, we suspect that these results were caused by the death of chronically homeless people. However, this idea still needs more evidence to support it.

Also in the second section, we found that the number of homeless moved to housing has decreased between 2018 and 2023. This matched with the result shown in section three that the total amount of homeless became inactive decreased in the same period. Considering the result in section three also suggested that the total amount of homeless is rising, we can infer that things are getting worse because there are more new homeless people emerging, while fewer people are returning to housing. Most population groups have a similar trend with the overall homeless population, except for the chronic population mentioned before.

To sum up, these data demonstrated three facts: First, the homeless population was mainly composed of people aged between 25 and 44, and most of them were registered as non-refugees, single adults; Second: The weather and season did not affect the occupy rate of shelters; Third, the total population of homeless has increased between 2018 and 2023. This might be due to increasing house prices and the pandemic, but still a need for evidence to prove they are relevant.

4.1 Weaknesses and next steps

The weakness of this investigation mainly comes from the limitation of data. Firstly, shelter sites that do not use SMIS and that are funded by other levels of government are not included, meaning that it is not a comprehensive data set that includes all shelter data in Toronto. Second, this data reflects only people who have used an overnight service and does not include people using other homeless services. This potentially suggests that the homeless community is larger than the number shown in this dataset.

To investigate this question deeper, we can also look at the house pricing and COVID cases data between the same period, so that they can be matched up and compared with the data of shelter occupation. We shall also search for other datasets that contain the dataset for shelters not included in this dataset, and get a more comprehensive look at the homeless population in Toronto. Finally, we can compare the amount of shelters available and the size of the homeless population, to see how many homeless are still not able to stay in shelters. We believe these approaches could lead to a deeper understanding of the Toronto shelter system and homeless population.

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