The Impact on Toronto's Shelter Flow for 2020-21*

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Abstract

Shelter usage is an indication of the progress of Toronto's fight against homelessness, and will provide a benchmark for future observations. In this report, we acquire and best decribe a dataset with this information; ranging from January 2020 to December 2021, to provide a deeper understanding of the content. Through a series of numerical summaries and visualizations, we interpret the data and observe the various impacts; such as the Covid-19 pandemic, on the data set.

1 Introduction

Homelessness is one of the largest struggles that humanity continuously faces, with 30,000 people homeless on any given night in Canada (Gaetz, Donaldson, Richter and Gulliver 2013). While there are few counties that are actually improving their homelessness numbers, such as Helsinki and Finland, where, "the number of long term homeless people in Finland has fallen by more than 35%" (Henley 2019), they are unfortunately outliers in the grander scheme. In fact, there are no counties in the world rid of homelessness (Coimbra 2016)!

The most common combatants for this problem around the world are homeless shelters; locations where homeless can reside. These aren't solutions to the problem, however can be temporary fixes for many individuals. These shelters contain information about how any one city is battling homelessness, as it keeps records of people coming in and out. With enough data, one could provide accurate predictions and summaries of the flow in these shelter systems. Today, we explore a data set which includes this information on Toronto, for the years 2020-21. We will observe the various characteristics of the data, and attempt to analyze and interpret it in context. By doing so, we further understand the impact the homeless population has on the shelters, and be closer to ending the fight against homelessness in Toronto. As previously mentioned, this is not a solution, but for our purposes serves as a center of information; since we must truly understand the problem before we find a solution.

In these years; 2020 and 2021, the world went through one of the most difficult times in the last century; the Covid-19 pandemic. With governmental relief programs in action, there were significant upgrades made to the 24-hour shelter system (Nerad, Iman, Wolfson, and Islam 2021), which (one would think) would clearly impact the data collected. This will be tested in the report. Due to this, results in this report can only be similar to situations such as the pandemic, and cannot be completely generalized; i.e. cannot be accurately used to predict future data, given the pandemic ends. Therefore, this report will improve the understanding only in the extreme situation of a worldwide pandemic.

All of the data processing was performed using the R programming language (R Core Team 2021), with the common package used throughout the paper being **tidyverse** (Wickham et al. 2019). Figures are most commonly created with **ggplot2** (Wikham 2016) and tables with **knitr** (Xie 2021) and **kableExtra** (Zhu 2021).

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*Code and data are available at: https://github.com/RayhanWalia/paper1_folder

2 Data

The data was acquired via the City of Toronto Open Data portal, through the R package **opendatatoronto** (Gelfand 2020); which contains various datasets on multiple different subjects; surrounding Toronto. This report considers the Toronto Shelter System Flow data set (Shelter 2022), which is updated monthly; however our concern is simply surrounding the years 2020-2021, the data for which has already been acquired.

2.1 Collection

These shelter systems have all been funded by the City of Toronto, which include overnight services, programs such as converting hotels/motels to shelters, as well as emergency shelters built for the pandemic (Shelter 2022 and Nerad, Iman, Wolfson, and Islam 2021). All of these shelters use the Shelter Management Information System (SMIS), that keeps a record of all individuals accessing the programs, to be able to create datasets such as this one to then later analyze.

The obvious limitation to the collection process, is that it is only conducted via City of Toronto sponsored shelters, and does not encompass the entire homeless population. It is estimated that approximately 18% of people experiencing homelessness in Toronto are not captured in this data (Shelter 2022). Sites that do not use the SMIS system are also not included, further adding to the specificity of this dataset. This translates to a weaker overall analysis, with any *major* result presented containing bias (source bias). The goal is to expand the dataset into involving all homeless individuals, including ones not accounted by the City of Toronto, to be able to fully understand the homeless situation in Toronto.

2.2 Charactersistics

Before we explore the characteristics of the data set, we must clean the variable names, which is done with the assistance of the **janitor** package (Firke 2021).

The dataset contains information such as; the number of people coming in and leaving the shelters, unique individuals and common folk entering the shelters, and more, all broken down into 7 categories describing different population groups. A variable was created representing the total number of people in the shelter system in any given month, which was calculated via adding the number of people in each age group for each population group.[1] To simplify the understanding of the data, we add generalized variables[2] by combining columns; such as the ones describing the number of people that have returned to the shelter, and the ones with the number of people leaving the shelter.

A brief overview[3] of the data can be observed in Table 1.

Table 1: January 2020 data for all population groups entering (Returned and Unique) and leaving (Moved) the Toronto shelter system, with actively homeless (Active) and the total number of residents in the system (Total)

Group	Returned	Unique	Active	Moved	Total
All Population	551	901	9916	1412	9916
Chronic	59	412	3471	358	3469
Refugees	40	407	2941	499	2941
Families	25	345	2706	455	2706
Youth	54	103	987	123	987
Single Adult	472	453	6223	834	6219
Non-refugees	511	494	6975	913	6975

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[1]Note, that the population groups are not independent, i.e. there could be a refugee family

[2]so it can encompass a larger range of people; all of whom have returned to the shelter, and all whom have left

[3]including only relevant (describing inflow, outflow, and residents) columns of the data

An interesting observation that can be made is the number of actively homeless people is similar (in some groups; exactly equal) to the total number of residents in the shelter. This conveys that roughly a similar number of people enter and leave the system each month; assuming this month (January) is a good representation for the data[4]. Via summarizing data for the entirety of the collection, this will be tested in the report.

2.2.1 Total Population

To further dive into the contents of this data, we first observe how the total population of each group changed across homeless shelters over time. As mentioned previously, this variable is attained via adding the various age groups for each population group. The trend can be observed in Figure 1.
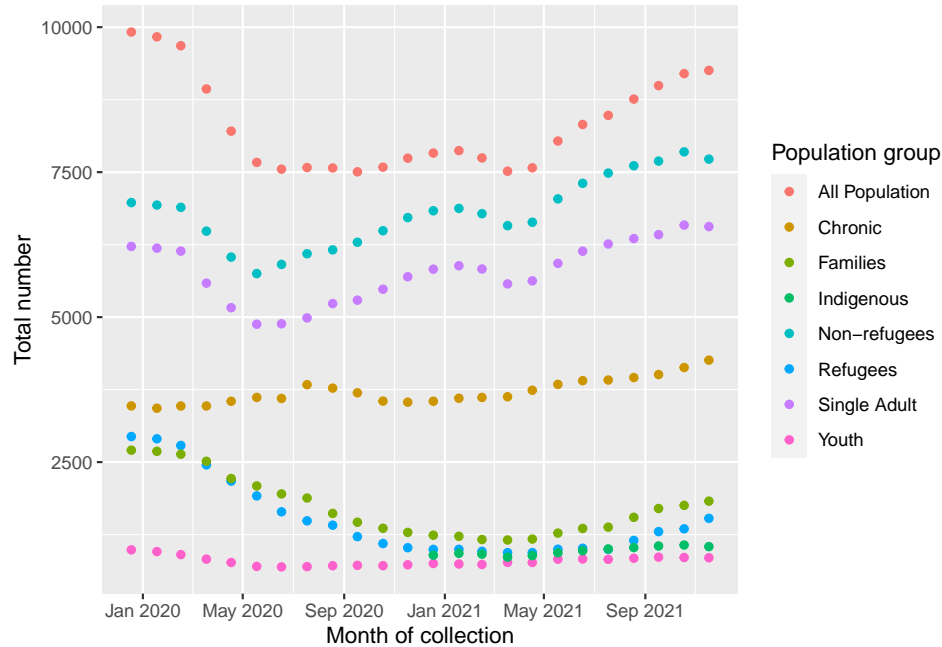

Figure 1: Trend of total shelter population for each group

It can be be observed that homelessness in most population groups drop quite significantly at the start, until they continue rising shortly after. The reason for this is attributed to the Covid-19 pandemic, where, "hundreds of people fled the city's shelters… due to fears of contracting the novel coronavirus" (Press 2021). We dive deeper into this fact in Figure 2. Families and refugees are two population groups that remained consistently low after the drop at the start, which might point to these groups not willing to risk going back to shelters in fear of catching the virus. Whether it is safer in a shelter where there's a possibility of catching a deadly virus, or on the streets; is a question that every homeless individual had to face. We also observe that during the winter months; around January in the figure above, the population slightly spikes. This can be attributed to the creation of various emergency shelters (Shelter 2022 and Nerad, Iman, Wolfson, and Islam 2021) and the presence of the cold, which drive the population back indoors.

Another observation that can be made in this figure is the consistent increase of chronic homeless population in shelters, while other populations dwindle. This can also be attested to the Covid-19 pandemic; seeing as the only people that had the opportunity to leave the shelters were 'non-chronic' (every group except chronic), while chronic patients most probably had no choice but to stay, due to their condition.

To test the pandemic's effect on the data, we can observe the bar-plot of individuals entering and leaving the shelter system each month. If there wasn't much of an effect, any change should be attributed to the actively homeless (unless there was a specific reform in order during period of collection). However, if a change in

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[4]knowing that the pandemic would begin in another 3 months, this might not be true

'flow' is observed, i.e. varying rates of people entering and leaving the system, then the pandemic would have had an influence on the data. This can be seen in Figure 2.

Figure 2: Number of people entering (blue) and leaving (red) the shelter system in Toronto

We notice an interesting quality of this plot, where the number of people exiting the system stayed the same; what significantly dropped were the number of people entering the shelters. This can now be directly related to the pandemic, due to fewer people wanting to use the shelter systems during the pandemic (Press 2020 and Press 2021). We can now definitely state the pandemic influenced our data.

Due to this, we can state that January is not the best estimate for our data; and cannot be used to make generalized conclusions like we did with Table 1. Instead, month-to-month information is the most reliable, due to the pandemic making the whole two years of collection inconsistent within itself.

We can continue to explore the total population, via witnessing the distribution of genders in the Toronto shelter system. This can be observed in Figure 3.

Here we can see a significant male population in the shelters, nearly double that of female, with the average male population as 5220 and average female population 2959 people. We can also observe a rising population of transgender, non binary, or two spirit, which might be attributed to more inclusion within shelters (Kayn et. al 2020).

It was found that on average males represent 62.8% of residents in homeless shelters, with females representing 35.6%, and the remaining 1.6% representing transgender, non-binary or two spirit individuals.

2.2.2 Age Groups

Diving deeper into our data set, we can explore the various age groups in the shelters for these two years, and observe their relative trend. This is an important metric for policy makers, to help the group that needs it the most. Figure 4 shows this trend.

This figure conveys some useful information; that during the drop in shelter population due to the virus, all except the over 65 age group dropped in population. This might be due to older people not being able to leave shelters as readily as the younger population.

We can also observe the under 16 homeless population in shelters dropped the most significantly out of all
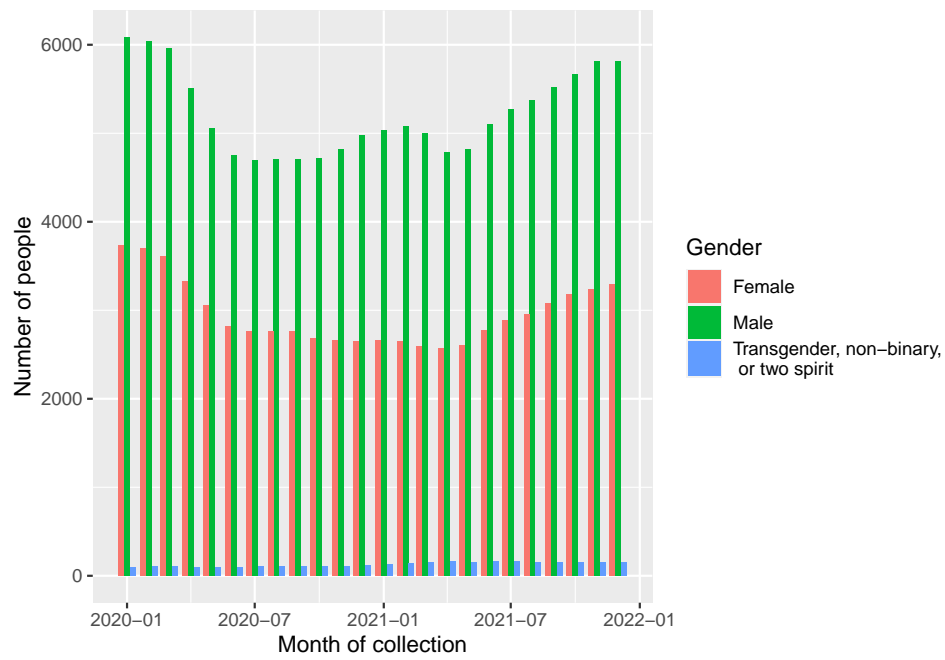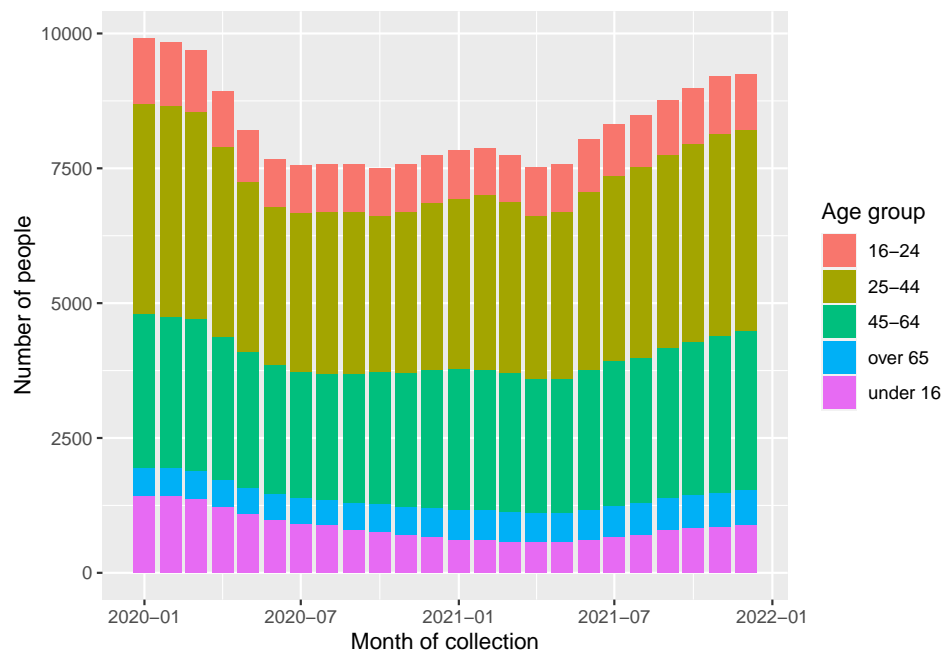
Figure 3: Shelter population over time, by gender

Figure 4: Shelter population by age-group

groups, and did not rise as much as the others as the pandemic started to calm down. This can also be confirmed by observing the 'Youth' group in Figure 1.

We further explore these groups, via a box plot of the various age groups, to quantify the overall change in population throughout the two years. This can be seen in Figure 5
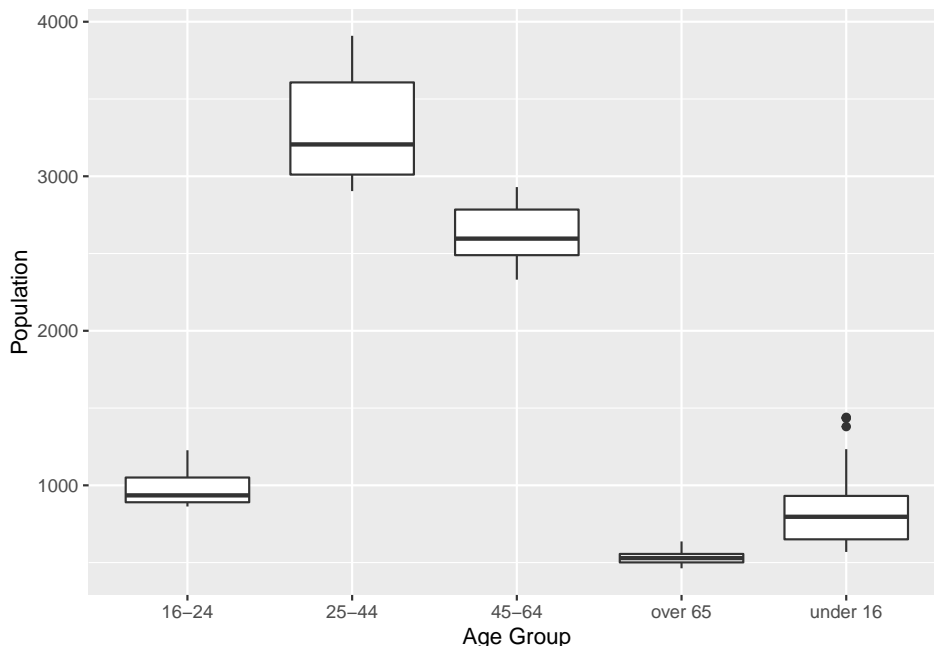

Figure 5: Boxplot showing range (inter-quartile range) of population for various age groups

Here, we can observe the age group with the largest range being 25-44, and the smallest; over 65. This is similar to the observations made in Figure 4, however provide a more quantitative measure. We can now make further sense of this, which is due to the disparity in the number of people in each population group. The low number of older (over 65) population; with the pandemic and therefore more susceptible to health complications, would have not been able to easily leave shelters. Those that were never in a shelter, thought it would be too risky to go to one due to their age, where individuals such as Robert Boast were, "more frightened of coronavirus than dying from stage four cancer" (Black Art 2020). This is evident in the plot above. The size of the boxes in the figure above (the IQR) represent the median 50% of the data, with the line representing the median. The distance of this line from the true 'middle' of the box tells us the skewness of the resulting data, with the age groups ranging from 16-64 all positively skewed. This tells us a higher concentration of the data lies at lower population numbers. The under-16 and over-65 category have relatively symmetric plots, indicating similar mean and median values.

3   Discussion

With all the data provided here, the hope was to be able to find the impact on the homeless shelters during these two years. The major impact being the virus, dictated how the shelter population behaved. Numbers started coming back to shelters as soon as the first wave ended. Here, we learn the difference between homeless population, and homeless shelter population. The individuals that left the system during the pandemic felt more secure in tents than they did in the shelters (Press 2020), however that did not mean they were no longer homeless (which we would interpret from the data). As of now, all we can summarize are the government controlled shelters, not the homeless population itself.

For future uses, we must aim to collect data from all shelters, and all homeless population. With food, health, emergency reforms in place, tracking of this data could be set up. The SMIS would have to be distributed

to all shelters, as well as distribution centers. With all individuals tracked, we can better understand and therefore combat homelessness in Toronto.

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