

Assignment 1

Introduction

Toronto's shelter system is an important component of the city's social safety net as it provides temporary housing to individuals and families that experience homelessness. However, recent trends have shown an increase in the demand for these services, leading to a pressing need for data-driven insights to inform policy and resource allocations. To better understand shelter utilization and inform strategic decision-making, this report examines a dataset titled "INF2178_A1_data.xlsx," which tracks the daily occupancy and capacity of Toronto's shelters throughout the year 2021.

The dataset offers a comprehensive look at different shelter organizations, their program models, and demographic profiles, providing an opportunity to analyze the dynamics of shelter use. This analysis is driven by five key research questions (RQs), each examining a different aspect of shelter capacity and utilization:

RQ1. How do occupancy rates vary by the type of shelter capacity?

RQ2: What is the impact of seasonal changes on shelter occupancy rates?

RQ3: Are there disparities in service utilization across different demographic sectors?

RQ4: How do occupancy rates differ among various shelter program models?

RQ5: What are the relationships between service user counts and occupancy rates?

Research Question 1: Shelter Capacity Utilization

The initial phase of the analysis focused on determining the distribution of shelter capacity utilization and identifying which types of shelters frequently operate over capacity. Using Python's data analysis libraries, the study cleaned the data and calculated occupancy rates for both bed-

based and room-based capacities. A t-test was conducted to compare these two capacity types, revealing a nuanced landscape of shelter use. As seen in Table 1, The average occupancy rate for bed-based capacity stood at approximately 92.79%, while room-based capacity had a slightly higher average occupancy rate of 93.41%. As seen in Table 2, a Welch's t-test confirmed a statistically significant difference between the two, with a p-value of approximately 6.86e-06, suggesting that room-based shelters were, on average, more utilized than bed-based ones.

The findings suggest that room-based shelters, potentially offering more privacy or accommodating families better, are preferred. This preference could lead to capacity strains, particularly in room-based shelters, and inform policymakers where to focus capacity expansion efforts. By pinpointing these distinctions, resources can be directed to alleviate the most pressing shelter demands and improve the overall efficacy of the shelter system.

Table 1. Table for capacity type and occupancy rate

| Capacity Type | Occupancy Rate |
|---------------------|----------------|
| Bed Based Capacity | 0.927885 |
| Room Based Capacity | 0.934087 |

Table 2. Welch's t-test results for shelter capacity utilization

| T-Statistic | P-value |
|--------------------|-------------------------|
| -4.498751771925636 | 0.000006860477551487939 |

RQ2: Seasonal Effects on Occupancy Rates

Seasonal changes were hypothesized to influence shelter occupancy rates, with expectations of higher rates during colder months. The analysis added a 'MONTH' column to the data, allowing for the grouping of data by month and the calculation of average occupancy rates. Figure 1 revealed lower occupancy during the summer months (May to July) and peaks in late fall and early winter (November and December). This fluctuation implies that the shelter system faces its highest pressure during the colder months, likely due to the harsh Canadian winters. Such insights can inform seasonal strategic planning, suggesting the need for increased winter resources and possibly more temporary shelters or emergency measures during peak periods. Ensuring that shelter services are responsive to these seasonal trends can help prevent the

overburdening of services during critical times and reduce the risk of individuals being without shelter in extreme weather.

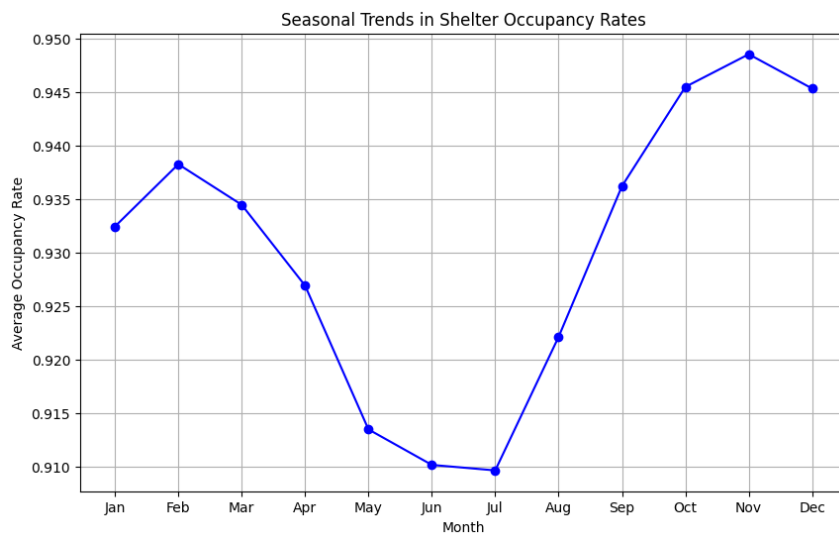


Figure 1. Line graph of seasonal trends of shelter occupancy rates

RQ3: Disparities in Service Utilization

The third question sought to uncover whether significant disparities exist in service utilization between shelters serving different demographic sectors. By grouping the data by 'SECTOR' and calculating the average occupancy rate for each and as seen in Figure 2, it was found that shelters for men had the highest average occupancy rate at 96.64%, while youth shelters had the lowest at 89.78%. This indicates a greater strain on shelters catering to men, which could be a result of several factors, including economic conditions, availability of support networks, or social services geared toward other demographics. Shelters for youth, while still highly utilized, showed relatively lower occupancy rates, suggesting that either the needs of this group are being met more effectively or that there are barriers to access. These disparities necessitate a deeper investigation into demographic-specific needs and could lead to the development of targeted interventions to ensure equitable access and support across all sectors of the homeless population.

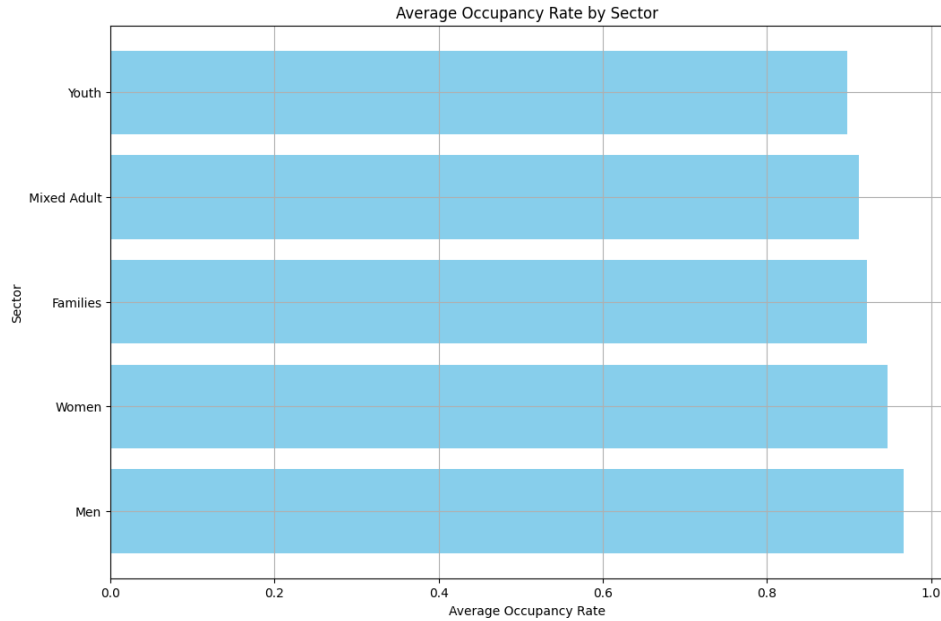


Figure 2. Bar plot of average occupancy rate by sector

RQ4: Program Model Preferences

Differences in occupancy rates between emergency and transitional shelter program models were examined to understand user preferences or needs. As displayed in Table 3, the analysis revealed a stark contrast: emergency shelters exhibited significantly higher occupancy rates than transitional shelters, with a p-value effectively at 0.0 according to Welch's t-test. This finding, as supported by Figure 3, suggests a higher demand for immediate, emergency shelter services, highlighting areas where the shelter system faces the most pressure and where policy interventions may be most needed.

Table 3. Welch's t-test results for average occupancy rate by program model

| T-Statistic | P-value |
|--------------------|---------|
| 40.981115372199206 | 0.0 |

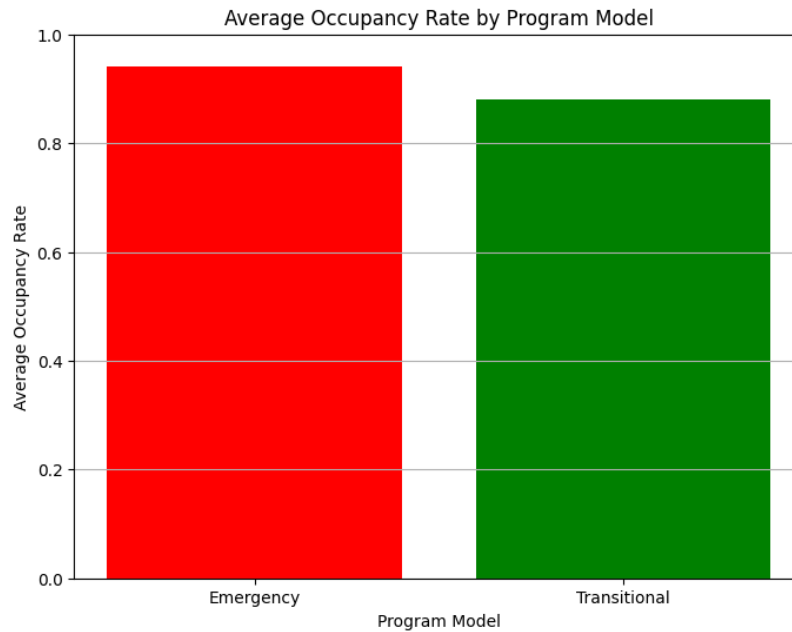


Figure 3. Bar plot for average occupancy by program model

RQ5: Service User Count and Occupancy Rates

Lastly, the relationship between service user count and occupancy rates was scrutinized. Shelters were categorized based on high and low service user counts, with a median split defining the categories. As seen in Table 1, the Welch's t-test showed a significant difference between the two groups, indicating that shelters with higher service user counts tended to have higher occupancy rates. As seen in Figure 4, a scatter plot visually represented this relationship, showing a broad dispersion and suggesting a complex interaction with other potential influencing factors. This finding is significant for understanding operational strains and can inform decisions on resource distribution to ensure that high-demand shelters are well-supported and can continue to operate effectively without compromising the quality of service.

Table 4. Welch's t-test results for service user count and occupancy rate

| T-Statistic | P-value |
|-------------------|---------|
| 51.72977423583775 | 0.0 |

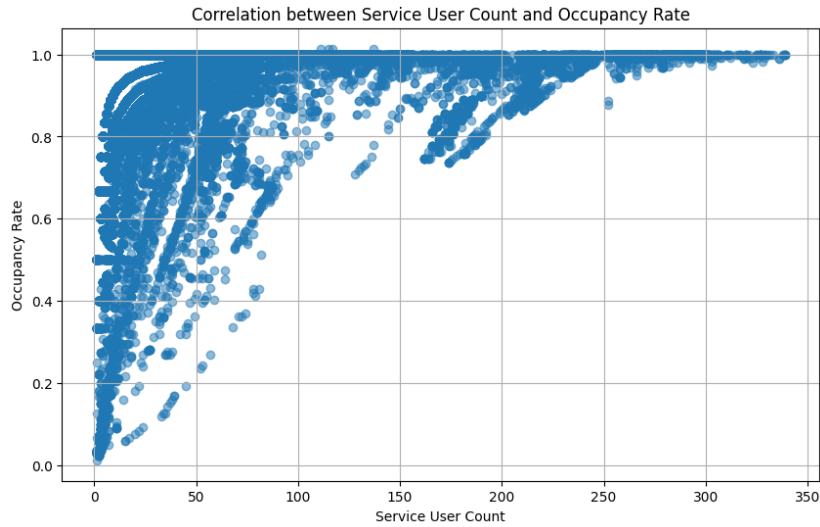


Figure 4. Scatter plot for correlation between service user count and occupancy rate

Conclusion

This analysis of Toronto's shelter occupancy trends has highlighted critical insights into the operations of the city's shelter system. With nearly full utilization across shelter capacities, significant seasonal impacts on demand, disparities in service utilization among demographic sectors, and a clear preference for emergency shelter services, the findings of this report are useful for policymakers and service providers. The data-driven approach offers a deeper understanding of shelter dynamics, paving the way for informed decision-making and strategic planning to enhance the efficacy and responsiveness of Toronto's shelter system.