Assignment 1

I preprocessed the shelter usage trend dataset for my analysis. For this dataset, I initially retained variables such as OCCUPANCY_DATE, SECTOR, PROGRAM_MODEL, SERVICE_USER_COUNT, CAPACITY_ACTUAL_BED, OCCUPIED_BEDS, CAPACITY_ACTUAL_ROOM, and OCCUPIED_ROOMS. I separated the data for beds and rooms and calculated their respective shelter occupancy rates, which were added to their respective tables. I selected these variables primarily because of my research question, which focuses on shelter usage trends, and these variables seemed to be key factors.

	OCCUPANCY_DATE	SECTOR	PROGRAM_MODEL	SERVICE_USER_COUNT	CAPACITY_ACTUAL_BED	OCCUPIED_BEDS	shelter_program_occupancy_rate
5	2021-01-01	Mixed Adult	Emergency	6	8.0	6.0	0.750000
10	2021-01-01	Men	Emergency	22	24.0	22.0	0.916667
11	2021-01-01	Men	Emergency	8	12.0	8.0	0.666667
21	2021-01-01	Men	Transitional	10	12.0	10.0	0.833333
25	2021-01-01	Families	Emergency	11	12.0	11.0	0.916667

	OCCUPANCY_DATE	SECTOR	PROGRAM_MODEL	SERVICE_USER_COUNT	CAPACITY_ACTUAL_ROOM	OCCUPIED_ROOMS	shelter_program_occupancy_rate
0	2021-01-01	Families	Emergency	74	29.0	26.0	0.896552
1	2021-01-01	Mixed Adult	Emergency	3	3.0	3.0	1.000000
2	2021-01-01	Men	Emergency	24	28.0	23.0	0.821429
3	2021-01-01	Mixed Adult	Emergency	25	17.0	17.0	1.000000
4	2021-01-01	Women	Emergency	13	14.0	13.0	0.928571

Research Question 1: Accommodation Type Variations

"How do occupancy rates and preference differ between bed-based and room-based accommodations within Toronto's shelter system, and Whether time is an important factor affecting occupancy rates"

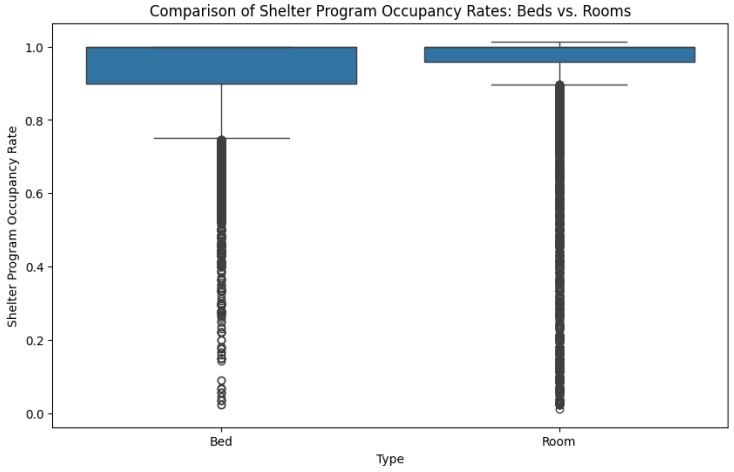
Focus for Analysis:

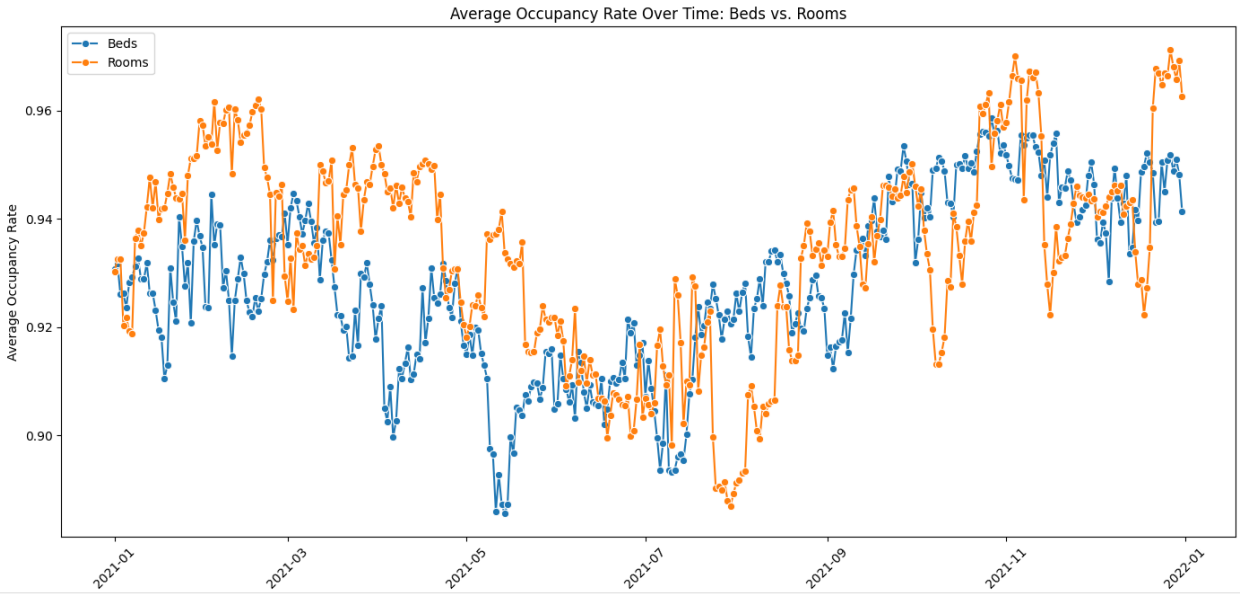
Compare the occupancy rates between beds and rooms to identify clear preferences or demands.

Plot the occupancy gap of bed and room between different months and their respective trends based on time

Result:

	Beds	Rooms
count	32399.000000	18545.000000
mean	0.927885	0.934087
std	0.122562	0.163241
min	0.022727	0.012048
25%	0.900000	0.958333
50%	1.000000	1.000000
75%	1.000000	1.000000
max	1.000000	1.014085
IQR	0.100000	0.041667
Standard Deviation	0.122562	0.163241





Discussion:

From the table and box plots above, we can clearly see that both beds and rooms have nearly the same occupancy rates. This suggests that most people do not differentiate between these factors. Surprisingly, even at the lowest point, the lowest occupancy rate is only around 2%. This raised some questions, leading me to create a line chart based on time. From the chart, I observed a relatively lower occupancy rate trend emerging after May each year. This could be attributed to the warming weather, as some individuals might choose not to stay in rooms during this period.

Research Question 2: Sector-Specific Occupancy Patterns

"What are the occupancy patterns across different sectors (e.g., Adult Men, Adult Women, Youth, Family) within the shelter system, and how do these patterns reflect the unique needs and challenges of each sector?"

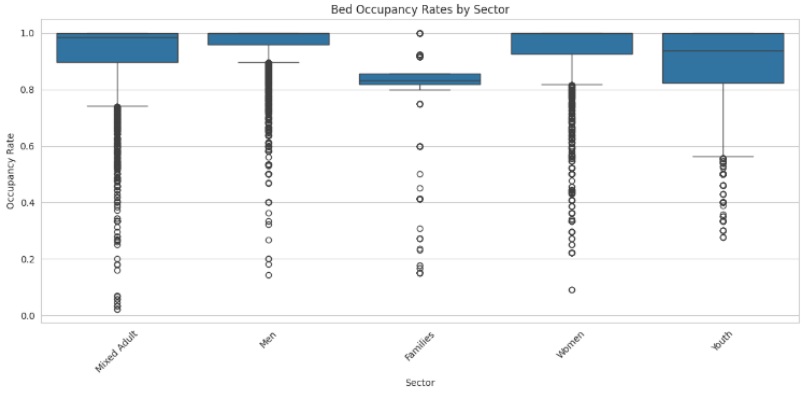
Focus for Analysis:

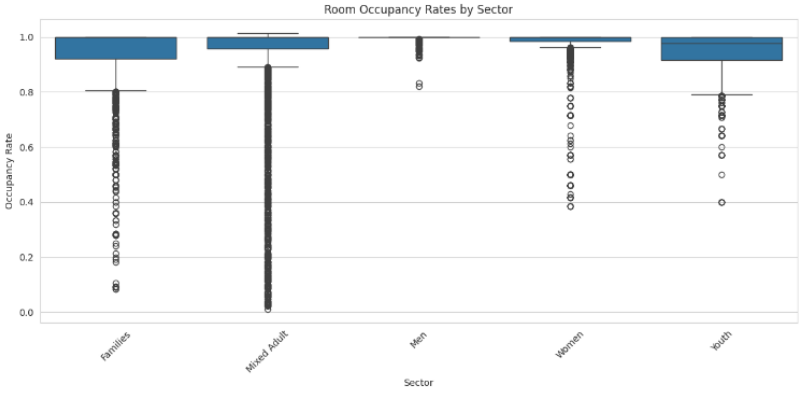
Analyze occupancy rates by sector to identify which sectors face higher demand or potential resource shortages.

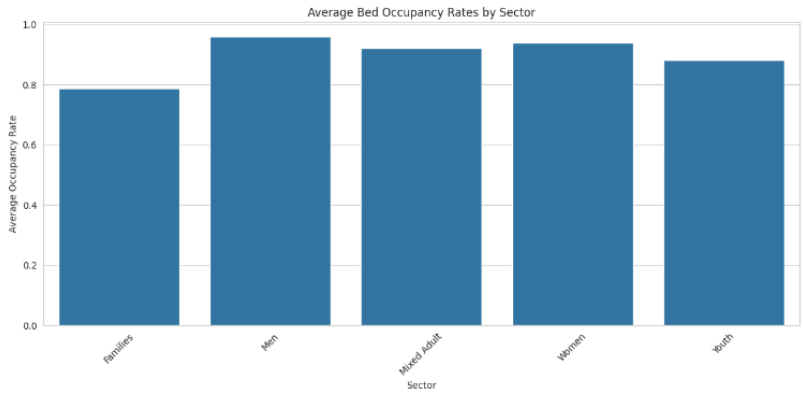
Explore demographic, social, and economic factors contributing to sector-specific occupancy trends.

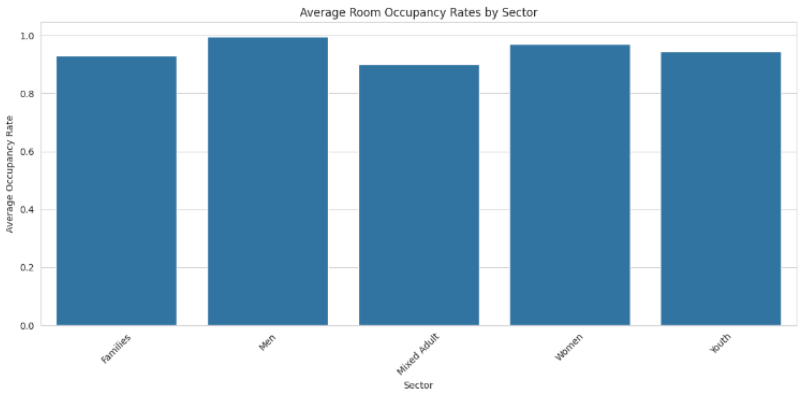
Evaluate how well the current shelter capacities and program models are meeting the distinct needs of each sector.

Result:









Discussion:

From the box plots and bar chart above, we can conclude that the occupancy rates of most sectors are not significantly affected by the type of accommodation. The only exception is 'Families,' which shows a notable difference in occupancy rates between bed-based and room-based accommodation. From the charts, it can be observed that the average occupancy rate for families in bed-based accommodation is just below 80%, while in room-based accommodation, the average occupancy rate exceeds 90%. I speculate that this is likely due to larger family sizes and the need for a certain level of privacy, leading to this phenomenon.

Research Question 3: Impact of Program Models

"How do different program models (e.g., Emergency, Transitional) affect shelter occupancy rates, and what does this reveal about the effectiveness and utilization of these models in addressing homelessness in Toronto?"

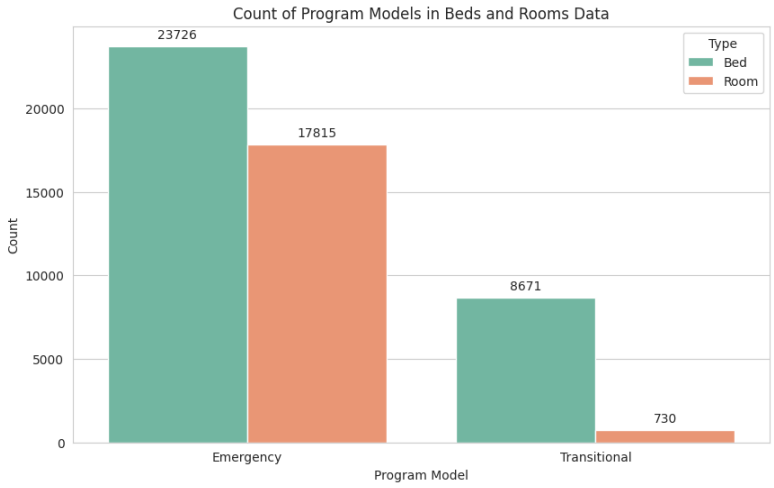
Focus for Analysis:

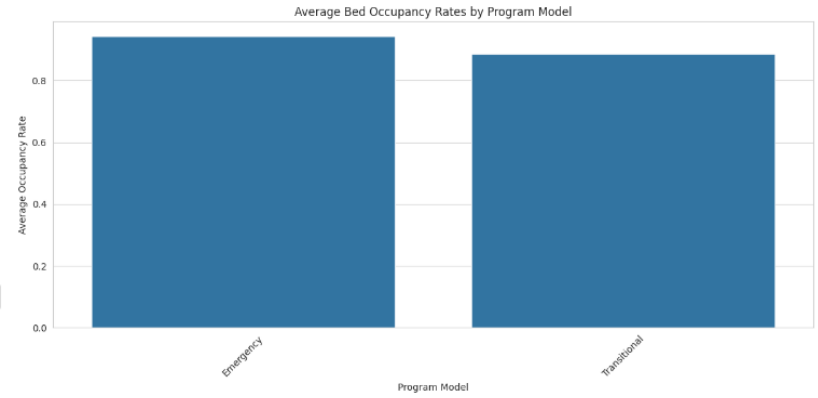
Compare occupancy rates across program models to assess their utilization and demand.

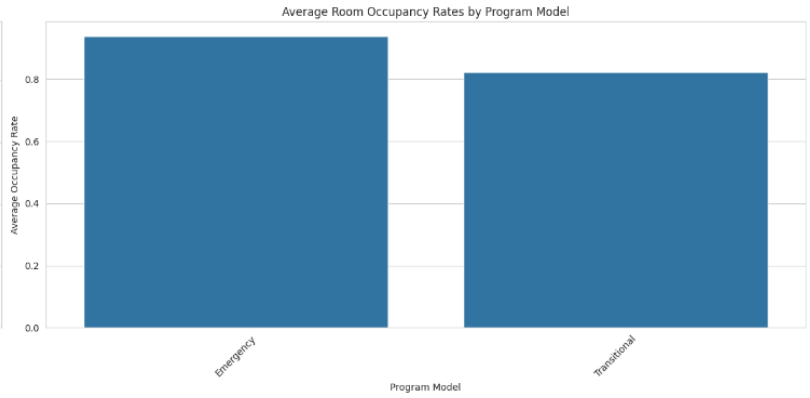
Examine the alignment of program models with the needs of their target populations, considering factors like duration of stay, support services, and exit outcomes.

Identify program models that are either underutilized or overstretched, suggesting areas for policy adjustment or resource reallocation.

Result:




Average Bed Occupancy Rates by Program Model
Average Occupancy Rate
0.0
0.2
0.4
0.6
0.8
Emergency
Transitional
Program Model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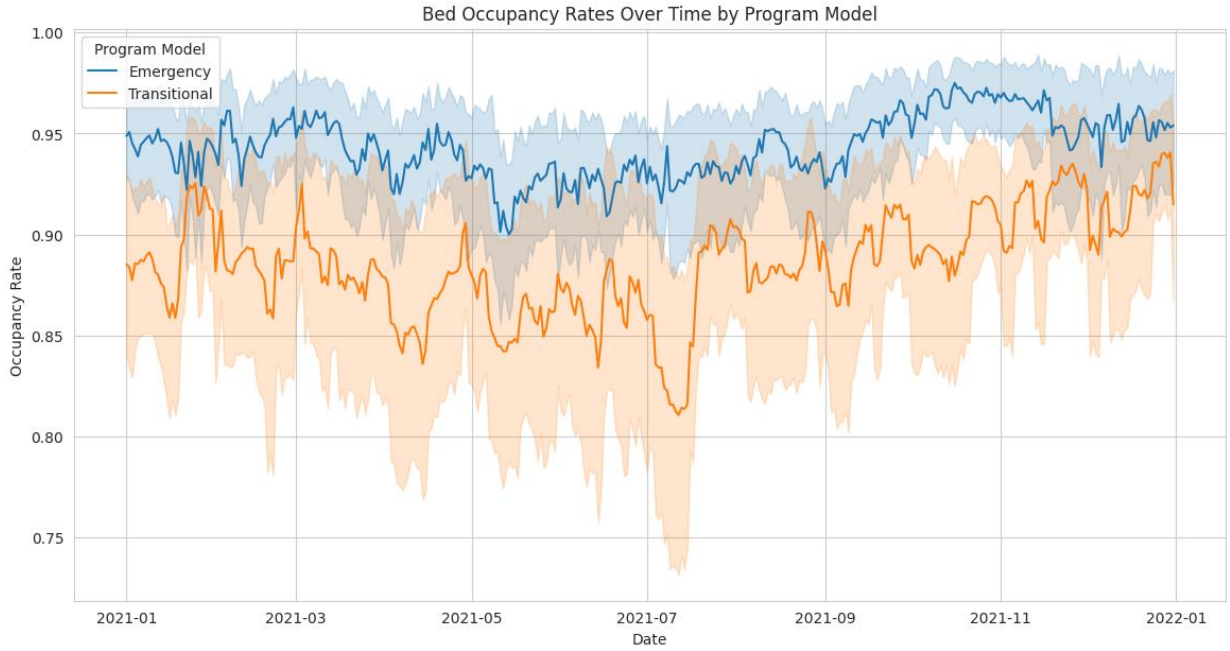
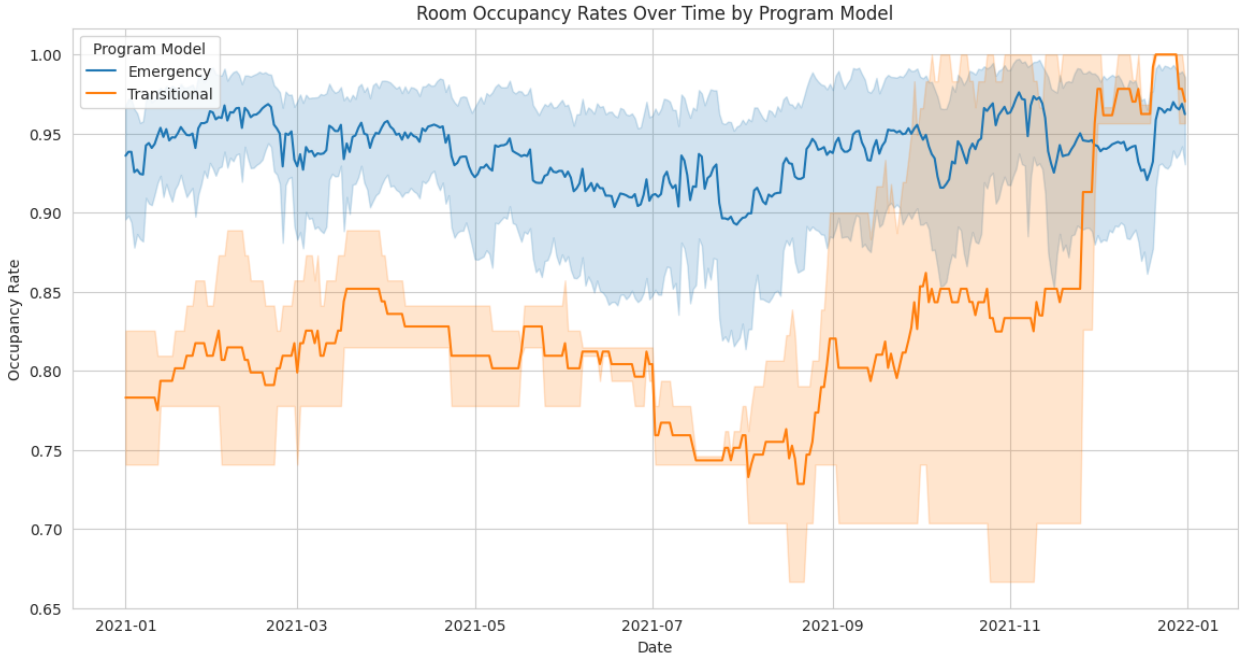

Bed Occupancy Rates Over Time by Program Model
Program Model
Emergency
Transitional
Occupancy Rate
1.00
0.95
0.90
0.85
0.80
0.75
2021-01
2021-03
2021-05
2021-07
2021-09
2021-11
2022-01
Date


Room Occupancy Rates Over Time by Program Model
Program Model
Emergency
Transitional
Occupancy Rate
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
2021-01
2021-03
2021-05
2021-07
2021-09
2021-11
2022-01
Date

Discussion:

From the first conclusion chart, it is evident that Emergency has a significant lead in both bed-based and room-based accommodation. The second chart clearly shows that even in terms of occupancy rate, Emergency remains ahead. It is challenging to discern trends from the bar chart. Therefore, the third and fourth charts vividly depict the monthly occupancy rate variations of Emergency and Transitional in both bed-based and room-based conditions. Emergency generally maintains an occupancy rate of around 95%. In contrast, Transitional exhibits more significant fluctuations, especially in the case of room-based accommodation, where the average rate is only around 80%.

T-test Analysis:

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Beds - Emergency vs. Transitional: T-Stat=38.780694714817365, P-Value=0.0
Rooms - Emergency vs. Transitional: T-Stat=18.903262158430557, P-Value=5.923255977527666e-79

Beds - Families vs. Mixed Adult: T-Stat=-18.955403427960587, P-Value=1.1881374444989306e-78

Beds - Men vs. Women: T-Stat=13.720, P-Value=0.000

Rooms - Men vs. Women: T-Stat=13.215, P-Value=0.000
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Summary of Findings:

Emergency vs. Transitional: There's a clear demand for Emergency shelters, as evidenced by higher occupancy rates compared to Transitional shelters. This suggests a need for robust Emergency shelter services and possibly a reevaluation of Transitional shelter capacity and accessibility.

Families vs. Mixed Adult: The lower occupancy rates in Family sectors might indicate potential barriers to access or underutilization, highlighting a need for targeted interventions to support families experiencing homelessness.

Men vs. Women: The higher occupancy rates in shelters for Men may reflect broader societal issues and underscore the importance of addressing gender-specific needs within the shelter system.

Further Analysis Recommendations:

Qualitative Research: Conduct interviews or focus groups with shelter users and staff to understand the qualitative aspects behind these quantitative findings, such as perceived barriers, service needs, and program effectiveness.