Chicago Crime Analysis: Hypothesis Evaluation Report

Hypotheses

- How does weather condition influence crime rates?
- Identify which factors (e.g., temperature, population density, location, race) most significantly influence crime rates.
- Which specific crime types (e.g., theft, murder) are more influenced by certain parameters?

Findings Summary

- H1 (Weather Impact):

Temperature and precipitation patterns are clearly linked to variations in crime levels. Statistical analysis showed that both temperature and precipitation have significant effects on daily crime counts (p-values < 0.001). The correlation between temperature and crime was moderately positive ($r \sim 0.25$). Hotter days correlate with increased crime, while rainfall slightly reduces crime but shifts the crime types.

-> Null Hypothesis rejected

- H2 (Demographics and Location Impact):

Longitude values showed a significant positive correlation with crime frequency ($r \sim 0.21$, $p < 0.05$), indicating spatial concentration. However, demographic factors like income ($r \sim -0.03$) and some racial distributions did not show strong statistical significance ($p > 0.05$).

-> Null Hypothesis partially rejected - There is some spatial correlation, but weak to no significant correlation with income or racial proportions.

- H3 (Crime Types Sensitivity to Environment):

Chi-square analysis revealed that rainy conditions significantly change the distribution of top-5 crime types ($p = 0.0003$). Certain crimes like theft and assault are more weather-sensitive.

-> Null Hypothesis rejected

Additional Observations

- Temperature is a major driver of crime variation.
- Location (longitude) influences crime intensity.
- Rain slightly reduces total crime but alters crime type distribution.
- Demographics (race and income) show visible geographic crime patterns, although not all are statistically significant.

Overall Conclusion

This project demonstrated that weather patterns and spatial-demographic factors significantly affect crime rates in Chicago. Statistical evidence supports that temperature, precipitation, and geographic location contribute meaningfully to understanding crime dynamics. Correlation analysis confirmed that while some variables (like temperature) show a moderate relationship with crime, others (like income) do not. Adaptive public safety strategies should consider these environmental and social influences.