PROJECT REPORT

This project investigates how street-lighting conditions may influence patterns of nighttime sexual assault in Jefferson County, Kentucky. Using 311 service-request data, sexual assault incident reports, GIS spatial mapping, and correlation and regression analyses, the study examines whether streetlight outages or inadequate illumination correspond with increased risk of sexual assault particularly among women. The project contributes to Louisville Metro's broader public health and safety goals by illuminating how environmental infrastructure may shape community vulnerability, equity, and wellbeing.

PURPOSE AND OBJECTIVES

The primary purpose of this project was to assess whether neighborhoods experiencing frequent street-light outages or insufficient nighttime lighting also exhibited higher percentages of sexual assault incidents. The data-driven objectives included:

• Identifying spatial and statistical patterns linking lighting conditions to nighttime sexual assault occurrences.

• Highlighting districts with high burdens of lighting-related service requests.

• Evaluating correlation and regression outputs to assess whether lighting conditions contribute to increased risk.

• Supporting evidence-based public health and urban-safety recommendations that promote gender equity and infrastructure fairness.

METHODS AND PROCESS

1. Data Collection

Data sources included 311 streetlight request data, sexual-assault incident reports from the Office for Women, and sunrise/sunset times from the U.S. Naval Observatory to isolate nighttime events.

2. Data Preprocessing

Data cleaning addressed duplicates and missing values; geocoding converted coordinates to district codes; datasets were integrated through spatial joins and nighttime filters.

3. Exploratory Data Analysis

Visualizations such as line graphs, bar charts, heatmaps, and scatterplots revealed variation in outage frequency and sexual-assault trends across districts and months.

4. Spatial Data Analysis

GIS mapping identified hotspot locations where streetlight outages and sexual-assault incidents overlapped, especially in historically underserved neighborhoods.

5. Statistical Analysis

Correlation tests showed a modest but significant association between outage frequency and nighttime assault percentages (current month $r = 0.211$, $p = 0.046$). Robust regression models further supported environmental influences on sexual-assault risk.

PROJECT RESULTS

Analysis shows that streetlight outages are unevenly distributed across districts, with Districts 5, 8, and 4 experiencing the highest outage burdens. Most outage requests (85.4%) remain open, indicating maintenance delays that may exacerbate safety concerns.

Nighttime sexual-assault victims were predominantly female (95.4%), and demographic patterns showed concentration among adults aged 18–45. GIS maps revealed clustering of incidents in areas also reporting high volumes of lighting outages.

Combined trend analysis showed that some months with elevated outage activity corresponded with increases in nighttime assaults. Spatial overlap and statistical results together suggest that inadequate lighting may contribute to environmental risk for sexual assaults during nighttime.

CONCLUSION

Findings indicate a meaningful relationship between poor street lighting and nighttime sexual-assault patterns in Jefferson County. While correlation does not prove causation, the evidence highlights the importance of equitable infrastructure investment, timely maintenance response, and environmental design strategies to improve public safety.