A SPATIAL ANALYSIS OF VIOLENT CRIME IN SAN ANTONIO

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GEOGRAPHY 596A
DECEMBER 13, 2021
OUTLINE

- Introduction & Background
- Goals & Objectives
- Data & Methodology
- Anticipated Results
- Next Steps
- References
Inherent geographical quality
- Occurs somewhere in space & time

Human geographers & social scientists have studied the spatial aspects of crime for decades

Theory of Social Disorganization

Vector of transmission for crime (Matthews; Sparks)

Determinants of violent crime
- Social & Physical Built Environment

- San Antonio ever changing city in terms of geography & population located within Bexar County in South Central Texas
- Area: 500 square miles (36 square miles in 1930's)
- Population: 1.5 million
  - 7th most populous city in the United States
  - 2nd largest in Texas
  - Ranks among fastest-growing metro areas
- Poverty: 17.8% of the population (US Census Bureau)
- Diverse City with a young population (City of San Antonio Office of Equity)
CRIME IN SAN ANTONIO

- City of San Antonio Public Safety
  - 63.3% of the general fund budget (City of San Antonio)

- San Antonio Police Department
  - Crime Prevention & Community Policing initiatives
  - San Antonio Fear Free Environment (SAFFE)

- Violent Crime Rate (per 100,000 of the population)
  - 806.4 – San Antonio
  - 446.5 – Texas
  - 398.6 – United States
GOALS & OBJECTIVES

- Examine the spatial patterns of the built environment and the determinants of violent crime utilizing Geographic Information Systems and spatial analysis.
- Detect spatial concentrations of violent crime incidents over time.
  
  - Where did violent crimes occur in San Antonio?
  - What is the spatial distribution of the different violent crime types?
  - What are the factors that influence sexual assault violent crimes in the neighborhoods of San Antonio?
DATA & METHODOLOGY

- Violent Crime Data
  - 154,000+ Incidents
  - Homicide, Rape, Robbery, & Aggravated Assault
  - Point Data also aggregated to Census Tracts and ZIP codes

- Time Period
  - 2017 to 2021*
  - What impact did the pandemic have on crime?

  *Data incomplete for 2021

Source: SAPD
DATA & METHODOLOGY CONTINUED

Base Data
- Census Tracts
- Violent Crimes reported to San Antonio Police Department

Socioeconomic Characteristics
- Poverty
- Race/Ethnicity
- Employment Status
- Educational Attainment

Built Environment Variables
- Housing Occupancy
- Alcohol availability
- Highways
- Parks/Greenways
## DATA SOURCES

<table>
<thead>
<tr>
<th>Layer Name</th>
<th>Description</th>
<th>Year</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Census Tracts</td>
<td>Geographic unit of analysis</td>
<td>2010</td>
<td>US Census Bureau/Esri Living Atlas</td>
</tr>
<tr>
<td>Zip Codes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Violent Crime</td>
<td>Point data aggregated to the census tracts</td>
<td>2017 - 2021</td>
<td>SAPD/Southwest Texas Fusion Center</td>
</tr>
<tr>
<td>Poverty Status</td>
<td>Percentage of the population whose income falls below the Federal poverty line</td>
<td>2015 - 2019</td>
<td>American Community Survey (ACS)/Esri Living Atlas</td>
</tr>
<tr>
<td>Unemployment Rate</td>
<td>Unemployment rate (%)</td>
<td>2021</td>
<td>Esri Demographics/Esri Living Atlas</td>
</tr>
<tr>
<td>Education</td>
<td>Percentage of adults (25+) who were not high school graduates</td>
<td>2015 - 2019</td>
<td>American Community Survey (ACS)/Esri Living Atlas</td>
</tr>
<tr>
<td>Housing Occupancy</td>
<td>Percent of housing units that are vacant, owner, &amp; renter occupied</td>
<td>2015 - 2019</td>
<td>American Community Survey (ACS)/Esri Living Atlas</td>
</tr>
<tr>
<td>Bars</td>
<td>List of license &amp; permits. Geocode addresses &amp; spatially joined to the census tracts. Number of bars/per 1,000 people</td>
<td>2021</td>
<td>Texas Alcoholic Beverage Commission (TABC Public Inquiry)</td>
</tr>
<tr>
<td>Highways</td>
<td>Major state and interstate highways</td>
<td>2021</td>
<td>City of San Antonio GIS</td>
</tr>
<tr>
<td>Parks/Greenways</td>
<td>Parks, natural areas, green space maintained by the San Antonio Parks &amp; Recreation Department</td>
<td>2021</td>
<td>City of San Antonio GIS</td>
</tr>
</tbody>
</table>
GEOGRAPHIC UNIT OF ANALYSIS: CENSUS TRACTS

- Census Tracts
  - Small, statistical subdivisions of a county
  - 366 tracts in Bexar County; 349 within city limits
- The relationship between alcohol availability & violence best studied at a small level of analysis (Zhu)
- Accepted as an appropriate measure in the criminal justice community
- Note, historic cities such as Boston & Chicago have long established neighborhood boundaries (Varano)
SOFTWARE

- Esri ArcGIS Pro
  - Combine data from various sources & formats
  - Geoprocessing
  - Aggregate data to the census tracts/ZIP codes
  - Create maps to visualize results

- GeoDa
  - For exploratory spatial data analysis

- CrimeStat
  - A statistics program for the spatial and temporal analysis of crime
**ANALYSIS & METHODS**

**Visualization & Statistics**

- Apply visualization and statistical methods to bring insights to the crime patterns

- Descriptive Statistics
  - Bar charts
  - Box plots

**Spatial Statistics**

- Point Pattern Analysis
  - Display concentration of violent crimes & visualize the hot and cold spots

- The Local Indicators of Spatial Association, or LISA, method identifies the localized map regions where data values are strongly positive or negatively associated with one another

- Explore advanced methods such as Geographic Weighted Regression

Data from SAPD
The ACS data layers are based on 5-year estimates.

Some census tracts have a population of zero and will be excluded from the study.

Violent Crime data only includes incidents reported to the San Antonio Police Department and does not include incidents reported to other law enforcement agencies outside the city limits and not within SAPD’s jurisdiction.

Violent Crime is not always reported, especially sexual assault.

The effects of aggregation on spatial patterns, or the Modifiable Areal Unit Problem (MAUP): Census Tracts or ZIP codes?
ANTICIPATED RESULTS

**SPATIAL**
- The built environment variables, specifically the proximity of alcohol-selling establishments, are significant predictors of violent crime.
- Crime events cluster in low income and racially/ethnically diverse neighborhoods (Zhang).

**TEMPORAL**
- The impact of the CoVID-19 pandemic
  - Elevated Crime Rates
  - Leverage the time/date stamp within the data to explore violent crime events before, during, and after the Emergency Declaration Enforcement
  - March 18, 2020 – March 10, 2021
NEXT STEPS

**January – February 2022**
- Data Collection & Processing

**March 2022**
- Analysis & Interpreting results

**April – May 2022**
- Writing & finalizing presentation
REFERENCES


THANK YOU

QUESTIONS?

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