

A SPATIAL ANALYSIS OF VIOLENT CRIME IN SAN ANTONIO

HOLLY GOLIGHTLY
ADVISOR – STEPHEN MATTHEWS

GEOGRAPHY 596A
DECEMBER 13, 2021



OUTLINE

- Introduction & Background
- Goals & Objectives
- Data & Methodology
- Anticipated Results
- Next Steps
- References



Photo credit: SAPD

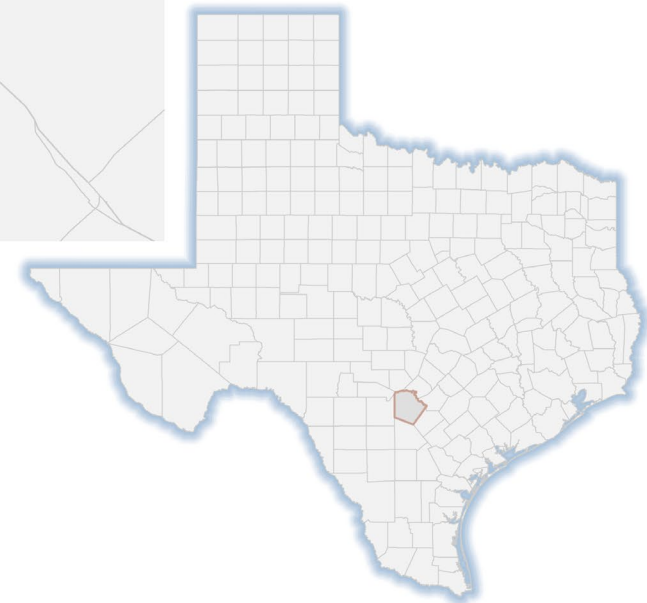
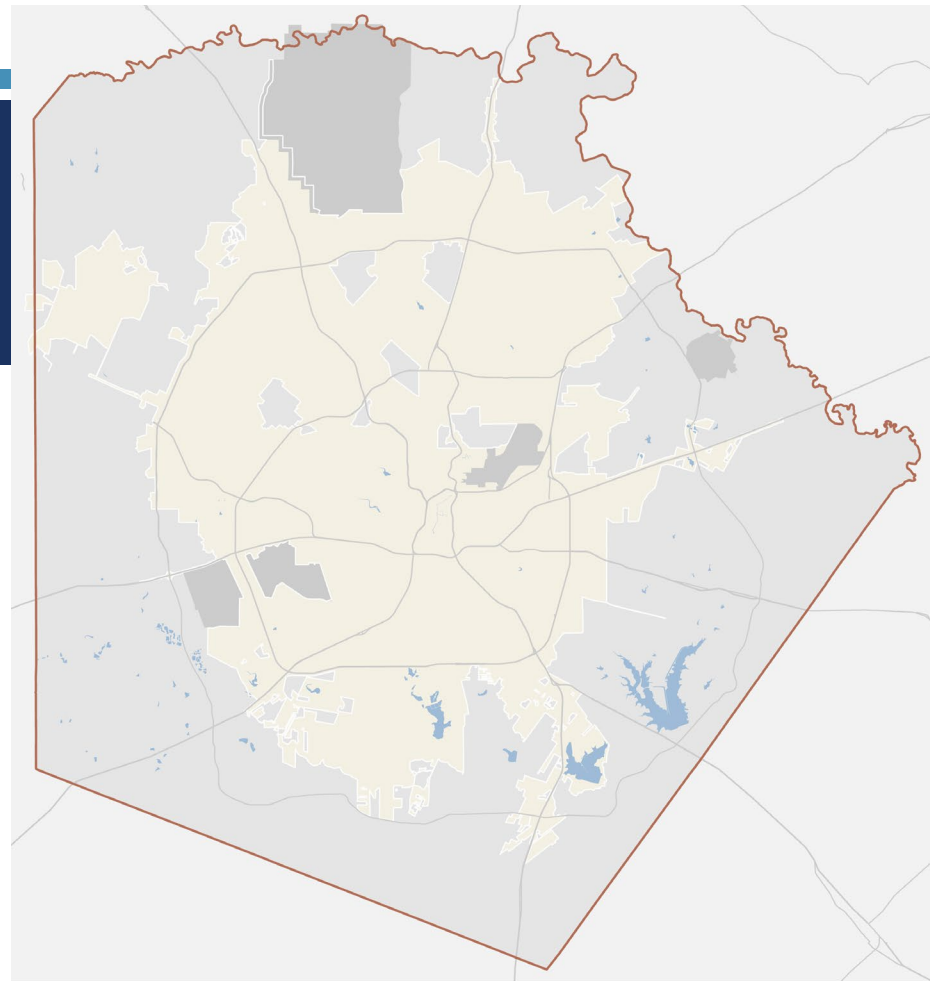
BACKGROUND: GEOGRAPHY OF CRIME

- 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



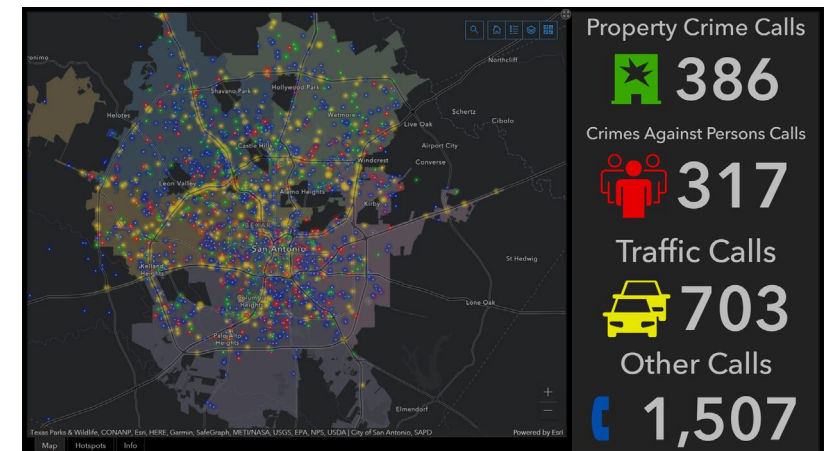
SAN ANTONIO

- 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

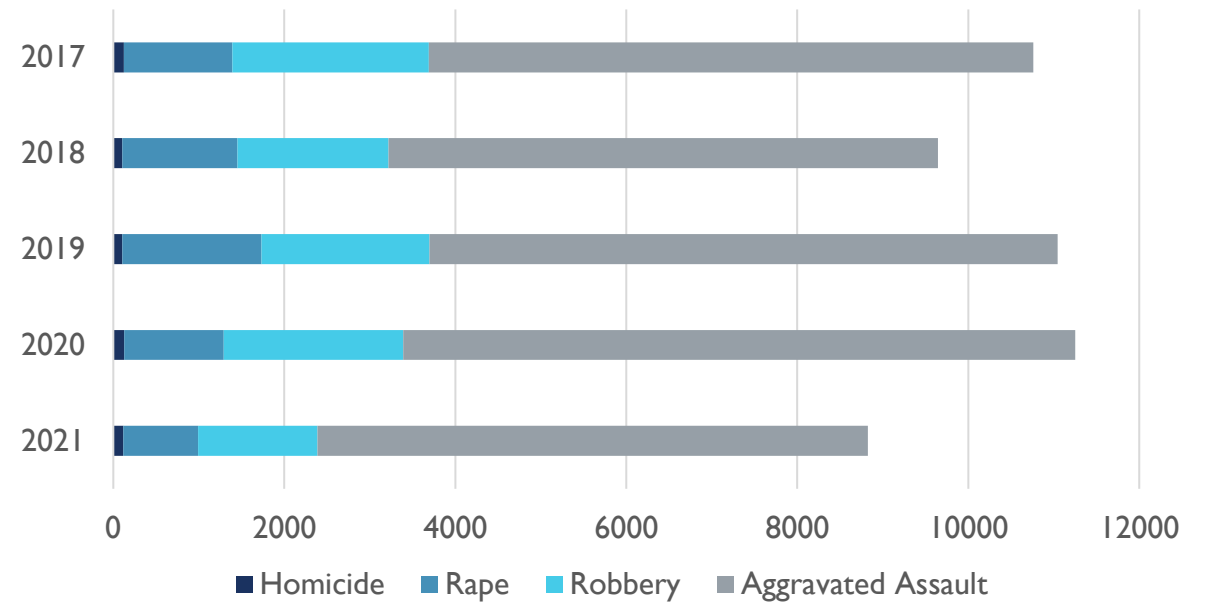
-
- Examine the spatial patterns of the built environment and the determinants of violent crime utilizing Geographic Information Systems and spatial analysis.
 - Detect spatial concentrations of violent crime incidents over time.
 - *Where did violent crimes occur in San Antonio?*
 - *What is the spatial 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

Violent Crimes 2017 - 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

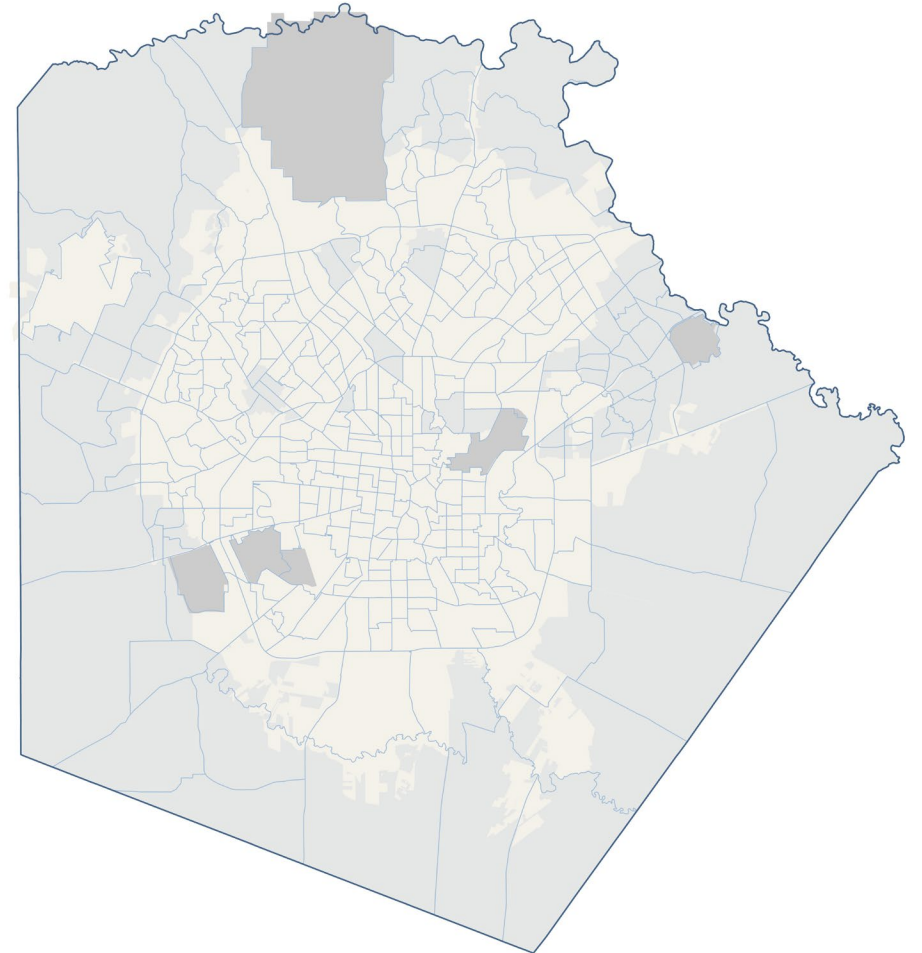
- Housing Occupancy
- Alcohol availability
- Highways
- Parks/Greenways

DATA SOURCES

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

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

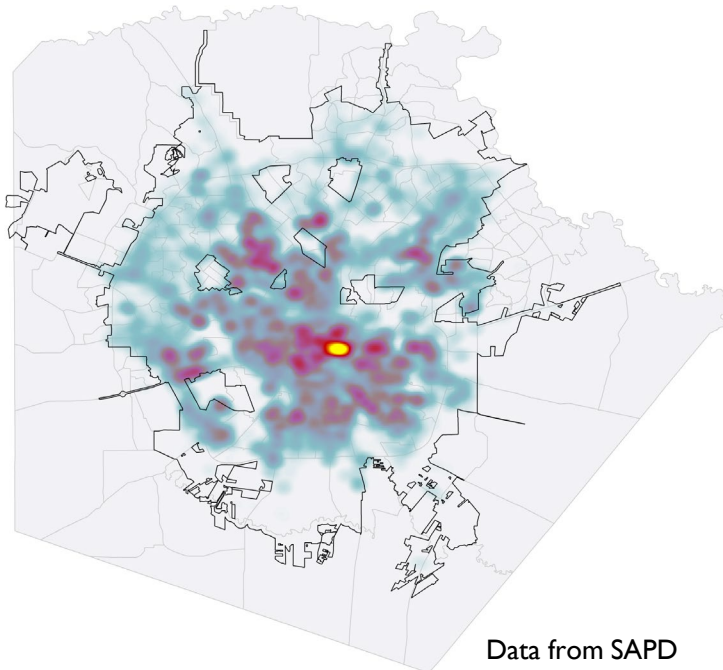


ArcGIS Pro

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

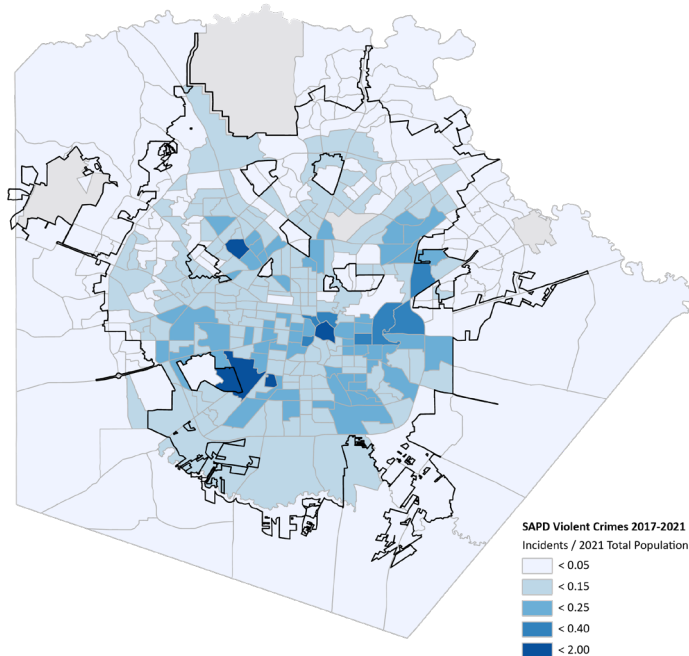
CHALLENGES & LIMITATIONS

- 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

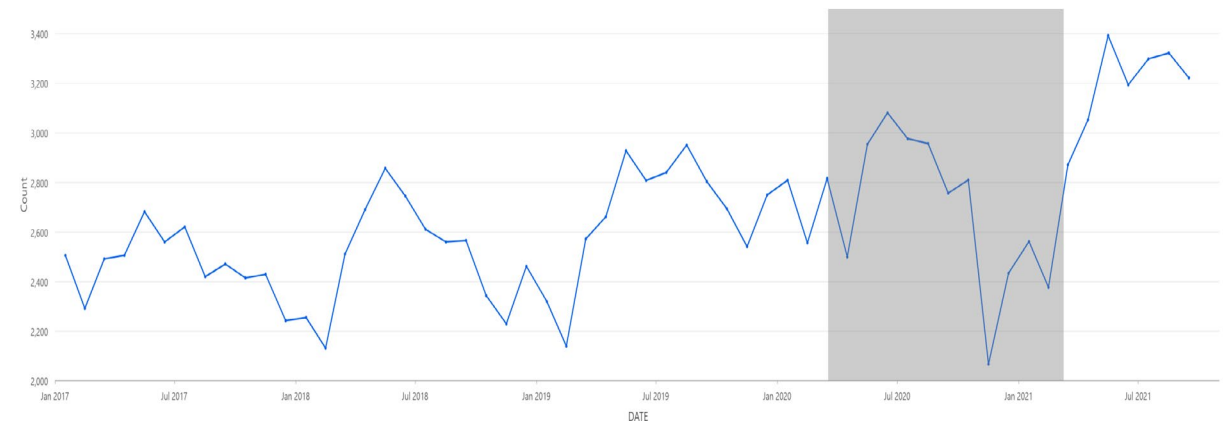
- The built environment variables, specifically the proximity of alcohol-selling establishments, are significant predictors of violent crime.
- Crime events cluster in low income and racially/ethnically diverse neighborhoods (Zhang).



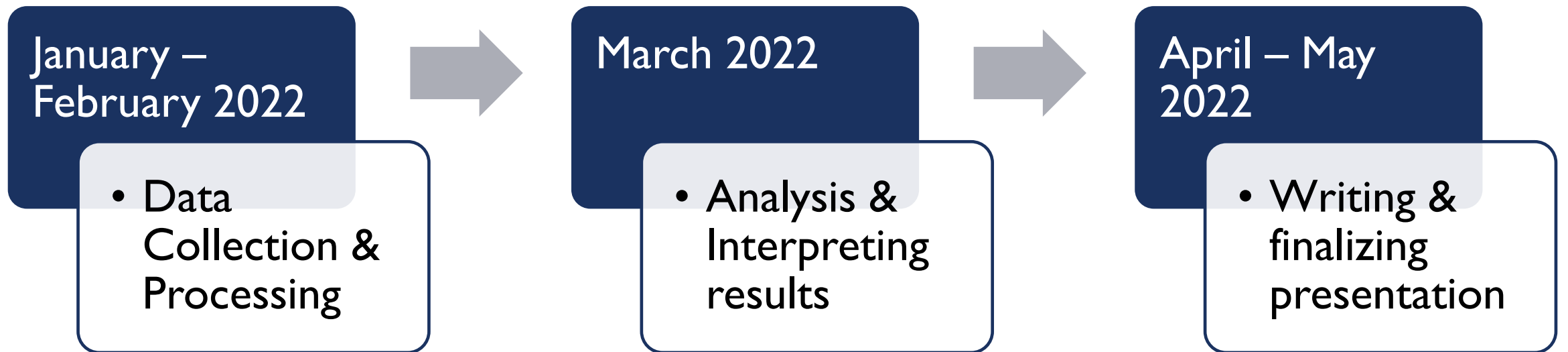
Data from SAPD

■ 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



REFERENCES

- City of San Antonio. (2021). Adopted Operating & Capital Budget Highlights. Retrieved October 18, 2021, from <https://www.sanantonio.gov/Portals/0/Files/budget/FY2022/AdoptedBudget-Highlights.pdf>
- City of San Antonio Office of Equity. (2019). Racial Equity Indicator Report. Retrieved October 18, 2021, from <https://www.sanantonio.gov/Portals/0/Files/Equity/IndicatorReport.pdf?ver=2020-04-17-194607-503>
- Hu, Y., Wang, F., Guin, C., & Zhu, H. (2018). A spatio-temporal kernel density estimation framework for predictive crime hotspot mapping and evaluation. *Applied Geography*, 99, 89-97. <https://www.sciencedirect.com/science/article/pii/S0143622818300560>.
- Mancha E.B., Zey M. (2013) Population Density, Density of Alcohol Retail Outlets, and Point of Consumption's Relation to Violent and Non-violent Crime: A Spatial Analysis. In: Hoque N., McGehee M., Bradshaw B. (eds) *Applied Demography and Public Health. Applied Demography Series*, vol 3. Springer, Dordrecht. https://doi.org/10.1007/978-94-007-6140-7_14
- Matthews, S. A., Yang, T. C., Hayslett, K. L., & Ruback, R. B. (2010). Built environment and property crime in Seattle, 1998–2000: A Bayesian analysis. *Environment and Planning A*, 42(6), 1403-1420.
- San Antonio Police Department. (2021). Uniform Crime Reports. Retrieved October 18, 2021, from <https://www.sanantonio.gov/SAPD/Uniform-Crime-Reports#30264278-202>.
- San Antonio Police Department (2021). San Antonio Fear Free Environment. Retrieved October 18, 2021, from <https://www.sanantonio.gov/SAPD/SAFFE>.
- Sparks, C. S. (2011). Violent crime in San Antonio, Texas: An application of spatial epidemiological methods. *Spatial and spatio-temporal epidemiology*, 2(4), 301-309. <https://www.sciencedirect.com/science/article/pii/S1877584511000529>.
- United State Census Bureau. (2019). Quick Facts: San Antonio. Retrieved October 18, 2021, from <https://www.census.gov/quickfacts/sanantoniocitytexas>.
- Varano, S. P., Schafer, J. A., Cancino, J. M., & Swatt, M. L. (2009). Constructing crime: Neighborhood characteristics and police recording behavior. *Journal of criminal justice*, 37(6), 553-563.
- Vilalta, C., & Muggah, R. (2014). Violent disorder in Ciudad Juarez: a spatial analysis of homicide. *Trends in organized crime*, 17(3), 161-180.
- Zhang, Y., Zhao, J., Ren, L., & Hoover, L. (2015). Space–Time Clustering of Crime Events and Neighborhood Characteristics in Houston. *Criminal Justice Review*, 40(3), 340-360.
- Zhu, L., Gorman, D. M., & Horel, S. (2004). Alcohol outlet density and violence: a geospatial analysis. *Alcohol and alcoholism*, 39(4), 369-375.



THANK YOU

QUESTIONS?

HMGOLIGHT@GMAIL.COM

