

Focused, Balanced, Data Driven... and Easy?



Narrowing the focus of enforcement action and community intervention targeting violence reduction.



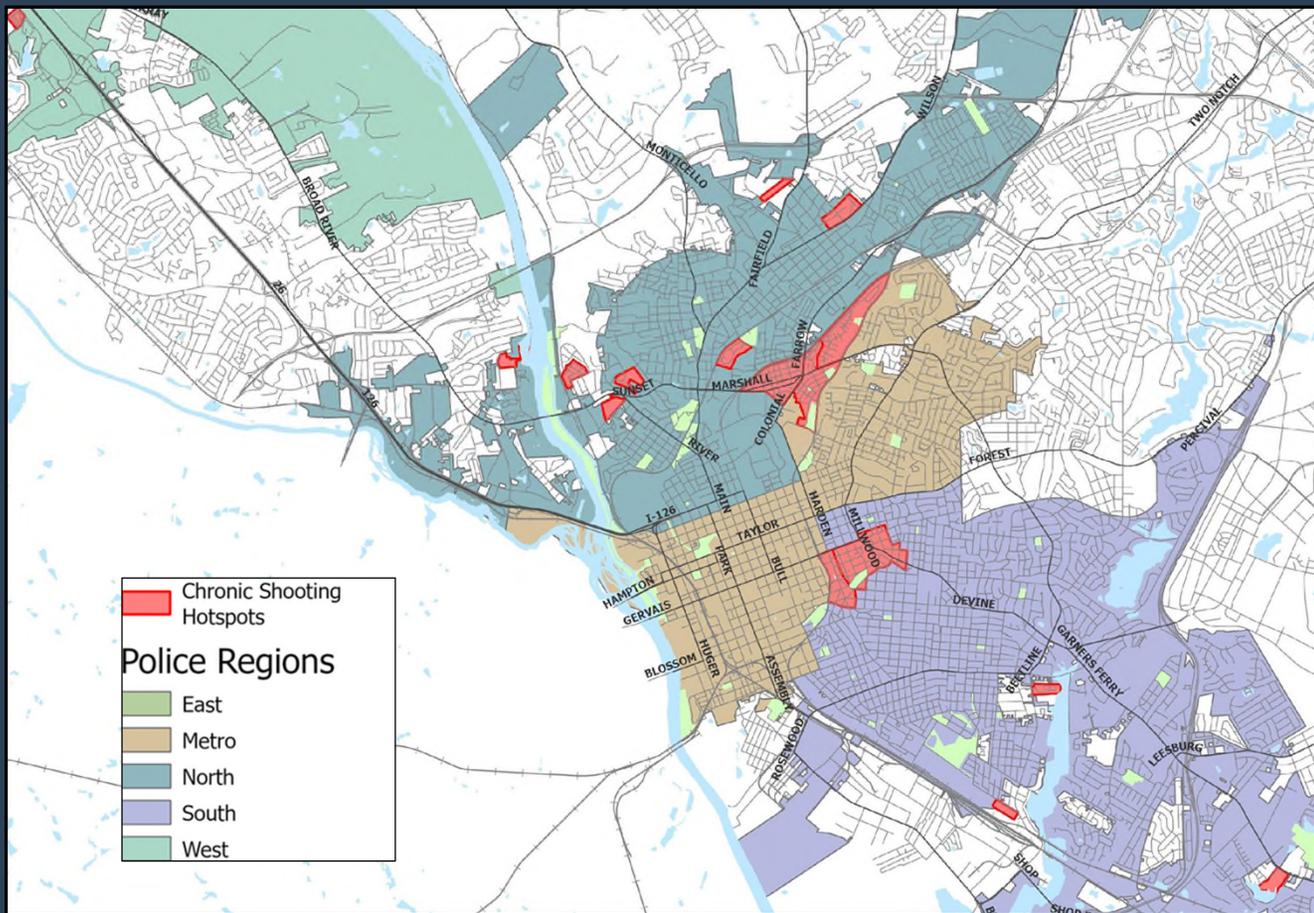
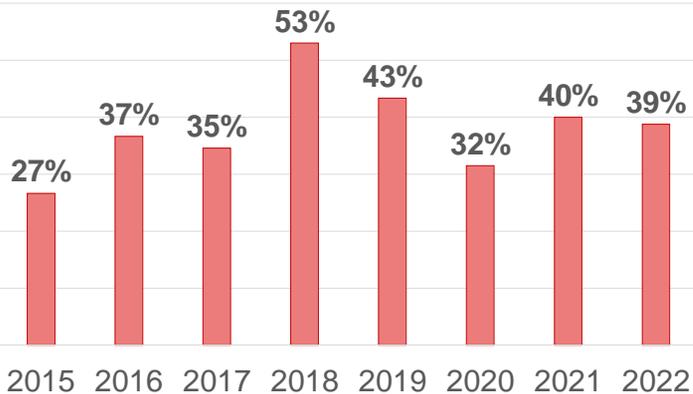
Narrowing Focus with Geospatial Analysis



Simple Crime Mapping can Greatly Narrow the Geographic Scope of Violence Reduction Efforts

The chronic shooting hot spots together account for only 2% of Columbia's surface area (1.34 square miles).

% of Person-Hit Shootings Occurring in Chronic Hot Spots per Year

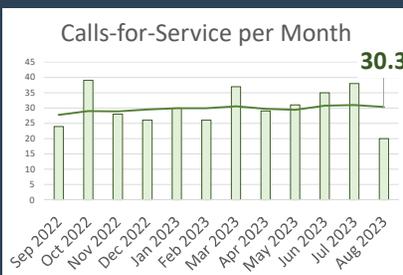
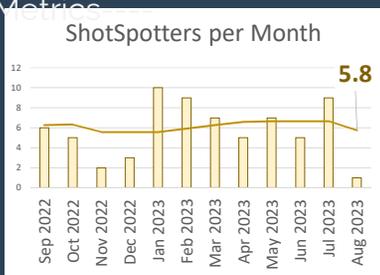
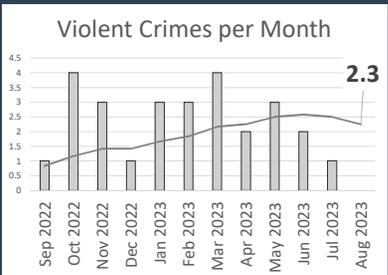
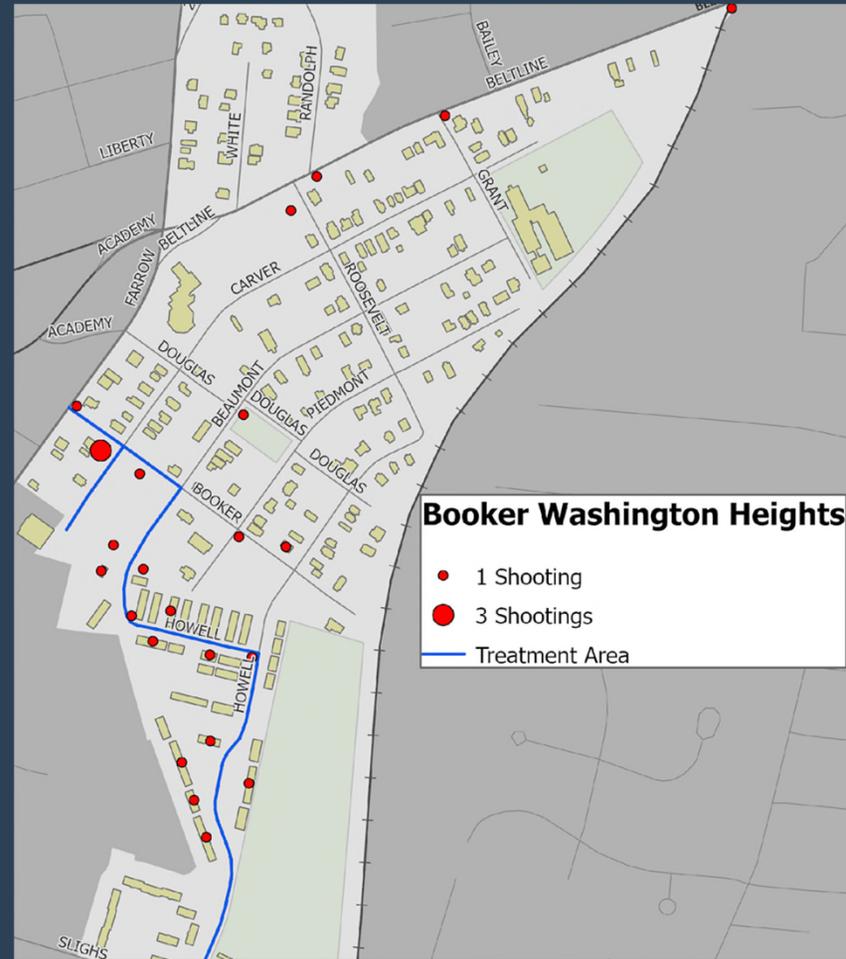
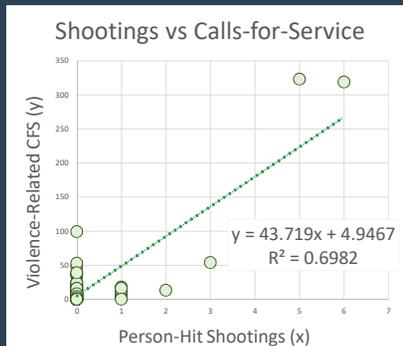
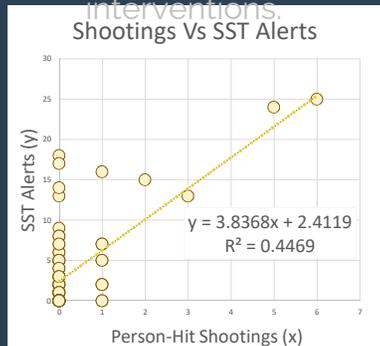
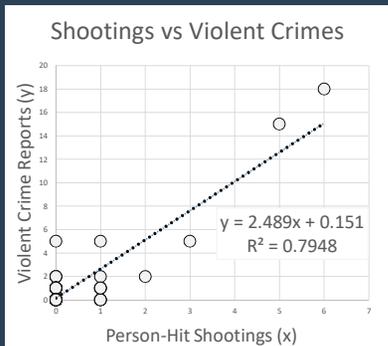


Analysis Can Further Narrow the Focus within Communities

In this neighborhood **73%** of the shootings have occurred at just **9%** of the street segments.

Shootings are rare, but strongly correlated with violent crime reports, SST alerts, and calls-for-service, which are more frequent.

These metrics can thus be used to assess the impact of short-term interventions.



----Community-Wide Metrics

----Treatment Area Metrics----

Violent Crimes per Month:
1.3 (57%)

SST Alerts per Month:
13.6 (45%)

Calls-for-Service per Month:
1.7 (29%)



Risk Terrain Modeling can Narrow the *Conceptual* Focus of Violence Reduction Strategies

What is Risk Terrain Modeling (RTM)?

6

Risk Terrain Modeling is an evidence-based analytical method for understanding how features of an environment impact the risk of a crime occurring at a location.

Systematic review and meta-analysis of risk terrain modelling (RTM) as a spatial forecasting method

The systematic review [of 25 studies] demonstrated that RTM has been successful in identifying at risk places for [property] crimes, violent crimes,... drug related crimes [and others]... almost half of future cases in the studies analyzed were captured in the top ten per cent of risk cells. This typically covers a very small portion of the full study area... RTM is an effective forecasting method that can be applied to identify places at greatest risk of an event and can be a useful tool in guiding targeted responses to crime problems.

Marchment, Zoe & Gill, Paul. (2021). Systematic review and meta-analysis of risk terrain modelling (RTM) as a spatial forecasting method. *Crime Science*. 10. 10.1186/s40163-021-00149-6. (https://www.researchgate.net/publication/352463008_Systematic_review_and_meta-analysis_of_risk_terrain_modelling_RTM_as_a_spatial_forecasting_method)

Evidence in Journal Publications

(From the RTM Website - <https://www.riskterrainmodeling.com/rtmworks.html>)

American Journal of Criminal Justice [2021,2018](#)
Applied Geography [2019, 2017](#)
Applied Spatial Analysis and Policy [2019, 2019, 2019, 2015](#)
Canadian Journal of Criminology and Criminal Justice [2018](#)
Cityscape [2011, 2015](#)
Child Abuse & Neglect [2016](#)
Computers & Industrial Engineering [2015](#)
Crime & Delinquency [2023, 2021, 2018, 2013](#)
Crime Mapping [2013, 2013, 2012](#)
Crime Science [2021, 2018](#)
Criminal Justice Review [2021, 2021, 2020, 2020](#)
Drug and Alcohol Dependence [2023](#)
European J on Criminal Policy and Research [2018, 2018, 2018, 2018, 2018, 2018, 2018, 2018, 2018](#)
Frontiers in Applied Mathematics and Statistics [2018](#)
Homicide Studies [2020](#)
International J of Drug Policy [2020](#)
International J of Comparative and Applied Criminal Justice [2021](#)
J of Contemporary Criminal Justice [2017](#)
J of Crime and Justice [2018, 2017](#)
J of Criminal Justice [2023, 2018, 2018, 2018, 2018, 2017, 2017, 2016](#)
J of Intelligence and Analysis [2019](#)
J of Interpersonal Violence [2017](#)
J of Place Management and Development [2020](#)
J of Quantitative Criminology [2019, 2011](#)
Justice Quarterly [2023, 2019, 2014, 2013, 2011](#)
Korean Criminological Review [2015](#)
Police Practice & Research [2021](#)
Police Quarterly [2021](#)
Policing and Society [2014](#)
Policing: An International Journal of Police Strategies & Management [2014](#)
PLOS ONE [2020](#)
Policing: A Journal of Policy and Practice [2022, 2018](#)
Social Science & Medicine [2020](#)
Social Science Research [2018](#)
Terrorism and Political Violence [2016](#)
Urban Studies [2016](#)



Benefits of Risk Terrain Modeling

Risk Terrain Modeling was the National Institute of Justice (NIJ) Term of the Month for January

From the NIJ website (<https://nij.ojp.gov/term-month#9spp8g>):

Risk terrain modeling is a science-based method of identifying and measuring crime risk posed by the features of a specific physical location...

Two important advantages of risk terrain modeling...:

- Scope of resource response to locations at risk: ... risk terrain modeling **creates opportunities for comprehensive responses not limited to law enforcement action**. For example, if poor lighting is found to elevate crime risk, then the streets department could be asked to improve it.
- Fourth Amendment protection from unreasonable search and seizure: **Risk terrain modeling focuses on attributes of a place, not of a person**. Thus, the use of risk terrain modeling to guide officer actions generally may be less likely than other proactive policing methods to be associated with a risk of constitutional rights violations....

Research on the application of risk terrain modeling in multiple communities has found it to be an effective and accurate method of identifying crime risk and altering the characteristics of a place to prevent crime problems.



RTM Supports Less Invasive Police-led Violent Crime Interventions

Data modeling helps reduce risk of violent crime in Atlantic City

Homicides and shooting injuries in Atlantic City reduced by 26 percent... [and] Robberies... reduced by 37 percent over 2017 compared to 2016.

Working with community members, the ACPD forms risk narratives that explain why crimes are associated with particular locations (Caplan, Kennedy, and Drawve 2018). For example, one narrative posits that drug deals were solicited at convenience stores, transactions then took place at unsupervised laundromats, and drug supplies were kept at vacant properties (Melamed 2017). These activities could then increase the risk for violent crime. At the same time, RTM helped refute the assumption that crimes are associated with housing projects (Melamed 2017).

The ACPD has worked to disrupt risk narratives and limit opportunities for crime (Caplan 2018). Patrol routes were revised, and the police conducted over 1,000 checks at businesses in high-risk areas in 2017 (Caplan, Kennedy, and Drawve 2018). Updated business check procedures required officers to get out of their vehicles, sign a log book, interact with store owners and customers, and establish an active police presence (Atlantic City Police Department 2018). Other city departments also worked to address risk factors by installing brighter street lights and modifying or demolishing 17 abandoned buildings in high-risk areas (Caplan, Kennedy, and Drawve 2018).

<https://www.sdsntrends.org/research/2018/9/27/case-study-risk-terrain-modeling-atlantic-city>

Preliminary RTM Analysis

Environmental Features Examined

Cuts

Cuts and areas that are within 150 feet of a cut were considered high risk for person hit shootings.

Abandoned Buildings

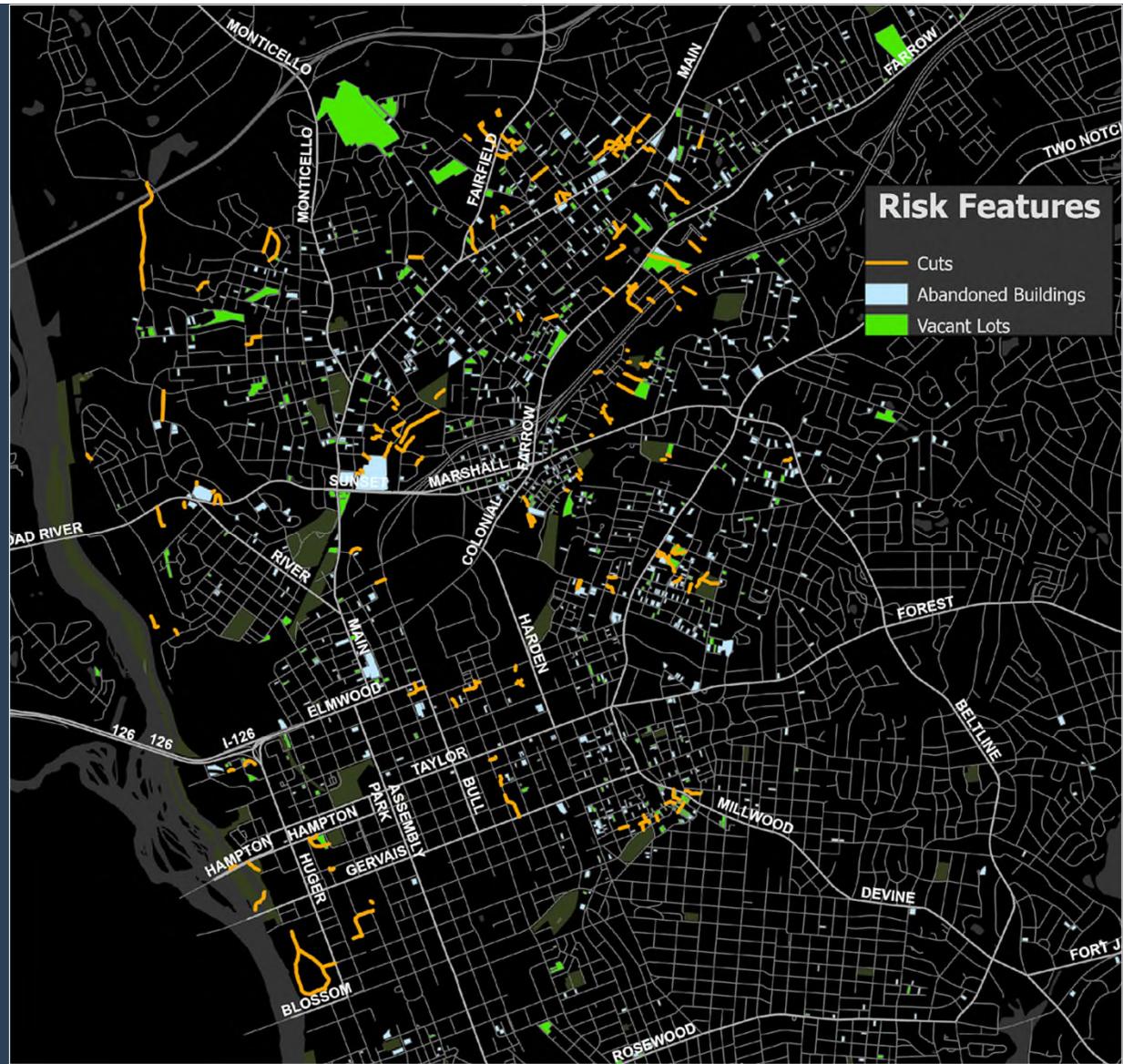
- Parcels containing an abandoned building were considered high risk.
- Areas with a concentration of abandoned buildings that is 2 standard deviations above average were considered high risk.

Vacant Lots

- Vacant lot parcels were considered high risk.
- Areas with a concentration of vacant lots that is 2 standard deviations above average were considered high risk.

Data Sources

Cut locations were provided by patrol officers.
Abandoned buildings and vacant lots were identified using recent code enforcement cases.



Preliminary RTM Analysis

Crime Data Used for Statistical Testing

Person Hit Shootings Jan-Jun 2022

Six months of person hit shooting data was used to test the statistical relationship between the previously shown features of the environment and the likelihood of a shooting occurring.

In this case shootings were counted per incident not per victim.

Unit of Analysis

The city was divided into a series of 100ftx100ft grid squares. The grid squares were then coded based on whether they contained a shooting event or any one of the five types of risk factors.

The total number of grid squares is 168,499. Only 33 experience a shooting (0.02%).



Is there a Statistically Significant Relationship between these Risk Features and Shootings?

The charts to the right show the relationship between the risk factors and shootings based on 100x100ft grid squares.

The first column shows how many grid squares had 1) no risk factor and no shooting, 2) the risk factor but no shooting, 3) no risk factor and a shooting, and 4) both the risk factor and a shooting.

The second column shows the percentage of all grid squares containing the risk factor vs the % of grids squares with NO shooting and the risk factor vs the % of grid squares with a shooting and the risk factor.

In each case the risk factor is more prevalent in grid squares that had a shooting than in the total population of grid squares. The final column shows whether that increase in prevalence is statistically significant.

		Shooting Occurred?	
		No	Yes
Cut Present?	No	165527	27
	Yes	2939	6
Total		168466	33

--- Percentages ---					
Total		No Shooting		Shooting	
No	98%	No	98%	No	82%
Yes	2%	Yes	2%	Yes	18%

Fisher's Exact Test Results	
P-Value:	Statistically Significant?
0.000021	Yes

		Shooting Occurred?	
		No	Yes
High Ab. Bldg Density?	No	155972	22
	Yes	12494	11
Total		168466	33

--- Percentages ---					
Total		No Shooting		Shooting	
No	93%	No	93%	No	67%
Yes	7%	Yes	7%	Yes	33%

Fisher's Exact Test Results	
P-Value:	Statistically Significant?
0.000016	Yes

		Shooting Occurred?	
		No	Yes
Abandoned Bldng Present?	No	163991	28
	Yes	4475	5
Total		168466	33

--- Percentages ---					
Total		No Shooting		Shooting	
No	97%	No	97%	No	85%
Yes	3%	Yes	3%	Yes	15%

Fisher's Exact Test Results	
P-Value:	Statistically Significant?
0.001691	Yes

		Shooting Occurred?	
		No	Yes
High Vacant Lot Density?	No	159252	26
	Yes	9214	7
Total		168466	33

--- Percentages ---					
Total		No Shooting		Shooting	
No	95%	No	95%	No	79%
Yes	5%	Yes	5%	Yes	21%

Fisher's Exact Test Results	
P-Value:	Statistically Significant?
0.001776	Yes

		Shooting Occurred?	
		No	Yes
Vacant Lot Present?	No	165557	32
	Yes	2909	1
Total		168466	33

--- Percentages ---					
Total		No Shooting		Shooting	
No	98%	No	98%	No	97%
Yes	2%	Yes	2%	Yes	3%

Fisher's Exact Test Results	
P-Value:	Statistically Significant?
0.437300	No



Regression Model Results

The risk factors that were found to have a statistically significant relationship to person hit shootings were then included in a logistic regression model to determine their relative weight for increasing the probability of a shooting occurring at a given location.

The results of the model indicate that there is wide variability in the increased relative risk the associated with each of these risk factors.

In the small number of grid squares where all four factors are present, there is almost a 1% chance of a shooting occurring in a 6 month period.

Risk Factor Present	Beta Coefficient	Increased Relative Risk	Probability of Shooting
Intercept (No Risk Factors)	-8.9797		0.01%
Cuts	1.989	631%	0.09%
High Ab Building Density	1.1889	228%	0.04%
Abandoned Building Present	0.9153	150%	0.03%
High Vacant Lot Density	0.2813	32%	0.02%
All Four Risk Factors Present	4.3745	7840%	0.99%

Results of the logistic regression model run in R:

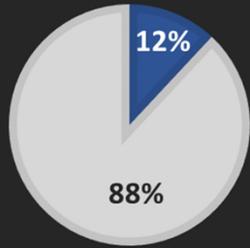
```
Call: glm(formula = PHS_Jan_Jun_22 ~ CutRaster + AbandonedBuildingsDensity +
  AbandonedBuildingsParcel + VacantLotDensity, family = "binomial",
  data = RSigificantRiskFactors)

Coefficients:
  (Intercept)          Cuts
    -8.9797         1.9890
AbandonedBuildingsDensity  AbandonedBuildingsParcel
    1.1889         0.9153
  VacantLotDensity
    0.2813
```

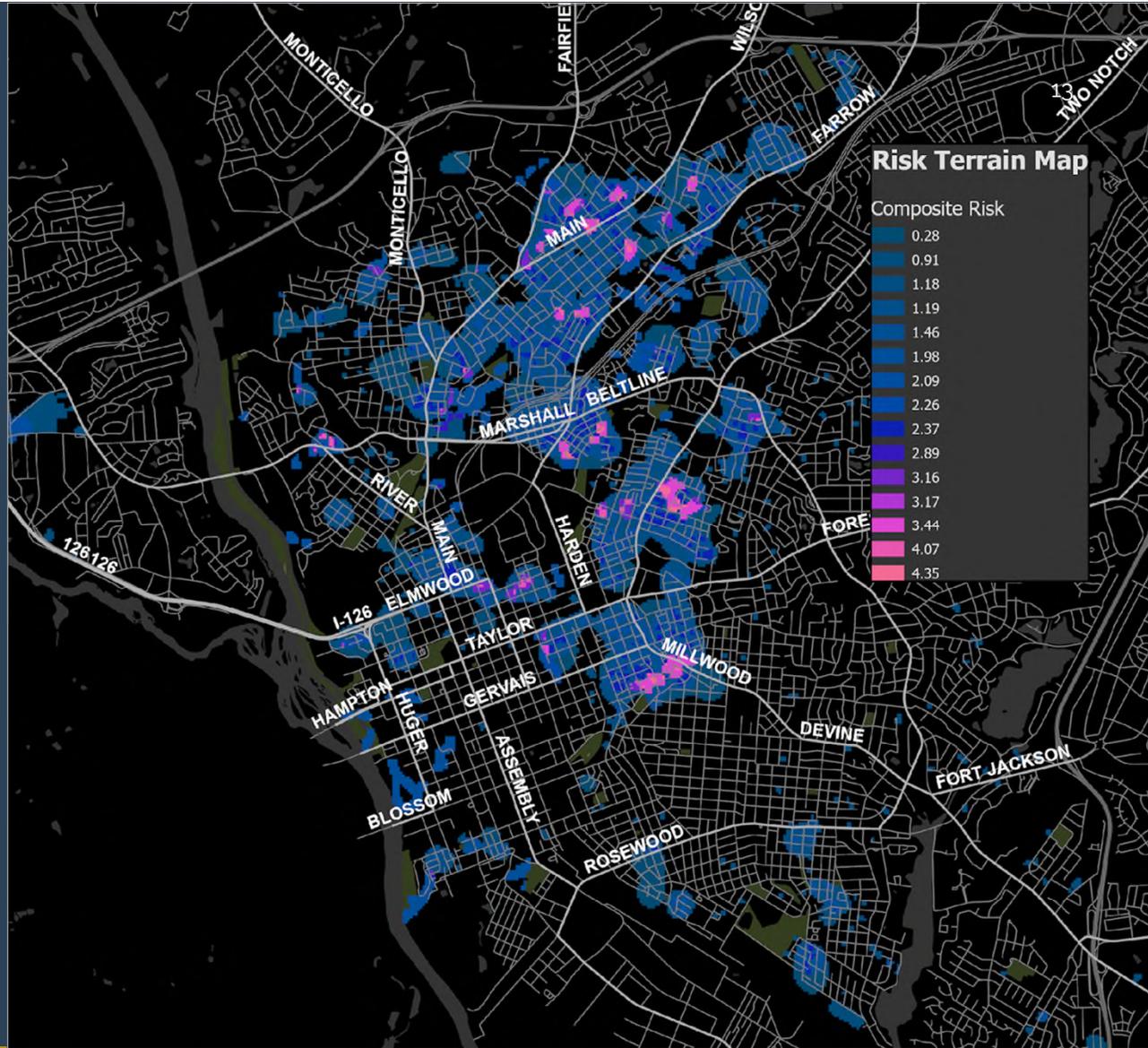
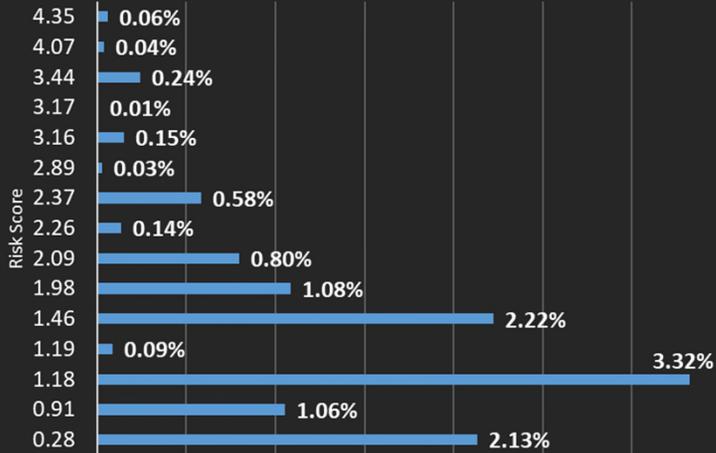
Composite Weighted Risk Map

% OF GRID SQUARES BY RISK

- Has Risk Factor
- No Risk Factor



High Risk Grid Squares as % of Total



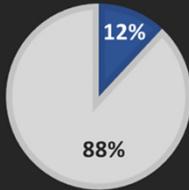
Predictive Power

Following 6 Months

Person Hit Shooting Incidents
July to December 2022

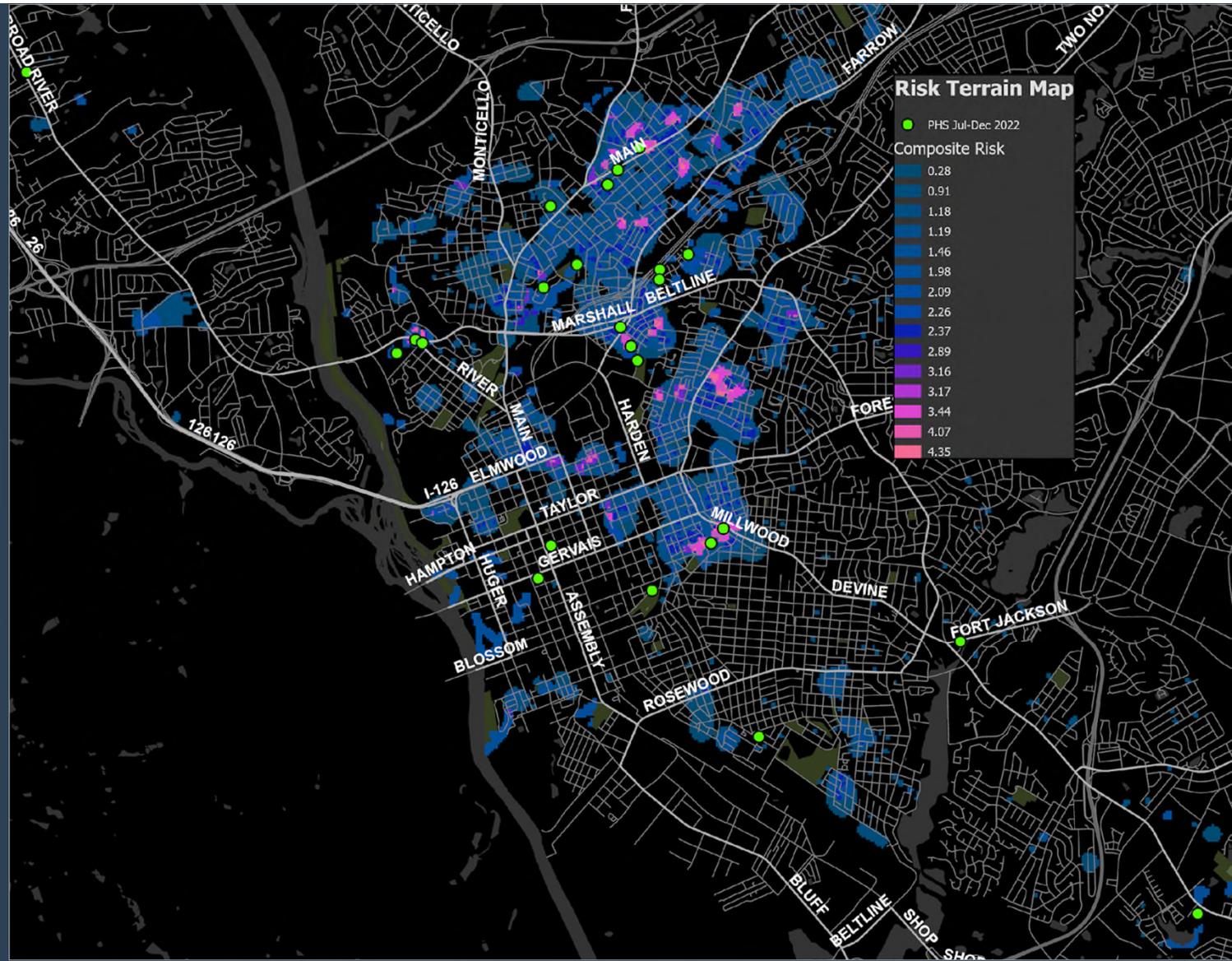
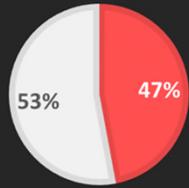
% OF GRID SQUARES BY RISK

- Has Risk Factor
- No Risk Factor



% OF PHS INCIDENTS JUL-DEC '22 IN HIGH RISK ZONE

- In High Risk Zone
- Not in High Risk Zone



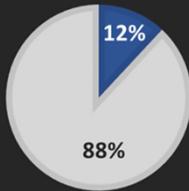
Risk Factors and Perennial Hot Spots

Historical
Data

Person Hit Shooting Incidents
2015 to 2022

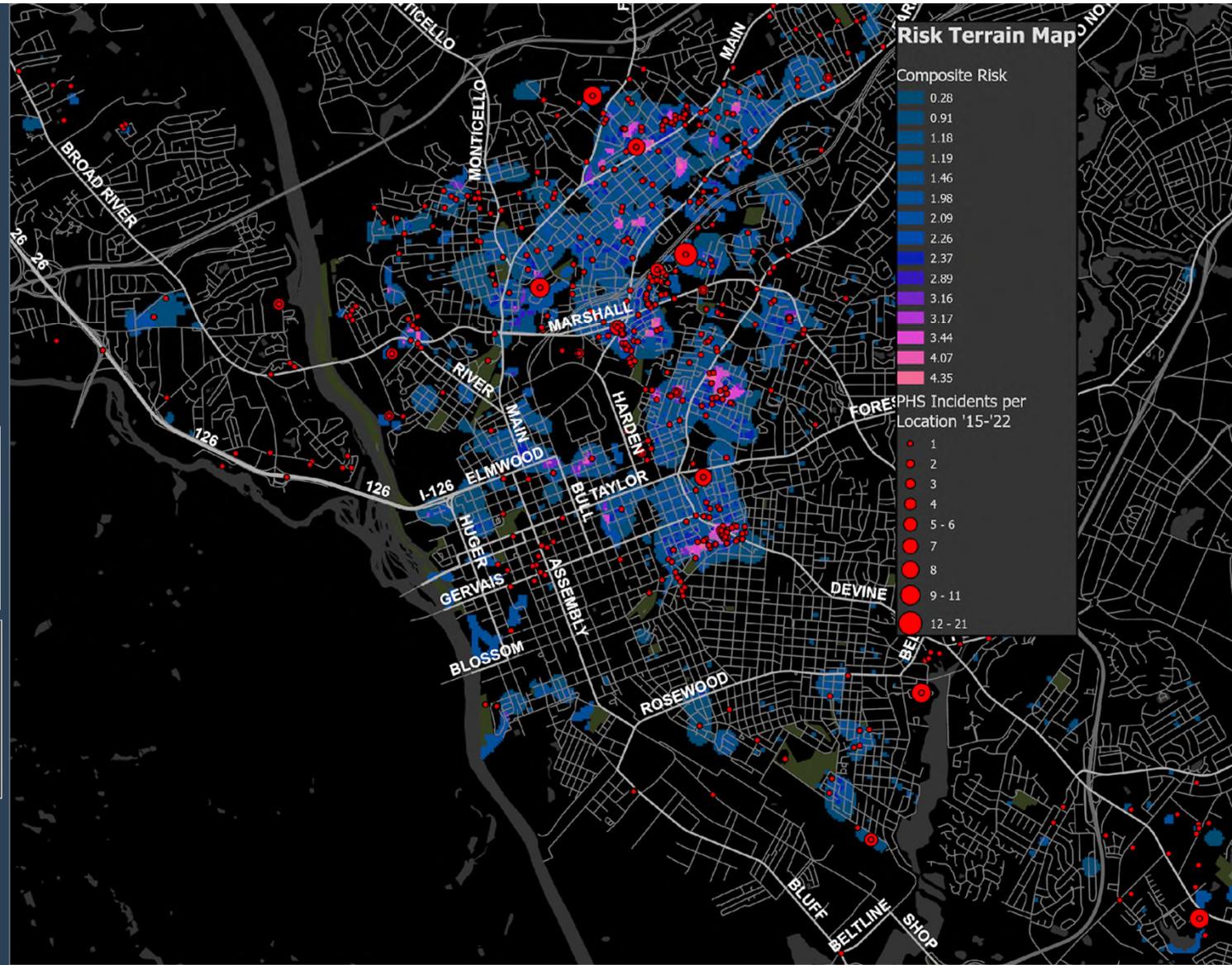
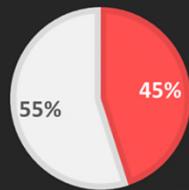
% OF GRID SQUARES BY RISK

- Has Risk Factor
- No Risk Factor



% OF PHS INCIDENTS 2015 TO 2022 IN HIGH RISK ZONE

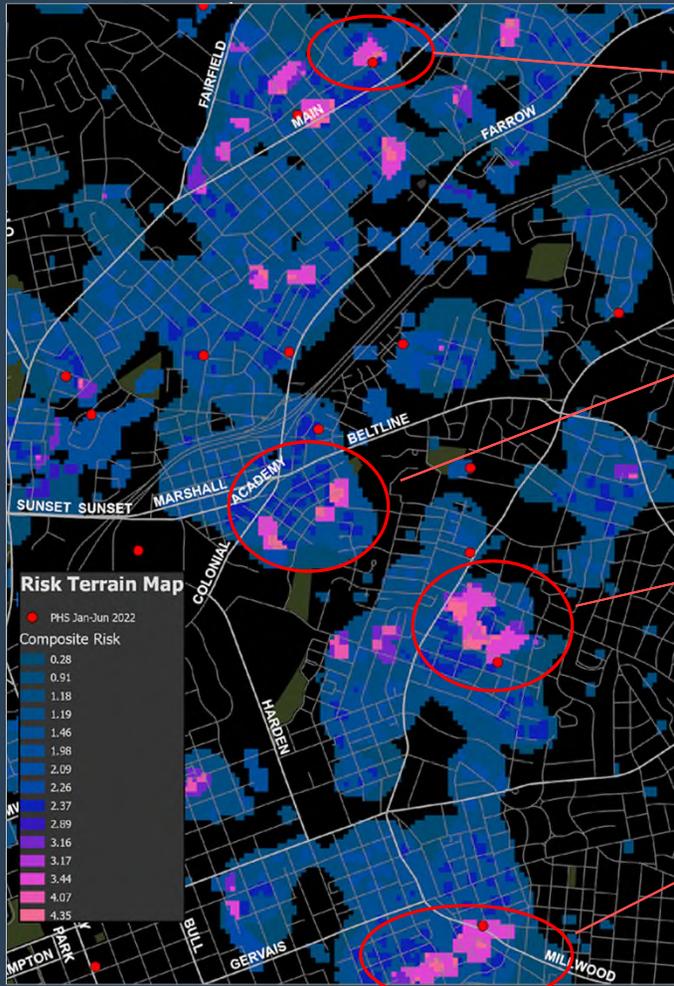
- In High Risk Zone
- Not in High Risk Zone



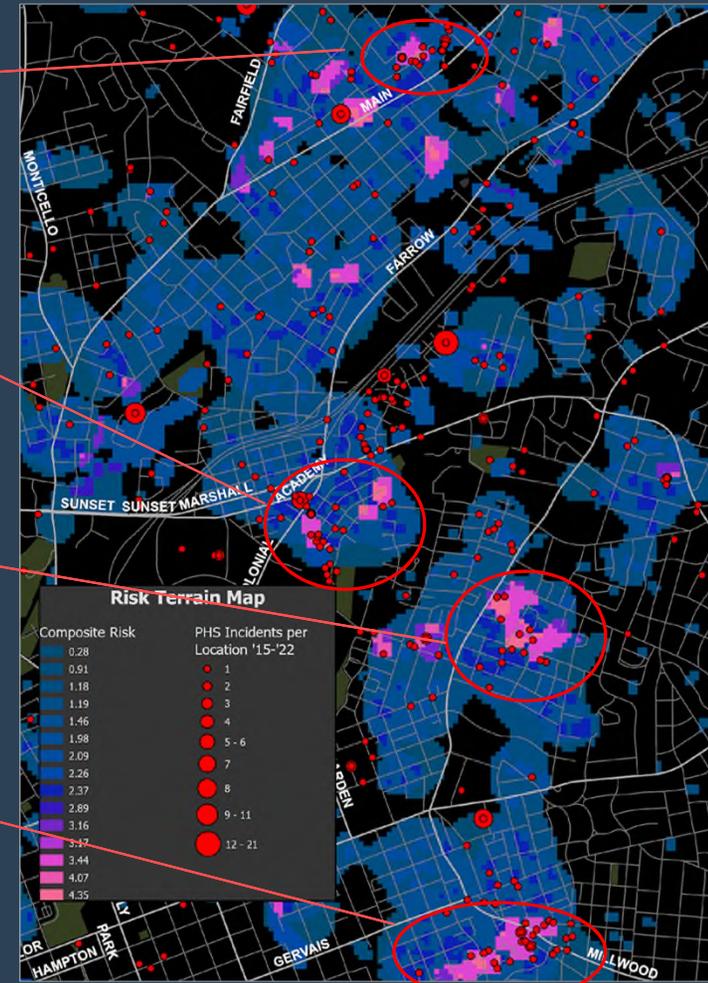


RTM and Perennial Hot Spots

Input Data (Jan-Jun)



Historical Data (2015 to 2022)



Dorrah-Randall

Booker Washington Heights

Pinehurst

MLK Park Neighborhood
Millwood Ave
King and Bratton Area

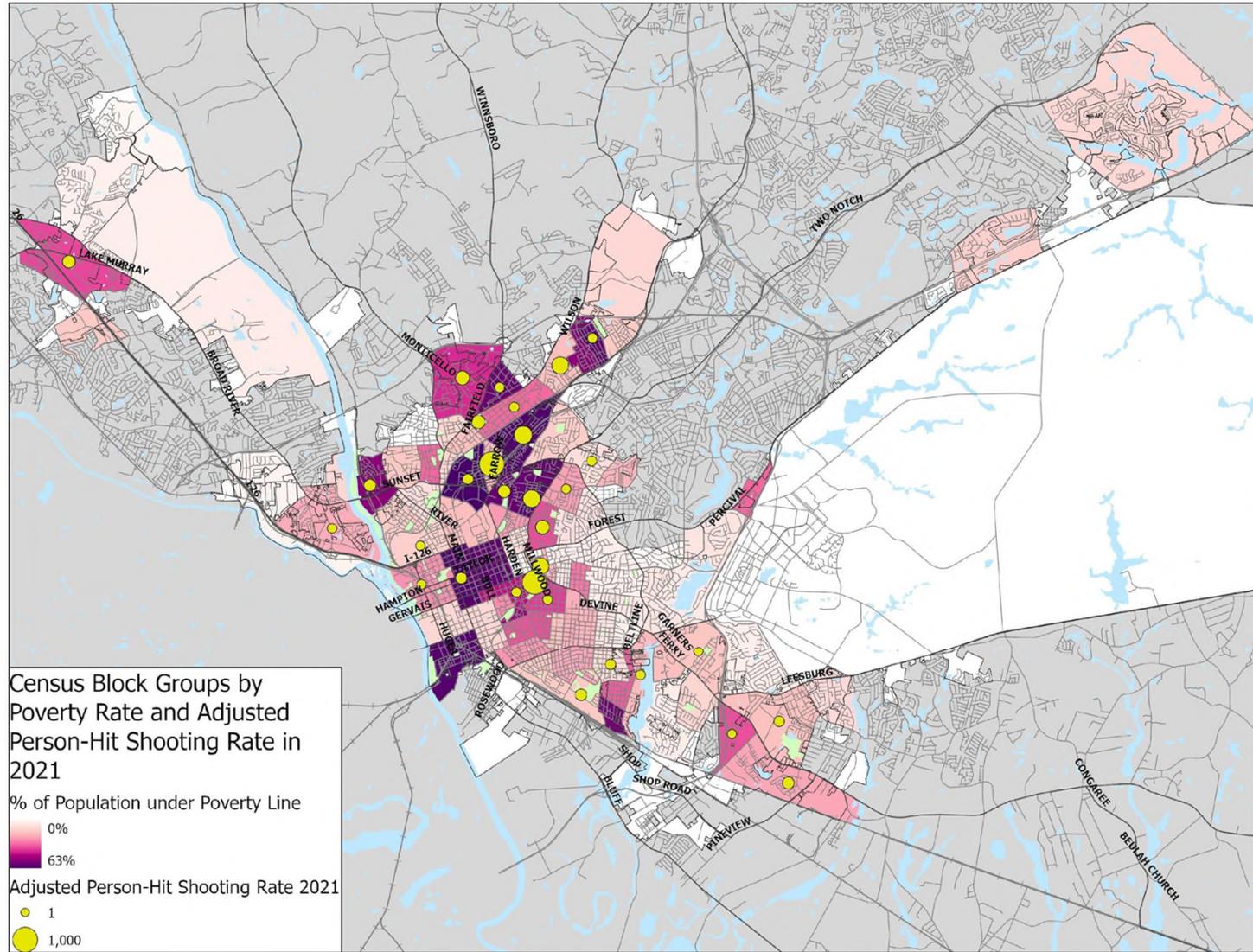


Risk Terrain vs Poverty Rate as Predictor of Community-Level Gun Violence



Poverty Rate vs Person-Hit Shooting Rate

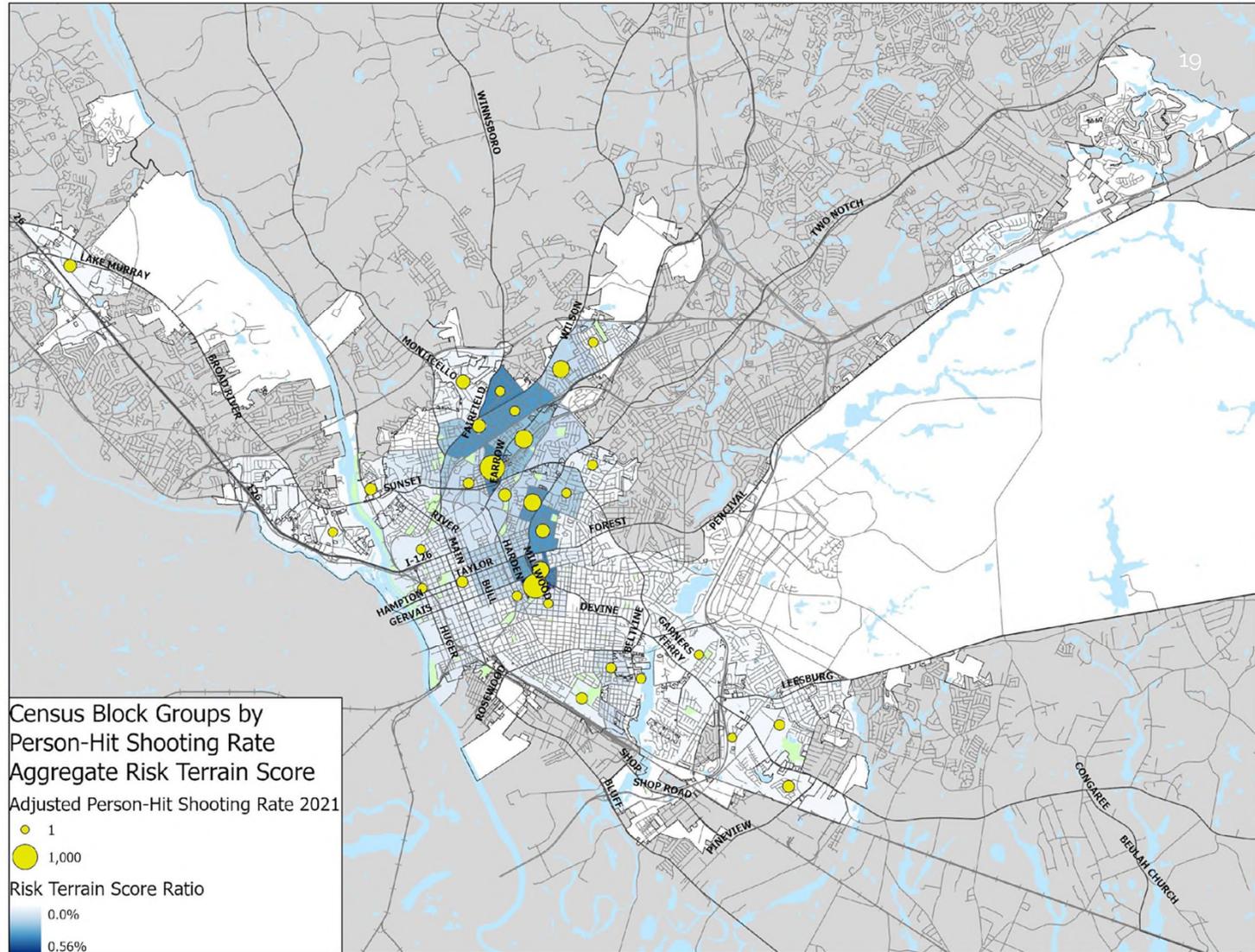
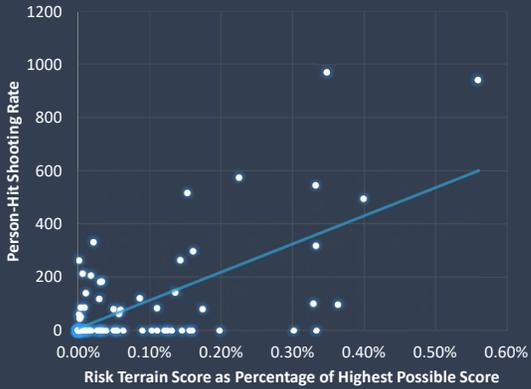
PHS Rate vs Poverty Rate 2021
($r = .32, \beta = 3.27$)





Aggregate Risk Terrain Score vs Person-Hit Shooting Rate

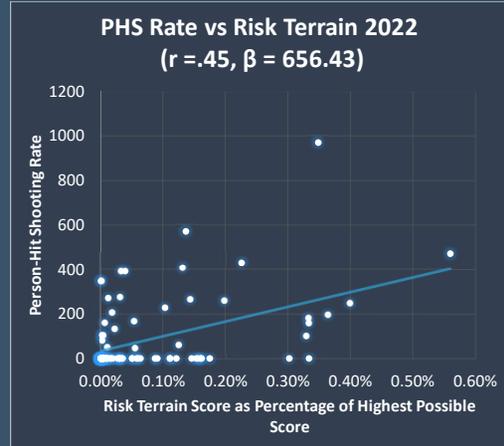
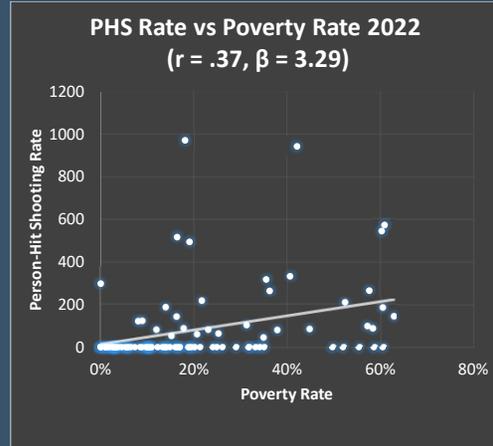
PHS Rate vs Risk Terrain Score 2021
($r = .65$, $\beta = 1,057.39$)



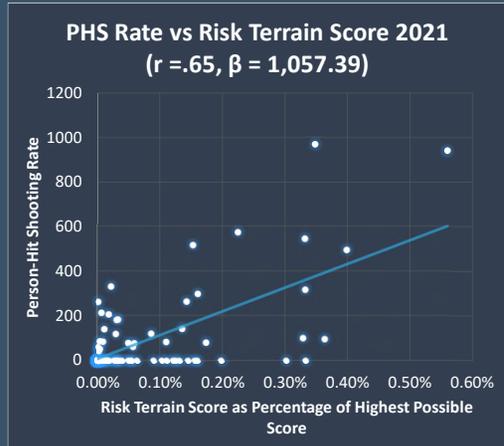
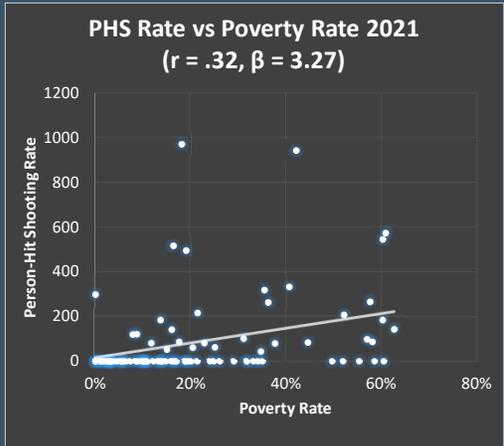


Comparing the Power of Poverty Rate and Risk Terrain Score to Predict PHS Rate by Year

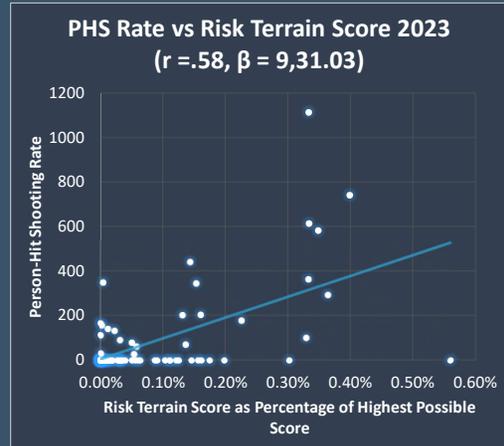
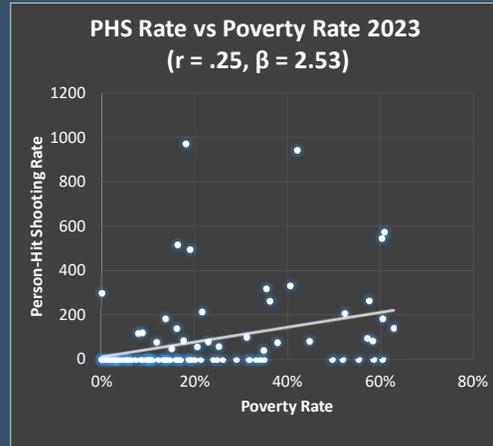
2022



2021



2023





Focused, Balanced, Data Driven

- Geospatial analysis, such as crime mapping and Risk Terrain Modeling can dramatically narrow the geographic scope of violence reduction efforts
- RTM can also narrow the conceptual scope of violence reduction efforts by shedding light on what features of the environment and related behaviors are most closely linked to violence
- The narrowing of focus keeps police from relying dragnet-style enforcement and allows for enforcement interventions targeting *only* the few places or behaviors driving violence in a community
- Geospatial analysis can also help direct community investment towards the places and poverty-related outcomes that are most closely connected with community violence
- Geospatial analysis is data-driven and so can help ensure objectivity in our understanding of the dynamics of violent crime in our communities



...and Easy?

Simple Requirements for Geospatial Analysis

Foundational Knowledge/Skills:

Data Management and Analysis

Geographic Information Systems

Basic Knowledge of Inferential Statistics

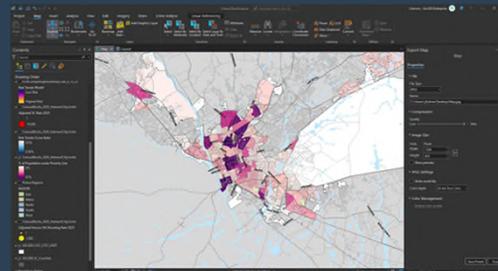
Tools:

Microsoft Excel



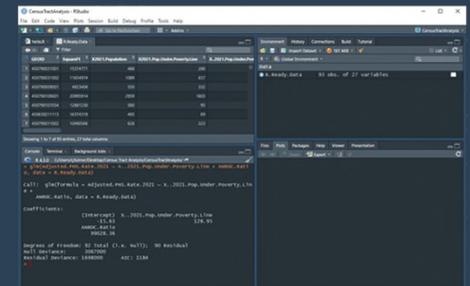
<https://www.microsoft.com/en-us/microsoft-365/excel>

ArcGIS Pro



<https://pro.arcgis.com/en/pro-app/latest/get-started/get-started.htm>

R Programming



<https://www.r-project.org/about.html>



Columbia Police Department

#1 Justice Square

Columbia, SC 29201



Social Media

Facebook, Twitter & Instagram - @columbiapdsc



(803)545-3500



www.columbiapd.net

Charleston County Criminal Justice Coordinating Council

October 20, 2023

SERVE



CONNECT

Mission & Vision

Mission

Fostering positive change through sustainable police-community partnerships

Vision

Police and citizens working together as one community to address root causes of crime and promote safety so everyone thrives.



[Serveandconnect.org](https://serveandconnect.org)

Compass

- Comprehensive approach to strengthening local community policing network
- Focuses on building locally-driven movements where police, citizens and local service providers work together to tackle significant community challenges



Compass is an evidence-informed process

Build Trust

Create a foundation of trust and communication between police and community partners, while engaging in deep listening and learning to understand local needs and opportunities. The goal is to identify where the common ground is that brings partners together.

Enhance Capacity

Enhance the capacity for police and community partners to identify, develop, and implement evidence-based solutions that tackle shared goals.

Implement Change

Support police and community partners in implementing, measuring, and improving change initiatives that address shared goals.

Sustain

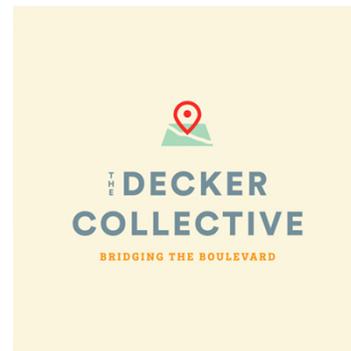
Support partners in establishing a plan for sustaining change within their community.

SAMPLE COMPASS PARTNER PROGRAMS

**North
Columbia**



**Richland
County**



**Youth-
Serving**



**Lexington
County**





Contact

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City of Columbia Office of Violent Crime Prevention (OVCP)



Trevon Fordham, Director



We Are Columbia

Framework for Addressing Violent Crime

	Prevention	Intervention	Enforcement
People	<ul style="list-style-type: none"> • Cognitive Behavioral Therapy • Family Programming 	<ul style="list-style-type: none"> • Cognitive Behavioral Therapy • Group Violence Reduction Strategies • Street Outreach 	<ul style="list-style-type: none"> • Homicide Clearance Improvements • Group Violence Reduction Strategies
Places	<ul style="list-style-type: none"> • Community Building • Partnership Oriented Crime Prevention 	<ul style="list-style-type: none"> • Blight and Nuisance Abatement • Service Restoration • Partnership Oriented Crime Prevention 	<ul style="list-style-type: none"> • Hot Spots Policing • Partnership Oriented Crime Prevention
Behaviors	<ul style="list-style-type: none"> • Cognitive Behavioral Therapy • Family Programming • Alcohol Restriction • Drug Treatment 	<ul style="list-style-type: none"> • Cognitive Behavioral Therapy • Group Violence Reduction Strategies • Street Outreach 	<ul style="list-style-type: none"> • Homicide Clearance Improvements • Group Violence Reduction Strategies



Aim:

To uphold the City of Columbia's mission of providing bold leadership and exemplary services to advance the quality of life for everyone, the Office of Violent Crime Prevention (OVCP) aims to coordinate the City's efforts of implementing prevention, intervention, and enforcement initiatives to reduce violent crime. The OVCP will accomplish its aims through strategic planning, engagement, coordination, programming, development, in addition to data evaluation and analysis.



Goal:

The goal of the OVCP is to coordinate the City's violence reduction efforts by developing a holistic and comprehensive approach that is data driven, embraces evidence-based practices, and includes collaborative partnerships with residents, government agencies, law enforcement, social service providers, and other community stakeholders.



OVCP Summary

- The Office of Violent Crime Prevention (OVCP) was established to devise strategic plans, evaluate and analyze data, implement programs, establish policy, coordinate resources, and promote effective partnerships to prevent and reduce violent crime while engaging in research and data collection.
- The Director for the Office of Violent Crime Prevention will serve as the City of Columbia's violent crime prevention expert and will provide consultation to City leadership, as well as coordinate efforts with other government agencies, nonprofits, and organizations to prevent and reduce violent crime.



Three OVCP Pillars

Pillar 1: Community Engagement and Programming



Pillar 2: Data Evaluation, Analysis, and Strategic Planning



Pillar 3: Development, Grants, and Assistance



The OVCP utilizes the following factors to define “highest risk” of violent crime involvement



Summary

OVCP will serve as the “quarterback” or the centralized office to direct, coordinate, align, and support violence prevention and intervention efforts:

- ❖ Assess and improve environmental factors and behaviors that lead to violent outcomes.
- ❖ Catalog and coordinate available resources from service providers and stakeholders.
- ❖ Connect community members with wraparound services such as job training, apprenticeships, and other alternatives to lifestyles that may lead to violent outcomes.
- ❖ Identify and secure funding designated for violence prevention, intervention, and reduction efforts.



Overall Goal: Work together to reduce violent crime in the City of Columbia and create safer communities!



CONTACT US:

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- ❖ Instagram-<https://www.instagram.com/WeAreColumbia/>
- ❖ Flickr-<https://www.flickr.com/photos/191155637@N07>