

Poor Health and Violent Crime Hot Spots: Mitigating the Undesirable Co-Occurrence Through Focused Place-Based Interventions

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Introduction: The geographic overlap of violence and poor health is a major public health concern. To understand whether and how place-based interventions targeting micro-geographic places can reduce this undesirable co-occurrence, the study addresses 2 important questions. First, to what extent are deteriorated health conditions associated with living at violent crime hot spots? Second, through what mechanisms can focused place-based interventions break the association between living with violence and deteriorated health?

Methods: This study used survey data from 2,724 respondents living on 328 street segments that were categorized as violent crime hot spots (181 segments with 1,532 respondents) versus non-hot spots (147 segments with 1,192 respondents) in 2013–2014 in Baltimore, Maryland. Propensity score analysis assessed whether individuals living at violent crime hot spots had lower general health perceptions than people living at non-hot spots. Marginal structural models estimated the proportion of total effects mediated by 3 theoretically informed intervening mechanisms. Analyses were conducted in 2019.

Results: Respondents living at violent crime hot spots had a lower level of self-rated general health ($b = -0.096$, 95% CI = $-0.176, -0.015$) and higher levels of health limitations ($b = 0.068$, 95% CI = $0.027, 0.109$) and problems (OR = 2.026 , 95% CI = $1.225, 3.349$) than those living at non-hot spots. Enhanced perceptions of safety, collective efficacy, and police legitimacy may break the association between living in places with extremely high levels of violence and deteriorated health.

Conclusions: Indicated or selective strategies are urgently needed to target micro-geographic locations with known increased risks, supplementing universal strategies applied to a broader community. *Am J Prev Med 2020;000(000):1–8. © 2020 American Journal of Preventive Medicine. Published by Elsevier Inc. All rights reserved.*

INTRODUCTION

Since the early 1990s, there has been a resurgence of interest in the role of place in shaping people's health.¹ Purely individual-based explanations of ill health are found incomplete and fail to capture important risk determinants. Contextual or neighborhood influences are considered essential in understanding the distribution of health and disease. Inequalities in social-economic resources and residential segregation by race/ethnicity lead to neighborhood physical and social characteristics that alter individual behavioral (e.g., lack of physical activity or unhealthy eating behavior) and mental (e.g.,

depression or anxiety) processes, which, in turn, affect health outcomes.^{2–4}

A particularly concerning phenomenon regarding the geographic distribution of ill health is that urban areas of concentrated, chronic disease and high morbidity and

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mortality rates are often the same areas where residents live with extremely high levels of crime and violence.⁵ Besides its direct impact on premature death, disability, and injury, research has established the connection between living with violence and a wide spectrum of adverse health outcomes such as chronic pain, recurring central nervous system symptoms, diagnosed functional gastrointestinal disorders, increased cardiovascular risk, and lack of adherence to medical treatment.^{6,7}

The fact that interpersonal violence concentrates in a small number of places in a city suggests that focused interventions targeted at micro-geographic scales (e.g., street segments) may be particularly effective and efficient in mitigating the co-occurrence.⁸ The law of crime concentration at places shows that across large cities, approximately 5% of street segments account for 50% of total crime and these crime hot spots evidence strong stability over time.^{8–11} Additionally, an extensive literature demonstrates strong street-by-street variability in crime and violence as well as social disorganization and opportunity mechanisms for crime.^{8,11–13} Neighborhoods (when defined as Census tract or block groups) are too heterogeneous to warrant the assumption that interventions would be equally effective across the geographic area. Even within a high-risk neighborhood, most places are relatively free of crime.^{8,9,14} Instead of labeling the whole neighborhood as unsafe and undesirable, it may be efficacious to address the coupling of violence and poor health at micro-geographic locations (e.g., violent crime hot spots).

Three lines of research suggest potential uncoupling forces. The fear of crime literature indicates that enhancing people's perception of safety may reduce depression, stress, and avoidance behavior that are detrimental to health because of living with high levels of violence.¹⁵ From a social disorganization perspective, cultivating collective efficacy among local residents creates a sense of active engagement in healthy lifestyles and informal social control of disorderly and health-compromising behaviors.¹⁶ Moreover, improving police legitimacy at crime hot spots may be fundamental to addressing the root causes of community problems (including health challenges) through collaborative efforts.^{17,18}

To understand whether and how place-based interventions targeting micro-geographic places can help reduce the undesirable co-occurrence of violence and ill health, the authors set out to address 2 research questions: First, does the co-occurrence persist after adjusting for shared selection factors at micro-geographic locations? Second, what are the mediating mechanisms between living at violent crime hot spots and deteriorated health? In other words, through what mechanisms

may public health and other interventions break the association?

METHODS

Study Sample

This study used survey data from 2,724 respondents living on 328 street segments that were categorized as violent crime hot spots (181 segments with 1,532 respondents) or non-hot spots (147 segments with 1,192 respondents) in 2013–2014 in Baltimore, Maryland. A street segment was defined as both sides of the street between 2 intersections.^{8,19} Street segment types were based on 2012 Baltimore Police Department calls-for-service data. The threshold for a violent crime hot spot was ≥ 17 violent crime calls in 2012, corresponding to the top 3% of violent crime segments in the city. Non-hot spot or comparison segments included all streets that did not meet the above threshold as well as falling below a threshold of 16 drug-related calls (the threshold for a drug crime hot spot in the parent study; Appendix A online provides further details).

To be eligible for participation, a street segment must have had at least 20 occupied residences because the study targeted for interview a minimum of 7 respondents on each street segment. To reduce spatial dependency, street segments could not be contiguous (Figure 1). Face-to-face surveys were then carried out at a random sample of residences on the sampled streets. After accounting for abandoned housing, the contact rate was 71.2%. The cooperation rate was 60.5%, which is above average for door-to-door surveying.²⁰ Surveys took an average of 20 minutes and respondents were given \$15 for their participation. An average of 8 surveys were completed on each street (6 minimum and 14 maximum). The study was approved by the IRB of George Mason University.

Measures

The key treatment or exposure variable was violent crime hot spots (1) versus non-hot spots (0). Four general health outcomes were examined. General perception of personal health was measured by a single item: *Would you say your personal health is...* with responses ranging from *very poor* (1), *poor* (2), *average* (3), *good* (4), to *very good* (5). Previous research has documented the validity of this measure of self-rated health.^{21,22} Health limitations were measured by a 7-item scale, asking the respondents if health issues limited their ability to conduct a variety of daily activities (Appendix B online provides technical details). Health problems were measured by asking the respondents: *Do you think you have any health problems that have resulted from living on your current block?* The answer *yes* was coded 1; *no* was coded 0. Hospitalization because of an illness or injury in the past year was measured by an indicator variable with *yes* coded 1 and *no* coded 0.

Informed by existing literature, the authors focused on 3 mediating or intervening variables. Perception of safety was measured by a 7-item scale, capturing the respondents' feelings of safety living on their current block. Collective efficacy was measured by a 12-item scale, tapping social cohesion and willingness to intervene against problems on the block.²³ Police legitimacy was measured by a 6-item scale, tapping the respondents' attitudes about police procedural justice on their block. In addition, 40 covariates were included in a propensity score analysis to adjust for self-selection

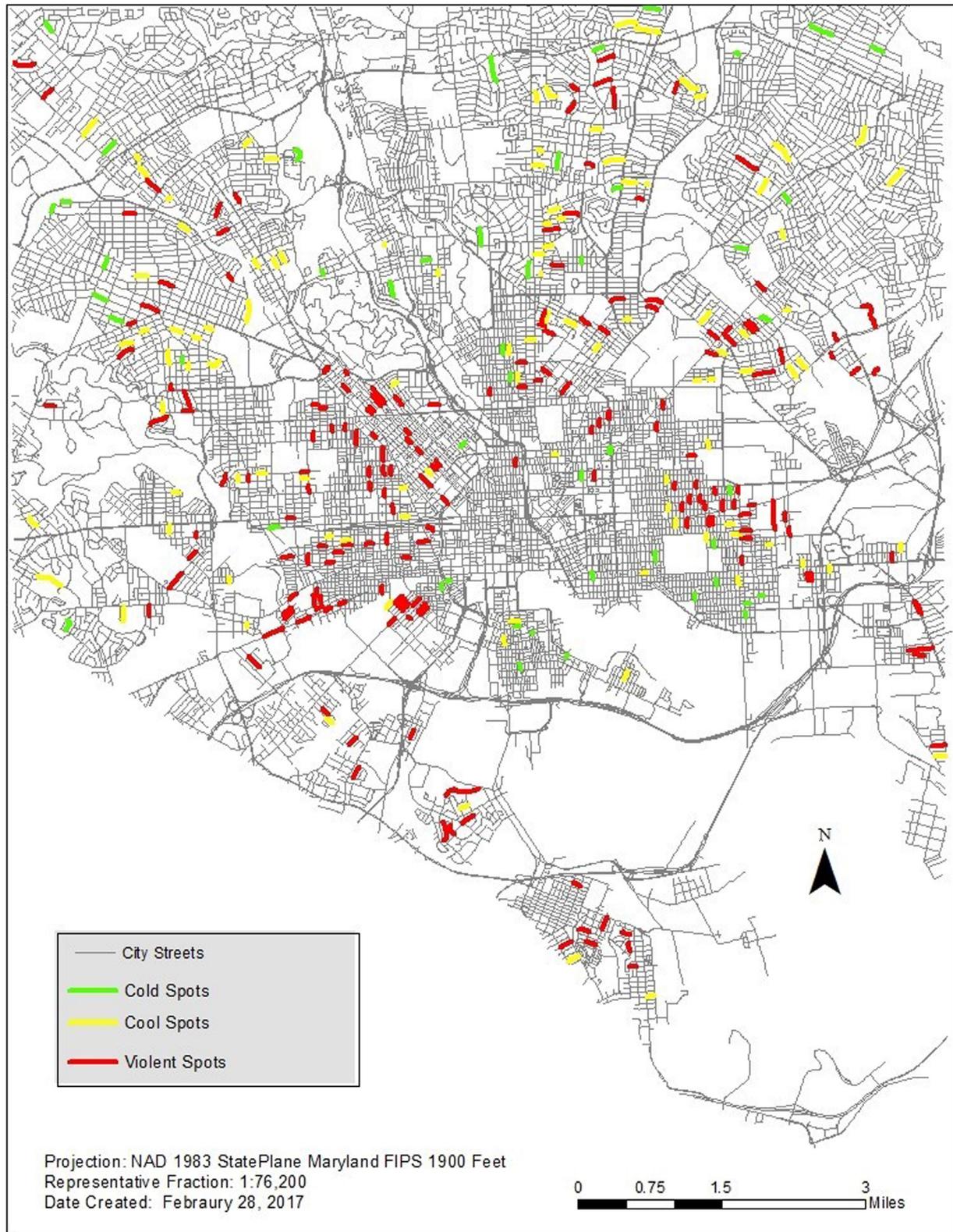


Figure 1. Geography of sampled street segments in Baltimore, Maryland.

into both violent crime hot spots and poor health (Appendix D, available online).

Statistical Analysis

First, the authors presented descriptive information and conducted unadjusted comparisons of key demographic characteristics and health outcomes across violent crime hot spots versus non-hot spots. Second, propensity score analysis was performed to adjust for selection bias and assess whether health outcomes remained different across street segment types after adjustment. Linear and logistic regressions were used, respectively, for continuous and binary outcomes with weighted data. Robust SEs were used to adjust for clustering of respondents on the street. As robustness checks, these relationships were examined including a spatial lag term of violent crime counts, respectively, at 3,000 feet and 5,000 feet, adjusting for possible spatial autocorrelation effects of nearby areas. The same substantive findings were observed. For clarity, the results were reported without the spatial lag term. Third, the authors dichotomized each intervening variable at its median and used marginal structural models to estimate the proportion of total effects mediated by each intervening mechanism (i.e., each intervening mechanism was a separate model).^{24,25} The interpretation is straightforward: if violent crime hot spots had at least a median level of perceptions of safety, collective efficacy, or police legitimacy across all street segments, would those associations become weaker and to what extent? The Monte Carlo method for assessing mediation was used to construct CIs for indirect effects (Appendix C online provides technical details).^{26,27} Statistical testing was two-sided with a threshold of $p < 0.05$. Analyses were conducted in 2019 with Stata, version 15.1 and R, version 3.5.1.

RESULTS

Table 1 presents descriptive information on key demographic characteristics and health outcomes across violent crime hot spots versus non-hot spots. Before adjusting for selection bias, individuals surveyed at hot

spots were more likely to be female, African American, unemployed and without a high school diploma, and have a household income $< \$25,000$. Individuals surveyed at hot spots also reported a lower level of self-rated general health (3.82 vs 4.02) and higher levels of health limitations (1.30 vs 1.18), health problems (5.7% vs 3.0%), and hospitalization because of an illness or injury (42.4% vs 36.0%) than those living at non-hot spots.

Table 2 reports the results from the propensity score analysis. As shown in Appendix D online, the 2 groups were well balanced on all observed covariates after weighting. In fully adjusted models, individuals surveyed in hot spots continued to have a lower level of self-rated general health ($b = -0.096$, 95% CI = $-0.176, -0.015$) and higher levels of health limitations ($b = 0.068$, 95% CI = $0.027, 0.109$) and health problems (OR = 2.026, 95% CI = $1.225, 3.349$). However, hospitalization because of an illness or injury (OR = 1.147, 95% CI = $0.953, 1.379$) was no longer statistically significant. Supplementary analysis indicated that adjusting for history of offending and drug use, in particular, may have led to this outcome.

Because the associations between living at violent crime hot spots and health outcomes persisted after adjustment for measured confounders, Table 3 reports the estimated regression coefficients and proportions of total effects mediated by distinct intervening mechanisms. In effect, having a median level of perception of safety on the block mediated $> 60\%$ of the total effect of violent crime hot spots on self-rated general health and health problems and 39% of the total effect of violent crime hot spots on health limitations. Having a median level of collective efficacy mediated 42% of the total effect of violent crime hot spots on health problems, and reaching a median level of police legitimacy mediated

Table 1. Descriptive Statistics for Key Demographic Characteristics and Health Outcomes by Street Segment Type

Variables	n	Non-hot spot: Mean (SD) or %	Violent crime hot spot: Mean (SD) or %	Diff
Demographic characteristics				
Age	2,686	44.69 (15.89)	43.92 (15.25)	$p = 0.200$
Male	2,678	43.7	39.0	$p = 0.015^*$
African American	2,682	64.7	77.7	$p < 0.001^{***}$
Below high school education	2,719	13.6	22.8	$p < 0.001^{***}$
Unemployed	2,718	24.9	38.3	$p < 0.001^{***}$
Household income below \$25,000	1,999	33.4	61.1	$p < 0.001^{***}$
Health measures				
Self-perception of general health	2,718	4.02 (0.88)	3.82 (0.93)	$p < 0.001^{***}$
Health limitation	2,710	1.18 (0.39)	1.30 (0.52)	$p < 0.001^{***}$
Health problem	2,693	3.0	5.7	$p = 0.001^{**}$
Hospitalization because of illness/injury	2,711	36.0	42.4	$p < 0.001^{***}$

Source: Author's analysis of the survey data.

Note: Boldface indicates statistical significance ($*p < 0.05$; $**p < 0.01$; $***p < 0.001$).

Diff, statistical difference.

Table 2. Results From Propensity Score Analysis Comparing Health Outcomes Across Violent Crime Hot Spots vs Non–Hot Spots

Variable	Linear regression with weighted data		Logistic regression with weighted data	
	General health (b)	Health limitation (b)	Health problem (OR)	Hospitalization (OR)
Point estimate (CI)	-0.096 (-0.176, -0.015)	0.068 (0.027, 0.109)	2.026 (1.225, 3.349)	1.147 (0.953, 1.379)
p-value	0.020*	0.001**	0.006**	0.146

Source: Author’s analysis of the survey data.

Note: Boldface indicates statistical significance (*p<0.05; **p<0.01).

Table 3. Regression Coefficients and Proportion of Total Effects Mediated by Different Intervening Mechanisms

Model number	X → M	M (X) → Y	X (M) → Y	95% CI for indirect effects from Monte Carlo simulation (R=20,000)	% mediated
1	-0.621***	0.178***	-0.058	(-0.186, -0.049)	65.4%
2	-0.621***	-0.051*	0.051*	(0.005, 0.064)	38.5%
3	-0.621***	-1.506***	0.536	(0.517, 1.436)	63.5%
4	-0.517***	0.065	-0.074	(-0.087, 0.013)	n.s.
5	-0.517***	-0.015	0.070**	(-0.016, 0.034)	n.s.
6	-0.517***	-0.770**	0.554*	(0.142, 0.723)	41.8%
7	-0.388***	0.052	-0.116**	(-0.060, 0.014)	n.s.
8	-0.388***	-0.081***	0.064**	(0.011, 0.059)	33.0%
9	-0.388***	-1.025***	0.602*	(0.154, 0.709)	39.7%

Source: Author’s analysis of the survey data.

Note: X=violent crime hot spots vs non–hot spots. Model 1: M=perception of safety, Y=general health; Model 2: M=perception of safety, Y=health limitation; Model 3: M=perception of safety, Y=health problem; Model 4: M=collective efficacy, Y=general health; Model 5: M=collective efficacy, Y=health limitation; Model 6: M=collective efficacy, Y= health problem; Model 7: M=police legitimacy, Y=general health; Model 8: M=police legitimacy, Y= health limitation; Model 9: M=police legitimacy, Y= health problem. Boldface indicates statistical significance (*p<0.05; **p<0.01; ***p<0.001).

n.s., not significant.

33% and 40% of the total effect of violent crime hot spots on health limitations and problems that may have resulted from living on the current block, respectively.

DISCUSSION

Although the geographic distribution of ill health is determined by multifaceted factors and processes beyond crime and violence, the coupling of deteriorated health at violent crime hot spots is particularly devastating for local residents who suffer from both acute social problems in urban America. From a prevention science perspective, indicated or selective strategies are urgently needed to target micro-geographic locations with known increased risks, supplementing universal strategies applied to a broader community.²⁸

These results confirm the geographic overlap of violence and ill health at the street segment level. After adjusting for all observed covariates through propensity score analysis, the differences in self-perception of general health, health limitations, and health problems across street segment types persisted. Violent crime hot spots are

not simply places with a great deal of violent offending, but also places with evidence of strong social and health disadvantages.^{19,29} Prior research has shown this relationship at higher geographic levels (e.g., Census tracts or block groups), but the replication of the overlap at the micro-geographic level is crucial because indicated or selective interventions operate best at this level. Compared with community-level efforts, focused interventions allow for increased dosage, precision, and effectiveness.¹³

Both formal and informal place-based interventions targeting micro-geographic locations can be employed to reduce community violence and, consequently, mitigate the undesirable co-occurrence. As a formal social control mechanism, hot spots policing is consistently found effective in reducing crime and violence without simply displacing crime into areas immediately surrounding targeted locations.^{17,18,30} Meta-analyses suggest a modest but statistically significant overall diffusion of crime-control benefits.^{11,31} Given its efficacy in crime and violence reduction, hot spots policing is widely implemented by police agencies across the nation, providing opportunities for joined-up solutions that incorporate law enforcement

practices as an integral component of public health endeavor.³² Other established place-based interventions from a public health or social services perspective that confer protection against violence include making structural changes to the built environment, such as converting vacant land to green spaces or remediating abandoned buildings and houses.^{33–35} Again, crime seems not simply to move around the corner following these interventions, and spillover crime reduction effects have been reported in a few studies. Moreover, these place-based interventions bring about concurrent health benefits, such as improved mental and cardiovascular health.^{35–37}

This study identified 3 modifiable mediating mechanisms, whereby interventions may further break the link between living with violence and deteriorated health. In brief, living at violent crime hot spots is associated with lower perceptions of safety, collective efficacy, and police legitimacy, which, in turn, are associated with lower self-rated health and higher levels of health limitations and problems. Though perceived safety may be modestly correlated with objective measures of crime and violence, it is the insecure feelings that lead to avoidance behavior that affects individual daily activities and normative social interactions, thereby generating negative health consequences.^{15,38} Increased perception of safety also alleviates depression, chronic stress, and other mental health problems.^{39,40} Regarding health limitations, increased perception of safety may strengthen one's self-efficacy to overcome some of the difficulties associated with health issues in performing daily routines.⁴¹

Reaching a median level of collective efficacy weakened the association between living at hot spots and self-assessment of health problems. Collective efficacy emphasizes active engagement that translates social resources embedded in kinship, friendship, and acquaintanceship networks into informal social control mechanisms.²³ That is, collective efficacy may lead to a sense of health problem resolution through the social control of health-compromising behaviors (i.e., the regulatory effect) and cultivation of healthy lifestyles, effective management of physical environment, and better access to health services and amenities.¹⁶

Equally important is the mediating effect of police legitimacy on the relationship between living at hot spots and health limitations and problems. Building or rebuilding citizen perceptions of police legitimacy leads to a sense of improved life quality and willingness to comply with conventional and health-promoting norms and regulations.^{42,43} When local residents perceive police as fulfilling their duties in a fair and respectful way and caring about people on the block (rather than introducing prejudice, discrimination, and associated health risks against them), they may be willing to make

extra efforts to overcome health limitations and eventually reduce health problems.

Good police–community relationships also exploit a wide spectrum of resources and facilitate collaborative solutions to the root causes of community problems (including, but not limited to, health challenges). These joined-up interventions are most likely to succeed in a department that as a whole is making reforms to improve police–community relationships. Otherwise, the positive impacts made by special units of police officers working on collaborative missions could quickly be eroded if the rest of the police were engaged in aggressive enforcement tactics. Limiting the intrusion of law enforcement is another reason why such interventions should be targeted toward specific street segments or locations with the highest risk of violence.

Future research should develop and test strategies that are capable of enhancing the identified intervening mechanisms at violent crime hot spots. As a pilot effort, the authors developed an innovative program in Baltimore, pairing a police officer and social worker to visit crime hot spots as an attempt to connect residents to mental health services.⁴⁴ This program provides an example of a successful effort to scale down health programs to the micro-geographic place as well as the partnering of law enforcement with other social agencies. Not only did the team come across a high level of health needs among residents in these places, they were able to connect people to services, enhance safety and collective efficacy, and rebuild trust in the police. Other promising joined-up programs between public health and law enforcement agencies include the Cardiff violence prevention model and homicide review interventions.^{45–47}

Limitations

This study has several limitations. First, the measure of violent crime hot spots was drawn from official data produced by citizen calls to the police. Such data are vulnerable to reporting biases, for example, the (un)willingness of citizens to call the police. At the same time, such data have been used widely in the examination of crime and are more inclusive than crime incident data (which are filtered by the police who decide whether a crime actually occurred). Second, self-assessments of general health may be subject to potential errors associated with survey research and not reflect objective health status. Yet, perceptions of health are important to consider in the context of public health. Third, the data were cross-sectional and propensity score methods could only adjust for observed covariates. Unmeasured covariates such as genetic factors could potentially bias the estimates. Future longitudinal studies and, ideally, experimental or quasi-experimental designs would be better for inferring causality. Fourth, the

authors assessed home-based exposures in this study. Future research should explore contextual information along individuals' daily routines.^{48,49} Finally, the results were derived from a sample of urban residents in Baltimore, Maryland. Replication efforts are needed to establish the generalizability of the findings.

CONCLUSIONS

Residents living at crime hot spots are likely to suffer from multiple marginalities and are often disadvantaged and cannot move owing to lack of economic and social capital.⁵⁰ Indeed, the findings demonstrated the geographic overlap of violence and ill health at the street segment level, a spatial unit that is relatively unexplored in the context of health, and that the differences in self-rated general health, health limitations, and health problems across street segment types could not be explained away by measured confounding factors. This study adds new evidence showing that existing violence reduction efforts may be more efficacious in mitigating the undesirable co-occurrence of violence and ill health when simultaneously enhancing local residents' perceptions of safety, collective efficacy, and police legitimacy. These mechanisms provide insights into the complex relationship between violence and poor health while also providing avenues to strengthen collaborations between public health and law enforcement to address poor health at crime hot spots.

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SUPPLEMENTAL MATERIAL

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