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Neighborhood Interventions to Reduce Violence

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Keywords

neighborhood interventions, neighborhood environment, violence, crime, housing, urban blight, alcohol outlets, schools, built environment

Abstract

Violence is a widespread problem that affects the physical, mental, and social health of individuals and communities. Violence comes with an immense economic cost to its victims and society at large. Although violence interventions have traditionally targeted individuals, changes to the built environment in places where violence occurs show promise as practical, sustainable, and high-impact preventive measures. This review examines studies that use quasi-experimental or experimental designs to compare violence outcomes for treatment and control groups before and after a change is implemented in the built environment. The most consistent evidence exists in the realm of housing and blight remediation of buildings and land. Some evidence suggests that reducing alcohol availability, improving street connectivity, and providing green housing environments can reduce violent crimes. Finally, studies suggest that neither transit changes nor school openings affect community violence.

INTRODUCTION

Violence is a pervasive problem that undermines the physical, mental, and social health of individuals and communities in the United States and around the world (28, 57, 86). In the United States, during 2015, more than 18,000 people died from homicide, and more than 1.5 million people were victims of nonfatal violent assaults (20). Violence is clearly a health problem because victims experience physical injuries, premature death, and adverse health behaviors (7, 19, 73, 79). Violence is also clustered in time and space (13, 40). Exposure to violence may lead to the intergenerational transmission of violence, or a “cycle of violence” (87), where childhood experiences such as abuse and neglect can lead to later victimization, perpetration (2), or self-harm (30, 68). Violence-related outcomes also come with an enormous economic cost. As one example, gun violence, the leading form of fatal violence, is estimated to cost the United States more than \$48 billion in medical and work loss costs annually (35).

Violence has many antecedents, including high-risk behaviors and high-risk environments. Altering high-risk environments, the neighborhoods and places that perpetually surround victims of violence, presents an opportunity for creating practical, sustainable, and high-impact ways to reduce violence (13). Given that violence is highly concentrated in places (63, 85), it is important to find effective place-based solutions. Violence prevention efforts have traditionally targeted individuals; although these approaches are important for curbing individual violence rates, they require significant individual effort in order to be effective and may have a limited population impact (37). Interventions that change places to promote healthy behaviors may affect a broader population and may be more sustainable by changing the structures of places that enable violence to remain persistently high (14).

This review systematically examines the literature regarding place-based interventions that change neighborhood environments to prevent violence. First, we review neighborhood factors associated with violence. Then, we briefly discuss theories linking neighborhoods to violence. We then spend the bulk of the article reviewing studies of how changes to neighborhood environments have impacted violence. Finally, we give our perspective on unanswered questions and future areas of inquiry for this field.

NEIGHBORHOODS AND VIOLENCE

We define violence broadly as the “intentional use of physical force or power to threaten or harm others” (86, p. 5). Violence is often operationalized in research studies by reported crime, which is a legal term and involves categorization of certain acts, such as assault or homicide, as a violation of state criminal law statutes. Although we do consider studies that used reported violent crimes, we do not consider studies that focused solely on property crimes, drug offenses, or nuisance crimes.

Neighborhood Factors

We define the neighborhood environment as the physical and social attributes of a place (29). The physical environment can be conceptualized to include the built environment, natural spaces, and food and housing resources. The social environment encompasses local institutions and social connections between neighbors (76).

Neighborhood factors that can increase risk for violence include concentrated poverty, high population turnover rates, population density (crowded housing), and low levels of social cohesion. Low levels of social cohesion are indicative of social disorder and lack of collective efficacy, which are risk factors for violence (77). Physical disorder, vacant buildings, and vacant lots can influence

violence (15). Mortgage foreclosures and ensuing vacancy have been associated with increased violent crimes (26, 47, 59). High density of alcohol outlets and high drug availability increase the risk of firearm homicide (44).

Neighborhood protective factors have also been measured. A case-control study of adolescent homicide victims in Philadelphia found that the presence of street lighting, illuminated walk/don't walk signs, painted crosswalks, public transportation, parks, and maintained vacant lots were significantly associated with at least 76% decreased odds of a homicide (27). A similar case-control study of adolescent victims of gun assault found that the presence of tree canopy cover significantly reduced the odds of gun assault in high-risk neighborhoods by 31% (56). Neighborhood attachment (residents' feelings of attachment and belonging to their neighborhood) (4) and high collective efficacy (neighbors' ability to detect and intervene in antisocial behavior) are also associated with protection against violence (49).

Repeated exposure to violence or the threat of violence can result in chronic stress, which has detrimental physiologic effects that can impact long-term cardiovascular health (61, 66, 88). People who live in high-crime neighborhoods may suffer from chronic fear and vigilance even if they are not directly exposed to violent crime (75, 81). People who feel unsafe may reduce their physical activity and adopt maladaptive coping strategies such as substance use, may develop mental illness, or may withdraw from neighborhood social and civic life (5, 32, 33, 46, 71, 81, 91).

Theories Linking Neighborhoods and Violence

A number of theories attempt to explain how neighborhood environments influence violence. Many of these theories come from the field of criminology, which is focused on explaining all forms of crime and not just violent acts.

Routine activities, environmental design, and situational crime prevention. Routine activities theory characterizes crime as an opportunistic process: Motivated offenders recognize criminal opportunities during daily routine activities and act on them. The elements of opportunity for a crime to occur involve a “motivated offender” who encounters a “suitable target” in the absence of a “capable guardian” (24, p. 590). Situational crime prevention (23) and crime prevention through environmental design (50, 67) draw on mechanisms outlined in routine activities theory and suggest that features of the built environment make areas more or less attractive to would-be offenders by affecting natural surveillance, access control, target hardening (e.g., installing security measures), and signs of territoriality (25). Environmental criminology also draws on these ideas (84) and emphasizes the fact that committed crimes occur only when appropriate opportunities are presented to motivated offenders. Manipulating the elements of crime opportunity could then be a strategy to prevent crime and violence from occurring (23).

Even in the presence of motivated offenders, neighborhood interventions could change routine activities of those who live or frequent an area, thereby influencing the supply of suitable targets and capable guardians. For example, people may walk, run, or bike in and around improved areas because they feel less fear, which increases the supply of potential witnesses and guardians. Offenders may choose to avoid a newly greened area because they no longer feel capable of committing a crime in that space without being detected (16).

Broken windows theory. Broken windows theory (52) also suggests that disordered and disinvested urban environments promote criminal activity by sending signals to offenders that an area lacks effective social control. Broken windows theory argues that physical signs of disorder promote crime and violence because blighted urban environments erode a sense of mutual regard

among residents and passersby, signaling that a space is inadequately watched over and that illegal activity will be tolerated (51, 52). Therefore, neighborhood interventions that, in effect, repair broken window elements may contribute to “defensible space,” indicating care for and surveillance of a space, which could reduce opportunities for violence and crime (67, 69, 83).

INTERVENTIONS TO THE NEIGHBORHOOD ENVIRONMENT

A review conducted 15 years ago provided a general overview of ways in which the built environment was associated with crime and violence prevention (63). However, given that the body of science at the time relied heavily on cross-sectional research, questions remained about the actual impact of interventions to the built environment on reducing violence. The present review focuses on studies that have a before-and-after comparison of a change in the built environment, most with a control group. We do not evaluate cross-sectional studies because they do not allow one to examine the change in violence as a result of the change to the built environment. Rather, they examine average differences between treatment and comparison groups with the assumption that, conditional on covariates, the two would have similar outcomes. As a result, they cannot rule out omitted variables or selection bias and the potential impact of historical effects that happen to the treatment group and not the control group. Study designs that rely on a before-and-after approach and a control group can control for common historical effects.

Most commonly, scientists have used quasi-experimental methods or natural experiments to mimic studies in which groups are randomly assigned to treatment and control conditions. These methods often take advantage of changes in policies or procedures that may be randomly assigned, although not by the investigators themselves. Although randomized controlled trials provide a better scientific standard, they are rare owing to a number of challenges, including a lack of sufficient funding and the logistical difficulties of randomly assigning environmental changes. We use the term intervention broadly to include both designed physical environment interventions, as well as changes that occurred and were studied using a natural experiment approach. We evaluate interventions that involve housing, land use and zoning, alcohol outlets, blight remediation, transportation and mobility, greening, and schools. We do not discuss police interventions; Braga & Weisburd (9) provide a comprehensive analysis of the relationship between policing and violence prevention. Studied interventions of neighborhood environments and their association with violence outcomes, and a brief summary of findings, are listed in **Table 1**. The previous review (63) was able to draw from early experimental studies and peer-reviewed published journal articles; however, the number of intervention studies, shown in **Table 1**, has increased in recent years. These intervention studies are discussed below.

Housing

High-rise public housing. Large-scale public housing was constructed in major cities beginning in the 1950s and is considered the most significant urban planning disaster of the twentieth century. These high-density developments, while providing housing, served to isolate poverty (39) and drug and violent crimes (31). In this article, we consider studies of change in violence at locations that experience a physical landscape change, rather than studies of change in violence due to policies that moved residents.

A general effort to deconcentrate public housing began in the 1960s (43). Only a few studies have considered the impact of dismantling high-rise public housing on crime. Aliprantis & Hartley (1) used a case-crossover design to evaluate changes in crime rates after the demolition of 161 high-rise public housing units in Chicago. Using each unit as its own control, the study found a

Table 1 Interventions and findings of quasi-experimental studies of neighborhood environments and violence outcomes

| Citation | Location ^a | Study period | Study design | Intervention ^b | Control | Findings |
|----------------------------|-----------------------------------|--------------|--------------------|---|--|---|
| Housing | | | | | | |
| Aliprantis & Hartley (1) | Chicago, IL, USA | 1990–2011 | Prepost comparison | Closure and demolition of 180 high-rise public housing buildings | None | Significant decrease in homicides around demolitions |
| Santiago et al. (78) | Denver, CO, USA | 1992–1995 | Prepost comparison | 38 dispersed public housing developments opening in Denver | None | Decrease in total crimes near dispersed housing sites, compared with citywide |
| Freedman & Owens (36) | USA | 1987–2007 | Prepost comparison | 29,870 LIHTC-subsidized rental housing developments (new construction and rehabilitation) placed in service | None | Decrease in robbery and assaults at the county level |
| Woo & Joh (89) | Austin, TX, USA | 2000–2009 | Quasi-experimental | 20 LIHTC-funded low-income rental housing developments | Remaining areas in census tracts | Nonsignificant decrease in total crime rate near LIHTC impact areas |
| Land use and zoning | | | | | | |
| Anderson et al. (3) | Los Angeles, CA, USA | 2006–2008 | Quasi-experimental | 361 parcels located on 205 blocks that changed zoning designations | Blocks that did not change zoning designation | Substantial neighborhood decrease in total crime. Effect influenced mostly by reductions in theft from automobiles and stolen cars |
| Masho et al. (64) | Richmond, VA, USA | 2003 | Quasi-experimental | Policy in place for 6 months that restricted sale of off-premise ETOH; limited it to 6 or 12 packs of beer and not single-serve 22- or 40-oz beer | Similar census tracts without restriction | No change in control group from pre- to post intervention; in intervention group there was a drop in pickups, which rebounded after policy was reversed |
| Heaton (42) | 11 cities and counties in VA, USA | 2004–2008 | Quasi-experimental | Blue law repeals for expanded liquor sales on Sundays | Crimes on days except Sunday; VA jurisdictions with no repeals | Significant increases in minor crimes (5%) and alcohol-related serious crimes (10%), no effect on domestic violence |

(Continued)

Table 1 (Continued)

| Citation | Location ^a | Study period | Study design | Intervention ^b | Control | Findings |
|---------------------------|---|--------------|---------------------------|---|---|---|
| Han et al. (41) | PA, USA | 2003–2011 | Quasi-experimental | 25 outlets affected by the blue law repeal | 69 outlets never allowed to sell on Sundays | Significant average increase in total crimes of 0.035 incidents within one-eighth of a mile of affected outlets |
| Holder (45) | 3 communities in CA and SC, USA | 1992–1996 | Efficacy prevention trial | Neighborhood preventive programs involving community mobilization, limited alcohol availability and access, and increased enforcement in 3 control-matched intervention communities | 1 unspecified community | Significant 2% reduction in incidents of hospitalization due to violent assault related to alcohol and other outcomes related to alcohol consumption and injury |
| Blight remediation | | | | | | |
| Spader et al. (80) | Cleveland, OH; Chicago, IL; Denver, CO, USA | 2008–2013 | Quasi-experimental | Neighborhood Stabilization Program-funded vacant property mitigations | Between 250 and 354 feet from properties | Significant reduction in property crimes and no change in violent crimes |
| Kondo et al. (54) | Philadelphia, PA, USA | 2011–2013 | Quasi-experimental | Vacant buildings that complied with the doors and windows ordinance or filed for renovation permit | Noncompliant vacant building | Significant reductions in gun assaults, assaults, nuisance crimes |
| Branas et al. (10) | Philadelphia, PA, USA | 1999–2008 | Quasi-experimental | 4,436 cleaned and greened vacant lots in Philadelphia between 1999 and 2008 | Untreated vacant lots | Significant reductions around greened vacant lots in gun assaults across the city and in vandalism in 1 section of the city |
| Kondo et al. (52) | Youngstown, OH, USA | 2011–2014 | Quasi-experimental | 244 vacant lots that were either contractor cleaned-and-greened or greened by community members | Untreated vacant lots | Significant reductions in burglaries around stabilization lots and in assaults around community reuse lots; significant increases in motor vehicle thefts around both types of lots |

(Continued)

Table 1 (Continued)

| Citation | Location ^a | Study period | Study design | Intervention ^b | Control | Findings |
|------------------------------------|-----------------------|--------------|--------------------|---|--|---|
| Garvin et al. (38) | Philadelphia, PA, USA | 2011 | Quasi-experimental | A vacant lot cluster in Philadelphia cleaned and greened in 2011 | Untreated vacant lots | Nonsignificant decrease in total crimes and gun assaults around greened vacant lots; people around the intervention vacant lots reported feeling significantly safer after greening |
| Transportation and mobility | | | | | | |
| Phillips & Sandler (70) | Washington, DC, USA | 2011–2013 | Quasi-experimental | 4,897 station-hour closures | Stations on same lines that did not close | Crime rates decreased by 5% at the stations located on the same line as the closed station |
| Billings et al. (6) | Charlotte, NC, USA | 1998–2008 | Quasi-experimental | 26 new light rail stations | Proposed light rail stations | No statistical difference in violent crimes |
| Poister (72) | Atlanta, GA, USA | 1993 | Prepost comparison | 2 transit station openings | None | Temporary increase in reported crimes after station opening, followed by a decline to the preintervention levels |
| Cerdá et al. (22) | Medellin, Columbia | 1999 | Quasi-experimental | New gondola system with 25 station openings in 1999 | Districts that did not receive system | 66% decline in the homicide rate, 75% decline in residential reports of violence following the introduction of the new transit system |
| Ridgeway & MacDonald (74) | Los Angeles, CA, USA | 1990–2012 | Quasi-experimental | New rail stations in 281 districts; transit strikes between 1990 and 2012 | Areas that could have had station openings; stations that were not affected by transit strikes | No statistical difference in violent crimes |
| Weber (84) | Milwaukee, WI, USA | 2005–2008 | Prepost comparison | Safe-ride program | None | Violent and nonviolent crimes decreased by 14% |

(Continued)

Table 1 (Continued)

| Citation | Location ^a | Study period | Study design | Intervention ^b | Control | Findings |
|------------------------|-----------------------|--------------|------------------------------|---|--|--|
| Zavoski et al. (91) | Hartford, CT, USA | Not given | Quasi-experimental | Street barrier construction | Adjacent streets with no barrier | 33% decline in violent crime incidents on the intervention street and 50% decline on adjacent streets |
| Lasley (60) | Los Angeles, CA, USA | 1990–1991 | Multiple prepost comparisons | New traffic barriers in 14 streets | None | Violent crimes in the intervention area decreased by 20% in 1990 and 14% in 1991 relative to 1989 |
| Ceccato & Haining (21) | Sweden and Denmark | 1998–2001 | Prepost comparison | New four-lane motorway and two-way rail bridge | None | No statistical difference in violent crimes |
| Greening | | | | | | |
| Kuo & Sullivan (58) | Chicago, IL, USA | Not given | Quasi-experimental | Random assignment to live in 18 public housing blocks with public green space | Public housing without green space | Women living in the greener housing blocks experienced less mental fatigue and less self-reported intimate partner violence and aggression |
| Kondo et al. (55) | Philadelphia, PA, USA | 2000–2011 | Quasi-experimental | 52 GSI installations | Wait-list sites with no GSI | No statistical difference in violent crimes |
| Schools | | | | | | |
| MacDonald et al. (62) | Philadelphia, PA, USA | 1998–2010 | Quasi-experimental | 63 charter school and 33 public school openings | Existing schools | Statistically significant 18% decline in the predicted crime counts within one-tenth of a mile of new public schools |
| Brinig & Garnett (17) | Chicago, IL, USA | 1990–1996 | Quasi-experimental | 39 school closures between 1990 and 1996 | Areas with no school closures | Police beats that experienced a Catholic school closure had a slower decline in crime relative to the police beats with no closures |
| Brinig & Garnett (18) | Chicago, IL, USA | 1999–2005 | Quasi-experimental | Catholic school closures and charter school openings | Catholic schools replaced by charter schools | Crime declined more slowly around Catholic school closures; no difference around charter school openings |

^aUS abbreviations: CA, California; CO, Colorado; CT, Connecticut; DC, District of Columbia; GA, Georgia; IL, Illinois; NC, North Carolina; OH, Ohio; PA, Pennsylvania; SC, South Carolina; TX, Texas; VA, Virginia; WI, Wisconsin.

^bOther abbreviations: ETOH, ethyl alcohol; GSI, green stormwater infrastructure; LITHC, low-income housing tax credit.

statistically significant 4.4% decrease in homicides at the units' locations after demolition. The authors also measured the change in crime at locations to which residents moved, and they found some increase in crime rates. However, this increase was much smaller than the decrease in violent crimes seen in the units' locations, suggesting that the removal of the public housing units had a larger effect on violent crimes than did resident displacement.

Scattered-site housing. Along with dismantling public housing high rises, agencies have replaced the former public housing strategy with voucher programs to subsidize rent in privately owned housing, scattered-site low-density public housing, or subsidized private affordable housing. Such housing developments can be controversial within receiving communities in part owing to a perception that they will increase crime. Three studies have shown that an increase in affordable housing units does not come with an increase in crime.

Santiago et al. (78) evaluated changes in neighborhood crime rates in census tracts where 38 dispersed public housing units were constructed between 1992 and 1995 in Denver, Colorado. They found that, compared with preconstruction crime levels, there was a significant decrease in total crimes of 0.41 incidents per 100 residents after construction of scattered-site public housing units. This study had no control group, however, so it is unclear if the observed reduction in crime levels was due to a historical effect that occurred in Denver in general and not just in the areas that received dispersed public housing units.

Freedman & Owens (36) examined the Federal Low-Income Housing Tax Credit (LIHTC) program, which have subsidized affordable housing units in the United States since 1986. The authors examined changes in crime rates in counties surrounding 29,870 LIHTC projects between 1987 and 2007. Variations in LIHTC program tax credits served as an exogenous source of variation in the intervention. The projects were almost equally new constructions and rehabilitations. The study found a 3% reduction in both assaults and robberies postconstruction.

Woo & Joh (89) used an adjusted interrupted-time series difference-in-differences approach to evaluate changes in crime around LIHTC sites in Austin, Texas, between 2000 and 2009. The authors evaluated changes in crime in micro neighborhoods within 2,000 feet of LIHTC sites. The remaining areas of census tracts that hosted each LIHTC site served as control locations. The analyses found statistically significant reductions in total crimes (0.51 incidents per 100 residents) and violent crimes (0.16 incidents per 100 residents), but treatment and control sites failed the parallel trend assumption test. Therefore, whether the results are not due to preexisting changes already occurring in the LIHTC sites is unclear.

Land Use and Zoning

In the United States, early-twentieth-century urban planners began using zoning laws to separate land uses, untangling residential from industrial and commercial areas. However, Jacobs's *The Death and Life of Great American Cities* (48) signaled the beginning of a movement to value and reintroduce the mixing of land uses to promote public life, build social connections, and deter crime. However, very few studies have used methods capable of detecting anything beyond association between land-use patterns and crime or violence.

The city of Los Angeles enacted zoning changes (primarily introduction of residential zoning) in a number of its neighborhoods between 2006 and 2010. Anderson et al. (3) conducted a quasi-experimental study that examined changes in crime rates within neighborhoods that experienced zoning changes, compared with neighborhoods that did not. They found that zoning change was associated with a relative 7% reduction in overall crime. However, only policy changes, not actual land-use changes, served as the intervention.

Alcohol consumption is associated with firearm violence (12). Alcohol outlets can facilitate an increased density of individuals participating in excess alcohol consumption, thereby increasing the number of motivated offenders or individuals vulnerable to victimization. Presence and density of alcohol outlets are thought to be determinants of crime and violence. Numerous studies have established the relationship between alcohol outlet density and assaults (including intimate partner violence) (11, 65). A number of different intervention-based approaches have been taken to reduce alcohol availability and related violence. Four quasi-experimental studies examined changes in crime or violence associated with changes in alcohol availability.

License restrictions are one method of reducing alcohol availability. The City of Richmond enacted temporary license restrictions in 2003 to require convenience grocery stores to stop selling 40- and 22-oz bottles of beer. Masho et al. (64) compared 18 stores located in census tracts that were subject to the license restriction with stores located in demographically similar census tracts that were not subject to the restriction. Among 15- to 24-year olds, they found a significant relative decline in intentional injury-related ambulance trips, from 19.6 to 0 (per 1,000) in treated tracts. The study also showed that intentional injury-related ambulance trips in treated tracts increased to 11.4 per 1,000 following the reversal of the licensing requirements after 6 months of enforcement.

Jurisdictions can limit alcohol availability by restricting parameters of sales. For example, a number of states have what are called “blue laws,” which enforce religious standards. Blue laws often restrict sales of alcohol on Sundays. States or smaller jurisdictions have been repealing or modifying these blue laws. Heaton (42) conducted a quasi-experimental study of changes in crime levels at the jurisdiction level in response to blue law repeals in 11 cities and counties between 2004 and 2008 in Virginia. The study found that the repeals led to a significant 5% increase in minor crimes and a 10% increase in alcohol-related serious crimes (including assault and crimes involving weapons). However, the study could not describe local dynamics of crime changes.

A subsequent study evaluated blue law repeals using a more refined geographic analysis. In 2003–2005, the State of Pennsylvania partly repealed state blue laws that allowed alcohol sales on Sundays. Prior to 2003, all state-run alcohol outlets were banned from selling alcohol on Sundays, whereas only 10% and 25% of state-run outlets in 2003 and 2005, respectively, were allowed to open on Sundays. Han et al. (41) conducted a prepost quasi-experimental study comparing changes in crimes around 25 outlets affected by the blue law repeal and 69 control outlets that were never allowed to sell on Sundays. The authors also examined changes in crimes on Sundays compared with other days of the week after the repeal. The study did not find significant effects on violent crimes but did find that the repeal was associated with a significant average increase in total crimes of 0.035 incidents within one-eighth miles of affected outlets, mostly driven by an increase in total crime in outlets located in lower socioeconomic neighborhoods.

Holder et al. (45) conducted a longitudinal multiple time series evaluation of alcohol-related injuries in three matched intervention communities in California and South Carolina over a five-year period. The intervention consisted of neighborhood preventive programs that involved community mobilization, limits on alcohol availability, and increased enforcement of drinking-and-driving laws. Although the interventions were all different and the study was underpowered, findings indicated that the interventions led to a statistically significant 2% reduction in incidents of hospitalization due to violent assault related to alcohol use, as well as other outcomes related to alcohol consumption and injury.

Blight Remediation

Since the 1950s, postindustrial cities have experienced rapid declines in manufacturing jobs, which have contributed to significant population decline and a large increase in the number of vacant

properties. For example, in 2010, Philadelphia, Pennsylvania, had more than 40,000 vacant properties, many of which contained structures. A number of initiatives aimed at reducing violence have mitigated these properties, for example by demolishing structures, removing trash and debris, or by planting and maintaining vegetation.

Abandoned housing mitigation. The cities of Cleveland, Chicago, and Denver have each used the federal Neighborhood Stabilization Program (NSP) to rehabilitate or demolish foreclosed and vacant properties. Spader et al. (80) used a difference-in-differences approach to compare changes in crimes within 250 feet of 1,468 intervention properties with crimes in control areas between 2009 and 2013. Although the study found that property demolition resulted in statistically significant decreases in property crimes, it did not find any significant changes in violent crimes. However, these findings are limited by a small sample of rehabilitated properties.

In 2011, the City of Philadelphia began enforcing a Doors and Windows Ordinance that required owners of abandoned buildings to install secure doors and windows on all structural openings. Kondo et al. (54) used a difference-in-differences approach to examine the impact of compliance with this ordinance on crime. The study compared the change in density of crimes between 2011 and 2014 around 676 properties that were remediated to comply with the ordinance with control properties that were not remediated. The study found that housing remediations were significantly associated with up to a 4% relative reduction in total crimes, assaults, and gun assaults. Housing remediations were also significantly associated with an 8% relative reduction in violent gun crimes in one city section.

Vacant lot greening. In some locations, the majority of vacant properties are abandoned lots that do not contain structures. One intervention for vacant spaces that has gained momentum by researchers, municipalities, and their constituents is cleaning and greening (10). A number of studies have investigated the relationship between vacant lot greening and crime.

Branas et al. (10) conducted a quasi-experimental study of the association between vacant lot greening and violence outcomes. This study evaluated changes in crime and health outcomes near 4,436 vacant lots that had been cleaned and greened between 1999 and 2008 compared with 13,308 control lots. They found an 8% statistically significant reduction in gun violence by greening vacant land. The cleaning and greening may have decreased opportunities for illegal activity, such as hiding guns, by removing uncontrolled growth of weeds and buildup of large trash items on vacant land.

A second quasi-experimental study of a vacant-lot greening program in Youngstown, Ohio, between 2011 and 2014 was conducted by Kondo et al. (53). This study examined the association between changes in crime around both 166 contractor-greened lots and 78 community reuse lots (primarily community gardens that were greened and maintained by community members) compared with about 959 control lots. The study found a significant reduction in property crimes around contractor-greened lots and a decrease in violent crimes around community reuse lots. Felony assaults decreased by as much as 27%.

Garvin et al. (38) conducted a pilot randomized-controlled trial of vacant lot greening in Philadelphia in 2011. They found a significant increase in perceptions of safety for residents living around vacant lots that were cleaned and greened compared with those living near vacant lots that were left blighted. They found a nonsignificant decrease in total crimes and gun assaults around greened vacant lots compared with control lots, but the study was not powered to find actual differences owing to the small number of case locations.

Transportation and Mobility

Public transit. Urban transportation systems, namely bus lines and rail lines, have long been subject to concern, owing to their potential role in crime and violence. The concern, in part, is that transportation systems, including transportation vehicles and stations, offer refuge to offenders and limited escape routes for potential victims (34). One way to examine the relationship between public transit and risk of crime is to evaluate changes in crime that occur with new service installation or during a service disruption. Five existing studies use quasi-experimental methods to examine the transit–crime relationship.

One study examined the impact of service disruptions on surrounding crime. Between 2011 and 2013, the Washington Metropolitan Area Transit Authority temporarily closed multiple train stations for a period of several consecutive days for renovation. Phillips & Sandler (70) used the variation in train service to estimate the effect of closures on crime rates in the areas immediately surrounding the stations. They considered total crimes, which included some violent crimes. The study demonstrated that following a closure, crime rates decreased by 5% within one-quarter of a mile of stations located on the same line as the closed station. The study also found that crime levels decreased the most in areas within one-quarter of a mile of the closed station and at stations where a few juveniles had been arrested in the past, which suggests that crime was mostly being imported to these locations by transit.

Four studies examined impacts of new transit system station openings on crime. Billings et al. (6) conducted a controlled prepost study of crime within 1.5 miles of 26 new light rail stations compared with crime around 26 proposed stations in Charlotte, North Carolina. Crime outcomes included reported property crimes and violent crimes (including assault, arson, homicide, rape, and robbery). Difference-in-differences estimations controlling for population density, demographics, transit usage, and preexisting crime levels were not statistically different on the basis of actual opening, and there was a relative significant decrease in property crimes around transit stations after announced openings.

In June 1993, the Metropolitan Atlanta Rapid Transit Authority opened two new rail transit stations. Poister (72) used time series analysis to evaluate changes in the criminal incidents in areas located within one mile of two new stations during the first 15 months after opening. Findings indicated a temporary increase in reported crimes at the time that the new stations began operating, followed by a decline to the preintervention levels. However, the study was underpowered and effect sizes were small, which suggests little if any effect.

The Latin American city of Medellín, Columbia, constructed a cable-propelled gondola system connecting the city center with low-income neighborhoods in 1999. Cerdá et al. (22) conducted a quasi-experimental study, comparing crime rates in 25 districts that received the gondola system with 23 comparable districts that did not. The study found that the intervention led to a 66% decline in homicides in treatment districts relative to control districts. They also concluded that residential reports of violence decreased by 75% in treatment districts following the introduction of the new transit system.

Ridgeway & MacDonald (74) used a prepost quasi-experimental design to estimate the effect of transit station openings and service disruptions in Los Angeles between 1990 and 2012 on crimes in 281 reporting districts. Violent crimes included in the study were aggravated assault, homicide, and robbery. During the study period, the Los Angeles County Metro Rail system opened and grew to incorporate six commuter lines, and two service disruptions (due to transit strikes) occurred. The authors found no evidence that transit station openings or disruptions resulted in changes in crime within surrounding areas.

Safe-ride programs. Another mechanism of the relationship between public transportation and crime involves safe-ride programs. For example, the University of Wisconsin-Milwaukee operated a program that provided students and staff with nightly transportation services to destinations within 1.5 miles of campus. Using variation in operating business hours between 2005 and 2008, Weber (84) examined the hourly impact of the safe-ride program on crime levels in affected areas. He found that crime levels decreased by approximately 14%. Heterogeneity analyses implied that the impact was largest and most significant during peak-crime hours, affecting both violent and nonviolent crimes.

Street patterns and connectivity. Outside of the public transportation system, the configuration of transportation routes for private vehicles could influence crime. For example, violent crimes tend to occur more on streets that are more accessible (8, 82). One study by Zavoski et al. (90) evaluated the impact of a single street barrier constructed by the Hartford Housing Authority in response to a drive-by shooting that wounded four teenagers near a large housing project. The study compared levels of crime incidents during the 15 months before and after the introduction of the street barrier. Though the study was underpowered, findings indicated a 33% decline in violent crime incidents on the intervention street and a 50% decline on adjacent streets. However, this study had no control group.

In 1990, the Los Angeles Police Department implemented Operation Cul-de-Sac, which installed permanent traffic barriers in 14 streets in Los Angeles between 1990 and 1991. The program aimed to reduce drive-by shootings between rival gangs. Lasley (60) evaluated the impact of the program on various crime measures and found that the overall violent crime levels (assault and murder) in the intervention area decreased by 20% in 1990 and 14% in 1991 relative to 1989, with no clear evidence of displacement to contiguous neighborhoods. Rates of violent crime returned to preintervention levels when the traffic barriers were removed.

A four-lane motorway and two-way track railway bridge were completed in 2000 to improve transportation between Sweden and Denmark. Using variation in incidents of crime between 1998 and 2001, Ceccato & Haining (21) compared crime levels before and after 2000. They found that crime levels did not change significantly after the bridge completion.

Greening

Cities are implementing greening programs as a means to promote environmental sustainability and social and economic development. Numerous studies have established an association between exposure to green space and public health, but few have evaluated interventions and few have specifically examined violence-related outcomes.

Kuo & Sullivan (58) conducted an early natural experiment of 145 women randomly assigned to live in 1 of 18 architecturally identical public housing blocks. The outdoor common spaces surrounding each block varied in terms of the presence of vegetation. The study found that women living in the greener housing blocks experienced less mental fatigue and less self-reported intimate partner violence and aggression.

Many cities with combined sewer systems are replacing paved gray surfaces with pervious vegetated cover. Some of these interventions are occurring in blighted spaces and represent a drastic change in landscape that could have relevance for community violence. Kondo et al. (55) conducted a quasi-experimental study of the effects of green stormwater infrastructure installation in Philadelphia between years 2000 and 2011 on crime. The study did not find any significant effects on violent crimes but did find reduced narcotics possession arrests around greened sites compared with control locations.

Schools

Changes to schools can change social presence and activity within communities, which can impact violence. Schools may influence violence because they alter the supply of potential offenders, victims, and available guardians.

MacDonald and colleagues (62) evaluated the effect of the opening of 59 charter schools and 24 public schools on crime in the surrounding neighborhoods. The authors used a difference-in-differences strategy to compare rates of overall crime and violent crime around schools before and after a school opening. They found that a public school opening led to a statistically significant 18% decline in the predicted total crime counts within a one-tenth-mile radius relative to the areas where a school was always present. No significant change was found for violent crimes.

Brinig & Garnett (17) evaluated changes in recorded incidents of crime surrounding Catholic school closures between 1990 and 1996 in Chicago. The authors found that police beats that experienced a Catholic school closure had a slower decline in crime relative to the police beats with no closures. In a separate analysis, Brinig & Garnett (18) compared changes in crimes surrounding Catholic schools that closed and Catholic schools that were replaced by charter schools. They found no change in crime rates surrounding charter school transitions, suggesting that Catholic school closure drove relative slower declines in crime. However, the design of these studies could not identify whether school closings or a shift in presence of school-age youth caused the change in crime. The decision-making process of school openings/closures is often influenced by community factors, meaning these studies may also have selection effects in their comparisons.

DISCUSSION

A small but growing number of studies have examined the effects of interventions in neighborhood environments on crime and violence. The most consistent evidence is in the realm of housing and blight remediation. Demolition of high-rise public housing, and provision of affordable scattered-site housing via new construction or rehabilitation, has reduced rates of homicide, assault, and violent crime in general in surrounding areas. A number of studies have also shown that, in poor or blighted environments, mitigating dilapidated housing through the remediation of open doors and windows and the cleaning and greening of vacant parcels can significantly decrease gun violence and other forms of violence.

There is sparse evaluation of other neighborhood interventions using quasi-experimental techniques. Some evidence suggests that reducing alcohol availability, reducing street connectivity, and providing green home environments can reduce violent crimes. A number of strong studies indicate that transit stations do not affect community violence, although a potential correlative link between the two has often been a community concern. Finally, there is no evidence that school openings change violent crime rates specifically; however, some evidence shows that school openings can reduce overall crime rates. Although displacement of violence could be at play in many of the studied interventions, it is either unaddressed or assessed through analysis of changes in violence in contiguous areas.

Research Challenges

Very few randomized controlled trials have been conducted to test the potentially causal effects of neighborhood interventions on violence, which could be due in part to the ethical, practical, and logistical challenges associated with social experimentation at a large scale. Quasi-experimental neighborhood intervention studies with well-selected control groups and well-specified models

provide alternative methods to estimate the impact of interventions with the built environment on violence as well as to potentially inform causal mechanisms. In addition, most studies that we examined relate to specific place-based interventions, where context played a role in both the intervention and the types of crimes or violence outcomes studied. The age and characteristics of housing stock and surrounding infrastructure, the socioeconomic forces that have shaped each geographic locality, will be different, and caution should be taken in trying to extrapolate study results to other contexts. Thus, knowledge of the context in which an intervention was evaluated is important for understanding effectiveness as conducted but also for understanding whether it could apply elsewhere.

Neighborhood environment interventions that target violence prevention, and their evaluation, require strong partnerships among a diverse set of actors, including municipalities, nonprofit organizations and community groups, academic institutions, and funders. Most of the literature reviewed does not mention the partnership building that was required to make the study possible. Determining the design, funding, analysis, and translation of neighborhood interventions aimed at reducing violence using an experimental approach requires a unique form of science that designs an intervention and evaluates its impact. It will also require greater mixed methods research, actively bringing in qualitative researchers such as anthropologists and ethnographers to better gauge mechanisms of action and inform later implementation efforts.

The study of neighborhood interventions on violence-related outcomes requires an applied science, where research questions arise from public health dilemmas and opportunities for intervention. Shared questions and research ventures, for example between multiple cities, could result in uncovering results that are generalizable to a broader set of contexts. Likewise, there is a need to share lessons regarding costs (and return on investment), ease of implementation, spillover effects, and long-term effects.

The science of neighborhood interventions does not come without ethical concerns. In some cases, randomization requires withholding, if temporarily, interventions that may have a positive effect. In addition, there may be both short- and long-term unquantified effects of interventions. For example, many low-resource communities are suspicious that neighborhood improvement projects may trigger displacement due to increased property values, taxes, and cost of living. These potentially negative effects, including unwanted gentrification, should also be actively evaluated. Yet, the science of neighborhood interventions could generate new knowledge of what works while providing support for implementation that might not otherwise happen in under-resourced communities. Investigators should exercise caution when deciding what, when, why, how, and who installs and receives the intervention.

More studies are needed that focus specifically on violence-related outcomes and their relationships to neighborhood environments. Crime records are systematically collected by many, if not most, municipalities; therefore, they provide a relatively simple secondary source of data for observational analyses. However, many violent crimes are not reported to the police. Measuring violence outcomes will require closer partnerships among researchers, medical systems, health providers, and emergency responders to provide a more complete picture of violence.

CONCLUSIONS

Neighborhood violence is a place-based problem that requires place-based solutions. An increasing number of quasi-experimental and experimental studies are verifying the positive impact of neighborhood changes and structural, scalable, and sustainable neighborhood interventions (14) on violence, especially in high-risk environments. Although the most consistent evidence exists in the realm of housing and blight remediation, there is opportunity for broader development of

implementation science to design and study these and other types of neighborhood interventions and their effects on violence.

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