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Review

Community violence and asthma
A review

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Key Messages

- Community violence exposure is associated with asthma incidence and exacerbation.
- Adverse associations are consistent across a growing body of epidemiologic research.
- Stress, behavior changes, and epigenetics likely all play a role in the associations between community violence exposure and asthma morbidity.
- Future research can disentangle respiratory effects of acute vs chronic community violence exposure and relevant spatial and temporal scales for both.
- Clinicians can consider violence exposure in screening practices, tailored asthma management plans, referral to support services, and patient education.

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ABSTRACT

Over the past 2 decades, epidemiologic studies have identified significant associations between exposure to violence, as a psychosocial stressor, and the incidence or exacerbation of asthma. Across diverse populations, study designs, and measures of community violence, researchers have consistently identified adverse associations. In this review, the published epidemiologic evidence is summarized with special attention to research published in the last 5 years and seminal papers. Hypothesized mechanisms for the direct effects of violence exposure and for how such exposure affects susceptibility to physical agents (eg, air pollution and extreme temperature) are discussed. These include stress-related pathways, behavioral mechanisms, and epigenetic mechanisms. Finally, clinical implications and recommendations are discussed.

Introduction

Since the early 2000s, a growing body of epidemiologic evidence has pointed to community violence exposure as a risk factor for asthma.[1-3] Community violence exposure, defined here as witnessing, hearing about, or being victimized by violent events at the community level (ie, levels of social organization beyond the household), can act as both an acute and chronic psychosocial stressor and increase the risk for asthma incidence and exacerbation.[4] This review sought to summarize the existing epidemiologic evidence on community violence exposure and asthma and to explore potential mechanisms with special attention to recent advances in the field.

The relationship between violence and asthma has been reviewed previously,[1,2,4-6] including 2 reviews in the past 5 years.[4,6] This review contributes to the literature on violence and asthma by focusing on community violence separately from other types of violence (eg, domestic violence) and exploring possible mechanisms of action beyond the psychosocial stress pathway, which most previous reviews emphasized. Finally, we provide a brief discussion of the clinical implications of the existing research and directions for future research.

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Although the text of this review focuses on seminal papers in the field and on recent studies, a comprehensive literature search was performed to summarize the predominant directions of effect across the body of literature. Details on the 43 included studies and search strategy can be found in eAppendix 1. Because very few (n = 4) studies included adult participants, this review will largely focus on studies of pediatric asthma, except where indicated.

Summary of Epidemiologic Literature

In 2001, in a case series published by Wright et al,[7] the authors discuss 4 children who presented to Boston-area hospitals with acute asthma episodes or new-onset wheeze after traumatic witnessing or experiencing of a violent event. The article called upon pediatricians to consider exposure to violence as a risk factor for asthma incidence. After the case series, a multi-city epidemiologic study by the same group reported an adverse association between witnessing community violence and asthma symptom days, even after adjustment for race and ethnicity, socioeconomic status, and other negative life events.[8] Since these early studies, researchers have consistently identified adverse associations between community violence exposure and asthma morbidity, mostly in children. The focus of this research has been largely in the contiguous United States[8-32] and Puerto Rico,[33-40] although reported adverse effects in Brazil[41-43] and South Africa[44] highlight that these associations are not unique to the United States and its territories. Figure 1 summarizes the directions of effect across the body of literature for pediatric asthma-related health outcomes with varying definitions of community violence exposure. Across diverse study designs, adverse associations are consistently reported.

Epidemiologic Study Designs

Most epidemiologic studies on community violence exposure and asthma morbidity have employed a cross-sectional design (n = 25 studies), thereby limiting any causal interpretation of associations

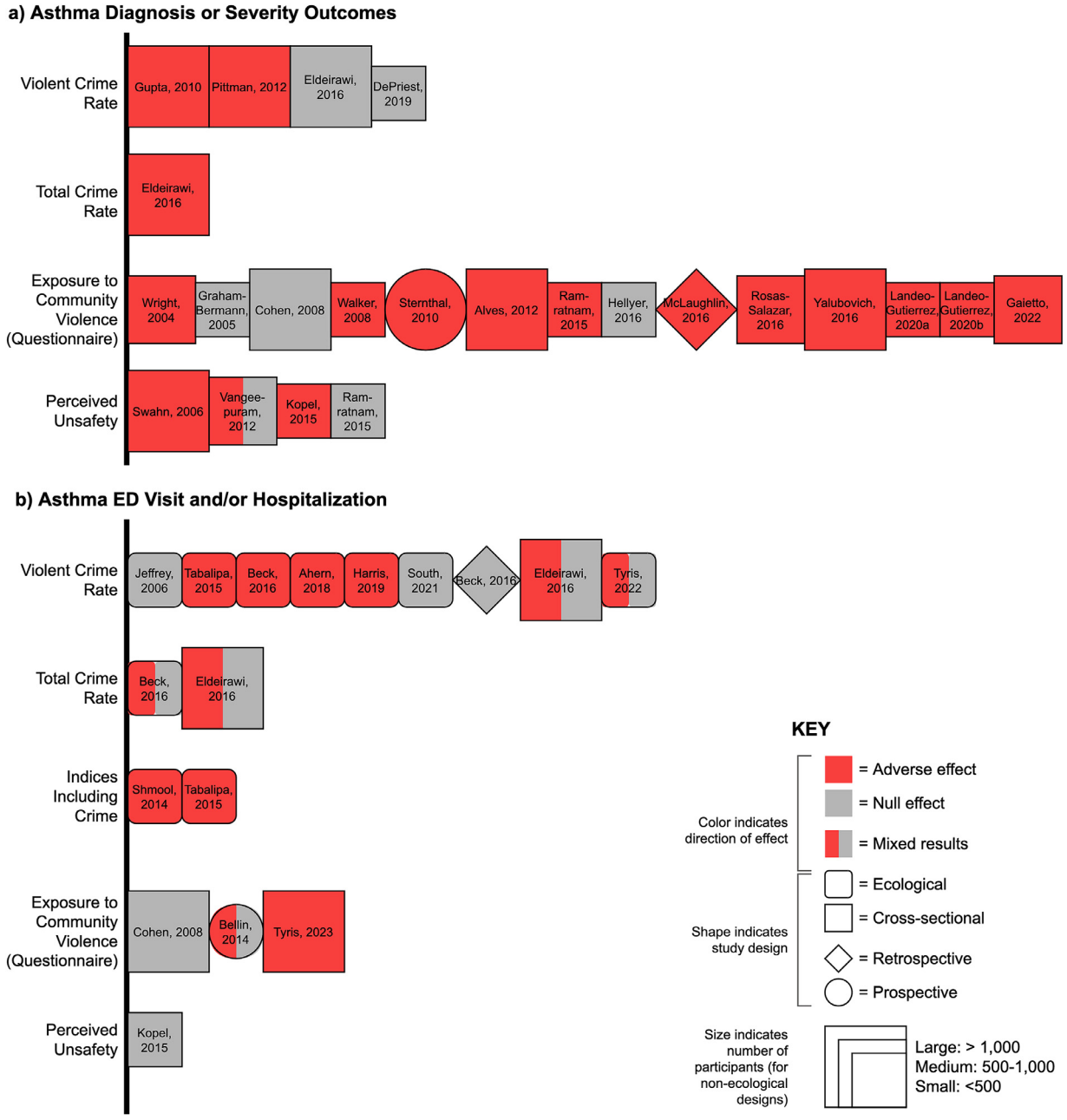

Figure 1. Effect direction of studies on community violence exposure and pediatric asthma outcomes. ED, emergency department.

because of a lack of information on the temporal relationship between the exposure and outcome (eTables 1 and 2). Other studies have employed an ecological study design (n = 9), which limits inference about individual-level risk (eTable 3).[19,28,29,43] Despite the limitations inherent to cross-sectional and ecological study designs, results from these studies are largely consistent with a small number of prospective studies (n = 3), such as the Sternthal et al[16] 2010 study of 2071 children in Chicago, Illinois. Parents of children in the Project on Human Development in Chicago Neighborhoods cohorts reported child exposure to community violence at an age of 3 years and later reported physician-diagnosed asthma diagnoses and/or asthma medication prescriptions at an age of 6 years. The authors reported a 53% to 55% statistically significant increase in the odds of asthma prevalence when comparing the middle or highest tertile of community violence exposure with the lowest tertile after adjusting for sex, age, and maternal asthma. The results did not change after further adjustment for household-level variables (eg, socioeconomic status, family violence, and maternal smoking) and neighborhood-level variables (eg, neighborhood disadvantage, collective efficacy, and social disorder). These results suggest that community violence, although correlated with neighborhood disadvantage, acts as its own unique contributor to adverse respiratory outcomes.

Exposure and Outcome Assessment

Across 2 decades of research, heterogeneity in the epidemiologic study design has limited the ability to compare numerical effect estimates between studies. The asthma outcomes that were assessed varied, including self- or caregiver-reported physician diagnosed asthma (n = 13),[15,16,20,26,33-38,40,41,45] asthma symptoms (n = 11),[8,9,12,14,17,20,21,25,39,42,44] and asthma-related emergency department (ED) visits or hospitalization (n = 18).[10,11,18,19,23,27-32,43] Furthermore, community violence exposure has been measured using either administrative or questionnaire data with little consistency in the exposure assessment. Community violence exposure has been operationalized using administrative data (n = 14), including area-level violent crime rates[11,13,15,19,20,22-24,28,30,32,45] and crime rates as part of larger neighborhood deprivation indices.[29,43] Self- or caregiver-reported community violence exposure questionnaires were also frequently used for exposure assessment (n = 19) with questionnaires either summed into scores[8,16–18,40,41] or coded as a binary exposure (any vs no exposure).[10,12,14,21,24,33-38,42,44] Other studies assessed perceived unsafety in one's community or neighborhood rather than witnessing specific violent events (n = 5).[9,25-27,42] Despite these inconsistencies in exposure and outcome assessments, studies have consistently identified community violence exposure as a risk factor for various asthma outcomes (Fig 1 and eTable 4).

Community Violence as an Effect Modifier

In addition to evaluating violence as a primary exposure related to asthma outcomes, several studies have treated community violence as a modifier of the associations between air pollution exposure and asthma outcomes (eTable 5).[46,47] This work posits that chronic stress, shown to alter immune, endocrine, and metabolic function (impacts often collectively referred to as allostatic load), may render individuals more susceptible to the health effects of physical exposures, including air pollution or extreme heat. As early as 2007, Clougherty et al[48] reported stronger associations between exposure to nitrogen dioxide (NO_2) pollution and asthma diagnosis among urban children exposed to high levels of community violence than among their peers with less violence exposure. More recent studies in New York City have found that children who live in areas with higher crime rates had a higher asthma-related ED visit risk associated with ozone (O_3) exposures than children who lived in lower-crime areas,[49] and similar patterns were observed for fine particulate matter ($PM_{2.5}$) exposure.[50] These findings suggest that exposure to community violence exacerbates asthma-related susceptibility to environmental hazards.

Focusing on At-Risk Populations

Recent epidemiologic work has focused on community violence exposure among children with current asthma and on asthma subtypes, such as atopic asthma. In a 2022 ecological study by Tyris et al,[23] the at-risk rate was used to investigate the association between violent crime rates and excess hospitalizations or ED visits for asthma among at-risk children by scaling population-based rate by census tract asthma prevalence. The authors reported that a 1% increase in the census tract violent crime rate in Washington, District of Columbia, was associated with an increase of 35 ED visits per 1000 children with asthma. A cross-sectional analysis of the nationally representative National Survey of Children's Health found that, among children with asthma, caregiver-report of a child ever witnessing or being a direct victim of violence (as a combined exposure) in their neighborhood was associated with an 111% increase in the odds of past-year health care use for any cause.[24] In 2 cohorts of Puerto Rican children and adolescents aged 9 to 20 years with high T2 immunity, Gaietto et al[39] reported an increased risk for current asthma based on higher scores on a community violence questionnaire[51] that focused on exposure in the preceding 6 months. In a prospective analysis in which both cohorts were pooled, higher baseline community violence exposure was also associated with an increased risk for new-onset asthma after adjusting for secondhand smoke exposure, overweight or obesity, and unhealthy diet score.

Implications for Future Research: Improved Community Violence Exposure Assessment

Although existing research indicates a consistent association between community violence exposure and asthma morbidity, important questions remain in understanding the relevant spatial and temporal scales at which exposure to community violence impacts asthma. In existing questionnaire-based studies, the spatial scale of exposure is either undefined or asks the respondent about community violence exposure in their self-defined community or neighborhood, whereas existing ecological studies have different definitions for neighborhood such as census tracts, police beats, police precincts, or ZIP codes. With respect to temporal scales, studies largely have been inconsistent in the temporal lag between reported exposure and asthma morbidity outcomes, and most studies assessed only 1 time scale. For example, questionnaires ask about past-year, past-month, or lifetime community violence exposure, whereas ecological studies measure average crime rates over a period concurrent with the outcome assessment. More targeted research could answer questions, such as for which asthma outcomes (eg, new onset, exacerbations, and control) is acute community violence exposure more harmful? For chronic exposure? How long after acute exposure to community violence is there an elevated risk of asthma morbidity? At which spatial scales (eg, neighborhood, city, and county) does exposure to community violence matter for respiratory health? Clarifying these relevant spatial and temporal scales and thereby improving the methods for measuring community violence exposure could help to refine the epidemiology, reveal the mechanisms of action related to health outcomes, and help to inform policy and interventions to reduce community violence exposure and its associated health impacts.

A few key studies have assessed the temporal and spatial dynamics of community violence exposure on asthma morbidity. In 2014, Bellin et al[18] tracked asthma-related health care use prospectively

after assessing community violence exposure at baseline and reported an increased risk for health care use in the first 2 months, followed by an increased, but not statistically significant, risk between 2 and 6 months, and no increased risk beyond 6 months. These results suggest that exposure to an index community violence event has an acute impact, which decays over time. More recently, in 2018, Ahern et al[30] identified patterns in community violence rates, derived from police and hospital records in Californian census places with more than 5000 residents, categorized into acute violence peaks and less acute violence increases. The authors compared the combined asthma hospital visits and mortality rates in months with and in those without an acute violence spike, defined as a deviation from the underlying time series patterns, and evaluated changes in outcomes associated with acute violence increases, defined as periodic increases in violent crime rates. Acute violence spikes, defined as 2 SDs above the baseline, were associated with an increase in asthma hospital visits or asthma mortality rates of 0.56 per 100,000 and 0.16 per 100,000, respectively, for a 10-unit increase in the continuous community violence rate. Although these effect sizes were small (corresponding to a total of 218 excess monthly asthma hospital visits associated with violence spikes across the study area), this research furthers the consideration of community violence exposure as a temporally dynamic exposure.

In a 2021 ecological study in Philadelphia, Pennsylvania, South et al[11] created space-time buffers around gun violence events and evaluated asthma ED visit counts for all ages within those buffers before and after the gun violence event. The authors reported null results for all combinations of 1/8 and $^1/_2$ mile spatial and 7-, 30-, and 60-day temporal buffers. These null results could have been the consequence of limited statistical power because of small case numbers within each buffer. Alternatively, these results may suggest that community violence exposure acts primarily through a chronic, rather than acute, pathway. Future epidemiologic studies should work to disentangle the complex spatiotemporal relationships between exposure to community violence and asthma to better guide clinical intervention and policy; this includes the use of prospective study designs or point-level crime data for more granular community violence exposure assessment.

Mechanisms

Several possible mechanisms may explain the consistent adverse associations between community violence exposure and asthma onset and morbidity. These are outlined in Figure 2 and are summarized here.

Stress Mechanisms

One mechanism through which exposure to community violence may impact asthma morbidity is through biologic pathways related to stress. These pathways may explain the direct association between community violence exposure and asthma and how this exposure can shape susceptibility to asthma triggers, such as air pollution. The relationship between stress and asthma has been reviewed previously,[52-55] including recently in adolescents by Landeo-Gutierrez et al,[56] and therefore this section will serve as an overview of the stress pathways rather than an in-depth review.

Acute exposures to violence and other severe stressors activate the hypothalamic-pituitary-adrenal (HPA) axis, and chronic exposure to such stressors can lead to dysregulation.[57] Chronic exposure to community violence can impact both the acute cortisol stress response and daily diurnal cortisol patterns. For example, Heissel et al[58] reported that local acute violent crime events were associated with increased cortisol awakening response the next day with stronger effects for exposure to more violent crimes. The authors also assessed whether associations varied by physical distance from the crime event but saw no differences across a distance range from 0.3 to 1.0 miles. More recently, Peckins et al[59] reported that higher exposure to household violence, neglect, abuse, and/or community violence (as a combined exposure) between ages 3 and 9 years was associated with a blunted cortisol response at an age of 15 years after controlling for social deprivation, baseline cortisol, and time before daily cortisol peak.

The HPA axis dysregulation is also linked to glucocorticoid receptor down-regulation and glucocorticoid resistance in animal and human studies. Glucocorticoids are widely used to control airway inflammation in asthma because they are anti-inflammatory and immunosuppressive in therapeutic doses. However, an estimated 5% to 10% of patients with asthma respond poorly to glucocorticoid treatment.[60] Animal studies consistently suggest a link between chronic stress and the down-regulation of glucocorticoid receptor sensitivity, as well as alterations in β-adrenergic receptor signaling pathways that lead to an increase in circulating inflammatory biomarkers.[61-63] Early studies in children with asthma reported that children with more early-life stress showed decreased glucocorticoid and β-adrenergic receptor mRNA,[64] and children with less parental support were less responsive to the anti-inflammatory effects of hydrocortisone.[65] More recently, Jiang et al[66] reported that, among youth aged 10 to 16 years, low familial socioeconomic status was associated with greater glucocorticoid resistance of T2 cytokines among youth with low levels of maternal support, but not among youth with high levels of maternal support. These findings suggest complex relationships between psychosocial stressors and protective factors in the etiology of glucocorticoid resistance.

Chronic stress can also lead to immune modulation. Several studies have shown that, among patients with asthma, both acute and chronic stress amplified a T2-dominant cytokine response to asthma triggers.[67,68] Additional studies in children without asthma have demonstrated an altered immune response among children exposed to psychological stress.[69,70] Several reviews[71-73] have highlighted that maternal and prenatal exposure to multiple stressors, including community violence, is associated with an increased risk for asthma among offspring with some evidence suggesting stronger impacts for stressor exposures later in pregnancy (ie, in the third trimester).[71] These intergenerational effects are hypothesized to occur because of cortisol-related changes in immune function (ie, atopic sensitization) and altered lung development in offspring.

Asthma morbidity may also be affected by the indirect effects of stress, such as poorer sleep quality, tobacco use, and increased overweight and obesity. For example, community violence exposure is associated with poorer sleep outcomes among children and adolescents across numerous studies,[74] and a recent meta-analysis found positive pooled associations between insomnia and asthma in adults and adolescents, although the pooled association was not statistically significant among children.[75] Several studies have documented increased smoking behaviors, a risk factor for asthma, among adults with poorer perceptions of neighborhood safety[76,77] and identified persistent stress as a barrier to quitting smoking.[78] It is important to note that, in several epidemiologic studies in children, associations between community violence exposure and asthma remained even after adjusting for exposure to tobacco smoke at home,[9,20,26,27,34-36,38,39,42] indicating that caregiver smoking behavior alone cannot fully explain these associations. Chronic social stress is additionally associated with an increased risk for overweight or obesity,[79] another risk factor for asthma onset and morbidity,[80,81] although research on the direct association between exposure to community violence exposure and overweight or obesity has produced mixed findings.[82-85]

Epigenetic Mechanisms

Changes in methylation and the expression of genes that regulate the physiological response to asthma triggers or treatment may also explain the associations between exposure to violence and asthma

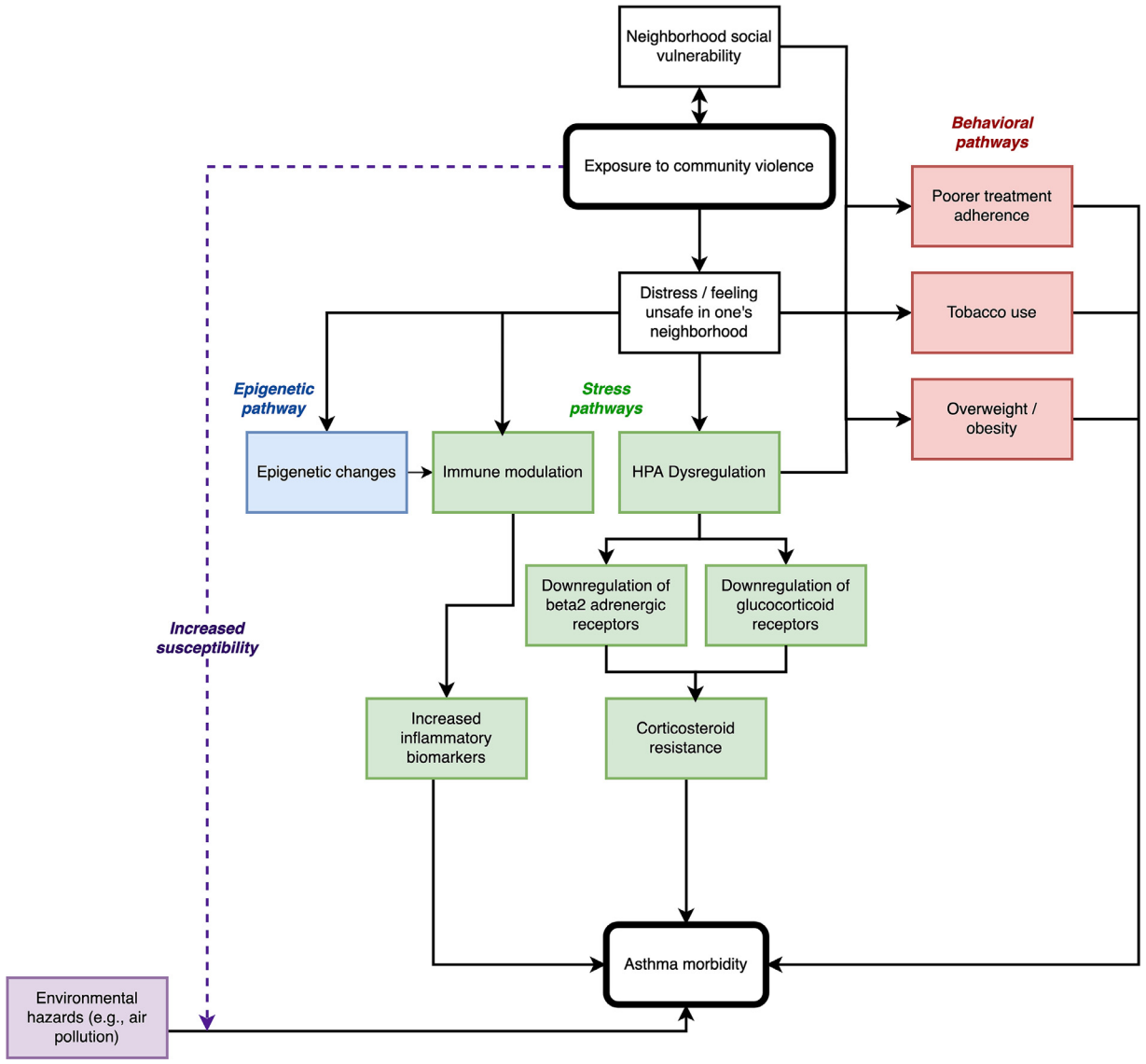

Figure 2. Hypothesized mechanisms explaining associations between exposure to community violence and asthma onset and morbidity. HPA, hypothalamic-pituitary-adrenal axis.

morbidity. In a cohort of Puerto Rican children, Chen et al[86] reported that exposure to violence was associated with methylation at a CpG site in the promoter of *ADCYAP1R1,* which may play a role in regulating glucocorticoid receptor gene expression. These epigenetic modifications were further associated with current asthma. In a more recent study, also in Puerto Rican children and adolescents, an epigenome-wide association study of nasal epithelial cells identified that DNA methylation at several CpG sites were associated with exposure to violence and further with atopic asthma.[87] Epigenetic modifications may also explain the associations between maternal exposure to stress and asthma onset in offspring. A 2016 study identified epigenetically deregulated neuroendocrine and neurotransmitter receptor interactions in stressed mothers and their offspring and deregulated calcium and Wnt signaling in offspring, which are both required for lung maturation in the prenatal period.[88]

Behavioral Mechanisms

In addition to stress pathways and epigenetic mechanisms, exposure to community violence may lead to behavior changes that, in turn, increase the risk for asthma onset or exacerbation. Higher levels of community violence may lead residents to restrict their outdoor activities because of fear of crime,[89] thereby increasing their exposure to indoor air pollutants and allergens[90,91] and leading to decreased physical activity and contributing to social isolation.[92] Recent research corroborates these behavioral pathways. For example, Marquet et al[93] reported a consistent negative association between local crime and park use in New York City with stronger negative associations with violent crimes among children and among girls compared with boys. Similarly, Singleton et al[94] reported greater physical inactivity in Chicago census tracts with higher violent crime rates after adjusting for walkability, park space, whether the tract is considered low income, and racial and ethnic composition. These findings suggest that fear of community violence leads to poorer health behaviors.

In addition, exposure to community violence may lead to poorer treatment adherence, although this relationship remains understudied. Only 1 study in adults has tested the relationship between exposure to community violence and asthma treatment adherence. A 2007 study by Williams et al[13] identified local crime rates as a negative predictor of inhaled corticosteroid treatment adherence among Black adults patients in Detroit, Michigan, after adjusting for multiple socioeconomic indicators. The authors hypothesized that residence

in a high-crime area may lead to perceived helplessness or lack of control over one's health, leading to poorer treatment adherence. Quantifying the role that behavioral mechanisms play in the relationship between community violence exposure and asthma morbidity remains a promising area of research. Familiar techniques, such as structural equation modeling and newer causal mediation analytic methods, could prove to be useful methods for elucidating these pathways.

Community Violence as a Proxy for Neighborhood Disinvestment

Because community violence often co-occurs with other indicators of neighborhood disinvestment and structural racism,[95] it is possible that community violence acts as a proxy for other neighborhood factors related to asthma, rather than as a cause itself. These include neighborhood characteristics potentially related to asthma, such as poverty, poor housing quality, unhealthy food environment, low health care access, and a lack of greenspace.[96-99] Of the cross-sectional, prospective, and retrospective epidemiologic studies reviewed here, all but 2 adjusted for individual or neighborhood-level covariates related to neighborhood context or composition, most commonly variables related to socioeconomic status. Even after adjusting for potential confounders, most studies still reported a statistically significant adverse association between community violence exposure and asthma. Future epidemiologic research should carefully consider confounding by and co-exposure to highly correlated neighborhood characteristics.

Future Research Directions

Epidemiologic studies have consistently identified community violence as a risk factor for asthma morbidity in children with less conclusive and fewer studies in adults. Gaps in the current literature suggest several paths for future research on this topic. First, more research is needed on the role of acute violence events in comparison with chronic exposure in asthma morbidity. Identifying whether isolated community violence events affect asthma morbidity through the same or different pathways as chronic exposures could help to inform clinical practice and intervention. Furthermore, this research could identify whether isolated events have different impacts in already-affected neighborhoods in comparison with neighborhoods in which violence is less common. Finally, a more comprehensive understanding of the spatial and temporal decay of respiratory effects associated with an acute violence event could inform targeted interventions.

Further research on the role of violence in shaping susceptibility to co-exposures to environmental hazards (eg, air pollution and heat) should engage methods that are amenable to the study of nonlinear effect modification and the inclusion of multiple modifiers. Given how strongly community violence co-patterns with other indicators of social vulnerability; for example, poverty or racial and ethnic segregation, a challenge for future research on violence and susceptibility is disentangling the effect of community violence from various other highly correlated social stressors.

Finally, further research is needed to understand the behavioral pathways that connect exposure to violence with asthma morbidity. Quantifying the contribution of various pathways (eg, epigenetics, behavioral, and HPA-axis mediated) to asthma morbidity poses a complex, yet important area of future research.

Clinical Implications

Several strategies can be integrated into clinical practice to help mitigate the impact of community violence on asthma outcomes and to improve the overall health and well-being of affected individuals and communities.

Screening and Assessment

Health care providers can incorporate questions about neighborhood safety and exposure to violence into their growing use of social determinants in health screening assessments. Screening tools can help to identify individuals who may be at higher risk because of community violence exposure. For example, screening tools for psychosocial problems, such as the Pediatric Symptom Checklist[100] or the Strengths and Difficulties Questionnaire,[101] can help to identify children who may be experiencing psychological distress related to exposure to violence. These tools are used to assess a range of behavioral and emotional symptoms, including anxiety, depression, and conduct problems, which may be exacerbated by exposure to community violence.

Tailored Asthma Management Plans

Health care providers should consider the environmental factors that contribute to asthma exacerbations, including exposure to community violence, when tailoring patients' Asthma Action Plans.[102] These plans guide patients to co-manage their asthma, know when more frequent follow-up visits are needed, closely monitor symptoms, and, accordingly, adjust medication regimens. In addition, health care providers can provide education to families on the association between community violence and asthma. This education can provide guidance to families on how to respond to community violence emergencies, including how to access medical care and resources during crises.

Referral to Support Services

Health care providers can refer patients and their families to support services, such as counseling, mental health services, and community resources that address the psychosocial impacts of living in neighborhoods with a high prevalence of violence. Several evidence-based intervention and prevention programs that address the psychological impacts of community violence are available.[103,104] Health care providers can collaborate with social workers, psychologists, or community health workers to provide comprehensive support. Addressing mental health needs alongside asthma management can improve the overall outcomes.[105,106]

Policy Advocacy

Health care providers can advocate for policies and initiatives that are aimed at improving neighborhood safety, such as increasing access to and the quality of social services, building political capacity among communities, strengthening social cohesion, and addressing the root causes of violence such as poverty and inequality.[107,108] Health care providers can collaborate with community organizations and policymakers to implement interventions aimed at reducing community violence.[109] Moreover, research findings that link community violence with adverse asthma outcomes can be used to advocate for policy changes at the local, state, and national levels. This might include initiatives to address systemic issues that contribute to community violence, such as implementing gun control laws, economic development programs, reducing excessive policing and incarceration, and investing in community infrastructure.

Conclusion

Accumulating evidence suggests that there is a strong, consistent association between exposure to community violence and asthma

with the bulk of research focused on children. Possible mechanisms of action include biologic stress pathways, behavioral changes, and epigenetic effects. Promising areas for future research include elucidating pertinent spatial and temporal scales of effect in epidemiologic studies, understanding the epigenetic pathways related to violence exposure, and clarifying the role that behavioral changes play in the associations between community violence exposure and asthma.

Supplementary Data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.anai.2024.07.016.

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Supplementary Data

eAppendix 1. Literature Search and Article Review Methodology

To identify studies related to community violence exposure and asthma, a search of PubMed was conducted, followed by title and abstract review, full-text review, and data extraction. Relevant articles were also identified in the reference section of articles identified in the initial search. The inclusion criteria were (1) articles published in the English language; (2) articles that considered community violence as the exposure, modifier, or mediator in which community violence was defined as witnessing, hearing about, or being victimized by violent events at the community level (ie, levels of social organization beyond the household), measured via self-reported questionnaire or using violent crime rates as a proxy measure; (3) articles with an asthma-related primary outcome (asthma diagnosis or prevalence, onset or incidence, exacerbation, severity, symptoms, asthma-related health care use, and asthma medication use); and (4) for the summary of epidemiologic evidence, reviews were excluded. After initial review of the search results, papers with September 11, 2001 attacks in New York City as the primary exposure were further excluded because this exposure was likely more relevant to acute disaster literature. There was no specific time frame of inclusion, and any study indexed by PubMed before the search date was eligible for inclusion. The search, review, and data extraction were performed by one member of the research team (L.F.).

A PubMed search was conducted on January 16, 2024 using the search terms ("Violence"[Mesh] AND "Asthma"[Mesh]) OR ((violence[title/abstract] OR crime[title/abstract]) AND asthma[title/abstract]) AND (neighborhood OR census tract OR block group OR region OR area OR community). This yielded 271 original results, which were narrowed to 47 original research articles. Upon full-text review of the 47 original research articles, 5 were further excluded (no community violence metric [n = 2] and 9/11 attacks as only exposure [n = 3]). Backward searching using reference lists from reviews resulted in the inclusion of 1 additional epidemiologic article, leading to a total of 43 original research articles that were included.

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eTable 1
Cross-Sectional, Prospective, and Retrospective Studies of Children in Which Community Violence Was the Primary Exposure of Interest

eReference	Location and time period	Population	Design	Violence exposure[a]	Outcome(s)	Covariates	Results (numeric)	Results (summary)
Wright et al[1]	Boston, MA; Chicago, IL; New York, NY; Dallas, TX; Seattle, WA; Tucson, AZ Years: 1998-2001	Children with current asthma Age: 5-12 y N: 851	C	Witnessing community violence (Ordinal score, 1-5) Reporter: caregiver Spatial scale: caregiver-defined neighborhood Temporal scale: 6 mo	Number of symptom d, past 2 wk Reporter: caregiver	Race and ethnicity; SES; study site	$P = .0008$ Per 1-unit increase in score.	Adverse effect, statistically significant (AS)
Graham-Bermann and Seng[2]	Michigan Years: 2001	Head Start Preschoolers Age: 3-4 y N: 160	C	Community violence exposure (SECV)[3]: Parent Version) (any/none) Intrafamily violence exposure (CTS[4]) Reporter: caregiver Spatial scale: unspecified Temporal scale: unspecified	Current asthma (past y) Reporter: caregiver "Within the past year, has your child had asthma?"		OR = 1.48 (P not shown) for any violence exposure (community, domestic, or maltreatment) vs none	ANS
Swahn and Bossarte[5]	US Years: 2003	Youth Risk Behavior Survey respondents with asthma Age: 9-12 y N: 1943	C	Missed school because of feeling unsafe (yes/no) Reporter: child Spatial scale: unspecified Temporal scale: 1 mo	Asthma episode (past y) Reporter: self "During the past 12 months, have you had an episode of asthma or asthma attack?"	Gender[d]; age; race and ethnicity; smoking; overweight; exercise	OR = 2.93 (1.90-4.53) for yes vs no	AS
Cohen et al[6]	San Juan and Cargas, Puerto Rico Years: 2003-2005	Children Age: 5-13 y N: 1213	C	Witnessing violence (Modified SECV[3]) (yes/no) Reporter: child Spatial scale: unspecified Temporal scale: 1 y	Current asthma (physician diagnosis [Dx], past y, including wheeze) Lifetime allergic rhinitis Health care use, past y Medication use, past y Reporter: caregiver	Sex; age; SES; health care access; stressful life events; abuse; parent perceived stress	For yes vs no: Current asthma: OR = 1.16 (0.66-2.06) Lifetime allergic rhinitis: OR = 1.07 (0.67-1.70) Health care use: OR = 0.93 (0.51-1.69) Medication use: OR = 1.08 (0.65-1.81)	Current asthma: ANS Lifetime allergic rhinitis: ANS Health care use: PNS Medication use: ANS
Walker et al, 2008[7,b]	US Years: NR	Children with asthma Age: 5-12 y N: 231	C	Child or parent witnessing community violence (yes/no) Reporter: caregiver Spatial scale: caregiver-defined neighborhood Temporal scale: 6 mo	Number of symptom nights, past 30 d Reporter: caregiver		Symptom nights, parent witness, $P = .03$ Symptom nights, child witness, $P = .05$ Symptom d, not reported	AS
Gupta et al[8]	Chicago, IL Years: 2003-2005	Chicago public school children Age: 3-14 y N: 45,371	C	Violent crime rate (per 100,000 population) (low, moderate, high) Reporter: administrative police records, 2003-2005 Spatial scale: Chicago PD police beats Temporal scale: N/A	Lifetime asthma (Dx) Reporter: caregiver	Sex; age; race and ethnicity; nSES; household member with asthma	OR high vs low = 1.27 (1.04-1.55) OR moderate vs low = 1.15 (1.02-1.29)	AS
Sternthal et al[9]	Chicago, IL Years: 1994-2001	Children in Project on Human Development in Chicago Neighborhoods cohorts Age: 0-9 y N: 2071	P	Exposure to neighborhood violence at wave 2 (1997-1999) (My Exposure to Violence Survey[10]) (Tertiles) Reporter: parent Spatial scale: neighborhood (parent-defined) Temporal scale: lifetime	Lifetime asthma at wave 3 (2000-2001) (Dx or ever using prescription medication for asthma [Rx]) Reporter: caregiver	Sex; age; race and ethnicity; SES; nSES; maternal smoking; maternal asthma; breastfeeding; social disorder; collective efficacy	OR high vs low = 1.56 (1.12-2.18) OR medium vs low = 1.60 (1.17-2.19)	AS

(*continued*)

eTable 1 (*Continued*)

eReference	Location and time period	Population	Design	Violence exposure[a]	Outcome(s)	Covariates	Results (numeric)	Results (summary)
Alves et al[11]	Salvador, Brazil; Bahia, Brazil Years: 2006	Children Age: 4-12 y N: 1232	C	Exposure to community violence (study-specific questionnaire, ordinal score 0-4) Reporter: parent Spatial scale: unspecified Temporal scale: 12 mo	Current asthma (past y symptoms + any lifetime asthma or wheeze) Reporter: caregiver	Sex; age; SES; housing conditions; parental asthma; BMI; micro-area	OR minimal vs low = 1.46 (0.93-2.30) OR moderate vs low = 1.78 (1.11-2.85) OR high vs low = 1.56 (1.12-2.18) OR maximum vs low = 1.94 (1.12-3.36)	AS
Pittman et al[12,b]	Winnipeg, Canada Years: 2001-2003	Children in Asthma, Genes, and Environment cohort Age: 7-8 y N: 1472	C	Crime rate (per 100,000 population) (quintiles) Reporter: administrative Spatial scale: census tract Temporal scale: 1-2 y	Lifetime asthma Reporter: caregiver	Parental asthma; hay fever; mold in household	Sexual assault rate: OR Q5 vs Q1 = 1.16 (1.02-1.32) Grand larceny rate: OR Q5 vs Q1 = 1.47 (1.00-2.16)	Sexual assault rate: AS Grand larceny rate: ANS
Vangeepuram et al[13]	New York, NY Years: 2004-2007	Inner-city children Age: 6-8 y N: 504	C	Perception of neighborhood safety (indicators, yes/no) Reporter: caregiver Spatial scale: neighborhood (caregiver-defined) Temporal scale: unspecified	Lifetime asthma (Dx) Reporter: caregiver	Gender[c];a ge; race and ethnicity; SES; household crowding; secondhand smoke; breastfeeding; language spoken at home	Feeling unsafe while walking: OR = 1.89 (1.13-3.14) Neighborhood perceived unsafe from crime: OR = 1.55 (0.86-2.80) Safety concerns affecting outdoor play: OR = 0.78 (0.43-1.39)	Feeling unsafe while walking: AS Neighborhood unsafe from crime: ANS Safety concerns affecting outdoor play: PNS
Hellyer et al[14]	Unspecified large urban area, US Years: 2002-2009	Children entering foster care Age: 9-11 y N: 367	C	Exposure to community violence (modified SECV[3]) (continuous score) Reporter: child Spatial scale: unspecified Temporal scale: 12 mo	Current asthma (unspecified time scale, no Dx or symptom questions) Reporter: caregiver and child: "Do you have any physical health problems that you've had for a long time?" If yes, asthma?	Gender[c]; age; race and ethnicity	OR = 1.004 (0.69-1.47) Per 1-unit increase in score SECV.	Null
Bellin et al[15]	2 unspecified major urban hospitals, US Years: 2008-2010	Inner-city children with asthma Age: 3-10 y N: 300	P	Exposure to community violence at baseline (community subscale from CRISYS[16]) (Continuous score) Reporter: caregiver Spatial scale: unspecified Temporal scale: 6 mo	Asthma-related ED visits or hospitalizations, past 6 mo (past 2 mo at 2-mo follow-up) Reporter: caregiver Follow-up: 12 mo	Age; SES; asthma severity; asthma control; informal social control; social cohesion; treatment group	Baseline b = 0.19 more visits per 1-unit increase in CRISYS; $P = .003$ 2 mo b = 0.12; $P = .04$ 6 mo b = 0.11; $P = .08$ 12 mo b = 0.02; $P = .40$ Per 1-unit increase in CRISYS.	Health care use, 0-2 mo: AS Health care use, 2-6 mo: ANS Health care use, >6 mo: null
Kopel et al[17]	Boston, MA Years: 2009-2012	School-age students with asthma Age: 5-15 y N: 119	C	Perception of neighborhood safety (yes vs no) Reporter: caregiver: "Is it safe to walk alone in the neighborhood at night?" Spatial scale: neighborhood (caregiver-defined) Temporal scale: unspecified	Poor asthma control score, past 4 wk Missed school because of asthma, >5 d in past y Asthma-related ED visit or hospitalization, past y Pulmonary function Reporter: caregiver	Gender[c]; age; race; SES; secondhand smoke; inhaled corticosteroid use; caregiver stress	Poor asthma control: OR = 2.2 (1.2-3.9) for no vs yes Missed school: OR = 1.8 (0.9-3.3) for no vs yes Health care use OR = 1.1 (0.6-1.9) for no vs yes	Poor asthma control: AS Missed school: ANS Health care use: null
Ramratnam et al[18]	San Juan, Puerto Rico Years: 2009-2010	Children Age: 9-14 y N: 466	C	Exposure to community violence, items from SECV[3] Hearing gunshots (more than once vs once or less) Afraid to leave the house (yes/no) Reporter: child Spatial scale: unspecified Temporal scale: lifetime	Current asthma (lifetime Dx + past y episode of wheeze) Reporter: caregiver	SES; secondhand smoke; parental asthma; residential distance to roadway	Hearing gunshots: OR = 1.7 (1.1-2.7) for more than once vs once or less Afraid to leave the home: OR = 1.4 (0.9-2.3) for yes vs no	Hearing gunshots: AS Afraid to leave the home: ANS

(*continued*)

eTable 1 (*Continued*)

eReference	Location and time period	Population	Design	Violence exposure[a]	Outcome(s)	Covariates	Results (numeric)	Results (summary)
Beck et al[19]	Cincinnati, OH Years: 2011-2013	Children with hospitalization for asthma Age: 2-17 y N: 981	R	Violent crime rate (per 1000 population) (quartiles) All crime rate (per 1000 population) (quartiles) Reporter: administrative (police records, average 2011-2013 crime rate) Spatial scale: census tract Temporal scale: N/A	Time to asthma-related reuse Reporter: administrative	Sex; age; race; insurance; nSES; density of housing code violations; neighborhood traffic-related air pollution	Violent crime rate: HR Q4 vs Q1 = 1.05 (0.63-1.76) All crime rate: HR Q4 vs Q1 = 0.99 (0.63, 1.54)	Violent crime rate: null All crime rate: null
Eldeirawi et al[20]	Chicago, IL Years: 2004	Mexican American children with asthma Age: 1-18 y N: 1966	C	Standardized violent crime counts ([number of violent crime incidents in each census tract - mean number of violent crime incidents in all census tracts in the study]/SD)(continuous) Standardized all crime count (continuous) Reporter: administrative (police records, 2004 annual average) Spatial scale: census tract Temporal scale: N/A	Lifetime asthma (Dx) Current asthma symptoms (past y) Lifetime wheezing Current wheeze (past y) Lifetime asthma ED visits and hospitalizations Reporter: caregiver	Sex; age; country of birth; health care access; daycare or preschool attendance; secondhand smoke exposure; family history of asthma; residential proximity to major roadway; nSES; neighborhood race and ethnicity	Total crime / lifetime asthma: OR = 1.23 (1.02-1.48) / lifetime wheezing: OR = 1.21 (1.06-1.37) / current wheezing: OR = 1.19 (0.95-1.49) / lifetime ED visits: = 1.53 (1.11-2.09) / lifetime hospitalizations: OR = 1.42 (0.86-2.36) Violent crime / lifetime asthma: OR = 1.16 (0.90-1.49) / lifetime wheezing: OR = 1.21 (1.03-1.42) / current wheeze: OR = 1.24 (0.98-1.58) / lifetime ED visits: OR = 1.57 (1.16-2.12) / lifetime hospitalizations: OR = 1.45 (0.89-2.37) Per 1-SD increase in standardized crime count.	Total crime / lifetime asthma: AS / lifetime wheezing: AS / current wheezing: ANS / lifetime ED visits: = AS / lifetime hospitalizations: ANS Violent crime / lifetime asthma: ANS / lifetime wheezing: AS / current wheeze: OR = ANS / lifetime ED visits: OR = AS / lifetime hospitalizations: ANS
McLaughlin et al[21,c]	US Years: 2001-2004	Children in National Comorbidity Survey Replication – Adolescent Supplement Age: 13-17 y N: 6483	R	Exposure to violence (PTSD section of the CIDI[22]) (direct or indirect, yes/no) Reporter: self Spatial scale: unspecified Temporal scale: lifetime	Lifetime asthma Reporter: self: "Have you ever had asthma?"	Sex; age; race and ethnicity; SES	Any violence: OR = 1.50 (1.13-1.99) for yes vs no Indirect violence: OR = 1.25 (0.53-2.94) for yes vs no	Any violence: AS Indirect violence: ANS
Rosas-Salazar et al[23]	San Juan, Puerto Rico; Hartford, CT Years: 2009-2010	Puerto Rican children Age: 9-14 y N: 747	C	My Exposure to Violence Scale[24,25] Hearing gunshots (more than once vs once or less) Reporter: child Spatial scale: unspecified Temporal scale: lifetime	Current asthma (lifetime Dx + past y episode of wheeze) Reporter: caregiver	Sex; age; SES; secondhand smoke; maternal asthma; study site	OR approximately 1.4 (1.2-1.6) for more than once vs once or less (inferred from figure)	AS

(*continued*)

eTable 1 (*Continued*)

eReference	Location and time period	Population	Design	Violence exposure[a]	Outcome(s)	Covariates	Results (numeric)	Results (summary)
Yakubovich et al[26]	Mpumalanga, KwaZulu-Natal, and Western Cape provinces, South Africa Years: 2009-2011	Children Age: 10-17 y N: 6002	C	Exposure to community violence (modified SECV[3]: Ever been assaulted, robbed, or witnessed stabbing or shooting) (any vs none) Reporter: self Spatial Scale: unspecified Temporal Scale: lifetime	Current asthma (past y) Reporter: self: "In the past year, have you had asthma?"	Sex; age; SES; location and urbanicity; domestic conflict; outdoor household tasks; depressive symptoms; anxiety symptoms	OR = 1.14 (1.00-1.30) for any vs none	AS
Szentpetery et al[27]	San Juan, Puerto Rico Years: 2009-2010	Children Age: 9-14 y N: 426	C	Exposure to community violence, items from SECV[3] Hearing gunshots (more than once / once or less) Reporter: child Spatial scale: unspecified Temporal scale: lifetime	Current asthma (lifetime Dx + past y episode of wheeze) Reporter: caregiver	Sex; age; SES; secondhand smoke; parental asthma; allergic rhinitis; obesity; unhealthy diet	OR = 1.8 (1.1-2.9) for more than once vs once or less	AS
Ribeiro-Silva et al[28]	Brazil Years: 2012	Ninth grade students Age: 13-17 y N: 109,104	C	Exposure to gun violence (yes/no) Feeling unsafe on way to school and at school (yes/no) Reporter: self Spatial scale: unspecified Temporal scale: unspecified	Wheeze, past y Reporter: self: "In the past 12 months, did you have wheezing (or chirping) in your chest?"	Sex; age; public or private school; SES index; family context; secondhand smoke; psychological aspects; lifestyle factors	Feeling unsafe on way home from school: PR = 1.19 (1.14-1.25) Feeling unsafe at school: PR = 1.37 (1.30-1.45) Exposure to fights with firearms: PR = 1.63 (1.55-1.70)	Feeling unsafe on way home from school: AS Feeling unsafe at school: AS Exposure to fights with firearms: AS
DePriest et al[29]	Urban area, US Years: NR	Medicaid-insured children with persistent asthma Age: 3-12 y N: 196	C	Violent crime rate (per 1000 population) Reporter: administrative (year unspecified) Spatial scale: census tract Temporal scale: N/A	Very poorly controlled asthma Reporter: caregiver	SES; secondhand smoke; asthma medication use; allergen sensitization; depression; social cohesion; greenspace; season	OR = 1.01 (0.93-1.10), units non specified	Null
Landeo-Gutierrez et al[30]	San Juan and Cargas, Puerto Rico Years: 2009-2010	Children Age: 6-14 y N: 632	C	My Exposure to Violence Scale[24]: Hearing gunshots (more than once vs once or less) Reporter: child Spatial scale: unspecified Temporal scale: lifetime	Current atopic asthma (lifetime Dx + ≥1 episode of wheeze in past y + positive IgE to allergens tested) Reporter: caregiver	Sex; age; BMI; prematurity; parental asthma; unhealthy diet; mold or mildew in home	OR = 1.72 (1.03-2.89) for more than once vs once or less	AS
Landeo-Gutierrez et al[30]	San Juan and Cargas, Puerto Rico Years: 2009-2010	Children Age: 6-14 y N: 472	C	Modified My Exposure to Violence Scale[24] (continuous score) Reporter: child Spatial scale: unspecified Temporal scale: 12 mo	Current asthma, past y Reporter: caregiver bronchodilator response Reporter: clinical test	Sex; age; SES; secondhand smoke; chronic stress	Current asthma: OR = 1.12 (1.02-1.22) Bronchodilator response: b = 0.46 (SE = 0.34) Per 1-unit increase in score.	Current asthma: AS Bronchodilator response: ANS

(*continued*)

eTable 1 (*Continued*)

eReference	Location and time period	Population	Design	Violence exposure[a]	Outcome(s)	Covariates	Results (numeric)	Results (summary)
Gaietto et al[32]	San Juan and Cargas, Puerto Rico Years: 2014-2017	Children and adolescents with high T_H2 immunity in 2 separate cohorts Age: 9-20 y N: 642	C	Exposure to violence (Community Violence Exposure Scale[25]) (continuous, 0-15 points) Reporter: self Spatial scale: unspecified Temporal scale: 12 mo	Current asthma (past y) Reporter: caregiver	Sex; age; SES; secondhand smoke; overweight or obesity; unhealthy diet; residential distance to major road	PR-GOAL cohort: OR = 1.17 (1.04-1.31) EVA-PR cohort: OR = 1.13 (1.03-1.25) Per 1-unit increase in score.	AS
Tyris et al[33]	US Years: 2018-2019	Children with asthma Age: 2-17 y N: 59,963	C	Exposure to neighborhood violence (yes/no) Reporter: caregiver: "Was this child a victim of violence or witnessed violence in his/her neighborhood?" Spatial scale: neighborhood (caregiver-defined) Temporal scale: lifetime	Health care use, past y Reporter: caregiver	Sex; age; comorbidities	OR = 2.11 (1.11-4.00) for yes vs no	AS

Abbreviations: ANS, adverse effect, not statistically significant (based on authors' threshold of significance); AS, adverse effect, statistically significant (based on authors' reported threshold of significance); BMI, body mass index; C, cross-sectional; CIDI, Composite International Diagnostic Interviewer[22]; CRISYS, Crisis in Family Systems scale[16]; CTS, Conflict Tactics Scale[4]; Dx, physician diagnosis; ED, emergency department; EVA-PR, the Epigenetic Variation and Childhood Asthma in Puerto Ricans Study; HR, hazard ratio; N/A, not applicable; NR, not reported; nSES, neighborhood socioeconomic status; OR, odds ratio; P, prospective; PNS, protective effect, not statistically significant (based on authors' threshold of significance); PR, prevalence ratio; PR-GOAL, the Puerto Rico Genetics of Asthma and Lifestyle study; PTSD, posttraumatic stress disorder; Q, quartile; R, retrospective; Rx, asthma medication prescription; SECV, Survey of Exposure to Community Violence[3]; SES, socioeconomic status.

NOTE: The articles are listed in chronological order by publication year. US refers to contiguous United States. Results shown as effect estimate (95% CI) unless otherwise noted. We define 'sex' to refer to biological sex, ie, male or female, and 'gender' to refer to a person's self-representation or identity, ie, 'boy' or 'girl'. In this table, we use terms used by the authors of the research reported. Instances where the authors use terms inconsistent with our definition are noted in footnotes.

[a]Temporal scale: for questionnaire-based studies, temporal scale refers to the time frame asked about in the questionnaire (eg, past 12 months).

[b]Study was prospective, but the analysis summarized here was cross-sectional.

[c]Does not explicitly distinguish between violence inside vs outside the home.

[d]The authors included 'gender' as a covariate but do not specify the categories used.

[e]The authors use the term 'gender' with categories of male and female, which is more consistent with the definition of 'sex'.

eTable 2
Cross-Sectional, Prospective, and Retrospective Studies of Adults in Which Community Violence Was the Primary Exposure of Interest

eReference	Location and time period	Population	Design	Violence exposure[a]	Outcome(s)	Covariates	Results (numeric)	Results (summary)
Williams et al[34]	Southwest Michigan Years: 1999-2001	Adults with asthma Age: 18-50 y N: 169	C	Crime rate (part 1 offenses / population) (continuous) Reporter: administrative Spatial scale: for Detroit residence, police scout-car area; for surrounding area, area of residence Temporal scale: 1 y	Inhaled corticosteroid adherence, continuous score Reporter: administrative (claims data, 2000-2001)	Sex; age; SES; comorbidities	Change in adherence = −27.3 + 13.2; $P = .04$ Per 10-fold increase in 2001 crime rate	AS
Apter et al[35]	Philadelphia, PA Years: NR	Adults with moderate to severe asthma Age: ≥18 y N: 397	P	Community violence exposure (yes/no) Reporter: self: "In the past 6 months, did you witness any violence in your neighborhood?" Spatial scale: neighborhood (self-defined) Temporal scale: 6 mo from baseline	Asthma-related ED visits Asthma-related hospitalizations Asthma-related quality of life FEV1 Reporter: self Follow-up: 26 mo	Sex; age; race and ethnicity; SES	For yes vs no: ED visits: RR = 2.27 (1.32-3.90) Hospitalizations: RR = 2.49 (1.11-5.60) ARQOL: RR = −0.49 (−0.77 to −0.025)	ED visits: AS Hospitalizations: AS ARQOL: AS Pulmonary function: null
Arthur et al[36]	San Bernadino, CA Years: 2011-2012	Adults living near San Bernadino Railyard Age: ≥18 y N: 792	C	Perceived neighborhood safety (strongly disagree or disagree vs agree or strongly agree) Reporter: self: "I feel safe walking in my community, day or night." and "Violence or crime is not a problem in my community." Spatial scale: community (self-defined) Temporal scale: unspecified	Respiratory illness (asthma, bronchial condition, emphysema, COPD) Reporter: self	Gender[c];a ge; race and ethnicity; SES; smoking; secondhand smoke; residential duration; number of household members; environmental hazard region	Perceived neighborhood safety: PR = 1.37 (1.07-1.74) Perceived community safe from crime: PR = 1.36 (1.02-1.72) Combined exposure: PR = 1.39 (1.09-1.76) For strongly disagree or disagree vs agree or strongly agree	AS
Han et al[37,b]	Puerto Rico Years: 2014-2016	Adults Age: 18-64 y N: 3049	C	Exposure to violence (Community Violence Exposure Scale[25]) (continuous, 0-15 points) Reporter: self Spatial scale: unspecified Temporal scale: lifetime	Current asthma (lifetime Dx + current asthma) Reporter: self: "Have you ever been told by a doctor or other professional that you have asthma?" and "Do you still have asthma?"	Sex; age; SES; smoking; BMI; exercise; depression; ever suicide attempt	OR, 1.14 (1.07-1.21) per 1-point increase in Community Violence Exposure Scale	AS

Abbreviations: ARQOL, Asthma Quality of Life Questionnaire; ANS, adverse effect, not statistically significant (based on authors' threshold of significance); AS, adverse effect, statistically significant (based on authors' reported threshold of significance); BMI, body mass index; C, cross-sectional; COPD, chronic obstructive pulmonary disease; Dx, diagnosis; ED, emergency department; FEV1, forced expiratory volume in the first second; HR, hazard ratio; NR, not reported; nSES, neighborhood socioeconomic status; OR, odds ratio; P, prospective; PNS, protective effect, not statistically significant (based on authors' threshold of significance); PR, prevalence ratio; RR, risk ratio; SES, socioeconomic status.
NOTE: The articles were listed in chronological order by publication year. US refers to contiguous United States.
Results shown as effect estimate (95% CI) unless otherwise noted. We define 'sex' to refer to biological sex, ie, male or female, and 'gender' to refer to a person's self-representation or identity, ie, 'boy' or 'girl'. In this table, we use terms used by the authors of the research reported. Instances where the authors use terms inconsistent with our definition are noted in footnotes.
[a]Temporal scale: for questionnaire-based studies, temporal scale refers to the time frame asked about in the questionnaire (eg, past 12 months).
[b]Does not explicitly distinguish between violence inside vs outside the home.
[c]The authors use the term 'gender' with categories of male and female, which is more consistent with the definition of 'sex'.

eTable 3
Ecological Studies in Which Exposure to Violence Was the Main Exposure

eReference	Location and time period	Age	No. and spatial scale	Violence exposure	Outcome(s)	Covariates	Results (numeric)	Results (summary)
Jeffrey et al[38]	Los Angeles, CA Years: 2000	0-18 y	86 cities	Violent crime rate (per 10,000) population), 2000 (continuous)	Asthma hospitalization rate (per 10,000 children)	Neighborhood race and ethnicity; nSES; domestic violence rate; nonviolent crime rate; assault hospitalization rate	Beta = −0.1 (−0.3 to 0.0) change in childhood asthma hospitalization rate Per 1-unit increase in violent crime rate	Null
Shmool et al[39]	New York, NY Years: 2008-2010	Children aged ≤14 y	34 UHF areas	Social stressor factors, 2009 (including crime rate and perceived neighborhood unsafety, continuous)	Asthma ED visit rate (%)		Crime and violence factor: RR = 1.039 (P < .0001) Increase in asthma ED visit rate (%) per IQR-increase in factor score	AS
Tabalipa et al[40]	Brazil Years: 2006	All ages	266 municipalities	IYVV and homicide dimension, 2006 (continuous)	Asthma-related hospitalization rate (per 10,000 population)		Overall IYVV score r = 0.24; P < .001 Homicide dimension r = 0.112; P = .034 Change in asthma-related hospitalization rate (per 10,000 population) per 1-unit increase in score.	Overall IYVV: AS Homicide dimension: AS
Beck et al[19]	Cincinnati, OH Years: 2011-2013	Children aged 2-17 y	104 census tracts	Violent and all crime rate, 2011-2013 (per 1000 population) (continuous)	Asthma-related ED visits or hospitalization rate (per 1000 population)	nSES; density of asthma-related housing code violations; neighborhood traffic-related air pollution	Violent crime: b = 6.5; P = .002 All crime: b = 4.5 per 1000; P = .02, in which b is the increase in asthma-related ED visit or hospitalization rate (per 1000 pop.) per 1-unit increase in crime rate (per 1000 pop.)	Violent crime: AS All crime: AS
Ahern et al[41]	California Years: 2005-2011	All ages	631 census-designated places	Community violence rate, monthly average (crime rate and hospital discharge records) (acute peaks and increases)	Asthma hospitalization and mortality rate	Rainfall; temperature; civil unrest events; nSES	Acute violence spikes: Residual rate difference (RD) = 0.56 (0.16-0.95) Acute violence increases: RD = 0.16 (0.03-0.3) per 100,000 increase in acute violence residual With residuals based on fitting a Kalman smoother to outcome rates in each place to remove predictable temporal patterning	Acute violent events: AS Acute violent increases: AS

(*continued*)

eTable 3 (*Continued*)

eReference	Location and time period	Age	No. and spatial scale	Violence exposure	Outcome(s)	Covariates	Results (numeric)	Results (summary)
Harris[42]	St. Louis, MO Years: 2010	Children aged ≤15 y	19 ZIP codes	Violent crime count, 2010 (continuous)	Asthma prevalence (ED discharges with asthma per 1000 children)		Statistically significant clustering of high asthma rates in areas with more violent crime. No numerical summary.	
Merrill et al[43]	Tulsa, OK Years: 2016-2017	Pediatric patients (age unspecified)	107 census tracts	Crime counts: homicide, rape, and narcotic-related offenses (continuous)	Asthma-related clinic visit counts		A full mediation model with toxic stress as the mediator (operationalized as rates of ADHD disorders [ICD-10 F90] and other anxiety disorders [ICD-10 F41]) on the neighborhood crime-asthma rate path fit the data well. A direct path from neighborhood crime to asthma was not supported.	
South et al[44]	Philadelphia, PA Years: 2013-2014	All ages	73,876 ED visits within space-time buffers: Progressive buffers around shooting incident: 1/8, 1/2 mile.	Shooting incident (yes/no) Temporal scale: 7 d, 30 d, 60 d after shooting	Asthma ED visits per space-time buffer		1/8 mile (mi.), 7 d: OR = 0.75 (0.28-2.01) 1/8 mi., 30 d: OR = 0.92 (0.6-1.42) 1/8 mi., 60 d: OR = 0.89 (0.66-1.19) 1/2 mi., 7 d: OR = 0.89 (0.70-1.13) 1/2 mi., 30 d: OR = 0.95 (0.85-1.07) 1/2 mi., 60 d: OR = 0.99 (0.91-1.08)	1/8 mi., 7 d: Null 1/8 mi., 30 d: Null 1/8 mi., 60 d: Null 1/2 mi., 7 d: Null 1/2 mi., 30 d: Null 1/2 mi., 60 d: Null
Tyris et al[45]	Washington, DC Years: 2018-2019	Children aged 2-17 y	161 census tracts	Violent crime rate (per census tract population) (continuous)	Asthma-specific ED visit or hospitalization	Sex; age; nSES; neighborhood limited English proficiency; asthma medication	35.3 excess ED visits per 100 children at risk (95% CI, 10.2-60.4) 2.0 excess hospitalizations per 100 children at risk (95% CI, -4.7-8.6) Per 1-percent increase in violent crime rate	ED visits: AS hospitalizations: null

Abbreviations: ADHD, attention-deficit hyperactivity disorder; ANS, adverse effect, not statistically significant (based on authors' threshold of significance); AS, adverse effect, statistically significant (based on authors' reported threshold of significance); ED, emergency department; ICD-10, International Classification of Diseases, 10th Revision; IYVV, Index of Youth Vulnerability to Violence; nSES, neighborhood socioeconomic status; OR, odds ratio; PNS, protective effect, not statistically significant (based on authors' threshold of significance); r, Pearson's *rho*; RD, risk difference; RR, risk ratio; SES, socioeconomic status; UHF, United Health Fund.

NOTE: The articles were listed in chronological order by publication year.

Results shown as effect estimate (95% CI) unless otherwise stated. We define 'sex' to refer to biological sex, ie, male or female, and 'gender' to refer to a person's self-representation or identity, ie, 'boy' or 'girl'. In this table, we use terms used by the authors of the research reported. Instances where the authors use terms inconsistent with our definition are noted in footnotes.

eTable 4
Summary of the Direction of Effects From Cross-Sectional, Prospective, and Retrospective Epidemiologic Studies for Outcome Categories Addressed by at Least 2 Studies[49]

Study	Study design	No.	Pop.	Region	Asthma	Health care use	Asthma symptoms	Wheeze	Asthma medication
Exposure to violence									
Wright et al[1]	CS	851	C	US			▼		
Graham-Bermann and Seng[2]	CS	160	C	US	▼				
Williams et al[34]	CS	169	C	US					▼
Cohen et al[6]	CS	1213	C	PR	▼	▲			▼
Walker et al[7]	CS	231	C	US			▼		
Apter et al[35]	CS	397	A	US		▼2			
Gupta et al[8]	CS	45,371	C	US	▼				
Sternthal et al[9]	P	2071	C	US	▼				
Alves et al[11]	CS	1232	C	BR	▼				
Pittman et al[12]	CS	1472	C	CA	◀ ▶				
Hellyer et al[14]	CS	367	C	US	◀ ▶				
Bellin et al[15]	P	300	C	US		◀ ▶			
Ramratnam et al[18]	CS	466	C	PR	◀ ▶				
Beck et al[19]	R	981	C	US		◀ ▶			
Eldeirawi et al[20]	CS	1966	C	US	▼	◀ ▶2		◀ ▶2	
McLaughlin et al[21]	R	6483	C	US	◀ ▶				
Rosas-Salazar et al[23]	CS	747	C	PR	▼				
Yakubovich et al[26]	CS	6002	C	SA	▼				
Szentpetery et al[27]	CS	426	C	PR	▼				
Ribeiro-Silva et al[28]	CS	109,104	C	BR				▼	
DePriest et al[29]	CS	196	C	US			◀ ▶		
Han et al[37]	CD	3049	A	PR	▼				
Landeo-Gutierrez[30](a)	CS	632	C	PR	▼				
Landeo-Gutierrez[31] (b)	CS	472	C	PR	▼				
Gaietto et al[32]	CS	642	C	PR	▼				
Tyris et al[33]	CS	59,963	C	US		▼			
Perceived lack of safety									
Swahn and Bossarte[5]	CS	1943	C	US	▼				
Vangeepuram et al[13]	CS	504	C	US	◀ ▶				
Kopel et al[17]	CS	119	C	US		◀ ▶	▼		
Arthur et al[36]	CS	792	A	US					
Ribeiro-Silva et al[28]	CS	109,104	C	BR				▼	

Abbreviations: BR, Brazil; CA, Canada; CS, cross-sectional; P, prospective; Pop., population [C = children and adolescents, A = Adults]; PR, Puerto Rico; R, retrospective; SA, South Africa; US, contiguous United States.
NOTE. This table was adapted from the Cochrane Handbook effect direction plot.[46]
Effect direction: upward arrow ▲ indicates protective health impact; downward arrow ▼ indicates adverse health impact; sideways arrow ◀ ▶ indicates null effect/mixed effects/conflicting findings; Sample size: analyzed sample size (individuals)––large arrow ▲ >1000; medium arrow ▲ 500-1000; small arrow ▲ <500; Subscript: Number of outcomes in each outcome category; no subscript indicates only 1 outcome in the category; Asthma diagnosis means current asthma and/or lifetime asthma; Asthma symptoms means asthma symptoms and/or asthma control outcomes; Health care use indicates asthma-related emergency department visit or hospitalization; Medication indicates adherence and/or use.

eTable 5
Studies in Which Exposure to Violence Was Evaluated as an Effect Modifier

eReference	Location	Population	No.	Main exposure	Violence exposure	Outcome(s)	Covariates	Results (numeric)	Results (summary)
Clougherty et al[46]	Boston, MA Years: 1987-1993	Children in community-based pregnancy cohort	413	NO_2 (continuous)	Witnessing violence (ETV) (above or below median) Reporter: self and caregiver Spatial scale: unspecified	Lifetime asthma (Dx) Reporter: caregiver	Sex; age; SES; secondhand smoke; maternal asthma	Among all children: OR high ETV = 1.63 (1.14-2.33) OR low ETV = 0.99 (0.73-1.34) Among nonmovers OR high ETV = 2.40 (1.48-3.88) OR low ETV = 0.85 (0.56-1.27) For above vs below median ETV per 1-SD increase (4.3 ppb) in NO_2	Exacerbating effect modification on NO_2 exposure, statistically significant interaction term ($P = .0009$)
Shmool et al[39,a]	New York, NY Years: 2008-2010	Children aged ≤14 y	NR	NO_2 (continuous)	Social stressor factors, 2009 (including crime rate and perceived neighborhood unsafety, continuous) Spatial scale: UHF area	Asthma ED visit rate (%)			No statistically significant effect modification on NO_2 exposure for crime and violence factor.
DePriest et al[29]	Unspecified urban area, US Years: NR	Children aged 3-12 y	196	Greenspace (NDVI, continuous)	Violent crime rate Reporter: administrative (year and scale unspecified) Spatial scale: census tract	Asthma control (very poorly controlled asthma)			No statistical evidence of effect modification by violent crime on the greenness-asthma association.
Sheffield et al[47,b]	New York, NY Years: 2005-2011	Children aged 5-18 y	11,719	O_3 (continuous)	Crime rate (2-y average) (quartiles) Reporter: administrative Spatial scale: police precinct	Asthma ED visit		Percentage excess risk, lag 1: Lowest crime rate = 6.0 (0.6-11.6) Highest crime rate 16.3 (6.9-26.6) Per 10-ppb increase in O_3.	Apparent effect modification with stronger effects in higher crime areas, interaction term not evaluated.
Sharma et al[48,b]	New York, NY Years: 2005-2011	Children aged 5-17 y	145,834	$PM_{2.5}$; NO_2; O_3; T_{min} (continuous)	Crime rate, 2009 (quintiles) Reporter: administrative data Spatial scale: census tract	Asthma ED visit		Violent crime seems to modify the effect of several air pollutants on asthma ED visits in a nonlinear manner. Compared with the highest and lowest quintiles of violent crime rate, those in the middle quintiles had associations closer to null, although most CIs overlapped. Modification was significant only for warm-season $PM_{2.5}$ (lag 1) and warm-season O_3 (lag 2).	

Abbreviations: Dx, diagnosis; ED, emergency department; ETV, exposure to violence; NO_2, nitrogen dioxide; NDVI, normalized difference vegetation index; NR, not reported; nSES, neighborhood socioeconomic status; O_3, ozone; OR, odds ratio (results shown as effect estimate [95% CI] unless otherwise stated); $PM_{2.5}$; particulate matter with diameter ≤ 2.5 μm; SES, socioeconomic status; UHF, United Health Fund; T_{min}, minimum temperature.
NOTE. Studies are listed in chronological order by publication year. We define 'sex' to refer to biological sex, ie, male or female, and 'gender' to refer to a person's self-representation or identity, ie, 'boy' or 'girl'. In this table, we use terms used by the authors of the research reported. Instances where the authors use terms inconsistent with our definition are noted in footnotes.
[a]Violence evaluated as part of a larger factor, including socioeconomic and built environment variables.
[b]Time-stratified, case-crossover inherently controls for confounders that are nonvarying within the time strata (1 month).