



Review article

The role of physical activity in the relationship between exposure to community violence and mental health: A systematic review

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ARTICLE INFO

Keywords:

Crime
Safety
Psychological well-being
Low-income countries
Ethnic and racial minorities
Child
Neighborhood
Built environment
Mediator
Sedentary behavior

ABSTRACT

Community violence is a global public health problem that is associated with mental health disorders. Physical activity can enhance mental health and may play an important role in the relationship between exposure to community violence and mental health. We systematically reviewed the literature to better understand the potential role of physical activity in this relationship. In this review, we searched the databases PubMed, Embase, Web of Science, Cochrane Central, PsycInfo, and SPORTdiscus, and conducted a grey literature search of one clinical trials registry and four organizations' websites. The review included quantitative observational studies, intervention studies, and qualitative studies published by November 30, 2022 and that involved generally healthy individuals across the lifespan. Eligible studies included measures of community violence, mental health, and physical activity. Five studies met the inclusion criteria for the review. Four studies were conducted in high-income countries, only two minority populations were represented in the studies, and none of the studies included older adults or children. Studies defined and measured community violence, mental health, and physical activity in different ways. In most studies, physical activity was not a primary focus but assessed as one item within a larger construct. The role of physical activity was examined differently across the studies and only one study found a significant role (mediator) of physical activity. This review revealed that few studies have specifically examined physical activity's role in the relationship between exposure to community violence and mental health. Further research is needed involving low-income countries, diverse minority populations, and children.

1. Introduction

Community violence continues to be a global public health problem and a major social determinant of health (Krug et al., 2002; UNODC, 2014). The victims of community violence are disproportionately people from lower-income, ethnic minority, and socially disadvantaged communities (Antunes and Ahlin, 2015; Zimmerman and Messner, 2013), with children and adolescents particularly affected (Bancalari et al.,

2022; Finkelhor et al., 2013; Guterman et al., 2010; Jain and Cohen, 2013). Community violence is associated with mental health disorders, which are significant contributors to the global burden of disease (Collaborators, 2022), among children, adolescents, and adults (Finkelhor et al., 2013; Lee et al., 2020; Raman et al., 2021; Zinzow et al., 2009a; Zinzow et al., 2009b). Living in a more socially disadvantaged community increases the likelihood of mental health disorders even in the absence of community violence (Bowen et al., 2022). When community

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<https://doi.org/10.1016/j.pmedr.2023.102509>

Received 8 August 2023; Received in revised form 28 October 2023; Accepted 8 November 2023

Available online 10 November 2023

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violence occurs in socially disadvantaged communities, people's mental health and ability to cope are significantly undermined, especially among children and youth (Alderton et al., 2019).

Physical activity is associated with various mental health benefits across the lifespan. In children and adolescents, physical activity is associated with lower levels of depression and anxiety as well as higher levels of self-esteem and cognitive functioning (Biddle et al., 2019). For adults, physical activity is considered an important component in the prevention and treatment of depression (Smith and Blumenthal, 2015), particularly because physical activity has been shown to lower depressive symptoms as well as symptoms of psychotic disorders such as schizophrenia (Mahindru et al., 2023; Rodríguez-Romo et al., 2022). In fact, recent evidence highlighted the compelling beneficial effects of physical activity for improving depression, anxiety, and psychological distress across a wide range of populations, including the general population, people with diagnosed mental health disorders, and people with chronic disease (Singh et al., 2023).

Community violence has been linked to negative physical health behaviors and outcomes, such as lack of exercise, physical inactivity, obesity, and elevated blood pressure (Johnson et al., 2009; Semenza and Stansfield, 2021; Wright et al., 2017), and may prevent people from experiencing the mental health benefits of physical activity. Gun-related violent crimes, such as homicides and shootings, are negatively associated with adults' and older adults' use of neighborhood parks and park-based physical activity levels (Han et al., 2018). In addition, in socially-disadvantaged communities where community violence often occurs, there may be few physical activity resources such as recreation centers (Jones et al., 2015). Perhaps, community violence could, at least in part, be a driver for fewer physical activity resources and facilities in socially-disadvantaged neighborhoods. Further, individuals who have directly experienced community violence may suffer injuries that limit or preclude participation in physical activity (Haegerich et al., 2014). In addition, individuals who have witnessed community violence may be fearful to go outside to engage in physical activity in their neighborhoods or leave their homes to travel to indoor community settings to be active (Chaparro et al., 2019; Kepper et al., 2019).

Community violence contributes to heightened crime and less pedestrian safety, which are two environmental attributes that are significantly associated with low physical activity levels among minority and low-income populations (Laddu et al., 2021). Since individuals in low-income communities often get their daily physical activity through active transport (e.g., walking and biking) in their neighborhoods (Ghimire and Bardaka, 2023; Lusk et al., 2019), community violence may be particularly harmful to both the physical activity and mental health of such individuals.

While reviews have examined exposure to community violence and mental health (Miliauskas et al., 2022; Yule et al., 2019), to our knowledge, no studies have yet reviewed and synthesized existing research to better understand the role of physical activity in the relationship between these two variables. The purpose of this systematic review was to examine the role of physical activity in the relationship between exposure to community violence and mental health, including whether physical activity mediates and/or moderates the relationship.

2. Methods

For the reporting of this review, the research team followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 recommendations (Page et al., 2021). The review was registered at the International Prospective Register of Systematic Reviews (PROSPERO) (ID: CRD42021244949).

2.1. Eligibility criteria

We included quantitative observational studies (longitudinal, cross-sectional, and case control), intervention studies (natural experiment

and trial), and qualitative studies involving the general healthy human population across the lifespan (infancy and above) published by November 30, 2022. We excluded other reviews, as well as studies involving non-ambulatory individuals, hospitalized patients, and athletes.

2.2. Type of exposure

Eligible studies were those which included exposure to community violence, conceptualized as instances of interpersonal harm from crime or threats of harm from crime within one's neighborhood or community. We excluded related constructs, such as domestic violence, physical maltreatment, sexual abuse, peer bullying, and media and video game violence (Kennedy and Ceballo, 2014). We included studies that described perceptions and/or fears of violent crime in the community as representing threats of harm from crime. Studies were eligible irrespective of the methods used to measure exposure to community violence and whether there were single or repeated measures of exposure.

2.3. Type of outcomes

Eligible studies were those that reported at least one measure of mental health disorder, such as depression, anxiety, post-traumatic stress disorder (PTSD), or other common mental health disorders (e.g., bipolar disorder, schizophrenia and other psychoses, dementia, and developmental disorders including autism), that were measured through objective clinical diagnosis and/or questionnaires. The variables of psychological well-being, emotional distress, and social support that are often involved with the experience of major mental health disorders were considered as additional outcomes. Studies were eligible irrespective of the methods used to measure all outcome variables. No restrictions were placed on the number of points at which any outcome was measured.

2.4. Other key variables of interest: Measures of physical activity

Eligible studies reported at least one measure of physical activity. We considered physical activity variables of all domains (leisure, occupation, domestic, active transport), types (exercise, sports, walking), and intensities (sedentary, light, moderate, vigorous). Eligible studies investigated the role of physical activity in the relationship between exposure to community violence and one or more of the outcome variables, including any potentially moderating or mediating influence of physical activity. Studies were eligible irrespective of the methods used to measure levels of physical activity.

2.5. Search methods

To identify studies for this systematic review, a medical librarian (SR) developed a detailed search strategy for each database. For the reporting of the search, guidance from the PRISMA-S extension was consulted. The medical librarian designed the original search strategies for PubMed (NLM) and subsequent database translations. The PubMed (NLM) search strategy was reviewed by the research team to check for accuracy and term relevancy and the medical librarian reviewed all completed search strategies for errors. The databases included PubMed (NLM), Embase (Elsevier), Web of Science (Clarivate Analytics), Cochrane Central (Wiley) PsycInfo (EbscoHost), and SPORTdiscus (EbscoHost) using a combination of keywords and subject headings with no date restrictions. A grey literature search included one clinical trials registry (ClinicalTrials.gov) and four organizations' websites: American College of Sports Medicine (<https://www.acsm.org/>), International Society for Behavioral Nutrition and Physical Activity (<https://isbnpa.org/>), International Society of Behavioral Medicine (<https://www.isbm.info/>), and Society of Behavioral Medicine (<https://www.sbm.org/>).

org/). The search was limited to exclude review articles. The database and grey literature searches were first performed on March 22, 2021. The database and grey literature searches were updated on November 30, 2022 using the same method and narrowing the time period for the searches from March 22, 2021 to November 30, 2022. The full search strategies are provided in Appendix A.

2.6. Study selection

All records retrieved from the database searches and the clinical trials registry were uploaded into EndNote 20 and duplicate records were eliminated (Bramer et al., 2016). The references were added to the systematic review screening tool Rayyan (<https://www.rayyan.ai/>) and any remaining duplicates were removed. For the initial database searches and the records retrieved thereafter, the records were divided into three relatively equal groups within Rayyan. Six trained student assistants worked in pairs (one pair per group of records) to independently screen titles and abstracts. Reviewers were blinded to each other's screening decisions. In the case of disagreement, a final decision was made by one of three researchers (AO, MS, JG). Next, the three researchers independently screened full-text articles for inclusion. The articles were divided into three groups with two researchers assigned to independently screen the articles for two groups. In case of disagreement, the third researcher (not assigned to the group) served as tiebreaker. The researchers were blinded to each other's decisions.

The research team followed the same procedures for updating the database searches. For records that we accessed and screened from the grey literature search involving the four organizations' websites, one trained student assistant and one of the researchers (MB) independently screened titles and abstracts. Reviewers were blinded to each other's screening decisions. In case of disagreement, a final decision was made by another researcher (JG). Next, two researchers (MB, JG) independently screened full-text articles for inclusion. The researchers then met to discuss their respective screening decisions and resolve any disagreements to arrive at final decisions.

2.7. Data extraction

We designed a data extraction form by modifying an existing template used for randomized controlled trials and non-randomized studies (Cochrane Airways, <https://airways.cochrane.org/data-collection>). Two researchers (MB, JG) independently extracted data from the included studies. Extracted data were compared, with any discrepancies resolved through discussion by the two researchers to arrive at a final decision. The following information was extracted from the included studies: title, year of publication, citation, author name(s) and contact details, design, aim(s), setting (city, country, and social context), recruitment method, sampling method, response rate, total participants, participants' demographics (e.g., age, sex, race/ethnicity, and socioeconomic status), exposures, outcomes, moderator/mediator variables, statistical techniques, key results, and main conclusions. When any study findings or details were unclear or missing, we contacted the study authors for clarification.

2.8. Risk of bias

We assessed risk of bias in the included studies using the Risk of Bias in Non-randomized Studies – of Exposure tool [ROBINS-E, (ROBINS-E Development Group, 2023)]. We used the ROBINS-E tool as there were no randomized studies in the included studies and this review focused on community violence as the key exposure. We adapted the ROBINS-E by assessing risk of bias for only six of the tool's seven domains. We omitted the domain entitled "Risk of bias due to post-exposure interventions" because there were no post exposure-interventions in any of the included studies. Two researchers (MB, JG) independently applied the adapted ROBINS-E tool to each included study, noting supporting

information and justifications for judgments of risk of bias for each of the six domains (low, some concerns, high risk, or very high risk). Any discrepancies in judgements of risk of bias or justifications for judgements were resolved through discussion by the two researchers to arrive at a final decision. The overall risk of bias judgement for a study was based on the highest level of bias determined in any of the six domains that we assessed.

2.9. Data synthesis

We determined that a meta-analysis approach to analyzing the data from the included studies was inappropriate due to the different types of designs, measures of the exposure (community violence), and measures of the outcome (mental health) used in the studies. Therefore, we conducted a narrative synthesis to summarize the studies' characteristics and findings.

3. Results

3.1. Search Results

Fig. 1 shows the flow of studies through the review process. The search resulted in 37,976 studies (37,941 from databases and 35 from ClinicalTrials.gov). After 7,862 duplicate studies were found and omitted, we screened the remaining 30,114 records, as well as 4 identified records from the Society of Behavioral Medicine website, resulting in a total of 30,118 records. We reviewed 66 full-text documents and included 5 studies (Altman et al., 2018; Elze et al., 1999; Foster et al., 2016; Stults-Kolehmainen et al., 2014; Tamura et al., 2020). We further searched through all titles and abstracts of references that cited any of the 5 included studies, as well as references cited within the 5 included studies. We did not find any additional articles that fulfilled the inclusion criteria from these reference citation searches. Appendix B includes a list of excluded studies from the full-text screening with the reasons for exclusion.

3.2. Characteristics of included studies

Table 1 summarizes the characteristics of the included studies. One included study involved a mixed-method design (Altman et al., 2018), three utilized cross-sectional designs (Elze et al., 1999; Stults-Kolehmainen et al., 2014; Tamura et al., 2020), and one employed a longitudinal design (Stults-Kolehmainen et al., 2014). Three of the studies were conducted in the United States (Elze et al., 1999; Stults-Kolehmainen et al., 2014; Tamura et al., 2020), one was conducted in Australia (Foster et al., 2016), and one in Mexico (Altman et al., 2018). Sample sizes across the studies ranged from 395 (Stults-Kolehmainen et al., 2014) to 2209 (Tamura et al., 2020) participants. All of the studies involved adult participants, except for one that involved adolescents (Elze et al., 1999), and all included both males and females. Two of the studies involved mostly African American individuals (Elze et al., 1999; Tamura et al., 2020), one included only Mexican participants (Altman et al., 2018), one included only Australian participants with race/ethnicity not reported (Foster et al., 2016), and one included participants from various racial/ethnic backgrounds (Stults-Kolehmainen et al., 2014). Three of the five studies reported both income level and education of the participants and/or their parents (Altman et al., 2018; Foster et al., 2016; Tamura et al., 2020) and two reported family structure (Elze et al., 1999; Foster et al., 2016).

3.3. Measures of community violence, mental health, and physical activity

Table 2 describes the measures of community violence, mental health, and physical activity assessed in the included studies. Community violence was assessed in a variety of ways with none of the studies

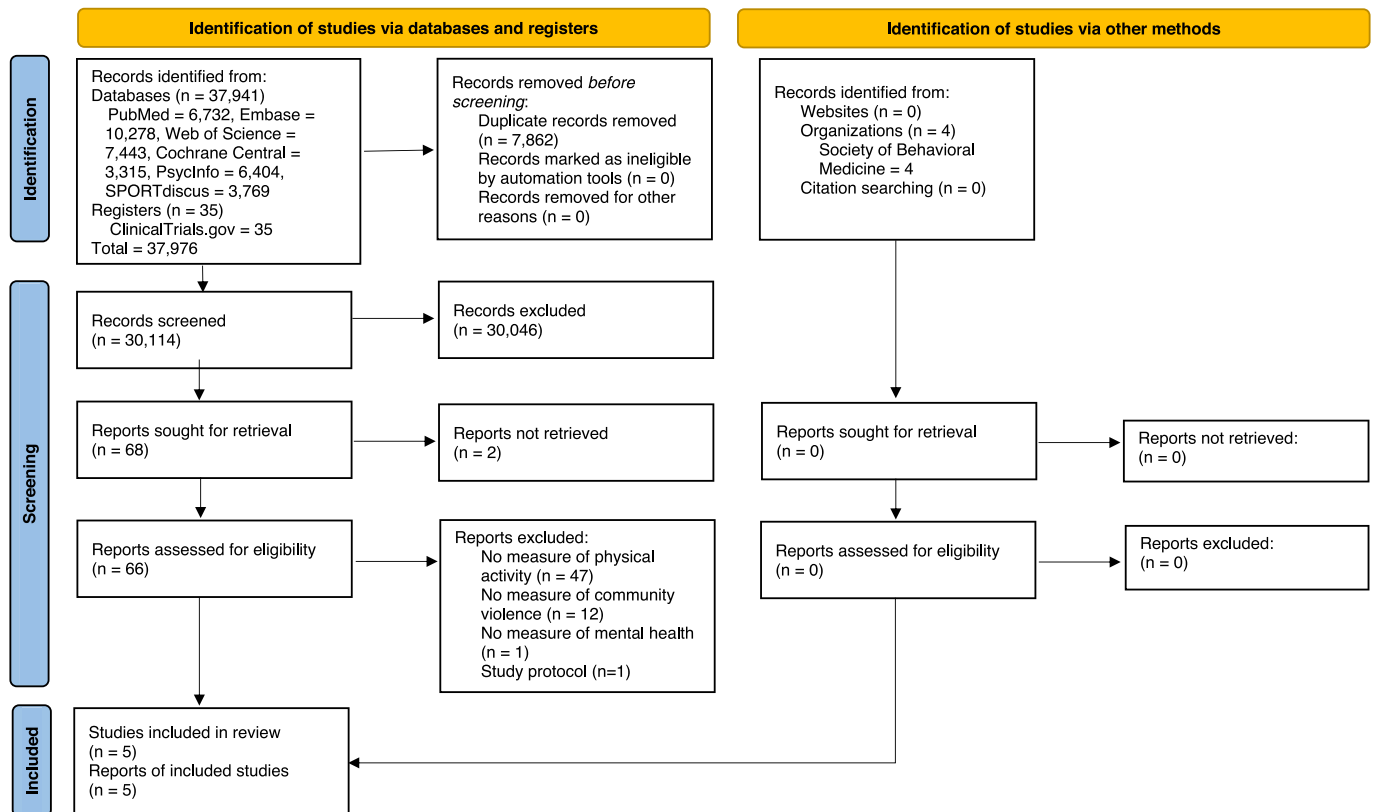


Fig. 1. Flow diagram of study selection process.

Table 1
Characteristics of included studies.

Author and year	Study design	Country	Sample size, N	Source of participants	Age, Mean ± SD	% Female	Race/Ethnicity	Sociodemographic variables
Altman et al., 2018	Mixed methods study	Mexico	481	2014 Study of Health and Migration in Mexico (SHMM), collected by researchers at Rice University in conjunction with psychiatrists at the Escuela de Medicina del Tecnológico de Monterrey in Monterrey, Nuevo Leon, Mexico	43.2 ± 16.2	46.7	Mexican	Secondary education achieved, 51.54 %; Has enough money to meet needs, 47.81 %
Elze et al., 1999	Cross-sectional study	United States of America	771	Adolescents who received services from gateway sectors such as child welfare, education, juvenile justice, and primary health care	15.3 (SD not reported)	57.0	African American 86 %, Other 14 % (no further details provided)	Youths' parents received public assistance, 15 %; Occupation: laborers or semiskilled workers, 33 %, blue collar occupations, 23 %, white collar, 14 %, and managerial or professional positions, 9 %; Two parent families, 14 %; Lived in families headed by a mother with or without another adult, 53 %, foster or group care, 14 % non-pare, not relatives, 12 %, with fathers, 5 %, and elsewhere, 2 %
Foster et al., 2016	Longitudinal study	Australia	531	RESidential Environments (RESIDE) Project	45.4 ± 11.8	62.3	Not Reported	Married, 87.2 %; secondary or less, 34 %; Income \$90,000 and higher, 42.8 %
Stults-Kolehmainen et al., 2014	Cross-sectional study	United States of America	395	Community Sample	29.4 ± 9.0	55.4	White 64.2 %, African American 26.1 %, Asian 4.6 %, Hispanic/Latino/Latina 7.3 %	Education at least grade 12, 85.3 %
Tamura et al., 2020	Cross-sectional study	United States of America	2209	Jackson Heart Study (JHS)	52.6 ± 12.2	64.2	African American	Graduated high school, 88.68 %; Income greater than or equal to \$50,000, 35.45 %, less than \$50,000, 51.61 %, Not reported, 12.95 %

using the same instrument. In two studies, participants were asked if they had ever witnessed violence (Elze et al., 1999; Stults-Kolehmainen et al., 2014). In one study, participants were asked about their perceptions of the safety of their neighborhoods, including how regularly events, such as neighborhood fighting, sexual assault, and robbery, occurred in their neighborhood (Tamura et al., 2020). In one study, participants were asked how safe they felt in their neighborhood and whether they had ever been a victim of violence (Altman et al., 2018). In one study, participants were asked about their fear of crime, such as having someone break into their house, being attacked by someone with a weapon, and being robbed or mugged on the street (Foster et al., 2016).

Mental health outcomes were assessed in a variety of ways with none of the studies using the same instrument. Two studies assessed psychological distress/psychological health problems (Elze et al., 1999; Stults-Kolehmainen et al., 2014), two assessed multiple dimensions of mental health problems, such as depression, substance abuse/dependence, and post-traumatic stress symptoms (Altman et al., 2018; Elze et al., 1999), and one assessed only depressive symptoms (Tamura et al., 2020).

Physical activity was assessed in a variety of ways with none of the studies using the same instrument. In all of the studies, participants were asked how often they participated in physical activity, but the type of physical activity assessed varied across the studies. In one study, physical activity participation was considered “high” if participants engaged in any form of physical activity 3 or more times a week (Altman et al., 2018). In another study, participants were asked how many afternoons or evenings a week they spent on organized sports (Elze et al., 1999). In the other studies, participants were asked how many minutes a week they spent walking and the purpose of walking (e.g., transport, recreation, health, or fitness) (Foster et al., 2016), how often in a month or week they exercised and for how long per exercise session (Stults-Kolehmainen et al., 2014), and how often they engaged in different types of physical activities in three domains: active living, home/life, and sport/exercise (Tamura et al., 2020). Two studies used a single question to assess physical activity participation (Altman et al., 2018; Elze et al., 1999) and only one study asked participants about the intensity of their physical activity participation (Tamura et al., 2020).

3.4. Risk of bias

Table 3 summarizes the results for each of the six risk of bias areas and the overall risk of bias area using the adapted ROBINS-E, (ROBINS-E Development Group, 2023). All studies were assessed as having some concerns of overall bias as they involved measurement of mental health outcomes based on participant self-report via questionnaires and/or interview questions. Consequently, participants served as outcome assessors and their knowledge of their own history of exposure to community violence might have influenced their self-assessments of mental health outcomes.

3.5. Effects of physical activity between exposure to community violence and mental health

Table 4 summarizes the effects of physical activity between exposure to community violence and mental health, which was investigated differently across the studies. In two studies, the mediating effect of physical activity on the relationship between community violence and mental health was assessed. In one of these studies, no mediation effect of physical activity was found (Altman et al., 2018). In the other study, significant indirect mediation effects were found for total physical activity on the relationship between perceptions of neighborhood violence and depressive symptoms (Tamura et al., 2020). Further sensitivity analyses showed that the significant, indirect mediation effect of physical activity was attributable to participation in active living tasks (e.g., walking or biking to and from work) and sport and exercise activities (Tamura et al., 2020). In another study, there was no interaction

between witnessing violence and participation in social activities (one of which was physical activity) as a predictor of conduct disorder and substance abuse symptoms (Elze et al., 1999). Those who participated often in organized sports, religious activities, and clubs and who regularly witnessed violence did not have lower conduct disorder symptoms. A fourth study found that higher psychological distress leads to higher fear of crime; however, this relationship was not explained by people engaging in constraining/avoiding behaviors, such as not going out to walk in their neighborhoods (Foster et al., 2016). The final study found no interaction effect of exercise buffering the association between cumulative adverse life events, which includes traumatic life events such as witnessing violence, and psychological health problems (Stults-Kolehmainen et al., 2014).

3.6. Qualitative findings from included studies

One study included qualitative methods (i.e., individual interviews), in which participants were asked about the impact of community violence on their mental health (Altman et al., 2018). Participants commented that they were afraid to go outside due to the potential of violence and felt increased stress from having to be inside. While participants were not asked questions specifically about physical activity, one mother expressed how fear of violence and concerns about the safety of her child kept her from taking her child to a playground even though her child wanted to go out and play (Altman et al., 2018).

4. Discussion

This systematic review identified five studies that examined physical activity in connection with exposure to community violence and mental health. The number of studies examining this topic was relatively low considering the prevalence of community violence worldwide (Krug et al., 2002; UNODC, 2014), the deleterious effects of community violence on people’s mental health (Finkelhor et al., 2013; Lee et al., 2020; Raman et al., 2021; Zinzow et al., 2009a; Zinzow et al., 2009b), and the important mental health benefits of physical activity (Bidde et al., 2019; Mahindru et al., 2023; Rodríguez-Romo et al., 2022). In addition to the paucity of evidence on this topic, we found the limited existing studies also defined and measured community violence, mental health, and physical activity in different ways. Exposure to community violence was conceptualized in three main ways: witnessing violence, being a victim of violence, and having perceptions about neighborhood safety/fear of crime. Mental health was assessed in two main ways: as a single condition (e.g., depression) and as multiple conditions (e.g., depression, substance abuse/dependence, and PTSD). For all studies, physical activity was assessed with self-report measures that included questions about how often participants were physically active. However, the type of physical activity included in the measures varied across the studies and included organized sports, walking, and exercise and only one study included a measure involving different categories (e.g., household, transport, and leisure) and intensities of physical activity. Further, in three studies, physical activity was assessed as part of a larger construct (e.g., stress-coping behaviors, social activities, and avoidance behaviors) involving multiple items. In two of these studies, physical activity was assessed with a single question and in one study physical activity was combined with two other variables (participation in religious activities and clubs) into a single measure. Based on this review’s findings, future studies specifically designed to examine physical activity’s role in the relationship between exposure to community violence and mental health, with similar definitions and measures of community violence and mental health as well as robust measures of physical activity, would help advance this important research topic.

Across the five studies, physical activity was examined in three main ways: mediator, moderator, and as part of an interaction to predict/explain a mental health outcome (e.g., interaction between witnessing violence and participating in organized sports to predict conduct

Table 2
Community violence, mental health, and physical activity measures used in the included studies.

Author and year	Exposure		Outcome		Physical activity	
	Community violence definition	Community violence measure	Mental health definition	Mental health measure	Physical activity definition	Physical activity measure
Altman et al., 2018	Perceptions and experiences of violence	One interview question about safety in one's community. One question about whether one has ever been a victim of violence.	Clinician diagnosed mental health disorders—including depressed episode, agoraphobia (e.g., fear of open, public spaces), alcohol abuse, and anxiety—and individual-level indicators of perceptions of violence and factors known to mediate the stress response	The Mini International Neuropsychiatric Interview (MINI)	Participation in high level of physical activity	Stress-coping behaviors (smoking cigarettes, drinking alcohol, having a doctor for routine care, and feeling rested when waking in the morning) were measured, including one interview question about engagement in physical activity (3 + times per week = high)
Elze et al., 1999	Neighborhood and school violence	The neighborhood violence index; An index of school violence; Extrafamilial personal victimization; Witnessing violence	Measures of depression, conduct disorder, and substance abuse or dependence; Post-traumatic stress symptoms	Diagnostic Interview Schedule for Children-Revised (DISC-R); Diagnostic Interview Schedule (DIS)	Participation in sports	Social activities were measured as the total count of the number of different types of activities in which an individual participated during the last 6 months, including religious activities, clubs, and sports
Foster et al., 2016	Fear of crime	One interview question about one's level of fear concerning having someone break into one's house, being attacked by someone with a weapon, being mugged or robbed on the street, having property damaged by vandals, and having someone loiter near one's home at night	Psychological distress	Kessler-6 (K6)	Walking	Avoidance behaviors (community participation and perceived social cohesion) were measured, including questions about physical activity with the Neighbourhood Physical Activity Questionnaire - Walking (minutes per week)
Stults-Kolehmainen et al., 2014	Witnessed violence	Cumulative Adversity Interview (CAI), Life Traumas subscale, which includes witnessed violence	Psychological health problems	Cornell Medical Index (CMI)	Frequency and duration of exercise	Items modified from the Nurses' Health Study: "How often do you typically exercise?" (Response options were: never, monthly or less, 2–3times/month, once/week, 2–3 times/week, and 4 times/week) and "How long do you typically exercise?" (Responses for this question included: not applicable, 0–15 min, 15–29 min, 30–44 min, 45–59 min, 60 min)
Tamura et al., 2020	Neighborhood violence	Perceived Neighborhood Social Environment (PNSE)-neighborhood violence subscale	Depressive symptoms	Center for Epidemiologic Studies - Depression (CES-D) scale	Engagement in physical activity in three domains: Active living (AL), home/life (HL), and sport/exercise activities (SE)	JHS Physical Activity (JPAC) Survey - Physical activity was measured in the following ways: (a) in each of the three domains (AL, HL, SE), (b) total physical activity (sum of the three domains), and (c) intensity of activity for the AL and HL domains

Table 3
Results of the assessment of risk of bias in the included studies.

Study	Risk of bias due to confounding	Risk of bias arising from measurement of the exposure	Risk of bias in selection of participants into the study (or into the analysis)	Risk of bias due to missing data	Risk of bias arising from measurement of the outcome	Risk of bias in selection of the reported result	Overall risk of bias
Altman et al., 2018	Low risk	Some concerns	Low risk	Low risk	Some concerns	Low risk	Some concerns
Elze et al., 1999	Low risk	Low risk	Low risk	Low risk	Some concerns	Low risk	Some concerns
Foster et al., 2016	Some concerns	Low risk	Some concerns	Low risk	Some concerns	Low risk	Some concerns
Stults-Kolehmainen et al., 2014	Low risk	Low risk	Low risk	Low risk	Some concerns	Low risk	Some concerns
Tamura et al., 2020	Low risk	Low risk	Low risk	Low risk	Some concerns	Low risk	Some concerns

disorder symptoms). Of these studies, only one reported a significant role (mediator) for physical activity: perceptions of neighborhood violence were associated with lower depressive symptoms when participants engaged in active living tasks, sports, and exercise. Physical activity has been shown to mediate the relationship between perceptions of crime safety and physical health outcomes, such as obesity (Brown et al., 2014). In addition, physical activity has been shown to mediate the relationship between perceptions of neighborhood personal safety and mental health-related quality of life (Van Dyck et al., 2015). When examined as a potential moderator, physical activity has been shown to reduce the effects of interpersonal violence (e.g., bullying) on adolescents’ mental health (Chen et al., 2020; Kirklewski et al., 2023). This systematic review reveals a need for more studies examining both the mediating and moderating role of physical activity between community violence, as compared to interpersonal violence, and mental health.

Four of the studies in the review were conducted in high-income countries and the other in an upper-middle-income country (Nations, 2023). This suggests a research gap on this topic concerning lower-and middle-income countries (LMICs) where 85 % of the world’s population resides and over 80 % of mental health disorders occur (Alloh et al., 2018; Javed et al., 2021; Rathod et al., 2017). Mental health disorders are significantly associated with experiencing traumatic events, including witnessing violence, in LMIC settings (Ribeiro et al., 2013; Uwakwe et al., 2012; van der Westhuizen et al., 2014). Only three of the five included studies involved minority populations and only two populations were represented (African Americans and Mexicans). In the United States, individuals of lower income and education who are black and Latinx have been found to be disproportionately exposed to community violence, particularly gun violence, and its harmful mental health effects (Magee et al., 2022; Smith et al., 2020). Based on this review’s findings, further research in low- and middle-income countries and with individuals from minority populations in high-income countries, particularly those living in low-income communities, is needed. Such individuals may not be able to relocate due to financial circumstances and may not want to leave their neighborhoods due to relationships they have formed. In these communities, it may be useful to examine the impact of alternative activities, such as Tai Chi, that can be done safely at home and may be beneficial for stress management (Niles et al., 2022).

Individuals’ perceptions about neighborhood safety/fear of crime comprised one of the main ways that community violence was conceptualized in the included studies. Researchers have suggested that individuals’ ratings of neighborhood safety may not adequately reflect the health consequences of living in a violent neighborhood (Johnson et al., 2009). Based on this review, researchers should thoughtfully consider what measure of exposure to community violence they utilize. There may be different effects on individuals’ mental health when considering perceptions of neighborhood safety compared to firsthand experiences of violence. One approach might be to utilize measures that focus solely

on firsthand experiences of violence, as they may still capture individuals’ perceptions of safety (Johnson et al., 2009). However, we recommend that researchers should measure both perceived and actual exposure to community violence in their studies as both measures may have different effects on mental health.

Heightened crime and less pedestrian safety are two environmental attributes that are significantly associated with physical activity levels among minority and low-income populations (Laddu et al., 2021). While none of the studies in this review considered environmental attributes in their definitions and measures of physical activity, making changes to built environment attributes is a common strategy to enhance physical activity (Zhong et al., 2022). Properly designing and implementing built environment interventions, including enhancing green spaces to mitigate community violence and encouraging the use of urban parks to enhance physical activity, among those most impacted by community violence are important areas for future research (Bonaccorsi et al., 2020; Foster et al., 2021; Shepley et al., 2019). Based on this review’s findings, a missing aspect of research is the use of qualitative methods to better understand minority and low-income residents’ perspectives regarding the role of physical activity in their daily challenges of living with community violence and its mental health effects. One potential area for future qualitative studies is to obtain residents’ perspectives to help determine how to better approach built environment interventions.

None of the included studies involved older adults or children. Understanding how children’s physical activity plays into the relationship between community violence and mental health may be particularly important since movement is essential for children’s brain development (Meijer et al., 2020), self-regulation (Bai et al., 2021), and mental health (Rodriguez-Ayllon et al., 2019). In addition, childhood is a key developmental period when children learn the fundamental movement skills to be active throughout life and reap the mental health benefits of physical activity (Bolger et al., 2021). Based on this review’s findings, parents’ concerns about community violence may be restricting children’s opportunities to go outside to play and practice movement skills. Further research would help determine how children’s exposure to community violence affects their development of movement skills and use of outdoor play spaces, which are important settings to enhance mental health (Pérez-del-Pulgar et al., 2021).

While sedentary behavior is associated with impaired mental health (Huang et al., 2020; Zhou et al., 2023), none of the included studies assessed the impact of sedentary behavior, such as exploring peoples’ fears about going outside increasing more time spent in indoor sedentary activities and worsening mental health disorders. In addition, none of the included studies examined psychological well-being as an outcome. The role of physical activity on aspects of psychological well-being [e.g., personal growth, close connections with others, and environmental mastery, (Avis et al., 2021)] among people experiencing community violence appears to be an unexplored area of research.

Only one of the included studies used a longitudinal design (Foster et al., 2016). Based on this review, there is a clear need for more

Table 4
Effects of physical activity between exposure to community violence and mental health.

Author and year	Sample size, N	Age, Mean \pm SD	% Female	Race/Ethnicity	Sociodemographic variables	Exposure	Outcome	Is physical activity a mediator or moderator?	Results	Did physical activity play significant role in the relationship between community violence and mental health?
Altman et al., 2018	481	43.18 \pm 16.2	46.71	Mexican	Secondary education achieved, 51.54 %; Has enough money to meet needs, 47.81 %	Perceptions and experiences of violence	Diagnosed psychiatric disorders	Mediator	No mediating effect of physical activity on the relationship between community violence and mental health was found. Statistics not reported.*	No
Elze et al., 1999	771	15.3 (SD not reported)	57	African American 86 %, Other 14 % (no further details provided)	Youths' parents received public assistance, 15 %; Occupation: laborers or semiskilled workers, 33 %, blue collar occupations, 23 %, white collar, 14 %, and managerial or professional positions, 9 %; Two parent families, 14 %; Lived in families headed by a mother with or without another adult, 53 %, foster or group care, 14 % non-parent relatives, 12 %, with fathers, 5 %, and elsewhere, 2 %	Exposure to violence	Mental health problems	N/A	Participation in social activities (combination of sports, religious activities, and clubs) was examined in relation to predicting conduct disorder symptoms and substance abuse symptoms, but the interaction was not significant. Statistics not reported.**	No
Foster et al., 2016	531	45.4 \pm 11.8	62.3	Not Reported	Married, 87.2 %; Secondary education or less, 34 %; Income \$90,000 and higher, 42.8 %	Fear of crime	Mental health	N/A	Results showed higher psychological distress leads over time to higher fear of crime, but this relationship was not explained by people engaging in constraining/avoiding behaviors, including not going out to walk in their neighborhoods. Model estimate without constraining/avoiding behaviors (0.074, SE = 0.025, p = 0.0013). Model estimate with constraining/avoiding behaviors (0.063, SE = 0.024, p = 0.0101).	No
Stults-Kolehmainen et al., 2014	395	29.42 \pm 8.95	55.4	White 64.2 %, African American 26.1 %, Asian 4.6 %, Hispanic/Latino/Latina 7.3 %	Education at least grade 12, 85.3 %	Cumulative adversity	Psychological health problems	Moderator	No moderating effect of exercise on the relationship between traumatic life events and psychological health problems. Statistics not reported.*	No

(continued on next page)

Table 4 (continued)

Author and year	Sample size, N	Age, Mean ± SD	% Female	Race/Ethnicity	Sociodemographic variables	Exposure	Outcome	Is physical activity a mediator or moderator?	Results	Did physical activity play significant role in the relationship between community violence and mental health?
Tamura et al., 2020	2209	52.64 ± 12.20	64.2	African American	Graduated high school, 88.68 %; Income greater than or equal to \$50,000, 35.45 %, less than \$50,000, 51.61 %, Not reported, 12.95 %	Perceived Neighborhood Social Environment (PNSE)	Depressive Symptoms	Mediator	Mediation analysis revealed that perceptions of higher levels of neighborhood violence were indirectly associated with depressive symptoms via total PA ($\beta = 0.26$, SE = 0.13, 95 % CI: 0.05–0.55). Further sensitivity analyses showed the mediation effects of PA were driven by the categories active living ($\beta = 0.22$, SE = 0.12, 95 % CI: 0.04–0.50) and sport/exercise activities ($\beta = 0.16$, SE = 0.10, 95 % CI: 0.01–0.38).	Yes

*Communicated with corresponding author to obtain statistics. No response received. ** Communicated with corresponding author to obtain statistics. Author responded that data is no longer available.

longitudinal studies on the impact of exposure to community violence on mental health. More research needs to be done to understand the trends in physical activity behaviors and mental health outcomes that occur as a result of increases or decreases in the incidence of community violence. Additionally, longitudinal intervention studies that address determinants, such as perceptions of neighborhood safety and availability of physical activity resources, in low-income communities that experience community violence are needed to understand how such interventions may influence physical activity behaviors and mental health outcomes. Considering the potential economic impact of community violence, including firearm injuries, on businesses' health care spending (Ranney et al., 2020; Song, 2022), longitudinal research would also help inform how community violence impacts the viability of organizations and businesses that offer physical activity services and resources (e.g., community centers, local fitness centers, and bicycle shops).

4.1. Study limitations and strengths

This review was limited by a small number of included studies, reducing the generalizability of the findings. Given that the inclusion criteria involved generally healthy individuals across the lifespan who were ambulatory, we may not have adequately captured studies that involved individuals with physical disabilities who ambulate with devices, such as wheelchairs. Further, we did not include measures of cognitive development, attention, or memory that may be considered proxies of mental health. Most of the studies included in this review used cross-sectional research designs, and the disparate measures of the outcomes and exposures in the included studies precluded a meta-analysis approach to analyzing the data. As such, a causal nature of these associations remains unclear. Also, all studies in this review used subjective measures of community violence and physical activity, and thus were subjected to social desirability bias or recall bias. The strengths of

this systematic review included a systematic screening and decision-making process. In addition, the predefined inclusion criteria were expansive allowing us to screen a large number of records and review several full-text documents. To our knowledge, this study is the first that systematically reviewed the existing literature regarding the role of physical activity in the association between community violence and mental health. The review not only considered several constructs of community violence (e.g., neighborhood violence, perception and experience of violence, witnessing violence, and fears of crime in one's community) and domains of mental health (e.g., depression, psychological distress, post-traumatic stress symptoms, and clinician diagnosed mental disorders), but also considered physical activity intensity, frequency and duration, and types (e.g., walking, sports, and exercise).

5. Conclusion

In conclusion, this systematic review revealed that few studies have specifically examined physical activity's role in the relationship between exposure to community violence and mental health, with only one study reporting a significant, mediating role of physical activity. In most studies, physical activity was not a primary focus but assessed as one item within a larger construct. In addition, most studies occurred in high-income countries, involved a limited number of minority populations, and did not include children or older adults. Enhancing mental health in the context of community violence is a pressing public health issue. Further research is needed to better understand the role physical activity might play in addressing this issue.

CRediT authorship contribution statement

Jeffrey S. Gehris: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Writing – original draft, Writing – review & editing, Supervision, Project administration. Adewale L. Oyeyemi:

Conceptualization, Methodology, Formal analysis, Investigation, Writing – review & editing, Supervision. **Mona L. Baishya:** Methodology, Validation, Formal analysis, Investigation, Writing – review & editing, Visualization. **Stephanie C. Roth:** Methodology, Data curation, Writing – review & editing. **Mark Stoutenberg:** Conceptualization, Methodology, Formal analysis, Investigation, Writing – review & editing, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Acknowledgements

We would like to acknowledge Jacob Brintzenhoff, MLIS, Medical Librarian, Krausz Podiatry Library for his assistance with updating the database and grey literature searches for this systematic review. We would also like to acknowledge the following individuals who assisted with the screening of records: Tolulope Adeniji, Nina Hernandez, Shuaibu Ibrahim, Cornelius Ishaku, Joshua Matthew, and Taylor Moore.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.pmedr.2023.102509>.

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