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Correlates of youth violence in low- and middle-income countries: A meta-analysis

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ABSTRACT

The highest rates of serious interpersonal violence occur in low-and-middle income countries (LMICs) especially in Latin America, the Caribbean, and sub–Saharan Africa. However, previous reviews of risk factors for youth violence focused almost entirely on studies from high-income countries (HICs). Rigorous synthesis of evidence is needed for LMICs. We conducted a meta-analysis of studies of youth violence in LMICs, identified by extensive searches in seven languages. Studies reporting correlates of violence perpetration in samples of 100 or more 10–29 year-olds from the general population in LMICs were included in the review. Eighty-six studies including 480,898 individuals from 60 countries were eligible for meta-analysis. Violent outcomes included fighting, carrying a weapon and other interpersonal violent behaviors (e.g. assault). The strongest correlates of youth violence (OR ≥ 2.5) were: male sex, impulsivity, conduct problems, sexual intercourse at an early age, smoking, alcohol use, using illicit drugs, being bullied, suffering criminal victimization, having deviant/delinquent peers, and watching violent television. We conclude that many correlates of youth violence in LMICs are similar to those that have been identified in HICs, but other biological, psychological, and cultural predictors remain to be tested in LMICs. Implications for research and policy are discussed.

1. Introduction

Violence is a major global health, social, and justice problem. Almost half a million people died from homicide in 2012 (United Nations Office on Drugs and Crime (UNODC), 2014). Nearly all of these deaths occur in low and middle-income countries (LMICs), and the highest rates are found in Latin America, the Caribbean, and sub-Saharan Africa (UNODC, 2014; WHO, 2015). Violence is seen as a significant threat to development in these regions because it involves major economic costs and loss of human capital (Bowman, Matzopoulos, Butchart, & Mercy, 2008). For example, the total cost of homicide alone is estimated at 0.33% of GDP in HICs, but in Latin America and the Caribbean regions this rises to 4.1% (Feron & Hoeffler, 2014). These costs exert a considerable economic burden on already stressed state systems (Bowman et al., 2008). Therefore, to seriously reduce global levels of violence in regions most at need, new research and prevention efforts are needed in LMICs. The 2030 Agenda for Sustainable Development explicitly included reducing violence among its goals and targets in order to help the development of sustainable societies (United Nations (UN), 2015).

The World Health Organization (WHO) defines violence as: "*The intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community that either results in or has a high likelihood of resulting in injury, death, psychological harm, maldevelopment or deprivation*" (WHO, 2002: 5). The WHO distinguished three broad types of violence: self-directed violence, interpersonal violence and collective violence (WHO, 2002). In this study, we focus on interpersonal violence. According to the classic age-crime curve, interpersonal violence is primarily committed by young men (peak age about 18 years old) (Farrington, 1986). About 200,000 homicides occur each year among people aged 10–29 years, making homicide the fourth leading cause of death in this age group (World Health Organization, WHO, 2015), and the leading cause of death for young people in Latin America.

Abbreviations: GNI, gross national income; HICs, high-income countries; LMICs, low- and middle-income countries; SES, Socioeconomic status; OR(s), Odd Ratio(s); UNDOC, United Nations Office on Drugs and Crime; WHO, World Health Organization

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Although the highest levels of violence and the majority of youth are in LMIC regions, research on violence has been mainly conducted in HICs (Krisch, Eisner, Mikton, & Butchart, 2015; Murray, Cerqueira, & Kahn, 2013). The focus of research in HICs means that recommendations for preventing youth violence in LMICs are often based on evidence from other regions (Atienzo, Baxter, & Kaltenthaler, 2017; Murray et al., 2018; Tonry, 2015). Therefore, there is a need for systematic examination of correlates of youth violence in LMICs.

Many correlates of youth violence and delinquency have been identified in HICs, as documented in the comprehensive *Handbook of Crime Correlates* (Ellis, Beaver, & Wright, 2009). Correlates are often conceptually organized in an ecological model, starting with influences most close to the individual, and moving outwards to consider the wider social context. Research in HICs shows that among *individual level risk factors*, the following are implicated: young age (Farrington, 1986); male gender (Beaver & Nedelec, 2015; Ribeaud & Eisner, 2010); pregnancy complications and associated neurological damage (Kandel & Mednick, 1991; Raine, Brennan, & Mednick, 1994); low resting heart rate (Farrington, 1998; Raine, 2013); internalizing disorders such as depression and anxiety (Caspi et al., 1994); personality traits such as risk-taking, hyperactivity, egocentrism (af Klinteberg, Andersson, Magnusson, & Stattin, 1993; Farrington, 1998; Hawkins et al., 1998); deficiencies in executive functions (Moffitt & Henry, 1989); cognitive deficits such as low IQ or limited vocabulary (Barker et al., 2011; Séguin, Parent, Tremblay, & Zelazo, 2009); child aggressive or antisocial behaviors, particularly if they are manifest at an early age (Loeber & Hay, 1997; Ribeaud & Eisner, 2010; Thornberry, Huizinga, & Loeber, 1995); moral values or beliefs favourable to deviant or criminal behavior (Jolliffe, Farrington, Loeber, & Pardini, 2016; Wikström, Oberwittler, Treiber, & Hardie, 2012); experiences of victimization (Resnick, Ireland, & Borowsky, 2004; Swahn et al., 2012); use of legal and illegal substances (Bennett, Holloway, & Farrington, 2008; Sussman, Skara, Weiner, & Dent, 2004).

With regard to *family risk factors*, youth violence in HICs is associated with family composition (Farrington, 1998; Jolliffe et al., 2016), low parental monitoring and high authoritarian or inconsistent discipline practices (Capaldi & Patterson, 1996; Ribeaud & Eisner, 2010); low parental involvement and attachment (Farrington, 1989; Thornberry et al., 1995); family conflict (Farrington, 1998); child maltreatment (Fergusson & Lynskey, 1997; Smith & Thornberry, 1995); having delinquent or violent siblings (Farrington, 1989; Ribeaud & Eisner, 2010); and being raised in a poor or low income family (Farrington, 1989).

Education and school risk factors that have been identified in studies in HICs, include poor academic performance (Maquin & Loeber, 1996; Resnick et al., 2004), low school commitment and bonding with classmates and teachers (Lösel & Farrington, 2012; Ribeaud & Eisner, 2010), and attending schools with high levels of violence and deviance (Farrington, 1989; Ribeaud & Eisner, 2010). Among *peer risk factors* associated with youth violence, the most prominent is having delinquent or antisocial peers (Moffitt, 1993; Pratt et al., 2010; Thornberry et al., 1995) or belonging to a gang (Decker, Katz, & Webb, 2008; Herrenkohl et al., 2000; Klein & Maxson, 2012). Finally, there are important *community or neighbourhood-level risk factors* associated with youth violence, such as living in: urban areas (Thornberry et al., 1995); poor neighbourhoods (Sampson & Lauritsen, 1994); neighbourhoods characterized by social disorganization, and high availability of drugs, firearms and adult offenders (Herrenkohl et al., 2000; Wikström & Loeber, 2000).

A number of systematic reviews and meta-analyses have synthesized the associations between these risk factors and youth violence and delinquency (for a recent review of reviews, see Farrington, Gaffney, & Ttofi, 2017). Empirical findings have been used to develop life-course theories of offending, such as the Integrated Cognitive Antisocial Potential (ICAP) Theory (Farrington, 2005) which includes both short (e.g., situational) and long-term (e.g., individual, family, school) risk factors. However, prior reviews and theories have been based almost entirely on studies conducted in HICs. It is possible that few primary studies exist in LMICs, but it is also the case that some prior reviews have purposely excluded non-western countries or LMICs, or used methods that are less likely to locate studies in LMICs (not searching in relevant regional databases, excluding studies not reported in English), or they have included only studies with large samples and long follow-up periods, which are harder to conduct in low-resource settings (Shenderovich et al., 2016).

The current meta-analysis is based on a sub-set of studies identified in the first major systematic review of all quantitative studies of correlates and risk factors for child conduct problems, aggression and bullying behavior, and youth gang involvement, crime and violence in LMICs (see Shenderovich et al., 2016, for an overview). Murray et al. (2018) recently synthesized the findings from longitudinal studies found in this project (Shenderovich et al., 2016). They found that risk factors such as prior conduct problems, poor educational performance, drug use, maternal smoking in pregnancy, having a young mother, experiencing family poverty, and having a large family generally predicted antisocial behaviors similarly in LMICs as in HICs. However, there were only seven LMIC longitudinal studies with an outcome of *violent* behavior, which could be included in that review (aside from longitudinal studies of other forms of child and youth antisocial behavior). Therefore, the present study combined both cross-sectional and longitudinal studies to provide a much larger database to analyse correlates of violence in LMICs, with three aims:

1. Generate more reliable results correlates of violence in LMICs, based on a larger number of studies
2. Examine additional correlates of violence in LMICs that were not identified in the limited number of longitudinal surveys previously reviewed
3. Examine moderators that could not previously be assessed with a smaller number of primary studies.

Most prior reviews focusing on HICs did not discriminate between different types of violent behavior, and examined outcomes of "aggressive behaviors", or any type of "violent offence" as outcomes (Derzon, 2010; Jolliffe & Farrington, 2004; Ogilvie, Newman, Todd, & Peck, 2014). It is possible that correlates have different associations with different types of violence (e.g., with general fighting or with weapon use). Therefore, we also aimed to advance on previous reviews by considering whether correlates showed different associations depending on the type of violence outcome examined – namely, all types of violence, fighting, or carrying a weapon.

2. Methods

Full details of the search and screening methods, and the review protocol of the overall systematic review project that aimed to identify all studies in LMICs that reported correlates of child and youth antisocial behavior are described in a separate article (Shenderovich et al., 2016). Findings from longitudinal studies can be found in Murray et al. (2018). Below, we provide a summary of the overall project methods and additional details about this specific study of correlates of youth violence.

2.1. Literature search strategies

As described by Shenderovich et al. (2016), an extensive search was conducted in seven languages. In summary, first a broad and sensitive search strategy was developed for multiple electronic databases. The search strategy combined terms for low- and middle-income countries, including names of all individual LMICs and relevant regions; children and youth; and relevant outcomes, including antisocial behavior, conduct problems and disorders, externalizing, aggression, bullying, crime,

violence, gang membership, etc. The following databases were searched in August–September 2013 without restriction on study years or languages: PsycINFO, MEDLINE, EMBASE, CINAHL, EconLit, Criminal Justice Abstracts, Russian Academy of Sciences Bibliographies, Sociological Abstracts & Social Services Abstracts, Applied Social Sciences Index and Abstracts, International Bibliography of the Social Sciences, ERIC, Web of Science, National Criminal Justice Reference Service Abstracts Database, CENTRAL, JOLIS, World Bank, Open Grey, Global Health Library, and Google Scholar.

To complement the English language searches, translated search terms were used in six other languages to search Google Scholar and 12 regional databases: Index Medicus, King Saud University Repository and YU-DSpace Repository in Arabic; CNKI, Wanfang Data and Cqvip in Chinese; Index Medicus Afro, Revue de Médicine tropicale, Agence Universitaire de la Francophonie and Refdoc in French; Elibrary.ru and Panteleimon in Russian; LILACS and SciELO in Spanish and Portuguese. A further search for grey literature was conducted by entering the keywords into general internet search engines, including Google and Baidu, and contacting over 200 researchers in the field to locate unpublished studies. Jim Derzon also searched his large database of longitudinal studies (see Derzon, 2010) to locate any other possibly eligible studies.

2.2. Inclusion criteria

The review protocol was prepared with pre-set inclusion criteria, specifying the population, and outcome measures, and several methodological quality criteria for drawing conclusions about risk factors (Jolliffe, Murray, Farrington, & Vannick, 2012; Murray, Farrington, & Eisner, 2009). In brief, studies must have been conducted in a LMIC, used a cross-sectional, longitudinal or case-control design, included at least 100 participants in the community, used random sampling or included the total population, measured child outcomes (aggression, conduct problems, bullying) between ages 10–18 years and youth outcomes (gang involvement, crime, violence) between ages 10–29 years. In total, 522 studies were located meeting all the inclusion criteria of the systematic review project. For our specific meta-analysis on correlates of youth violence, the following additional inclusion criteria were stipulated:

(1) The study included an outcome measure of violent behavior, including fighting, carrying a weapon, other specific violent behaviors such as assault, or a summary measure of violent behaviors in general. The outcome behavior could occur in any context (e.g. school, university, households, and streets). Studies that had both violent and non-violent behavior outcomes (e.g. theft, burglary, drugs offenses, truancy) were included only if there was a clear distinction between both types of behavior, in which case, only the violent outcome was included in the meta-analyses. Studies reporting bullying were included only if a violent outcome such as fighting was listed separately to other non-violent bullying behaviors. Studies reporting a composite measure of violent behaviors were included only if all behaviors comprising that composite outcome were described and were violent (see definition below). The following outcomes were not included in the review: gang involvement, sexual assault, intimate partner and dating violence.
(2) The study participants were aged between 10 and 29 years old and lived in LMICs. LMICs were defined as countries with a low- or middle-income status according to the World Bank during the period between 1987 and 2012 (for more detail, see Murray et al., 2018; Shenderovich et al., 2016).
(3) The study included sufficient statistical information to calculate an effect size. The measure of the effect size used in the meta-analyses was the bivariate (zero-order) odd ratio (OR), based the proportion of participants showing violent/non-violent behaviors. Studies that reported only adjusted effect sizes were not included in the meta-analyses.
(4) Only risk factors that were examined in at least two studies were meta-analysed. Age and school grade were excluded from meta-analyses because studies tended to use an arbitrary cut points (13 years old, and 6 and 9 grades), in samples of different age ranges and with different comparison groups, making it impossible to produce meaningful combined effect sizes.

2.3. Data extraction

Data were extracted by three of the authors (OSR, NT and YS) using a standardized form which included the following information: authors, year of publication, country, sample size, sampling technique, age group, percentage of males, type of violent outcome, reference time for the outcome, risk domains, risk factors, response rate, percentage of males, type of respondent, type of design, and statistical analyses. Any differences were resolved by discussion between all authors.

The eligible studies reported on numerous different correlates of violence, which we group under five domains – individual, family, peer, school, and community. **Individual-level factors** included pre-natal factors, socio-demographic factors, behavior problems and psychological traits, drug and alcohol use, violent victimization, educational performance, and media consumption. *Pre-natal problems* included maternal alcohol/tobacco use during pregnancy, intrauterine growth, urinary infection in pregnancy, bleeding during pregnancy, use of medicines during pregnancy, abortion attempt, obstetric complications. *Sociodemographic factors* included gender, not being employed, not studying, no religious practice. *Behavior problems and early sexual intercourse* included conduct problems/disorder and early sexual intercourse. *Psychological factors* included impulsivity, lack of sensitivity to others, tolerance to deviance, common mental disorders, low self-esteem and suicidality. *Drug and alcohol use* included smoking tobacco and use of alcohol or illegal drugs. *Victimization* included being bullied, being assaulted, robbed or sexually abused, suffering corporal punishment at home or at school, suffering or being exposed to domestic violence or maltreatment, neighbourhood victimization. *Education and school factors* included weak attachment to school and poor academic performance, attending urban and public schools. *Media consumption* included watching violent TV.

Family-level factors included sociodemographic factors, parental education and socioeconomic status, parenting behaviors, parental substance use. *Parental sociodemographic factors* included divorced/separated parents, single mother, living with only one parent, living with biological parent & step-parent, young mother ($\leq$20 years old[1]), having two or more siblings. *Socioeconomic factors* included low parental education and low family socioeconomic status. *Parenting practices and behaviors* included poor parental supervision, parent–child conflicts, family dysfunction (composite construct reported in studies, encompassing low attachment, poor communication, lack of support, negative parenting practices), and parental substance use.

Peer-level factors included having a deviant or delinquent peer group. **School-level factors** included a public school and urban school. Finally, **community-level factors** included living in urban areas, neighbourhood "risk", "problems" and "crime", as well as availability of drugs in the community.

Three outcomes of violent behavior were examined in this review. 1) *All violence*: any measure of violence reported by the studies included in this meta-analysis. This category includes all types of fighting and all types of carrying a weapon (as described below), and any other type of violence eligible for the review (such as physical violence or assault against school staff, students or strangers, physically injuring someone, assault with a weapon robbery/extortion, threatening with violence/weapon/knife, throwing objects at others, physical harassment, and

[1] This age was used by studies included in the meta-analysis.

composite measures of violent behaviors). 2) *Fighting* included the following behaviors: fighting, fighting with serious injuries, fighting with other students, fist fighting, gang fighting, group fights, gun fights, individual fights, knife fights, physical fights, physical fights in the school. 3) *Carrying a weapon* included: carrying a weapon at school, carrying a weapon, carrying a gun, carrying a gun in the school, carrying a knife, carrying a knife in the school, possession of assault weapon.

Eleven potential moderators were coded in this meta-analysis. Categorical moderator variables were: sample sex (male, female, both), outcome type (carrying a weapon, fighting, other violence, violent behavior), WHO world regions[2] (Africa, Americas, Europe, Mediterranean, South East Asia and Western Pacific region), Gross National Income over the period between 1987 and 2012 (GNI, categorized as high, low, lower-middle, and upper-middle-income), study sampling method (random, convenience, combination of random and convenience, census), study design (cross sectional, longitudinal, case-control), and the reference period for the violent outcome (life time, last 3 years, last year, last 18 months, last three months, last month, last two weeks). Continuous moderators included were: national homicide rates per 100,000 habitants,[3] sample size, percentage of males in the sample, and response rate.

2.4. Independence of samples

Since several studies reported several correlates and/or multiple violent outcomes, it was often possible to calculate more than one effect size for a single study. To maintain independence of samples within each meta-analysis, a single effect size from each study was selected for each specific meta-analysis, based on the following procedures: 1) Different types of violence (i.e. fighting and carrying a weapon) were meta-analysed separately. 2) When multiple measures of the same type of violence (e.g. carrying a knife, carrying a gun) were reported, an average effect size was calculated, and that single average effect size was used in the meta-analysis. 3) For longitudinal studies that reported several waves, the effect size for the last wave was selected. 4) Some studies reported data for the total sample as well as separate measures of the outcome for males and females. In these cases, separate effect sizes for males and females were extracted and both included in the meta-analysis 5) Different correlates were meta-analysed separately. 6) When analysing multiple correlates together in a single "domain", e.g. parental education and low family SES for socioeconomic domain, we followed the same method as described by Witt, van Dorn, and Fazel (2013) – whereby when a single study reported more than one correlate per domain, the correlate with higher *Z* score was included in the analysis because *Z* score reflects both the strength of the association and its precision (Witt et al., 2013, p. e55942).

2.5. Effect sizes

Where results were not originally reported as odds ratios (ORs), we calculated ORs for the meta-analysis from frequencies or proportions, or estimated them using correlation coefficients, and means and SD (for conversion formulas, see Lipsey & Wilson, 2001). Alongside pooled ORs and 95% confidence intervals, for each correlate-outcome association, the number of studies (k), and the I^2 was also reported. An OR of 1 indicates no association between the correlate and violence, while values of 1.5, 2.5, 4.0 and 10.0 indicate weak, moderate, strong and very strong associations, respectively (Rosenthal, 1996). For heterogeneity (I^2), a value of 0% indicates no observed heterogeneity, and larger values show increasing heterogeneity (Higgins, Thompson, Deeks, & Altman, 2003).

2.6. Statistical analyses

Separate meta-analyses were carried out based for the three main outcome categories: all violence, fighting, and carrying a weapon. High heterogeneity between effect sizes was assumed because of the diversity of measures of correlates, different types of violent outcomes, varying types of samples and measures, and the sociocultural variation in samples used in each analysis. Therefore, the meta-analyses are based on random effect models, in which relative weights assigned to each study are more balanced than those assigned under fixed effects (Borenstein, Hedges, Higgins, & Rothstein, 2009). Finally, Egger's regression and Duval and Tweedie's Trim were used to examine possible publication bias. Effect sizes were calculated using Comprehensive Meta-Analysis statistical software (CMA, Version 3.3.070).

When I^2 was equal or > 75%, meta-regression was applied to investigate moderating factors that might explain the heterogeneity. The between studies heterogeneity test with random effects, analogous to the ANOVA, with random effects was employed for examining the categorical moderator variables. The fixed effect meta-regression analyses were conducted for the continuous moderator variables.

3. Results

Among the 522 studies that had been identified in this systematic review project (Murray et al., 2018; Shenderovich et al., 2016), a total of 86 studies from 60 countries reporting on 480,898 individuals were eligible for inclusion in the current meta-analysis on correlates of youth violence. A total of 367 effect sizes were extracted from these studies. It should be noted that some single studies reported multiple effect sizes, resulting in more effect sizes than studies. Table 1 describes the studies included in the meta-analyses. A total of 60 studies reported fighting, 37 studies reported carrying a weapon, 37 studies reported other violent behaviors, with all 87 studies included in the "all violence" outcome domain. Sample sizes varied from 199 to 109,105 subjects. The majority of the studies were cross-sectional (k = 76), and few were longitudinal (k = 5)[4] or case control studies (k = 3). The studies were conducted in 60 countries: Brazil (k = 12), South Africa (k = 9), China (k = 5), Chile, Colombia, Nigeria, India, Turkey, and Uganda (k = 4), Czech Republic, Namibia, Thailand, Venezuela, and Zimbabwe (k = 3), Argentina, Egypt, Jordan, Kenya, Lebanon, Mexico, Philippines, Swaziland and Zambia (k = 2) and one each from Armenia, Bosnia & Herzegovina, Botswana, Croatia, Djibouti, El Salvador, Estonia, Ethiopia, Ghana, Guyana, Hungary, Indonesia, Iran, Jamaica, Kenya, Lithuania, Libya, Macedonia, Morocco, Myanmar, Oman, Peru, Poland, Puerto Rico, Republic of Marshall Island, Republic of Palau, Romania, Russia, El Salvador, Slovakia, Suriname, Sri Lanka, Tanzania, Trinidad and Tobago, Tunisia, Ukraine, and Uruguay. Four studies were cross-country. The samples were selected through random sampling (k = 62), convenience sampling (k = 4) and population-based cohort (k = 5), mainly from the schools (k = 67) and households (k = 13). The main outcome reference period was last year (k = 35), followed by studies that reported two reference periods (e.g. last year and last month)

[2] http://www.who.int/healthinfo/global_burden_disease/definition_regions/en/.

[3] Data obtained from the UN Office on Drugs and Crimes International Homicide Statistics database.

[4] Note that the review of LMIC longitudinal studies by Murray et al. (2018) included 39 studies, but the majority focused on child antisocial behavior and aggression. In that review, 7 focused on violence, whereas only 5 longitudinal studies on violence are included in the current meta-analyses; this difference is explained as follows. Three studies reviewed by Murray et al. (2018) were not included in the current meta-analyses because they did not meet the additional inclusion criteria set for this work, and one study in Murray et al. (2018) with outcomes of conduct problems/aggression, was included in the current analysis of violence because it contained an item on "fighting" which was included as violence for the current review.

Table 1
Characteristics of the studies included in the meta-analysis.

Authors (year)	Type of publication	Country	Cross-country	Homicides rates per 100,000 (study publication year)	N (in which the analysis based on)	GNI (1987-2012)	Sex	Age (range-mean)	% Males	Sampling method	Design	Recruitment	Response rate (%)	Outcome (in which the analysis based on)	Outcome reference period	Risk domain (in which the analysis based on)
Aghajanian, & Moghadas (1998)	JA	Iran	No	NR	799	LM	Male	NR	100	Random	Cross-sectional	Households	NR	F	Last month	Parental sociodemographic
Alikasifoglu et al. (2004)	JA	Turkey	No	4.4	4078	LM	Both	15-20	52	Random	Cross-sectional	School	92	F CW	Last year	Sociodemographic School
Amrani et al. (2002)	JA	Tunisia	No	NR	353	LM	Both	12—24	53	Random	Cross-sectional	School	NR	OV	NR	Sociodemographic
Andrade et al. (2012)	JA	Brazil	No	26.2	60973	UM	Male Female	13-15	47	Random	Cross-sectional	School	NR	OV	Last month	Sociodemographic Substance use Victimization Parental sociodemographic Parental SES School
Azevedo da Silva et al. (2009)	JA	Brazil	No	22.6	960	UM	Both	11—15	48	Random	Cross-sectional	Households	NR	F CW	Last year	Sociodemographic Psychological Substance use Parental sociodemographic Parental SES
Azevedo da Silva et al. (2012)	JA	Brazil	No	26.2	1145	UM	Both	15-18	49	Random	Cross-sectional	Households	NR	F CW	Last 2 weeks	Victimization
Balling, Grunbaum, Speicher, McManus, and Kann (2004)	Report	Republic of the Marshall Islands, Republic of Palau	Yes	NR	1452	LM UM	Both	NR	49	Population-based cohort	Cross-sectional	School	92	F CW	Last year Last month	Sociodemographic
Birkbeck, Morillo, and Crespo (2010)	Book	Venezuela	No	45.1	2395	UM	Both	12 -16+	NR	Random	Cross-sectional	School	60	F CW OV	Lifetime Last year	Community
Blatny, Hrdlicka, Ruchkin, Vermeiren, and Schwab-Stone (2006)	JA	Czech Republic	No	1.3	4980	UM	Male Female	15	44	Random	Cross-sectional	School	NR	F CW	Last year	Sociodemographic Community
Bolyky, Gyory, Kerezsi, Parti, and Sarik (2010))	Book	Hungary	No	1.4	2295	UM	Both	12-15+	NR	Random	Cross-sectional	School	NR	F CW OV	Lifetime Last year	Community
Bovenkerk & Wolf (2010)	Book	Republic of Suriname	No	9.5	2380	LM	Both	15	47	Random	Cross-sectional	School	100	F CW OV	Lifetime Last year	Community
Brook et al. (2003)	JA	Colombia	No	53.4	2837	LM	Male Female	12—17	53	Random	Cross-sectional	Households	80	VB	NR	Behavior problems Substance use Victimization Media consumption Parenting practices & parent behaviors Peers Community

(*continued on next page*)

Table 1 (*continued*)

Authors (year)	Type of publication	Country	Cross-country	Homicides rates per 100,000 (study publication year)	N (in which the analysis based on)	GNI (1987-2012)	Sex	Age (range-mean)	% Males	Sampling method	Design	Recruitment	Response rate (%)	Outcome (in which the analysis based on)	Outcome reference period	Risk domain (in which the analysis based on)
Brook, Brook, and Whiteman (2007)	JA	Colombia	No	34.8	1151	LM	Male	13-20	100	Stratified Random	Longitudinal	Households	77	VB	Last year	Behavior problems Substance use Victimization Media consumption Parental sociodemographic Parenting practices & parent behavior Peers School Community
Brown et al. (2009)	JA	Namibia Swaziland Uganda Zambia Zimbabwe	Yes	18 15.9 10.1 6.0 NR	22656	L	Both	13-15	44	Random	Cross-sectional	School	82 96 69 70	F	Last year	Sociodemographic Psychological Substance use
Budimlic, Maljević, and Muratbegović (2010)	Book	Bosnia and Herzegovina	No	1.5	1756	LM	Both	12—15	50	Random	Cross-sectional	School	NR	F CW OV	Lifetime	Sociodemographic Parental SES Parenting practices Peers Education Community
Burianek & Podana (2010)	Book	Czech Republic	No	1.0	2788	UM	Both	12—15	NR	Random	Cross-sectional	School	88	F CW OV VB	Lifetime Last year	Sociodemographic arental sociodemographic Community
Caicedo, Gonçalves, González, and Victora (2010)	JA	Brazil	No	21.8	5228	UM	Male Female	0-25	52	Population-based cohort	Longitudinal	Households	NR	VB	Lifetime	Prenatal Sociodemographic Parental sociodemographic Parental SES
Can (2009)	JA	Turkey	No	5.2	408	UM	Both	NR	NR	Random	Cross-sectional	School	NR	CW OV	Last year	Sociodemographic Substance use
Cano, Gutiérrez, and Nizama (2009)	JA	Peru	No	10.2	530	LM	Both	12—19	50	Random	Cross-sectional	School	97	VB	NR	Sociodemographic Psychological
Carlini-Marlatt, Gazal-Carvalho, Gouveia, and Souza (2003)	JA	Brazil	No	NR	1808	UM	Both	12—18	NR	Random	Cross-sectional	School	100	F CW	Last year	Substance use
Celbiş, Karaoğlu, Eğri, and Özdemir (2012)	JA	Turkey	No	4.3	1175	LM	Both	16	64	Random	Cross-sectional	School	89	F CW	Last year	Sociodemographic School
Chaveepojnkamjorn & Pichainarong (2012)	JA	Thailand	No	4.9	5184	LM	Male	15-18	100	Random	Cross-sectional	School	NR	F CW	Last year	Substance use
Chen, Chi & Li (2008)	JA	China	No	1.1	1064	LM	Both	11—-19	55	Convenience	Cross-sectional	School	NR	F	Last year	Sociodemographic
Choe, Zimmerman, and Devnarain (2012)	JA	South Africa	No	30.7	424	UM	Both	13-21	38	Convenience	Cross-sectional	School	NR	VB	Last year	Sociodemographic Victimization Parenting practices

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Table 1 (*continued*)

Authors (year)	Type of publication	Country	Cross-country	Homicides rates per 100,000 (study publication year)	N (in which the analysis based on)	GNI (1987-2012)	Sex	Age (range-mean)	% Males	Sampling method	Design	Recruitment	Response rate (%)	Outcome (in which the analysis based on)	Outcome reference period	Risk domain (in which the analysis based on)
Colares, Franca, and Gonzalez (2009)	JA	Brazil	No	22.6	382	UM	Both	20-29	30	NR	Cross-sectional	School	NR	F CW	Last year Last month	Sociodemographic
Curto, Paula, do Nascimento, Murray, and Bordin (2011)	JA	Brazil	No	24.0	248	UM	Both	11—17	47	Random	Cross-sectional	Households	NR	F OV	NR	Sociodemographic
Czabariski, Gruszczyńska, Marczewski, and Siemaszko (2010)	Book	Poland	No	1.1	2114	UM	Both	12—17	45	Mix	Cross-sectional	School	60	F CW OV	Lifetime Last year	Sociodemographic Community
El Hajj, Afifi, Khawaja, and Harpham (2011)	JA	Lebanon	No	3.7	674	UM	Male	13-18	100	Random	Cross-sectional	Households	85	F	Last 3 months	Sociodemographic Psychology Victimization Parental sociodemographic Parental SES Education Victimization
Flisher et al. (1996a)	JA	South Africa	No	60.4	3269	UM	Male	NR	100	Random	Cross-sectional	School	NR	CW	Last month	Sociodemographic Psychology Early sexual behavior Substance use
Flisher et al. (1996b)	JA	South Africa	No	60.4	7340	UM	Both	NR	44	Random	Cross-sectional	School	NR	CW	Last month	Early sexual behavior Substance use
Flisher, Mathews, Mukoma, and Lombard (2006)	JA	South Africa	No	39.2	6266	UM	Both	10—17	45	Random	Cross-sectional	School	NR	F CW	Last year Last month	Sociodemographic
Flisher, Ward, et al. (2006))	JA	South Africa	No	39.2	10669	UM	Both	14-20	43	Random	Cross-sectional	School	NR	CW	Last month	Sociodemographic
Florenzano, Pino, and Marchandón (1993)	JA	Chile	No	NR	1904	UM	Both	10—19	42	Random	Cross-sectional	School	NR	F	Last year	Sociodemographic
Florenzano et al. (2009)	JA	Chile	No	3.7	1447	UM	Both	12—19	42	Random	Cross-sectional	School	NR	F	NR	Sociodemographic
González-Quiñones & de la Hoz-Restrepo (2011)	JA	Colombia	No	34.1	12302	LM	Both	10—19	49	NR	Cross-sectional	School	NR	CW	Last year	Sociodemographic Parenting practices & parent behaviours
Granero, Poni, Escobar-Poni, and Escobar (2011)	JA	Venezuela	No	47.9	2070	UM	Both	NR	44	Random	Cross-sectional	School	NR	F CW	Last year Last month	Sociodemographic
Hamdulay and Mash (2011)	JA	South Africa	No	29.9	438	UM	Both	≤16-16+	48	Random	Cross-sectional	School	NR	F CW	Last year Last month	Substance use
Hein & Barrientos (2004)	JA	Chile	No	NR	1411	UM	Both	12—18	53	Random	Cross-sectional	School	NR	F OV	Last year	Sociodemographic School

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Table 1 (*continued*)

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Hill, Stonecipher, Barnes, and Merrill (2003)	JA	Ukranie	No	7.6	478	LM	Both	13—18	41	NR	Cross-sectional	School	NR	F CW	Last year Last month	Sociodemographic
Horta, Horta, Pinheiro, and Krindges (2010)	JA	Brazil	No	21.8	960	UM	Both	NR	NR	Random	Cross-sectional	Households	92	F CW	Last year	Parental sociodemographic
Hrubá, Kukla, Okrajek, and Peřina (2012)	JA	Czech Republic	No	1.0	4777	UM	Both	7 and 11	NR	Population-based cohort	Longitudinal	Clinic	78	F	Last year	Behavior problems
IBGE (2013)	Report	Brazil	No	26.5	109105	UM	Both	13-15	48	Random	Cross-sectional	School	NR	F	Last month	Sociodemographic School
Inandi et al. (2009)	JA	Turkey	No	5.2	1575	UM	Both	16	49	Random	Cross-sectional	School	97	VB	Lifetime	Substance use
Juárez et al. (1998)	JA	Mexico	No	14.0	3501	UM	Both	13-19	51	Random	Cross-sectional	School	NR	OV	Last year	Sociodemographic Substance use
Justickaja, Kalpokas, and Usele (2010)	Book	Lithuania	No	7.0	2188	UM	Male Female Both	12—17	47	Mix	Cross-sectional	School	NR	VB	Lifetime Last year	Sociodemographic Parental sociodemographic Community
Kishore, Singh, Grewal, Singh, and Roy (1999)	JA	India	No	4.2	351	L	Male	10—19	100	NR	Cross-sectional	Households	93	CW	Last month	Community
Konnov, Makarov, Pozdnyakova, Safin, and Salagaev (2010)	Book	Russia	No	16.0	2959	LM	Both	11—17	NR	Random	Cross-sectional	School	81	F CW OV	Lifetime Last year	Sociodemographic Behaviour problems Substance use Community
Lei, Zhu, Zhao, and Xu (2013)	JA	China	No	0.8	2707	LM	Both	12—17	54	Random	Cross-sectional	School	NR	F	NR	Psychological
Leoschut (2009)	Monograph	South Africa	No	33.0	4391	UM	Both	12—22	50	Random	Cross-sectional	Households	NR	F CW OV	Last year	Sociodemographic Victimization
Limin (2011)	JA	China	No	0.9	670	LM	Both	10—17	NR	NR	Cross-sectional	School	NR	F	NR	Parental practices
Lippe, Brener, McManus, Kann, and Speicher (2008)	Report	Puerto Rico	No	21.6	2640	UM	Both	NR	47	Random	Cross-sectional	School	85	F CW	Last year Last month	Sociodemographic
Lotrean, Laza, Ionut, and de Vries (2010)	JA	Romania	No	2.0	1598	LM	Both	11—25	50	Random	Cross-sectional	School University	NR	F	Last month	Sociodemographic
Margaryan & Gabuzyan (2010)	Book	Armenia	No	1.9	2099	LM	Both	NR	55	Mix	Cross-sectional	School	84	F CW OV	Lifetime Last year	Sociodemographic Behavior problems Peers Parenting practices Education Community
Markina & Saar (2010)	Book	Estonia	No	5.3	2613	UM	Both	12—16	NR	Random	Cross-sectional	School	83	F CW OV	Lifetime Last year	Community
Mejia, Kliewer, and Williams (2006)	JA	Colombia	No	36.8	1300	LM	Both	11—19	49	Mix	Case-control	School Criminal justice institution	100	VB	Lifetime	Behavior problems Victimization

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Table 1 (*continued*)

Authors (year)	Type of publication	Country	Cross-country	Homicides rates per 100,000 (study publication year)	N (in which the analysis based on)	GNI (1987-2012)	Sex	Age (range-mean)	% Males	Sampling method	Design	Recruitment	Response rate (%)	Outcome (in which the analysis based on)	Outcome reference period	Risk domain (in which the analysis based on)
Momino et al. (2012)	JA	Brazil	No	26.2	416	UM	Male	13-21	100	Mix	Case-control	Households School Criminal justice institution	NR	VB	N/A	Prenatal Victimization Parent behavior
Mukhopadhyay, Mukhopadhyay, Sinhababu, and Biswas (2012)	JA	India	No	3.4	2068	L	Both	13-16+	70	NR	Cross-sectional	School	87	F CW	Last month Last year	Sociodemographic Parental SES Education Community
Murray, Maughan, et al. (2015)	JA	Brazil	No	27.7	3618	UM	Male Female	11—18	50	Population-based cohort	Longitudinal	Hospital	NR	VB	Last year	Behaviour problems
Murray, Menezes, et al., 2015	JA	Brazil	No	26.7	3618	UM	Male Female	11—18	50	Population-based cohort	Longitudinal	Hospital	NR	VB	Last year	Sociodemographic Prenatal Parental sociodemographic Parental SES
Musisi, Kinyanda, Nakasujja, and Nakigudde (2007)	JA	Uganda	No	8.8	299	L	Both	10—18	45	Convenience	Case-control	School	NR	F	NR	Parental sociodemographic
Muula, Herring, Siziya, and Rudatsikira (2009)	JA	Venezuela	No	49.0	2229	UM	Both	≤13-16+	53	Random	Cross-sectional	School	88	F	Last year	Sociodemographic Substance use Victimization Parental practices
Odejide, Ohaeri, Adelekan, and Ikuesan (1987)	JA	Nigeria	No	NR	2079	L	Both	NR	53	Random	Cross-sectional	School	NR	F	NR	Substance use
Okour & Hijazi (2009)	JA	Jordan	No	2	1560	UM	Both	18-26	59	Random	Cross-sectional	School	96	OV	Last 3 years	Sociodemographic Victimization Parental sociodemographic Parenting practices
Omigbodun, Dogra, Esan, and Adedokun (2008)	JA	Nigeria	No	NR	1429	L	Both	10—17	51	Random	Cross-sectional	School	94	F	Last year	Psychological
Omisore et al. (2013)	JA	Nigeria	No	NR	800	L	Both	10-17+	51	Random	Cross-sectional	School	NR	OV	Last year	School
Owoaje & Ndubusi (2010)	JA	Nigeria	No	11	516	L	Both	13-15	56	Random	Cross-sectional	School	NR	F	Last year	Sociodemographic
Pahl, Brook, Morojele, and Brook (2010)	JA	South Africa	No	30.9	731	UM	Both	12—17	47	Random	Cross-sectional	Households	90	OV	NR	Sociodemographic Parental SES Parenting practices Peer Community
Peltzer (2009)	JA	Kenya Namibia Uganda Zimbabwe	Yes	5.6 18.0 10.1 NR	12740	L LM L L	Both	13-15	47	Random	Cross-sectional	School	NR	F	Last year	Sociodemographic
Pengpid & Peltzer (2013)	JA	Thailand	No	4.3	2758	LM	Male Female	13-15	47	Random	Cross-sectional	School	93	F	Last year	Victimization
Pierobon, Barak, Hazrati, and Jacobsen (2013)	JA	Argentine	No	NR	1328	UM	Male Female	13-18	48	Random	Cross-sectional	School	82	F	Last year	Sociodemographic Substance use

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Table 1 (*continued*)

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Pitel et al. (2012)	JA	Slovakia	No	1.4	3674	UM	Male Female	15	48	Random	Cross-sectional	School	79	F	Last year	Sociodemographic
Reininger, Pérez, Aguirre Flores, Chen, and Rahbar (2012)	JA	Mexico	No	21.3	1181	UM	Male Female	12—15	48	Random	Cross-sectional	School	44	F	Last year	Sociodemographic Parental SES
Rucevic (2009)	JA	Croatia	No	1	706	UM	Both	12—19	32	Random	Cross-sectional	School	82	VB	Lifetime	Behavior problems
Rudatsikira, Mataya, Siziya, and Muula (2008)	JA	Chile	No	3.5	2105	UM	Male Female	13-16	51	Random	Cross-sectional	School	85	F	Last year	Sociodemographic Victimization Substance use Parenting practices
Rudatsikira, Siziya, Kazembe, and Muula (2007)	JA	Namibia	No	NR	6283	LM	Male Female	13-16	55	Random	Cross-sectional	School	NR	F	Last year	Sociodemographic Victimization Substance use Parenting practices
Rudatsikira, Muula, and Siziya (2008)	JA	Philippines	No	6.4	7338	LM	Male Female	≤13-16+	43	Random	Cross-sectional	School	84	F	Last year	Sociodemographic Victimization Substance use Parenting practices
Samanta, Mukherjee, Ghosh, and Dasgupta (2012)	JA	India	No	3.4	199	L	Male	13-15	100	Convenience	Cross-sectional	School	93	F	Last month	Community
Samms-Vaughan, Jackson, and Ashley (2004)	JA	Jamaica	No	55.2	1674	LM	Both	11—12	49	NR	Cross-sectional	School	97	F CW	Last year	Parental SES
Seekings & Thaler (2010)	Book chapter	South Africa	No	30.9	1420	UM	Both	14—22	86	Mix	Longitudinal	Neighbourhoods Households	NR	OV	Last 3 years	Sociodemographic Behavior problem Victimization Substance use Parent behavior Community
Sharma, Grover, and Chaturvedi (2008)	JA	India	No	3.5	550	LM	Both	14-19	67	Random	Cross-sectional	School	NR	F CW OV	Last year Last month	Sociodemographic Parent behavior School
Siziya, Rudatsikira, and Muula (2009)	JA	Zimbabwe	No	NR	1997	L	Both	≤13-16+	49	Random	Cross-sectional	School	NR	F	Last year	Sociodemographic
Springer, Parcel, Baumler, and Ross (2006)	JA	El Salvador	No	65.8	979	LM	Both	12—19	52	Random	Cross-sectional	School	NR	F CW OV	Last year Last month	Sociodemographic Education School Parental SES
Swahn, Gressard, Palmier, Yao, and Haberlen (2013)	JA	(see footnote)	Yes	1—30	83633	L-UM	Both	13-16	36-60	Random	Cross-sectional	School	75-99	F	Last year Last month	Sociodemographic
Terasaki, Gelaye, Berhane, and Williams (2009)	JA	Ethiopia	No	NR	1176	L	Male	NR	100	Random	Cross-sectional	School	NR	VB	Last year	Psychological

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Table 1 (*continued*)

Authors (year)	Type of publication	Country	Cross-country	Homicides rates per 100,000 (study publication year)	N (in which the analysis based on)	GNI (1987-2012)	Sex	Age (range-mean)	% Males	Sampling method	Design	Recruitment	Response rate (%)	Outcome (in which the analysis based on)	Outcome reference period	Risk domain (in which the analysis based on)
Walsh et al. (2013)	JA	Macedonia	No	1.1	5086	LM	Both	11—15	49	Random	Cross-sectional	School	89	F CW	Last year Last month	Sociodemographic
Wang (2005)	JA	China	No	1.1	5300	LM	Both	15—26	48	Random	Cross-sectional	University	74	F	Last year	Sociodemographic
Youssef, Attia, and Kamel (1999)	JA	Egypt	No	NR	2170	LM	Both	10—20	61	Random	Cross-sectional	School	NR	F	Last 18 months	Sociodemographic Behavior problems Victimization Substance use Parental sociodemographic Parental SES Parenting practices & parent behaviors Media consumption

Note: CW = carrying a weapon, F = fighting, GNI = gross national income, JA = journal article, L = low income, LM = low-middle income, NR = not reported, OV = other violence, SES = socioeconomic status, UM = upper-middle income, VB = violent behaviour.

(k = 21) and lifetime (k = 5).

3.1. Individual-level factors

3.1.1. Prenatal problems

Three types of pre-natal problems were analysed as possible correlates of violence: smoking during pregnancy, alcohol consumption during pregnancy, and obstetric complications (e.g. urinary infections, abortion attempts, etc.) (see Table 2). There was not a significant association between all violence and either smoking in pregnancy or alcohol use in pregnancy. Three studies showed zero association between obstetric complications and violence. For alcohol use there was significant heterogeneity (I^2 = 96%***).

3.1.2. Sociodemographic factors

Four sociodemographic characteristics were meta-analysed as possible correlates of youth violence, of which only one (male sex) was statistically significant. For effect sizes see Table 3. Male sex was strongly associated with all violence, fighting and carrying a weapon. No significant association was observed for unemployed, not studying or religion, but the heterogeneity (I^2) was above 70% for all factors except for not studying.

3.1.3. Behavior problems and early sexual intercourse

All violence was significantly associated with conduct problems, sexual intercourse at an early age, and these associations did not show significant heterogeneity (I^2 = 42%, 0%, respectively) except for conduct problems (I^2 = 80%***) (see Table 2).

3.1.4. Psychological factors

Impulsivity and tolerance to deviance were moderately associated with all violence and yielded significant and high heterogeneity (I^2 = 96%*** and 80%***, respectively), whereas lack of sensitivity to others and common mental disorders were weakly associated with all violence and both yielded high heterogeneity (I^2 = 85%** and I^2 = 96%***, respectively). Low self-esteem was weakly and non-significantly associated with all violence, and had low heterogeneity (I^2 = 42%) (see Table 4). Both all violence and fighting were associated with suicidality (ideation and planning), but the effect sizes were weak. These associations did not show significant heterogeneity, but heterogeneity was higher for planned suicide and all violence (I^2 = 65%).

3.1.5. Drugs and alcohol use

All violence was moderately correlated with all types of legal and illegal substance use: smoking tobacco, drinking alcohol and any substance use (i.e. smoking tobacco, drinking alcohol or illegal drugs use). The strongest association was between illegal drug use and all violence. Fighting and carrying a weapon showed significant correlations with all substance use correlates, but carrying a weapon had larger pooled effect sizes than fighting Additionally, only effect sizes for carrying a weapon showed no heterogeneity (smoking tobacco and drug use: I^2 = 0%. Drinking alcohol: I^2 = 26%) (see Table 4).

3.1.6. Victimization

The all violence outcome (perpetration of any kind of violence) was moderately associated with all types of victimization studied, especially being bullied and being frequently bullied. Heterogeneity was high for all correlates (all > 75% I^2) (see Table 5). Fighting had an even slightly larger association with both bullying correlates and a particularly strong association with being robbed and sexually assaulted. However, this finding is based on only two studies with high heterogeneity (I^2 = 100%).

3.1.7. Education factors

All education factors showed significant correlations with the all violence outcome. The strongest association was weak school

Table 2
Prenatal problems, behavior problems and early sexual intercourse correlates of youth violence in LMICs under the random effects model.

Correlates	All violence			Fighting			Carrying a weapon		
	k	OR (95%CI)	I^2(%)	*k*	OR (95%CI)	I^2(%)	*k*	OR (95%CI)	I^2(%)
Prenatal problems									
Maternal smoking in pregnancy	2	1.27 (1.00–1.60)*	45**						
Maternal alcohol use in pregnancy	2	1.24 (0.65–2.38)	96***a						
Obstetric complications[1]	3	1.06 (0.93–1.20)	43						
Behavior problems & sexual intercourse at early age correlates									
Conduct problems[2]	6	2.73 (2.20–3.38)***	80***	4	2.96 (2.31–3.79)***	61	3	3.24 (2.85–3.68)***	0
Sexual intercourse at an early age	2	3.26 (2.64–4.03)***	0				2	3.26 (2.64–4.03)***	0

Note: I^2 = percentage of variability in effect size estimates that is attributable to between-study variation, *k* = number of studies, OR (95%CI) = odds ratio (95% confidence intervals).
a = *p*-value for a X^2 test for heterogeneity.
*** $p < .001$.
** $p < .01$ level.
* $p < .05$ level.
[1] Obstetric complications included: intrauterine growth, urinary infection, bleeding, use of medicines, abortion attempt.
[2] Conduct problems included symptoms of oppositional defiant, conduct disorders, vandalism and truancy.

attachment. Fighting was moderately associated with weak school attachment and had high homogeneity (I^2 = 0%). Carrying a weapon was significantly associated with weak school attachment, and no significant heterogeneity was detected (I^2 = 0%) (see Table 7).

3.1.8. Media consumption

All violence was moderately associated with watching violent TV (see Table 7).

3.2. Family-level factors

3.2.1. Parental sociodemographic factors

As Table 6 shows, out of the 12 family/parenting variables considered as possible correlates of all violence, only half of them were significantly associated with the outcome. All violence outcome was correlated with having a young mother, living with a biological parent and step parent (vs. both biological parents).

3.2.2. Parental socioeconomic status

There was a significant, but weak associations with the all violence outcome and low family SES (income), whereas for fighting, it was not significant.

3.2.3. Parenting practices and parent behaviors

All violence outcome was correlated with low parental supervision/monitoring, general family dysfunction (i.e., low attachment, communication, support, parenting practices), parental substance use, and parent-child conflicts. Heterogeneity was low for all results except for parent-child conflicts (I^2 = 91%***). Fighting was weakly associated only with low parental supervision/monitoring and with low heterogeneity (I^2 = 47%). Carrying a weapon showed a significant association with low parental monitoring with no heterogeneity (I^2 = 0%).

3.3. Peer factors

All violence was moderately associated with peer characteristics. Deviant peers showed the strongest effect size. All associations had high heterogeneity ($I^2 \geq 63$) for both the all violence outcome and fighting (see Table 7).

3.4. School factors

Both public and urban school showed weak but statistically significant correlations with the all violence outcome and fighting, with significant heterogeneity for all results. Carrying a weapon was weakly associated with going to a public school but not associated with an urban school, with no significant heterogeneity detected (see Table 7).

3.5. Community factors

All violence was moderately associated with community correlates except for drug availability in the community. Significant, but weak associations with the all violence outcome were also found living in large cities. Fighting was correlated with neighbourhood problems. All associations had high heterogeneity ($I^2 \geq 63$) for both the all violence outcome and fighting (see Table 7).

Table 3
Sociodemographic correlates of youth violence in LMICs under the random effects model.

Correlates	All violence			Fighting			Carrying a weapon		
	k	OR (95%CI)	I^2(%)	*k*	OR (95%CI)	I^2(%)	*k*	OR (95%CI)	I^2(%)
Male sex	50	3.00 (2.71–3.32)***	97***a	39	2.66 (2.37–2.98)***	97***	21	4.86 (3.60–6.56)***	96***
Unemployed	6	1.00 (0.63–1.57)	95***	3	1.35 (0.54–3.36)	96***			
Not studying	2	1.12 (0.90–1.40)	36**						
No religious practice	2	1.33 (0.98–1.80)	62*	2	1.25 (0.88–1.77)	67*			

Note: Note: $I^2(\%)$ = percentage of variability in effect size estimates that is attributable to between-study variation, *k* = number of studies, OR (95%CI) = odds ratio (95% confidence intervals), SES = socioeconomic status.
a = *p*-value for a X^2 test for heterogeneity.
*** $p < .001$.
** $p < .01$.
* $p < .05$.

Table 4
Psychological and substance use correlates of youth violence in LMICs under the random effects model.

Correlates	All violence			Fighting			Carrying a weapon		
	k	OR (95%CI)	I^2(%)	*k*	OR (95%CI)	I^2(%)	*k*	OR (95%CI)	I^2(%)
Psychological factors									
Impulsivity	3	2.82 (1.44–5.51)**	96***[a]						
Lack of sensitivity to others	2	1.66 (1.23–2.23)**	85**						
Tolerance to deviance	2	2.47 (1.90–3.21)***	80**						
Common mental disorders (depression, anxiety)	2	1.48 (1.14–1.91)**	42						
Low self-esteem	2	1.41 (0.49–4.04)	96***	2	1.41 (0.49–4.04)	96***			
Suicide ideation	3	1.71 (1.46–2.00)***	33	2	1.69 (1.59–1.80)***	0			
Suicide planning/attempt	3	2.04 (1.60–2.60)***	65	2	1.81 (1.70–1.91)***	0			
Drugs and alcohol use									
Smoking tobacco	9	2.95 (2.55–3.42)***	69***[a]	5	2.91 (2.14–3.97)***	86***	5	2.95 (2.49–3.50)***	0
Drinking alcohol	15	2.61 (2.23–3.06)***	93***	9	2.54 (2.14–3.01)***	82***	7	3.04 (2.62–3.54)***	26
Any illicit drug use	11	3.82 (3.08–4.74)***	89***	4	2.84 (2.21–3.65)***	64*	4	3.72 (2.99–4.62)***	0
Any substance use[1]	5	3.52 (2.57–4.81)***	92***	4	3.14 (2.27–4.33)***	90***			

Note: I^2*(%)* = percentage of variability in effect size estimates that is attributable to between-study variation, *k* = number of studies, OR (95%CI) = odds ratio (95% confidence intervals).
a = *p*-value for a X^2 test for heterogeneity.
*** $p < .001$.
** $p < .01$.
* $p < .05$.
[1] Combination of smoking tobacco, drinking alcohol and illegal drugs use.

Table 5
Victimization correlates of youth violence in LMICs under the random effects model.

Correlates	All violence			Fighting		
	k	OR (95%CI)	I^2(%)	*k*	OR (95%CI)	I^2(%)
Being bullied	4	2.84 (2.10–3.83)***	90***[a]	4	3.01 (2.21–4.10)***	90***
High incidence of being bullied	3	2.77 (2.01–3.81)***	83***	2	3.38 (2.90–3.94)***	0
Witnessing/exposure to domestic/family verbal, physical violence	4	2.26 (1.68–3.04)***	76**			
Suffered maltreatment (threats, banned from food/money, expelling from home, corporal punishment)	5	1.65 (1.10–2.47)*	92***			
Being robbed, assaulted, sexually assaulted and neighbourhood victimization	4	3.30 (2.24–4.86)***	100***	2	4.56 (1.74–11.93)**	100***

Note: Note: I^2*(%)* = percentage of variability in effect size estimates that is attributable to between-study variation, *k* = number of studies, OR (95%CI) = odds ratio (95% confidence intervals).
a = *p*-value for a X^2 test for heterogeneity. OR = odds ratio, 95% CI = 95% confidence interval.
*** $p < .001$.
** $p < .01$.
* $p < .05$.

3.6. Moderator analyses of results for individual correlates of all violence

We conducted moderator analyses in relation to all the correlates that showed significant and high heterogeneity ($I^2 \geq 75\%$) based on at least six studies for the all violence outcome. As such, ten correlates were examined in the moderator analyses: male sex, unemployed, conduct problems, drinking alcohol, any illicit drug use, low family SES, low parental supervision/monitoring, parent-child conflicts, public school, and living in large city-urban area. Eleven possible moderators were tested for each of these ten correlates of all violence. Table 8 shows the moderators that were significant for each correlate (for further detail, see supplement material, TS1).

The following showed significant effect modification for at least five different correlates: type of violence outcome, outcome reference period, study sampling method, country GNI (1987–2012). As such, significant differences in effect sizes were found between behaviors categorized as carrying a weapon, fighting, other violence, and all violent behavior. The all violent behavior outcome had larger effect sizes for illegal drug use and parent-child conflicts compared with other violent behaviors, whereas carrying a weapon had the largest effect size associated with sex male and living in a large city, compared with other types of violence.

Considering all violence as an outcome, there was significant moderation of effect size according to the length of outcome reference period for: sex male, unemployed, drinking alcohol, illegal drug use, low family SES and parent-child conflicts.

Stronger relationships were found when all violence was reported across the lifetime, for illegal drug use, drinking alcohol, and low family SES. Effect sizes for parent-child conflicts were larger when the reference period was the last 3 years. Effect sizes were larger for male sex and unemployment, when violence was reported in the last month.

There were also significant differences in effect sizes according to the sampling methods used across the studies, with the strongest correlation found among mixed sampling methods (when conduct problems were analysed as a correlate of all violence), followed by random sampling methods (for drinking alcohol), convenience sampling (for parent-child conflicts), and the census method (for low family SES).

Finally, considering the country's GNI (1987–2012) as a moderator, associations with all violence were strongest in low-middle income countries compared to low- and upper-middle-income countries, for: male sex, not being employed, conduct problems, drug use and living in a large city. The effect of public school (rather than private) was strongest in low-income countries.

Interestingly, homicide rates only moderated the correlation between all violence and drug use ($B = 0.01$, SE = 0.005; $p = .01$), and parent-child conflicts ($B = -0.01$, SE = 0.003; $p = .000$).

Table 6
Family correlates of youth violence in LMICs under the random effects model.

Correlates	All violence			Fighting			Carrying a weapon		
	k	OR (95%CI)	I^2(%)	*k*	OR (95%CI)	I^2(%)	*k*	OR (95%CI)	I^2(%)
Parental sociodemographic factors									
Divorced/separated parents	3	1.36 (0.87–2.15)	0						
Single mother	2	1.04 (0.82–1.33)	0						
Living with only one parent (vs. both)	3	1.27 (0.96–1.69)	0	2	1.28 (0.86–1.91)	0			
Living with no biological parent (vs. at least one)	5	0.93 (0.80–1.08)	57**[a]	3	0.98 (0.76–1.27)	14			
Living with biological parent & step-parent (vs. both biological parents)	2	1.82 (1.43–2.31)***	0						
Young mother (≤20 years old)	2	1.46 (1.02–2.10)*	0						
Two or more siblings	2	1.13 (0.94–1.36)	0						
Parental socioeconomic status									
Low parental education	4	1.14 (0.99–1.33)	84***	2	0.92 (0.31–2.72)	72			
Low family SES	10	1.25 (1.09–1.44)**	75***	7	1.10 (0.91–1.34)	73***	4	1.33 (1.10–1.61)**	0
Parenting practices and parent behaviors									
Low parental supervision/monitoring	7	1.71 (1.52–1.92)***	41	5	1.71 (1.48–1.97) ***	47	2	1.93 (1.61–2.31)***	0
Parent–child conflicts	7	1.37 (1.04–1.82)*	91***	2	0.76 (0.35–1.63)	95***			
Family with dysfunction	2	2.22 (1.68–2.94)***	0						
Parental substance use	6	1.48 (1.33–1.65)***	12						

Note: Note: I^2*(%)* = percentage of variability in effect size estimates that is attributable to between-study variation, *k* = number of studies, OR (95%CI) = odds ratio (95% confidence intervals).
a = *p*-value for a X^2 test for heterogeneity. OR = odds ratio, 95% CI = 95% confidence interval.
*** $p < .001$.
** $p < .01$.
* $p < .05$.

3.7. Publication bias for correlates of all violence

There was no evidence of publication bias in the results. First, the Duval and Tweedie's Trim and Fill analysis determined that 0 studies had to be added to either side to create a symmetrical plot (notice there are no red values in Fig. 1). Secondly, Egger's regression model confirmed that the heterogeneity was not due to publication bias ($B = -0.18$, SE = 0.43, $p = .67$) (for further detail on both tests see Borenstein et al., 2009).

3.8. Risk subcategories in meta-analyses for all violence

Correlates of all violence were grouped into fifteen subcategories to provide average associations for each type of risk (see Fig. 2). The strongest associations (OR ≥ 3) with all violence were for peer factors ($k = 4$), male sex ($k = 50$), substance use ($k = 21$), and victimization ($k = 16$). Additionally, behavior problems & early sexual intercourse ($k = 6$), media consumption ($k = 2$), and psychological factors ($k = 13$) also yielded significant associations with OR > 2.0. Significant but weaker associations (OR ≤ 1.82) were found for the other subdomains [i.e. community factors ($k = 18$), parental sociodemographic factors ($k = 12$) and SES ($k = 9$), parenting practices ($k = 16$), prenatal factors

Table 7
Education, media consumption, peer, school and community correlates of youth violence in LMICs under the random effects model.

Correlates	All violence			Fighting			Carrying a weapon		
	k	OR (95%CI)	I^2(%)	*k*	OR (95%CI)	I^2(%)	*k*	OR (95%CI)	I^2(%)
Education factors									
Weak attachment to school	2	2.33 (2.09–2.59)***	0	2	2.40 (2.08–2.76)***	0	2	2.24 (1.91–2.63)***	0
Poor academic achievement	3	1.31 (1.00–1.72)*	46	2	1.34 (0.75–2.39)	68*			
Media consumption									
Watching violent TV	3	2.59 (2.17–3.09)***	63*[a]						
Peer factors									
Deviant peer group	3	4.00 (2.87–5.54)***	86***						
Delinquent peer group	2	2.80 (1.88–4.16)***	77**						
School factors									
Public school	7	1.33 (1.08–1.64)**	86***	4	1.28 (0.92–1.78)	87***	2	2.33 (1.03–5.28)*	28
School located in urban area	2	1.43 (1.03–1.98)*	82***	2	1.63 (0.80–3.31)	95***	2	1.20 (0.89–1.64)	0
Community factors									
Neighbourhood risk/problems/high crime	4	2.27 (1.66–3.11)***	89***	2	2.45 (1.82–3.29)***	74*			
Living in large city-urban area	14	1.43 (1.28–1.59)***	87***	12	1.26 (1.02–1.54)*	92***	11	1.67 (1.45–1.92)***	73***
Drugs availability in the community	3	1.19 (0.62–2.28)	97***						

Note: I^2*(%)* = percentage of variability in effect size estimates that is attributable to between-study variation, *k* = number of studies, OR (95%CI) = odds ratio (95% confidence intervals).
a = *p*-value for a X^2 test for heterogeneity. OR = odds ratio, 95% CI = 95% confidence interval
*** $p < .001$.
** $p < .01$.
* $p < .05$.

Table 8
Significant categorical and continuous moderators for correlates with an $I^2 \geq 75\%$ and with $k \geq 6$ for all violence.

Correlates		Univariate Meta-Regression for continuous moderators			ANOVA for categorical moderators		Moderators subcategory with strongest effect size	
	Moderator	B	SE	p-value	$Q_{between}$	p-value	OR (95%CI)	p-value
Sex (male)	Type of violence				19.85	0.000	CW(k = 24): 4.86 (3.60–6.56)	0.000
	WHO region				31.89	0.000	Europe(k = 25): 4.44 (3.75–5.27)	0.000
	Outcome reference period				35.83	0.000	Last month(k = 20): 4.13 (3.20–5.34)	0.000
	GNI (1987–2012)				49.51	0.000	LM(k = 39): 3.42 (2.81–4.15)	0.000
Unemployed	Type of violence				13.189	0.001	F(k = 3): 1.35 (0.54–3.36)	0.525
	Outcome reference period				65.70	0.000	Last 18 months(k = 1): 2.67 (2.21–3.24)	0.000
	GNI (1987–2012)				47.28	0.000	LM(k = 1): 2.67 (2.21–3.24)	0.000
Behavior problems	GNI (1987–2012)				5.89	0.015	LM(k = 6): 3.26 (2.98–3.56)	0.000
	Sampling method				14.37	0.001	Mix(k = 3): 3.78 (2.72–5.26)	0.000
	Design				13.52	0.000	Cross-sectional(k = 7): 3.26 (2.98–3.56)	0.000
Drinking alcohol	Outcome reference period				93.21	0.000	Lifetime(k = 1): 3.13 (2.88–3.41)	0.000
	Sampling method				24.55	0.000	Random(k = 24): 2.68 (2.29–3.14)	0.000
	Design				24.55	0.000	Cross-sectional(k = 24): 2.68 (2.29–3.14)	0.000
(Any) illegal drug use	Type of violence				11.32	0.010	VB(k = 4): 5.94 (4.17–8.47)	0.000
	Outcome reference period				39.88	0.000	Lifetime(k = 1): 7.12 (1.52–33.49)	0.012
	GNI (1987–2012)				8.07	0.018	LM(k = 3): 5.89 (4.05–8.57)	0.000
	Homicide rates	0.01	0.005	0.01				
Low parental supervision/ monitoring	WHO region				8.83	0.032	Europe(k = 4): 1.95 (1.63–2.33)	0.000
Low family SES	WHO region				8.26	0.041	America(k = 13): 1.39 (1.15–1.67)	0.001
	Outcome reference period				44.17	0.000	Lifetime(k = 2): 10.80 (4.87–23.96)	0.000
	Sampling method				9.26	0.010	Census (k = 6): 1.86 (1.33–2.59)	0.000
	Design				7.04	0.008	Longitudinal(k = 4): 2.24 (1.40–3.58)	0.000
	% Males	−0.005	0.003	0.04			–	–
Parent-child conflicts	Type of violence				3.76	0.052	VB(k = 6): 1.66 (1.35–2.03)	0.000
	WHO region				55.95	0.000	Africa(k = 2): 1.87 (1.52–2.29)	0.000
	Outcome reference period				23.53	0.000	Last 3 years(k = 1): 2.62 (1.87–3.68)	0.000
	Sampling method				42.67	0.000	Convenience(k = 1): 1.61 (1.13–2.28)	0.008
	Homicides rate	−0.01	0.003	0.000				
	Response rate	0.03	0.012	0.009				
Public school	Type of sample				14.15	0.001	Total (k = 8): 1.50 (1.17–1.91)	0.001
	GNI (1987–2012)				6.07	0.048	L (k = 2): 1.80 (1.49–2.17)	0.000
Living in large city-urban area	Type of violence				8.60	0.035	CW(k = 20): 1.67 (1.45–1.92)	0.000
	GNI (1987–2012)				9.49	0.009	LM(k = 18): 1.86 (1.48–2.34)	0.000
	Sampling method				9.76	0.021	Convenience(k = 1): 3.27 (1.80–5.94)	0.000

Note: Only moderators with significant results are included. All moderators tested include: type of violence (carrying a weapon, fighting, other violence, violent behavior), sample sex (male, female, total), WHO region (Africa, Americas, Europe, Mediterranean, South East Asia and Western Pacific region), outcome reference period (lifetime, last 3 years, last year, last 18 months, last three months, last month, last two weeks), GNI (1987–2012) (low, lower-middle, and upper-middle-income), sampling method (random, convenience, mixed, census), study design (cross sectional, longitudinal, case-control), homicides rate x 100,000, sample size, % male, and response rate. CW = Carrying a weapon, GNI = Gross National Income, k = number of studies, L = Low income country, LM = Low-middle income country, VB = Violent behavior, WHO region = World Health Organization region.

($k = 3$), and school and education factors ($k = 12$)]. However, apart from participant sex, sociodemographic factors ($k = 6$) were not significantly associated with all violence.

4. Discussion

The purpose of this meta-analysis was to synthesize evidence on correlates of youth violence in LMICs. We included 86 studies (mostly cross-sectional, but also some longitudinal studies) in meta-analyses, with a total of 480,898 individuals aged 10–29 in 60 countries. We investigated 48 potential correlates of youth violence reported in bivariate analyses. Only one previous systematic review has examined risk factors for youth violence in LMICs (Murray et al., 2018), and that included only seven relevant longitudinal studies. Hence, to our knowledge, this is the most comprehensive review of correlates of youth violence in LMICs to date.

Prior to discussing the findings, it is worth considering the value of research on correlates of violence in criminology and public health. Research on correlates may be seen as a first step towards identifying prospective risk factors, and finally causal mechanisms that may be targeted in preventive interventions (Kraemer, Lowe, & Kupfer, 2005, Murray et al., 2009). By their nature, cross-sectional studies, which were the majority in this review, cannot establish temporal sequencing of cause before effect, and bivariate correlates leave open alternative explanations for any association found (confounding). Nonetheless, identifying patterns of correlates in cross-sectional studies was an important scientific advance in criminology in high-income countries in the 20th century, and many major meta-analyses on risk factors in HICs (Derzon, 2001, 2010, Hawkins et al., 1998, Lipsey & Derzon, 1998) still focus entirely on bivariate associations. Given the dearth of more sophisticated and a larger number of longitudinal studies on causes of violence in LMICs (Murray et al., 2018), an important first step in LMICs is to document the basic patterning of correlates of violence to guide future research. We hope the evidence synthesized in this review

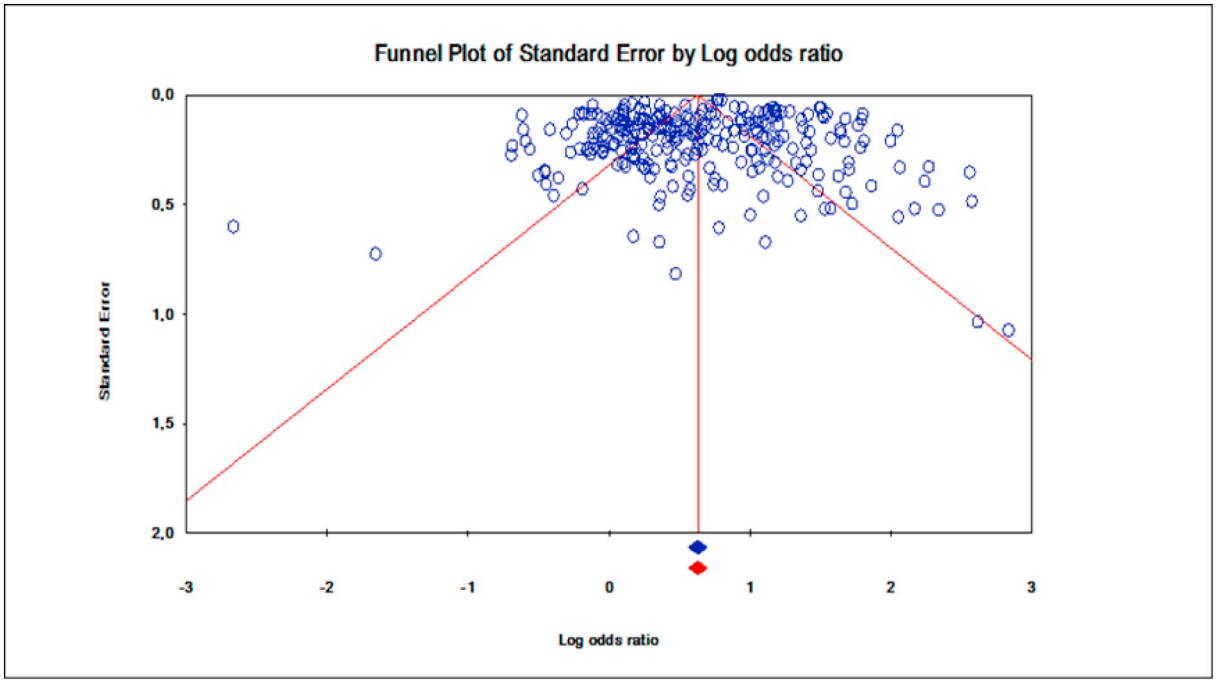

Fig. 1. Funnel Plot of Standard Error by Log Odds Ratio for individual correlates of all violence. Observed studies and the summary effect size are shown in blue. The summary effect size imputed by Duval and Tweedie's Trim and Fill is filled in red. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

will be useful to this end.

The first general finding from this review is that youth violence in LMIC has a number of similar correlates as has previously been found in HICs, such as having: a young mother, male sex, common mental disorders, suicidality, tolerance to deviance, weak attachment to school, poor academic achievement, going to a public school or to a school located in urban area, living with a stepfather/mother, low family SES, maltreatment, low parental supervision, poor family functioning, parent–child conflicts, parental/sibling substance use, living in a high crime or risky neighbourhood, and living in larger cities. The strongest correlates of youth violence (OR ≥ 2.5) were: male sex, impulsivity, conduct problems, sexual intercourse at early age, smoking, drinking alcohol, using any illicit drugs, being bullied, suffering criminal victimization, watching violent TV, and deviant/delinquent peers.

The correlates identified in this review of studies in LMICs fit within various different niches of an ecological model (individual, relationship, and wider community factors). They can also be understood in relation to life-course theories, for example the ICAP theory (Farrington, 2005), which states that the accumulation of long- and short-term risk factors in several domains increases the probability of committing serious offenses. Our findings partly support this theory. First, both short- and long-term influences were highly correlated with fighting and carrying a weapon (e.g., conduct problems, impulsivity, tolerance to deviance, substance use, weak school attachment, low parental supervision/monitoring, deviant peers, neighbourhood problems). Second, the importance of situational factors was suggested by the fact that in contexts of high homicide rates, the association between drug use and violence was stronger. However, future studies should examine further how short- and long-term factors interact with each other in LMICs.

Although many correlates previously identified in HICS were replicated in this review, there were a number of variables that showed weak or no association in the LMIC studies synthesized here. Of particular note were a number of family factors. Six showed no significant association with violence: divorced/separated parents, single mother, large family (2+ siblings), living with only one parent (vs. both), living with no parent (vs. at least one), and low parental education. These essentially concern family structure, as opposed to family processes that were positively associated with violence in LMICs (e.g., low supervision, family dysfunction, and parent-child conflicts were positively associated with violence in this review). Possibly, family structural variables only associate with violence where they influence more proximal processes involved in the development of antisocial behavior, such as parenting styles. And how family structure affects internal family processes may depend on social context – such that stronger effects are observed in high-income countries. For example, in Derzon's (2010) meta-analysis of longitudinal studies of violence in HICs, family size, separated from parents, and family SES were important predictors.

Neighbourhood risk is a salient predictor of adolescent violence (Ingoldsby & Shaw, 2002). We found that both neighbourhood risk and low family SES were significantly associated with violence but the effects of low family SES were very weak. This is consistent with Osgood and Chambers's research (2000) suggesting that neighbourhood context (i.e., residential instability and ethnic heterogeneity) is a more salient predictor of adolescent violence than poverty in the neighbourhood. Evidence indicate that neighbourhood effects can be mediated by more proximal factors such parental monitoring and distal ones such as lack of informal social control and supervision of peer activities (Ingoldsby & Shaw, 2002, Leventhal & Brooks-Gunn, 2000), as well as urban resilience (Davis, 2012).

Unusually in this review, correlates were examined for different types of violence, specifically fighting and carrying a weapon. We found that these specific violent behaviors shared several correlates at individual, family and school levels. This suggests that both behaviors might be seen as a part of a violent lifestyle and could potentially be targeted by similar prevention strategies. Carrying a weapon showed stronger associations than fighting for male sex, conduct problems, drinking alcohol, illicit drug use, public school, low family SES, low parental supervision/monitoring, and living in a large city. However, conclusions have to be cautious because few studies reported the outcome of carrying a weapon. The strongest difference between these two outcomes was for male sex, based on 21 studies. Qualitative research suggests that carrying weapons could be motivated both by aggression and the need for protection from aggression (Carter et al., 2013, Lizotte,

Domains	Odds ratio	Lower limit	Upper limit	Z-Value	p-Value
Behavior & risk taking	2,97	2,48	3,55	11,96	0,000
Community	1,42	1,09	1,86	2,60	0,009
Education	1,91	1,32	2,77	3,45	0,001
Male	3,19	2,76	3,70	15,53	0,000
Media consumption	2,61	1,64	4,16	4,04	0,000
Parental sociodemographic	1,31	1,00	1,71	1,96	0,049
Parental socioeconomic	1,32	1,08	1,61	2,72	0,007
Parenting practices	1,61	1,35	1,92	5,34	0,000
Peers	3,74	2,53	5,53	6,64	0,000
Prenatal	1,67	1,39	2,00	5,59	0,000
Psychological	2,11	1,71	2,59	7,10	0,000
School	1,61	1,23	2,10	3,49	0,000
Sociodemographic	1,14	0,65	2,01	0,47	0,632
Substance use	3,18	2,70	3,76	13,64	0,000
Victimization	3,03	1,67	5,52	3,65	0,000

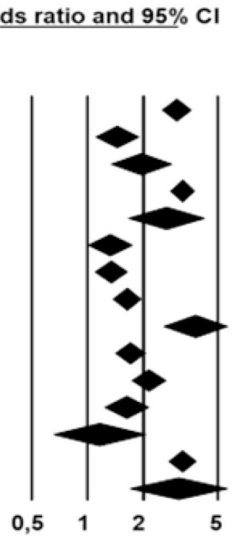

Fig. 2. Youth violence in LMIC according to subdomains.

Krohn, Howell, Tobin, & Howard, 2000, Thaler, 2011). Our findings also demonstrate a link between victimization and perpetration of violence, similar to previous studies (e.g., Ttofi, Farrington, & Lösel, 2012).

Moderator analyses were used to examine study characteristics and contextual factors that might alter the strength of association between measured correlates and youth violence. Four moderators (type of violence, outcome reference period, the study sampling technique, and country GNI) were associated with heterogeneity for five or more correlates of all violence. Additionally, the effect of drug use on violence was conditional on the national rate of homicide – that is, when the homicides rate is high, the association of drug use and violence is stronger. The link between drug use, violence, and homicide is a major theme in the literature. Goldstein's systemic violence model highlights aggressive patterns of interaction within illegal systems of drug distribution (Goldstein, 1985). In the USA, drug dealing, particularly high drug sales, has been a primary driver of illegal gun carrying (Lizotte et al., 2000). In countries with high levels of violence, the historical roots of gangs, gang identities and motivations, and their relationship to the state and society, are critical areas for research, and perhaps more important than the study of the relationship of drug use and crime at the level of the individual user. Gangs are coherent and functional groups providing security to socially excluded populations in the absence of state security (Shaw, 2012, Winton, 2014), and conflicts between gangs and with the state have a major role in the production of violence. Hence, the association of drug use with violence, may be highly dependent on the social context of gang activity, as indicated by national homicide rates.

Rates of interpersonal violence vary widely across LMICs, being much lower in Asia than in Latin America and Africa (UNODC, 2014, WHO, 2015). Violence trends tend to follow similar patterns across countries in the same geographic region (Lappi-Seppala & Lehti, 2014). Interestingly however, within our analyses, geographic region was not a consistent moderator of associations between correlates and violence. Nonetheless, even considering correlates that replicate across regions, such as male sex (e.g., Blumberg et al., 2009, Pickett et al., 2005), magnitudes still vary country to country. For instance, evidence from the Global School-Based Student Health Survey (GSHS) suggest that the magnitude of gender differences in fighting varies vastly between different LMICs (Nivette, Sutherland, Eisner, & Murray, 2019), although the explanation for such variation is still unclear.

One key factor to understand high levels of violence in Latin America might be the role of organized crime and criminal networks, particularly related to the production and distribution of drugs (Demombynes, 2011, Koonings & Kruijt, 2015). State institutions have been corrupted by drug trafficking, with police, courts and other officials overwhelmed by the resources deployed by drug cartels (Demombynes, 2011). In some cities, such as São Paolo, in Brazil, organized crime can occur both with and without violence. The latter case happens when an armed criminal group gains the territorial control with an unwritten accord with the state security forces (Davis, 2012). Moreover, crime-reduction policies (i.e., mass-incarceration, sentences harsher) against criminal networks can increase prison gangs' power over street-level actors by orchestrating violence (Lessing, 2015). The role of proximal and distal correlates in youth violence in these cities is still an issue that needs to be explored.

The public health approach frames violence not only as a social order and justice issue but also as health problem (Moore, 1995), which arises from interrelated bio-psycho-social factors which can be targeted at three levels of prevention: prevention before violence takes place (*primary prevention)*; prevention that tackles early manifestations of violence before its progression (*secondary prevention*); and interventions focused on reducing trauma among victims and rehabilitating and reintegrating offenders (*tertiary prevention*) (Lee, 2017). The approach relies on identifying risk and protective factors, which can then be targeted in relevant preventative interventions, particularly primary and secondary prevention interventions (Krug, Mercy, Dahlberg, & Zwi, 2002). Various contextual influences are recognized as highly important rather than viewing violence as specific to an individual or a group (Shaw, 2012). Malleable risk factors can be targeted by interventions, while non-malleable risk factors can be used for targeting interventions and identifying higher-risk groups. However, there is limited knowledge on the effectiveness of programs to prevent violence in the most violent LMIC regions. A recent systematic review on interventions to prevent youth violence in Latin America identified only 9 studies, generally with weak causal designs (Atienzo et al., 2017).

Given that youth violence is a result of the interaction of causes at several levels, it seems reasonable that effective interventions need to address risk factors in multiple niches of the ecological model. The current review, finding important associations at each ecological level supports this view. An example of interventions working most effectively when implemented at different levels is a recent prevention strategy (Blattman, Jamison, & Sheridan, 2017) offering both $200 cash as well as cognitive behavioral therapy to high risk men in Liberia. While therapy on its own was initially effective, the combination of cash and therapy showed more long-lasting results in reducing crime and violence. It is thought this because the cognitive skills learned (i.e., self-regulation, patience, and a noncriminal identity and lifestyle) helped men to invest the cash in businesses or savings.

While our review has focused on correlates of violence measured at the individual-level (ecological studies were excluded), there is evidence that violence tends to take place in specific spaces, and several successful interventions have focused on policing such "hotspots" (Braga, Papachristos, & Hureau, 2012). Other promising broad strategies include drug and alcohol control policies, reducing access to firearms, spatial modification and urban upgrading, and poverty de-concentration (WHO, 2015), as well as reform of juvenile justice systems and direct engagement with armed groups through conflict resolution (Dowdney, 2006). Given the overlap between risk factors for mental health problems and violence perpetration (Thumann, Nur, Naker, & Devries, 2016), such as violence victimization, there might be opportunities for inter-sectorial collaboration in violence prevention.

4.1. Limitations and future directions

While this study applied meta-analysis to a large number of primary studies on violence in 60 LMICs for the first time, there were several limitations. Most individual meta-analyses were based on results from only several countries and only five studies included a population-based sample making it difficult to generalise these results. Moreover, several important predictors of youth violence were rarely included in LMICs studies. Future research in LMIC should also examine whether youth violence is associated with other child rearing factors such as family stress, home discord, parental antisocial behavior (Derzon, 2010), insecure attachment and anxiety (Ogilvie et al., 2014), low empathy (both cognitive and emotional) (Jolliffe & Farrington, 2004), and financial debt (Hoeve et al., 2014). Finally, more research attention in LMICs should be given to individual-level correlates that have been proven to be robust predictors of youth violence in HICs such as psychopathic and callous–unemotional traits or low resting heart rate (Flexon & Meldrum, 2012, Murray et al., 2016). There is also a need for studies examining biological predictors and using genetically-sensitive designs (see Murray et al., 2018, Raine, Venables, & Mednick, 1997, Scarpa, Raine, Venables, & Mednick, 1997). We found that neighbourhood risk factors were significant correlates of violence, but we could not explore other contextual factors, such as levels of social disorganization, arms use, and presence of criminal and drug trafficking networks, which play an important role in many contexts.

Most of the correlates included in our study were present in a small number of studies and often combined diverse constructs. For example, the correlate "neighbourhood" included broad categories (i.e., "neighbourhood risk" and "neighbourhood problems") that can overlap with other correlates such as "drugs availability in the community". Many correlates related to psychopathology and personality traits, the family, and school were excluded from meta-analyses because they appeared in only one study. The development and administration of standardized measures in cross-cultural collaborative research can help overcome this limitation (Murray et al., 2018). Since most of the empirical evidence (including our study) comes mostly from middle-income countries (Shenderovich et al., 2016), future cross-cultural research should focus on including low-income societies.

As previously discussed, the cross-sectional nature of most of the studies included in our meta-analysis precludes any causal interpretation. More longitudinal studies are needed in order to help identify causal risk factors. Consequently, examining changes in correlates and violence over time would help us to identify causes from markers (Murray & Farrington, 2010). Moreover, the inclusion of more longitudinal designs will also allow to distinguish which factors are more relevant across different stages of development of youths (Eisner & Malti, 2015, Loeber & Hay, 1997). Given the various possible interactions of risk and protective factors across time (Lösel & Farrington, 2012), studies in LMICs can draw on person-centred analyses such as latent trajectory models (Land, 2015).

5. Conclusion

Many studies in LMICs have tested for potential correlates of youth violence. Key correlates are not dissimilar to those previously found in reviews of evidence from HICs. Considering the extremely high rates of youth violence in some LMIC regions, and the major tolls this takes on victims, communities, health systems, and economies, advancing research to identify actual causal mechanisms that can be targeted with preventive interventions is a priority.

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Authors' contributions

OSR participated in the study selection, codification, data extraction, the statistical analysis, and wrote the manuscript. NT participated in the study selection, codification, data extraction and wrote the manuscript. YS participated in the acquisition of the data, selection, codification, data extraction and helped draft the manuscript. JM conceived and coordinated the review project, and helped draft the manuscript. All authors read and approved the final manuscript.

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Declaration of Competing Interest

The authors declare that they have no competing interests.

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[5] References marked with an asterisk indicate studies included in the meta-analysis.

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