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Risk Factors for Antisocial Behavior in Low- and Middle-Income Countries: A Systematic Review of Longitudinal Studies

ABSTRACT

Violent crime is a major cause of social instability, injury, and death in low- and middle-income countries. Longitudinal studies in high-income countries have provided important evidence on developmental precursors of violence and other antisocial behaviors. However, there may be unique influences or different risk factor effects in other social settings. Extensive searches in seven languages and screening of over 60,000 references identified 39 longitudinal studies of antisocial behavior in low- and middle-income countries. Many risk factors have roughly the same average effects as when studied in high-income countries. Stability of aggression over a 3-year period is almost identical across low- and middle-income countries and high-income countries. Dimensions of comorbid psychopathology such as low self-control, hyperactivity, and sensation seeking are associated with antisocial behavior in low- and middle-income countries, but some early physical health factors have consistently weak or null effects.

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Although 80 percent of the world's population live in low- and middle-income countries (LMICs), most behavioral research has been conducted in "WEIRD" populations—Western, Educated, Industrialized, and Democratic societies (Henrich, Heine, and Norenzayan 2010). This raises fundamental questions about the generalizability of current scientific knowledge and its utility for practice and policy across all human societies. In this essay, we review evidence on risk factors for antisocial behavior in LMICs and consider whether results from high-income countries (HICs) apply similarly in LMICs.

Violence is a major cause of social instability, injury, mental health problems, and death in many LMICs (Bowman et al. 2008; Matzopoulos et al. 2008). For example, in Latin America and the Caribbean, interpersonal violence was the leading cause of death among 15–49-year-olds in 2013 (Institute for Health Metrics and Evaluation 2016). Violence is a complex, multifactorial behavior, often preceded by childhood conduct disorders, which also carry many adverse consequences through the life course. Prospective longitudinal studies provide the strongest evidence about predictors of violence, conduct disorders, and other antisocial behaviors, but major reviews of the literature have focused almost exclusively on HICs. Because risk processes for antisocial behavior may not be universal, identifying robust predictors of antisocial behavior in LMICs is a priority to develop effective interventions for most of the world.

Different types of antisocial behavior have different geographic patterns. Homicide, the most serious form of interpersonal violence, shows enormous variation across both time and space. In western Europe, homi-

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cide rates declined from about 25 homicides per 100,000 people per year in the Middle Ages to about 1.0 per year in the early twenty-first century (Eisner 2014). Currently, the highest rates of homicide are found in LMICs in the Americas and in sub-Saharan Africa, with rates comparable to those in Europe many centuries ago. In 2013, there were 23.6 homicides per 100,000 people in Latin America and the Caribbean and 20.3 in southern sub-Saharan Africa (Institute for Health Metrics and Evaluation 2016). Rates of nonfatal violence are considerably harder to compare across countries, but self-report surveys suggest levels of assault are nearly three times higher in LMICs than in HICs (Wolf, Gray, and Fazel 2014). In contrast to these striking geographic variations in violence, rates of childhood conduct disorder (about 3.6 percent) and oppositional defiant disorder (2.1 percent) appear to be fairly constant around the globe (Canino et al. 2010; Polanczyk et al. 2015). This geographic variability in violence and similarity in rates of childhood disruptive disorders are puzzling given the strong stability of antisocial behavior in individuals through time, at least within HICs (Olweus 1979). Possibly, varying levels of stability in antisocial behavior across LMICs could help explain these patterns.

Developmental and life course theories of antisocial behavior highlight the influence of individual and environmental processes involved in self-control, moral reasoning, social bonding, and social learning from early life through adulthood (Farrington 2005*b*; Eisner and Malti 2015). Prospective longitudinal studies provide the most important evidence on the natural history of antisocial behavior and the interplay of multiple risk and protective factors through the life course and across different ecological levels (Farrington 2013). Evidence from major longitudinal studies has been synthesized in several prior narrative and meta-analytic reviews (Lipsey and Derzon 1998; Rutter, Giller, and Hagell 1998; Hawkins et al. 2000; Derzon 2010; Murray and Farrington 2010; Farrington 2013, 2015*b*; Tanner-Smith, Wilson, and Lipsey 2013; Eisner and Malti 2015). Key risk factors identified include individual factors such as impulsivity, low IQ, and low school achievement; parenting factors such as poor supervision, punitive or erratic discipline, cold attitude, and child physical abuse; other parent and family characteristics, such as parental conflict, disrupted families, antisocial parents, large family size, and low family income; antisocial peers, high delinquency rate schools, and high-crime neighborhoods. Results are not always consistent across studies, complex interactions still need to be clarified, and the identification of causes, as opposed to mere

statistical associations, remains a major challenge for research, but increasing progress is being made (Jaffee, Strait, and Odgers 2012).

Despite the advances made in longitudinal research on antisocial behavior, prior reviews of this evidence focus almost exclusively on studies in western Europe, North America, and Australasia. For example, David Farrington (2015*b*) recently reviewed 30 key longitudinal studies in criminology, and all but one were conducted in high-income countries, possibly because of the strong criteria used to select studies for inclusion in the review—studies with at least 300 participants, personal interviews, and follow-ups of at least 5 years. In other areas of behavioral science, WEIRD populations are considered "among the least representative populations one could find for generalizing about humans" (Henrich, Heine, and Norenzayan 2010, p. 61). Why prior reviews have not included more LMIC studies is not entirely clear. It is possible that relevant longitudinal studies are lacking in LMICs, that prior reviews did not aim to cover LMICs, or that standard reviewing methods (e.g., searching only in English) do not locate studies in LMICs. We imagine that most scholars assume that good longitudinal studies are lacking in LMICs.

It should be noted that some longitudinal surveys in HICs selected participants from socioeconomically disadvantaged populations, for example, the working-class sample living in inner London recruited in the classic Cambridge Study in Delinquent Development (Piquero, Farrington, and Blumstein 2007; Farrington, Piquero, and Jennings 2013) and the inner-city black youths included in the Philadelphia cohort of the Collaborative Perinatal Project (Denno 1990; Tibbetts and Piquero 1999). However, it would of course be a mistake to simply extrapolate results from these populations to people living in LMICs, with different levels of poverty and inequality and sociocultural conditions.

Given the focus of prior reviews on longitudinal studies in HICs, we aim here to synthesize the available evidence on risk factors for antisocial behavior in LMICs and consider whether findings are comparable across settings. We bring together findings from a surprisingly large number of longitudinal studies in LMICs, identified through extensive searches in seven languages. In the first section of the essay, we introduce theoretical perspectives on why risk factors for antisocial behavior could vary across the globe and define key terms used in the subsequent review of the empirical evidence. Section II describes the types of community-based, longitudinal studies that we searched for in LMICs, how we searched for them, and the approach we used to review their findings. Section III

describes the 39 longitudinal studies we identified in LMICs and synthesizes their findings, organized in an ecological model of individual-level factors, early health factors, child rearing processes, maltreatment and other adversities, family characteristics, and wider social influences. Although these studies have produced an enormous collection of results, for most risk factors we examine, only a small handful of individual surveys in LMICs provide relevant evidence. We quantitatively pool the results wherever possible using meta-analysis and summarize all study findings in the text to provide a single, comprehensive resource that details existing findings on risk factors in LMICs. Section IV discusses broad theoretical and research implications.

Table 1 gives an overview of the results from our meta-analyses of LMIC studies, where similar constructs were available in prior reviews of studies from HICs. With few exceptions, average bivariate associations were very similar between LMICs and HICs. These similar findings across vastly different sociocultural contexts point toward global similarity in risk factors for antisocial behavior. However, there are two important caveats to this conclusion. First, because the associations represent bivariate correlations, one cannot draw conclusions about the similarity of causal processes. Second, these average associations mask considerable variability in results across different LMIC studies, which could represent context-specific influences of risk factors on antisocial behavior, as well as methodological variation between studies. Half of the meta-analyses of LMIC studies had at least moderate heterogeneity in the results.

Although it is difficult to draw broad conclusions about overall replicability of risk factors based on the current LMIC evidence, and for some risk factors only a very small number of studies were available, the following key empirical findings emerged. First, past behavior was the strongest predictor of future antisocial behavior in LMICs, and associations were very similar to those found previously in HIC studies. Second, other relatively strong bivariate predictors of antisocial behavior in LMICs included hyperactivity and sensation seeking, low social competence, authoritarian parenting, and maternal smoking in pregnancy. Third, for these and other risk factors in LMICs, associations with antisocial behavior were generally similar in size, or slightly smaller than those in HICs, although some associations, such as having a large family and low maternal education, were considerably weaker in LMICs than in HICs. Fourth, there was little specificity in the type of antisocial behavior predicted by

TABLE 1

Comparison of Average Risk Factor Associations for Antisocial Behavior in Low- and Middle-Income Countries (LMICs) and High-Income Countries (HICs)

Risk Factor	Strength of Association in LMICs: This Review	Strength of Association in HICs: Prior Reviews
Individual-level risk factors:		
Prior aggression	Large for aggression	Large for aggression[1]
Prior conduct problems	Large for conduct problems	Large for conduct problems[2]
	Medium for violence	Medium for violence[3]
Hyperactivity	Negligible for crime	Small for crime[4]
Poor educational performance	Negligible for intimate partner violence	Small for violence[3]
Drug use	Large for violence	Large for violence[3]
Early life health risk factors:		
Low birth weight	Negligible for conduct problems	Negligible for conduct problems[5]
Premature birth	Negligible for conduct problems	Negligible for conduct problems[5]
Child rearing practices:		
Maternal authoritarian parenting	Medium for conduct problems & aggression	Medium for conduct problems[2]
Maternal warmth	Small for conduct problems & aggression	Medium for conduct problems[2]
Maternal authoritative parenting	Medium for conduct problems & aggression	Medium for conduct problems[2]
Family sociodemographic factors:		
Poor family during childhood	Small for conduct problems	Medium for conduct problems[2]
	Small for violence	Small for violence[3]
Low maternal education	Small for conduct problems	Large for conduct problems[2]
Young mother at birth	Small for conduct problems	Small for conduct problems[2]
	Small for violence	Negligible for violence[2]
Many siblings	Negligible for violence	Medium for violence[2]

NOTE.—Associations are bivariate correlations. The strength of association is described as follows (see Sec. II): negligible, $d < 0.10$; small, $d = 0.10$; medium, $d = 0.25$; large, $d = 0.50$. References for prior reviews in HICs: [1]Olweus (1979); [2]Derzon (2010); [3]Lipsey and Derzon (1998); [4]Tanner-Smith, Wilson, and Lipsey (2013); [5]Aarnoudse-Moens et al. (2009). For some risk factors in the current review, described later in the essay, no prior, comparable review was located for studies in HICs.

risk factors in LMICs, but associations tended to be stronger for child conduct problems and aggression, compared with youth crime or violence. This may be due to a longer time span between the risk factors and young adult outcomes of crime and violence. Fifth, there was good evidence that some of the early health factors studied, such as low birth weight, were not associated with antisocial behavior. Finally, there was substantial heterogeneity in the results for many risk factors investigated in LMICs; however, it is not currently possible to determine if this reflects variations in methodology between studies or substantive differences across social contexts.

We conclude that, although individual studies have provided important local evidence in a number of LMICs, and some broad patterns of findings are discernible, the bigger picture concerning replicability of findings across context is unclear, given the limited evidence available on each risk factor and methodological differences between existing studies in LMICs. It would therefore be premature to conclude whether the etiology of antisocial behavior reflects universal human phenomena or a mix of universal and context-contingent factors. We outline our hopes for a new generation of global coordinated research projects, using common methods and measures, to provide robust evidence on the degree of universality versus specificity of different risk processes involved in antisocial behavior across the life course.

I. Theories, Aims, and Definitions

In this section, we review theoretical perspectives on why risk factors might influence antisocial behavior differently across social contexts and specify our aims and definitions.

A. Why Might Risk Factors for Antisocial Behavior Not Be Universal?

It is possible that risk factors previously identified in HICs reflect universal patterns of human behavior and that similar empirical patterns will obtain consistently across all societies. Some existing studies have compared risk factors between different HICs and found very similar associations, for example, between Pittsburgh, Pennsylvania, and London, England (Farrington and Loeber 1999; see also Farrington 2015*a*). However, given the great diversity in social contexts across LMICs, there are several reasons why risk and protective factors might not replicate so consistently elsewhere. First, even within HICs, numerous surveys sug-

gest that the effects of individual-level and family-level risk factors can depend on community context; that is, there are interaction effects between risk factors across ecological levels. For example, in the Pittsburgh Youth Study, boys' impulsivity level was positively associated with crime for males living in poor neighborhoods but posed reduced risk for those in better-off neighborhoods (Lynam et al. 2000). Many studies show that parental supervision has stronger effects on child antisocial behavior in high-risk social settings than in less deprived contexts (Schonberg and Shaw 2007). Therefore, looking across the globe to consider populations in radically different socioeconomic and cultural circumstances in LMICs, there may be systematic variability in risk factor associations according to geographic location.

Schonberg and Shaw (2007) discuss two theories why individual and family-level risk factors will probably have stronger effects on child behavior in more deprived social settings. First is the idea that risk factor effects increase when they co-occur: that cumulative risk exposure has multiplicative effects (Appleyard et al. 2005). This "synergistic model" also predicts that risk factors are more likely to co-occur in deprived social settings. Therefore, a single risk factor in a deprived context is likely to have stronger effects on child antisocial behavior than in less deprived settings. A second and related theory also predicts stronger risk factor effects in contexts of adversity but emphasizes the interaction between "vulnerability factors" and "provoking agents" (Schonberg and Shaw 2007). According to this perspective, individual vulnerability factors (such as genetic disposition) result in antisocial behavior only if provoking agents in the environment are also present. For example, adoption studies have shown that increased genetic risk for antisocial behavior, indicated by biological parents having a criminal record, predicts antisocial behavior only when adopting families also present some form of environmental risk (Raine 2002*b*). Hence, individual-level risk factors should have larger effects in disadvantaged environments that trigger those dispositions.

A contrasting theoretical perspective predicts that individual-level risk factors will have weaker associations with antisocial behavior in high-risk environments because strong social forces override individual-level influences in these settings. Raine (2013) calls this the "social push" hypothesis. Accordingly, biological risk factors should have their strongest influence on antisocial behavior in relatively benign social environments and, by contrast, be overridden in contexts of high social adversity. Raine describes a range of findings on biological factors such as resting heart rate

and skin-conductance reactivity, showing that effects are stronger in less disadvantaged social contexts.

Rutter (1999) points to other, more general, considerations about how social contexts can influence risk factor effects. He particularly emphasizes the issue of what a risk factor means socially, pointing to several ways this could influence its effects on behavior. For example, the marked changes in social views concerning childbearing out of wedlock through the twentieth century imply different consequences for mothers and children, with far greater effect in the 1930s, when unmarried mothers were viewed with serious social disapproval, than in later decades. The relative distribution of a risk factor across the population is another facet of social meaning that could alter a risk factor's effects. Specifically, a risk factor's influence might depend on a person's relative social standing rather than an absolute effect. A clear example is the advantage that educational attainment buys in the job market: large population increases in educational attainment have altered the minimum qualification level required to obtain skilled jobs (Rutter 1999). Thinking cross-sectionally, risk factor effects could also vary between countries because of different distributions of risk factors between populations. For example, varying levels of income inequality might mean that low family income has different associations with antisocial behavior across different countries. Rutter terms this a "comparative social context effect" because it reflects the importance of a person's social standing in relation to others.

In summary, from four theoretical perspectives, different broad empirical predictions may be made about patterns of risk factor effects in LMICs. First, according to a universalist view, risk factor associations should be consistent both in and across LMICs compared with HICs. Second, individual- and family-level risk factors would be expected to have stronger effects in LMICs than in HICs, according to a "multiplicative effects" model, because of the higher likelihood of exposure to additional social disadvantage in LMICs. Third, according to the "social push" perspective, individual-level risk factors should have weaker effects in LMICs than in HICs because greater social disadvantage in LMICs overrides individual-level influences. According to both the "multiplicative effects" model and the "social push" model, variation in risk factor associations would also be expected across LMICs, given their many sociocultural differences. Fourth, if social meanings of risk factors influence their effects, one would also expect heterogeneity in effects, both across LMICs and between LMICs and HICs.

B. Aims

Longitudinal evidence from LMICs is important to test the universality of current developmental and life course theories, identify any context-specific influences on antisocial behavior, and deliver effective interventions in areas of the world most affected by violence. Longitudinal research in LMICs is also important because some risk factors do not occur commonly in HICs. For example, prospective evidence on the link between early childhood malnutrition and antisocial behavior was first described in the Mauritius Child Development Study (Liu et al. 2004). Also, causal inference can be strengthened from research in LMICs if the patterning of underlying confounding factors is different from that in HICs (Batty et al. 2007; Ebrahim et al. 2013). For example, a recent Brazilian study of breast feeding provided plausible evidence of causal effects on intelligence because breast feeding was not strongly socially patterned in that setting, although breast feeding is highly associated with maternal education and income in many HICs (Victora et al. 2015). Considering the importance of synthesizing evidence on predictors of antisocial behavior in LMICs, we have four aims:

1. To identify and characterize existing longitudinal studies of antisocial behavior in LMICs.
2. To synthesize findings in LMICs on longitudinal predictors of child conduct problems and aggression and youth crime and violence.
3. To compare average risk factor associations in LMICs with previous findings from HICs.
4. To examine the consistency of results across LMICs to provide evidence about the possible universality or cross-country or cultural specificity of predictors.

C. Definitions

"Low- and middle-income countries" (LMICs) are defined as countries with a low- or middle-income status according to the World Bank; they are also sometimes referred to as developing countries. Because a country's income status can change from year to year, we defined LMICs as countries classified as low- or middle-income during more than half of the years 1987–2012 for which World Bank classifications were available. By this definition, 164 countries were identified as LMICs. Although categorizing countries as low- and middle-income is internationally recognized, the

terms hide great disparity within and across countries. For example, about 75 percent of the world's poor live in middle-income countries such as China, India, and Brazil (Sumner 2011). Despite enormous sociocultural heterogeneity across low- and middle-income countries, most have elevated rates of absolute poverty, income inequality, and violence, placing families, communities, and youths at greater risk (Knerr, Gardner, and Cluver 2013).

"Conduct problems" refer to antisocial behaviors in childhood and adolescence that are symptomatic of oppositional defiant disorder and conduct disorders (American Psychiatric Association 2013). We acknowledge that LMICs are spread across a wide range of cultures, and there is not a consensus about the universality of psychiatric disorders, given the lack of biological markers and gold standards for validation (Canino and Alegria 2008). However, in our review, nearly all studies examined conduct problem symptoms, rather than diagnoses, using instruments such as Achenbach's System of Empirically Based Assessment (e.g., the "externalizing" subscale of the Child Behavior Checklist; Achenbach and Rescorla 2000) or the Strengths and Difficulties Questionnaire ("conduct problems" subscale; Goodman 1997), which ask respondents about child behaviors such as temper tantrums, stealing, lying, and fighting. These instruments have shown good psychometric properties across a range of cultures and settings (Achenbach, Rescorla, and Ivanova 2012; Rescorla et al. 2012).

"Aggression" refers to behaviors intended to cause physical or psychological harm to others. We examine risk factors for child and adolescent aggression separately from general conduct problems because of the large literature on aggression as a specific type of conduct problem, with different developmental patterns, subtypes, and potentially different prognoses and risk factors (Eisner and Malti 2015). Measures such as the aggression subscale on the Child Behavior Checklist (Achenbach and Rescorla 2000) are commonly used to assess the extent of children's aggressive behaviors.

"Violence" is defined by the World Health Organization (2002, p. 5) as "the intentional use of physical force or power, threatened or actual . . . that either results in or has a high likelihood of resulting in injury, death, psychological harm, maldevelopment, or deprivation." We review studies of interpersonal physical violence by youths (10–29 years old) committed both within families, or with intimate partners, and in the community. We exclude studies of suicidal behaviors or other forms of self-directed violence. Violence can be measured using self-reports or reports by other

knowledgeable people (such as parents or teachers) or by collecting official records (e.g., police or court records). We also review findings on risk factors for youth crime that includes nonviolent offending, for two reasons. First, nonviolent offending is one manifestation of conduct disorder, and second, violent and nonviolent criminal behaviors are highly associated (Farrington 1998).

"Antisocial behavior" refers to a wide variety of behaviors that violate societal norms or laws (Rutter, Giller, and Hagell 1998), including the various behaviors we examine—child aggression and conduct problems and youth violence and crime. Given the strong correlations between these behaviors, some researchers consider them manifestations of the same underlying individual potential for antisocial conduct (Farrington 1991, 2005*a*).

We generally use the terms "childhood" to refer to ages under 10, "adolescence" to ages 10–17, and "young adulthood" to ages 18–29, with "youth" referring to ages 10–29, following the World Health Organization's (2015) definition of youth violence. However, sometimes we had to use other distinctions made in the literature regarding specific studies or types of variables.

We review "longitudinal predictors," which are variables associated with and preceding conduct problems or violence. Longitudinal predictors that increase the risk for adverse outcomes are called "risk factors." Although most predictors we consider are risk factors, some variables lower the risk of an adverse outcome and are called "protective factors." Direct protective factors predict a lower probability of antisocial behavior across the whole population, whereas buffering protective factors predict a low probability of antisocial behavior specifically among at-risk groups (Lösel and Farrington 2012). A distinction might also be drawn between "explanatory" and "nonexplanatory" risk factors; explanatory ones clearly measure a construct different from the outcome behavior, and nonexplanatory ones could be measuring the same underlying construct as the outcome (Farrington, Gaffney, and Ttofi 2017). For example, drug and alcohol abuse could be measuring the same underlying construct (such as a broad externalizing behavior syndrome; Patrick et al. 2015) as offending. Maybe peer delinquency is also measuring the same underlying construct as delinquency, because of co-offending.

Prospective longitudinal studies are the gold standard for investigating risk and protective factors because they can establish clear temporal

order and avoid bias that can arise in retrospective studies (Kraemer, Lowe, and Kupfer 2005). We consider only prospectively measured predictors of antisocial behavior in longitudinal studies. Hence, we do not include findings on correlates measured at the same time as antisocial behavior. Also, we do not review effects of prevention programs unless they yield insight into the effects of naturally occurring risk factors. We focus on modifiable risk factors that can change during the life course, and therefore might be targets for interventions, rather than static risk factors such as a person's sex or race.

Critically, predictors are not necessarily causal. A risk factor might predict conduct problems or violence merely because it is associated with other causes (confounders), not because it itself influences the behavior. Therefore, although longitudinal predictors meet two criteria for causation (precedence and association), many do not meet a third criterion—that no confounding variable explains the association. Identifying which predictors are causes and which are merely markers of other causes is a major challenge for research, requiring use of experimental or quasi-experimental studies and genetically sensitive research designs to help rule out alternative explanations (Rutter et al. 2001; Shadish, Cook, and Campbell 2002; Rutter 2003; Kraemer, Lowe, and Kupfer 2005; Murray, Farrington, and Eisner 2009; Jaffee, Strait, and Odgers 2012; Eisner and Malti 2015). Most findings we summarize do not permit strong causal inference, but we highlight studies that used stronger methods to improve causal inference, such as negative controls, experiments that target specific risk factors, cross-cohort comparisons, and twin studies (Richmond et al. 2014). Analysis of within-individual change through time has also been recommended as a way to improve causal inference in longitudinal studies (Farrington 1988; Murray, Farrington, and Eisner 2009).

II. Methods

Systematic reviews use thorough and explicit search methods, with preset eligibility criteria to locate all available evidence on a research topic, and ideally use quantitative analyses to synthesize the results from primary studies. In this section we detail the systematic review methods used to search for longitudinal studies in low- and middle-income countries, eligibility criteria, and our approach to synthesizing the results on risk factors for antisocial behavior.

A. Search Strategy

We conducted an extensive search for all available evidence on correlates and predictors of childhood conduct problems, aggression, and youth crime and violence in LMICs in multiple languages. Full details of the search and screening methods and the review protocol are described in a separate article (Shenderovich et al. 2016). In summary, we first developed a broad and sensitive search strategy 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 youths; and relevant outcomes, including antisocial behavior, conduct problems and disorders, externalizing, aggression, bullying, crime, violence, gang membership, and so forth. We searched the following databases 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 and 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, we used translated search terms 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; and 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 (2010) also searched his large database of longitudinal studies to locate any other possibly eligible studies.

B. Eligibility Criteria and Screening

The review protocol was prepared with preset inclusion criteria. Inclusion criteria specified the population, outcome measures, and several methodological quality criteria for drawing conclusions about risk factors (Murray, Farrington, and Eisner 2009; Jolliffe et al. 2012). Only pro-

spective longitudinal studies were included in this essay, although cross-sectional and retrospective studies will be examined in other publications. To be eligible, studies must have met all the following criteria:

1. The study was conducted in an LMIC.
2. The study included at least 100 participants.
3. The study reported at least one test of association between a potential predictor of childhood conduct problems or aggression, youth violence, or crime.
4. Conduct problems and aggression were measured between birth and age 18, and youth crime and violence were measured between ages 10 and 29.
5. Child conduct problems and aggression were measured using standardized instruments such as the Child Behavior Checklist or instruments with enough detail to determine that items concerning other behaviors, such as hyperactivity, were not included in the outcome.
6. Measures of violence and crime were based on self-reports, criminal records, or other reports.
7. The risk factor and the outcome were measured at the level of an individual. For example, studies of group-level correlates of neighborhood crime rates were not included. Ecological research was beyond our scope.
8. Participants must have been recruited using random or stratified probability sampling or sampling of an entire population of children or youths in the community.
9. If participants were recruited at schools or other institutions, such as maternity hospitals in birth cohort studies, participants must have been recruited from at least two such institutions to increase generalizability of the findings.
10. Only prospective longitudinal studies were eligible.

We excluded cross-sectional and retrospective studies and excluded several longitudinal studies if they reported only correlates measured at the same time as the behavioral outcome (Jackson 2001; Botcheva, Feldman, and Liederman 2002; Velásquez et al. 2002; Friday et al. 2003, 2005; Taylor et al. 2004; Samms-Vaughan, Jackson, and Ashley 2005; Reyes et al. 2008; Zhou et al. 2012). Experimental studies that evaluated interventions that changed potential risk or protective factors for conduct problems, aggression, crime, or violence were included, as experimental studies can help identify causal effects of modifiable exposures.

All 44,318 titles and abstracts in English were screened for potentially relevant studies by Yulia Shenderovich, with Joseph Murray supervising decisions in cases of doubt. Non-English searches and screening of 17,290 titles and abstracts were conducted by six graduate students—four native speakers and two students fluent in the relevant languages. For all references referring to potentially eligible studies, 1,437 full texts were retrieved and screened. A team of 17 people translated all potentially eligible texts reported in languages other than English. All studies meeting the eligibility criteria, whether published or unpublished, conducted at any time up until the searches were completed were eligible. Two authors verified that all studies included met all eligibility criteria. Figure 1 shows a PRISMA flow diagram for the search and screening process.

C. Synthesis of Findings

We followed prior reviews (Hawkins et al. 1998; Rutter, Giller, and Hagell 1998; Hill 2002; Farrington and Welsh 2007; Murray and Farrington 2010; Tanner-Smith, Wilson, and Lipsey 2013) and grouped risk factors according to a bioecological model (Bronfenbrenner and Morris 2007) in the following categories: individual factors; perinatal and early childhood health factors; child rearing factors; maltreatment and other adverse life events; family characteristics; peer factors; school factors, community factors, and cultural influences. Findings are reported in relation to the age at which children were exposed to each risk factor and age at outcome measurement, and separately for females and males, wherever original results were stratified by sex.

Meta-analyses were used to synthesize multiple findings from different studies for the same risk factor–outcome association. Evidence was also narratively reviewed to characterize the evidence included in the meta-analyses and to discuss additional findings that were ineligible for meta-analysis. Meta-analyses were conducted using random-effects models (using metan in Stata 12.1), given expected heterogeneity of results across different samples. Prior meta-analyses of predictors of antisocial behavior have generally synthesized only bivariate associations from primary studies (Hawkins et al. 1998; Lipsey and Derzon 1998; Derzon 2010; Tanner-Smith, Wilson, and Lipsey 2013). Most of the meta-analyses we undertook also synthesize only bivariate associations. However, if multiple studies applied similar methods to calculate covariate-adjusted associations, we also meta-analyzed those results, separately, to consider the strength of risk factor associations independent of possible confounding

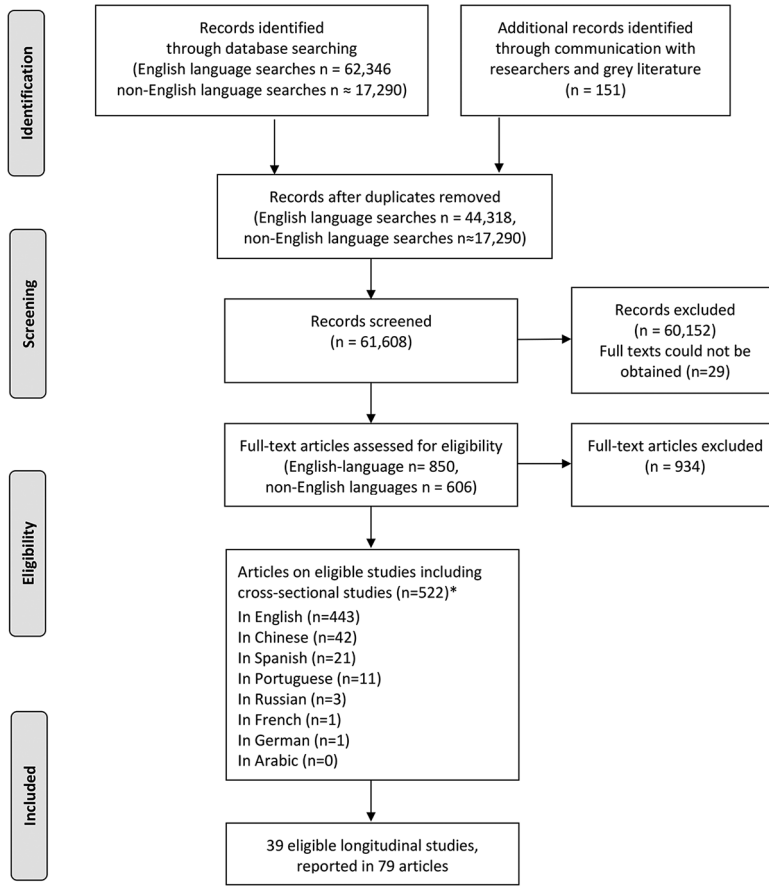

FIG. 1.—PRISMA flow diagram of review search and screening process. * Three studies were reclassified as eligible since Shenderovich et al. (2016).

variables. Studies that adjusted for potentially mediating mechanisms (variables on the causal pathway between the predictor and outcome) were not included in meta-analyses (Victora et al. 1997). Adjusting for mediating variables will downwardly bias estimates of risk factor effects.

All studies meeting the eligibility criteria were included in the narrative review, but only studies with an effect size and standard error were included in meta-analyses. For this reason and because we judged some studies too different in their designs and analyses to warrant quantitative

pooling of results, some meta-analyses contain fewer studies than the corresponding narrative reviews. Specifically, all findings were included in meta-analyses, unless: multiple studies were not available for the same risk factor–outcome association, mediating mechanisms were adjusted for in the analysis, it was not possible to calculate an effect size for a particular study, or multiple studies used such different designs and analyses that we judged meta-analysis was inappropriate.

Despite these restrictions, many studies had multiple results that were eligible for meta-analyses. To ensure that each meta-analysis was based on independent results, the following procedures were followed:

1. Separate meta-analyses were conducted for each predictor.
2. Separate meta-analyses were conducted for each outcome of child conduct problems and aggression and youth violence and crime.
3. Separate meta-analyses were conducted for bivariate and covariate-adjusted results.
4. Males and females were treated as separate samples where results were stratified by sex.
5. Where there were still multiple results from a single study, the outcome assessed longest after the predictor was used.
6. Where there were still multiple results from a single study, they were averaged, and the average effect size was used in meta-analysis.

Meta-analyses were used first to estimate average associations in LMIC studies. These findings were also compared with results from comparable reviews of longitudinal studies in HICs, to consider the robustness of findings between HICs and LMICs. However, average results in LMICs may obscure important heterogeneity in risk factor effects, for example, between different regions. For most risk factors, it was not possible to test whether results from LMICs varied systematically by region (or by other possible moderators, such as methodological characteristics of the studies), because meta-analyses included too few studies for this type of moderator analysis. However, for the variable that had the largest number of effect sizes (prior conduct problems and aggression), we grouped relevant results according to world region (World Health Organization [WHO] regions of Africa, Americas, Europe, and Western Pacific region) and tested whether these regions or other study characteristics moderated effect sizes in meta-analysis.

In the narrative review, we report effect sizes as they were presented in individual studies in their original form, for example, as odds ratios (OR) or risk ratios (RR) for dichotomous associations and correlations (r) or standardized regression coefficients for associations with continuous outcomes. Unless stated otherwise, results are based on bivariate tests of associations between predictors and outcomes. Meta-analytic results are reported using the standardized mean difference (d), representing the difference in the behavioral outcome (in standard deviation units) between individuals exposed to a risk factor and individuals not exposed. The same type of effect size (d) was used to report meta-analyses of associations adjusted for confounding variables. Sometimes, the terms small, medium, and large are used to describe the magnitude of an effect size, often following Jacob Cohen's (1988) suggestions. However, existing conventions about what constitutes small, medium, and large, including those of Cohen, are not empirically grounded and ignore the context of the research (Hill et al. 2008). To describe the size of risk factor associations, we used empirical benchmarks based on all 96 effect sizes coded for the meta-analyses. First, we rank-ordered the 96 (absolute) effect sizes, ranging from 0.0 to 5.5, and then divided them into quartiles. The quartiles were then used to define minimum values for small ($d = 0.10$), medium ($d = 0.25$), and large ($d = 0.50$) associations. Equivalent cutoffs for ORs are approximately 1.2, 1.6, and 2.5, respectively. This internal approach—defining the magnitude of effect sizes relative to other findings on the same theme—is similar to that used by Lipsey and Wilson (1993) in their meta-analysis of psychosocial interventions. We also report the I^2 statistic for meta-analytic results, which shows the proportion of the total variance in effect sizes that is beyond chance. As a rough rule of thumb, $I^2 = 0$ percent suggests no heterogeneity, $I^2 = 25$ percent suggests low heterogeneity, $I^2 = 50$ percent suggests moderate heterogeneity, and $I^2 = 75$ percent suggests high heterogeneity (Higgins et al. 2003).

III. Empirical Findings

This section synthesizes results from 39 longitudinal studies of child conduct problems, aggression, and youth violence and crime in 18 low- and middle-income countries. Section A describes the studies, and Sections B–J present their results grouped according to a bioecological categorization of risk factors. Section K compares meta-analytic results with meta-

analytic results from previous reviews of studies of risk factors in high-income countries.

A. Description of the Studies

Of the 39 studies eligible, 12 were conducted in China, six in Brazil, five in South Africa (one of which also included a sample in Tanzania), two in the Czech Republic, two in Jamaica, and one in each of Barbados, Belarus, Chile, Colombia, Croatia, Guatemala, Mauritius, the Philippines, Poland, Puerto Rico, Russia, the Seychelles, and former Yugoslavia. Levels of serious violence in these countries range widely. Compared to the global average of six homicides per 100,000 people per year, homicide rates were lower in Chile, China, Croatia, the Czech Republic, Mauritius, and Poland in 2013; higher (up to 15 per 100,000) in Barbados, Belarus, the Philippines, and the Seychelles; and very high (over 15 per 100,000) in Brazil, Colombia, Guatemala, Jamaica, Russia, and South Africa (Institute for Health Metrics and Evaluation 2016). Looking at development levels in terms of the Human Development Index, indicating longevity, education, and income levels, most included countries ($n = 15/18$) had a high level of development in 2014 (UN Development Programme 2015). Two (Poland and Czech Republic) were classified as very highly developed, 13 were highly developed, and three (Guatemala, Philippines, and South Africa) were considered as having a medium level of development. No country had a low level of human development. Two countries (Puerto Rico and former Yugoslavia) lacked data on homicide and human development.

Table 2 summarizes the characteristics of the 39 studies. The study numbers shown in table 2 are used throughout this essay to refer to individual study results (e.g., #1 refers to the Barbados Nutrition Study). Twenty-nine of the studies focused on childhood conduct problems or aggression, five focused on youth violence or crime, and another five examined both childhood conduct problems or aggression and youth violence or crime. Twelve studies were based on birth cohorts, one study sampled children using health care registers, 18 recruited children in preschools or schools, four were based on household samples, and four used a matched risk–control group design, in which children exposed to a risk factor were matched with a control group and both groups were prospectively followed until outcome assessment. Ten studies assessed participants only during childhood (up to age 9), 22 assessed participants during adolescence (between ages 10 and 19), and seven followed

TABLE 2

Longitudinal Studies of Child and Youth Antisocial Behavior in Low- and Middle-Income Countries

Study #	Location	Study Name (Papers in Review)	Sample Type	Baseline Characteristics	Age at Follow-Ups	Data Sources	Outcomes in Review
1	Barbados: National	Barbados Nutrition Study (Galler and Ramsey 1989; Galler et al. 2011; Galler et al. 2012)	Matched risk and control groups	129 children with malnutrition (*marasmus*) in first year of life in 1967–72, and 129 children without malnutrition (recruited at ages 5–11) matched on sex, age, handedness, and neighborhood	5–11, 9–15, 11–17 years	Parents, self-report, teachers, medical exams	Conduct problems
2	Belarus: Minsk city, Minsk region, Brest, Mogilev, Gomel, Vitebsk, Grodno	Promotion of Breast-feeding Intervention Trial (Kramer et al. 2008)	Birth cohort	17,046 healthy breast-fed infants weighing at least 2,500 g, born in 1996–97, included in a cluster randomized trial of an intervention that substantially increased the duration children were breast-fed	1, 2, 3, 6, 9 months; 1, 6, 11 years	Parents, teachers, medical assessments	Conduct problems
3	Brazil: Pelotas	1982 Pelotas Birth Cohort Study (Caicedo et al. 2010)	Birth cohort	5,914 children born in hospitals in city of Pelotas in 1982	1, 3, 13, 14, 18, 19, 23, 25, 30 years; criminal records to age 30	Parents, self-report, medical exams, criminal records	Violence

TABLE 2 (*Continued*)

Study #	Location	Study Name (Papers in Review)	Sample Type	Baseline Characteristics	Age at Follow-Ups	Data Sources	Outcomes in Review
4	Brazil: Pelotas (compared with British study)	1993 Pelotas Birth Cohort Study (Anselmi et al. 2008; Brion et al. 2010; Anselmi et al. 2012; Kieling et al. 2013; Murray, Maughan, et al. 2015; Murray, Menezes, et al. 2015)	Birth cohort	5,249 children born in hospitals in city of Pelotas in 1993	1, 3, and 6 months; 1 and 4 years (subsample); 11, 15, and 18 years (full sample); criminal records to age 18	Parents, self-report, medical exams, criminal records	Conduct problems, crime, violence
5	Brazil: Pelotas	2004 Pelotas Birth Cohort Study (Matijasevich et al. 2014; Petresco et al. 2014)[a]	Birth cohort	4,231 children born in hospitals in city of Pelotas in 2004	3 months; 1, 2, 4, and 6 years	Parents, self-report, medical exams	Conduct problems
6	Brazil: Pernambuco State	ENSUZI (Emond et al. 2006)	Matched risk and control groups	202 low-birth-weight infants and 212 non-low-birth-weight infants from low-income families born in maternity centers in 1993, matched on sex (39% male) and time of birth; included in trial of zinc treatment	8 years	Parents, teachers, medical exams	Conduct problems

	7	Brazil: São Gonçalo	São Gonçalo 2005 Study[b] (de Assis et al. 2013)	School sample	500 children in 1st elementary grade (age 7 years) randomly sampled in 54 public schools in 2005	8 and 10 years	Parents	Conduct problems
	8	Brazil: São Luís	The 1997/98 São Luís Cohort (Rodriguez et al. 2011)	Birth cohort	2,443 singleton births randomly sampled in city of São Luis in 1997–98	8 years (subsample)	Parents	Conduct problems
	9	Chile: Santiago	Santiago 1992/93 Study[b] (de la Barra, Toledo, and Rodríguez 2003, 2005)	School sample	1,279 1st graders (age 6 years) from seven schools in three districts of West Santiago in 1992/93	11 years	Teachers and parents	Aggression, conduct problems
	10	China: Beijing	Beijing 2000 Study[b] (Zhou et al. 2008; Tao, Zhou, and Wang 2010; Zhou, Main, and Wang 2010; Chen et al. 2011)	School sample	425 children aged 6–9 in 1st and 2nd grades in two elementary schools in Beijing in 2000	10–13 years	Parents, self-report, peers, teachers	Conduct problems
	11	China: Beijing	Beijing 2002 Study[b] (Chen et al. 2012)	School sample	1,162 3rd-grade children (age 9 years) in nine elementary schools in Beijing in 2002	10, 11, and 12 years	Teachers, self-report, and peers	Aggression
	12	China: Beijing	Beijing 2004 Study[b] (Zhang 2013)	Preschool sample	115 children age 2 years in three nursery schools in Beijing in 2004	3 and 4 years	Parents	Conduct problems

TABLE 2 (*Continued*)

Study #	Location	Study Name (Papers in Review)	Sample Type	Baseline Characteristics	Age at Follow-Ups	Data Sources	Outcomes in Review
13	China: Beijing	Beijing Twin Study (Hou et al. 2013)	School sample	1,387 pairs of twins age 10–18 years in 620 schools in Beijing in 2008–9	12–20 years	Parents and self-report	Conduct problems
14	China: Beijing	Beijing-Daxing Study[b] (Zhu, Yan, and Li 2011)	Health care system sample	122 children age 2–3 years in the Daxing District of Beijing registered in the health care management system	4–5 years	Parents	Conduct problems
15	China: Beijing and Shanghai	Beijing-Shanghai 1994–95 Study[b] (Chen et al. 2002; Wang et al. 2006)	Birth cohort	216 children age 2 years randomly selected from local birth registration offices in Beijing and Shanghai in 1994–95	4 years	Direct observation, parents	Aggression
16	China: Jinan	Jinan 2000 Study[b] (Zhang et al. 2003)	Preschool sample	217 children mean age 3 years in four preschools in Jinan city, Shandong in 2000	4, 4.5 years	Direct observation	Aggression
17	China: Jinan	Jinan Study[b] (Chen 2011; Chen 2012)	School sample	1,618 children age 9 years and 2,164 children age 11 years in 11 primary schools in Jinan city, Shandong	10, 11, 12, 13, 14 years	Parents, self-report, peers	Aggression

18	China: Jintan	China Jintan Child Cohort Study (Liu et al. 2014)	Preschool sample	1,656 children age 3–5 years in four preschools in Jintan city in 2004–5	6 years	Parents, teachers, medical exams	Aggression, conduct problems
19	China: Nanjing	Nanjing Survey (Tseng et al. 2000)	Preschool sample	697 children age 3–6 years in urban and rural areas of Nanjing city in 1984–85	7–10, 9–12, and 13–16 years	Parents	Conduct problems
20	China: Shanghai	Shanghai Longitudinal Project (Chen, Rubin, and Li 1997; Chen et al. 1999)	School sample	480 children in 2nd and 4th grades (mean ages 7 and 10) in two schools in Shanghai city in 1990	11 years (younger children) 14 years (older children)	Parents, teachers, peers	Aggression, conduct problems
21	China: Shanghai	Shanghai 1994 Study[b] (Chen et al. 2000; Chen, He, and Li 2004)	School sample	540 children in 6th grade (mean age 11 years) in four schools in Shanghai city in 1994	13 years	Parents, self-report, teachers, peers, school records	Aggression, conduct problems
22	Colombia: Bogotá, Medellin, and Barranquilla	Colombia 1995/96 Study (Brook et al. 2003; Brook, Brook, and Whiteman 2007)	Household sample	2,837 adolescents age 12–17 living with biological mothers randomly sampled in Bogotá, Medellin, and Barranquilla cities in 1995/96	14–19 years	Parents, self-report	Delinquency, violence
23	Croatia: Zagreb	Children in War (Rabotegsaric, Zuzul, and Kerestes 1994)	Preschool sample	686 children on average age 5 years in eight preschools in Zagreb city in 1991	6 years	Preschool teachers	Aggression

TABLE 2 (*Continued*)

Study #	Location	Study Name (Papers in Review)	Sample Type	Baseline Characteristics	Age at Follow-Ups	Data Sources	Outcomes in Review
24	Czech Republic: Prague	Prague Study (Dytrych, Matějček, and Schüller 1988; Kubička et al. 1995)	Matched risk and control groups	220 children whose mothers applied for and were denied abortion during pregnancy in 1961–63, matched with 220 children in the same school classes in 1970, in Prague	9, 14–16, 21–23, 27–31, 32–35	Parents, self-report, teachers, criminal, medical, and other official records	Crime
25	Czech Republic: Brno	European Longitudinal Study of Pregnancy and Childhood (ELSPAC) (Kukla, Hruba, and Tyrlik 2008)	Birth cohort	7,589 children with expected dates of delivery March 1991–June 1992 in Brno city or with expected delivery April 1991–June 1992 in Znojmo rural district	8, 11, and 13 years	Parents, self-report, teachers, medical exams	Aggression, conduct problems
26	Guatemala: Guatemala City	Guatemala 2006 Study[b] (DiGirolamo et al. 2010)	School sample	750 children aged 6–11 years in five public schools in a poor community in Guatemala city, included in trial of a zinc supplement in 2006	6.5–11.5 years	Parents, self-reports, medical exams	Aggression, conduct problems

	27	Jamaica: Kingston	Jamaica 1986 Study[b] (Chang et al. 2002; Walker, Chang, et al. 2007)	Matched risk and control groups	129 children with stunting aged 9–24 months in poor neighborhoods and 84 nonstunted children matched on age, sex, and neighborhood, in Kingston in 1986–87, included in a trial of a diet supplement and home visit intervention of 2-year duration	7–8, 11–12, 17–18 years	Parents, self-report, psychological assessment	Conduct problems, antisocial behavior
	28	Mauritius: Vacoas and Quatre Bornes	Mauritius Child Health Project (Clark 1982; Venables 1989; Raine, Venables, and Mednick 1997; Raine et al. 1998; Raine et al. 2002; Liu et al. 2004; Liu et al. 2009; Gao et al. 2010a; Gao et al. 2010b; Gao et al. 2013)	Birth cohort	1,795 children born in Vacoas and Quatre Bornes towns in 1969–70, recruited at age 3 using vaccination records, with 100 participants given a nutritional, educational, and physical exercise program	4, 5, and 6 years (subsample); 8, 11, 17, 23, 28, and 35 years (full sample)	Parents, self-report, medical exams, hospital records, criminal records	Aggression, antisocial behavior, crime, violence
	29	Philippines: Cebu	Cebu Longitudinal Health and Nutrition Survey (Fehringer and Hindin 2009)	Birth cohort	3,080 children born in Cebu between May 1983 and April 1984	1, 2, 8, 11, 15, 18, 21, 23 years	Parents, self-report, medical exams	Intimate partner violence

TABLE 2 (*Continued*)

Study #	Location	Study Name (Papers in Review)	Sample Type	Baseline Characteristics	Age at Follow-Ups	Data Sources	Outcomes in Review
30	Poland: Warsaw (compared with studies in Australia, Finland, Germany, Israel, Netherlands, US)	Poland 1979 Study[b] (Frączek 1986; Groebel 1988)	School sample	260 children in 1st and 3rd grades (ages 7 and 9 years) in two schools in Warsaw in 1979	7, 8, 9 years (younger children); 9, 10, 11 years (older children)	Parents, self-reports, peer nominations	Aggression
31	Puerto Rico: Standard Metropolitan Areas in Puerto Rico (compared with study in US)	Boricua Youth Study (Bird et al. 2007; Duarte et al. 2008; Maldonado-Molina et al. 2009; Jennings et al. 2010)	Household sample	1,353 children mean age 9 years (range 5–13) randomly sampled in standard metropolitan areas of San Juan and Caguas cities in 2000 (matched with 1,414 Puerto Rican children living in the Bronx, NY)	10, 11 years (on average)	Parents, self-report	Conduct problems/ disorders, delinquency
32	Russia: Voronezh	Voronezh 1995 Study[b] (Leavitt et al. 2013; Nelson et al. 2014)	Preschool sample	212 children age 3–6 years in three nursery schools in Voronezh city in 1995	13–16 years	Parents, self-report, teachers, peers	Aggression

33	Seychelles	Seychelles Child Development Cohort (Myers et al. 2000; Davidson et al. 2011)	Birth cohort	779 children born in the Seychelles (about 50% of all live births) in 1989	6, 19, and 29 months; 5.5, 9, 10.5, 17, 19, 22, and 24 years	Parents, self-report, medical exams	Conduct problems
34	South Africa: Cape Town	Cape Area Panel Study (Seekings and Thaler 2011; Thaler 2011)	Household sample	4,752 youths age 14–22 years randomly selected in metropolitan Cape Town in 2002	15–23 and 16–24 years (subsamples); 17–25, 18–26, and 20–29 years	Self-report	Violence
35	South Africa: Cape Town and Mankweng; Tanzania: Dar es Salaam	SATZ (Wubs et al. 2013)	School sample	7,274 children age 10–18 years in Cape Town and Makweng (South Africa) and Dar es Salaam (Tanzania) in 2004; included in a trial of school-based HIV prevention programs	10.5–18.5, 11–19 years (two follow-ups at half year intervals)	Self-report	Intimate partner violence
36	South Africa: greater Johannesburg area	Birth to Twenty (Barbarin, Richter, and DeWet 2001; Sabet et al. 2009)	Birth cohort	3,275 children born in Soweto-Johannesburg during 7 weeks in 1990	6 months; 1, 2, 3–4, 5, 7–8, 9–10, 11–12, 13, 14, 15 years	Parents, medical exams	Aggression, conduct problems
37	South Africa: Western Cape and Mpumalanga provinces	Young Carers South Africa (Boyes et al. 2014; Waller, Gardner, and Cluver 2014)	Household sample	3,515 children age 10–17 living in the Western Cape and Mpumalanga in 2009–11	11–18 years	Self-report	Conduct problems

TABLE 2 (*Continued*)

Study #	Location	Study Name (Papers in Review)	Sample Type	Baseline Characteristics	Age at Follow-Ups	Data Sources	Outcomes in Review
38	South Africa: National	South Africa 1974 Study[b] (Botha and Mels 1990)	School sample	2,476 white children age 9–12 years in school grades 3–5 across South Africa in 1974	12–15, 14–17, 16–19	Self-report and teachers	Aggression
39	Yugoslavia (Kosovo): K. Mitrovica and Pristina	Yugoslavia Prospective Study of Environmental Lead Exposure (Wasserman et al. 1998; Factor-Litvak et al. 1999; Wasserman et al. 2001)	Birth cohort	706 children (stratified on lead levels in blood) whose mothers were recruited midpregnancy in K. Mitrovica (next to a lead smelter) and Pristina (relatively unexposed to lead), Yugoslavia in 1985–1986	6 months; 1, 2, 3, 4, 5, 6, 7 years	Parents and self-report	Aggression, conduct problems

[a] Results in Matijasevich et al. (2014) are based on analyses pooling the entire 2004 Pelotas Birth Cohort Study and a subsample of the 1993 Pelotas Birth Cohort Study.

[b] Name assigned to study in this review (not official study name).

participants into young adulthood (20+). The studies used a mixture of participants' self-reports, direct observations, parent reports, teacher reports, peer reports, medical exams, and official records to assess behavior and possible risk and protective factors. Three studies (#4, #30, #31) made direct comparisons of results with matched samples in high-income countries. Six studies involved evaluations of interventions, including zinc supplement interventions in Brazil and Guatemala (#6, #26), a diet supplement and home visits by health workers in Jamaica (#27), a nutritional and environmental enrichment program in Mauritius (#28), an HIV prevention program in South Africa and Tanzania (#35), and a breast-feeding promotion program in Belarus (#2).

In total, 96 effect sizes were extracted for use in meta-analyses. Table 3 shows that studies in Brazil and China contributed the majority of effect sizes to the meta-analyses. The most common results were for individual-level predictors and conduct problem outcomes. Most effect sizes were smaller than 0.50, and the vast majority (88 out of 95) represent bivariate associations.

B. Individual-Level Characteristics

Longitudinal studies in HICs have identified numerous individual characteristics that are associated with antisocial behavior, including biological factors such as low resting heart rate, and psychological factors including temperament, hyperactivity, low IQ, poor social skills, and positive attitudes toward delinquency (Hinshaw 1992; Rutter, Giller, and Hagell 1998; Hill 2002; Farrington and Welsh 2007; Murray and Farrington 2010). Of course, not all risk factors consistently replicate across studies, but one of the strongest and most replicable predictors of future antisocial behavior is prior antisocial behavior (Lipsey and Derzon 1998). We first review evidence for such continuity in antisocial behavior in LMICs before considering evidence on other individual biological and psychological factors. Table 4 shows the meta-analytic results for individual-level factors, and findings from individual studies are summarized below.

1. *Continuity in Antisocial Behavior through Time.* In a classic review, Dan Olweus (1979) found that the continuity in an individual's aggressive behavior through time was about as strong as continuity in intelligence. Across 16 samples in the United States, England, and Sweden, the (disattenuated) correlation coefficient for the continuity in aggression was 0.68, with an average time interval between measures of 5.8 years

TABLE 3

Study Results Included in Meta-Analyses

	Number of Effect Sizes
Type of risk factor:	
Individual	32
Early health	23
Parenting	14
Family	27
Behavioral outcome:	
Aggression	20
Conduct problems	50
Violence	24
Crime	2
Participant sex:	
Females only	14
Males only	19
Females and males	63
Effect size (*d*):	
<−0.50	3
−0.50 to 0.20	7
−0.20 to 0.00	13
0.01 to 0.20	31
0.21 to 0.50	19
0.51 to 0.80	8
0.81 to 1.00	5
>1.00	10
Bivariate/adjusted effect size:	
Bivariate	89
Adjusted	7
Country of study:	
Barbados	2
Brazil	41
Chile	2
China	27
Croatia	1
Czech Republic	1
Jamaica	3
Mauritius	3
Philippines	1
Poland	1
Puerto Rico	1
Russia	5
South Africa	6
Yugoslavia	2

TABLE 4

Meta-Analytic Results for Associations between Individual Factors and Child Conduct Problems and Youth Violence

Predictor	Behavioral Outcome	Number of Studies	Studies Included (#)	Type of Association	Effect Size *d*	95% CI	p^a	Heterogeneity I^2	Heterogeneity p^b
Prior aggression	Aggression	9	(4, 11, 10, 13, 16, 20, 21, 27, 30)	Bivariate	1.6	(.9 to 3.3)	<.001	99.3%	<.001
Prior conduct problems	Conduct problems	9	(4, 9, 10, 12, 13, 14, 28, 31, 37)	Bivariate	.9	(.6 to 2.1)	<.001	97.1%	<.001
	Crime	2	(4, 28)	Bivariate	.12	(−.20 to .44)	.437	76%	.041
	Violence	2	(4, 22)	Bivariate	.34	(.13 to .56)	.018	83%	.015
Hyperactivity	Conduct problems	2	(9, 10)	Bivariate	.51	(.34 to .69)	<.001	0%	.590
	Crime	2	(4, 28)	Bivariate	.04	(−.40 to .47)	.867	87%	.006
Poor educational performance	Aggression	2	(10, 21)	Bivariate	.00	(−.53 to .52)	.993	93%	<.001
	Intimate partner violence	2	(28, 34)	Bivariate	.05	(−.17 to .28)	.650	78%	.032
Drug use	Violence	2	(23, 34)	Bivariate	.69	(.46 to .92)	<.001	51%	.154
Sociability	Conduct problems	2	(20, 21)	Bivariate	−.03	(−.20 to .14)	.701	0%	.335
Social competence	Conduct problems	2	(10, 21)	Bivariate	−.43	(−.58 to −.28)	<.001	0%	.735

NOTE.—# = study ID number shown in table 2; p^a = *p*-value for *d* effect size; p^b = *p*-value for a χ^2 test for heterogeneity. Random-effects models.

(Olweus 1979). In our review of LMICs, nine studies assessed the continuity of aggression, and nine studies assessed the continuity of conduct problems, using the same informants on both occasions.[1] To compare the extent of continuity in aggression and conduct problems in these studies with previous findings from HICs, we used the same procedure as Olweus and calculated disattenuated correlation coefficients.[2] We combined results for both sexes, as there were few studies with separate results for males and females. The average time interval between assessments was 3.0 years (range 1.0–8.0 years) for aggression and 2.8 years (range 0.8–8.0 years) for conduct problems.

Pooling results from nine LMIC studies in meta-analysis, the average disattenuated correlation coefficient for continuity in aggression was 0.75 (95% confidence interval [CI] = 0.40 to 0.91, $p < 0.001$). To compare this with results from Olweus's review, we estimated the correlation coefficient in Olweus's review for the same time interval (3 years).[3] Results were almost identical: the disattenuated correlation was 0.73 for studies with a 3-year interval in Olweus's review. Considering the continuity in conduct problems in LMICs, pooling results from nine studies, the average disattenuated correlation coefficient was 0.49 (95% CI = 0.36 to 0.61, $p < 0.001$).

There was significant ($p < 0.001$) heterogeneity in the results for both continuity in aggression and conduct problems in LMICs. Figure 2 shows the extent of continuity in aggression and conduct problems according to the time interval between measures, with no clear pattern in

[1] Studies included were Frączek (1986), Botha and Mels (1990), Chen, Rubin, and Li (1997), Raine, Venables, and Mednick (1997), Zhang et al. (2003), Chen, He, and Li (2004), de la Barra, Toledo, and Rodríguez (2005), Anselmi et al. (2008), Duarte et al. (2008), Zhou, Main, and Wang (2010), Zhu, Yan, and Li (2011), Chen et al. (2012), Hou et al. (2013), and Zhang (2013).

[2] Attenuation refers to the systematic reduction in continuity coefficients caused by measurement error. Disattenuated correlation coefficients are estimated using the following equation:

$$r_d = r_{xy} / \sqrt{(r_{xx} \times r_{yy})},$$

where r_d is the disattenuated correlation coefficient, r_{xy} is the observed correlation between x and y, and r_{xx} and r_{yy} are the reliability coefficients for x and y. Following Olweus (1979), if incomplete data were available on reliability coefficients, values were estimated from similar studies, using higher values wherever appropriate, because using low-reliability coefficients can artificially inflate estimates of the disattenuated correlation.

[3] This was calculated from the regression model estimated by Olweus: $y = 0.78 - (0.18 \times x)$, where y is the disattenuated correlation coefficient and x is the interval between measures in years (in this case 3.0).

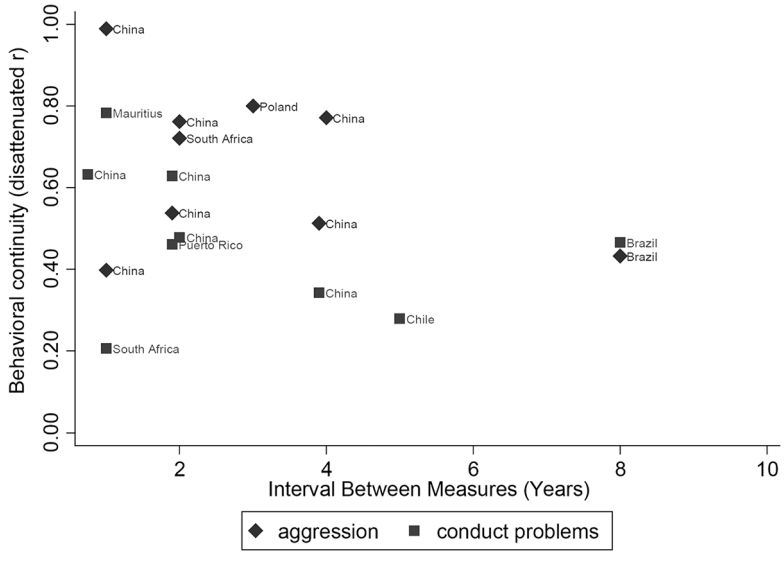

FIG. 2.—Continuity in aggression and conduct problems through time in LMICs, according to the time interval between measures.

the results. In meta-regression, we also tested whether the extent of continuity was related to children's age at first assessment, the time interval between measures, the Human Development Index score of the country of study, the country homicide rate, and the WHO region of the study. No variable was significantly related to continuity in aggression or continuity in conduct problems (all $p > 0.05$). To compare with other meta-analytic results in this review, the results for continuity in aggression and conduct problems were converted into a *d*-type effect size and are shown in table 4.[4]

Three studies in LMICs found a small amount of continuity evident between childhood conduct problems and later violence or crime. Among 11-year-olds in Pelotas, Brazil, conduct problems predicted self-reported violence at age 18 (RR = 1.4 for males and 1.9 for females; #4: Murray, Menezes, et al. 2015). The corresponding increased risk for nonviolent

[4] These meta-analyses were conducted on the basis of uncorrected correlation coefficients, rather than disattenuated ones, to increase comparability with other results in the review. For other risk factors, reliability information was not available to calculate disattenuated associations.

crime was 1.7 for males and 2.7 for females. This continuity was quite similar to that found in a matched study in Britain (Murray, Menezes, et al. 2015). In Colombia, boys' behavior problems at school at ages 12–17 predicted self-reported violence 2 years later ($r = 0.22$; #22: Brook et al. 2001). Continuity in violent behavior itself from ages 12–17 to 2 years later was slightly stronger ($r = 0.37$). However, there was no association between conduct problems measured at age 11 and crime at age 23 ($d = -0.08$ in follow-back analyses) in a Mauritius study (#28: Gao et al. 2013). Pooling results for the association between conduct problems and violence for males in two of these studies (#4, #22), the effect size was medium ($d = 0.34$, table 4) with significant heterogeneity between the two. Pooling results for the association between conduct problems and crime for males in two studies (#4, #28), the effect size was small ($d = 0.12$, table 4) with significant heterogeneity.

In summary, across nine longitudinal studies in LMICs, the average continuity in aggressive behavior over 3 years was very similar to that found previously in HICs. However, there was less continuity in conduct problems than aggression in LMICs, and the association between conduct problems in childhood and crime and violence in young adulthood was weak. There was marked heterogeneity in the extent of continuity in antisocial behavior in LMIC studies, but this was not explained by differences in participant age, length of follow-up period, or other study characteristics.

2. *Biological Factors.* Biological factors that have been related to the development of antisocial behavior in HIC settings include genetic influences, characteristics of brain structure and functioning, features of the autonomic nervous system, and hormonal influences (see, e.g., Rutter, Giller, and Hagell 1998; Raine 2013; DeLisi and Vaughn 2015). An interesting question is whether biological factors have similar effects across LMIC settings, or whether biological influences are attenuated in contexts in which social adversity is greater, as suggested by the social push hypothesis (Raine 2013). Only one longitudinal study in an LMIC examined a genetic influence on antisocial behavior: in a test of the interaction between the genetic polymorphism encoding the monoamine oxidase A (MAOA) enzyme and child maltreatment, originally reported by Caspi et al. (2002) for males in New Zealand. In Pelotas, Brazil, there was no evidence of a main effect of the same MAOA genetic variant on boys' conduct problems at age 15 or of an interaction between the MAOA variant and maltreatment in predicting conduct problems (#4: Kieling et al. 2013).

The Mauritius Child Health Project (#28) provides unique evidence on the association between several biological variables and antisocial behavior. Children who were taller ($d = 0.30$), weighed more ($d = 0.25$), and had greater body "bulk" ($d = 0.25$) at age 3 were more likely to be aggressive at age 11, but they were not more likely to show nonaggressive conduct problems (Raine et al. 1998). Presumably, these associations reflect physical ability to dominate in a fight, which would explain why there was no association with nonaggressive behaviors. Biological measures of electrodermal activity (e.g., skin concordance during an auditory paradigm) were also used as indicators of child fear conditioning and emotionality and tested in relation to antisocial behavior. Electrodermal measures of emotionality at age 3 were associated with teacher ratings of child aggression at age 9 for males, but not for females (Clark 1982). Electrodermal measures of fear conditioning at age 3 also predicted officially recorded crime up to age 23 (Gao et al. 2010*a*). Furthermore, children with persistently low fear conditioning between ages 3 and 8 had more aggressive ($d = 0.57$) and nonaggressive conduct problems ($d = 0.52$) at age 8 (Gao et al. 2010*b*). In relation to autonomic functioning, low resting heart rate when children were age 3 predicted aggressive behavior (RR = 2.1) at age 11, but not nonaggressive conduct problems, after adjustment for other biological and psychological covariates (Raine et al. 1997). In the only test of brain functioning and antisocial behavior in an LMIC study, individuals in the Mauritius study with criminal records at age 23 were compared with controls on measures of P3 amplitude at age 11, a particular brain response during a cognitive task that reflects attentional processing capacity. Criminal offenders had lower P3 amplitude compared with controls ($d = 0.32$), and this association persisted even after adjusting for antisocial behavior and hyperactivity at age 11 and alcoholism at age 23 (Gao et al. 2013).

In summary, only two longitudinal studies provide evidence on biological risk factors for antisocial behavior in LMICs. The lack of a gene-environment interaction in the Brazilian study could reflect a predominance of social factors causing conduct problems in that context, measurement differences across studies, or a more generic replication problem in gene-by-environment research (Duncan and Keller 2011; but see Byrd and Manuck [2014] for positive meta-analytic results on the maltreatment-by-MAOA finding). In Mauritius, a small LMIC country with relatively low levels of serious violence (UN Office on Drugs and Crime 2013), numerous childhood biological indicators (larger body size, low resting heart

rate, low skin conductance, autonomic fear conditioning, and P3 amplitude) were associated with later conduct problems, particularly aggression, and some measures also predicted increased risk of crime in early adulthood. These investigations in Mauritius are unique within the LMIC studies reviewed here, and many are novel worldwide.

3. *Early Child Temperament.* Although research in HICs has highlighted the importance of children's early temperament for the development of antisocial behavior (White et al. 1990; Caspi et al. 1995), results on this topic from four studies in Brazil, China, and Mauritius were mixed. In Pelotas, Brazil, no aspect of temperament or psychosocial functioning (withdrawn, somatic complaints, anxious/depressed, social problems, thought problems) at age 4 predicted conduct problems at age 12, adjusting for baseline conduct problems and family socioeconomic status (#4: Anselmi et al. 2008). It is possible that these null findings arose because of "overcontrol," that is, the adjustment of baseline conduct problems, which might themselves have been affected by early temperament. In a study in Beijing and Shanghai, children's affective behaviors with their mothers were assessed at age 2, but these were not associated with aggression at age 4 (#15: Wang et al. 2006). However, in a second study in Beijing, both child internalizing problems ($r = 0.28$) and social competence ($r = -0.35$) at age 2 predicted conduct problems 1 year later (#12: Zhang 2013). In Mauritius, having a sensation-seeking temperament at age 3 predicted aggressive, but not nonaggressive, conduct problems at age 11, adjusting for covariates including height, weight, and body size (#28: Raine et al. 1998), but fearlessness at age 3 was not predictive. As previously discussed, early biological measures that tap into constructs of emotionality and poor fear conditioning were also associated with aggression at age 8 in the Mauritius study (#28) and with crime up to age 23.

In summary, two studies in China and Mauritius found associations between several early temperament characteristics (stimulation seeking, poor social competence, emotionality, and poor fear conditioning) and later antisocial behavior, but further research is needed to clarify the effects, given that two other studies reported null findings.

4. *Hyperactivity and Attention Deficit.* Hyperactivity is one of the most robust risk factors for conduct problems and crime found across longitudinal studies in HICs, with numerous related concepts also predicting antisocial behavior, including attention deficit, restlessness, clumsiness, low

self-control, impulsiveness, and risk taking (Rutter, Giller, and Hagell 1998; Pratt et al. 2002; Jolliffe and Farrington 2008; Murray and Farrington 2010). Results from two studies in Chile and China were consistent with this literature. In Chile, hyperactivity at age 6 predicted conduct problems (OR = 2.2) at age 11 (#9: de la Barra, Toledo, and Rodríguez 2005), and among 6–9-year-olds in Beijing, higher effortful control (the reverse of impulsiveness) predicted less aggression and fewer conduct problems at ages 10–13 ($r = -0.26$ for both outcomes, averaging across parent, teacher, and child reports; #10: Zhou, Main, and Wang 2010). Pooling results from these two studies (#9, #10), there was an overall moderate bivariate association between hyperactivity and conduct problems ($d = 0.51$, table 4). However, in Pelotas, Brazil, hyperactivity at age 4 did not significantly predict conduct problems at age 12, independently of baseline conduct problems and socioeconomic status (#4: Anselmi et al. 2008). Again, it is possible that the total effects of hyperactivity were underestimated because baseline conduct problems were adjusted for in the analysis (no bivariate results were available to include in meta-analysis).

Considering hyperactivity measured after early childhood, three LMIC studies assessed associations with violence and crime in LMICs. Meta-analyzing results from two studies (#4, #28), the average bivariate association was almost zero ($d = 0.04$, table 4), but there was considerable heterogeneity. Specifically, in Mauritius, there was no significant association between hyperactivity at age 11 and crime at age 23 (#28: Gao et al. 2013). However, in Pelotas, Brazil, hyperactivity at age 11 predicted violence at age 18 (RR = 1.8 females, 1.3 males), although results for nonviolent crime were weaker and nonsignificant (RR = 1.3 females, 1.2 males), adjusting for child conduct problems and perinatal and family factors (#4: Murray, Menezes, et al. 2015). Comparing associations with a matched British study, the effects of hyperactivity on violent and nonviolent crime in Pelotas were similar between sites (Murray, Menezes, et al. 2015). In a third study that examined trajectories of delinquency (and could not be included in the meta-analysis), sensation-seeking among 5–13-year-olds in Puerto Rico predicted delinquent behavior over a 2-year period for both girls and boys, adjusting for various other individual, family, and social factors. Compared with Puerto Rican children living in New York, associations were similar between the two sites, even though the shape of the trajectories differed (#31: Maldonado-Molina et al. 2009; Jennings et al. 2010).

In summary, studies in LMICs generally show positive associations between hyperactivity, conduct problems, and violence but weak associations with youth crime.

5. *Internalizing Problems.* Internalizing problems are characterized by symptoms of anxiety and depression and are related to other concepts such as sensitivity, shyness, and poor self-concept. In six studies in LMICs, there were only null or weak associations between measures of internalizing problems and antisocial behavior. The studies are summarized below but were too heterogeneous in their designs and analyses to pool in meta-analyses. Three studies of internalizing problems and antisocial behavior were conducted in China, all showing weak or null associations. In the first, in Beijing, there was no significant association between child depressive symptoms and aggressive behavior over four waves of assessment between ages 9 and 12 (#11: Chen et al. 2012). This was a rather special study because repeated waves of data were used to account for continuity in behavior when estimating the associations. In a second study, in Shanghai, shyness at mean age 11 was only weakly associated with lower aggression 2 years later ($r = -0.10$), and there was no significant association between low self-worth and aggression (#21: Chen, He, and Li 2004). In another Shanghai study, neither shyness/sensitivity nor poor self-perception at ages 7 and 10 was significantly associated with conduct problems 4 years later (#20: Chen et al. 1999).

Additional weak or null associations concerning internalizing problems were found in Chile and Colombia. In Santiago, Chile, neither "social contact" nor "emotional maturity" among 6-year-olds significantly predicted conduct problems at age 11 (#9: de la Barra, Toledo, and Rodríguez 2003, 2005). Greater "sensitivity" among 12–17-year-old Colombian males was only weakly associated ($r = -0.06$) with lower levels of violence 2 years later (#22: Brook, Brook, and Whiteman 2007). However, in Puerto Rico, children's self-esteem at ages 5–13 predicted trajectories of delinquency over the following 2 years (#31: Maldonado-Molina et al. 2009). Higher self-esteem was observed among children whose delinquency remained persistently low compared with children who had initially high then declining rates of delinquency. Interestingly, a rather different pattern emerged among Puerto Rican children living in New York, where self-esteem was highest among children who had persistently elevated levels of delinquency over the 3-year study period (Maldonado-Molina et al. 2009).

To summarize, existing evidence in LMICs generally suggests weak or no associations between internalizing problems or related concepts and conduct problems.

6. *Intelligence and Educational Performance.* Low intelligence and poor educational attainment are well-replicated predictors of antisocial behavior in HICs (Hinshaw 1992; Rutter, Giller, and Hagell 1998; Farrington and Welsh 2007; Murray and Farrington 2010). Three studies in LMICs also found that low intelligence predicted various forms of antisocial behavior, but associations were robust after adjustment for confounding factors in only two studies. Meta-analyses were not conducted because of the different outcomes assessed across the studies. In Mauritius, low spatial intelligence, but not verbal intelligence, at age 3 predicted persistent antisocial behavior between ages 8 and 17, adjusting for social adversity, hyperactivity, and reading ability (#28: Raine et al. 2002). Also, in the Seychelles, children with lower intelligence scores at age 11 had more conduct problems at 17, adjusting for children's mercury exposure, maternal IQ, and socioeconomic position (#33: Davidson et al. 2011). Among Polish children aged 7 and 9, lower intelligence did not predict aggression over a 2-year period, adjusting for baseline aggression, violent television viewing, and sociodemographic factors (#30: Frączek 1986).

Regarding school performance, two Chinese studies found only weak effects on antisocial behavior, and their pooled bivariate association was zero ($d = 0.00$, table 4). In Beijing, lower school grades at ages 6–9 had a weak association with conduct problems ($r = 0.16$) but were also associated with less aggression ($r = -0.13$) at ages 10–13, averaging across parent, teacher, and child reports (#10: Zhou, Main, and Wang 2010). In Shanghai, children with lower participation and competence in school activities at mean age 11 had slightly higher aggression scores ($r = 0.13$) 2 years later (#21: Chen, He, and Li 2004).

Two studies in the Philippines (#29) and South Africa (#34) also showed null or weak associations between lower educational achievement and violence, and their pooled bivariate association was almost zero ($d = 0.04$, table 4), with significant heterogeneity between their results. The first study, in the Philippines, found that completing fewer school years by age 18 was not significantly associated with perpetrating intimate partner violence 3 years later, either in bivariate analysis or in adjusting for family of origin characteristics and other individual and household factors (#29: Fehringer and Hindin 2009). Among South African males,

those with low educational attainment at ages 18–26 were at increased risk (OR = 1.4) for self-reported perpetration of family or intimate partner violence 3 years later (#34: Thaler 2011). However, in this study, there was no association with violence against strangers, adjusting for childhood background factors and youth unemployment (Seekings and Thaler 2011).

In summary, there are few studies concerning intelligence and school performance and the development of antisocial behavior in LMICs. Existing studies in China, Mauritius, Poland, South Africa, and the Philippines show weak and inconsistent associations.

7. *Drug and Alcohol Use.* Drug and alcohol use might contribute to antisocial behavior in several ways, including through physiological changes that increase disinhibited behavior, disruption of family and social bonds, involvement in theft to purchase drugs, and increasing contact with organized violent groups involved in drug trafficking (Goldstein 1985; Rutter, Giller, and Hagell 1998; Atkinson et al. 2009). Substance use problems could also be an indicator of a broad externalizing behavior syndrome, underpinned by a common construct of behavioral disinhibition (Patrick et al. 2015) and as such represent a marker rather than an explanatory cause of other antisocial behaviors. Although drug use is generally less common in LMICs than in HICs, it is associated with greater risk of mortality in LMICs than in HICs (Medina-Mora and Gibbs 2013).

Only three longitudinal studies have investigated drug or alcohol use as possible risk factors for antisocial behavior in LMICs: one found no association with conduct problems, and two showed associations with violence and delinquency. Two studies (#22, #34) that could be meta-analyzed showed a large-sized average bivariate association between drug use and violence ($d = 0.69$, table 4). In the first study, conducted in Colombia, marijuana use by 12–17-year-old males was associated with four times the odds of participation in delinquency 2 years later (#22: Brook et al. 2003), and lifetime drug use was associated ($r = 0.36$) with increased levels of violence (Brook, Brook, and Whiteman 2007). In the second study, South African males aged 14–22 who reported drug taking or drinking multiple times over a 4-year period were at increased risk for perpetrating family or intimate partner violence 7 years later (OR = 2.6 for drugs; OR = 1.5 for drinking; #34: Thaler 2011). Heavy drinking across multiple waves was also associated with increased risk (OR = 1.7) of violence against strangers, adjusting for drinking and drug taking in the participant's childhood home and neighborhood poverty in childhood (#34: Seekings and Thaler 2011). However, in another South African

study (not in the meta-analysis because only adjusted results were available), a combined measure of alcohol and drug use at ages 10–17 was only weakly associated with conduct problems 1 year later ($\beta = 0.04$), adjusting for baseline measures of conduct problems, poverty, sociodemographics, and violence exposure (#37: Waller, Gardner, and Cluver 2014). The adjustment for baseline conduct problems in this study might have caused an underestimation of the total effect of drug and alcohol use on conduct problems.

In summary, two studies in LMICs show associations between drug use and later antisocial behavior, but it is not clear which mechanisms are involved or whether these represent causal effects. Future research should test possible competing mechanisms and incorporate tests of whether drug use predicts antisocial behavior only because they both form a broader syndrome of externalizing behavior.

8. *Other, Less Studied, Individual Factors.* Numerous other individual factors have been found to relate to the development of antisocial behavior in HICs but have not been extensively investigated in LMICs. Here, we summarize findings from the few studies in LMICs that examined antisocial behavior in relation to social competence, locus of control, attitudes toward deviance, and religiosity. One would expect that attitudes favorable to antisocial behavior would strongly predict antisocial behavior itself. Indeed, in Puerto Rico, 5–13-year-old children with positive attitudes to delinquency were most likely to have a high but declining rate of delinquency, adjusting for several other individual, family, and social factors (#31: Maldonado-Molina et al. 2009; Jennings et al. 2010). Similar effects were observed in a matched sample of Puerto Rican youths in New York (Maldonado-Molina et al. 2009; Jennings et al. 2010). However, in Colombia, a tolerant attitude toward "deviance" at ages 12–17 predicted ($r = 0.17$) violent behavior 2 years later only weakly (#22: Brook, Brook, and Whiteman 2007).

Two studies in Shanghai (#20, #21) showed no association between children's sociability and later conduct problems (Chen et al. 1999, 2000). The pooled bivariate association in these studies was almost zero ($d = -0.03$, table 4). However, prosocial behavior at age 11 predicted fewer conduct problems 2 years later ($r = -0.22$) in one of the studies (#21: Chen et al. 2000), and social competence at ages 6–9 also predicted fewer conduct problems 4 years later in another study in Beijing (average $r = -0.20$; #10: Tao, Zhou, and Wang 2010; Chen et al. 2011). The pooled bivariate association between social competence/prosocial behavior and

conduct problems in these two studies (#10, #21) was medium and negative ($d = -0.43$, table 4).

The psychological trait of having an "external locus of control" was investigated as a possible predictor of delinquency in San Juan, Puerto Rico (#31). External locus of control means perceiving your life as mainly influenced by uncontrollable, external forces. Children aged 5–13 with a higher external locus of control were more likely to show high but declining trajectories of delinquency over a 2-year period (#31: Maldonado-Molina et al. 2009), in contrast to a matched sample in the Bronx, New York, where external locus of control did not associate with any particular delinquency trajectory.

Religiosity has been theorized to be protective against antisocial behavior (Baier and Wright 2001). However, a study in the Philippines found no association between frequent church attendance at age 18 and risk of perpetration of intimate partner violence 3 years later, in either bivariate or multivariate analyses (both RR = 1.0), adjusting for family of origin characteristics including intergenerational violence and other individual and household factors (#29: Fehringer and Hindin 2009).

In summary, a small number of LMIC studies suggest antisocial behavior might have a small association with low levels of social competence, having an external locus of control, and having attitudes favorable to delinquency. The limited evidence available in LMICs suggests no association between antisocial behavior and sociability or religiosity.

C. Prenatal and Early Health Influences

It is estimated that over 200 million children in LMICs do not reach their developmental potential by age 5 because of nutritional deficiencies, exposure to toxins, violence, poverty, and other health and social problems early in life (Grantham-McGregor et al. 2007; Walker, Wachs, et al. 2007). Some longitudinal research in HICs suggests that early health risks affect children's neurological development and thereby increase vulnerability to environmental stresses causing antisocial behavior (Moffitt 1993; Raine 2002*a*; Brennan, Grekin, and Mednick 2003; Liu 2011). This line of research has led to the development of prevention programs from pregnancy onward to enhance children's development and reduce risk of adverse outcomes, including antisocial behavior (Tremblay and Japel 2003). Eleven longitudinal studies in LMICs examined pregnancy and perinatal factors as possible influences on child conduct problems and youth violence, in Brazil, the Czech Republic, Mauritius, South Africa, and former

Yugoslavia. Meta-analytic results are shown in table 5, with results from individual studies summarized below.

1. *Prenatal and Birth Factors.* Unplanned pregnancy was examined as a possible risk factor for children's antisocial behavior in Pelotas, Brazil (#4: Murray, Maughan, et al. 2015). However, it was only weakly associated with offspring conduct problems at age 11 (females RR = 1.3; males RR = 1.2) and violence at age 18 (females RR = 1.5; males RR = 1.2). The very different, and less common, event of an unwanted pregnancy was the focus of a long-term prospective investigation in the Czech Republic. Children of mothers who, unsuccessfully, applied for an abortion were compared with matched control children in the same school classes and assessed in adulthood. Children from unwanted pregnancies were more likely than control children (OR = 2.2) to have a criminal record by ages 22–24 (#24: Dytrych, Matějček, and Schüller 1988), but there was almost no difference (OR = 1.2) in the probability of having a criminal record at age 30 (Kubička et al. 1995), suggesting an attenuation of long-term risk associated with unwanted pregnancies.

Maternal smoking in pregnancy was examined as a predictor of child conduct problems in four studies in Brazil, the Czech Republic, and former Yugoslavia. Meta-analysis of these studies revealed a medium-sized average bivariate association ($d = 0.36$, across #4, #25, #39) and reduced covariate-adjusted association ($d = 0.26$, across #4, #5, #39; table 5). In Pelotas, Brazil, maternal smoking in pregnancy was associated with children's conduct problems at age 4 (OR = 1.4), adjusting for paternal smoking, parental education, family income, and social class (#4: Brion et al. 2010). That children's conduct problems were associated with maternal but not paternal smoking increased the plausibility of biological effects of tobacco exposure in utero (Brion et al. 2010). In contrast to many HICs, maternal smoking in pregnancy was not strongly socially patterned in Pelotas, Brazil, helping to rule out explanations based on family income or social class. Associations with conduct problems persisted in follow-ups of the same cohort at ages 11 and 15 (#4: Anselmi et al. 2012; Murray, Maughan, et al. 2015). In another study in Pelotas, Brazil, maternal smoking in pregnancy was associated with higher levels of children's conduct problems at age 4 ($d = 0.25$), adjusting for a range of sociodemographic factors, maternal psychopathology, and childbirth characteristics (#5: Matijasevich et al. 2014). Also, in former Yugoslavia, maternal smoking in pregnancy predicted conduct problems at ages 4–5, adjusting for age, sex, ethnicity, lead exposure, birth weight, maternal education, and

TABLE 5

Meta-Analytic Results for Associations between Early Life Health Factors and Child Conduct Problems and Youth Violence

Predictor	Behavioral Outcome	Number of Studies	Studies Included (#)	Type of Association	Effect Size *d*	95% CI	p^a	Heterogeneity	
								I^2	p^b
Maternal smoking in pregnancy	Conduct problems	3	(4, 25, 39)	Bivariate	.36	(.30 to .42)	<.001	0%	.600
		3	(4, 5, 39)	Adjusted	.26	(.20 to .32)	<.001	0%	.461
	Violence	2	(3, 4)	Bivariate	.13	(.00 to .26)	.055	45%	.180
Low birth weight	Conduct problems	3	(6, 8, 36)	Bivariate	.01	(−.12 to .14)	.857	0%	.908
		2	(5, 36)	Adjusted	.02	(−.07 to .11)	.679	0%	.324
Premature birth	Conduct problems	4	(4, 5, 8)	Bivariate	.04	(−.03 to .10)	.283	0%	.942
Malnutrition	Conduct problems	3	(1, 26, 28)	Bivariate	.35	(.01 to .69)	.044	82%	.004
	Conduct problems	2	(1, 27)	Adjusted	.35	(.07 to .73)	.013	0%	.822

NOTE.—# = study ID number shown in table 2; p^a = *p*-value for *d* effect size; p^b = *p*-value for a χ^2 test for heterogeneity. Random-effects models.

parental warmth toward the child (#39: Wasserman et al. 2001). Moreover, maternal smoking in pregnancy predicted conduct problems at age 8 (e.g., OR = 1.7 for "provokes fights") in the Czech Republic, although associations weakened by age 13 (#25: Kukla, Hruba, and Tyrlik 2008).

Only two studies in LMICs investigated whether maternal smoking in pregnancy predicted youth violence, both in Pelotas, Brazil. Their pooled bivariate results yielded a small and nonsignificant association ($d = 0.13$, table 5). In a cohort of children born in 1982, there was no association between maternal smoking in pregnancy and conviction for violence up to age 25, either in bivariate analyses or in adjusting for sociodemographic factors (adjusted RR = 1.1 for males, 0.8 for females; #3: Caicedo et al. 2010). However, in a later cohort, born in 1993, maternal smoking in pregnancy predicted self-reported violence at age 18 for females (RR = 1.7), but not for males (RR = 1.1; #4: Murray, Maughan, et al. 2015).

Maternal alcohol use in pregnancy, urinary infection in pregnancy, and intrauterine growth restriction were also examined as predictors of conduct problems and violence in the 1993 cohort in Pelotas, Brazil (#4: Murray, Maughan, et al. 2015). Conduct problems at age 11 were moderately associated with maternal alcohol use in pregnancy (males only, RR = 1.5) and urinary infection in pregnancy (females only, RR = 1.3), but not intrauterine growth restriction for either sex. The only variable associated with violence at age 18 was maternal alcohol use in pregnancy (males only, RR = 1.5). These findings were compared with those from a matched study in Britain; several risk factor associations were weaker in Pelotas than in the British study, especially for males (Murray, Maughan, et al. 2015).

Mercury exposure in utero was investigated as another toxin that might affect children's neurodevelopment and later antisocial behavior in a study in the Seychelles (#33). However, there was no association between mercury exposure and children's aggressive or conduct problem behaviors at ages 5 and 17 (Myers et al. 2000; Davidson et al. 2011).

Complications at birth (such as breech birth, use of forceps during delivery, caesarean delivery, or difficulty with breathing) were weakly associated with conduct problems at age 11 in Mauritius, and this relationship was partly mediated by low IQ (#28: Liu et al. 2009). However, in Pelotas, Brazil, birth complications did not predict violent crime up to age 25, adjusting for sociodemographic factors and maternal smoking in pregnancy (RR = 1.1 for males and 1.2 for females; #3: Caicedo et al. 2010).

Six studies, in Brazil, South Africa, the Seychelles, and former Yugoslavia, convincingly show that there is no association between low birth weight and children's conduct problems. Individually, each reported no association (#5, #6, #8, #33, #36, #39; Myers et al. 2000; Wasserman et al. 2001; Emond et al. 2006; Sabet et al. 2009; Rodriguez et al. 2011; Matijasevich et al. 2014). Pooling effect sizes for low birth weight (<2,500 grams) reported in three studies (#6, #8, #36), the average association with conduct problems was almost zero ($d = 0.01$, table 5). Covariate-adjusted results were also nonsignificant in five studies (Myers et al. 2000; Wasserman et al. 2001; Sabet et al. 2009; Rodriguez et al. 2011; Matijasevich et al. 2014) and almost zero ($d = 0.02$, table 5) in meta-analysis of two studies for which effect sizes could be computed (#5, #36). Birth weight was also unrelated to violent crime in the 1982 Pelotas study, both before and after adjusting for sociodemographic factors (adjusted RR = 1.3 for males; #3: Caicedo et al. 2010). Similarly, premature birth did not predict child conduct problems in all three Brazilian studies that tested the association (#4, #5, #8: Rodriguez et al. 2011; Matijasevich et al. 2014; Murray, Maughan, et al. 2015). The pooled bivariate association in these three studies was almost zero ($d = 0.04$, table 5), and one covariate-adjusted result was nonsignificant (#8: Rodriguez et al. 2011).

In summary, the perinatal factor most consistently associated with child conduct problems in LMIC studies is maternal smoking in pregnancy. Although the evidence is limited, it points toward a possible biological effect of this risk factor, given that maternal smoking but not paternal smoking was predictive in one study, and some results showed associations even after adjustment for covariates. However, similar results have previously been reported in HICs (for a review and meta-analysis, see Wakschlag et al. [2002]; Pratt, McGloin, and Fearn [2006]), only to be questioned by null findings in studies with stronger research designs, including twin studies and sibling comparisons (Maughan et al. 2004; D'Onofrio et al. 2008; Jaffee, Strait, and Odgers 2012). Hence, it is difficult to know whether the associations observed in studies in LMICs really reflect causal effects. Several studies consistently showed that low birth weight and preterm birth were not associated with children's conduct problems, which is consistent with a prior meta-analysis of very low birth weight and prematurity in HICs (Aarnoudse-Moens et al. 2009). Limited evidence on associations between unplanned pregnancy, unwanted pregnancy, alcohol use in pregnancy, intrauterine growth restriction, and birth complications also suggested zero or only weak associations with conduct

problems and violence. These various null and weak findings in LMIC studies are important to consider, given prominent theories predicting adverse influences of early health risks on antisocial behavior via effects on neurological functioning (Raine 2002*a*, 2013; Eryigit Madzwamuse et al. 2015). However, these studies tended to examine health risks in isolation. Studies in HICs show that prenatal and perinatal health risks are influential when considered in interaction with subsequent adverse social environments (Piquero and Tibbetts 1999; Tibbetts and Piquero 1999; Raine 2002*b*), as predicted by some developmental theories (Moffitt 1993). Future research should test for such interactions in LMIC studies.

2. *Early Life Health Influences.* Malnutrition in the first years of life and early exposure to toxins, such as lead, have been hypothesized to increase risk for antisocial behavior via effects on neurological processes related to behavior control (Raine 2002*a*; Liu 2011). Seven studies examined health factors including malnutrition and exposure to toxins in early childhood as possible risk factors for later antisocial behavior in Barbados, Brazil, China, Guatemala, Jamaica, Mauritius, and former Yugoslavia. Three studies had mixed findings on the effects of malnutrition (see studies #1, #27, #28). Their pooled bivariate association between early malnutrition and later conduct problems was medium ($d = 0.35$, table 5), with high heterogeneity in the results. Pooling covariate-adjusted results available in two studies (#1, #27) produced a similar association ($d = 0.35$, table 5) without heterogeneity. Their individual findings were as follows. In Barbados (#1), children with malnutrition in their first year of life were at increased risk for self-reported conduct problems at ages 11–17 ($\beta = 0.19$), adjusting for living conditions in the home (Galler et al. 2012), but malnutrition did not independently predict parent-rated aggression or teacher-rated conduct problems at 9–17 (Galler and Ramsey 1989; Galler et al. 2011). In Jamaica (#27), children with stunting at ages 9–24 months were at increased risk for parent-reported conduct problems at ages 11–12 and oppositional behavior at age 17, but not teacher-reported conduct problems at ages 11–12 or self-reported antisocial behavior at age 17 (Chang et al. 2002; Walker, Chang, et al. 2007). In the same study, there was no significant difference in oppositional-antisocial behavior by stunting status, adjusting for both housing conditions and witnessing violence (#27: Walker, Chang, et al. 2007). In Mauritius, malnutrition at age 3 predicted aggression at 8 and conduct disorder at 17, but there was no association with aggression or delinquency at age 11 or 17 (#28: Liu et al. 2004).

It has been suggested that breast feeding may reduce risk for antisocial behavior because of its positive effects on mother-child bonding and nutrients in breast milk that contribute to neuronal development (Anderson, Johnstone, and Remley 1999; Fergusson and Woodward 1999; Caicedo et al. 2010). Little evidence is available on this topic in high-income countries. However, a strong test of the hypothesis was conducted in Belarus, in a large cluster-randomized trial evaluating effects of breast feeding promotion by pediatric health workers in selected hospitals. Breast feeding duration was substantially increased in the experimental group, and this was found to improve infant health up to age 1 (#2: Kramer et al. 2001). However, at age 6, the experimental and control groups had identical levels of conduct problems, as rated by both parents ($d = 0.0$) and teachers ($d = 0.0$), indicating no protective effect of breast feeding on child conduct problems (#2: Kramer et al. 2008). Null results for breast feeding were also reported in relation to violence in Pelotas, Brazil, where longer breast feeding duration did not predict differential risk for violent conviction up to age 25 (#3: Caicedo et al. 2010). The relative lack of socioeconomic patterning in rates of breast feeding in the Pelotas context helped rule out confounding in this study.

Lead ingestion has been hypothesized to influence child development and antisocial behavior via its effects on cognition and brain functioning. Many ecological studies suggest an association between environmental lead levels and criminal behavior (Nevin 2007; Mielke and Zahran 2012). Neurological research shows effects of lead exposure on brain development (Wright et al. 2008), and a longitudinal study in the United States found an association between pre- and postnatal lead exposure and adult crime (Cecil et al. 2008). However, longitudinal data from LMICs have not supported the lead–antisocial behavior hypothesis. In former Yugoslavia, five out of six measures of blood lead levels taken up to age 2.5 were not associated with child aggression at age 3 (#39: Wasserman et al. 1998; Factor-Litvak et al. 1999). In the same study, children's average lead exposure during early childhood was not associated with aggression at ages 4–5 in bivariate analyses, although it was associated ($B = 0.32$) with the delinquency subscale of the Child Behavior Checklist after adjusting for sociodemographics, early health factors, and maternal warmth and responsiveness (Wasserman et al. 2001). In a Chinese study, children's blood lead levels at age 3 did not significantly predict aggressive or oppositional defiant behavior at age 5, adjusting for sociodemographic factors and child IQ (#18: Liu et al. 2014).

In Guatemala, the effects of a zinc supplementation intervention on the mental health of school children aged 6–11 were investigated in a randomized control trial (#26: DiGirolamo et al. 2010). Although the intervention successfully increased zinc levels ($d = 0.29$), among treated children there was no evidence that increases in zinc changed child aggressive behavior or conduct problems.

In summary, although there is some evidence for a small association between malnutrition and child conduct problems, existing evidence in LMICs does not suggest a strong influence of early childhood health factors on the development of conduct problems or violence. Individual studies of zinc and lead exposure indicated no effect on antisocial behavior. Two LMIC studies on breast feeding, including one randomized control trial, are particularly unusual in the literature and provide strong evidence that breast feeding is not a direct protective factor for antisocial behavior.

D. Child Rearing Processes

Child rearing processes play a fundamental role in several major theories of the development of antisocial behavior (Moffitt 1993; Patterson 1995; Farrington 2005*b*). However, the effects of any given parenting practice may depend partly on cultural norms and the meanings given to those behaviors (Lansford et al. 2005). For example, it has been suggested that tougher parenting styles may predict better adjustment for children in high-risk communities but worse adjustment for children in low-risk environments (Cummings, Davies, and Campbell 2000). There is considerable variability across LMICs in the extent of use of harsh discipline, including physical punishment, and its cultural acceptability (Lansford and Deater-Deckard 2012; UN Children's Fund 2014); hence it may be expected that parenting practices would have heterogeneous effects on child behavior across different cultural contexts.

1. *Harsh, Coercive, and Rejecting Parenting.* Parental harsh and inconsistent discipline is considered an important risk factor contributing to escalating difficulties in parent-child interactions and the onset and persistence of behavior problems (Rothbaum and Weisz 1994; Patterson 1995; Smith and Stern 1997; McCord 1998; Farrington 2002; Gershoff 2002). For example, a meta-analysis of 88 studies showed that corporal punishment was associated with increased child aggression ($d = 0.36$) and adult crime and antisocial behavior ($d = 0.42$; Gershoff 2002). Moreover, although familial confounding and child effects (child behavior

causing harsh parenting) are relevant, quasi-experimental studies and randomized experiments are consistent with the view that harsh parenting is a causal risk factor for antisocial behavior (Jaffee, Strait, and Odgers 2012).

Longitudinal evidence on associations between harsh parenting and child antisocial behavior in LMICs comes from China, Russia, Brazil, Poland, Puerto Rico, South Africa, and Colombia. Findings from individual studies are summarized below, and meta-analytic results are shown in table 6. It is important to note that associations between parenting and child adjustment tend to be highest when assessments of both variables are based on parental reports (Collishaw et al. 2009). Nearly all studies in LMICs used parental reports to assess parenting practices; therefore, we pay particular attention to whether or not child behavior was also assessed by parents or by other informants.

"Authoritarian parenting" refers to a general style of parenting involving coercion, harsh punishment, and withdrawal of affection and has been linked to the development of antisocial behavior in various studies in HICs (Baumrind 1966; Farrington 2002; Hoeve et al. 2009). In LMICs, two studies, in China (#10) and Russia (#32), reported weak associations between maternal authoritarian parenting and child conduct problems. In the Chinese study, authoritarian parenting when children were 6–9 years old weakly predicted ($r = 0.14$) child conduct problems reported by parents, teachers, and children themselves 3 years later, adjusting for other parental characteristics and child conduct problems at baseline (Zhou et al. 2008; see also Tao, Zhou, and Wang 2010; #10: Chen et al. 2011). In the Russian study, maternal authoritarian parenting in the preschool years predicted self-rated adolescent physical aggression for girls ($\beta = 0.34$) and relational aggression for boys ($\beta = 0.35$), adjusting for other parenting factors and preschool child aggression (#32: Nelson et al. 2014). However, in the same study, maternal authoritarian parenting did not significantly predict relational aggression for girls or physical aggression for boys; and paternal authoritarian parenting was not associated with any child outcome. The pooled bivariate association between maternal authoritarian parenting and child behavior problems in these studies was medium-sized and significant ($d = 0.38$, table 6).

Other studies of authoritarian parenting were not meta-analyzed because they examined only specific subdomains of authoritarian parenting, but nearly all reported positive associations with child behavior problems. Three such studies were conducted in Beijing. The first (#14) found that

TABLE 6

Meta-Analytic Results for Associations between Child Rearing Factors and Child Conduct Problems

Predictor	Behavioral Outcome	Number of Studies	Studies Included (#)	Type of Association	Effect Size *d*	95% CI	p^a	Heterogeneity I^2	Heterogeneity p^b
Maternal authoritarian parenting	Conduct problems and aggression	2	(10, 32)	Bivariate	.38	(.21 to .58)	<.001	0%	.853
Maternal warmth	Conduct problems and aggression	3	(12, 10, 15, 20)	Bivariate	−.12	(−.32 to .07)	.224	37%	.189
Maternal authoritative parenting	Conduct problems and aggression	3	(11, 15, 32)	Bivariate	−.26	(−.62 to .10)	.162	66%	.018
Paternal authoritative parenting	Aggression	2	(15, 32)	Bivariate	−.25	(−.51 to .0)	.053	0%	.387

NOTE.—# = study ID number shown in table 2; p^a = *p*-value for *d* effect size; p^b = *p*-value for a χ^2 test for heterogeneity. Random-effects models.

parental rejecting behaviors of 2-year-olds predicted parent-rated conduct problems ($\beta = 0.25$) when children were aged 4, adjusting for baseline child conduct problems (Zhu et al. 2011). A second study of 2-year-olds in Beijing (#15) found that parental power assertion and harsh parenting when children were aged 2 predicted observer-rated child aggression at age 4 ($\beta = 0.16$), adjusting for other parenting factors and child noncompliance at baseline (Chen et al. 2002). In a third Beijing study (#10), punitive parental reactions to children's negative emotions, when they were aged 6–9, also weakly correlated with children's conduct problems 3 years later ($\beta = 0.07$), adjusting for baseline child behavior and family socioeconomic position (Tao, Zhou, and Wang 2010).

Studies in Brazil and Poland also showed positive associations between specific aspects of authoritarian parenting and antisocial behavior. In São Gonçalo, Brazil, parental verbal aggression when children were aged 7 predicted increased parent-rated conduct problems over the next 3 years ($d = 0.30$), adjusting for baseline sociodemographic factors and various types of home and community violence (#7: de Assis et al. 2013). In Poland (#30), parenting characterized as rejecting of children at ages 7 and 9 was associated with child aggression over the next 3 years in both parent and self-reports ($\beta = 0.32$ for boys and 0.30 for girls), adjusting for other parenting variables, sociodemographics, and violent television viewing (Frączek 1986). Parental "punishment" (presumably referring to harsh punishment) also predicted girls' ($\beta = 0.20$) peer-rated aggressive behavior, but there was no significant association for boys (#30: Frączek 1986). More equivocal results were reported from a Russian study (#32) that examined parental "psychological control" of preschool children as a possible predictor of adolescent self-reported aggression. For boys, there was no significant association, adjusting for other parenting factors and early child aggression (Nelson et al. 2014). For girls, paternal psychological control predicted more relational and physical aggression ($\beta = 0.40$ and 0.36, respectively), but maternal psychological control predicted less physical aggression ($\beta = -0.26$) and was not associated with relational aggression.

Hou et al. (2013) conducted a rare genetically sensitive study of the effects of hostile parenting on children in Beijing, China (#13). Differences in parents' treatment of monozygotic twins were examined in relation to subsequent twin differences in conduct problems, assessed by parent and self-reports. Twins exposed to more parental hostility than their twin sibling at ages 10–18 did not show more conduct problems 2 years later. By contrast, initial twin differences in conduct problems did predict later pa-

rental hostility. This suggested that, rather than parental hostility causing increases in conduct problems, the reverse was true: child conduct problems elicited higher levels of parental hostility in adolescence.

Two studies that examined indicators of harsh parenting in relation to delinquent or violent behavior in LMICs had different findings. In Colombia, strict parental discipline reported by adolescents at ages 12–17 was not associated with self-reported violent behavior 2 years later (#22: Brook, Brook, and Whiteman 2007). In Puerto Rico, parental coercive discipline reported by children aged 5–13 was highest among those with a high rate of delinquency that quite rapidly declined over the next 2 years (#31: Maldonado-Molina et al. 2009).

As would be expected, parent-child conflict was associated with antisocial behavior in the two studies that examined this issue in LMICs. Among 2-year-old Chinese children, mother-child conflict predicted mother-reported child conduct problems ($r = 0.37$) 9 months later (#12: Zhang 2013). In Colombia, adolescent-reported conflict with parents at ages 12–17 was weakly associated with self-reported violent behavior ($r = 0.14$) 2 years later (#22: Brook, Brook, and Whiteman 2007). Given that the studies analyzed different outcomes, they were not meta-analyzed.

In summary, studies of authoritarian parenting styles and specific aspects of harsh parenting generally show associations with child antisocial behavior in LMICs, although not all findings were positive. Notably, all studies relied on questionnaires to assess parents' attitudes and behaviors, and all but two relied on parental reports. More sensitive observational measures may reveal different patterns. A particular problem with interpreting associations found in these studies is that harsh parenting practices can arise in response to child misbehavior (possible reverse causation), and genetic influences might produce spurious associations between parental and child behaviors (Jaffee, Strait, and Odgers 2012), as suggested by one genetically sensitive study conducted in China (Hou et al. 2013). Causal inference should be strengthened in future research in LMICs by conducting more observational studies that examine within-individual change in both parenting and child behavior through time, employing genetically sensitive research designs, and also by conducting randomized trials of parenting programs designed to reduce child behavior problems, and testing whether intervention effects are mediated by reductions in harsh parenting practices (Rutter et al. 2001). Such studies have been conducted in HICs (Forehand et al. 2014), but not to our knowledge as part of randomized trials in LMICs (Knerr, Gardner, and Cluver 2013).

2. *Authoritative and Warm Parenting.* In contrast to harsh and rejecting parenting behaviors, an "authoritative" parenting style, combining warmth and limit setting guided by explanations, is theorized to reduce child problem behavior (Larzelere, Morris, and Harrist 2013). However, findings on this issue were mixed in three studies in LMICs, producing a medium-sized, nonsignificant association in meta-analysis. Individual studies included in the meta-analysis were conducted in Russia and China. Among Russian preschool children, authoritative parenting predicted lower levels of self-reported physical aggression for boys ($\beta = -0.29$ mothers; $\beta = -0.39$ fathers), but not for girls, adjusting for other parenting factors (#32: Nelson et al. 2014). Considering relational aggression as an outcome in the same study, only paternal authoritative parenting was predictive, and only for boys ($\beta = -0.39$; #32: Nelson et al. 2014). Among 6–9-year-old children in Beijing, authoritative parenting predicted slightly fewer ($r = -0.12$) child conduct problems 3 years later, assessed by parents, teachers, and children themselves, adjusting for other parental characteristics and child conduct problems at baseline (Zhou et al. 2008; see also Tao, Zhou, and Wang 2010; #10: Chen et al. 2011). In another Beijing study, maternal "inductive parenting" (a concept similar to authoritative parenting), when children were aged 2, predicted less observer-rated aggression for girls ($r = -0.45$), but not for boys; paternal inductive parenting was not associated with child aggression (#15: Chen et al. 2002). In a meta-analysis of these three studies (#10, #15, #32), the bivariate association between maternal authoritative parenting and child conduct problems and aggression was medium but nonsignificant ($d = -0.26$, table 6), with significant heterogeneity. Meta-analysis of the two studies (#15, #32) that examined the bivariate association between paternal authoritative parenting and child aggression was of similar magnitude ($d = -0.25$, table 6).

We conducted a separate meta-analysis of bivariate results from four Chinese studies that examined related subdimensions of authoritative parenting: parental warmth, closeness, acceptance, and responsiveness. Among 2-year-olds in Beijing, paternal warmth ($r = -0.21$), but not maternal warmth, predicted less observer-rated child aggression at age 4 (#15: Chen et al. 2002). In another sample of 2-year-old children in Beijing, mother-child closeness predicted fewer ($r = -0.28$) conduct problems reported by mothers at ages 3–4 (#12: Zhang 2013). A third Beijing study found no significant association between parental supportiveness in response to child negative emotions among 6–9-year-olds and child conduct

problems 3 years later (#10: Tao, Zhou, and Wang 2010). However, in a Shanghai study, maternal acceptance (warmth, enjoyment, and less rejection) toward 7- and 10-year-old children predicted less ($\beta = -0.14$) child aggressive and disruptive behavior 4 years later, as reported by peers (#20: Chen et al. 1999). Pooling results across these studies (#12, #10, #15, #20) produced a small bivariate association between maternal "warmth" and child behavior problems ($d = -0.12$) that was not significant (table 6).

Three other studies in Poland, former Yugoslavia, and Puerto Rico examined specific aspects of authoritative parenting in multivariate models and had mixed results. Among 7- and 9-year-old Polish children, parental "nurturance" predicted lower peer-rated aggressive behavior ($\beta = -0.19$) for girls over a 3-year period, adjusting for sociodemographics, other parenting variables, and child violent television viewing, but there was no significant association for boys (#30: Frączek 1986). In former Yugoslavia, observer ratings of parental warmth and responsiveness with 3-year-old children predicted reduced maternal-reported conduct problems, but not aggression, when children were aged 4–5, adjusting for perinatal and demographic factors (#39: Wasserman et al. 2001). In Puerto Rico, levels of family and social support toward children aged 9, on average, did not significantly predict self-reported delinquency over the next 2 years, as was also found in a matched sample in New York (#31: Maldonado-Molina et al. 2009).

In the genetically sensitive twin study in Beijing (#13), Hou et al. (2013) examined differences in levels of parental warmth between monozygotic twins as a predictor of twin differences in conduct problems, assessed using both parent and self-reports. The results were null: twin differences in maternal and paternal warmth at ages 10–18 did not associate with levels of conduct problems 2 years later.

Authoritative parenting might be contrasted with overly permissive parenting in which children are not given clear limits about behavior. In Voronezh in Russia, "overly permissive" parenting during children's preschool years was examined as a possible predictor of adolescent self-rated relational or physical aggression, adjusting for other parenting factors and child aggression in preschool (#32: Nelson et al. 2014). For boys, there was no significant association. For girls, high permissiveness by fathers predicted more physical aggression ($\beta = 0.45$); however, high permissiveness by mothers predicted less physical aggression ($\beta = -0.23$), and there were no significant associations with relational aggression.

Among Colombian males, those who reported fewer parental rules at ages 12–17 had marginally higher levels of self-reported violence 2 years later ($r = 0.08$; #22: Brook, Brook, and Whiteman 2007).

In summary, although several studies in LMICs found that authoritative parenting was associated with less child antisocial behavior, results were not consistent, and few studies adjusted for other child and family factors when estimating these effects. As with research on harsh parenting, future studies about the effects of authoritative parenting should use observational measures and strengthen causal inference by analyzing within-individual change, using genetically sensitive designs, and integrating findings from observational studies with those from randomized trials of parenting programs.

E. Maltreatment and Other Adverse Life Events

Stressful life experiences including maltreatment predict a range of adverse health and behavioral outcomes. The effects of multiple stressful events have been highlighted as of particular importance for children's development (Anda et al. 2005). Stress can affect neurocognitive and endocrine systems, children's relationships, and learning processes that are implicated in the development of antisocial behavior (Susman 2006). Recent estimates suggest that more than half of children (ages 2–17) worldwide experienced violence during a 1-year period (Hillis et al. 2016). Across 25 LMICs, it was estimated that between 20 and 50 percent of 13–15-year-old children were physically attacked in the previous 12 months (UN Children's Fund 2014). In this section, we review evidence from LMICs on the effects of maltreatment and other adverse life events on antisocial behavior. The studies summarized below were considered too heterogeneous in their designs and analyses to pool in meta-analyses.

Surprisingly, the three longitudinal studies in LMICs that examined effects of maltreatment on antisocial behavior all found weak or null associations. In São Gonçalo, Brazil, severe parental physical violence against children, reported by parents when children were aged 7, was not significantly associated with child conduct problems over the following 3 years, adjusting for baseline sociodemographic factors and other home and community violence (#7: de Assis et al. 2013). In South Africa, physical, emotional, and sexual maltreatment reported by adolescents aged 10–17 was only weakly associated ($\beta = 0.04$) with conduct problems 1 year later, adjusting for baseline levels of child behavior, poverty, and other forms

of home and community violence (#37: Waller, Gardner, and Cluver 2014). In another South African study, male youths aged 14–22 who reported having been physically abused as a child were not at increased risk of perpetrating family or intimate partner violence 7 years later (#34: Thaler 2011).

These same three studies in Brazil and South Africa, and a fourth in the Philippines, also reported weak or null effects of other forms of family violence on antisocial behavior. In São Gonçalo, Brazil, physical violence between grandparents when children were aged 7 was weakly associated ($d = 0.32$) with conduct problems over the next 3 years, adjusting for baseline sociodemographic factors and other types of home and community violence (#7: de Assis et al. 2013); physical violence between parents was not significantly predictive. In South Africa, exposure to family physical and emotional violence at ages 10–17 was not associated ($\beta = 0.01$) with conduct problems 1 year later, adjusting for baseline poverty level, child behavior, maltreatment, and community violence (#37: Waller, Gardner, and Cluver 2014). Also in South Africa, intimate partner violence suffered by mothers until children were age 5 was weakly associated with child aggression ($r = 0.13$), but not with oppositional behavior at age 5 (#36: Barbarin, Richter, and DeWet 2001). In Cebu, the Philippines, recall of interparental violence at age 18 was not associated with perpetrating intimate partner violence 3 years later, in either bivariate or multivariate analyses, adjusting for other family of origin characteristics and current individual and household factors (#29: Fehringer and Hindin 2009).

War-related trauma increases children's risk for mental health problems such as post-traumatic stress disorder (Thabet and Vostanis 1999). A study conducted in Croatia (#23) was the only longitudinal study in an LMIC to compare child antisocial behavior according to differences in exposure to war. The study included 208 children in Zagreb assessed at age 5 in 1991, before the war in Yugoslavia started, who were then followed up at age 6, during the war (#23: Rabotegsaric, Zuzul, and Kerestes 1994). Comparing the same children before and during the war, no change in aggression was observed. Also, there was no difference in levels of aggression between children during the war and a control group of the same age prior to the war. However, the extent of exposure to wartime traumatic events was not assessed in this study, which is an important moderator of the effects of war on other mental health outcomes such as post-traumatic stress disorder (Pine, Costello, and Masten 2005).

Four studies in LMICs examined other forms of stressful life events, such as death of a family member, permanent house moves, and experiences of discrimination, in relation to child antisocial behavior. In Pelotas, Brazil, a composite measure of stressful life events up to age 11 predicted conduct problems at age 15 ($d = 0.39$, comparing children who experienced multiple stressful events versus no events; #4: Anselmi et al. 2012). In Colombia, experiences of discrimination at ages 12–17 were not associated ($r = 0.01$) with violent behavior 2 years later (#22: Brook, Brook, and Whiteman 2007). In Puerto Rico, stressful life events at mean age 9 were most common among children who then showed high but rapidly declining delinquency rates, followed by children who showed low but stable rates of delinquency over a 2-year period (#31: Maldonado-Molina et al. 2009). In a matched sample of Puerto Rican children in New York, stressful life events were most common among children with a high and increasing rate of offending.

Some of these findings on effects of stressful life events in LMICs are at odds with comparable findings in HICs. Perhaps the most striking difference concerns the effects of child maltreatment. A meta-analysis of the effects of experiencing violence on antisocial behavior in HICs revealed an overall association of $d = 0.55$ but found a reduced effect ($d = 0.31$) among prospective studies, many of which involved child maltreatment (Wilson, Stover, and Berkowitz 2009). Quite similar associations were found for violence experienced in the home ($d = 0.34$) and in the community ($d = 0.24$). In their review of studies with genetically sensitive research designs, Jaffee et al. (2012) concluded that maltreatment does have causal effects on children's antisocial behavior, with genetic factors explaining only a very small amount of the association. The null and weak findings on the effects of witnessing violence between other family members were largely in keeping with findings of Wilson et al. (2009, p. 773), who concluded that "the overall relationship between witnessing violence and juvenile delinquency was negligible ($d = .15$)."

In summary, associations between child conduct problems and experiences of violence in the home, including maltreatment, were weak or inconsistent in LMIC studies, and associations with other stressful life events were also generally weak. However, the true consequences of these experiences on young people's behavior may be obscured in these studies because many adjusted for possible mediating mechanisms, including child behavior measured at the same time as the exposure variable, which could downwardly bias the results. Further research is required on

the influence of stressful life events on children in LMICs, particularly experiences of violence, with careful treatment of confounders and mediators used in analyses. Other severe traumas experienced by many children in LMICs, such as female genital mutilation, being orphaned by AIDS, traumas associated with child labor, and wartime traumas, are very important areas for future research (Benjet et al. 2009).

F. Family Characteristics

Family influences play a central role in developmental theories of antisocial behavior (Farrington 1994) and represent a key focus for preventive intervention (Farrington and Welsh 2003). The earlier section on child rearing processes highlighted the importance of parenting practices such as discipline methods, supervision, and affection. In this section, we consider associations between antisocial behavior outcomes and parental mental health and behavior, family socioeconomic factors, and family demographics. Jim Derzon's (2010) meta-analysis of longitudinal studies in HICs confirmed the following significant correlations between family factors and crime: family stress, $r = 0.214$; parent antisocial behavior, $r = 0.150$; broken home, $r = 0.095$; separated from parents, $r = 0.083$; low family socioeconomic status, $r = 0.129$; large family size, $r = 0.110$; young parent(s), $r = 0.079$; and urban housing, $r = 0.133$.

1. *Parental Mental Health and Behavior.* Parental care of children may be compromised if parents themselves experience stress and mental health problems (Cummings, Davies, and Campbell 2000; Keenan and Shaw 2003). This is potentially a major issue in LMICs where rates of maternal mental disorders are estimated to be significantly higher than in HICs (Affonso et al. 2000; Walker, Wachs, et al. 2007). Higher rates of mental disorders among poor populations in LMICs are driven by experiences of anxiety associated with economic insecurity, hopelessness regarding future opportunities, rapid social changes, and risks of violence and physical ill health (Patel and Kleinman 2003). However, only two studies prospectively examined maternal mental health as a possible risk factor for children's conduct problems in LMICs. Both were in Pelotas, Brazil, and both were consistent with the literature in HICs in showing higher rates of child behavior problems among children whose mothers had mental health problems. In the first study, children whose mothers screened positive for mental health problems when children were aged 11 had raised levels of conduct problems at age 15 ($d = 0.54$; #4: Anselmi et al.

2012). In a second study, maternal psychiatric problems when children were 3 months old predicted conduct problems, rule breaking, and aggressive behaviors at age 4, adjusting for a range of sociodemographic factors and children's characteristics at birth (#5: Matijasevich et al. 2014).

Chen et al. (2011) proposed that Eastern and Western cultures have different values about emotion expression, and as such, parental expression of emotion might have different effects on children in China compared with Western countries, where most previous research on this topic had been conducted. In a study in Beijing, they examined associations between three types of parental emotion expression in the family (negative dominant expression, positive expression, and negative submissive expression) when children were 6–9 years old and tested for associations with children's conduct problems 3 years later (#10: Chen et al. 2011). Adjusting for family socioeconomic status, parenting styles, and child conduct problems at baseline, only parental expression of negative dominant emotion predicted ($\beta = 0.25$) later child conduct problems.

The intergenerational transmission of antisocial behavior is a major theme in the international literature, with both genetic and environmental mechanisms implicated in the transmission (Rhee and Waldman 2002; Thornberry et al. 2003; Farrington, Coid, and Murray 2009; Murray, Farrington, and Sekol 2012). No longitudinal study in an LMIC tested the link between parental crime and child antisocial behavior. However, among 12–17-year-olds in Colombia, illicit drug use by parents and siblings was weakly associated with youth violence 2 years later ($r = 0.07$ for mothers, $r = 0.18$ for fathers, $r = 0.16$ for siblings; #22: Brook, Brook, and Whiteman 2007). Problematic parental drug use can undermine household stability and child care (Barnard and McKeganey 2004), which could affect antisocial behavior. In South Africa, 14–22-year-olds who reported that drugs or alcohol were used in their childhood home were more likely (OR = 1.7) to self-report violence against strangers 7 years later, adjusting for education, unemployment, childhood poverty, and family structure (#34: Seekings and Thaler 2011). In the Philippines, parental alcohol use (not necessarily problematic use) when children were aged 10 was not significantly associated with perpetration of partner violence at age 21 (#29: Fehringer and Hindin 2009).

In summary, the evidence on the influence of parental mental health and behavior on child and youth antisocial behavior is extremely sparse in LMICs. The few existing studies, in Brazil, Colombia, South Africa, and the Philippines, show positive associations between parental mental

health problems and child conduct problems, and parental illicit drug use and youth violence, although no study used a genetically informative design to disentangle potential environmental effects from genetic influences. A single study in China suggests a particular role of parental negative dominant expressivity as a potential predictor of child conduct problems.

2. *Family Poverty, Parental Education, and Employment.* Poverty and low socioeconomic status can influence child development through proximal influences in the home, such as undernutrition or overcrowding, and through more distal mechanisms such as reduced educational opportunities (Wachs 1999; Walker et al. 2011). Quasi-experimental studies in HICs suggest causal effects of family poverty on antisocial behavior (Jaffee, Strait, and Odgers 2012). Therefore, children from impoverished backgrounds in LMICs may be at increased risk for conduct problems or violence. Meta-analytic results on this topic are shown in table 7, with findings from individual studies summarized below.

Six studies in LMICs examined associations between poverty and child conduct problems. The three studies (#4, #5, #37) that were included in a meta-analysis were conducted in Brazil and South Africa. The pooled bivariate association between poverty and conduct problems was small (d = 0.12, table 7), with high heterogeneity in the results. In Pelotas, Brazil, low family income at birth was associated with child conduct problems at age 11 for boys (RR = 1.3) and girls (RR = 1.5; #4: Murray, Maughan, et al. 2015). Also, children whose families remained poor or became poor between birth and age 11 had more conduct problems at age 15 (β = 0.61, comparing persistently low versus persistently high family income groups), adjusting for other sociodemographic factors (#4: Anselmi et al. 2012). These effects were partly explained by stressful life events and maternal mental health problems associated with poverty (Anselmi et al. 2012). In a second study in Pelotas, lower family wealth at birth was also associated with oppositional behavior and conduct disorder at age 6 (RR = 5.0, comparing bottom and top income quintiles); however, this association was mainly a function of the highest income group having a particularly low risk of disorder compared to all other groups (#5: Petresco et al. 2014). In South Africa, family poverty at ages 10–17 was not associated with conduct problems 1 year later (#37: Waller, Gardner, and Cluver 2014). Three other studies that lacked sufficient information for inclusion in the meta-analysis were conducted in Brazil and Poland and had similarly weak or null results. In São Luís, Brazil, children in low-income families at birth were not at increased risk of conduct problems

TABLE 7

Meta-Analytic Results on Family Sociodemographic Factors in Relation to Child Conduct Problems and Youth Violence

Predictor	Behavioral Outcome	Number of Studies	Studies Included (#)	Type of Association	Effect Size *d*	95% CI	p^a	Heterogeneity	
								I^2	p^b
Poor family during childhood	Conduct problems	3	(4, 5, 37)	Bivariate	.12	(.03 to .21)	.012	82%	.001
	Violence	2	(3, 4)	Bivariate	.18	(.07 to .30)	.001	0%	.658
Low maternal education	Conduct problems	3	(4, 8, 12)	Bivariate	.15	(−.02 to .32)	.088	57%	.099
Young mother at birth	Conduct problems	2	(4, 8)	Bivariate	.20	(−.03 to .42)	.087	83%	.015
	Violence	2	(3, 4)	Bivariate	.21	(.01 to .41)	.045	60%	.059
Single mother at birth	Conduct problems	2	(4, 8)	Bivariate	.17	(.09 to .25)	<.001	0%	.424
	Violence	2	(3, 4)	Bivariate	.01	(−.13 to .15)	.853	0%	.793
Many siblings	Violence	2	(3, 4)	Bivariate	.06	(−.06 to .19)	.324	0%	.598

NOTE.—# = study ID number shown in table 2; p^a = *p*-value for *d* effect size; p^b = *p*-value for a χ^2 test for heterogeneity. Random-effects models.

at ages 7–9, compared to children in medium-income families, although there was some increased risk comparing children in middle-income families to those in high-income families (RR = 1.3; #8: Rodriguez et al. 2011). In São Gonçalo, Brazil, 7-year-old children in poor families did not have significantly increased rates of conduct problems over the next 3 years, adjusting for other sociodemographic factors and experiences of violence (#7: de Assis et al. 2013). Among Polish children aged 7 and 9, parental income was not significantly associated with children's aggressive behavior over the next 3 years, adjusting for baseline aggression, IQ, and sociodemographic factors (#30: Frączek 1986).

Considering family poverty as a predictor of violence, results from two of the Pelotas cohorts in Brazil were pooled in a meta-analysis. In the first study, children whose family income was below the minimum wage at birth in 1982 had a higher risk for conviction for violence up to age 25 (males OR = 2.3, females OR = 1.4), compared to all other children (#3: Caicedo et al. 2010). However, in the later 1993 Pelotas Birth Cohort Study, low family income at birth was not significantly associated with self-reported violence at age 18 for males (RR = 1.2) or females (RR = 1.4; #4: Murray, Maughan, et al. 2015); also effect sizes were smaller in this Brazilian study than in a matched British birth cohort (Murray, Maughan, et al. 2015). Combining results from these two cohorts, the association between family poverty and violence was weak ($d = 0.18$, table 7).

In three other studies in Puerto Rico, the Philippines, and South Africa, associations between family poverty and general delinquency and intimate partner violence were all null. In Puerto Rico, family welfare receipt among 5–13-year-old children did not predict trajectories of delinquency over the next 2 years, as was also found in a matched sample in New York (#31: Maldonado-Molina et al. 2009). Among 10-year-olds in the Philippines, neither household income nor wealth predicted perpetration of partner violence at age 21 (#29: Fehringer and Hindin 2009). In South Africa, males aged 14–22 who reported having been poor as a child were not at significantly higher risk of self-reported perpetration of family or intimate partner violence 7 years later (#34: Thaler 2011).

Low parental education was investigated as a predictor of antisocial behavior in eight studies in Brazil, China, the Philippines, Poland, and former Yugoslavia. Pooling bivariate results that were available in three of the studies in Brazil and China (#4, #8, #12), the association between low maternal education at birth and child conduct problems was weak ($d = 0.15$, table 7) and nonsignificant, with moderate heterogeneity in

the results. Five other studies (#5, #7, #8, #29, #37) also reported nonsignificant covariate-adjusted associations between parental education and child conduct problems and aggression (Frączek 1986; Wasserman et al. 2001; Rodriguez et al. 2011; de Assis et al. 2013; Matijasevich et al. 2014). These could not be meta-analyzed given differences in the multivariate analyses used.

Related concepts of family socioeconomic status and parental IQ were investigated in two studies. In Beijing (#10), a combined measure of low parental education and low family income when children were aged 6–9 was positively associated with child conduct problems 4 years later (β = 0.16), adjusting for parenting styles and child behavior at baseline (see also Tao, Zhou, and Wang 2010; Chen et al. 2011). In a study in the Seychelles (#33), family socioeconomic position at age 9 was unassociated with conduct problems at age 17, but maternal IQ at age 10 was negatively predictive, adjusting for the child's own IQ and mercury exposure (Davidson et al. 2011).

Two studies that examined the association between low parental education and youth violence had weak and null findings. In Pelotas, Brazil, low maternal education at birth was associated with self-reported violence at age 18 for females (RR = 1.4) but not for males (RR = 1.1; #4: Murray, Maughan, et al. 2015). These results were similar to those found in a matched British study (Murray, Maughan, et al. 2015). In the Philippines, maternal education, indicated by the number of years of schooling, was not associated with perpetration of partner violence at age 21, either before or after adjusting for other parental sociodemographics and domestic violence in the childhood home (RR = 0.96 for both estimates; #29: Fehringer and Hindin 2009).

Parental employment status was not associated with child conduct problems or aggression in three studies in Brazil and Poland. In Pelotas, Brazil, children born to parents who had a "proletariat" occupation were not more likely than children of "bourgeois" parents to show conduct problems at age 4 (#4: Brion et al. 2010). Also, in São Gonçalo, Brazil, having unemployed parents at age 7 did not significantly predict child conduct problems over the following 3 years, adjusting for other family sociodemographics and experiences of violence (#7: de Assis et al. 2013). In Poland, paternal occupational status when children were aged 7 and 9 was not significantly associated with child aggressive behavior over the next 3 years, adjusting for baseline aggression, IQ, violent television viewing, and other sociodemographics (#30: Frączek 1986).

Thaler (2011) found significant associations between South African men's own poverty and unemployment at ages 17–25 and perpetration of family or intimate partner violence 4 years later (#34); odds ratios were 2.0 for being very poor and 1.8 for unemployment.

In summary, existing LMICs studies reveal only weak associations between childhood poverty, parental education, and employment with future antisocial behavior. Some LMIC studies included mediating mechanisms in adjusted analyses, meaning that the overall effects of socioeconomic factors might have been underestimated in those studies. However, bivariate associations also tended to be weak or null, suggesting that these family background factors are not important influences on the development of conduct problems or violence in these studies. These findings on poverty in the family of origin and its impact on antisocial behavior are not markedly different from those reported in HICs. In a meta-analysis of predictors for youth crime and violence, based on 41 prospective studies in HICs, Tanner-Smith et al. (2013) found that correlations between socioeconomic status and later crime and violence were weak ($r < 0.20$) or nonsignificant, regardless of the age at which the predictor was measured (childhood, early adolescence, or later adolescence) and of the age at which the outcome was measured (early adolescence, late adolescence, or early adulthood). An examination of studies using designs that allow stronger causal inferences concluded that poverty and family income do have a causal role in antisocial behavior (Jaffee, Strait, and Odgers 2012), but it did not provide a pooled effect size estimate that could be compared to our findings. The only LMIC study that investigated the influence of poverty and unemployment in young adulthood (as opposed to poverty and unemployment in the family of origin) found a positive association with family and partner violence in South Africa.

3. *Parental Age, Marital Status, and Family Size.* Sociodemographic factors that have been associated with antisocial behavior in HICs include being born to a teenage parent, living in a single-parent household, and having a large family (Hawkins et al. 1998; Jaffee, Strait, and Odgers 2001; Derzon 2010; Murray and Farrington 2010). There is also some evidence for causal effects of young motherhood and divorce on children's antisocial behavior (Jaffee, Strait, and Odgers 2012). Results from two Brazilian studies (#4, #8) on the association between low maternal age at birth (<20 years) and child conduct problems were combined in a meta-analysis. In Pelotas (#4), having a young mother at birth was associated with child conduct problems at both age 11 (RR = 1.3 for males,

1.5 for females; Murray, Maughan, et al. 2015) and age 15 ($d = 0.30$; Anselmi et al. 2012). However, in São Luís, lower maternal age at birth was not associated with child conduct problems (#8: Rodriguez et al. 2011). The meta-analysis of these two studies (#4, #8) produced a weak and nonsignificant association between low maternal age at birth and child conduct problems ($d = 0.20$, table 7), with significant heterogeneity in the results. Additional evidence on this topic comes from a later study in Pelotas, which did find an association between lower maternal age and child conduct problems at age 4, adjusting for other sociodemographic factors, maternal psychiatric disorder, and childbirth characteristics (#5: Matijasevich et al. 2014). However, in São Gonçalo, Brazil, lower parental age was not associated with child conduct problems over the next 3 years, adjusting for other sociodemographic factors and experiences of violence (#7: de Assis et al. 2013). Moreover, in the Seychelles, maternal age was not associated with child conduct problems at age 5 (Myers et al. 2000).

Considering risk for violence, in the 1982 cohort in Pelotas, Brazil, having a young mother at birth (<20 years) predicted conviction for violence up to age 25 for females, adjusting for other sociodemographic factors and maternal smoking in pregnancy (bivariate RR = 3.8, adjusted RR = 2.9); however, there was no significant association for males (#3: Caicedo et al. 2010). In the later 1993 Pelotas cohort, having a young mother at birth (<20 years) was not associated with self-reported violence at age 18 for males or females (#4: Murray, Maughan, et al. 2015). Pooling the bivariate results from these two studies, having a young mother at birth (<20 years) was weakly associated with youth violence ($d = 0.21$, table 7). In the Philippines, maternal age was not associated with perpetration of intimate partner violence at age 21, either in bivariate analyses or in multivariate analyses adjusting for other family factors in childhood (#29: Fehringer and Hindin 2009).

Three Brazilian studies (#4, #5, #8) examined the association between parental marital status and child conduct problems; their pooled bivariate association was almost zero ($d = 0.01$, table 7). In the 1993 Pelotas cohort, having a single mother at birth was associated with child conduct problems both at age 11 (RR = 1.2 for males; RR = 1.4 for females; #4: Murray, Maughan, et al. 2015) and at age 15 ($d = 0.19$; #4: Anselmi et al. 2012). In the later 2004 Pelotas cohort, having a single mother at birth was also associated with child conduct problems at age 4, adjusting for other sociodemographic factors, maternal psychiatric disorder, and childbirth characteristics (#5: Matijasevich et al. 2014). However, in São

Luís, Brazil, having a single mother at birth was not significantly associated with child conduct problems (#8: Rodriguez et al. 2011). Considering violence as an outcome, there was no association with having a single mother at birth in the two older (1982 and 1993) Pelotas cohorts (#3: Caicedo et al. 2010; #4: Murray, Maughan, et al. 2015).

Three studies examined whether large family size was associated with child conduct problems. Two of the studies in Pelotas, Brazil, reported weak and null associations. In the 1993 cohort, having three or more siblings at birth was weakly associated with conduct problems at age 11 (RR = 1.2 for both males and females; #4: Murray, Maughan, et al. 2015). In the 2004 cohort, maternal parity at birth was not associated with child conduct problems at age 4, adjusting for other sociodemographic factors, maternal psychiatric disorder, and childbirth characteristics (#5: Matijasevich et al. 2014). In China, the single-child policy represents a unique setting to investigate family size and child behavior. A study in Nanjing compared 3–6-year-olds with and without siblings on 116 different behaviors assessed four times over a 10-year period. For boys, only four conduct behaviors were significantly more frequent when siblings were present (#19: Tseng et al. 2000). For girls with siblings, only temper tantrums were more frequent than for girls without siblings. The very large number of tests conducted in this study (116 each for boys and girls) suggests that these may well be chance findings.

Youth violence was investigated in relation to family size in the two Pelotas studies of children born in 1982 and 1993. In the 1982 cohort, violent conviction up to age 25 was assessed in relation to how many younger and older siblings children had had at age 4. For males, having any younger siblings predicted increased risk of violence (RR = 1.9), adjusting for family sociodemographics, mother smoking in pregnancy, and childbirth characteristics, but there was no significant association with having older siblings and no significant association for females (#3: Caicedo et al. 2010). In the 1993 cohort, there was no significant association between having three or more older siblings at birth and risk of self-reported violence at age 18 (#4: Murray, Maughan, et al. 2015). Combining these two studies in meta-analysis, the association between having multiple older siblings (two or more in the 1982 cohort, three or more in the 1993 cohort) and youth violence was almost zero ($d = 0.06$, table 7).

In summary, existing evidence suggests only weak associations between some family sociodemographic factors in the development of conduct problems and violence in LMICs. Notably, nearly all studies to date

have been conducted in Brazil. The associations between having a young mother at birth and conduct problems and violence were small. The association between having a single mother at birth and conduct problems was small, and there was no association with violence. There was a negligible association between having a large family and conduct problems, and no association with violence.

4. *Other, Less Studied, Family Factors.* In the Philippines, parental joint decision making and maternal church attendance measured when children were aged 10 were not associated with perpetration of partner violence at age 21, adjusting for sociodemographic factors, intergenerational violence, and other youth characteristics (#29: Fehringer and Hindin 2009).

In former Yugoslavia, living in an apartment (compared to in a house or on a farm) in the perinatal period was not significantly associated with child aggression at age 3, adjusting for sociodemographic factors and an assessment of the child's home learning environment (#39: Wasserman et al. 1998).

G. Peer Characteristics

Adolescence is a period of heightened social sensitivity when peers exert strong influence on risk-taking behaviors (Blakemore and Mills 2014). Two types of peer influence have been studied extensively in relation to antisocial behavior: reinforcement or modeling of antisocial behavior by antisocial peers and possible protective effects of having a supportive friendship network (Jaffee, Strait, and Odgers 2012; Eisner and Malti 2015). It is important to emphasize that spurious associations between peer characteristics and child antisocial behavior can arise in two main ways. First, antisocial children may seek companionship with peers showing similar antisocial tendencies; second, children's own aggressive behaviors may cause particular peer responses, such as social rejection (Jaffee, Strait, and Odgers 2012). Hence, the issue of social causation versus social selection is particularly difficult to disentangle concerning peer effects. Studies of peer influences on antisocial behavior in LMICs were considered too heterogeneous in their designs and analyses to pool results in meta-analyses, but individual study results are summarized below.

Four studies in China, Colombia, Puerto Rico, and South Africa examined the influence of antisocial peers on antisocial behavior. A genetically sensitive study in Beijing is particularly interesting because it tested whether twin differences in antisocial peers at ages 10–18 predicted twin

differences in conduct problems 2 years later (#13: Hou et al. 2013). The results did not support the social causation hypothesis: initial differences between twins in peer antisocial behavior did not predict later differences in conduct problems, adjusting for baseline parental warmth/hostility and child conduct problems. In Colombia (#22), 12–17-year-olds whose peers were involved in delinquency and drug use were at increased risk for violent behavior 2 years later ($r = 0.22$ and 0.27, respectively; Brook, Brook, and Whiteman 2007). However, associations were nonsignificant when adjusted for individual characteristics and violent behavior measured at baseline. Among 5–13-year-olds in Puerto Rico, differences in peer delinquency levels predicted children's own delinquency over the following 3 years (#31: Maldonado-Molina et al. 2009). Specifically, peer delinquency was highest among children whose own delinquency showed an initially high but declining trajectory. Interestingly, in a matched sample in New York, peer delinquency was also highest among children who had declining delinquency rates rather than those who had high and increasing rates of delinquency (Maldonado-Molina et al. 2009). In South Africa, 14–22-year-olds who had many friends using drugs were at increased risk for perpetration of family and intimate partner violence 7 years later (OR = 1.5), but having many friends drinking alcohol was not associated with this outcome (#34: Thaler 2011).

Peer popularity and peer rejection were investigated in three studies in China and Puerto Rico, and each found a significant association with antisocial behavior. In Beijing, there were bidirectional relationships, with aggressive behaviors increasing risk for subsequent social rejection, and social rejection also contributing to later aggression, over a 4-year period from age 9 (#11: Chen et al. 2012). In Shanghai, greater popularity at mean age 11 was associated with less aggression 2 years later ($r = -0.24$; #21: Chen, He, and Li 2004). In Puerto Rico, peer relations at 5–13 differed only slightly according to children's trajectories of delinquency over the next 2 years, with positive peer relations being highest among nonoffenders (#31: Maldonado-Molina et al. 2009). There was no significant association in a matched sample in New York (Maldonado-Molina et al. 2009).

Three studies in LMICs suggest a weak association between both bullying and peer victimization and antisocial behavior. In São Gonçalo, Brazil, violent victimization at school among 7-year-olds was very weakly associated with conduct problems in the next 3 years ($d = 0.15$), adjusting for baseline sociodemographic factors and other types of home and community violence (#7: de Assis et al. 2013). In Jinan, China, victimization

by peers and child aggression were assessed annually for 4 years among children aged 9 and 11 years at baseline. Physical victimization by peers was weakly associated with physical aggression ($\beta = 0.05$), and relational victimization by peers was weakly associated with relational aggression ($\beta = 0.05$), but only in the last years of the study, not before transitioning from primary to middle school (#17: Chen 2012). In South Africa, experiencing any bullying at ages 10–17 was only weakly associated with conduct problems 1 year later ($d = 0.16$), but experiencing four or more types of bullying was strongly associated ($d = 0.58$) and remained significant adjusting for child demographics, family poverty, and residence location (#37: Boyes et al. 2014).

In summary, nine studies in LMICs suggest that antisocial behavior is positively associated with both peer victimization and having antisocial peers, and it is inversely associated with both peer popularity and positive peer relations. The relatively weak association found between peer victimization and antisocial behavior is broadly consistent with a 2012 meta-analysis that found that bullying victimization predicted violence with an odds ratio of 1.43 (equivalent to a small effect size of $d = 0.19$; Ttofi, Farrington, and Lösel 2012). Regarding the influence of antisocial peers, limited evidence from LMICs suggests that reverse causation is important, with one genetically sensitive study finding no effect of peer antisocial behavior on later conduct problems and another study showing bidirectional effects between aggression and social rejection.

H. School Environment

In HICs, it is well established that there are large differences in rates of antisocial behavior between different schools (Rutter, Giller, and Hagell 1998). Children with antisocial behaviors disproportionately attend high–delinquency rate schools that have high levels of distrust between teachers and students, low commitment to the school by students, and unclear and inconsistently enforced rules (Graham 1988). However, what is less clear is to what extent such differences reflect school influences related to their organization, climate, and practices or different intakes of children into schools (Rutter et al. 1979; Rutter, Giller, and Hagell 1998). Only one study in an LMIC examined the influence of school environment on youth antisocial behavior. In Puerto Rico (#31), the school environment was assessed at ages 5–13 by asking children about factors such as the number of substitute teachers they had had in the previous year. School envi-

ronments were much more negative among children with high initial delinquency rates, which then declined over a 2-year period, and among children with moderate and stable delinquency rates, compared to children with a nonoffending trajectory (respectively, $d = 1.1$ and 0.6; #31: Maldonado-Molina et al. 2009). Negative school environment also distinguished children's delinquency trajectories after adjusting for a range of individual, family, peer, and social factors. And negative school environment was also found to be important for delinquency trajectories in a matched sample in New York: children with a high and increasing rate of delinquency had the most negative school environments (Maldonado-Molina et al. 2009).

In summary, a single LMIC longitudinal study conducted in Puerto Rico found large effects of school environment on children's delinquent development. However, much more research is needed on this important topic, particularly using experimental and quasi-experimental designs to test causal mechanisms (Rutter, Giller, and Hagell 1998).

I. Community Influences

A long history of research in HICs has established that offenders tend disproportionately to live in inner-city areas characterized by physical deterioration, neighborhood disorganization, and high residential mobility (Shaw and McKay 1969). However, it is difficult to determine to what extent the areas themselves influence antisocial behavior and to what extent people with antisocial behavior tend to live in deprived areas, for example, because of family poverty or public housing allocation policies.

Few LMIC studies examined associations between neighborhood characteristics and antisocial behavior, and they were too heterogeneous to pool in a meta-analysis. Considering the influence of neighborhood crime rates, Brook et al. (2007) investigated whether drug availability, neighborhood risk, and danger on the street predicted youth violent behavior 2 years later among 12–17-year-old Colombians (#22). Only community drug availability was significantly associated with perpetrating violence ($r = 0.11$). In South Africa, community violence and political violence near children's homes were assessed from children's birth to age 5. Community violence was associated with child aggression ($r = 0.13$), but not oppositional behavior at age 5 (#36: Barbarin et al. 2001); political violence was not associated with aggressive or oppositional behavior.

The only study to examine neighborhood poverty was a South African survey of 14–22-year-old males. Youths who had grown up in poor neighborhoods were at increased risk (OR = 1.7) for perpetrating family or intimate partner violence 7 years later (#34: Thaler 2011). However, in separate analysis of the same study, there was no association between childhood neighborhood poverty and perpetrating violence against strangers (#34: Seekings and Thaler 2011).

Violent victimization in the community was inconsistently associated with conduct problems in three studies in LMICs. In São Gonçalo, Brazil, violent victimization in the community at age 7 was not significantly associated with conduct problems over the next 3 years, adjusting for baseline sociodemographic factors and other types of home and school violence (#7: de Assis et al. 2013). In South Africa, witnessing or being a victim of serious violence in the community at ages 10–17 was only weakly associated ($\beta = 0.07$) with conduct problems 1 year later, adjusting for baseline child behavior, poverty, and violence in the home (#37: Waller, Gardner, and Cluver 2014). Also in South Africa, violent victimization of a family member between children's birth and age 5 was weakly associated with oppositional behaviors ($r = 0.07$), but not aggression at age 5 (#36: Barbarin et al. 2001).

Two studies in LMICs found positive associations between violent victimization and perpetration of violence or delinquency. In Colombia, violent victimization at ages 12–17 was associated ($r = 0.31$) with violent behavior 2 years later (#22: Brook, Brook, and Whiteman 2007). In Puerto Rico, exposure to violence at mean age 9 was highest among children who had high but rapidly declining delinquency rates over the next 2 years, followed by children who had low but stable rates of delinquency (#31: Maldonado-Molina et al. 2009). In a matched sample of Puerto Rican children living in New York, exposure to violence was highest among children with a high and increasing rate of offending—a delinquency trajectory that did not exist in the sample living in Puerto Rico (Maldonado-Molina et al. 2009).

In summary, limited evidence suggests small associations between antisocial behavior and community poverty, drug availability, and violence in Colombia and South Africa. Individual studies report associations between violent victimization and later violence, but evidence was inconsistent regarding the association between victimization and conduct problems.

J. Cultural and Media Influences

The influence of media violence on children and youths is an important theme in the international literature (Rutter, Giller, and Hagell 1998; Huesmann et al. 2003; Bushman and Huesmann 2006). Its effects on children were studied in Poland as part of a large international project on this topic (Huesmann and Eron 1986). At baseline, Polish children aged 7–9 were interviewed about their favorite television programs, which were then coded by research staff for violent content. Preference for violent television programs was associated with child aggression over a 3-year period ($r = 0.14$ for both boys and girls), independently of baseline levels of aggression (#30: Frączek 1986; Groebel 1988) and also independently of child IQ, parenting factors, and parental social class. Associations between violent television viewing and aggression in matched samples in HICs were for boys and girls, respectively, $r = 0.15$ and 0.14 in the United States; $r = 0.08$ and 0.00 in Australia; $r = 0.21$ and 0.65 in Finland; and $r = 0.29$ and 0.52 in Israel, adjusting for baseline aggression (Groebel 1988). Hence, associations varied considerably between countries, and the small correlations in Poland were most similar to those in the United States. In Colombia, 12–17-year-old males who reported a preference for violent television also reported more violent behavior ($r = 0.14$) 2 years later (#22: Brook, Brook, and Whiteman 2007). Of course, this association could reflect proviolent attitudes causing a preference for both violent television and violent behavior.

Cultural beliefs about masculinity and sexual entitlement may facilitate perpetration of intimate partner violence (Santana et al. 2006; Jewkes et al. 2011). Believing in male sexual entitlement was investigated as a possible risk factor for perpetrating intimate partner violence in a study in three towns in South Africa and Tanzania (#35: Wubs et al. 2013). Adjusting for baseline violence at ages 10–18, adolescents who believed in male sexual entitlement were more likely to perpetrate intimate partner violence 6 months later in all three study sites (OR = 1.3 in Cape Town; OR = 1.6 in Mankweng; OR = 1.8 in Dar es Salaam), although the association persisted to a 1-year follow-up only in Cape Town (OR = 1.3).

A unique investigation of the effects of "acculturation" and "cultural stress" was conducted in San Juan, Puerto Rico, and in a matched sample of Puerto Rican families in New York. When children were aged 5–13, children and parents were assessed for levels of "acculturation" (meaning

how much they used English and were integrated into US cultural norms) and "cultural stress" (meaning how much distress they experienced from pressure to adapt to US cultural norms). Children's conduct problems were predicted only by parental acculturation and cultural stress (r = 0.15 and 0.13, respectively), and only in the San Juan sample, not in the matched New York sample (#31: Duarte et al. 2008). However, children's delinquency rates did vary according to their own levels of acculturation in San Juan: children who showed initially high and then declining levels of delinquency over 2 years had higher levels of acculturation than children in the nonoffending group and children in the stable but moderate delinquency group (#31: Maldonado-Molina et al. 2009; Jennings et al. 2010); this difference was not observed in the matched New York sample.

In summary, there are few longitudinal studies on the influence of cultural and media influences on antisocial behavior in LMICs. Small associations were observed between television violence and antisocial behavior. A single study in South Africa found short-term associations between beliefs about male sexual entitlement and intimate partner violence. One study found a weak association between the degree of family integration into US culture and the development of antisocial behavior among Puerto Rican children.

K. Relative Strength of Predictors and Comparison of Results with Those of High-Income Countries

In this section, we consider the relative size of risk factor associations estimated in the meta-analyses of studies in LMICs and how those results compare with findings from existing similar meta-analyses of longitudinal studies in HICs. To compare like with like, we examine bivariate associations from the current review while recognizing that these are less informative regarding causal inference. We used findings from prior meta-analyses that examined a wide range of risk factors in HICs (Lipsey and Derzon 1998; Derzon 2010; Tanner-Smith, Wilson, and Lipsey 2013), as well as searching for additional meta-analyses of individual risk factors in bibliographic databases and David Farrington's recent systematic review of reviews (Farrington, Gaffney, and Ttofti 2017). Additional meta-analyses of bivariate associations based on longitudinal studies from HICs were located only for aggression (Olweus 1979) and very low birth weight/prematurity (Aarnoudse-Moens et al. 2009). Note that in the latter review, the cutoff for very low birth weight (<1,500 grams) was lower than that for low birth weight (<2,500 grams) in our review.

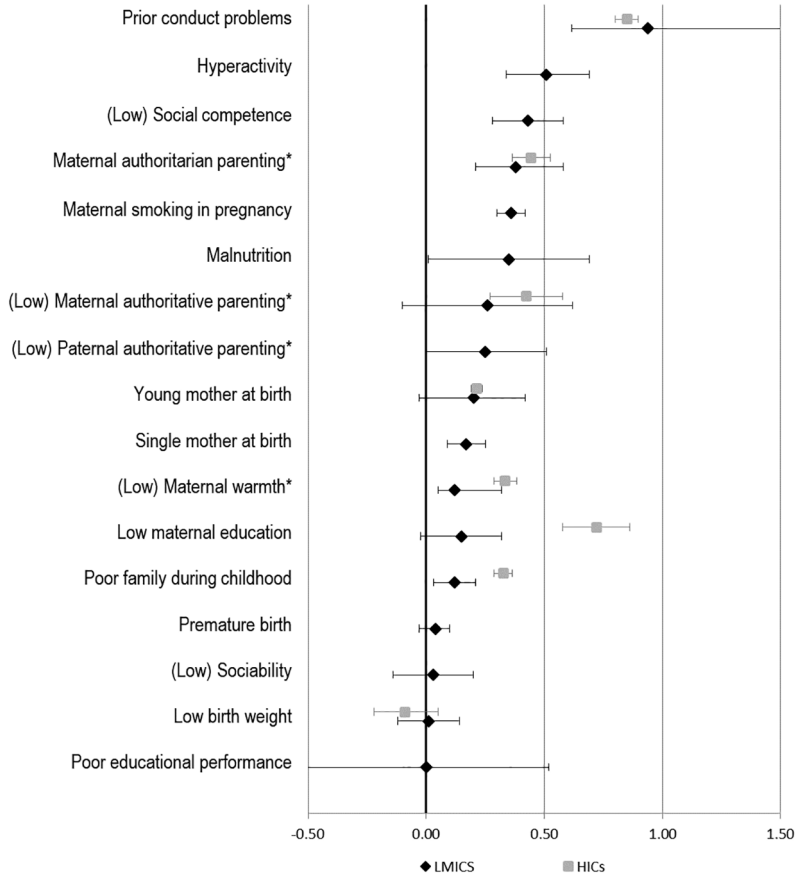

FIG. 3.—Longitudinal predictors of child conduct problems: average bivariate associations (*d* and 95 percent confidence interval). * Results refer to aggression or conduct problems with aggression.

Figures 3 and 4 show the pooled bivariate associations between risk factors and child conduct problems and youth violence in LMICs, ordered by size. Consistent with evidence from HICs (Lipsey and Derzon 1998; Tanner-Smith, Wilson, and Lipsey 2013), the strongest associations in LMICs relate to prior measures of antisocial behavior: prior conduct problems predicting later conduct problems and drug use and conduct problems predicting violence. The next-strongest predictors of conduct problems in LMICs were hyperactivity, low social competence, maternal

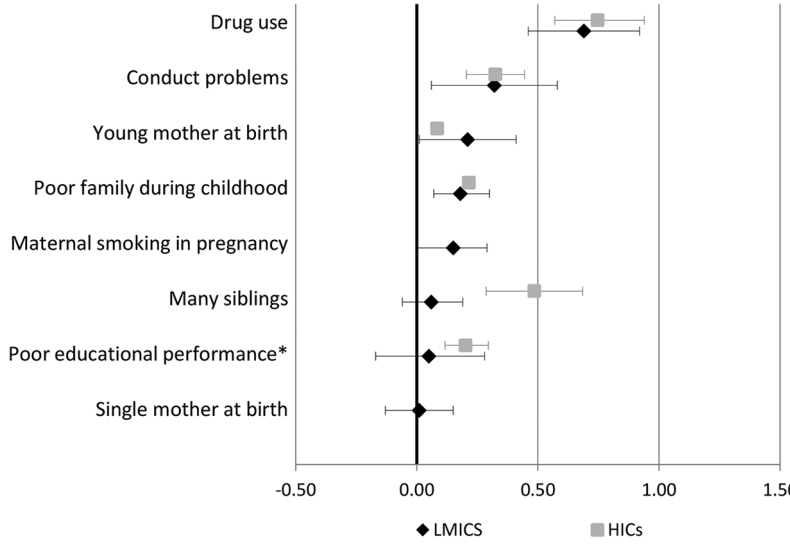

FIG. 4.—Longitudinal predictors of youth violence: average bivariate associations (*d* and 95 percent confidence interval). * Results for LMICs refer to intimate partner violence.

authoritarian parenting, maternal smoking in pregnancy, and malnutrition, with associations ranging from $d = 0.35$ to 0.51. For violence, the next-strongest risk factors, after prior antisocial behavior, were having a young mother at birth, family poverty during childhood, and maternal smoking in pregnancy, but the strength of these associations was small ($d = 0.15$ to 0.21). Associations for comparable constructs assessed in HICs (also shown in figs. 3 and 4) were generally similar or slightly stronger compared with those from LMICs. In fact, the only significant and large differences were for low maternal education and having a poor family, associated more strongly with conduct problems in HICs (both $p < 0.001$), and having many siblings, which was also more strongly associated with violence in HICs ($p < 0.001$).

IV. Discussion

We identified 39 longitudinal studies of child and youth antisocial behavior in low- and middle-income countries. This is a remarkable number of studies, given that prior reviews have been based almost exclusively on surveys in WEIRD populations in HICs. Studies in LMICs variously ex-

amined the roles of individual factors, child rearing processes, adverse childhood experiences, family characteristics, and peer, school, community, and cultural factors in the development of antisocial behavior, although for a number of risk factors, evidence in LMICs was sparse. Below, we discuss key theoretical issues related to the findings, focusing on the following general themes: global replicability of risk factors, the stability of antisocial behavior through time, paradoxical cross-country rates of conduct disorder and serious violence, early childhood as a possible sensitive period, the role of parenting factors, and some striking null findings that emerged in the review.

A. Global Risk Factors for Antisocial Behavior?

This review of risk factors for antisocial behavior in LMIC countries was motivated, in part, by a fundamental question of criminology: Do theories of offending and antisocial behavior have universal validity across all human societies? Or are there differences between societies, not only in the prevalence of causal mechanisms but also in their effects?

Many developmental and life course theories in criminology were developed in the 1990s. They responded to an increasing set of regularities, based on a growing number of longitudinal studies in HICs, that required explanation. Prominent theories developed in this period include, for example, Terrie Moffitt's (1993) dual taxonomy of offending behavior, Thornberry and Krohn's (Thornberry et al. 1994; Thornberry and Krohn 2005) interactional theory of antisocial behavior, Sampson and Laub's (1993) age-graded informal control theory, and Farrington's (2003) integrated cognitive antisocial potential theory; others are described by Farrington (2005*b*).

Few if any of these life course and developmental theories in criminology specify the range of societies and contexts that they apply to. An exception is Moffitt's dual taxonomy in that the adolescence-limited group is believed to reflect underlying tensions associated with the transition from childhood to adulthood that are specific to modern societies. In contrast, most theories implicitly assume that the causal mechanisms involved in the stability and change of antisocial behavior apply to all societies, at all times, in all places.

The present review has brought together a previously unknown wealth of regularities and evidence on risk factors in LMICs. In the broadest sense, findings on the patterning of risk factors are consistent with what has been found in HICs. Measures of underlying psychological propen-

sity show the highest associations with antisocial behavior over time, proximal risk factors tend to be more consistently associated, and distal risk factors generally have weak associations with behavioral outcomes. This first set of findings points to generalizability of results across the globe.

While important, these regularities provide limited insight into whether the life course theories developed in criminology have universal validity, let alone which theory is more suited to explain the empirical regularities. The reason is that, although average risk factor associations were generally similar between LMICs and HICs, heterogeneity was common between individual studies in LMICs. We emphasize that this could be primarily an artifact of different methodologies applied across surveys; however, it is also possible that it reflects true differences in risk factor effects between geographic locations and cultural groups in LMICs.

This systematic review consists of 39 studies from five continents: 13 studies were conducted in Asia, eight in South America, seven in Africa, seven in Europe, and four in North America, which entail diverse economic conditions, societies, and cultures. As discussed by Schonberg and Shaw (2007), variations in socioeconomic surroundings may alter the effects of individual- and family-level risk factors because of multiplicative effects of risk factors when they accumulate. Also, societies differ along other, broader, cultural dimensions that could also alter proximal mechanisms in the development of antisocial behavior. Major cultural dimensions identified in cross-national studies include individualism-collectivism, uncertainty avoidance, masculinity-femininity, power distance, long- and short-term orientation, and indulgence-restraint (Hofstede and Hofstede 2001); traditionalist values versus secular-rational values, survival values versus self-expression values (Inglehart, Basanez, and Moreno 1998); and tight versus loose cultures (Gelfand et al. 2011). As well as influencing the prevalence rates of risk factors, such as particular parenting practices (Lansford et al. 2005; Bornstein 2012), these sociocultural dimensions could interact with proximal processes to produce different risk factor effects (Lansford 2010).

Cultural factors relating to discipline, moral development, and tolerance of deviance may be particularly relevant in influencing individual- and family-level risk factors for antisocial behavior. For example, Rutter (1999) argued that the link between a risk factor and an outcome may depend on whether either variable denotes an "illegitimate" behavior within a cultural context. We examined various constructs whose norma-

tive connotations vary across settings. These include, for example, parental corporal punishment, school bullying, gender-based violence against women, parental separation, breast feeding, and premarital sex. Unfortunately, however, the small number of studies in LMICs for each specific variable, and the lack of information about normative expectations in each study context, make it impossible to say whether normative context or other macro-level variables do moderate associations between putative risk factors and outcomes. For the same reason, it is not possible to conclude whether current evidence better supports the hypothesis of "multiplicative effects" of risk factors (stronger effects in contexts of social disadvantage) or the "social push" hypothesis (weaker effects of biological risk factors in disadvantaged environments).

We highlight three main methodological influences that could also give rise to the heterogeneity observed in results across LMICs: assessment instruments, sources of information, and variables adjusted for in analyses. First, when studies use different instruments to assess the same variable, results could differ because of different validity or reliability levels of each instrument. Even when the same instrument is used across studies, variance in item functioning may mean that results differ because of a lack of adequate cross-cultural adaptation of instruments. Second, variations in the informants used to collect data, on both risk factors and outcomes, could cause variations in the findings. For example, parental reports and child self-reports of maltreatment exposure are likely to have very different validity, and both were used in different studies. Third, heterogeneity in effects may also result from different confounding variables adjusted for in each study. Even when considering only bivariate associations, different "confounding structures" across social settings—the degree of social patterning of risk factors—could give rise to different associations.

Therefore, while the amount of evidence on risk factors for antisocial behavior in LMICs is far greater than we had expected before embarking on this work and includes some intriguing individual results, the broad findings, comparing both across and between LMICs and HICs, do not resolve the fundamental issue of the universal validity of causal mechanisms for antisocial behavior. As we discuss below, this should motivate new studies across LMICs, particularly new cross-cultural collaborative research projects, using similar methodologies to test for context effects on risk factor associations.

B. Stability of Aggression in LMICs

In LMIC studies, the average continuity in aggressive behavior when measured with the same informant over a 3-year period was high (adjusted $r = 0.75$) and almost identical to the extent of continuity found in studies in HICs (Olweus 1979). However, there was also considerable variation in LMIC results that was not explained by differences in child age, the time lag between assessments of aggression, or several country-level characteristics, such as homicide rates or development levels. More recent evidence from HICs also demonstrates considerable heterogeneity in the stability of various types of antisocial behavior (Derzon 2001). This heterogeneity might relate to methodological issues, such as different instruments used, or it might be explained by the causal mechanisms underlying the stability of aggression. Olweus (1979) suggested that stability of aggression is caused by relatively constant individual characteristics or motivational systems. Current theories suggest that these tendencies are due to time-invariant genetic influences, neurocognitive impairments incurred in the first years of life, and stable personality characteristics, such as psychopathy or callous-unemotional traits (van Goozen et al. 2007; Frick and White 2008). It is hard to see how such time-constant factors could explain variation in the stability of aggression between contexts. However, "state-dependent" theories might offer more explanation. State-dependent theories propose that stability in aggression is primarily caused by continuity in the social environment. Continuity in social bonds, social learning processes, strains, and negative life events are cited as important causes (Eisner and Malti 2015). Importantly, changes in those same processes could also cause changes in the degree of stability in aggression. Therefore, according to theories of state dependency, different degrees of continuity in social conditions between LMICs could account for different levels of stability in aggression. Future research should test the different possible social mechanisms involved.

C. The Prevalence Paradox: International Rates of Conduct Problems and Serious Violence

Several studies in LMICs demonstrated some continuity in conduct problems through time and an association between conduct problems and later violence. This general continuity in antisocial behavior produces an apparent paradox, considering the fairly constant rates of conduct disorder found around the globe (Canino et al. 2010) in contrast to the enormous cross-country variability in levels of serious violence,

with rates of homicide ranging from about one per 100,000 persons in the United Kingdom to about 90 in Honduras (UN Office on Drugs and Crime 2013). How can these contrasting geographic patterns for conduct disorder and violence occur alongside continuity in antisocial behavior, including from conduct problems to violence? Why might countries with higher levels of violence not also have higher levels of child conduct disorder? One possible explanation concerns the aforementioned heterogeneity in levels of stability in antisocial behavior. For example, there might be stronger continuity of antisocial behavior in countries that have higher rates of violence. However, we found no evidence to support this hypothesis: the stability of aggression did not vary systematically with national homicide rates.

A second possible explanation for the puzzling differences in geographic patterns of conduct disorder and violence, alongside individual-level stability in antisocial behavior, concerns the specific subtypes of antisocial behavior being considered. Behavioral stability was strongest for aggression, but it was weaker for conduct problems and weaker still for continuity between childhood conduct problems and youth crime or violence (see also Derzon [2001] and Burt [2012] for similar findings in HICs). Hence, we believe that the quite constant rates of conduct disorders observed across geographic regions are compatible with varying levels of violence, simply because continuity from conduct problems to violence is not strong: childhood conduct problems are far from deterministic of future violence. It should also be considered that although rates of conduct disorder appear similar across cultures (Canino et al. 2010), rates of child behavior problems, as measured by the Child Behavior Checklist, show modest cross-national variability (Rescorla et al. 2012). Therefore, it is also possible that rates of serious violence do covary with levels of child behavior problems measured as symptom scores, but we are not aware of studies that have tested this hypothesis.

D. Early Childhood as a Sensitive Period of Development

The first 1,000 days of life are considered a critical window of opportunity to set children on a path of healthy development by ensuring adequate nutrition, cognitive stimulation, and safe and caring environments (Engle et al. 2007). Early health problems have been hypothesized to influence child behavior via effects on the developing brain, with possible risk factors including prenatal and postnatal malnutrition, tobacco and alcohol use in pregnancy, birth complications, brain injury, and exposure

to toxins (Liu 2011). However, in the current review, birth cohort studies in LMICs showed mostly weak or zero effects of several early health factors on antisocial behavior. For instance, one of the most consistent findings was the absence of an association between low birth weight and antisocial behavior—replicated across six studies and producing a pooled effect size of zero. Weak or null findings were also found for premature birth, birth complications, lead and mercury exposure, breast feeding, and zinc consumption. Results for the association between malnutrition and antisocial behavior were mixed, and although several studies reported positive associations between maternal smoking in pregnancy and antisocial behavior, the causal status of these findings is unclear, given the lack of genetically sensitive research designs in LMIC studies. More robust studies of maternal smoking in pregnancy have revealed null or weak effects on antisocial behavior in HICs (Jaffee, Strait, and Odgers 2012). Hence, the general conclusion must be that the evidence to date generally shows weak or no influence of early life health factors in the development of antisocial behavior in LMICs.

Weak effects of early health factors have also been reported in several longitudinal studies in HICs. For example, low birth weight was not an independent predictor of conduct problems or crime in a British birth cohort (Murray et al. 2010). However, the consistent null results in LMIC studies are striking, especially given that many LMICs have relatively poor neonatal health care provision (Lawn, Cousens, and Zupan 2005). The null and weak findings in LMICs may have implications for developmental theories that hypothesize particularly strong effects of early health factors in the context of high social risk, for example, Moffitt's (1993) theory of life course persistent antisocial behavior. However, to test such developmental theories adequately, future LMIC studies need to use repeated measures to distinguish trajectories of antisocial behavior according to age of onset and persistence through the life course. Also needed are studies of possible interactions between early health variables and social risk factors within LMIC settings, which are proposed as key processes in causing early onset and persistent antisocial behavior (Moffitt 1993).

E. Parenting Influences

Weak and null findings on early health factors do not imply that early childhood is not a sensitive period, as other types of early influences might be more important for the development of antisocial behavior.

In particular, several LMIC studies found associations between parenting practices measured in preschool years and subsequent conduct problems. Authoritarian parenting practices, such as coercive discipline, were positively associated with child antisocial behavior, whereas authoritative parenting practices, combining warmth and clear limit setting, predicted fewer behavior problems. However, these results were not all consistent, effect sizes were generally modest, and studies lacked more sophisticated designs for ruling out reciprocal causation and for disentangling the effects of parental behavior from other confounding variables.

Overall, the findings are at least moderately consistent with the notion that parenting practices are predictive of conduct problems and violence in LMICs, just as they are in HICs. It should be noted that effect sizes are modest in HICs, around $r = 0.2$ (Hoeve et al. 2009), as well as in our review. In particular, our findings are important in showing that in countries such as China, where authoritarian parenting values are thought to be more normative than in the West (Chao 1994), such parenting styles nevertheless are still associated with higher levels of conduct problems, just as they are in "Western" countries, including in the studies we examined in Poland and Russia. Similarly, positive, "authoritative" styles of parenting tended to be associated with lower levels of child conduct problems, just as they are in HICs, albeit with more inconsistent findings across LMIC studies.

Although there is a lack of clear-cut evidence for the causal role of parenting in the LMIC studies, confidence in the causal role of parenting as an intervention strategy comes from extensive evidence from randomized trials, both in the field and in lab conditions in HICs (Piquero et al. 2009, 2016; Leijten et al. 2015). Although the majority of parenting field trials are in HICs, an increasing number have been conducted in LMICs (Mejia, Calam, and Sanders 2012; Knerr, Gardner, and Cluver 2013; Leijten et al. 2016), and most of these trials show improvements in positive parenting and in child problem behavior, in a range of age groups from toddlerhood through teenage years. Furthermore, findings from systematic reviews of interventions are broadly consistent with our risk factor findings, suggesting that cultural variation in parenting need not necessarily be a barrier to transporting such programs across countries, cultures, and service contexts. Thus, effect sizes were equivalent for parenting interventions developed within a particular country, compared to those imported from abroad (Leijten et al. 2016). A second review suggested that effectiveness of parenting interventions when transported from one country to another was not dependent on the degree of similarity between

countries in cultural values or child and family policy regimes (Gardner, Montgomery, and Knerr 2015).

F. Striking Null Findings in LMICs

Early health factors had only weak associations with antisocial behavior in LMICs. Perhaps more surprisingly, several other potential risk factors also failed to have positive associations with antisocial behavior. For example, poor educational performance, maltreatment, large family size, low maternal education, and family poverty had notably weak or null associations. However, it would be wrong to assume that evidence in HICs provides a completely different, consistent set of positive results. With respect to some risk factors, null results in LMIC studies may reflect inconsistent evidence in the global literature. For example, the failed replication of an MAOA-abuse interaction in predicting conduct problems in a Brazilian study (Kieling et al. 2013) may reflect generally inconsistent results rather than anything specific about the Brazilian context (Duncan and Keller 2011).

However, some of our null findings were surprising, particularly those concerning the lack of effects of maltreatment on conduct problems or violence; albeit only three studies examined this topic, and so only tentative conclusions are warranted. There are several possible explanations for the differences between generally positive findings in HICs and the null findings from LMICs with regard to the association between child maltreatment and later antisocial behavior. First, there may be true differences. One possible explanation might be that harsh physical punishment and child maltreatment are more widespread and considered more normative in LMICs. This might lead more children to believe that harsh punishment is used as part of a planned strategy that is in their best interests, which might reduce some of its adverse effects (Lansford 2010; Vittrup and Holden 2010). Second, it is possible that the larger effects found in HICs (see, e.g., Wilson, Stover, and Berkowitz [2009] for the most comparable results in HICs) are due to the longer time periods between measures of exposure and outcome in studies in HICs and possible "sleeper effects"—whereby effects that are weak or undetectable at first strengthen and become measurable later. The time lags in the eight prospective studies in HICs included in the review by Wilson et al. (2009) range between 3 and 24 years, with many in the region of 10 years. The equivalent time lags in the three studies in our review were 3 years (de Assis et al. 2013), 1 year (Waller, Gardner, and Cluver 2014), and 7 years

(Thaler 2011)—a mean of 3.7. There is some evidence for "sleeper effects" in relation to corporal punishment and harsh parenting (Tanner-Smith, Wilson, and Lipsey 2013; Coley, Kull, and Carrano 2014), child sexual abuse (Putnam 2003; Smith, Ireland, and Thornberry 2005; Trickett, Noll, and Putnam 2011), and exposure to intimate partner violence (Vu et al. 2016). Third, it is also possible that differences are due to methodological factors, such as differences in types of child maltreatment considered as predictors (physical, sexual, psychological, neglect) or sources of reports (self-report, parental reports, administrative records).

G. Strengths and Limitations

We are not aware of any prior review that has synthesized, narratively or meta-analytically, evidence on longitudinal predictors of antisocial behavior across LMICs. This review, we believe, has several important strengths, including the enormous search efforts that went into locating studies in LMICs in multiple languages, the large number of eligible studies retrieved, meta-analytic synthesis of many risk factors, and comparisons made with findings from HICs. However, there are also important reasons to treat our findings with caution.

Importantly, almost none of the primary studies used methods that allow for strong causal inference. Apart from a few studies that used randomized trials to target specific risk factors or a single study that used twins to eliminate genetic confounding, nearly all studies relied on regression-based models to adjust for a limited number of possible confounding factors. An increasing range of advanced study designs and analytic methods can help improve causal inference about risk factors (Jaffee, Strait, and Odgers 2012), but these have been rarely used in studies in LMICs. In the context of regression-based studies, it was often unclear whether the covariates that were included in multivariate models really represented confounding factors that should be controlled for when estimating causal effects, or whether they actually measured mediating mechanisms on the causal pathway between the risk factor and behavioral outcome. Adjusting for mediating mechanisms can bias estimates of risk factor total effects downward (Schisterman, Cole, and Platt 2009), and considerable care is needed in selecting variables for inclusion in multivariate models in future research. A related point is that researchers sometimes included earlier measures of the outcome variable in multivariate models. By doing this, the coefficient for the risk factor will represent

its association with change in the outcome through time, which may not be the objective of the study. These considerations raise doubts about how to interpret some individual study findings. However, our meta-analyses excluded such studies when calculating pooled effect sizes. Most prior meta-analyses of risk factors in HICs (Hawkins et al. 1998; Lipsey and Derzon 1998; Derzon 2010; Tanner-Smith, Wilson, and Lipsey 2013) have synthesized only bivariate associations, and our meta-analyses also mostly synthesized only bivariate associations, although we were able to pool some covariate-adjusted effect sizes.

As in HICs, the longitudinal studies in LMICs used many different sampling methods, follow-up periods, informants, and measures. Hence, heterogeneity in results seems as likely to reflect methodological variations as possible true differences in effects of predictors across different LMIC contexts. Unfortunately, relatively few primary studies were available for each risk factor considered; hence, it was rarely possible to investigate the population characteristics or study features that might explain any observed heterogeneity.

Although we included studies from 14 different LMICs, the vast majority came from Brazil and China, two powerful countries in their respective regions, but with vastly different cultures and sociopolitical structures. Such large, medium-income countries also dominate in other areas of research in LMICs; for example, a systematic review on predictors of physical activity in LMICs found most evidence in Brazil and China (Sallis et al. 2016). Notably, apart from studies in three countries (China, the Philippines, and South Africa), there was no other evidence available from Asia or Africa. Also, although violence is a critical issue affecting many LMICs, of the 39 studies reviewed here, only seven provided data on predictors of violence. Therefore, the evidence base is particularly weak for drawing conclusions about predictors of violence, despite the major impact that it has on many LMICs.

A further limitation in the evidence we reviewed concerns the high likelihood of reporting and publication bias in observational studies, which may explain some of the heterogeneity and failure to replicate across studies, in both HICs and LMICs. Outcome reporting bias has been well documented in randomized control trials (Smyth et al. 2011), and it is likely to be a greater source of bias in observational studies, where prespecified protocols are rarer than for trials, analytic strategies are more varied, and data may be available for many investigators to mine. Where weak associations were found in individual studies, these might be accounted for

by methodological limitations, in terms of low-quality measures or high rates of attrition, for example. However, some weak and null findings were replicated across multiple studies with different methodologies, increasing confidence that those variables really were not associated with antisocial behavior.

H. Implications for Research

Some key issues confronting LMIC populations have not received adequate research attention in relation to the development of antisocial behavior. Experiences of civil conflict and migration are major issues that require study in LMICs. Other severe traumas commonly experienced in LMICs, such as female genital mutilation, being orphaned by AIDS, and stresses associated with child labor, are important areas for future research. Research with a resilience framework would be particularly valuable to consider ways in which individuals may cope with such traumas in LMIC contexts. Another research priority is to develop understanding of how macro-level influences that are known to covary with violence, such as illegitimate state institutions and national levels of income-inequality (Nivette 2011; Nivette and Eisner 2013), interact with individual development to cause antisocial behavior in LMICs. New studies should increase construct and internal validity by using multiple informants, well-validated and culturally adapted measures, and appropriate designs to increase understanding of causal mechanisms, such as sibling and twin studies, natural experiments, and analytic approaches such as propensity scores, analysis of within-individual change, and instrumental variables.

As new studies are conducted and additional results become available from more diverse settings across LMICs, it will become possible to assess the robustness of the current findings and identify causes of heterogeneity between study results. Understanding of the processes involved in the development of conduct problems, aggression, and delinquency across different cultures could be substantially enhanced from comparative longitudinal studies. These would be studies that are based on comparable sampling strategies, measurement tools, and analytic approaches in two or more populations with different cultural, economic, or social characteristics. Such studies would allow research to rule out many of the possible methodological reasons for heterogeneity between studies and provide a much better basis for understanding the extent to which there is cross-cultural variation in mechanisms leading to antisocial behavior. David Farrington (2001) laid out a program for comparative

cross-national longitudinal surveys in Europe, which would investigate to what extent criminal careers, risk factors, and intervention effects are the same across participating countries. He recommends correlating the strength of risk factor associations across sites (see, e.g., Farrington et al. 2015). Even more ambitiously, a similar research program could be advanced across LMICs. An existing consortium of birth cohort studies in Brazil, Guatemala, India, the Philippines, and South Africa coordinates research on health, nutrition, and human capital in those settings (Richter et al. 2012). New projects could compare influences on the development of antisocial behavior and violence across LMICs.

A series of measures could help to improve comparability of developmental risk factor research across LMICs and human societies more generally. First, it seems important that studies conducted in different cultures use comparable and cross-culturally validated instruments to measure core constructs such as parenting, self-control, or aggression. Organizations such as the UNICEF Office of Research or the World Health Organization can help to promote good practice through recommendations. Second, developmental studies should be encouraged to publish research protocols similar to protocols for experimental studies. This would help to improve understanding of which putative risk factors were measured in a study and to what extent published results are based on fishing expeditions or on hypothesis-driven deductive reasoning.

Future syntheses of research on antisocial behavior should take a global view. Given the striking restriction of previous reviews to literature from HICs, we aimed to synthesize the existing evidence in LMICs. However, future reviews could encompass all world regions, increasing both the statistical power for quantitative syntheses of results and the potential to examine methodological and substantive factors that explain heterogeneity in findings around the globe.

V. Conclusion

A large body of longitudinal research on antisocial behavior from LMICs has been excluded from most reviews on this topic. The most robust findings that emerge from these studies are that conduct problems tend to persist; dimensions of comorbid psychopathology such as low self-control, hyperactivity, and sensation seeking are also associated with antisocial behavior; many risk factors appear to have roughly the same average effects as when studied in HICs; and some early health factors have

weak or null effects. The time is ripe for a new generation of collaborative research, with carefully coordinated methods, to identify global and context-specific mechanisms involved in the development of antisocial behaviors.

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