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Review Article

Environmental Risk Factors of Conduct Disorder: An Overview of Meta-Analyses

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Abstract

Objective: Conduct disorder is one of the most common disorders of childhood and adolescence. This disorder imposes high costs on the individual, family and community. Understanding the risk factors associated with conduct disorder can provide a comprehensive picture of the disorder. Therefore, the aim of this study is to investigate the risk factors related with conduct disorder.
Method: We included meta-analyses that reported one or more risk factors of conduct disorder. We searched PubMed and Scopus until July 19, 2025. One author assessed the quality of the included studies using the ROBIS, and two authors extracted relevant data independently.
Results: We found 12 articles that met the inclusion criteria, from which data pertaining to 17 meta-analyses were extracted. The risk factors identified by the meta-analyses were as follows: severe psychiatric disorders in parents, postnatal exposure to second-hand smoke, atopic dermatitis, being children of alcoholics, prenatal alcohol exposure, maternal smoking during pregnancy, maternal alcohol use during pregnancy, overweight/obesity, maternal perinatal depression, preconception overweight, and preconception obesity.
Conclusion: Drawing on 17 meta-analyses, this study provides a comprehensive synthesis of the risk factors associated with conduct disorder. The findings can inform policymakers and healthcare professionals to develop targeted interventions, such as public health campaigns and support programs for at-risk families, to mitigate these risks. Furthermore, this study highlights the gaps in the existing literature, including the reliance on older studies and methodological limitations, paving the way for future research to address these shortcomings and strengthen the evidence base.

Key words: *Conduct Disorder; Epidemiology; Meta-Analysis; Review; Risk Factors*

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Due to their prevalence, early onset, and impact on children, families, and communities, childhood and adolescent mental disorders, including conduct disorder, are public health concerns (1, 2). Conduct disorder is a psychiatric diagnosis characterized by a repetitive and persistent pattern of behavior, in which fundamental rights of others as well as age-appropriate social norms or laws are violated. Conduct disorder is a clinical condition affecting the mental health of children and adolescents under 18 years of age, which involves a multitude of social, emotional and behavioral problems with high costs for society. Aggressive behaviors toward other people or animals, bullying as well as deception, theft or other serious violations of the law such as staying out at night despite parental opposition are the main features of this disorder (3-5).

Conduct disorder is associated with other psychiatric disorders such as substance use, antisocial personality disorder, and attention deficit/hyperactivity disorder (ADHD). It is also related to poor educational outcomes, physical health problems, early pregnancy, and higher rates of automobile accidents and injuries (6-8).

Estimates of the prevalence of conduct disorder vary from region to region (9). However, the overall prevalence of this disorder globally is 8%, specifically 7% in women and 11% in men (10). The role of genetic factors in the occurrence of this disorder has been previously demonstrated (11). It is worth noting that environmental factors can influence the importance of genetic factors in conduct disorder (12). Various studies have indicated the role of environmental risk factors in the development of conduct disorder, including socioeconomic disadvantage of the family, maladaptive parental behavior, maternal smoking during pregnancy, childhood exposure to abuse/violence (13, 14). In addition, various meta-analyses have been conducted worldwide to investigate the risk factors for conduct disorder (15-19). Xie *et al*. conducted a meta-analysis of 6 studies (n = 94091) and found that children and adolescents with atopic dermatitis were 49% more likely to develop conduct disorder (OR: 1.494, 95% CI: 1.230, 1.815; I^2: 39) (19). In a meta-analysis of 19 cohort studies (n = 32,757), Wetherill *et al*. discovered that children of alcoholics were more than 2.5 times as likely to have conduct disorder (OR: 2.64, 95% CI: 2.29, 4.06; I^2: 96). In the same meta-analysis of four studies (n = 4,759), they stated that prenatal alcohol exposure increased the likelihood of a child developing conduct disorder by more than threefold (OR: 3.06, 95% CI: 1.62, 5.75; I^2: 98) (18).

Conduct disorder is a major public health concern due to its high prevalence, the challenges it poses to children, adolescents, and their families, as well as the substantial societal costs associated with conduct disorder (3, 10, 20). Given the importance of understanding conduct disorder, numerous researchers have investigated its environmental risk factors through systematic reviews and meta-analyses. However, the growing number of meta-analyses highlights the need for a comprehensive synthesis to consolidate the findings and provide a richer understanding of the risk factors. Additionally, the quality of the existing meta-analyses remains uncertain, and one objective of this study is to evaluate the methodological quality of these meta-analyses. To our knowledge, no umbrella review has been conducted to systematically evaluate and integrate these meta-analyses while also assessing their quality. This study aims to address this gap by reviewing existing meta-analyses that identify risk factors for conduct disorder. We anticipate that our findings will offer a comprehensive perspective and valuable insights, serving as a resource for future research and clinical practice.

Materials and Methods

Search Strategy to Identify Relevant Studies

This systematic overview of meta-analyses was reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (21). We systematically searched two international databases, namely PubMed and Scopus until July 19, 2025. The search strategy includes MeSH terms and free keywords as follows: (“Conduct disorder*” OR “Conduct problem*” AND Risk* AND "systematic review* OR review* OR meta-analysis OR metaanalysis OR "meta analysis"). Additionally, we used systematic (review[pt] OR meta-analysis[pt] OR systematic[sb]) in PubMed and in Scopus we limited the DOCTYPE to “review.” Each database was searched without restrictions on region and year of publication.

Risk of Bias (Quality) Assessment

The quality of the included meta-analyses was assessed using the ROBIS tool (Risk of Bias in Systematic Reviews), a rigorously developed instrument designed specifically to evaluate the risk of bias in systematic reviews and meta-analyses. ROBIS consists of three phases: assessing relevance, identifying concerns with the review process across four domains (study eligibility criteria, identification and selection of studies, data collection and study appraisal, and synthesis and findings), and making an overall judgment on the risk of bias. Each domain is evaluated based on predefined criteria with an emphasis on transparency and methodological rigor (22).

Inclusion and Exclusion Criteria

Studies fulfilling the following criteria were included: they used meta-analysis, reported at least one risk factor of conduct disorder, and were peer-reviewed published papers. The following studies were excluded: primary studies, reviews without meta-analysis, duplicate publications, and meta-analyses that calculated the risk factor for conduct disorder along with other disorders and did not calculate an effect size for conduct disorder alone.

Data Extraction

Two investigators extracted the data independently, and differences between them were resolved by a third investigator. The data extraction checklist included the name of the first author, publication year, number of databases searched, number of included studies, number of participants, design of included studies, risk factors, risk of bias assessment tool, reported effect size, and p-value.

Results

Literature Search

A total of 492 articles were retrieved from the PubMed and Scopus databases. A total of 114 articles were excluded due to duplicates. One reviewer reviewed the titles and abstracts of the remaining 378 articles. A total of 64 articles were identified for full-text review. Two reviewers independently assessed the articles, and 12 articles were ultimately selected. Disagreements between the two researchers were resolved through consensus. The process of searching and examining articles is shown in Figure 1.

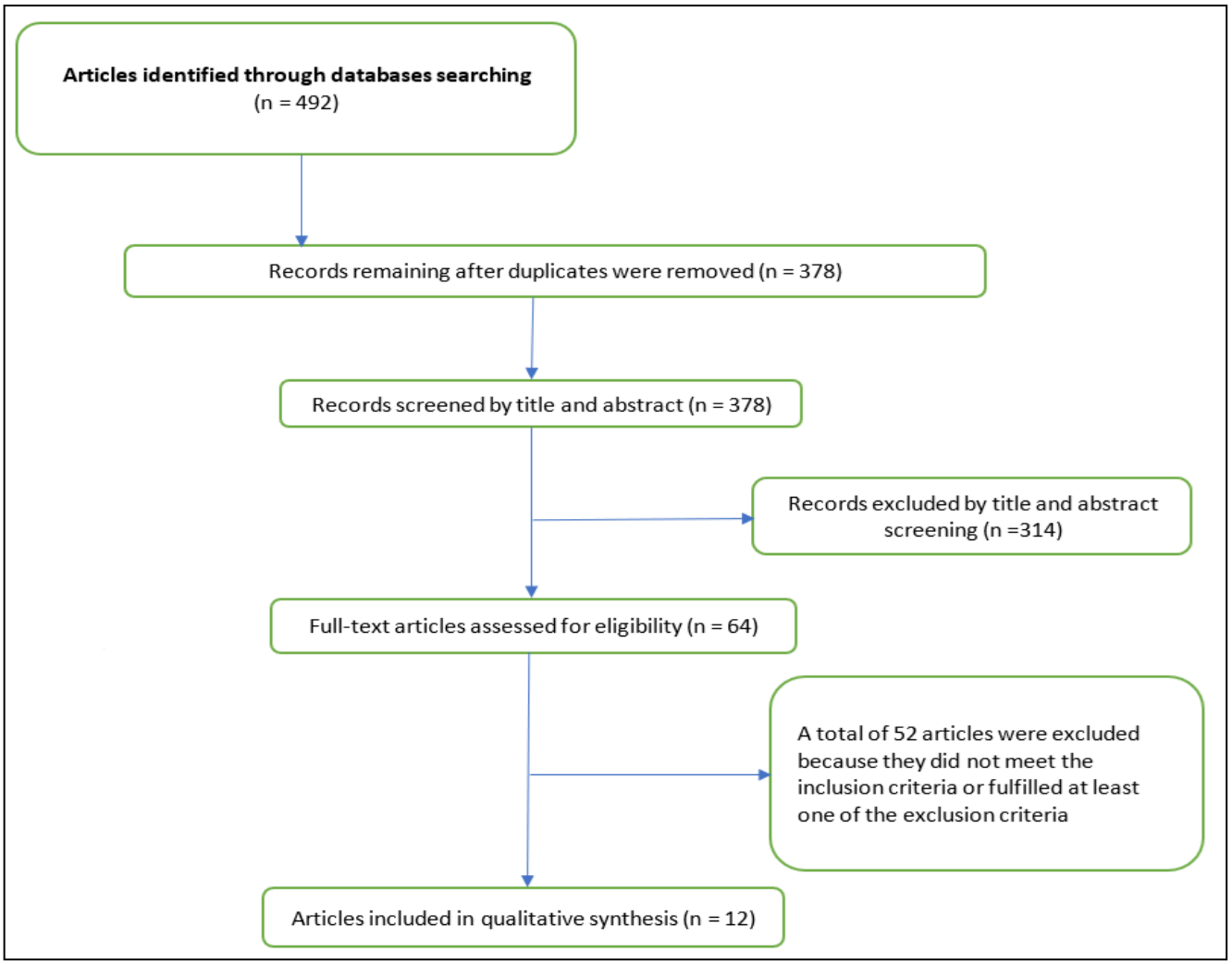

Figure 1. PRISMA Flow Diagram of the Study Selection Process for the Overview of Environmental Risk Factors for Conduct Disorder

Study Characteristics

A total of 12 articles were included (15-19, 23-29). Out of 12 included articles, data from 17 meta-analyses were extracted. The lowest and highest number of studies included in the meta-analyses were three (17) and 33 studies (16), respectively. Due to the heterogeneity of the extracted risk factors and the differences in the types of reported effect sizes, we were unable to perform a meta-meta-analysis. Most studies reported OR and RR. One study reported r (23) and one study reported SMD (25). One meta-analysis published in 1990 also reported mean effect sizes, most of which were Pearson correlations according to the author (30).

Identified Risk Factors of Conduct Disorder

According to the results of this study, severe psychiatric disorders in parents (RR: 1.787; 95%CI: 1.049, 3.047) (24), postnatal exposure to second-hand smoke (OR: 1.33; 95%CI: 1.00, 1.77) (26), atopic dermatitis (OR: 1.494; 95%CI: 1.230, 1.815) (19), being children of alcoholics (OR: 2.64; 95%CI: 2.29, 4.06) (18), prenatal alcohol exposure (OR: 3.06; 95%CI: 1.62, 5.75) (18), maternal smoking during pregnancy (OR: 2.06; 95%CI: 1.67, 2.54) (17), maternal alcohol use during pregnancy (OR: 2.11; 95%CI: 1.42, 3.15) (17), overweight/obesity (OR: 1.324; 95%CI: 1.175, 1.493) (15), preconception obesity (OR: 1.16; 95%CI: 1.00, 1.35) (27), preconception overweight (OR: 1.07; 95%CI: 0.93, 1.23) (27), left-behind children (LBC) (RR: 1.10; 95%CI: 0.97, 1.26) (28), and maternal perinatal depression (OR: 1.41; 95%CI: 1.04, 1.77) (29) were identified as risk factors for conduct disorder. The extracted information from the meta-analyses is summarized in Table 1.

Table 1. Data Extraction Form for the Overview of Environmental Risk Factors for Conduct Disorder

First Author (Year)	Number of Databases Searched (Date Range)	Number of Included Studies (Total Number of Participants)	Study Design of Included Studies	Risk of Bias Assessment Tool	Risk Factors	Effect Size	Quantity (95% CI)	P-value	I^2 (%)
Anderson et al. (2023) (23)	2 (2000-2022)	4 (N = 1628)	Longitudinal, cross-sectional	*	Parental drug use disorders	r	0.35 (0.16, 0.51)	< 0.001	81.81
Ayano et al. (2021) (24)	4	5	Cohort, Case-control	Newcastle-Ottawa Scale (NOS)	Severe psychiatric disorders in parents	RR	1.787 (1.049, 3.047)	0.430	0
Fellmeth et al. (2018) (25)	9 (Inception-2018)	6 (N = 8296)	Cross-sectional, cohort, case-control	NOS	Left-behind children and adolescents with at least one migrant parent	SMD	0.16 (0.04, 0.28)	0.000	84
Huang et al. (2021) (26)	4 (Inception-2020)	4	Cross-sectional and cohort	NOS and 11-item checklist which was recommended by the Agency for Healthcare Research and Quality (AHRQ)	Postnatal exposure to second-hand smoke	OR	1.33 (1.00, 1.77)	0.051	61.5
Xie et al. (2019) (19)	8 (Inception-2018)	6 (N = 94091)	Cohort, case control, cross-sectional	NOS	Atopic dermatitis (AD)	OR	1.494(1.230, 1.815)	< 0.001	39
Wetherill et al. (2018) (18)	3 (Inception-2017)	19 (N = 32757)	Cohort	*	children of alcoholics (COA)	OR	2.64(2.29, 4.06)	*	96

Wetherill et al. (2018) (18)	3 (Inception-2017)	4 (4759)	Cohort	*	prenatal alcohol exposure (PAE)	OR	3.06(1.62, 5.75)	*	98
Ruisch et al. (2018) (17)	3 (1990-2016)	25 (N = 115,297)	Observational Studies	NOS	Maternal smoking during pregnancy	OR	2.06 (1.67, 2.54)	< 0.001	92.9
Ruisch et al. (2018) (17)	3 (1990-2016)	9 (N = 50626)	Observational Studies	NOS	Maternal alcohol use during pregnancy	OR	2.11 (1.42, 3.15)	< 0.001	76.01
Ruisch et al. (2018) (17)	3 (1990-2016)	3 (N = 1,263)	Observational Studies	NOS	Maternal cannabis use during pregnancy	OR	1.29 (0.93, 1.81)	0.436	0
Reid and Crisafulli (1990) (16)	5(1957-1988)	33	*	*	Marital Discord	Mean Effect Size (The majority of studies reported the Pearson correlations (r))	0.16	*	*
Nujic et al. (2021) (15)	5 (Inception-2020)	13(79027)	Cross-sectional	The Joanna Briggs Institute Critical Appraisal tool	overweight/obesity	OR	1.324 (1.175, 1.493)	> 0.01	86.68
Nujic et al. (2021) (15)	5 (Inception-2020)	4(14502)	Longitudinal	The Joanna Briggs Institute Critical Appraisal tool	overweight/obesity	OR	1.107 (0.886, 1.382)	0.37	*
Duko (2024) (27)	4 (Inception-2024)	6	Observational Studies	NOS	Preconception obesity	OR	1.16 (1.00, 1.35)	0.083	48.6
Duko et al. (2024) (27)	4 (Inception-2024)	7	Observational studies	NOS	Preconception overweight	OR	1.07 (0.93, 1.23)	0.001	73.6

Lin et al. (2025) (28)	6 (2020-2024)	6(24009)	Cross-sectional, Cohort, Longitudinal	The Joanna Briggs Institute Critical Appraisal tool	Left-behind children (LBC)	RR	1.10 (0.97, 1.26)	> 0.05	60.30
Tusa et al. (2025) (29)	6 (Inception-2023)	7	Observational studies	NOS	Maternal perinatal depression	OR	1.41 (1.04–1.77)	*	95.5

*: Not reported

Methodological Quality

Based on the quality assessment of studies using the ROBIS tool, varying levels of bias were identified. Several articles demonstrated acceptable quality in Phases 2 and 3 across different domains. For instance, studies (15) and (25) consistently showed a "LOW" status in all domains, indicating high quality and minimal risk of bias. In contrast, studies (16) and (18) displayed "HIGH" levels of bias in multiple domains. These results highlight the variability in study quality and the need for improvements in the design and execution of certain studies (Table 2).

Table 2. Risk of Bias Assessment for the Overview of Environmental Risk Factors for Conduct Disorder Using the Risk of Bias in Systematic Reviews (ROBIS) Tool

Author / Year	Identifying Concerns with the Review Process				Judging Risk of Bias
	Study Eligibility Criteria	Identification and Selection of Studies	Data Collection and Study Appraisal	Synthesis and Findings	
Anderson et al. (2023) (23)	LOW	HIGH	LOW	LOW	LOW
Ayano et al. (2021) (24)	HIGH	HIGH	LOW	LOW	HIGH
Fellmeth et al. (2018) (25)	LOW	LOW	LOW	LOW	LOW
Huang et al. (2021) (26)	LOW	HIGH	HIGH	LOW	LOW
Nujic et al. (2021) (15)	LOW	LOW	LOW	LOW	LOW
Reid and Crisafulli (1990) (16)	HIGH	LOW	HIGH	HIGH	HIGH
Ruisch et al. (2018) (17)	UNCLEAR	HIGH	HIGH	LOW	HIGH
Wetherill et al. (2018) (18)	HIGH	HIGH	HIGH	HIGH	HIGH
Xie et al. (2019) (19)	HIGH	LOW	LOW	LOW	LOW
Duko et al. (2024) (27)	HIGH	HIGH	LOW	LOW	LOW
Lin et al. (2025) (28)	LOW	HIGH	LOW	LOW	LOW
Tusa et al. (2025) (29)	HIGH	LOW	LOW	LOW	LOW

Discussion

The aim of this study was to review published meta-analyses on risk factors for conduct disorder. Information originating from 17 meta-analyses was extracted from 12 articles.

The studies included in this review highlight the significant contribution of environmental risk factors such as exposure to second-hand smoke (26), maternal smoking during pregnancy (17), and prenatal alcohol exposure (18) to an increased likelihood of conduct disorder. These findings underscore the profound influence of environmental conditions on mental health outcomes and emphasize the need for comprehensive prevention and intervention strategies targeting these modifiable factors.

Policymakers and mental health professionals must prioritize public health campaigns aimed at reducing these environmental risks. For instance, increasing awareness about the dangers of prenatal exposure to tobacco and alcohol, alongside implementing stricter regulations on smoking and alcohol consumption during pregnancy, could help mitigate these risks. Furthermore, offering supportive programs for at-risk families, including parenting education and access to mental health services, may play a critical role in reducing the prevalence of conduct disorder in future generations.

By addressing these environmental risk factors through evidence-based strategies, it becomes possible to promote healthier developmental trajectories and minimize the long-term societal burden associated with conduct disorder.

Due to the heterogeneity of the extracted risk factors and the differences in the types of reported effect sizes, we were unable to perform a meta-meta-analysis and limited ourselves to an overview of the meta-analyses. Although this offers valuable insights, critical limitations in the available evidence base, methodological issues, and gaps in research warrant discussion to guide future studies and practical applications.

A prominent limitation identified in this review was the scarcity of high-quality research with a specific focus on conduct disorder. Compared to other psychiatric disorders (31-35), conduct disorder remains under-researched, particularly in terms of longitudinal studies that can robustly establish risk factors. Many of the meta-analyses combined data on conduct disorder with other behavioral disorders, making it difficult to disentangle risk factors unique to conduct disorder. This paucity of targeted research highlights the need for investigations specifically focused on conduct disorder. Future studies should prioritize this disorder, ensuring that their findings contribute directly to understanding its etiology while informing prevention strategies.

One meta-analysis was published in 1990 (16). This meta-analysis used the mean effect sizes to identify risk factors, most of which, according to the author, were Pearson's r. It has now been recognized that we should not combine all the different types of effect sizes together. In addition, Pearson correlations (r) can indicate correlation, not risk factors. Given that this meta-analysis was published 35 years ago and because of its incorrect approach to combining effect sizes, it is suggested that a study be conducted again with a similar objective to correct these errors.

Some meta-analyses included cross-sectional studies, which are inherently limited in establishing causality. Cross-sectional designs provide snapshots of associations at a single time point but cannot confirm whether a factor preceded the onset of conduct disorder, a critical criterion for identifying the risk factors (36, 37). As a result, some findings in these meta-analyses may reflect correlates rather than true risk factors.

Some meta-analyses reported effect sizes such as correlation coefficients (r), which do not indicate the magnitude or likelihood of the risk associated with exposure. However, we also included data from studies that reported effect sizes other than RR and OR to provide a clear view of the studies conducted. To address these limitations, the following recommendations are proposed:

1. Further longitudinal and cohort studies focusing exclusively on conduct disorder are needed to provide a robust evidence base. This will help clarify whether identified risk factors are unique to conduct disorder or shared with other disorders.
2. To establish causality, future meta-analyses should prioritize studies with longitudinal designs.
3. Older meta-analyses should be replicated using recent studies and current diagnostic criteria.
4. Adhering to guidelines such as PRISMA will enhance transparency and comparability across studies (21, 38).
5. Future meta-analyses must prioritize risk estimates (e.g., risk ratios) over correlation coefficients to provide clearer insights into the magnitude of risk.

Limitation

This overview has several limitations that should be acknowledged. First, we included only articles published in English, which may introduce language bias and potentially exclude valuable findings from non-English studies. This restriction could limit the comprehensiveness and representativeness of the evidence under review. Second, our search strategy was confined to two major databases, PubMed and Scopus. While these databases are extensive and widely used, the inclusion of additional databases, such as PsycINFO, Web of Science, or Embase, might have captured further studies and strengthened the overall findings. The reliance on these two databases may have inadvertently excluded relevant studies, particularly those indexed in specialized or regional repositories.

Despite these limitations, this review provides significant insights into the environmental and other risk factors associated with conduct disorder and underscores the importance of addressing these factors in prevention and intervention efforts.

Conclusion

This overview of environmental risk factors primarily highlights the role of environmental influences in the development of conduct disorder, including severe parental psychiatric disorders, postnatal exposure to second-hand smoke, atopic dermatitis, being a child of an alcoholic, prenatal alcohol exposure, maternal smoking during pregnancy, maternal alcohol use during pregnancy, overweight/obesity, maternal perinatal depression, and preconception overweight/obesity. Notably, some factors, such as maternal smoking and alcohol use during pregnancy, maternal perinatal depression, and preconception overweight/obesity, can increase the likelihood of conduct disorder even before birth.

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Conflict of Interest

None.

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