

Meta-Analysis of the Association Between Prenatal Cocaine Exposure and Youth Substance Use

Background

Prenatal drug exposure is a significant public health concern, with illicit substance use among pregnant women increasing from 5.9% in 2012 to 7.7% in 2021.¹ Among these substances, past-month cocaine use is reported by 0.7-0.8% of pregnant women.² Unlike other substances including alcohol, tobacco or opioids, cocaine's combination of teratogenic, vasoconstrictive, and dopaminergic effects creates risk for a distinct pattern of fetal brain injury and developmental disruption that warrants further investigation.

Given the persistent public health burden of prenatal cocaine exposure (PCE) and the intergenerational cycle of substance use, a systematic synthesis of the literature on the association between PCE and offspring substance use is urgently needed. Identifying pathways from PCE to adolescent and young adult substance use can inform early prevention strategies, guide clinical monitoring, and support policy efforts aimed at mitigating long-term behavioral health disparities among substance-exposed populations.³ Existing studies examining PCE and later youth substance use have produced heterogeneous outcomes reflecting differences in study design, exposure and outcome definitions, duration of follow-up, and control for confounding variables. All of these factors limit the ability to draw clear conclusions from each individual study.

This systematic review and meta-analysis will evaluate the strength and consistency of associations between PCE and later substance use across developmental stages from early adolescence through emerging adulthood. By integrating data from longitudinal cohorts, this project seeks to clarify the developmental trajectories linking prenatal exposure to substance use vulnerability. Specifically, this meta-analysis will examine potential moderating factors, including early substance use initiation, influencing these outcomes. Prior systematic reviews have largely focused on neurodevelopmental and cognitive outcomes, whereas the findings of the current study will provide a critical evidence base for targeted early intervention and public health policy addressing the long-term substance use association of prenatal drug exposure.

Methods

Search Strategy

A comprehensive literature search for the association between PCE and offspring substance use was conducted in PubMed/MEDLINE, Embase, PsycINFO, Web of Science, Scopus, and CINAHL from database inception through July 18, 2025. Search strategies were constructed that combined controlled vocabulary (e.g., Medical Subject Headings [MeSH], Emtree terms, Thesaurus of Psychological Index Terms) with free-text keywords. Core PCE-related terms (e.g., "prenatal cocaine exposure," "in utero cocaine," "maternal cocaine use") were combined with terms related to adolescence and young adults (e.g., "adolescent," "young adult," "juvenile") and substance use behavior (e.g., "alcoholic beverages" "initiation," "abuse"). The search was limited to English-language studies and human studies. To ensure comprehensive coverage, we also hand-searched the reference lists of included studies and prior reviews. Methodologically

rigorous grey literature (e.g., dissertations, government or institutional reports, white papers) was considered eligible if publicly accessible and sufficiently detailed for appraisal.

Data Extraction/Coding Procedures

Data extraction and study coding were conducted using a standardized coding framework developed a priori to reveal study design characteristics, exposure measurement definitions, and substance use outcomes relevant to this meta-analysis. Extracted variables included study design, cohort characteristics, sample size, participant demographics, method of PCE ascertainment (maternal self-report, medical record documentation, or biological assay), age at follow-up assessment and substance use outcomes. Coded substance use outcomes included age of initiation, frequency or severity of use, and presence of problematic use including a substance use disorder across alcohol, tobacco, marijuana, and other substances. When available, adjusted and unadjusted effect size estimates were extracted.

Results

Substance Use Search

The search for PCE and adolescent/young adult substance use yielded $N = 2,345$ records. Figure 1 provides a PRISMA flow diagram overview of the literature search and study extraction. After removing 848 duplicates, 1497 unique records remained for screening. Following title and abstract review, 1445 records were excluded, leaving 52 full-text articles for full assessment. Of these, 14 records were excluded for not meeting eligibility criteria (e.g., assessed maternal or caregiver substance use only rather than offspring use; unclear that maternal use was prenatal vs. postnatal; or insufficient methodological detail). The final sample included 38 articles, representing $k = [X]$ distinct cohorts.

Preliminary Results

Preliminary effect size calculations using data from five studies were conducted. The mean resultant effect size indicates a small but statistically significant association between PCE and later substance use (Hedges' $g = 0.29$, $p < 0.05$).

Conclusion

These preliminary findings suggest a relationship between PCE and later substance use risk, which is consistent with the prior literature stating that PCE can lead to adverse developmental outcomes. Further analyses of the complete data set will include examination of potential moderators of the association between PCE and youth substance use, as well as examination of whether the association differs for studies using adjusted (i.e., include covariates) vs. unadjusted effect sizes.

References

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