Adverse Childhood Experiences are Associated with illicit drug use among pregnant women with middle to high socioeconomic status: Findings from the All Our Families Cohort

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Abstract

Background: Adverse childhood experiences (ACEs) are associated with illicit drug use among pregnant women who are socioeconomically vulnerable. While it is assumed that the impact of ACEs on illicit drug use is reduced among pregnant women who are well educated and have higher socioeconomic status, this assumption has not been well tested in the literature. The objective of this study was to examine the impact of maternal ACEs on illicit drug use among pregnant women who are well-educated women, have middle to high household incomes, and seeking regular prenatal care. Findings can inform clinicians about potential associations between ACEs and drug use in pregnancy within a population that they are frequently in contact with.

Methods: This study is a secondary analysis of a prospective cohort study that collected data from 1,680 women during and after pregnancy in Calgary, Canada between 2008-2011 using mailed surveys. Illicit drug use in pregnancy was self-reported by women at 34-36 weeks gestation. An established scale examined maternal ACEs before 18 years. Logistic regression models and 95% confidence intervals tested associations between maternal ACE scores and illicit drug use in pregnancy.

Results: Overall, 3.3% of women in this predominantly married, well-educated, middle and upper middle income sample (mean age 31 years) reported illicit drug use in pregnancy. Women with 2-3 ACEs had more than a two-fold increase, and women with 4 or more ACEs had almost a four-fold increase in illicit drug use in pregnancy, relative to women with 0-1 ACEs after adjustment for confounders. Exposure to child abuse was more consistently associated with illicit drug use in pregnancy than exposure to household dysfunction in childhood.

Conclusions: Findings combine with others to speak to the public health significance of maternal ACEs on substance use among expectant mothers across the socioeconomic spectrum; particularly child abuse. This information, can be used by women and the clinicians serving them, to better understand the role that ACEs could play in their decision to use illicit drugs in pregnancy.

1. Introduction

Women who use illicit drugs during pregnancy are an elusive population who often remain unidentified due to fear of reprisal and judgement and hence, have not been well studied.[1,2] There is an urgent need for more research focused on this population given the growing availability of potent drugs such as fentanyl and methamphetamine on the illicit, and increasing illicit drug use among women and girls of child-bearing age.[3–6] Illicit (or street) drug use involves the use of substances manufactured and/or sold illegally. Illicit drugs most commonly used in pregnancy are cannabis and opioids derived from street sources, methamphetamine, and cocaine.[7–9] Across surveys, approximately 1–5% of women report illicit drug use in pregnancy, with biomarker research suggesting the actual prevalence is higher.[10–16]

Illicit drug use has acute and long term toxic impacts on pregnant women and children due to exposure to the drug, the uncertainty of the dose being taken, and the contamination of illicit drugs with other substances and chemicals.[11,17–21] In Canada, fentanyl has been detected in the illegal drug supply country-wide across jurisdictions.[22] A recent study that asked Canadians to anonymously submit illicit drug samples for analysis found 60% had been adulterated with substances the person had not anticipated, making it difficult to mitigate risk (e.g., have a naloxone kit on hand).[23]

Illicit drug use among pregnant women is often ascribed to those who are *vulnerable* to substance misuse due to low socioeconomic status, young age, unmarried status, unintended pregnancy, low prenatal care, exposure to domestic violence, and previous addictions.[24–27] As a result, much research has focused on women with these experiences. Within low socioeconomic samples, adverse childhood experiences (ACEs), defined as child maltreatment and exposure to household dysfunction before 18 years of age, are strongly associated with illicit drug use in pregnancy, as well poor birth outcomes more generally.[28,29] For example, a study of single, low income, African American women found the association between having three or more ACEs and illicit drug use in pregnancy was strong (OR of 6) and dose-dependent.[24]

While it is often assumed that the impact of ACEs on illicit drug use is reduced among pregnant women with average to high socioeconomic status, this assumption is not well tested in the scientific literature. The one study to date that did not adjust for confounders found ACE score was weakly associated with illicit drug use in pregnancy in a sample of women with average socioeconomic status .[12] It is unclear whether illicit drug use and alcohol use in pregnancy were examined as a combined variable in this analysis.[12]

The objective of the present study was to examine associations between maternal ACE score and illicit drug use in pregnancy (i.e., separate from alcohol use in pregnancy) in a sample of women with middle to high socioeconomic status who were receiving regular prenatal care, after adjustment for confounders.[30,31]

2. Methods

2.1 Study sample

The current investigation is a cross-sectional analysis of the All Our Families prospective cohort which collected data from women during and after pregnancy on determinants of maternal and infant health.[32–34] Pregnant women were recruited from medical offices and the community in Calgary, Canada between 2008 and 2011. Inclusion criteria were: (1) maternal age ≥ 18 years, (2) being < 25 weeks gestation, (3) receiving prenatal care, and (4) being fluent in English. The present analysis was conducted in 2019. The dataset supporting the conclusions of this article is available in the PolicyWise for Children

& Families SAGE Metadata repository [S01-197845.4: https://sagemetadata.policywise.com/nada/index.php/catalog/1#metadata-identification].[34]

2.2 Procedure

Pregnant women and mothers completed six mailed survey packages with postage-paid return envelopes spanning pregnancy to three years postpartum; three of which were used in this secondary analysis (mean time to complete: 25 min each).[32] The first time point used in this analysis collected at < 25 weeks gestation included questions on participant sociodemographics. The second timepoint collected 34–36 weeks gestation included questions on illicit drug use during pregnancy. The third timepoint collected three years after birth included questions about maternal ACEs before 18 years of age. Full data collection procedures are reported elsewhere.[32,35]

2.3 Methods of Follow-Up

Approximately 83% of the 4,011 pregnant women who enquired about the study met inclusion criteria and agreed to participate (*N* = 3,341). Trained research assistants contacted the participants if data were missing or clarification of responses was required. Participants who failed to return their questionnaire within three weeks were contacted by telephone and/or e-mail and reminded to complete the questionnaire; multiple attempts were made until the participant was contacted and provided the opportunity for a repeat mail-out. To keep participants engaged and updated, congratulation cards were sent after the birth of their baby, as well as newsletters semi-annually containing project progress and preliminary results. Despite these efforts, there was attrition over the course of the study with approximately 70% of eligible participants returning all survey packages mailed to them.[32,35] At the three-year time point 2,909 women were eligible for follow-up. Among these, 60% completed all relevant questions related to the variables examined in the present analysis (*N* = 1,680).

2.4 Measures

2.4.1 Drug use

The use of illicit drugs in pregnancy was assessed at 34–36 weeks gestation by the question: *Since becoming pregnant (including before you knew you were pregnant), did you ever use illicit drugs*? Responses options were yes or no.

2.4.2 ACEs

At infant age 36 months, mothers were asked to recall ACEs that occurred in their lives before the age of 18 using a detailed questionnaire adapted from the original ACE checklist.[28] Questions about maternal ACEs were asked at the third data collection time point because this longitudinal study was developed and funded in phases, with data collection about maternal ACEs proposed during the time 3 data collection window. For consistency with the original scoring of Felitti et al. and in response to pilot testing, questions were simplified for some of the original ACE questions to elicit yes/no responses instead of

frequencies (often/very often) during data collection.[36] Detailed information about specific ACE questions used in this study can be found in Hetherington et al. (2020) Appendix 1.[36]

2.4.3. Sociodemographics

Maternal age, education, yearly household income, marital status, pregnancy intention, and parity (birth to a fetus > 24 weeks) were collected in the first questionnaire package completed by mothers at < 25 weeks gestation.

2.5 Statistical Analysis

Using separate logistic regression models, adjusted odds ratios (AORs) and 95% confidence intervals (CIs) assessed the odds of using illicit drugs in pregnancy as a function of a 3-category ACE score (0–1 ACE, 2–3 ACEs and ≥ 4 ACEs), a 3-category child abuse score (no child abuse, 1 form of child abuse, 2 or more forms of child abuse); and childhood household dysfunction score (no household dysfunction, 1 form of household dysfunction, 2 or more forms of household dysfunction). This categorization was selected as it provided similarly-sized groups of women who reported drug use across these ACE categories, thus providing sufficient cell sizes for analysis.

Potential confounders were tested before inclusion in models, keeping in mind that analyses that follow the “more control variables is better” approach have been frequently criticized in the literature, and the assumption that large numbers of control variables improve causal inference has been debunked.[37–39] Thus, variables associated with illicit drug use in pregnancy at $p < 0.20$ were retained as confounders including maternal age, marital status, education, income, parity, and whether the pregnancy was intended. We purposively refrained from controlling for mental health given the impacts of ACE score on mental health are well documented across longitudinal studies; as are the impacts of mental health on illicit drug use.[40] Thus, controlling for mental health variables, which likely sit on the causal pathway between ACEs and the use of illicit drugs in pregnancy, would introduce bias by decomposing the total effect of x on y into its parts.[38] Missing data were handled using listwise deletion. All analyses were run using SPSS 26.0.

3. Results

3.1 Description of Sample

Sample descriptives are provided in Table 1. Participants ranged in age from 18–45 years at < 25 weeks gestation (M = 30.9 years, SD = 4.4). Participants were well educated (92% had a university or college degree), had mean households incomes above the national average, and were more likely to be married than the general population.[30,31] Approximately half had other children. The current pregnancy was intended for the majority (84%) of the sample. Maternal ACE score ranged from 0 to 8 (M = 1.5, SD = 1.7). ACE exposures were common among expectant mothers with 61% reporting at least one ACE before the

age of 18. Four or more ACEs were reported by 14.2% of the sample. Illicit drug use in pregnancy was reported by 3.3% of the sample (n = 55).

Table 1
Overall sample characteristics and prevalence of illicit drug use in pregnancy by sample characteristic (*N* = 1,680)

Maternal characteristic	Sample frequency *n* (%)	Prevalence of illicit drug use in pregnancy by characteristic *n* (%)
Sample total	1680 (100)	55 (100)
Age		
< 35 yrs	1347 (80.2)	supressed [a]
≥ 35 yrs	333 (19.8)	supressed
Education		
≤ High school	136 (8.1)	14 (10.3)
≥ University or college	1544 (91.9)	41 (2.7)
Household income (yearly)		
<$10,000 – $69,999	326 (19.4)	19 (5.8)
≥$70,000	1354 (80.6)	36 (2.7)
Marital status		
Married/living common law	1612 (96.0)	44 (2.7)
Not currently married	68 (4.0)	11 (16.2)
Parity		
No previous births	824 (49.0)	40 (4.9)
≥ 1 previous birth	856 (51.0)	15 (1.8)
Pregnancy was intended		
Yes	1413 (84.1)	30 (2.1)
No	267 (15.9)	25 (9.4)
ACE score		
0–1	1023 (60.9)	18 (1.7)
2–3	419 (24.9)	20 (4.8)
≥4	238 (14.2)	18 (7.6)
Maternal ACE child abuse score		

[a]Age by prevalence of illicit drug use in pregnancy was suppressed due to cell count under *n* = 10.

Maternal characteristic	Sample frequency *n* (%)	Prevalence of illicit drug use in pregnancy by characteristic *n* (%)
No child abuse	929 (55.4)	16 (1.7)
1 form of child abuse	451 (26.8)	20 (4.4)
2–3 forms of child abuse	299 (17.8)	19 (6.4)
Maternal ACE household dysfunction score		
No household dysfunction	866 (51.5)	18 (2.1)
1 form of household dysfunction	397 (23.6)	14 (3.5)
2–6 forms of household dysfunction	417 (24.8)	23 (5.5)

[a]Age by prevalence of illicit drug use in pregnancy was suppressed due to cell count under *n* = 10.

Table 2
Odds ratios (ORs) and adjusted odds ratios (AORs) of illicit drug use in pregnancy by ACE categories (*N* = 1,680)a

Models	OR (95% CI)	AOR (95% CI)
Model 1: Maternal ACE score < 18 years		
0–1	1.0 (Reference)	1.0 (Reference)
2–3	**2.9 (1.5, 5.5)**	**2.4 (1.2, 4.8)**
≥4	**5.0 (2.6, 9.7)**	**3.9 (1.9, 8.0)**
Model 2: Maternal ACE child abuse score < 18 years		
No abuse in childhood	1.0 (Reference)	1.0 (Reference)
1 form of child abuse	**2.6 (1.4, 5.0)**	**2.2 (1.1, 4.4)**
2–3 forms of child abuse	**3.9 (2.0, 7.5)**	**3.0 (1.5, 6.1)**
Model 3: Maternal ACE household dysfunction score < 18 years		
No household dysfunction	1.0 (Reference)	1.0 (Reference)
1 form of household dysfunction	1.9 (0.9, 3.8)	1.3 (0.6, 2.7)
2–6 forms of household dysfunction	**3.0 (1.6, 5.6)**	**2.1 (1.1, 4.0)**

[a]Statistically significant variables presented in bold. Models were adjusted for maternal age, education, income, marital status, parity, and whether the pregnancy was intended.

3.2 Maternal ACE Score and Illicit Drug Use in Pregnancy

Overall, 1.7% of women with 0–1 ACEs reported illicit drug use in pregnancy, compared to 4.8% of women with 2–3 ACEs, and 7.6% of women with 4 or more ACEs (Table 1). In an adjusted logistic regression model, the association between ACE score and illicit drug use in pregnancy was moderate. Compared to women with 0–1 ACEs, women with 2–3 ACEs had more than a two-fold increase, and women with 4 or more ACEs had almost a four-fold increase in the odds of illicit drug use in pregnancy after adjustment for confounders.

Child abuse was reported by 44.3% of the sample. Emotional abuse was most commonly reported (36.0%), followed by physical abuse (16.7%) and sexual abuse (13.3%). Compared to women who did not experience child abuse, women who experienced 1 form of child abuse had more than a two-fold increase in the odds of illicit drug use in pregnancy; while women who experienced 2 to 3 forms of child abuse had a three-fold increase in the odds of illicit drug use in pregnancy, after adjustment for confounders.

At least one form of household dysfunction in childhood was reported by 48.3% of the sample. The most common exposure was mental illness in the home (24.7%) followed by parental separation (23.2%). There was no association between experiencing one form of household dysfunction in childhood and illicit drug use in pregnancy. Approximately one quarter of the sample reported 2–6 forms of household dysfunction in childhood (Table 1). This subsample had a two-fold increase in the odds of illicit drug use in pregnancy.

4. Discussion

Overall, 3.3% of women in this well-educated, middle and high-income, predominantly married sample reported illicit drug use in pregnancy. This finding is comparable to surveys across jurisdictions that have found 1–5% of women report illicit drug use in pregnancy.[10–16] Within the present sample, maternal ACEs were common and associated with a two to four-fold increase in illicit drug use during pregnancy. A US study among young, single, low-income, African-American women found a strong dose-dependent association between maternal ACEs and illicit drug use in pregnancy.[24] In the present socioeconomically-affluent sample, this association was statistically significant and moderate in strength after adjustment for confounders. Maternal experiences of child abuse were more strongly and consistently associated with illicit drug use in pregnancy than experiences of household dysfunction as a child.

While the types of illicit drugs used by pregnant women in this study and how frequently they were used is unknown, the decision to use drugs garnered from illicit sources during pregnancy is itself a concern, given illicit drugs are often adulterated with contaminants and unknown substances, and the dose being taken cannot be ascertained. Risky reward-seeking behavior has been shown to be fueled altered patterns of brain development among children exposed to ACEs, which may be compounded during pregnancy given it can be an emotionally vulnerable time for women.[41,42] A 2019 study of approximately 26,000 pregnant women in Ontario concluded that *maternal depression* was the most important risk factor for tobacco, alcohol and cannabis use in pregnancy. ACEs have been shown to predict mental health problems during pregnancy, including depression.[43–45] Given the high prevalence of ACEs among women

of childbearing age, ACE score may serve as an antecedent variable that helps to explain the strong associations between depression and substance use in pregnancy documented in the Ontario cohort.[26] While the small number of pregnant women reporting drug use in the present sample limits our ability to test this hypothesis using a mediated analysis ($n = 55$), it is a question that follows naturally from the combined findings of this paper, and that of Brown and colleagues, and should be considered in future studies.[26]

We also note that the associations documented in this observational study do not imply causation or suggest that a large percentage of women with an elevated ACE score will use illicit drugs in pregnancy. The overall percentage of women who reported illicit drug use while pregnant remained small, regardless of maternal ACE exposure. Indeed, even among women with 4 or more ACEs, 93% reported they did use illicit drugs use in pregnancy.

4.1 Limitations

Adverse childhood experiences and illicit drug use in pregnancy were self-reported and may have been under-reported.[14] While retrospective reports of major, easily defined ACEs have acceptable psychometric properties, research comparing self-report to biomarker data suggests women underreport substance use in pregnancy.[13–15, 46,47] More women were married and the average income and education of participants was higher than the national average in Canada, thus reducing the generalizability of the findings to high-risk populations. There was attrition over the course of the study, with approximately 70% of participants returning all survey packages mailed to them, and 58% of women completing all questions relevant to this secondary analysis of the data.

4.2 Conclusions

Despite the protective factors inherent within the present sample, maternal ACEs were common and associated with a moderate increase in the odds of illicit drug use in pregnancy. The present findings combine with others to speak to the public health significance of maternal ACEs on substance misuse in pregnancy across the socioeconomic spectrum.

Abbreviations

ACEs Adverse childhood experiences

Declarations

Ethics approval and consent to participate

The study was approved by the Conjoint Health Research Ethics Board at the University of Calgary (Ethics ID 20821 and 22821).

Consent for publication

Not applicable.

Competing interests

The authors report no financial or other disclosures

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Authors' contributions

CC developed the research questions for the dataset, analyzed the data, and drafted the manuscript. ST designed and implemented the study from which the dataset was derived, and provided feedback on the manuscript.

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Data Access

The dataset supporting the conclusions of this article is available in the PolicyWise for Children & Families SAGE Metadata repository [S01-197845.4: https://sagemetadata.policywise.com/nada/index.php/catalog/1#metadata-identification].[34]

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48. **DECLARATIONS**.