

# A Critical Review on Association Between Maternal Smoking During Pregnancy and Psychopathology Symptoms

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## Abstract

The use of tobacco during pregnancy may be associated with other problematic prenatal health behaviors. During pregnancy, smoking, prenatal health behavior, and mental health are interrelated. Studying factors that contribute to variations in prenatal health practices among pregnant women who smoke was the purpose of this study. A study of birth mothers' health behaviors and mental health symptoms at 5 - 6 months after birth was conducted. Approximately a quarter of the participants reported smoking six or more cigarettes a day for at least one trimester. Mothers who smoked more than 6 cigarettes daily displayed higher levels of antisocial behavior as well as depression among those who smoked less than 6 cigarettes daily; antisocial behaviors and depressive symptoms were not associated with prenatal folate use. Prenatal care visits were fewer for mothers who smoked fewer than six cigarettes daily. Prenatal care visits were not associated with antisocial behaviors and anxiety symptoms. The author concludes, there may be a link between maternal antisocial behavior and depression symptoms during pregnancy, independent of prenatal care quality, and poorer compliance with recommendations for folate supplementation.

**Keywords:** Psychopathology, Smoking pregnancy, Women

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**Citation:** Hrudaii P, Singh M, Wani E (2024) A Critical Review on Association Between Maternal Smoking During Pregnancy and Psychopathology Symptoms. *J Womens Health Care Manage*, Volume 5:4. 163. DOI: <https://doi.org/10.47275/2692-0948-163>

**Received:** August 18, 2024; **Accepted:** October 25, 2024; **Published:** October 30, 2024

## Introduction

Health practices during pregnancy are poorly understood by some women but are crucial to ensuring optimal health outcomes for women and their children. This is especially true for pregnant women who smoke. Smoking continues to be a habit for about half of pregnant women. There is evidence that smoking during pregnancy is associated with sub-optimal prenatal health practices, including inadequate prenatal care and poor adherence to guidelines for taking prenatal folate supplements. When women are having difficulty quitting smoking during pregnancy, they are more likely to be nicotine dependent and to smoke six or more cigarettes per day, which has been linked to significant adverse effects on the fetal nervous system. During this study, women who did or did not smoke heavily during pregnancy were compared on other suboptimal prenatal health practices, including symptoms of psychopathology [1]. It is possible to identify additional risks to offspring that are not directly associated with intrauterine nicotine exposure by clarifying the interrelationships among pregnancy health practices associated with heavy smoking during pregnancy. To explain why pregnant women may continue to smoke during pregnancy and engage in other poor prenatal health practices, previous investigations suggest two models, each involving a different pattern of psychopathology [2]. First of all, depression is common among pregnant smokers, but there is still uncertainty about the exact nature and direction of this relationship. Pregnant smokers may use cigarette smoking to help alleviate symptoms associated with depression and anxiety [3]. Literature suggests that women with depression or anxiety symptoms are more likely to smoke during pregnancy or be unable to

stop. Prenatal health practices are also negatively affected by depression during pregnancy. There are, however, few studies that examine whether depressive symptoms and smoking during pregnancy may affect mothers' prenatal health behaviors differently [4-6].

Another model is based on a broader pattern of externalizing behaviors, specifically antisocial behaviors, to explain suboptimal prenatal health practices among pregnant smokers. Antisocial behavior is defined as one that violates social norms and rights of others, either intentionally or unintentionally, and commonly involves disrespecting others, impulsive behavior, or substance abuse [7, 8]. As a result of this theory, smoking during pregnancy, taking prenatal folate as recommended, and receiving adequate prenatal care may be related to an underlying disposition to violate social norms, break rules, and lack of self-regulation, which can lead to antisocial behavior [9]. The antisocial model of prenatal health practices in relation to pregnancy smoking has been found to be valid based on a review of literature on psychological characteristics that differentiate smokers who spontaneously quit during pregnancy from those who do not. In particular, a history of conduct disorders as a child, a predictor of antisocial behavior in adulthood, has been linked to failure to quit smoking during pregnancy [10]. When nicotine dependence is controlled, other mental disorders such as depression, anxiety, bipolar disorder, and schizophrenia are not associated with failure to quit smoking during pregnancy. During pregnancy, women who smoke at heavy levels may experience variations in prenatal health practices. The purpose of this study was to examine the relationships between prenatal folate supplementation frequency, prenatal care visits attended, prenatal antisocial behaviors, and prenatal

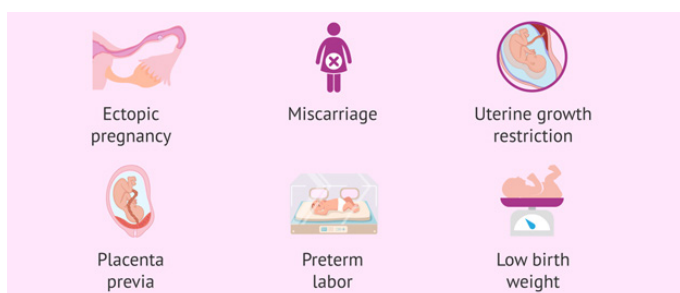
depression and anxiety symptoms. Several papers on PubMed, PMC discussed on the possible differences in associations between women who smoke heavily during pregnancy and those who do not [11]. By examining the relationship between heavier prenatal smoking and additional prenatal health practices, this study extended the work of two models of addiction and sometimes opioid use too. This paper also examined whether the findings were consistent with a depression or antisocial model of sub-optimal prenatal health care [2].

## Methodology

The early growth and development study (EGDS) enrolled birth mothers in examining how genes and environment interact with offspring development while following children from birth to adolescence. It examined the interaction between genes and environment [12]. In order to be eligible to participate, birth parents had to be recruited from adoption agencies across the country. The infant had to be placed with a non-relative, was placed within 3 months of birth, had no major medical conditions, and the adoptive parents understood English at a level equivalent to an 8th grader [13]. The recruitment process took place through different agencies in belonging to different states. No matter whether the linked adoptive family participated or not, all birth mothers were included. At approximately 5 months postpartum, birth mothers were interviewed in person in several studies. All data was collected and noted.

## Danger of smoking during pregnancy

The amount of cigarette smoking during the 9 months of pregnancy was assessed using a modified version of the life history calendar method referred to as the pregnancy history calendar, which required mothers to report experiences specific to the prenatal period, including doctor visits, substance use, and depression and anxiety symptoms [14]. Smoking habits were assessed in person in the homes of pregnant women during all three trimesters of their pregnancy. There is good reliability and improved recall with this method. As a result, fetal central nervous system development was assessed using the McNeil-Sjöström scale for obstetric complications, an empirically based scale that quantifies the likelihood that multiple pregnancy, labor, delivery, and neonatal factors adversely affect fetal mental development. A McNeil's framework was used to assign risk levels to each risk factor (on a scale of 1 - 6). The range includes 1 = Not harmful or relevant; 2 = Not likely harmful or relevant; 3 = Potentially but not clearly harmful or relevant; 4 = Potentially clearly harmful or relevant; 5 = Potentially clearly greatly harmful/relevant; and 6 = Very great harm to or deviation in offspring. A 6 point risk score was derived based on a frame reflecting harmful smoking levels recommended by the McNeil-Sjöström scale [15]. For at least one trimester of pregnancy, the severity of smoking was quantified, and a dichotomous variable was created to distinguish women who smoked at harmful levels from those who smoked less or not at all (Figure 1). For at least one trimester, nearly a quarter of participants smoked six or more cigarettes [16].



**Figure 1:** Issues related to smoking during pregnancy.

## Prenatal health behaviors, depressive and anxiety symptoms and antisocial behaviors

A scale of 1 to 5 was used to assess the frequency with which mothers took prenatal vitamins (with folate supplementation). Additionally, they reported the number of prenatal visits they attended. Three outliers were set to equal 25 visits. All but one participant reported 25 prenatal care visits or less.

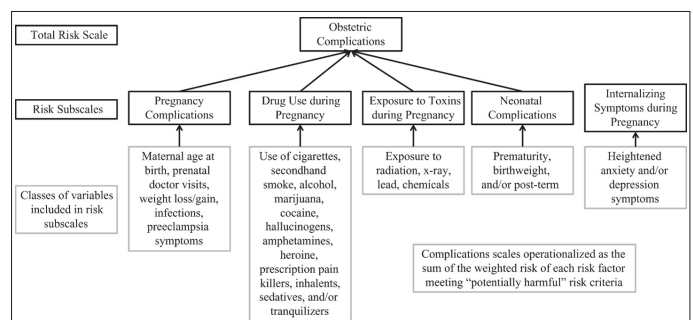
The pregnancy history calendar was used to assess depression and anxiety symptoms experienced during pregnancy using six items from the Beck depression inventory (BDI), in addition to five items from the Beck anxiety inventory (BAI), respectively. Scores were calculated by adding the sadness and anhedonia screenings (each scored; no = 0, yes = 2) and the 5 BDI items (each on scale from 0 to 3). Scores could range from 0 - 19. Total scores for the 4 BAI could range from 0 - 12 [17].

Elliot's 38 item social behavior questionnaire contains a subscale index offense that measures antisocial behavior. On a 5 point scale, mothers rated the frequency with which they violated others' rights in the past year (including pregnancy), lying, stealing, destroying or damaging property, intentionally setting a fire, and carrying a concealed weapon (1 = Never; 2 = Once or twice; 3 = Once a month; 4 = At least once a month; and 5 = Every day) [18].

## Covariates and data analytic plan

According to the McNeil-Sjöström obstetric complications scale, pregnancy complications were coded by the perinatal risk index, based on maternal reports on a pregnancy screener, the details of which have already been described. During pregnancy, mothers filled out the pregnancy history calendar to report their alcohol consumption. In addition, covariates including gestational age, mother's income, and mother's education were also examined [2].

First, bivariate correlations were conducted between the variables of interest and potential covariates. Regression was conducted with any covariates significantly influencing the variables of interest; standardized residuals were saved and used in subsequent analyses. We examined whether prenatal smoking moderated the effect of psychopathology (depressive symptoms, anxiety symptoms, and antisocial behaviors) on prenatal health behaviors (i.e., prenatal folate supplementation and prenatal visits) using Mplus version 7.3 with full-information maximum likelihood estimation. This study examined both proposed models of addiction including maternal reports of depressive and anxiety symptoms, along with antisocial behaviors, as predictors of prenatal health behaviors [19-23]. During pregnancy, multi-group analyses were conducted to compare models of mothers who smoked six or more cigarettes a day with those who smoked less or none at all (Figure 2). Last but not least, the model fit was compared to the unconstrained model in order to determine whether the magnitudes of effects were different between the two groups [24-28].



**Figure 2:** Total risk scale.



## Result

The studies provide descriptive statistics for psychosocial characteristics and prenatal care behavior variables. Nearly one-quarter of mothers smoked heavily during pregnancy [29-33]. The natural log was used to transform all variables except those with positively skewed antisocial behavior. During pregnancy, prenatal care visits correlated significantly with gestational age and other study variables. Birth mother's age at delivery, and depressive symptoms, birth mother's education and antisocial behaviors [34-39]. It was found that the birth mother's household income is correlated with her antisocial behavior, that prenatal folate use is correlated with pregnancy complications, that prenatal visits are correlated with stress, and that depressive symptoms are correlated with prenatal visits. In the study, alcohol consumption during pregnancy was not associated with any of the variables [40, 41].

## Path analysis

After adjusting for prenatal depressive and anxiety symptoms, path analysis was used to test the hypothesis that antisocial behavior is associated with prenatal care behaviors for heavy pregnancy smokers [42-46]. Overall, fitting indices suggested the model tested fit the data well. There was a significant association between lowering prenatal folate use by heavy smokers and higher levels of antisocial behavior and depressive symptoms. The presence of prenatal anxiety symptoms was not associated with prenatal folate use. In addition, the number of prenatal care visits attended was directly related to prenatal folate consumption [47, 48]. The number of prenatal care visits was not related to antisocial behavior, depressive symptoms, or anxiety symptoms.

There was no association between antisocial behaviors, depression symptoms, and anxiety symptoms in mothers who did not smoke and those who did not smoke a low amount of tobacco [49]. There was an association between a higher frequency of prenatal folate use and the number of prenatal care visits attended. A positive association was also found between prenatal visits and mothers' depressive symptoms, while antisocial behaviors and anxiety symptoms were not associated with prenatal visits [50, 51]. The constraint of heavy smokers' and non-smoking/low smoking groups' paths to equal resulted in a worse fit [52, 53].

## Discussion

Most papers used a large sample of pregnant women with multiple psychosocial risk factors to further examine the previously observed differences in prenatal health behaviors between heavy pregnant smokers and non-smokers. It is consistent with existing literature that women who smoke heavily during pregnancy (i.e., 6 or more cigarettes per day tend to avoid prenatal folate use and attend fewer prenatal care visits than women who smoke less and women who do not smoke.

These results support models emphasizing depressive symptoms or antisocial behavior as underlying psychopathologies that influence prenatal health care. In mothers who were heavy smokers, maternal depression symptoms were associated with decreased prenatal folate use a finding that supports the self-medication model of addiction, as well as indicating that these mothers are more likely to engage in additional problematic prenatal health practices. Additional findings indicate that prenatal folate use is associated with antisocial behavior in mothers who also smoke heavily, supporting the antisocial behavior model of poor prenatal health. The findings support both models because mothers who smoked heavily during pregnancy and experienced depressive symptoms or antisocial behaviors had a higher risk of additional problematic prenatal health behaviors, which can lead to more developmental problems. As such, although

these two models might have previously focused on explaining how smoking and psychopathology work together, these findings indicate the importance of understanding the relationship between smoking and psychopathology symptoms not only for their direct relationship with child outcomes, but also for the increased risk to the child due to additional problematic prenatal health behaviors.

Identifying the causal mechanisms linking pregnancy smoking and offspring externalizing problems can also be guided by the relationship between maternal antisocial behaviors, smoking during pregnancy, and prenatal folate use. As a result of heavy smoking, which adversely affects fetal central nervous system development,<sup>8</sup> The authors found that heavy smokers were more likely to violate social norms and other people's rights (antisocial behaviors), and that they could be more susceptible to folate deficiency during pregnancy. In addition to nutritional deficiencies in pregnancy, maternal behavior may also affect child psychological outcomes such as externalizing behaviors. Cost is another possible confounding factor when it comes to prenatal folates. All analyses were controlled for household income; therefore, the findings cannot be explained by the cost of prenatal folate alone. It is important to understand the relationships between psychopathology symptoms and prenatal folate use, especially for mothers who smoke during pregnancy in order to support them to invest in their health and the health of their babies. The use of counseling, feedback, and incentives during pregnancy could be an effective psychosocial intervention for helping women quit smoking during pregnancy and increasing the proportion of women who quit smoking late in pregnancy, thus reducing the number of infants born with low birth weight. The most successful prenatal smoking cessation interventions are those that provide financial incentives for biologically confirmed abstinence from smoking. As a result, these programs for pregnant mothers who smoke could be a particularly effective way to reduce the associations found in the study. Since healthcare disparities exist, it is crucial to acknowledge biases and stigmas that affect current healthcare practices and ultimately patient care. To support this vulnerable population, interventions should be framed neutrally and should avoid perpetuating future biases. Learning more about pregnant women who smoke is a crucial step in this process.

## Conclusion

Women who smoke during pregnancy have poorer prenatal health practices as a result of a constellation of factors that are related to smoking during pregnancy. As this study included mothers who adopted their child, the findings might not be generalizable to mothers planning to parent their biological children. Even though our sample of pregnant women had a higher proportion of cigarette use during pregnancy (37.6%) than the general population (8%), they attended the recommended number of prenatal care visits. As a final note, the information about smoking was self-reported and not based on biological evidence. Participants may not report their behaviors accurately, and researchers acknowledge that possibility. The validity of self-report, however, can be as high as that of biological markers if the data is collected appropriately. The study results may be affected by the large standard deviations of many of the key variables. There is a need to investigate whether these findings are replicable in another sample and whether maternal smoking during pregnancy is associated with additional prenatal health behaviors (e.g., nutrition). As individual traits have been shown to play a significant role in long-term substance abuse, it may be possible to incorporate temperament and/or personality dimensions into the model. Smoking during pregnancy may be associated with maternal psychopathological symptoms (depressive symptoms or antisocial behaviors). Interventions targeting





smoking during pregnancy might reduce the link between maternal psychopathology and poor prenatal health practices and improve mother-child outcomes.

## Acknowledgements

None.

## Conflict of Interest

None.

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