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Smoking and its Effects on Postpartum Depression

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Abstract

An estimated 10 to 15% of new mothers experience symptoms of postpartum depression (PPD), and while it has been estimated that up to 10% of women smoke tobacco during the last 3 months of pregnancy(1), there has been limited research into the effects this behavior has on the development of PPD. To establish if a relationship exists between the two, a literature search of published research studies was completed to gather data for examination. Of the pertinent articles, there were 11 that supported an association between smoking before or during pregnancy and postpartum depression, and the results of these were examined in depth. All studies found some sort of correlation, however not all findings were statistically significant. One of the biggest remaining questions is that of the causality between the relationship. No one has yet been able to establish whether postpartum depression is caused by smoking at any point during a mothers lifetime, or whether having depression is a risk factor for continued smoking.

1 Introduction

Postpartum depression has been noted since Hippocrates studied medicine in classical Greece, however, it was not officially a psychiatric disorder until 1994.(2) It is estimated that 10-15% of new mothers experience symptoms of postpartum depression. These symptoms may include anxiety, sadness, excessive irritability, anger, agitation, misery, loss of pleasure, inability to sleep or sleeping too much, and fear of not being a good mother, along with other symptoms.(2) PPD can appear within days after giving birth or it can occur as late as months after. An official diagnosis can be made up to 4 weeks after giving birth.(2) Without treatment, these symptoms can last for weeks to months, and there seems to be no distinguishing factors connecting diagnosed women. Some research has been done looking at prenatal health behaviors that may put a woman at higher risk for development of PPD, including caffeine and vitamin intake.(4) This has also led to research on smoking tobacco and whether this predisposes women to the development of PPD. While it has been estimated that up to 10% of women smoke tobacco during pregnancy, there has been limited research into the effects this behavior has on PPD.(5) Little is known about the causes of PPD and this project aimed to determine if there is a connection between smoking and postpartum depression.

The long-term goal of this project was to establish if there is a connection between smoking during pregnancy and the development of postpartum depression. Smoking is a known health risk in pregnancy resulting in preterm birth, low birth weights, miscarriages, and even increases in risk of sudden infant death syndrome.(6) However, smoking has not been extensively studied in regards to postpartum depression. Our hypothesis was that smoking is a risk factor and may contribute to the development of postpartum depression. Cigarette smoking has been found to increase the risk of other mood disorders, such as major depression, so it is likely a risk for other forms of depression such as PPD.(6)

The study gathered data from published research studies using databases such as PubMed and Ovid Medline and analyzed the results to determine if a relationship between smoking during pregnancy and postpartum depression exists. It looked at mothers who have never smoked, mothers who stopped smoking

during pregnancy, and mothers who continued to smoke throughout pregnancy. It excluded mothers with a history of depression disorders to only assess the development of PPD. The study also aimed to determine if postpartum depression lead to smoking after pregnancy. The working hypothesis was that if a mother develops PPD, then she is more likely to reestablish smoking habits after the birth. A further look into the data regarding mothers who stopped smoking during pregnancy was done to hopefully show if and when they starting smoking postpartum and if PPD could be the cause. This research also excluded mothers with a history of depression disorders.

Expected outcomes were improved insight into the relationship between smoking tobacco and postpartum depression. By establishing a greater understanding in smoking as a risk factor for postpartum depression, further research can be done to look into a potential biological relationship between the two. Hopefully, when the risks for developing postpartum depression have been established, whether relating to smoking or involving other risks, the treatment for postpartum depression will be easier to manage. The results from this study can help achieve the ultimate goal of reducing postpartum depression symptoms and occurrence for many mothers.

2 Methods

To establish whether or not a relationship exists between smoking during pregnancy and the development of postpartum depression, a literature search of published research studies was completed to gather data. Utilizing databases such as PubMed and Ovid Medline, the search was narrowed down using specific criteria. On Ovid Medline, an exploded search with the keywords postpartum depression yielded 4362 articles and the exploded search with the keyword smoking yielded 134143 articles. Extrapolating the articles from both searches (using search 1 and search 2 together) narrowed down the field of interest to 37 articles. Limiting the search to articles involving humans and those in the English language did not narrow the results any further.

The resulting articles abstracts were searched for data that had implications regarding the research question. Those that did not look at the effects of smoking on postpartum depression, such as an article on the association between infertility treatments and postpartum depression, were discarded, yielding 15 results. After obtaining only potentially valuable articles, the group members then went on to review them.

In order to ensure reliable data, each article was reviewed by gathering a list of population studied, limitations, and strengths, and summarizing the results. Upon review, articles were thrown out based on specific patient exclusion criteria. This exclusion criteria included case study articles, data regarding mothers with a history of depressive disorder, and data regarding mothers with history of usage of drugs of abuse. The members then compiled all the information and reviewed differences. The articles that had differing data for each member were then discussed within the group to ensure a consensus. Once the information for each article was compiled, the members decided if any of the articles did not meet the standard of evidence (Level 1-3) or were not relevant for the research question. If it was agreed upon by at least two members that the information did not meet their standard, the article was then thrown out. Each member's information was combined, yielding 11 results (Figure 1).

3 Results

Of the resulting articles, 11 supported an association between smoking before or during pregnancy and postpartum depression (Table 1). One such study was performed by Dagher to examine the relationship between prenatal health behaviors and postpartum depression. The prospective cohort study looked at 662 English speaking women over the age of 18 who were included based on their smoking status in a 1:2 smoker to nonsmoker ratio. Women were interviewed in hospital 24 hours after delivery and at 8 weeks postpartum. Depression was evaluated using the Edinburgh Postnatal Depression Scale (EPDS) at 8 weeks, which assessed how the women felt during the past 7 days. Characteristics that were being evaluated in the study included caffeine intake, vitamin intake, and smoking status. Of the 662 women, 38% identified

themselves as smokers, 62% as coffee drinkers, and 81% took prenatal vitamins. At 8 weeks postpartum, 6.5% of women were classified as having postpartum depression. Smoking anytime during pregnancy resulted in women scoring 2.34 points higher on the EPDS than women who had not smoked (p-value <0.001). A previous study conducted by Stephen Matthey examined differences in scores on the EPDS and found a 4-point difference was needed for a clinician to be 95% confident that the score change accurately reflected a difference in mood.⁶ The results of this study may not be clinically significant, however they were able to find an association between prenatal smoking and symptoms of postpartum depression, indicating a need to further examine the effects of smoking during pregnancy on postpartum depression. This study suggests that smoking status may provide health care providers with a marker for future postpartum depression symptoms and offer motivation to initiate smoking cessation. Strengths of this study include the large sample size, validated questions, and a multivariate statistical technique. One limitation was that women who participated in this study were recruited from a single hospital and had similar demographics to each other, making it difficult to generalize to other groups of women. Secondly, postpartum depression was self-reported and was not confirmed as a medical diagnosis.⁽⁴⁾

The United States Centers for Disease Control has run a Pregnancy Risk Assessment Monitoring System (PRAMS) since 1987, which serves to gather state-specific, population-based data about prenatal and postnatal maternal experiences. This has been a database of choice for many researchers regarding smoking and the effects on pregnancies and mothers. One such study was performed by Salimi, and looked at 29,654 women who had reported smoking 3 months prior to pregnancy. The retrospective, cross-sectional study was able to look at PRAMS standardized data from postpartum surveys, however it was not able to include whether mothers had history of depression, and only 2 standardized survey questions were used to evaluate the presence of PPD. Salimi found that participants whose smoking was either reduced or unchanged from their pre-pregnancy levels were about 30% more likely to have PPD compared to the mothers who quit smoking (95% CI = 1.10-1.60, p-value = 0.001). Participants who increased their smoking levels postpartum were 80% more likely to have PPD compared to those who quit (95% CI = 1.5-2.30, p-value <0.001). In a 3 time-point analysis of data, participants who continued smoking at any level during pregnancy and postpartum had 1.48 times the odds of reporting PPD compared to those who quit smoking during pregnancy and maintained cessation. Those who quit smoking during pregnancy but then resumed postpartum were 1.28 times more likely to report PPD.⁽⁸⁾

One of the first studies that came out regarding smoking and postpartum depression was performed by Pritchard. The prospective study was conducted in Glasgow, Scotland to look at the association between smoking status, depression and other socioeconomic factors. A total of 395 women who were pregnant with their second child were included and given questionnaires at 20 and 30 weeks of pregnancy. Depression was screened for using the Hospital Anxiety and Depression scale, with a score of 11 or above being classified as case depressed. Additionally, smoking status as well as income was self-reported at 20 and 30 weeks. Finally, stressful life events from the previous year and between weeks 20 and 30 was evaluated using the Life Events Inventory. Their results show that smoking was associated with significantly higher rates of case depression at both 20 and 30 weeks with a p-value of <0.001 (20 weeks: 9.2% vs 4.7% and 30 weeks: 22.7% vs. 7.6%). Overall, 22.7% of smokers experienced depression at either time period compared to 5.1% of non-smokers (OR = 5.49, CI = 2.76-10.93). Researchers were able to identify a group of 47 women who were in the top quartile on the Life Events Inventory and were classified as high psychosocial risk. From this group, 25 were smokers who experienced prolonged depression and were compared to smokers who were not high risk. There was no significant difference found between these two groups and rates of depression. This suggests that smoking itself is an independent risk factor for development of depression. Overall, smokers were more likely to experience depression symptoms compared to non-smokers even within different socioeconomic groups. Limitations of this study include self-reporting of smoking status, which may provide unreliable information. Additionally, this was a small study, including women from a single hospital and those included in the study were pregnant with their second child (parity 1), which may include bias for healthier mothers compared to first-time mothers.⁽⁶⁾

McCoy conducted a retrospective study in Oklahoma and analyzed the records of 1072 women who were 4-weeks postpartum to look for correlations between postpartum depression and specific patient characteristics.

These characteristics included breastfeeding status, method of delivery, history of depression, marital status, patient age, and tobacco use. The EPDS was used to screen for postpartum depression, with a score of 13 or higher being indicative of PPD. Women who were currently on antidepressant medications were excluded from the study, leaving 209 women remaining. From this population, it was found that 81 women had a score of 13 or higher on the EPDS and were classified as depressed. The results of their analysis showed that cigarette smoking resulted in a significantly higher occurrence of PPD when compared to non-smoking (p -value = 0.01), with a risk factor of 1.58 (p -value <0.5). Ultimately, their results showed three combinations of characteristics that increased the likelihood of having PPD: not breastfeeding and a history of depression, cigarette smoking and a history of depression, and cigarette smoking and not breastfeeding. From these combinations, cigarette smoking and a non-breastfeeding status was the most additive, followed by cigarette smoking and a prior history of depression. This suggests that women who have two of these characteristics are more likely to experience PPD than if they have one alone. These results recommend that healthcare providers ask new mothers about their breastfeeding status, tobacco use and any history of depression in order to monitor for, diagnose and treat PPD as soon as possible. This study had limitations, one being that the study population was based on convenience sampling. Additionally, screening for PPD was not routinely done at the time of the study, so their results were skewed towards women who had previously reported feeling depressed, prompting their doctors to administer the EPDS. Also, the population served by the sites studied is primarily low income women, which is a risk factor for PPD in itself. This does not allow the results of the study to be applied to the general population in the US.(9)

Zhu surveyed 487 women in Norway to compare the levels of depression in women who were never smokers, former smokers, and current smokers. A questionnaire was used to identify smoking status, which was self-reported by the mothers. The Center for Epidemiologic Studies Depression Scale (CES-D) was used to measure depressive symptoms, which included 20 questions graded on a scale of 0-3. Women who scored a 16 or above were considered to have depressive symptoms. Of the participants, 13.1% were identified as current smokers, 35.9% as former smokers, and the remainder had never smoked. Their results showed that depression increased from never smokers to current smokers, with rates of 12.9%, 25.1% and 37.5% respectively (p -value <0.001). Depressed women were 4.1 times more likely to be smokers than non-depressed women. Also, depressed women were more likely to be former smokers than non-depressed women with an odds ratio of 2.3 (p -value <0.001). Some shortfalls of this study include the CES-D being first translated from English to Norwegian, and then the results translated back into English for final scoring, which could lead to discrepancies. Secondly, the causality of the relationship cannot be entirely established. Do women develop depression because of smoking, or does underlying depression contribute to the inability to quit smoking? (10)

Whitaker looked to find a correlation between an episode of major depression and smoking status 15 months following delivery. They hypothesized that either smoking or depression increased the likelihood of the other condition and examined this question by surveying 4353 new mothers following delivery and 15 months after delivery. Women were classified as having had a major depressive episode (MDE) if they reported having had a two-week period in which experienced a dysphoric mood or anhedonia occurring almost every day. Additionally, they needed to report having 3 other symptoms of major depression listed in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV). Smokers were classified by having had a cigarette in the past month. Women were excluded if there was data missing on either depression or smoking habits. Upon analysis, it was discovered that 26.6% of women identified themselves as smokers, 13.1% had a depressive episode, and 5.0% were smokers who had a depressive episode. Women who identified themselves as smokers experienced a major depressive episode 5.6 percentage points more than non-smokers, which is a relative increase of 46% (17.7% vs. 12.1%). Additionally, the prevalence of smoking among women who experienced an MDE was 8.5 percentage points higher than women who had not experienced one (34% vs. 25.5%), a relative increase of 33%. (11) Women surveyed in this study were exclusively from large US cities, and contained a large population of single mothers, which does not allow the results to be applied to the general population. Additionally, there cannot be a causal association applied between smoking and depression. This data does show however, the co-occurrence of depression and smoking, suggesting the need to treat these two conditions together.(11)

4 Discussion and Conclusion

Many of the studies under observation supported a relationship between smoking before, during, and after pregnancy and the increased risk of developing postpartum depression. Some studies looked specifically at mothers who stopped smoking during pregnancy, while others looked for those who remained smokers. All studies found some sort of correlation, however not all findings were statistically significant. As for our primary question of whether smoking specifically during pregnancy increased risk of postpartum depression, all studies that examined this found a significant relationship between the two.

One of the biggest remaining questions is that of the causality between the relationship. No one has yet been able to establish whether postpartum depression is caused by smoking at any point during a mother's lifetime, or whether having depression is a risk factor for continued smoking. This is something that could use more research, however it is a conundrum that may not have a definitive answer, since depression is such a multifactorial disease state.

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Tables/Figures

Table 1: Reviewed Articles

Author	Setting/ Intervention	Study Design	Patient Population	Results
Dagher ⁴	Investigated the association between prenatal health behaviors including caffeine intake, vitamin intake and tobacco use	Prospective cohort	Women at least 18 years old and spoke English from one university hospital. Interviewed at 24 hours post-delivery and 8 weeks postpartum. Edinburgh Postnatal Depression Scale was used to determine depression	Analysis showed that cigarette smoking at any time during pregnancy and not taking prenatal vitamins were significantly associated with higher rates of depression, while caffeine use was not.
Pritchard ⁶	Examine the relationship between smoking in pregnancy and depressive symptoms	Prospective survey analysis	395 women filled out questionnaires at 20 and 30 weeks gestation with their second child. Hospital anxiety and depression scale (HAD) was used to score depression	Smoking was significantly associated with possible depression or depression classifications at both 20 and 30 weeks, with P-values < 0.001 in both cases. The greatest significance was with those diagnosed as depressed at 30 weeks, with 22.5% of smokers versus 7.6% of non-smokers.
Salimi ⁸	Relationship between smoking prior to pregnancy and postpartum to postpartum depression	Retrospective, cross-sectional	29,654 US women who smoked 3 months prior to pregnancy	In the 2-point time analysis, participants whose smoking was unchanged or reduced were 30% more likely to have PPD compared to those who had quit smoking. Those who increased their smoking were 80% more likely to have PPD. In the 3-point time analysis, participants who smoked at all during pregnancy had 1.48 times the odds of PPD
McCoy ⁹	Correlation between postpartum depression and characteristics of mother including breastfeeding status, marital status, type	Retrospective	588 women from 3 university clinics in Tulsa, Oklahoma	Prior history of depression and tobacco use were significant risk factors for an EPDS score of 13 or above, indicating PPD.

	of delivery, history of depression and tobacco use			
S.H. Zhu ¹⁰	Assess the rates of depression in current smokers, former smokers and non-smokers during pregnancy	Regression analysis of survey results, prospective survey	487 pregnant women (aged 17–44) from two hospitals in Norway. Depression was assessed using the CES-d	Both current and former smokers had more depressive symptoms compared to non-smokers at 37.5%, 25.1% and 12.9% respectively.
Whitaker ¹¹	Looked to find a correlation between smoking and a major depressive episode	Prospective	4353 new mothers	Five percent of the population were smokers who had a depressive episode. Women who identified themselves as smokers experienced a major depressive episode 5.6% more than non-smokers, which is a relative increase of 46% (17.7% vs. 12.1%).
Goedhart ¹²	The association of psychosocial problems with continued smoking during pregnancy in Amsterdam.	Prospective survey, used CES-D to classify depression	1947 pregnant women who reported smoking before pregnancy. Data was collected through a pregnancy-questionnaire given after the first prenatal care visit and was filled out by 8266 women in total. (Amsterdam Born Children and their Development Study.)	Pregnancy-related anxiety, high job strain, and exposure to violence (physical/ sexual) caused women to more often continue smoking during pregnancy. Depressive symptoms and anxiety were not associated with smoking during pregnancy.

Figure 1: Study Selection Flow Diagram

