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The Relationship Between Postpartum Depression and Perinatal Cigarette Smoking: An Analysis of PRAMS Data[☆]

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ABSTRACT

Introduction: This study examines the relationship between postpartum depression (PPD) and cigarette smoking from prior to pregnancy to postpartum.

Methods: The study sample consisted of 29,654 U.S. women who reported smoking in the 3 months prior to pregnancy and for whom data on PPD were available from the Pregnancy Risk Assessment Monitoring System (PRAMS). Two sets of analyses were conducted. The first compared smoking at 2 time points (prior to pregnancy and postpartum) and the second at 3 time points (prior to pregnancy, during pregnancy, and postpartum). PPD was defined as responses of “often” or “always” to 2 questions: “Since your baby was born, how often have you felt down, depressed, or sad?” and “Since your new baby was born, how often have you had little interest or little pleasure in doing things?”

Results: Overall, 22% of the sample endorsed PPD symptoms. In the 2 time-point analysis, controlling for known confounders, participants whose smoking was reduced or unchanged postpartum were about 30% more likely to have PPD compared to those who quit (OR: 1.34; 95% CI = 1.10–1.60, $p = 0.001$; OR: 1.32; 95% CI: 1.10–1.50, $p < 0.001$ respectively). Participants who increased smoking postpartum were 80% more likely to have PPD compared to those who quit (OR: 1.80; 95% CI: 1.50–2.30, $p < 0.001$). In the 3 time-point analysis, participants who continued smoking at any level during pregnancy and postpartum had 1.48 times the odds of reporting PPD (95% CI: 1.26, 1.73) compared to those who quit during pregnancy and remained quit postpartum. Participants who quit during pregnancy but resumed postpartum had 1.28 times the odds of reporting PPD (95% CI: 1.06, 1.53) compared to those who quit during pregnancy and remained quit postpartum.

Conclusion: Results suggest an association among women who smoke cigarettes prior to pregnancy between PPD and continued smoking during pregnancy and postpartum.

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1. Introduction

Postpartum depression (PPD) is a relatively common disorder with potentially devastating effects (Beck, 2002, 2006; Gress-Smith, Luecken, Lemery-Chalfant, & Howe, 2012; Roux, Anderson, & Roan, 2002). PPD has a lifetime prevalence of approximately 13% (Jewell, Dunn, Bondy, & Leiferman, 2010) and, similar to other episodes of major depressive disorder, can vary in severity. In its most severe form, PPD symptoms may include hallucinations, delusions, suicidal ideation, and/or homicidal ideation, which can lead to maternal and child death (Brockington, 2004; Zauderer, 2009). However milder forms of PPD can also have a significant impact on maternal and child well-being (Gress-Smith et al.,

2012; Rhodes & Segre, 2013). Although the causes of PPD are unknown, it has been associated with the hormonal fluctuations of childbirth, stress, lack of social support, interpersonal violence, and substance abuse (Dennis & Vigod, 2013; Fernandez, Grizzell, & Wecker, 2013; Goyal, Gay, & Lee, 2010; Kahn, Certain, & Whitaker, 2002; Marcus, 2009).

About 22% of women of reproductive age in the United States smoke cigarettes (Centers for Disease Control and Prevention (CDC), 2008). Although approximately half of female smokers quit smoking during pregnancy (Colman & Joyce, 2003; Martin et al., 2007; Tong et al., 2009), the majority who quit relapse within 6 months after delivery (Allen, Prince, & Dietz, 2009; Correa-Fernández et al., 2012; Kahn et al., 2002; Park et al., 2009; Solomon et al., 2008). Previous studies have demonstrated a relationship between maternal mental health and postpartum resumption of cigarette smoking, with both worsening stress and depression during pregnancy and PPD associated with smoking relapse following delivery (Allen et al., 2009; Park et al., 2009). The main objective of this study was to examine the relationship between PPD and the change in cigarette smoking behavior across 2

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(prior to pregnancy and postpartum) and 3 time points (prior to pregnancy, during pregnancy, and postpartum).

2. Materials and methods

2.1. Study population

The Pregnancy and Risk Assessment Monitoring System (PRAMS) is a population-based project of the CDC and state health departments which surveys postpartum women about factors before, during, and shortly after their most recent pregnancy. PRAMS data are collected from 23 states and New York City, each of which uses a stratified sample system to recruit 100–300 women per month who have delivered a live infant. Detailed information about the PRAMS methodology has been published elsewhere (Shulman, Gilbert, Msphbrenda, & Lansky, 2006). Data from 2004–2008 (Wave 5) were used for this analysis and limited to women who reported “any cigarette smoking in the 3 months prior to pregnancy” and for whom data were available regarding PPD ($N = 29,654$).

2.2. Measures

Smoking at 3 time points was assessed: 3 months prior to pregnancy, during the last 3 months of pregnancy, and postpartum. The postpartum period was defined as the time between delivery and survey completion, which ranged from 2 to 9 months after delivery. Cigarette smoking behavior was assessed by response to survey items which aggregated the number of cigarettes smoked into 7 categories: none, less than 1, 1–5, 6–10, 11–20, 21–40, and 41 or more. As noted previously, inclusion criteria dictated that all participants endorsed smoking in the 3 months prior to pregnancy. Two distinct analyses were conducted to capture the relationship between PPD and perinatal smoking behavior change. First, participants were compared at 2 time points (prior to pregnancy and postpartum) on 4 smoking status variables: quit, reduced, unchanged, and increased smoking. Second, participants were compared at 3 time points (prior to pregnancy during pregnancy, and postpartum) on 3 smoking status variables: 1) smoking prior to pregnancy, not smoking (quit) during last 3 months of pregnancy, and remained quit through the postpartum period, 2) smoking prior to pregnancy, not smoking (quit) during last 3 months of pregnancy, and resumed smoking postpartum, and 3) smoking prior to pregnancy, continued smoking during last 3 months of pregnancy, and continued smoking postpartum. For the purpose of this study, PPD was defined by endorsement of PPD symptoms, as indicated by a response of “often” or “always” to both of 2 PRAMS survey questions: “Since your baby was born, how often have you felt down, depressed or hopeless?” and “Since your new baby was born, how often have you had little interest or little pleasure in doing things?” These 2 questions, based on a validated screen for general depression (Whooley, Avins, Miranda, & Browner, 1997), were adapted by the CDC as a surveillance tool for self-reported PPD on PRAMS. No other questions about depressive symptoms were included on the survey in every state. Socio-demographic factors such as race, age, education, marital status, parity, and income one year before delivery were captured in PRAMS. The institutional review boards at the University of Maryland School of Medicine, Johns Hopkins University School of Medicine, and Maryland Department of Health and Mental Hygiene qualified this project as exempt research.

2.3. Statistical analyses

Weighted univariate and multivariate analysis were performed using STATA v 12.0 to account for PRAMS' complex sampling design (Shulman et al., 2006) and reported as population proportions with 95% confidence intervals. The weighted univariate analysis applying Chi square testing was performed to evaluate the association of the individual independent variables or confounders with PPD using $p = 0.05$ as the level of significance. Weighted univariate and multivariate

logistic analyses were performed reporting crude and adjusted odds ratio. Backwards logistic regression model analysis was performed manually adjusting for important potential confounders. Finally, effect sizes for the odds ratio of the association between PPD and perinatal smoking were calculated using the standard formula.

3. Results

The study sample consisted of 29,654 women who reported smoking cigarettes in the 3 months prior to pregnancy and for whom data on PPD were available. Table 1 depicts the participant characteristics, both overall and stratified by change in smoking status from prior to pregnancy to postpartum (2 time-point analysis) and postpartum depression (PPD). Seventy-five percent of participants – all of whom endorsed smoking prior to pregnancy – also reported smoking postpartum (at reduced, unchanged, or increased levels). Twenty-two percent of all participants endorsed PPD symptoms. Participants who reported reduced, unchanged, or increased smoking from prior to pregnancy to postpartum were significantly more likely to have PPD compared to those who quit smoking (23, 23, and 33% vs. 15%, $p < 0.001$, respectively). Overall, most participants were less than 30-years old, at least high school-educated, and with an annual income under \$50,000. Most participants were white, but 30% of Black/non-Hispanic and 26% of Other/non-Hispanic participants reported PPD, $p = 0.02$ and $p = 0.007$ respectively.

The association of PPD and smoking behavior change from prior to pregnancy to postpartum (2 time-point analysis) and other participant characteristics is illustrated in Table 2. Controlling for known confounders, participants who reported reduced or unchanged smoking from prior to pregnancy to postpartum were about 30% more likely to have PPD than those who quit (OR: 1.34; 95% CI = 1.10–1.60; OR: 1.32; 95% CI: 1.10–1.50, respectively) and those who reported increased smoking were 80% more likely to have PPD compared to those who quit (OR: 1.80; 95% CI: 1.50–2.30, $p < 0.001$). As previously mentioned, overall Black/non-Hispanic and Other/non-Hispanic women were more likely to have PPD compared to whites. PPD was also more common as both age and income decreased.

Table 3 stratifies the results based on smoking behavior across 3 time points (prior to pregnancy, during pregnancy, and postpartum). Slightly over half of all study participants continued to smoke during the last 3 months of pregnancy and postpartum. Among the remaining half who were not smoking during the last 3 months of pregnancy, half remained quit postpartum and half resumed smoking postpartum. Therefore, only one quarter of all participants were not smoking postpartum. Participants who continued smoking during the last 3 months of pregnancy and postpartum had 1.48 times the odds of reporting PPD (95% CI: 1.26, 1.73) compared to those who were not smoking during the last 3 months of pregnancy and remained quit postpartum, with an odds ratio effect size of 0.4. Participants who were not smoking during the last 3 months of pregnancy but resumed postpartum had 1.28 times the odds of reporting PPD (95% CI: 1.06, 1.53) compared to those who were not smoking during the last 3 months of pregnancy and remained quit postpartum, with an odds ratio effect size of 0.25.

4. Discussion

This study of nationally representative data suggests a significant relationship between PPD and perinatal smoking behavior. By analyzing the association between PPD and cigarette smoking behavior change among participants at both 2 (prior to pregnancy and postpartum) and 3 time points (prior to pregnancy, during pregnancy, and postpartum), a more complex understanding of the relationship between PPD and perinatal cigarette smoking, both separately and in concert, emerges. Specifically, these results suggest that women who smoke cigarettes prior to pregnancy and continue to smoke during the last 3 months of pregnancy and postpartum are more likely to have PPD

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