Original Investigation

The association of depressive, anxiety, and stress symptoms and postpartum relapse to smoking: A longitudinal study

Elyse R. Park, Yuchiao Chang, Virginia Quinn, Susan Regan, Lee Cohen, Adele Viguera, Christina Psaros, Kaile Ross, & Nancy Rigotti

Abstract

Introduction: The aim of this prospective repeated measures, mixed-methods observational study was to assess whether depressive, anxiety, and stress symptoms are associated with postpartum relapse to smoking.

Methods: A total of 65 women who smoked prior to pregnancy and had not smoked during the last month of pregnancy were recruited at delivery and followed for 24 weeks. Surveys administered at baseline and at 2, 6, 12, and 24 weeks postpartum assessed smoking status and symptoms of depression (Beck Depression Inventory [BDI]), anxiety (Beck Anxiety Inventory [BAI]), and stress (Perceived Stress Scale [PSS]). In-depth interviews were conducted with women who reported smoking.

Results: Although 92% of the participants reported a strong desire to stay quit, 47% resumed smoking by 24 weeks postpartum. Baseline factors associated with smoking at 24 weeks were having had a prior delivery, not being happy about the pregnancy, undergoing counseling for depression or anxiety during pregnancy, and ever having struggled with depression ($p < .05$). In a repeated measures regression model, the slope of BDI scores from baseline to the 12-week follow-up differed between nonsmokers and smokers (-0.12 vs. $+0.11$ units/week, $p = .03$). The slope of PSS scores also differed between nonsmokers and smokers (-0.05 vs. $+0.08$ units/week, $p = .04$). In qualitative interviews, most women who relapsed attributed their relapse and continued smoking to negative emotions.

Discussion: Among women who quit smoking during pregnancy, a worsening of depressive and stress symptoms over 12 weeks postpartum was associated with an increased risk of smoking by 24 weeks.

Introduction

Approximately one third of female smokers quit once they learn that they are pregnant (Fingerhut, Kleinman, & Kendrick, 1990; Floyd, Rimer, Giovino, Mullen, & Sullivan, 1993; LeClere & Wilson, 1997; Severson, Andrews, Lichtenstein, Wall, & Zoref, 1995), but up to two thirds of women who stop smoking during pregnancy relapse within 6 months after delivery (Colman & Joyce, 2003; Fingerhut et al., 1990; Martin et al., 2008; McBride & Pirie, 1990; McBride, Pirie, & Curry, 1992; Ratner, Johnson, Bottorff, Dahinten, & Hall, 2000). Women who remain tobacco abstinent after delivery experience health benefits that include protection of infants from secondhand smoke exposure, lower risk of poor pregnancy outcomes in subsequent pregnancies, and decreased personal risk of tobacco-related health problems (Mullen, 2004). To increase the proportion of women who maintain tobacco abstinence after delivery, it is necessary to understand the modifiable factors associated with postpartum relapse to smoking.

In the general population, depression, anxiety, and stress are more common among smokers than nonsmokers; these factors are barriers to smoking cessation and triggers for relapse

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(Breslau, Kilbey, & Andreski, 1991; Curry & McBride, 1994; Glassman & Covey, 1996; Glassman et al., 1990; Hall, Munoz, Reus, & Sees, 1993; Kendler et al., 1993). Among pregnant women, current and former smokers are more likely to report depressive symptoms than never-smokers (Zhu & Valbo, 2002), and pregnant smokers are more likely than pregnant nonsmokers to have a mood disorder (major depressive disorder, dysthymia, and hypomania) or an anxiety disorder (panic disorder, phobia, and generalized anxiety disorder; Goodwin, Keyes, & Simuro, 2007). Although pregnant women who quit during pregnancy have lower levels of depressive and stress symptoms, compared with women who continue to smoke (Blalock, Robinson, Wetter, & Cinciripini, 2006; Bullock, Mears, Woodcock, & Record, 2001; Ludman et al., 2000), prenatal quitters are at risk for both mood fluctuations and smoking relapse after delivery.

Postpartum depression affects approximately 10%–13% of U.S. women (DaCosta, Larouche, Dritsa, & Brender, 2000; Lee et al., 2003). Generalized anxiety disorder is more common in the postpartum period than in the general female population (Ross & McLean, 2006). A few studies have found that women who meet criteria for a clinical diagnosis of depression (e.g., using the Composite International Diagnostic Interview Short-Form) or who have evidence of depression defined by a formal mental health profile are at elevated risk of postpartum relapse to smoking (Martin et al., 2008; Ratner et al., 2000; Whitaker, Orzol, & Kahn, 2007). However, many postpartum women have depressive symptoms that do not meet diagnostic criteria for depression. It is not clear whether having symptoms of depression is associated with postpartum relapse to smoking.

The effect of anxiety and stress symptoms on postpartum relapse to smoking also is unclear. Two small studies examined the effect of stress and depressive symptoms on postpartum relapse to smoking. A longitudinal study of 87 women who quit smoking during pregnancy found that elevated Beck Depression Inventory (BDI) scores at the end of pregnancy were associated with an increased risk of relapse by 6 months (Solomon et al., 2007); the BDI was not administered after delivery. A qualitative study of 49 inner-city women who stopped smoking before or during pregnancy found that those who relapsed postpartum reported that stress was the primary reason for their return to smoking (Letourneau et al., 2007).

The purpose of this longitudinal study was to determine if postpartum worsening of depressive, anxiety, and stress symptoms is associated with postpartum return to smoking. We enrolled women, immediately after delivery, who had quit smoking before or early in pregnancy and assessed symptoms of depression, anxiety, stress, and smoking status repeatedly over 24 weeks. We hypothesized that an increase in depressive, anxiety, and stress symptoms during the postpartum period would be associated with an increased likelihood of smoking at 24 weeks postpartum. We also sought to explore attributions for smoking relapse using qualitative methods. Our study builds on previous research by (a) assessing the influence of postpartum depressive, anxiety, and stress symptoms on postpartum relapse to smoking; (b) assessing these symptoms and smoking status repeatedly over 24 weeks postpartum; and (c) combining quantitative measures of these symptoms with qualitative reports of emotions prior to a smoking episode.

Methods

In this repeated measures observational study, approved by the Partners HealthCare Institutional Review Board, women who had quit smoking during or just before pregnancy were enrolled at delivery and were assessed at 2, 6, 12, and 24 weeks postpartum. Women who reported at one of the assessments that they were smoking were asked open-ended questions about their relapse experience.

Study population

Recruitment was conducted at the Brigham and Women's Hospital Obstetrics Service in Boston, MA. Women were eligible for participation if they were (a) recent quitters (smoked at least 1 cigarette/week within 6 months prior to conception but did not smoke during the last month of pregnancy), (b) had access to a telephone, (c) were at least 18 years old, and (d) spoke English. Women were excluded if they had a severe psychiatric history (history of schizophrenia or major depressive disorder at delivery) or had a newborn with a major congenital anomaly or who was born at under 25 weeks gestation.

Patient recruitment and data collection

Recruitment took place from January to October 2005. Each weekday, a research assistant screened the hospital charts and electronic medical records of all new admissions to Brigham and Women's Hospital postpartum floors to identify smoking status and obtained approval from the patients' nurses or obstetricians to approach potentially eligible patients. The research assistant administered the American College of Obstetricians and Gynecologists recommended smoking status screening question (modified for the postpartum period; American College of Obstetricians and Gynecologists, 2002), obtained informed consent, and administered the baseline survey. Participants were reimbursed US \$15 for each assessment, and an additional \$10 was given to participants who completed all four follow-up assessments.

Measures and data collection

Baseline data were collected on demographic factors (age, education, insurance type, marital status, and race/ethnicity), pregnancy characteristics (parity, feelings about pregnancy ["How did you feel when you found out you were pregnant with your new baby?"; D'Angelo et al., 2007]), smoking characteristics (daily prepregnancy smoking rate, weeks quit, desire to stay quit, and partner smoking status), depression and anxiety history ("Have you ever struggled with depression? anxiety?"), and counseling history ("During your pregnancy, did you get counseling for depression or anxiety?"). The BDI and the BAI were used to assess depression and anxiety symptoms (Beck, Epstein, Brown, & Steer, 1988; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961). The BDI is a 21-item inventory of symptoms experienced over the past week. The BAI assesses 21 anxiety symptoms experienced over the past week (BDI and BAI range = 0–63). Stress was measured with the four-item Perceived Stress Scale (PSS; range = 0–16; Cohen, Kamarck, & Mermelstein, 1983).

At each follow-up telephone assessment, we administered the BDI, BAI, and PSS and asked about smoking status. A woman was defined as a smoker if she reported having smoked a

cigarette, even a puff, in the past week. Four individuals who were smokers at 12 weeks and missed the 24-week survey were classified as smokers at 24 weeks. Upon initial report of smoking, women were qualitatively interviewed about their relapse experiences. A semistructured interview guide was used, which included the following domains: relapse episode ("Please tell me about your return to smoking"), smoking attributions ("What caused you to smoke?"), and the relationship between mood and smoking ("How, if at all, does your mood impact your smoking or not smoking?"). Interviews lasted approximately 20–30 min.

Data analyses

Quantitative analyses were conducted with SAS version 9.13. We conducted a univariate analysis to investigate baseline factors associated with smoking at the 24-week follow-up. Because of the small sample size and nonnormal distributions, Fisher's exact tests and Wilcoxon rank-sum tests were used to compare variables between smokers and nonsmokers. Our hypothesis was that a worsening of depressive, anxiety, and stress symptoms during the postpartum period would be associated with smoking at 24 weeks. To test this hypothesis, we conducted longitudinal analyses with mixed-effects regression models that assessed the relationship between the slope of change in BDI, BAI, and PSS scores over time and the smoking status at the 24-week follow-up. To enable us to see the effect of changes in BDI, BAI, and PSS over the entire 24 weeks, as well as over the initial 12 weeks, we modeled these variables in two ways: (a) using all five observation points (baseline to 24 weeks) and (b) using four observation points (baseline to 12 weeks).

Qualitative interviews were audiotaped and transcribed. Content analyses were conducted using NVIVO 8.0 software and an iterative multistep process performed by two research assistants using the techniques described by Miles and Huberman (1984). Major and minor themes within each content area (relapse episode, smoking attributions, and the relationship between mood and smoking) were identified; data were coded for frequency, intensity, and duration (Krueger & Casey, 2000). Results from each phase of the analyses were compared; discrepancies were discussed with the Principal Investigator until resolution was reached. To ensure dependability and credibility (Devers, 1999), all interviews were audiotaped, coders analyzed the data independently; at each phase of the analyses, the coders discussed their findings and compared their coding to the raw data.

Results

During the 10-month study period, the hospital charts of 3,666 postpartum women were screened. We were unable to screen 34 patients whose charts indicated that they were potentially eligible. A total of 101 eligible patients were identified and 65 patients (64% of those eligible) enrolled. The most common reasons for refusal were being overwhelmed during their post-delivery stay (44%) or anticipating that they would not have time to participate in the follow-up surveys (31%); 6% did not want to talk about their smoking history. A total of 44 patients whose charts indicated that they were potentially eligible were ineligible once approached: 41 were ineligible due to their smoking status (nonsmokers, long-term former smokers, or current smokers) and 3 did not speak English.

Table 1. Baseline characteristics (N=65)

Sociodemographic characteristics	
Age, years; <i>M (SD)</i>	28.8 (6.1)
Education (%)	
Less than high school	7.7
High school graduate/some college	53.8
College graduate plus	38.5
Insurance type (%)	
Private	48.3
Marital status (%)	
Married/living with a partner	55.4
Race/ethnicity (%)	
White	52.3
Black	20.0
Hispanic	21.5
Other	6.2
Pregnancy characteristics	
Nulliparous (%)	67.7
Unhappy/not sure about pregnancy (%)	32.8
Smoking characteristics	
Cigarettes per day prior to quit; <i>M (SD)</i>	8.4 (6.2)
Weeks quit; <i>M (SD)</i>	17.3 (19.3)
Desire to stay quit (a lot) (%)	92.2
Spouse current smoker (%)	42.4
Mood characteristics	
BDI; <i>M (SD)</i> ^a	5.8 (4.7)
BAI; <i>M (SD)</i> ^b	6.1 (6.7)
PSS; <i>M (SD)</i> ^c	8.3 (2.9)
Ever struggled with depression (%)	23.1
Ever struggled with anxiety (%)	15.6
Had mood counseling during pregnancy (%)	10.8

Note. ^aBeck Depression Inventory (BDI) scoring range = 0–63.

^bBeck Anxiety Inventory (BAI) scoring range = 0–63.

^cPerceived Stress Scale (PSS) range = 0–16, higher = greater perceived stress.

Follow-up assessments were completed with 80% of participants at 2 weeks, 82% at 6 weeks, 80% at 12 weeks, and 75% at 24 weeks. Women who completed the 24-week survey did not differ significantly from women who did not complete the 24-week survey on sociodemographic characteristics. Table 1 displays the baseline characteristics of the sample. Fifty-two percent self-identified as White, 20% as Black, and 22% as Hispanic. Prepregnancy mean smoking rate was 8.4 cigarettes/day (*SD* = 6.2). Almost all participants (92%) expressed a strong desire to stay quit after delivery. At baseline, mean BDI and BAI scores were 5.8 (*SD* = 4.7) and 6.1 (*SD* = 6.7), respectively; 23% of participants reported that they had "ever struggled with depression," 15% had "ever struggled with anxiety," and 11% had counseling for depression or anxiety during pregnancy.

Smoking rates among participants who completed follow-up surveys were 10% at 2 weeks, 25% at 6 weeks, 37% at 12 weeks, and 47% at 24 weeks. Assuming that nonrespondents were smokers, we found that smoking rates reached 60% by 24 weeks. Table 2 displays baseline factors associated with return to smoking by 24 weeks postpartum in a univariate analysis. Smoking was associated ($p < .05$) with having had a previous delivery, being unhappy about the current pregnancy, undergoing counseling

Table 2. Baseline characteristics associated with smoking status at 24 weeks postpartum (N=49)

	Smoking status at 24-week follow-up		
	Nonsmoker (<i>n</i> = 26)	Smoker (<i>n</i> = 23)	<i>p</i> value
Sociodemographic characteristics			
Age, years; <i>M</i> (<i>SD</i>)	27.7 (6.0)	28.7 (5.7)	.59
Education (%)			
Less than high school	0	13.0	.09
High school graduate/some college	50.0	56.5	
College graduate or more	50.0	30.4	
Insurance type (%)			
Private	54.2	38.1	.63
Marital status (%)			
Married/living with partner	65.4	43.5	.15
Race/ethnicity (%)			
White	61.5	43.5	.53
Black	15.4	34.8	
Hispanic	19.2	17.4	
Other	3.8	4.3	
Pregnancy characteristics			
Nulliparous (%)	84.6	47.8	.01
Unhappy/not sure about pregnancy (%)	23.1	54.5	.03
Baseline smoking characteristics			
Cigarettes per day prior to pregnancy; <i>M</i> (<i>SD</i>)	8.3 (6.9)	8.2 (6.2)	.73
Weeks quit (median)	4.5	8.0	.83
Desire to stay quit (a lot, %)	92.0	95.7	1.0
Spouse current smoker (%)	50.0	42.9	.90
Mood characteristics			
BDI; <i>M</i> (<i>SD</i>) ^a	5.7 (4.5)	5.3 (4.8)	.63
BAI; <i>M</i> (<i>SD</i>) ^b	7.4 (7.0)	4.7 (5.8)	.23
PSS; <i>M</i> (<i>SD</i>) ^c	7.8 (2.7)	8.3 (3.0)	.57
Ever struggled with depression (%)	7.7	39.1	.01
Ever struggled with anxiety (%)	16.0	8.7	.67
Had mood counseling during pregnancy (%)	0.0	21.7	.02

Note. ^aBeck Depression Inventory (BDI) scoring range = 0–63.

^bBeck Anxiety Inventory (BAI) scoring range = 0–63.

^cPerceived Stress Scale (PSS) range = 0–16, higher = greater perceived stress.

for depression or anxiety during pregnancy, and ever having struggled with depression. Figure 1 shows the mean BDI, BAI, and PSS scores, for each follow-up timepoint, of women who had resumed smoking compared with women who were not smoking at 24 weeks. For both smokers and nonsmokers, BDI and BAI scores decreased over 6 weeks and rose at 12 weeks.

Table 3 displays the relationship between the change in BDI, BAI, and PSS scores postpartum and the smoking status at 24 weeks. To address our hypothesis that an increase in depressive, anxiety, and stress symptoms would be associated with smoking

Figure 1. Mean mood scores (Beck Depression Inventory, Beck Anxiety Inventory, and Perceived Stress Scale) by smoking status. Only participants who completed the 24-week survey are presented in these analyses.

at 24 weeks postpartum, we examined the slope of these scores at 0–24 and at 0–12 weeks. The mean slope of BDI scores between baseline and 24 weeks postpartum decreased (–0.07 units/week) among nonsmokers and rose (+0.05 units/week) among those who smoked ($p = .01$). Findings were similar when BDI scores were limited to assessments from baseline to 12 weeks. Nonsmokers had a larger decrease in the slope of BAI scores over 24 weeks than did women who smoked (–0.14 vs. –0.06), but the difference was not statistically significant ($p = .11$). Nonsmokers at 24 weeks had a mean decrease in PSS scores over 12 weeks (–0.05 units/week), whereas those who smoked had an increase in PSS scores of +0.08 units/week ($p = .04$). Using a composite score of BDI, BAI, and PSS symptoms, we found that smokers' symptoms increased significantly (0.31), compared with a decrease in symptoms among nonsmokers (–0.62; $p = .005$), between baseline and 12 weeks.

Qualitative impressions of relapse

A total of 25 women relapsed and were qualitatively interviewed about their relapse episodes. Some identified environmental triggers, such as drinking and being around others who were smoking, and a few cited physiological triggers, such as cravings. Almost all women cited negative emotions as the reason for their relapse and subsequent smoking behaviors.

About half of the women were alone, not in the presence of another adult, when they relapsed. When alone, women smoked to cope with negative feelings; being stressed was the most commonly mentioned trigger; other frequently cited emotions were feeling nervous or feeling frustrated. Some were struggling with childcare. One woman said, "My baby was stressing me out ..." and another explained, "... Aggravation. Little things and once I get

Table 3. Change in BDI, BAI, and PSS scores and smoking status at 24 weeks; postpartum mixed-effects regression models (N=65)

	Smoking status at 24-week follow-up		
	Nonsmoker	Smoker	<i>p</i> value
	<i>M</i> (<i>SE</i>)	<i>M</i> (<i>SE</i>)	
Slope of BDI, BAI, and PSS scores (0–24 weeks) ^a			
BDI ^b	−0.07 (0.05)	0.05 (0.04)	.01
BAI ^c	−0.14 (0.06)	−0.06 (0.04)	.11
PSS ^d	0.02 (0.03)	0.07 (0.03)	.19
Total scale (BDI + BAI + PSS)	−0.10 (0.18)	0.28 (0.13)	.03
Slope of BDI, BAI, and PSS scores (0–12 weeks) ^a			
BDI ^b	−0.12 (0.10)	0.11 (0.07)	.03
BAI ^c	−0.31 (0.11)	−0.16 (0.08)	.17
PSS ^d	−0.05 (0.07)	0.08 (0.05)	.04
Total scale (BDI + BAI + PSS) ^e	−0.62 (0.33)	0.31 (0.24)	.005

Note. ^aSlope unit of analysis = 1 week.

^bBeck Depression Inventory (BDI) scoring range = 0–63, higher = greater depression.

^cBeck Anxiety Inventory (BAI) scoring range = 0–63, higher = greater anxiety.

^dPerceived Stress Scale (PSS) range = 0–16, higher = greater perceived stress.

^eTotal scale = cumulative score of BDI + BAI + PSS. The PSS was multiplied by 4 (range = 0–64).

upset or mad [smoking] is my way of calming down” Others were upset about the prospect of returning to work. One woman reported, “Stress and nervousness; it was right before my first day back to work” Another woman said, “I think, going back to work—I was nervous, anxious ... it was either the week I started or the week before I was starting”

Heard across the interviews was a repeated sentiment that women felt that they had no other outlet for their emotions and thus sought relief through smoking. One woman expressed, “I think when I’m stressed or I’m upset with something, I am thinking about a cigarette in a way that helps me to relax. This is my problem because I do not know any other way to relax when I’m stressed.” Another woman described, “I was getting depressed ... my nerves started getting bad. That is how it started. It made me feel relief and relaxed. I was feeling depressed and to calm myself down, it relaxed me.”

Most women perceived a relationship between their emotions and smoking. One woman noted, “I think it impacts it greatly. Like, if I am in a bad mood, I feel frustrated or in a down mood. I will smoke more” Another woman explained, “My mood triggers me to smoke. I would say stress and anger” One woman commented, “I’m more likely to smoke when I’m anxious.” However, a few women denied the relationship between mood and smoking; these women felt that they were simply influenced by the presence of other smokers.

Discussion

Helping women who quit smoking during pregnancy to stay quit postpartum is a key public health goal. The present study aimed to determine whether depressive, anxiety, and stress symptoms were associated with postpartum smoking among women who had stopped smoking during pregnancy. To our knowledge, this is the first study to explore the relationship between depressive, anxiety, and stress symptoms assessed repeatedly after delivery and smoking status by 24 weeks postpartum. Women who were smoking by 24 weeks postpartum had a higher score of combined depressive, anxiety, and stress symptoms compared with women who were nonsmokers. Depressive and stress symptoms were significantly associated with risk of relapse.

Previous research has shown a relationship between mood and postpartum relapse to smoking among women who met clinical criteria for depression (Whitaker et al., 2007), but our work suggests that a relationship exists between postpartum depressive symptoms and postpartum relapse. Solomon et al. (2007) showed an association between end-of-pregnancy depressive symptoms (BDI = 6.0 for nonsmokers and 8.9 for smokers) and postpartum relapse. We found that changes in postpartum depressive symptoms, even among our sample of women with low levels of depressive symptoms at delivery (mean BDI at delivery = 5.7 for nonsmokers and 5.3 for smokers), were associated with postpartum relapse by 24 weeks. Nonsmokers’ depressive symptoms decreased, whereas smokers’ depressive symptoms increased. Women who relapsed mentioned depressive symptoms when describing their episodes.

Our findings also suggest that a relationship exists between prepregnancy or prenatal mood and postpartum smoking. Women who relapsed by 24 weeks were more likely to report a history of ever having struggled with depression and having antenatal counseling for depression or anxiety, compared with women who did not relapse. Some clinical implications can be drawn about this subgroup of women with a depressive history who are at risk for postpartum relapse. First, clinicians should take care to address depressive symptoms during pregnancy and to prepare women for mood changes postpartum. Second, these women should be monitored postpartum to help them cope with mood changes or challenges as they occur; referrals for psychological support might be beneficial.

We found evidence that changes in perceived stress over 12 weeks postpartum were associated with smoking status at 24 weeks. Smokers’ perceived stress symptoms increased, whereas nonsmokers’ stress symptoms decreased. Women’s qualitative descriptions of their relapse experiences highlighted the influence of stress and a dearth of skills needed to manage stress. Our findings are similar to a qualitative study (Letourneau et al., 2007) conducted with inner-city women, in which stress was the most commonly cited reason for postpartum return to smoking. Clinicians might consider helping women to monitor their stress levels postpartum; women could benefit from being taught strategies to cope with elevated stress.

We did not detect a significant effect of anxiety on 24-week smoking status, although the slope of anxiety symptoms decreased more among nonsmokers at 24 weeks than it did

among women who smoked. Some women admittedly smoked due to being “nervous” or “anxious,” but smokers described being affected by stress rather than anxiety.

In the present study, as in others (McBride & Pirie, 1990; Solomon et al., 2007), approximately half of women who returned to smoking did so within the initial 6 weeks postpartum. Future studies might explore whether there are different risk factors for “early” (within 6 weeks) versus “late” (6 weeks to 6 months) relapse. For example, some women relapsed early on in the postpartum period due to the stress of having a newborn, whereas others who relapsed around 12 weeks attributed their relapses to stress due to concerns about returning to work. Postpartum relapse prevention interventions for these women would have a different focus and timing.

We observed a relationship between these emotions and postpartum smoking, even though study participants were light smokers (prepregnancy average daily smoking rate was 8.4 cigarettes). As a comparison, Solomon et al. (2007) found that end-of-pregnancy BDI scores were related to 6-month smoking relapse and that the mean daily prepregnancy smoking rate was 15.2 cigarettes for smokers versus 10.1 cigarettes for abstainers. However, the relapse rate in our study was similar to previous studies, so the low rate of prepregnancy smoking was not salient in this work.

Study limitations should be noted. First, we relied on self-report to assess smoking status. Second, the sample size limited the power of our analysis to detect differences in BDI, BAI, and PSS scores between smokers and nonsmokers. Therefore, we cannot rule out a small effect of anxiety symptoms on postpartum smoking. The sample size also precluded our ability to adjust for potential confounders in the relationship between BDI, BAI, and PSS symptoms and postpartum smoking (e.g., smoking addiction, low social support, and weight gain concerns). Finally, although we assessed depressive, anxiety, and stress symptoms repeatedly, more frequent quantitative and qualitative assessments using an ecological momentary assessment technique (Shiffman et al., 2007) would provide further insights into the relationship between these symptoms and postpartum smoking, as well as the context-specific triggers of relapse.

Three areas deserve further exploration with this population to inform clinical interventions. First, specifically which emotional symptoms are the most salient in this relationship? For example, within depression, is it irritability or a sense of worthlessness associated with relapse? Although we measured the BDI and BAI multiple times postpartum, we did not have a large enough sample size to examine which symptoms, or cluster of symptoms, were associated with postpartum relapse. A postpartum stressors scale is needed to assess the prominence and effects of specific stressors. Second, what are women’s emotional coping processes? Qualitative descriptions of relapse episodes suggested that these women might struggle with affect regulation. They did not seem to know how to cope with negative feelings, so they reverted to smoking. Third, what is the relationship between emotions and other relapse risk factors? For example, are women more vulnerable to depressive symptoms when they are particularly sleepy?

In summary, the present study found that a composite of depressive, anxiety, and stress symptoms in the 24 weeks follow-

ing delivery was associated with postpartum smoking among women who quit smoking during pregnancy. Larger, in-depth studies are needed to elucidate these associations and target risk factors to prevent postpartum relapse to smoking.

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