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Weight Concerns, Mood, and Postpartum Smoking Relapse

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Abstract

Background—The majority of women who quit smoking as a result of pregnancy will resume smoking during the first 6 months postpartum. Evidence suggests that changes in depressive symptoms, perceived stress, and concerns about weight may relate to postpartum smoking relapse.

Purpose—This study was designed to prospectively evaluate the relationship of mood and weight concerns to postpartum smoking among women who quit smoking during pregnancy.

Methods—Pregnant women who had quit smoking ($N = 183$) were recruited between February 2003 and November 2006. Women completed assessments of mood (depressive symptoms, perceived stress, positive and negative affect) and weight concerns during the third trimester of pregnancy, and at 6, 12, and 24 weeks postpartum. Self-reported smoking status was verified by expired-air carbon monoxide and salivary cotinine at each assessment. Cox regression analyses in which mood and weight concerns were treated as time dependent covariates were conducted in 2007 and 2009.

Results—By 24 weeks postpartum, 65% of women had resumed smoking. Smoking-related weight concerns increased risk of relapse, and positive affect and self-efficacy for weight management without smoking decreased risk of relapse postpartum. Moreover, after controlling for variables previously related to postpartum relapse, weight concerns remained significantly related to smoking relapse.

Conclusions—Smoking-related weight concerns and positive affect increase the likelihood that a woman will resume smoking postpartum. Moreover, weight concerns appear to be salient even in the context of other factors shown to affect postpartum smoking. This study suggests that interventions may need to address women's weight concerns and mood to help sustain smoking abstinence after childbirth.

Introduction

The majority of women who quit during pregnancy will resume smoking following childbirth, thereby exposing their young children to tobacco smoke. By 6 months postpartum, at least 60%

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of women who were quit during pregnancy will have returned to tobacco smoking.¹⁻⁴ In addition to the negative health consequences of smoking for the women themselves⁵⁻¹⁰, the effects of second hand exposure on children are substantial. Tobacco smoke exposure has been linked to many childhood medical problems including sudden infant death syndrome, ear infections, respiratory illness and asthma^{11,12} as well as to deficits in cognitive and behavioral performance among children.¹³⁻¹⁵ Given the importance of preventing postpartum smoking, a greater understanding of factors associated with postpartum smoking relapse, particularly factors that are modifiable, will inform efforts to sustain smoking abstinence and thereby positively affect the health of women and children.

To date, studies have identified several demographic and situational factors related to smoking. The use of alcohol¹⁶, minority race^{17,18}, higher levels of nicotine dependence^{4,17,19} and lower levels of education¹⁸ have been associated with a resumption of smoking after pregnancy. In addition, having a partner who smokes has received consistent support as a correlate of postpartum smoking.^{2,4,16,19-21} In contrast, support for another hypothesized risk factor, bottle rather than breastfeeding the baby, has been inconsistent.^{2,4,20,22}

Mood changes and concerns about shape and weight also may relate to postpartum smoking²³ and would represent modifiable targets for prevention interventions. Many women experience depressive symptoms postpartum^{24,25}, and depressive symptoms have been associated with smoking relapses²⁶⁻²⁹, independently of nicotine dependence.³⁰ Moreover, major depressive disorder^{31,32} and depressive symptoms during pregnancy³³ have been linked to postpartum smoking, as have depressive symptoms during the first 6 months postpartum³⁴ and the self-report of lifetime depression.³⁵ Stress also relates to postpartum smoking relapse.^{33,35,36}

Similarly, maladaptive eating attitudes, dieting behaviors and concerns about shape or weight increase postpartum^{37,38}, suggesting that weight concerns are common during the postpartum period. Weight concerns affect smoking, particularly among women^{39,40}, and initial evidence suggests that this may be true for postpartum smoking as well. For example, concerns about weight^{2,19}, having gained more than an average amount of weight during pregnancy¹⁷, and the use of snacking as a strategy to cope with prenatal smoking urges¹⁹ have been related to postpartum relapse. Remaining abstinent from smoking has been associated with increased confidence in preventing weight gain⁴¹, and self-efficacy to manage weight has been linked to greater motivation for maintaining postpartum abstinence.⁴²

In summary, although available evidence suggests that mood and weight can increase vulnerability to smoking relapse postpartum, previous studies have often relied on single-item assessments of complex mood and weight concern variables and cross-sectional, retrospective comparisons. Prospective data, using validated assessment instruments to investigate the roles that changes in mood and weight concerns play in postpartum smoking relapse, are lacking. Systematic evaluation of these variables is particularly important because weight concerns and mood are modifiable and may make important targets for interventions to prevent relapse. Accordingly, this study was designed to examine the relationship of weight concerns and mood experienced during pregnancy in the context of other demographic and situational factors that may affect to postpartum smoking relapse. Specifically, it was hypothesized that women who reported mood symptoms, stress, or concerns about weight over the course of the first 6 months postpartum would be more likely to return to smoking.

Methods

Procedure

This study was conducted at a large, urban hospital in Pittsburgh, PA, and was reviewed and approved annually by the local IRB. Participants were recruited through advertisements in local media that targeted pregnant women in outpatient obstetric and gynecologic clinics as well as agencies serving women and children between February 2003 and November 2006. Women who contacted the study were screened for eligibility by phone, and interested women who were not currently in the third trimester of pregnancy were scheduled to be called again in their third trimester to document eligibility. Women were eligible to participate if they: (1) reported having smoked at least eight cigarettes per day for at least 1 month prior to becoming pregnant, (2) were not currently smoking, as verified by an expired-air carbon monoxide (CO) reading of 8 ppm or less, (3) were aged >14 years, (4) and were at least 28 weeks pregnant. Women consented to participate prior to assessment. For participants aged 14–18 years, parent/guardian consent and child assent were obtained.

Women who were currently in their third trimester of pregnancy (i.e., at least 28 weeks gestation) met with a member of the research team, completed a time-line follow-back interview about previous smoking habits and provided an expired air sample to measure carbon monoxide content. Women were contacted at 6, 12 and 24 weeks postpartum to complete assessments. A subsample ($n = 56$) were enrolled initially in a pilot study. These women were followed through 12 weeks postpartum only and did not complete measures of education and income.

All women were compensated for completing assessments. Women received \$15 at the first assessment, and \$20, \$30 and \$35 at 6, 12 and 24 weeks, respectively.

Participants

A total of 543 women responded to advertisements about the study, of whom 469 were pregnant and 418 screened for eligibility to participate. The final sample consisted of 183 women (Figure 1). Descriptive information about the sample is shown in Table 1.

Attrition—Retention rates were good, with 83.1%, 76.5% and 81.1% of women completing assessment at 6, 12 and 24 weeks postpartum, respectively. At 24 weeks, women who were lost to follow-up had lower levels of education (13.5% vs 86.5% high school graduates, $p = .001$), were younger (21.9 ± 3.8 vs 25.3 ± 5.4 , $p = .004$) and had smoked for fewer years prior to the current pregnancy (7.1 ± 4.8 vs 9.8 ± 5.5 , $p = .03$) compared to those who returned for the 24 week–postpartum assessment.

Definition of Relapse—At each visit after delivery, women were interviewed about smoking using the time-line follow-back methodology⁴³, and expired-air carbon monoxide (CO) was measured. CO was assessed with a Vitalograph® BreathCO carbon monoxide monitor. The number of days between delivery and the date of smoking relapse was calculated. Postpartum relapse was defined as the self-report of smoking for 7 consecutive days at any point after delivery and prior to the assessment, or a biochemical indication of smoking at the assessment.⁴⁴ A CO reading of less than or equal to 8 parts per million (ppm) was used to confirm self-reported nonsmoking.⁴⁵ Women who were lost to follow-up were considered to have relapsed. However, when women who missed an assessment were evaluated at a subsequent assessment and reported nonsmoking, which was confirmed biochemically, the earlier assessment also was coded as nonsmoking.

Assessments

Women completed assessments of demographic and situational variables, smoking, mood, and weight concerns near the end of pregnancy and at approximately 6, 12 and 24 weeks postpartum.

Demographic and pregnancy-related information—Demographic information and information about partner's smoking status were collected. For women without a partner in the home, the partner was coded as not smoking. Participants also reported their intention to breastfeed, current alcohol use and whether the pregnancy was intentional.

Smoking behavior—Because women were required to be abstinent at the time of entry into the study, women were asked to “think back to the last time you smoked every day for at least one month” and complete the Fagerstrom Test of Nicotine Dependence (FTND). The FTND is a widely used, psychometrically sound six-item self-report measure of nicotine dependence. Women also provided information on the number of cigarettes smoked prior to quitting, number of years they had been smoking and when and how they quit smoking during the current pregnancy.

Weight concerns—To assess general weight concerns, participants completed the Three-Factor Eating Questionnaire (TFEQ), which contains three empirically derived factors.⁴⁶ The Restraint factor reflects conscious thoughts and purposeful behaviors to control food intake. The Disinhibition factor reflects a tendency to relinquish control over food intake in response to environmental or emotional stimuli, and the Hunger factor reflects the behavioral consequences of subjective hunger. Women also completed a six-item questionnaire designed to assess cessation-specific weight concerns (Borrelli et al., 1998) and a six-item questionnaire assessing self-efficacy for weight management after quitting smoking. (Borrelli et al., 1998)

Mood—Participants completed the Center for Epidemiological Studies Depression Scale (CES-D) to assess current depressive symptoms. The CES-D was selected because it appears to be less sensitive than other depression scales to somatic symptoms that may be common during the postpartum period.⁴⁷ Women also completed the Perceived Stress Scale (PSS), (Cohen et al., 1983) which assesses the degree to which an individual appraises situations as stressful. The PSS is a 14-item instrument with adequate reliability that has been used in other smoking cessation studies. The Positive and Negative Affect Scales⁴⁸ were used as an assessment of negative (e.g., hostility, fear) and positive (e.g., happiness, excitement) affectivity. This measure was chosen to offer a broader assessment of mood in conjunction with depressive symptoms and perceived stress.

Data Analyses

Data were initially analyzed in 2007 and final models were conducted in 2009. T-tests and chi-square tests were used to compare women who had and had not relapsed by 24 weeks postpartum, and women who did and did not complete assessments at 12 and 24 weeks on baseline (pregnancy) demographic variables. In these analyses, subjects who were lost to follow-up were treated as relapsed. Because mood and weight concerns are likely to change over the course of the perinatal and postpartum periods, an analytic scheme was chosen that incorporated differing levels of these variables over time. To examine the hypothesis that smoking-specific weight concerns (weight concern and weight self-efficacy), general weight concerns (Restraint, Disinhibition, Hunger), or mood (perceived stress, CES-D, positive and negative affect) were associated with time to postpartum relapse, Cox regression models were used in which these time-varying measures were entered univariately to predict time to relapse. This model makes use of the covariates that occurred most closely in time prior to relapse in calculating the hazard ratio for relapse.

Finally, a multivariable model was used to evaluate the relationship of the significant mood and weight concerns variables in the context of demographic and situational variables previously related to postpartum relapse. Specifically, having a partner who smokes, alcohol use, minority race, lower level of education¹⁸ higher levels of pre-pregnancy nicotine dependence, and infant feeding methods¹⁸ may relate to relapse. Education was not included in the multivariable analysis because education was not assessed on the first 56 women, and many women in the sample were not old enough to have completed their education. Thus, adjustment was made for the effect of five situational and demographic covariates (nicotine dependence, partner smoking, race, alcohol use and intention to breastfeed), by running separate Cox models with the significant time-varying mood and weight concern variables.

Results

Relapse Rates

Rates of biochemically verified abstinence from smoking at 6, 12 and 24 weeks postpartum were 53.5% ($n = 98$), 37.7% ($n = 69$) and 34.7% ($n = 44$), respectively. On average, relapse to smoking occurred 43.8 (SD = 45.2) days after delivery for women who resumed smoking by 24 weeks.

Baseline Factors Related to Relapse—As shown in Table 2, at 24 weeks postpartum, older, married women who had been quit for a longer time during pregnancy were more likely than younger, unmarried women to have maintained abstinence at 24 months postpartum.

Changes in Mood, Perceived Stress and Weight Concern Related to Time to Relapse—Table 3 shows the univariate results of a time-dependent analysis of relationships of mood and weight concerns variables to postpartum relapse. Smoking-specific weight concerns and positive affect were related to relapse risk. Specifically, concerns about managing weight without cigarettes was associated with faster time to relapse ($p = .007$). In contrast, confidence in ability to maintain weight without smoking was protective against smoking relapse ($p = .048$). Positive affect also was associated with decreased relapse risk over the first 24 weeks postpartum ($p = .029$). Moreover, when the mood and weight concerns variables with significant univariate relationships to relapse were considered in the context of the demographic variables that have been shown to be related to postpartum smoking (Table 3), weight concerns remained significantly related to relapse risk ($\chi^2 = 5.41$ $p = .02$).

Discussion

The current study provides the first prospective documentation of the relationship between weight concerns and postpartum smoking relapse, and augments previous data suggesting the role of mood symptoms in relapse by using established measures of mood, affect and stress. Findings also suggest new targets for intervention to minimize smoking relapse postpartum. Specifically, these data suggest that positive affect and weight concerns relate to the resumption of smoking in the postpartum period. Feeling confident to manage weight without smoking and the experience of positive emotional states decreased the risk of postpartum relapse during the first 6 months postpartum, while feeling concerned about weight gain related to not smoking and the use of smoking as a tool to manage weight increased the likelihood of resuming smoking. Moreover, the association between weight concerns and postpartum smoking is salient even after controlling for demographic (race, education), and other situational factors (breastfeeding, alcohol use and degree of nicotine dependence) that previously have been shown to relate to smoking postpartum.

In the two previous studies that followed pregnant women who quit through the early postpartum period, depressive symptoms at the end of pregnancy³³ and the self-report of having

“ever struggled with depression”³⁵ were related to relapse. However, no evidence was found of an association between depressive symptoms over time and postpartum smoking. One reason for the discrepant findings may be the assessment of mood variables. Included in this study were measures of depressive symptoms designed to assess both postpartum symptoms, and a general depressive symptom tool that is less sensitive to some of the somatic complaints common in the of the postpartum period⁴⁷ as well as a measure of positive and negative affect. Although depressive symptoms were not found to be associated with smoking relapse, low levels of positive affect were. Positive affect refers to the experience of activated, alert and happy states and thus low levels of positive affect may reflect an enduring dispositional vulnerability in contrast to depressive symptoms that fluctuate over time.

It also is noteworthy that no association was found between changes in perceived stress and postpartum smoking. This finding is in contrast to previous reports relating stress to smoking relapse among general samples of smokers.⁵⁰ However, an examination of the means of self-reported stress over time suggests that perceived stress levels were high beginning in late pregnancy and remained high through 24 weeks postpartum. Thus, measures of perceived stress may not be specific enough to capture the increased vulnerability that precipitates smoking.

There are several strengths to this study, including the use of an analytic strategy designed to account for fluctuations in mood and weight concerns over the postpartum period and the comprehensive assessment of mood. Nonetheless, there are some limitations to consider. First, the assessment of dynamic variables such as mood and weight concerns happened at fixed points over the course of the postpartum period. Although the current analytic strategy accounted for mood and weight concerns over time, it is possible that the self-report of these concerns occurred many days prior to relapse. Thus, it is not possible to evaluate from these data the precise causal relationship of relapse to weight concerns and mood. Sampling women more frequently throughout the postpartum period would allow a more complete evaluation of the ways in which mood and weight concerns affect smoking. Moreover, given that most relapse occurs early in the postpartum period, frequently sampling women in the initial postpartum weeks may provide better evidence about the predictors of early relapse.

Other limitations concern attrition and the sample size. Young postpartum women have many demands on their time, and, although the current levels of retention were good, women lost to follow-up differed from those who were retained. Specifically, women who did not return for assessment at 24 weeks postpartum were younger, had completed less education and smoked for fewer years, which may limit the generalizability of these data to older, more-educated samples. However, both education and years of smoking are highly correlated with age, and the age of women in this sample suggests that some may not have completed high school. As such education may not be a useful covariate. Nonetheless, the finding that younger women were less likely to complete assessments may limit the utility of these findings in developing relapse prevention interventions for young women postpartum. Finally, although expired-air carbon monoxide was used to validate self-report of nonsmoking in this sample, use of additional biochemical markers, such as salivary or urine cotinine measures, may be important postpartum. Given the lack of efficacious interventions to prevent smoking postpartum and the potential impact of smoking relapse for women and children, identifying modifiable correlates of postpartum smoking will inform the design of postpartum smoking relapse prevention interventions. In particular the finding that weight concerns relate to smoking relapse postpartum above and beyond other demographic or situational factors is particularly relevant because smoking-related weight concerns are modifiable.^{51,52}

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Figure 1.
Participant flow

Table 1

Characteristics of participants (N=183).

Characteristic	
Age (M $\pm$ SD)	24.2 $\pm$ 5.4
Race (% white)	62.1
Household income (% <\$10,000) ^a	40.2
Education level (% High school graduate or more)	81.9
Marital Status (% married)	42.0
Weeks quit at baseline (M $\pm$ SD)	20.6 $\pm$ 10.4
Pre-pregnancy cigarettes/day (M $\pm$ SD)	13.7 $\pm$ 8.3
Years smoking (M $\pm$ SD)	9.0 $\pm$ 5.7
# Previous quit attempts (M $\pm$ SD)	3.6 $\pm$ 4.6
Pre-pregnancy FTND (M $\pm$ SD)	3.5 $\pm$ 2.1
% Quit smoking during or before first trimester	76.2
% Partner current smoking	51.9
Pregnancy intentional (% yes)	34.3
Intend to breastfeed (% yes)	67.0
Smoking-Specific Weight Concerns	
Weight Concerns (0–10)	4.5 $\pm$ 2.2
Weight Self-Efficacy (0–10)	6.1 $\pm$ 2.2
General Weight Concerns	
Restraint	10.5 $\pm$ 2.0
Disinhibition	8.6 $\pm$ 2.6
Hunger	7.4 $\pm$ 2.5
Mood	
Perceived Stress	25.9 $\pm$ 7.3
CES-D	17.3 $\pm$ 8.9
% CES-D > 16 (probable depression)	54.1
Positive Affect	20.8 $\pm$ 8.6
Negative Affect	7.5 $\pm$ 6.5

^a not asked of first 56 women

CES-D, FTND,

Table 2

Baseline participant characteristics by smoking status at 24 weeks postpartum.

Characteristic	Relapsed ^a (n=83)	Abstinent (n=44)	p-value
Age (M ± SD)	23.9 (4.9)	26.1 (5.7)	.02
Race (% white)	67	76	.35
Household income (% <\$10,000)*	43	36	.46
Education (% At least high school graduate)	77	91	.06
Marital Status (% married)	35	60	.03
# Weeks quit during pregnancy (M ± SD)	18.5 (12.2)	25.1 (13.3)	.009
Pre-pregnancy cigarettes/day (M ± SD)	16.4 (8.3)	15.4 (6.5)	.52
Years smoking (M ± SD)	8.8 (5.3)	10.3 (5.8)	.13
# Previous quit attempts (M ± SD)	4.1 (6.0)	3.0 (2.3)	.36
Pre-pregnancy FTND (M ± SD)	3.8 (2.2)	3.4 (2.0)	.20
Partner smokes (% yes)	51	55	.67
Motivation for postpartum abstinence (% a lot)	57	86	.001
Pregnancy intentional (% yes)	34	36	.80
Intend to breastfeed (% yes)	65	80	.08

^aMissing included as relapsed

Table 3

Relationship of mood and weight concerns variables and time to smoking relapse

	Univariate HR [95%CI]	Controlling for baseline covariates
Smoking-Specific Weight Concerns		
Weight Concerns (0–10)	1.14 [1.04,1.25]	1.21 [1.02,1.24]
Weight Self-Efficacy (0–10)	0.91 [0.83,0.99]	0.92 [0.84,1.02]
General Weight Concerns		
Restraint	0.95 [0.86,1.05]	—
Disinhibition	1.02 [0.94,1.11]	—
Hunger	0.95 [0.87,1.04]	—
Mood		
Perceived Stress	1.01 [0.98,1.04]	—
CES-D	1.02 [0.99,1.04]	—
Positive Affect	0.97 [0.95,0.99]	0.98 [0.95,1.00]
Negative Affect	1.02 [0.98,1.05]	—

Boldface indicates significant results.

Baseline covariates controlled for are pre-pregnancy nicotine dependence, partner's smoking status, race, alcohol use and intention to breastfeed.

CES-D,