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Depressive symptoms predict smoking status among pregnant women

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Abstract

The current study assessed self-reported psychopathology in women who spontaneously quit or continued smoking after learning that they are pregnant and examined whether any potential differences remained after control for confounding variables. All participants (77 smokers and 50 spontaneous quitters) completed 3 assessments of psychological functioning prior to enrollment in either smoking cessation or relapse prevention studies. Assessments included the Brief Symptom Inventory (BSI); the Beck Depression Inventory (BDI); and the Adult Self-Report (ASR). Smokers and spontaneous quitters differed on sociodemographic and smoking characteristics. In terms of psychological functioning, smokers reported significantly more depression/anxiety symptoms and withdrawn behavior than spontaneous quitters on the BSI and the ASR. Higher depression scores on the BSI were associated with increased odds of continued smoking, even after controlling for sociodemographic and smoking variables in multivariate analyses. These results suggest that depressive symptoms may be an independent contributor to the problem of continued smoking during pregnancy, which may have implications for smoking-cessation interventions among pregnant women.

Keywords

Pregnant women; pregnant smokers; spontaneous quitters; depression

1. Introduction

Smoking during pregnancy has major health consequences for the mother and child (Cnattingius, 2004). Approximately 15% of women who are regular smokers spontaneously quit upon learning that they are pregnant with little or no intervention and are referred to as spontaneous quitters (Solomon & Quinn, 2004). Efficacious interventions to promote smoking cessation among those who continue to smoke are available, but cessation rates are often low

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(< 20%; Lumley, Oliver, Chamberlain, & Oakley, 2004). A recent review of the characteristics of spontaneous quitters suggests that these women differ from pregnant smokers along a number of dimensions, including socioeconomic, demographic, pregnancy, and smoking characteristics (Solomon & Quinn, 2004). For example, spontaneous quitters are better educated, have a greater annual income, and are more likely to be married, have planned their pregnancy, and have smoked fewer cigarettes per day pre-pregnancy.

Psychological functioning may also differ between smokers and spontaneous quitters. One early cross-sectional study examined depression and mental distress among low-income pregnant women and reported that smokers had lower scores on the General Health Questionnaire, indicative of better mental health (McCormick et al., 1990). In a more recent large-scale study, pregnant women were recruited from two managed care organizations for a randomized controlled trial of smoking cessation and relapse prevention interventions (Ludman et al., 2000). Depression was assessed using a modified RAND screening instrument. In contrast to the findings of McCormick et al. (1990), smokers self-reported higher levels of depression compared to quitters. Ludman and colleagues then examined whether there was an association between depression and smoking status, but found that depression did not independently predict smoking status at baseline after controlling for sociodemographic, smoking, and pregnancy characteristics.

Two reports examined history of disruptive behavior in a convenience sample of pregnant smokers and spontaneous quitters. In the first (Wakschlag et al., 2003), the authors found that more smokers reported a history of disruptive behavior (e.g. truancy, fighting in adolescence) compared to spontaneous quitters; however, after controlling for sociodemographic characteristics, these behaviors did not independently predict current smoking status. The second report on this sample utilized data from structured clinical interviews to examine retrospective history of conduct disorder (CD) and attention deficit hyperactivity disorder (ADHD) diagnoses (Kodl & Wakschlag, 2004). Of those with a history of CD or ADHD diagnoses, a majority smoked during pregnancy. In addition, having a history of a CD diagnosis remained a significant predictor of current smoking status after controlling for smoking-related and sociodemographic variables.

This relatively small literature comparing smokers and spontaneous quitters on psychological functioning has notable limitations. First, the direction of differences in psychological symptomatology between pregnant smokers and quitters has varied across studies. Second, the types of psychological symptoms examined have been relatively limited and have not examined the full range of internalizing and externalizing behaviors in these two groups. The purpose of this study was to examine mental health symptoms using standardized, well-validated self-report measures that assess a wide range of psychological symptoms in a sample of smokers and spontaneous quitters. We also examined whether self-reported psychological symptoms were associated with increased odds of continuing to smoke after controlling for sociodemographic and smoking characteristics. We hypothesized that smokers would report more problems, especially mood and anxiety symptoms, than spontaneous quitters and that these problems would continue to predict smoking status even after controlling for differences in sociodemographic and smoking variables.

2. Methods

2.1. Participants

Data were obtained from 127 women enrolled in a university-based outpatient research clinic conducting clinical trials to examine the efficacy of voucher-based incentives to promote smoking cessation and relapse prevention during pregnancy and postpartum (see Higgins et al., 2004 and Heil et al., 2008). At the trial intake assessment, all participants completed

measures of demographic characteristics and smoking, as well as measures of psychological functioning (see below). Those who reported any smoking in the past 7 days and had a urine cotinine level of > 80 ng/mL were categorized as smokers ($n=77$) while those who reported no smoking in the past 7 days and had a urine cotinine level of ≤ 80 ng/mL were categorized as spontaneous quitters ($n=50$). The University of Vermont Institutional Review Board approved the study and written informed consent was obtained from each participant.

2.2. Measures

2.2.1. Brief Symptom Inventory (Derogatis, 1993)—The Brief Symptom Inventory (BSI) is a 53-item self-report questionnaire. Nine areas of psychiatric symptom presentation are assessed (see Table 1). Additionally, a summary score, the Global Severity Index (GSI), is computed which represents a measure of overall psychological distress. Acceptable reliability and validity indices of the subscales and GSI have been demonstrated (Derogatis & Melisaratos, 1983).

2.2.2. Beck Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961)—The Beck Depression Inventory (BDI) is a 21-item scale measuring depressive symptoms, with higher scores indicating greater severity. A score of ≥ 10 has been suggested as a clinical cutpoint (Beck, Steer, & Garbin, 1988).

2.2.3. Adult Self-Report (Achenbach & Rescorla, 2003)—The Adult Self-Report (ASR) is a 126-item standardized, empirically validated measure of problem behaviors. Eight syndrome scales are used to compute three broad-spectrum scales: internalizing, externalizing and total problems (see Table 2). Higher raw scores indicate more problem behaviors on each scale. Raw scores can be converted into standardized T scores; however, raw scores are used in the analyses since the conversion of raw scores to T scores truncates the range of scores at the lower end. Responses on the ASR can also be used to form scales based on DSM-IV criteria. The DSM-oriented scores correspond to six DSM-IV diagnostic categories (see Table 2). Acceptable reliability and validity of the ASR have been previously established (Achenbach & Rescorla, 2003).

2.3. Statistical Analyses

Comparisons between smokers and quitters on sociodemographic characteristics, smoking variables, and measures of psychopathology were performed using t-tests for continuous variables and chi square tests for categorical variables. Logistic regressions were used to determine the ability of self-reported psychopathology to predict smoking status, after controlling for relevant sociodemographic and smoking variables. First, a stepwise logistic regression was conducted with those variables that were significantly different between the groups in univariate comparisons to determine candidates for inclusion in subsequent multivariate models. Next, logistic regressions were performed to evaluate each self-reported psychopathology scale as a predictor of smoking status “forcing in” the variables found to be significant in the stepwise regression. The results of these logistic regressions are presented in terms of the adjusted odds ratio (OR) and corresponding 95% confidence intervals (CI) associated with each measure of psychopathology. Because odds ratios correspond to a 1-unit change in the predictor variable, which does not represent a clinically meaningful difference for these psychopathology variables, the derived ORs have been transformed to represent the increased odds of continuing to smoke per one standard deviation increase in each explanatory variable. These ORs are equivalent to those that would result from logistic regressions based on the explanatory variables being standardized prior to analysis. All statistical analyses were performed using SAS Statistical Software Version 8.2 (SAS Institute, Cary, NC). Statistical significance was determined based on $p \leq .05$.

3. Results

3.1. Sociodemographic and Smoking Characteristics

Smokers were significantly younger (mean $\pm$ SD; 24.3 ± 5 vs. 26.3 ± 6), less educated (11.9 ± 2 vs. 13.9 ± 2), and smaller percentages had private insurance (16% vs. 64%), were married (18% vs. 48%), and were pregnant with their first child (46% vs. 66%) compared to quitters. Regarding smoking characteristics, smokers smoked more cigarettes per day pre-pregnancy (18.8 ± 8 vs. 9.0 ± 6) and began smoking at a younger age (14.1 ± 3 vs. 16.8 ± 4).

3.2. Psychological Functioning

3.2.1. Univariate analyses—Smokers reported significantly more symptoms on the depression subscale of the BSI than quitters ($t(124)=2.92$; Table 1). Additionally, smokers reported significantly more symptoms on the psychoticism subscale (e.g. feels lonely even with others) than quitters ($t(123)=2.13$).

Smokers tended to report more symptoms of depression on the BDI compared to quitters (10.3 ± 7.1 vs. 8.5 ± 6.8) but this difference did not reach statistical significance.

Smokers reported significantly more symptoms on the anxious/depressed and withdrawn syndrome scales of the ASR ($t(123$ and $124)=2.22$ and 2.14 ; Table 2). These scales are two of the three syndrome scales that make up the broad-spectrum internalizing scale, which also showed significantly higher scores for smokers compared to quitters ($t(122)=2.73$). Significant differences also emerged on two ASR DSM-oriented scales, with smokers endorsing more symptoms consistent with a DSM diagnosis of depression ($t(125)=1.96$) and avoidant personality disorder ($t(125)=2.64$) than quitters.

3.2.2. Multivariate analyses—The stepwise logistic regression to determine which sociodemographic and smoking variables to include in the multivariate models resulted in three variables satisfying the $p < .05$ inclusion criterion. The first variable to enter the model to predict continued smoking was pre-pregnancy smoking (OR=6.73 per 10 cigarette increase, 95% CI=3.11–16.06, $p < .001$). Second, increased education decreased odds of pregnancy smoking (OR=0.73 per year increase, 95% CI=0.57–0.95, $p = .01$). Third, having private insurance decreased odds of pregnancy smoking (OR=0.28 private insurance vs. no private insurance, 95% CI=0.09–0.86, $p = .03$).

Higher scores on the depression subscale of the BSI continued to be associated with increased odds of continuing to smoke after learning of the pregnancy (OR=2.39, 95% CI=1.22–4.70, $p = .01$) after adjusting for cigarettes per day pre-pregnancy, education, and insurance status. The estimated odds of continued smoking were doubled per one standard deviation increase in the score on the BSI depression scale. There were no other psychopathology variables, which remained a significant predictor after control for sociodemographic and smoking variables.

4. Discussion

The first purpose of the present study was to characterize mental health symptoms using standardized measures that assess a wide range of symptoms in a sample of pregnant women who either continued to smoke or spontaneously quit after learning of the pregnancy. Pregnant smokers reported more symptoms of depression and also reported more symptoms of withdrawn and avoidant behavior compared to spontaneous quitters.

The second purpose of the present study was to examine whether self-reported psychological symptoms were associated with increased odds of continuing to smoke after controlling for sociodemographic and smoking characteristics. As expected, smokers and quitters differed on

sociodemographic and smoking characteristics. In multivariate analyses that controlled for significant sociodemographic and smoking predictors, only level of depressive symptoms, as measured by the BSI, remained significantly associated with continued smoking after learning of the pregnancy. Higher scores doubled the odds of continuing to smoke after learning of the pregnancy. This is particularly interesting because the mean level of depressive symptoms reported by smokers on this measure was sub-clinical and did not reach the threshold for either the borderline or clinical range.

Our findings are in contrast to the report by Ludman et al. (2000), which found that after control for multiple predictors, depressive symptoms in pregnant women did not differ between smokers and spontaneous quitters. Comparisons across studies are somewhat difficult because of differences in methodology, particularly differences in the multivariate logistic modeling and the types of variables that were included in the models, and may account for the divergent findings. In addition, differences on externalizing behavior did not emerge in the present study in contrast to two prior studies (Kodl & Wakschlag, 2004; Wakschlag et al., 2003). The lack of replication may be due to the different measures of externalizing behaviors used in the prior studies and to the difference in timing of the interviews. Given relatively few studies on externalizing behavior problems in pregnant smokers and spontaneous quitters, continued assessment using rigorous instruments is suggested to more thoroughly address this question.

The present study has some potential limitations. First, the relatively small sample size limited power and thus likely underestimates potential differences between pregnant smokers and spontaneous quitters. Second, we do not have pre-pregnancy measures of psychological symptoms and have no way of knowing how the process of quitting impacted the symptoms of the spontaneous quitters prior to our intake assessment. Nevertheless, these results suggest that depressive symptoms may be an independent contributor to the problem of continued smoking during pregnancy, which may have implications for smoking-cessation interventions among pregnant women.

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References

- Achenbach, TM.; Rescorla, LA. Manual for the ASEBA adult forms & profiles. Burlington, VT: University of Vermont, Research Center for Children, Youth, & Families; 2003.
- Beck AT, Steer RA, Garbin MG. Psychometric properties of the Beck Depression Inventory: Twenty-five years of evaluation. *Clinical Psychology Review* 1988;8:77–100.
- Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J. An inventory for measuring depression. *Archives of General Psychiatry* 1961;4:561–571. [PubMed: 13688369]
- Cnattingius S. The epidemiology of smoking during pregnancy: Smoking prevalence, maternal characteristics, and pregnancy outcomes. *Nicotine & Tobacco Research* 2004;6(S2):S125–S140. [PubMed: 15203816]
- Derogatis, LR. Brief Symptom Inventory. Minneapolis, MN: National Computer Systems, Inc; 1993.
- Derogatis LR, Melisaratos N. The Brief Symptom Inventory: An introductory report. *Psychological Medicine* 1983;13(3):595–605. [PubMed: 6622612]
- Heil SH, Higgins ST, Bernstein IM, Solomon LJ, Thomas CS, Badger GJ, et al. Effects of voucher-based incentives on abstinence from cigarette smoking and fetal growth among pregnant women. *Addiction* 2008;109:1009–1018. [PubMed: 18482424]

- Higgins ST, Heil SH, Solomon LJ, Bernstein IM, Lussier JP, Abel RL, et al. A pilot study on voucher-based incentives to promote abstinence from cigarettes smoking during pregnancy and post-partum. *Nicotine & Tobacco Research* 2004;6:1015–1020. [PubMed: 15801574]
- Kodl MM, Wakschlag LS. Does a childhood history of externalizing problems predict smoking during pregnancy? *Addictive Behaviors* 2004;29:273–279. [PubMed: 14732416]
- Ludman EJ, McBride CM, Nelson JC, Curry SJ, Grothaus LC, Lando HA, et al. Stress, depressive symptoms, and smoking cessation among pregnant women. *Health Psychology* 2000;19(1):21–27. [PubMed: 10711584]
- Lumley J, Oliver SS, Chamberlain C, Oakley L. Interventions for promoting smoking cessation during pregnancy. *Cochrane Database of Systematic Review* 2004;(4):1–88.
- McCormick MC, Brooks-Gunn J, Shorter T, Holmes JH, Wallace CY, Heagarty MC. Factors associated with smoking in low-income pregnant women: Relationship to birth weight, stressful life events, social support, health behaviors and mental distress. *Journal of Clinical Epidemiology* 1990;43(5):441–448. [PubMed: 2324784]
- Solomon LJ, Quinn VP. Spontaneous quitting: Self-initiated smoking cessation in early pregnancy. *Nicotine & Tobacco Research* 2004;6(S2):S203–S216. [PubMed: 15203822]
- Wakschlag LS, Pickett KE, Middlecamp MK, Walton LL, Tenzer P, Levanthal BL. Pregnant smokers who quit, pregnant smokers who don't: Does history of problem behavior make a difference? *Social Science & Medicine* 2003;56:2449–2460. [PubMed: 12742608]

Table 1

Raw scores on the Brief Symptom Inventory

	Smokers (n=77)	Spontaneous quitters (n=50)	p value
Somatic complaints	0.77 ± 0.52	0.67 ± 0.58	.32
Obsessive-compulsive	0.76 ± 0.65	0.80 ± 0.71	.78
Interpersonal sensitivity	0.66 ± 0.54	0.53 ± 0.53	.16
Depression	0.56 ± 0.69	0.26 ± 0.45	<.01
Anxiety	0.46 ± 0.48	0.37 ± 0.45	.31
Hostility	0.71 ± 0.62	0.57 ± 0.57	.22
Phobic anxiety	0.27 ± 0.44	0.16 ± 0.28	.09
Paranoid ideation	0.51 ± 0.65	0.39 ± 0.56	.28
Psychoticism	0.28 ± 0.38	0.16 ± 0.26	.05
Global Severity Index	0.57 ± 0.41	0.45 ± 0.38	.10

Note. Values represent mean ± *SD*

Table 2

Raw scores on the Adult Self-Report

	Smokers (n=77)	Spontaneous quitters (n=50)	p value
INTERNALIZING	14.7 ± 9.0	10.9 ± 6.8	.01
Anxious/Depressed	7.1 ± 5.6	5.2 ± 4.1	.03
Withdrawn	2.3 ± 2.4	1.6 ± 1.7	.04
Somatic	5.2 ± 3.5	4.1 ± 3.6	.08
EXTERNALIZING	10.8 ± 7.6	9.6 ± 6.7	.37
Aggression	6.1 ± 4.6	5.5 ± 4.3	.45
Rule-breaking	3.0 ± 2.9	2.2 ± 2.3	.11
Intrusive behaviors	1.7 ± 1.6	1.8 ± 1.9	.57
Thought problems	2.1 ± 2.0	1.8 ± 1.5	.34
Attention problems	6.6 ± 4.4	5.4 ± 3.6	.12
TOTAL PROBLEMS	42.4 ± 23.7	35.1 ± 19.1	.07
DSM-oriented scales			
Depressive problems	5.9 ± 3.9	4.6 ± 3.2	.05
Anxiety problems	3.7 ± 2.6	3.8 ± 2.1	.89
Somatic problems	3.7 ± 2.7	2.8 ± 3.1	.08
Avoidant personality problems	2.8 ± 2.4	1.8 ± 1.6	.01
ADHD problems	5.6 ± 3.9	4.9 ± 3.2	.32
Antisocial personality problems	3.8 ± 3.9	3.0 ± 2.9	.15

Note. Values represent mean ± *SD*. The internalizing score is comprised of three syndrome scales assessing anxious/depressed behavior, somatic complaints, and withdrawn behavior. The externalizing score is comprised of aggressive behavior, rule-breaking behavior, and intrusive behavior. The internalizing and externalizing scores are added together with the scores on the two remaining syndrome scales, thought and attention problems, to form the total problems score.