

Abuse-Related Post-Traumatic Stress, Coping, and Tobacco Use in Pregnancy

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ABSTRACT

Objective: To examine the relationship between trauma history, posttraumatic stress disorder (PTSD), coping, and smoking in a diverse sample of pregnant women, some of whom are active smokers.

Design: Secondary analysis from a prospective study on PTSD and pregnancy outcomes.

Setting: Maternity clinics at three health systems in the midwestern United States.

Participants: Women age 18 or older (1,547) interviewed at gestational age fewer than 28 weeks.

Methods: Participants were classified at nonsmokers, quitters (stopped smoking during pregnancy), and pregnancy smokers. Demographic, trauma, and pregnancy factors, substance use, and use of tobacco to cope were compared across groups. Logistic regression assessed the influence of these factors on being a smoker versus a nonsmoker and a quitter versus a pregnancy smoker.

Results: Smokers differed from nonsmokers on all demographic risk factors (being African American, being pregnant as a teen, having lower income and less education, and living in high-crime areas), had higher rates of current and lifetime PTSD, and were more likely to report abuse as their worst trauma. Pregnancy smokers had lower levels of education, were more likely to classify their worst trauma as "extremely troubling," and were more likely to exhibit PTSD hyperarousal symptoms. In regression models, smoking "to cope with emotions and problems" doubled the odds of continuing to smoke while pregnant even after accounting for several relevant risk factors.

Conclusion: Smoking behavior in pregnancy may be influenced by the need to cope with abuse-related PTSD symptoms. Clinicians should consider using trauma-informed interventions when working with tobacco-using pregnant women.

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(Continued)

Maternal smoking behavior during pregnancy is known to have negative health consequences for the mother and child during the fetal and neonatal periods (Cnattingius, 2004; Kleinman & Madans, 1985; Stein & Kline, 1983). Smoking can increase the risks of infertility, ectopic pregnancy, placental abruption, placenta previa, preterm birth, stillbirth, and certain congenital malformations and increase by two to three times the odds of sudden infant death syndrome (Cnattingius). Relationships have been found between maternal smoking and spontaneous abortion (Stein & Kline), and maternal smoking is among the most significant predictors of low birth weight, even after accounting for a variety of socioeconomic stressors (Brooke, Anderson, Bland, Peacock, & Stewart, 1989). However, despite the well-established ill effects for mother and fetus of smoking while pregnant, many women continue to do so. The purpose of this article is to examine possible influences on continuing

to smoke during pregnancy in light of recent research on posttraumatic stress disorder (PTSD) in pregnancy. Specifically, we consider the influences of socioeconomic status (SES) risk factors, past trauma, and smoking "to cope with difficult emotions or problems" on women's tendency to continue smoking while pregnant.

Smoking in Pregnancy

A number of factors influence the probability of continuing to smoke during pregnancy. First, some addiction-related factors appear to play a role in mothers' inability or unwillingness to quit. For example, a history of heavy smoking, an early age at first use, and exposure to second-hand smoke all predict an inability to quit during pregnancy (Cnattingius, 2004). Life stress-related factors also appear to play a role, with positive correlations between smoking during pregnancy and having more

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children in the house, an unplanned pregnancy, an unemployed partner, perceptions of more life stress, stressful life events during pregnancy, and a perceived lack of control over life (Bullock, Mears, Woodcock, & Record, 2001; Dejin-Karlsson et al., 1996). In addition, demographic factors such as low SES, low education, and a lack of social support are all associated with continuing to smoke while pregnant (Bullock et al.).

The Influence of Posttraumatic Stress Disorder on Smoking in the Public

A psychological syndrome with physical manifestations, PTSD generally occurs following exposure to an overwhelming trauma. The point prevalence of PTSD among women is 4.6%, with a lifetime prevalence of 12.3% (Resnick, Kilpatrick, Dansky, Saunders, & Best, 1993). In studies of nonpregnant samples (e.g., men and women), those with PTSD had a fourfold increase in the odds of smoking (Breslau, Davis, & Shultz, 2003). Studies have shown that 40% to 60% of individuals with PTSD smoke, compared to approximately 20% of the population in general (Beckham et al., 1997; Lasser et al., 2000). These smokers are also more likely to be heavy smokers. A recent literature review by Feldner, Babson, and Zvolensky (2007) concluded that exposure to trauma is associated with increased smoking behavior, including smoking, smoking amount, and nicotine dependence, and that lifetime and current smoking rates are higher among individuals with lifetime or current PTSD.

PTSD and Pregnancy

Recent studies find a higher point prevalence of PTSD among pregnant women than women from a national sample (Seng et al., 2010). Seng, Low, Sperlich, Ronis, and Liberzon (2009) found that women with preexisting PTSD report much higher numbers of symptoms of PTSD than women in a similar but not pregnant sample. Therefore, it is likely exacerbation of PTSD accounts for the higher prevalence during pregnancy. Women with abuse in their backgrounds are at greatest risk for meeting diagnostic criteria prenatally (Seng et al., 2009). Studies of pregnant sexual abuse survivors (Grimstad, Backe, Jacobsen, & Schei, 1998) and of pregnant women with PTSD (Morland et al., 2007; Smith, Poschman, Cavaleri, Howell, & Yonkers, 2006) have found associations with tobacco and illicit drug use during pregnancy. However, though noting the association between tobacco use and PTSD, these studies did not focus on tobacco use as a principal outcome measure nor take other re-

lated factors, such as the use of tobacco to cope, into account.

Poor and minority women with PTSD during pregnancy have limited access to resources that might facilitate quitting behavior. For example, they are less likely to have had mental health treatment (Seng, Kohn-Wood, McPherson, & Sperlich, 2011) and are also less likely to have social support from a partner or from their family of origin (Kruse, Kane Low, & Seng, 2011). Women enrolled in maternity care in low-resource settings also have very high rates of PTSD (i.e., 13.9% in public sector clinics vs. 2.7% in private sector clinics; Seng et al., 2009) that correspond to their relatively higher rates of adverse perinatal and infant birth outcomes (Seng, Kane Low, Sperlich, Ronis, & Liberzon, 2011). Disadvantaged, PTSD-affected women who are pregnant consequently may have more stressors and a greater PTSD symptom load with which to cope while simultaneously having fewer resources to do so. This distress is likely coupled with less access to pharmacologic mental health treatments (e.g., selective serotonin reuptake inhibitors), due to income levels (e.g., Kuno & Rothbard, 2005) and to the risks of using pharmacological treatment during pregnancy (e.g., Einarson, Selby, & Koren, 2001).

Tobacco Use to Cope

Cigarette smoking may be used as a coping strategy or for mood control, especially among women (Dejin-Karlsson et al., 1996; Edwards & Sims-Jones, 1998; Waldron, 1991), and is often conceptualized as a form of self-medication among people with PTSD (Miller & Guidry, 2001). Thus, among pregnant women in low-resource settings, post-traumatic stress may be a particularly important factor to consider when attempting to reduce tobacco use. Trauma-informed interventions may have greater potential for success than current smoking cessation standards of care that do not consider tobacco use as a form of self-medication for post-traumatic stress.

The purpose of this article is to examine the relationships between demographic risk factors, trauma, tobacco use, and coping in a diverse sample of pregnant women via a secondary analysis. Researchers have noted relationships between tobacco and/or substance use and PTSD but did not consider (a) tobacco use as a specific outcome of interest or (b) differences between those who quit and those who continue smoking while pregnant. We analyze smoking behavior in relation to demographic risk factors, trauma history and PTSD, pregnancy-related factors, prior and current mental health treatment, substance use, and women's

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disclosures that they use tobacco “to cope with emotions or problems.” This information can be used to design targeted interventions for pregnant women with a history of trauma who continue to smoke during pregnancy. Results could further inform clinicians of the obstacles faced by these women as they attempt to change their smoking behaviors.

Data and Methods

Design and Parent Study Description

This is a secondary analysis of a prospective three-cohort study of the effects of PTSD on pregnancy outcomes (NIH NR008767, PI Seng). Data for this analysis are from the initial survey interview conducted prior to 28 weeks gestation. Recruitment, procedures, and instruments have been fully described elsewhere (Seng et al., 2009) and are briefly summarized here.

Recruitment and Interview Procedures

In eight maternity clinics at three health systems in the midwestern United States, obstetric clinic nurses determined eligibility (age 18 or older, expecting a first infant, able to speak English without an interpreter, and gestational age fewer than 28 weeks) from the new patient history and invited eligible women to take part in a telephone survey about “stressful things that happen to women, emotions, and pregnancy.” Interested women received a written information document and gave contact information. A survey research organization (DataStat, Ann Arbor, Michigan) conducted the interviews from August 2005 through October 2007. Interviews began by verifying eligibility and continued with a verbal informed consent process, including explanation of the Confidentiality Certificate protections. Institutional Review Board approvals were obtained from all three health systems where recruitment took place. Professional research interviewers used a computer-assisted telephone interview (CATI) program to conduct a standardized psychiatric diagnostic interview designed for use with lay interviewers. Interviews lasted an average of 33 minutes. Participants who completed the interview were sent a \$20 check by mail. A computerized algorithm applied *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV;* American Psychiatric Association, 1994)

PTSD symptom diagnostic criteria and assigned women to one of three cohorts for follow-up: PTSD-diagnosed (lifetime, $n = 319$), trauma-exposed, but resilient controls ($n = 380$), and nonexposed controls ($n = 350$). Women who did not fit these cohort definitions ($n = 532$), most of whom had partial PTSD, were dismissed from follow-up, but their data are included in analyses of this first interview, so this should be considered an unselected sample. The size of the sample ($n = 1,581$) was determined based on power analysis and attrition estimates so that clinical obstetric conditions of interest occurring at rates as low as 2% (e.g., hyperemesis gravidarum) could be studied.

Organizing Framework

The theoretical relationships we assess with our first logistic regression model (forthcoming) posit that smoking is an outcome of abuse trauma and PTSD, especially among low-resource women. In a second model, we posit that pregnancy smoking is an outcome of these factors and may be additionally modified by pregnancy wantedness and by other substance use, and that using tobacco to cope with emotions is a key explanatory factor.

Measures

Wherever possible the interview used established instruments. Trauma history was assessed using the Life Stressor Checklist (LSC; Wolfe & Kimerling, 1997) which was modified for use in a telephone format to assess 29 potentially traumatic events as occurring or not and obtaining more in-depth information about the two worst (index) exposures, including age and impact at the time and past-year impact. This measure is designed for use with women and is considered the most sensitive measure of potentially traumatic events (Cusack, Falsetti, & de Arellano, 2002). Lifetime and current (past month) PTSD symptoms and diagnosis were obtained using the National Women's Study PTSD module (Resnick et al., 1993), a telephone interview used in the largest epidemiological study of PTSD in women, with high sensitivity (sensitivity 0.99, specificity of 0.79) to PTSD when compared with the established Structured Clinical Interview for DSM Disorders (SCID; Kilpatrick et al., 1994). Demographic information, pregnancy wantedness, and substance use data, including information about quantity of cigarettes smoked and timing of cessation (if applicable), were gathered using the Centers for Disease Control and Prevention Prenatal Risk Assessment and Monitoring System (PRAMS) survey (Beck et al., 2002). Crime rate was considered an aspect of sociodemographic status because this environmental factor is a known risk

for PTSD. This risk factor was coded as above or below the average U.S. crime rate based on statistics from the Federal Bureau of Investigation Uniform Crime Report in 2000 and the woman's zip code (simplymaps.com, retrieved May 20, 2009). Two items included in this analysis were generated for this survey. We asked about past and current (pregnancy) use of psychotherapy and psychotropic medications and about use of 12 coping strategies known to be used by women with PTSD to cope with symptoms. These strategies are considered to reflect "engaged" and "disengaged" approaches (Rauch, DeFeaver, Oetting, Graham-Bermann, & Seng, 2011). The stem for this set of queries related to alcohol, tobacco, and illicit drugs asked, "Which, if any, of these ways have you ever used to cope with emotions or problems"?

Data Reduction and Smoking Classification

Summary variables used in a previous study of PTSD and childbirth (Seng et al., 2008) are used in this analysis and are briefly described here. Sociodemographic status is represented using a six-level (0-5) index that is the sum of the following five risk factors for current PTSD: young age (<21), African American race, poverty, low education (high school or less), and living in a high-crime-rate zip code. Participants have been classified with regard to their trauma history based on their "worst" (index) exposure into five trauma types: family context trauma (e.g., not having enough money for food, family member jailed, having been fostered or adopted, caretaking of sick relative, divorce, sudden, unexpected death of a loved one), event trauma (e.g., being in an accident, disaster, or war zone), reproductive trauma (characterized as "having a difficult time because of an abortion or miscarriage" in this sample of nulliparous women), abuse trauma (lifetime sexual, physical, or emotional abuse, or physical neglect), and "other" which was left unspecified. Finally, participants were divided into one of three mutually exclusive smoking groups: Group 1: Nonsmokers, participants who reported no cigarette use before or during pregnancy ($n = 1,159$); Group 2: Quitters, participants who reported cigarette use before pregnancy, then reported no cigarette use during pregnancy ($n = 191$); Group 3: Pregnancy smokers, participants who reported any cigarette use during pregnancy ($n = 197$), including 11 women who reported no smoking prepregnancy.

Analysis Plan

Description of the sample was conducted by comparing smoking groups' profiles on demographic risk factors, trauma history and PTSD, pregnancy-

related factors, prior and current mental health treatment, substance use, and women's disclosures that they use tobacco "to cope with emotions or problems" using *t* tests or one-way analysis of variance (ANOVA) for interval-level variables and chi-square tests for nominal variables. Step-wise logistic regression modeling was conducted to answer two primary research questions and one post hoc question.

To what extent do trauma and PTSD predict ever being a smoker? Is this moderated by sociodemographic status?

After controlling for sociodemographic status, trauma history, and PTSD, to what extent does using tobacco as a strategy to cope with emotions and other pregnancy factors (e.g., wantedness, other substance use) predict not being able to quit smoking during pregnancy?

Do PTSD symptom clusters (intrusive reexperiencing, avoidance and emotional numbing, and autonomic hyperarousal) differentially predict smoking during pregnancy?

Results

Smoking Classification

Thirty-four women (2%) had reported using tobacco to cope at some time but did not report whether they used tobacco in pregnancy and were hence unable to be classified as quitters or pregnant smokers. They were removed from the analysis. Nonsmokers ($n = 1,159$) were 75% of the sample. Nonsmokers were contrasted with (ever, lifetime) smokers ($n = 388$, 25%) in some analyses. For other analyses, lifetime smokers were divided into quitters ($n = 191$, 12%) and pregnancy smokers ($n = 197$, 13%). In the tables comparing groups, statistics were generated to compare nonsmokers and smokers first, then to compare quitters and pregnancy smokers.

Demographics

Demographic risk factors were contrasted in Table 1. Table 1 shows a consistent pattern: nonsmokers differed significantly from smokers on all demographic risk variables including being African American, being pregnant as a teen, living in poverty, having a secondary education or less, and living in high-crime areas. Nonsmokers also had fewer SES risk factors (1.6 , $SD = 1.8$) than smokers (2.3 , $SD = 1.7$). Pregnancy smokers were significantly more like to have lower education (secondary education or less) than quitters (72% vs. 58%).

Table 1: Comparison of Risk Factors of Nonsmokers Versus Smokers and Quitters Versus Pregnancy Smokers

	Prepregnancy			Pregnancy		
	Nonsmokers (1,159)	Smokers (388)	χ^2/F	Quitters (191)	Pregnancy smokers (197)	χ^2/F
African American (%/n)	42.6 (494)	54.4 (211)	16.20***	54.5 (104)	54.3 (107)	0.001
Teen (%/n)	23.1 (268)	28.1 (109)	3.90*	28.0 (55)	27.4 (54)	0.09
Poverty (%/n)	19.2 (223)	34.0 (132)	35.91***	30.9 (59)	37.1 (73)	1.64
Secondary education or less (%/n)	41.1 (476)	65.0 (252)	66.53***	58.1 (111)	71.6 (141)	7.72**
More than U.S. average crime rate (%/n)	37.6 (436)	52.8 (205)	27.74***	56.0 (107)	49.8 (98)	1.53
Mean number of risk factors (%/n)	1.6 (1,159)	2.3 (388)	44.27***	2.3 (191)	2.4 (197)	0.45

Note. ANOVA used for mean number of risk factors. Chi-square used for all other tests.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Mental Health and Trauma History (Table 2)

Smokers had significantly higher rates of current PTSD (16% vs. 6%) and lifetime PTSD (current

included; 32% vs. 16%) than did nonsmokers. Likewise, pregnancy smokers had significantly higher rates of both current (21% vs. 11%) and lifetime (38% vs. 28%) PTSD compared to quitters. Smok-

Table 2: Comparison of Mental Health Issues and Trauma Histories of Nonsmokers Versus Smokers and Quitters Versus Pregnancy Smokers

	Prepregnancy			Pregnancy		
	Nonsmokers (1,159)	Smokers (388)	χ^2/F	Quitters (191)	Pregnancy smokers (197)	χ^2/F
Current PTSD diagnosis (%/n)	6.3 (73)	16.0 (62)	34.20***	11.0 (21)	20.8 (41)	6.96**
Lifetime PTSD diagnosis (%/n)	15.9 (184)	32.3 (127)	51.42***	27.8 (53)	37.6 (74)	4.24*
Treatment, group therapy, or prescription medication use:						
Prior to pregnancy (%/n)	13.6 (114)	22.9 (64)	13.8***	21.3 (30)	24.4 (34)	0.45
During pregnancy (%/n)	5.0 (58)	6.7 (26)	1.63	5.8 (11)	7.6 (15)	0.53
Worst trauma type						
Family context (%/n)	49.3 (571)	46.9 (182)	0.65	45.6 (87)	48.2 (95)	0.28
Event (%/n)	11.3 (131)	12.9 (50)	0.71	14.7 (28)	11.2 (22)	1.05
Reproductive (%/n)	3.9 (45)	6.2 (24)	3.62 [†]	7.9 (15)	4.6 (9)	1.80
Abuse (%/n)	11.2 (130)	23.5 (91)	35.55***	21.5 (41)	25.4 (50)	0.83
Abuse trauma count (0-8) (mean/n)	0.5 (1,159)	1.2 (388)	91.49***	1.0 (191)	1.5 (197)	24.13***
Worst trauma was "extremely troubling" (%/n)	8.2 (87)	19.2 (72)	34.0***	12.9 (24)	25.3 (48)	9.27**
Pregnancy was wanted (%/n)	51.8 (593)	32.5 (123)	42.93***	35.8 (67)	29.2 (56)	1.92

Note. PTSD = posttraumatic stress disorder.

ANOVA used for abuse trauma count. Chi-square used for all other tests.

[†] $p < .10$.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

ers were more likely than nonsmokers to report abuse as their worst trauma (24% vs. 11%) and were more likely to report that their worst past-year trauma was “extremely troubling” (19% vs. 8%). Significantly more pregnancy smokers than quitters likewise classified their worst trauma as extremely troubling (25% vs. 13%).

Pregnancy Wantedness

Smokers differed from nonsmokers in the “wantedness” of their current pregnancies, with more nonsmokers (52%) classifying their pregnancy as wanted “now” or “sooner” than smokers (33%). There was no significant difference in pregnancy wantedness between quitters and pregnancy smokers.

Treatment History

Overall, 17% of the sample had received mental health treatment or used prescription medication at some point (not shown). Smokers differed significantly from nonsmokers in their rates of treatment, with more smokers (23%) having received treatment prior to pregnancy than nonsmokers (14%). Notably, no treatment differences exist during pregnancy.

Drug Use History (Table 3)

Participants were asked if they ever used “alcohol,” “tobacco,” or “marijuana, recreational drugs or [abused] prescription drugs” (henceforth “other drugs”) “to cope with emotions or problems.” Smokers differed from nonsmokers in the percentage that used alcohol to cope (26% vs. 11%) and other drugs to cope (26% vs. 5%). In addition, signifi-

cantly more pregnancy smokers had used tobacco to cope at some time than had quitters (69% vs. 50%). When questioned about any alcohol or drug use in pregnancy, significantly more pregnancy smokers than quitters reported alcohol use (23% vs. 13%) and other drug use (16% vs. 3%), revealing a strong possibility of polysubstance use among pregnancy smokers.

Smoking Prior to Pregnancy

To explore changes in smoking behavior possibly elicited by pregnancy, we analyzed the differences in number of cigarettes smoked prior to and during pregnancy. Quitters smoked a significantly different number of cigarettes before pregnancy than did pregnancy smokers ($p < .001$; Table 4), with the majority of quitters (72%) smoking fewer than 10 cigarettes a day, whereas the majority of pregnancy smokers (56%) smoked 10 cigarettes or more. Of note, however, among pregnancy smokers, none reported smoking 20 or more cigarettes (down from 12%) during pregnancy, and 57% report smoking less than they did before they were pregnant (not shown).

Regression Models

Three logistic regression models were used to understand the factors that increased the risk of (a) being a smoker versus a nonsmoker and (b) continuing to smoke during pregnancy versus successfully quitting. An additional model was used post hoc to assess the affects of PTSD symptom clusters (intrusive reexperiencing, avoidance and emotional numbing, and autonomic hyperarousal) on inability to quit smoking during pregnancy.

Table 3: Drug Use History of Nonsmokers Versus Smokers, and Quitters Versus Pregnancy Smokers

	Pre-Pregnancy			Pregnancy		
	Nonsmokers (1,159)	Smokers (388)	χ^2/F	Quitters (191)	Pregnancy smokers (197)	χ^2/F
Have you ever used _____ to cope?						
Tobacco (%/n)	na	59.3 (23)	na	49.7 (95)	68.5 (135)	14.2***
Alcohol (%/n)	11.1 (129)	25.5 (99)	47.87***	27.8 (53)	23.4 (46)	0.99
Other drugs (%/n)	4.6 (53)	25.5 (99)	143.9***	24.1 (46)	26.9 (53)	0.41
Any alcohol use during pregnancy (%/n)	13.4 (155)	17.5 (68)	4.06*	12.0 (23)	22.8 (45)	7.83**
Other drugs use during pregnancy (%/n)	2.5 (29)	9.5 (66)	35.21***	3.1 (6)	15.8 (31)	17.83***

Note. Chi-square used for all tests.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 4: Percentages of Participants That Smoked Various Number of Cigarettes per Day While Pregnant

	Less Than 1	1-9	10-20	More Than 20	χ^2
Cigarettes prior to pregnancy					65.64*
Quitters (191) (%/n)	7.9 (15)	63.9 (122)	24.6 (47)	1.6 (3)	
Pregnancy smokers (197) (%/n)	8.6 (17)	29.4 (58)	44.7 (88)	11.7 (23)	

Note. Chi-square used for all tests.
* $p < .001$.

The first logistic regression model (Table 5) considered in three steps the influence of the sum of abuse traumas (step 1), lifetime prevalence of PTSD (inclusive of current PTSD; step 2), and the influence of cumulative sociodemographic risk factors (step 3), on the odds of being a smoker, with nonsmokers as the reference group. The sum of abuse traumas was significant at every step of the regression, with each additional instance of abuse increasing the odds of being a smoker by 33% after all controls were entered in the model. Lifetime PTSD likewise significantly increased the odds of being a smoker by 64%, even after controlling for SES risk.

The second step-wise logistic regression model (Table 6) considered in five steps the influence of the sum of abuse traumas (step 1), current PTSD, lifetime PTSD (exclusive of current PTSD; step 2), whether a pregnancy was wanted, whether a patient's worst trauma was "extremely" troubling (step 3), use of tobacco to cope (step 4), and cumulative SES risk factors (step 5) on the odds of quitting versus continuing to smoke during pregnancy.

The sum of abuse traumas fell from significance with the addition of the use of tobacco to cope, which increased the odds of continuing to smoke

while pregnant by 227%. Neither current nor lifetime PTSD were significant, nor was wantedness of pregnancy or impact of past trauma.

Because lifetime and current PTSD significantly differed between quitters and pregnant smokers, it was unexpected that PTSD would be reduced to nonsignificance when adding covariates to the logistic regression models. Thus, we ran a third logistic regression model (not shown) with PTSD separated into symptom clusters. After controlling for SES risk factors and abuse trauma, each additional Cluster D symptom (hyperarousal) increased the odds of continuing to smoke during pregnancy by 39%. The finding the Cluster D symptomatology is associated with tobacco use has been seen before in samples of veterans (Beckham et al., 1997), but, to the best of our knowledge, has not been shown among pregnant women.

Discussion

PTSD is associated with worse health outcomes generally, in part due to its association with risk behaviors, including smoking. Previous perinatal studies have found associations between an abuse history and smoking in pregnancy (Grimstad et al., 1998) and between PTSD and smoking in

Table 5: Step-Wise Logistic Regression Model of Risk Factors for Being a Smoker Versus a Non-Smoker

	Block 1		Block 2		Block 3		Variance Explained	
	OR	95% CI	OR	95% CI	OR	95% CI	R ²	ΔR^2
Abuse trauma sum	1.48**	1.35-1.61	1.37**	1.24-1.51	1.33**	1.21-1.46	0.045	—
Lifetime PTSD diagnosis			1.67*	1.23-2.26	1.64*	1.21-2.21	0.051	0.06
Cumulative SES risk factors					1.19**	1.11-1.27	0.067	0.16

Note. OR = odds ratio; CI = confidence intervals; PTSD = posttraumatic stress disorder; SES = socioeconomic status.
N = 1,547 for all Blocks.
 $p < .05$.
* $p < .01$.
** $p < .001$.

pregnancy (Morland et al., 2007; Smith et al., 2006). This analysis extends knowledge by confirming that abuse history, PTSD—especially hyperarousal symptoms—and low socioeconomic status contribute additively to being a smoker and to being unable to quit in pregnancy. The strongest predictor of being unable to quit was disclosure that tobacco use functions for the woman as a way to cope with emotions or problems, consistent with the theory that smoking may be a form of self-medicating for the symptoms of PTSD (e.g., Miller & Guidry, 2001).

Interpretation of the results of this analysis should take limitations into account. This is a secondary analysis, so the information about smoking was limited, with a single item being used to indicate that tobacco is being used to cope with emotions or problems. Because roughly 40% of smokers did not smoke “to cope with difficult emotions and problems,” there are clearly other motivations for smoking that are not captured by this single item. Also, the PTSD symptoms of hyperarousal may or may not be considered “emotions” or problematic by the participants. Future research should inquire about different motivations for smoking/continuing to smoke while pregnant, perhaps using open-

Using tobacco to cope increased the odds of pregnancy smoking by 227%, even after controlling for socioeconomic stress and current and lifetime post-traumatic stress disorder.

ended questions. Future studies should also query explicitly the extent to which women smoke in response to memories of traumatic events or other PTSD symptoms or distress. Pregnancy smoking is by self-report via survey items in use for national perinatal risk assessment monitoring by the CDC, but any self-report of such stigmatized behavior, especially in pregnancy, is likely underreported, potentially making our results an underestimation. Thus, future research should include objective physiological indicators of recent smoking behavior (e.g., urinary cotinine and baseline exhaled carbon monoxide; see Berkman, Dickenson, Falk, & Liberman, 2011). Also, our sample includes only women expecting their first infant. Future research should include women that have experienced childbirth previously, to investigate possible differences in coping strategies and effects of trauma in larger households.

Table 6: Logistic Regression Model of Risk of Continuing to Smoke During Pregnancy

	Block 1		Block 2		Block 3		Block 4		Block 5		Variance Explained	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	R ²	ΔR ²
Abuse trauma sum	1.26**	1.10-1.45	1.21*	1.04-1.42	1.21*	1.03-1.42	1.18†	1.0-1.39	1.18†	1.00-1.39	0.021	—
Current PTSD dx			1.55*	0.81-2.95	1.30	0.69-2.62	1.42	0.71-2.81	1.42	0.71-2.85	—	—
Lifetime PTSD dx (no current)			0.95	0.54-1.66	0.90	0.50-1.62	0.86	0.48-1.55	0.86	0.48-1.55	0.025	0.004
Wantedness of pregnancy					0.75	0.48-1.18	0.75	0.47-1.18	0.75	0.47-1.18	—	—
Impact of worst past-year trauma					1.27	0.96-1.67	1.25	0.95-1.65	1.25	0.95-1.65	0.036	0.011
Use of tobacco to cope							2.27***	1.46-3.52	2.26***	1.45-3.53	0.063	0.033
Cumulative SES risk factors									1.00	0.87-1.13	0.063	0.000

Note. OR = odds ratio; CI = confidence intervals; PTSD = posttraumatic stress disorder; dx = diagnosis; SES = socioeconomic status. n = 388 for Block 1 and Block 2; n = 370 for all others.
 † p < .10.
 * p < .05.
 ** p < .01.
 *** p < .001.

For abuse survivors with posttraumatic stress disorder, addressing links between smoking and traumatic stress may lead to better cessation rates, pregnancy outcomes, and lifetime health.

There are strengths as well. This is a large, diverse sample. It includes women from public- and private-sector prenatal clinics, making the findings more generalizable. Trauma history and mental health status were measured with well-established epidemiologic interviews. And, although the single item inquiry of smoking to cope is not an exhaustive list of possible motivations, it was predictive of continued smoking in pregnancy and correlated with higher rates of PTSD. Thus, it could serve as a starting point for the development of a screening tool to be used when working with pregnant women.

There are several implications for research. Qualitative study is warranted to help verify the self-medicating theory of tobacco use and to elucidate details about barriers to quitting that are related to trauma history, PTSD, and lack of coping resources, especially among pregnant women. Biological research is needed to elucidate the pathways by which nicotine may be soothing to PTSD symptoms in general, and symptoms of autonomic hyperarousal specifically. Recent development in experience sampling and ecological momentary assessment in difficult to reach populations (Galloway, Didier, Garrison, & Mendelson, 2008; Kimhy et al., 2010), ecological hormone collection (Seng et al., 2008), and innovative uses of technology among substance users and smokers (Berkman et al., 2011) could easily be adapted to samples of pregnant smokers and could provide invaluable data about the daily lives and influences that contribute to continued smoking and drug use in this population.

Intervention studies of medications for PTSD would contribute knowledge if they also assessed the impact of the medication on smoking behavior. Such data would inform the benefit and risk assessment undertaken when counseling pregnant women about pharmacotherapy for PTSD. It is possible that the risks to mother and fetus from medication are less than those associated with nicotine. Finally, intervention research is urgently needed to compare the effectiveness of trauma-informed treatment for tobacco addiction with standard smoking cessation programs for pregnant women; addressing the dynamic processes of smoking as an effort to

soothe the hyperarousal and as an addiction may yield better results.

Nurses, nurse practitioners, midwives, and physicians can use the results of this study to improve their interactions with pregnant clients who have not been able to quit smoking by the time they enter prenatal care. Specifically, we advocate for an increase in trauma-informed intervention as defined by the Substance Abuse and Mental Health Services Administration (SAMHSA). We believe that trauma-informed care, or care that is "modified to include a basic understanding of how trauma affects the life of an individual seeking services" (SAMHSA, n.d.) could be beneficial for professionals who work with pregnant women. Trauma-informed treatment can recognize the cooccurrence of pregnancy and smoking as an indication of a history of trauma, and work with or refer the client accordingly. Acknowledging the role of traumatic stress as a trigger for smoking, and assessing whether this dynamic fits the client, may further improve the working alliance.

Conclusion

Forty percent of women who are smoking in pregnancy have had lifetime PTSD, and 20% meet full diagnostic criteria in pregnancy. Pregnancy is a window of opportunity to have a strong impact on health behaviors because it is a time in a woman's life where she is particularly motivated to be healthy and has frequent contact with health care professionals who can support her efforts to decrease risk behaviors. For abuse survivors with PTSD, addressing the link between smoking and traumatic stress may lead to better cessation rates, better pregnancy outcomes, and better health across her life span. Last, given that a number of negative health effects for the fetus have proven dose-response relationships with smoking (e.g., preterm birth, still birth) and that women tend to reduce their cigarette use during pregnancy, smoking reduction, not just cessation, is a useful target when working with women who smoke during pregnancy.

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