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The Relationship between Posttraumatic Stress Disorder and Smoking Outcome Expectancies Among U.S. Military Veterans who served since September 11, 2001

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Abstract

Posttraumatic stress disorder (PTSD) is associated with increased rates of smoking although little is known regarding the mechanisms underlying this relationship. The current study examined expectations about smoking outcomes among smokers with and without PTSD. The sample included 96 Veterans (mean age of 34 years) and included 17% women and 50% racial minorities. Smoking expectancies were measured with the Smoking Consequences Questionnaire-Adult (Copeland, Brandon, & Quinn, 1995). Consistent with previous work suggesting that smokers with PTSD smoke in an effort to reduce negative affect, unadjusted analyses indicated that smokers with PTSD ($n = 38$) had higher expectations that smoking reduces negative affect than smokers without PTSD ($d = 0.61$). Smokers with PTSD also had increased expectancies associated with boredom reduction ($d = 0.48$), stimulation ($d = 0.61$), taste/sensorimotor manipulation aspects of smoking ($d = 0.73$), and social facilitation ($d = 0.61$). Results of hierarchical linear regression analyses, indicated that PTSD symptom severity was uniquely associated with these expectancies beyond the effects of gender and nicotine dependence. More positive beliefs about the consequences of smoking may increase risk of continued smoking among those with PTSD who smoke. Further understanding of smoking expectancies in this group may help in developing interventions tailored for this vulnerable population.

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Exposure to trauma and the development of posttraumatic stress disorder (PTSD) are associated with smoking (Fu et al., 2007). Population based estimates suggest that 45% of persons with PTSD smoke compared to only 25% of those in the general population (Lasser et al., 2000). Surprisingly, little is known regarding the mechanisms that may underlie the association between PTSD and smoking.

Increasing evidence suggests that persons with PTSD smoke to reduce negative affect to a greater extent than those without the disorder (Feldner, Babson, & Zvolensky, 2007). It is thought that in the absence of more adaptive coping strategies, PTSD smokers are motivated to smoke in order to cope with high levels of distress (Beckham et al., 2008). Questionnaire studies examining motives to smoke among those with PTSD have suggested that PTSD smokers are indeed more likely to smoke to reduce negative affect than those without PTSD (Beckham et al., 1997; Feldner, Babson, Zvolensky, Vujanovic, et al., 2007).

Although there is evidence for the association between PTSD and motivation to smoke in order to reduce negative affect, there is extremely little work that has examined the relationship between PTSD and smoking outcome expectancies. Smoking outcome expectancies are related but distinct from motivations and reflect the anticipated consequences of smoking (Cohen, McCarthy, Brown & Myers, 2002). Expectancies are thought to either promote or to inhibit behavioral responses and a growing body of work has demonstrated a relationship between smoking outcome expectancies and smoking behavior (Cohen et al., 2002; Wetter et al., 1994).

To date, there has been only one study that has examined smoking expectancies among persons with PTSD. Marshall and colleagues (2008) examined expectancies among a sample of 47 community volunteers with PTSD in comparison to a control group of smokers without any Axis I psychopathology using the four-factor version of the Smoking Consequences Questionnaire (Brandon & Baker, 1991). Results indicated that persons with PTSD had greater expectations for negative reinforcement (e.g., "Smoking helps me calm down when I feel nervous") but also for expectations of appetite control and negative consequences of smoking. More work is needed to examine the association between PTSD and smoking expectancies including (a) a broader examination of various smoking expectancies and (b) examination of the PTSD-expectancy relationship after accounting for the effects of gender and nicotine dependence, both of which have been associated with other cognitive constructs related to smoking (e.g., smoking motives) in previous studies (Feldner, Babson, & Zvolensky, 2007; Pulvers et al, 2004).

The current study was designed to further examine the association between PTSD and smoking expectancies. As an extension of previous work, smoking expectancies among military veterans rather than community volunteers were examined and analyses accounted for potential confounds of nicotine dependence and gender. The present study employed the Smoking Consequences Questionnaire-Adult (Copeland et al., 1995), a broader, standardized measure of smoking expectancies that includes 10 subscales that are thought to reflect the more refined expectancies found in experienced smokers. The measure allows for a direct examination of expectancies related to reduction of negative affect. It was hypothesized that PTSD would be significantly associated with increased negative affect reduction expectations. Exploratory analyses examined associations between PTSD and other smoking related expectancies.

Method

Participants

Participants were 96 smokers who had participated in the Mid-Atlantic Mental Illness Research, Education and Clinical Center Recruitment Database for the Study of Post-Deployment Mental Health (Registry). Procedures and recruitment methods for the Registry are detailed elsewhere (see, Calhoun et al., 2010). Inclusion criteria for the current study included smokers recruited between November 2005 and April 2009 who had completed measures described below. The sample included 17% females, 50% racial minorities, and had an average age of 34 years ($SD = 9.5$).

Measures

PTSD diagnosis was based on the Structured Clinical Interview for *The Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)* Axis I Disorders (SCID; First, Spitzer, Gibbon, & Williams, 1997). Fleiss' (1971) kappa was calculated across 17 clinical interviewers for 7 SCID training videos with reliability for the PTSD diagnosis of 1.0. PTSD symptom severity was assessed with the Davidson Trauma Scale (Davidson et al., 1997) which has demonstrated reliability ($\alpha = .98$) and validity among recent veterans (McDonald, Beckham, Morey, & Calhoun, 2009).

The Fagerström Test of Nicotine Dependence (Heatherton, Kozlowski, Frecker, & Fagerström, 1991) is a well-established, reliable ($\alpha = .68$ in this sample), 6-item measure with scores ranging from 0–10 used to assess nicotine dependence. Smoking expectancies were assessed with the Smoking Consequences Questionnaire-Adult (Copeland et al., 1995), a 55-item measure designed to assess smoking outcome expectancies which is valid and reliable ($\alpha = .96$ in this sample) among smokers with psychiatric conditions (Buckley et al., 2005).

Analyses

ANOVA was used to examine bivariate associations between PTSD and smoking expectancies. Hierarchical linear regression procedures were used to examine whether PTSD symptoms contributed to unique variance in expectations beyond nicotine dependence and gender for any expectancy related to PTSD in unadjusted analyses. The use of a continuous measure of PTSD symptoms in the linear regression model increases power and avoids problems associated with analysis of covariance when non-randomized groups differ on baseline characteristics (for a discussion, see Miller & Chapman, 2001). For each model, gender and nicotine dependence were entered in Step 1 followed by PTSD symptoms in Step 2.

Results

The rate of PTSD was 39% in this sample. There were no differences in age, gender, or race, between those with and without PTSD. A larger proportion of smokers with PTSD (92%) had been deployed to Iraq/Afghanistan than non-PTSD smokers 48%, $\chi^2(1, N = 96) = 18.96$, $p < .001$. As well, those with PTSD had higher Davidson Trauma Scale scores, 94.97 ($SD = 26.42$), than those without--28.22 ($SD = 29.71$), $F(1,94) = 125.50$, $p < .001$. Table 1 presents bivariate associations between PTSD and smoking related variables including subscale scores from the Smoking Consequences Questionnaire. PTSD was related to negative affect reduction expectancies as well as increased stimulation/state enhancement, taste/sensorimotor, social facilitation, and boredom reduction expectancies.

Table 2 provides a summary of regression analyses examining smoking expectancies that differed by group. PTSD severity was significantly related to increased negative affect reduction expectancies even after accounting for the potential confounding effects of gender and nicotine dependence. Similar results were found for expectations associated with smoking for stimulation/state enhancement, sensorimotor manipulation, social facilitation, and boredom reduction.

Discussion

PTSD was related to negative affect reduction expectancies beyond both gender and nicotine dependence. These data extend previous studies examining PTSD and smoking expectancies (e.g., Marshall et al., 2008) and are consistent with previous findings suggesting that individuals with PTSD may smoke to manage aversive feeling states (Beckham et al., 2005; Beckham et al., 2008).

The links between smoking expectancies and smoking behavior in veterans with PTSD are likely complex. Exploratory analyses indicated that PTSD severity was associated with expectations for increased stimulation/state enhancement, taste/sensorimotor manipulation, and social facilitation expectancies. Veterans with PTSD appear to expect that nicotine will enhance baseline functioning. Individuals with PTSD often complain of cognitive disturbances, and accumulating evidence suggests that PTSD is associated with mild deficits in attention and memory (Vasterling et al., 2002).

PTSD smokers seemed to view smoking as more pleasurable than smokers without PTSD. These findings are in contrast to one previous study that compared non-psychiatric and psychiatric smokers which found no difference in sensorimotor expectancies using the Smoking Consequences Questionnaire (Buckley et al., 2005). There was no evidence that those with PTSD were less concerned about the negative health effects of smoking than those without the disorder, so it is unlikely that veterans with PTSD perceive smoking as more pleasurable because they lack concern regarding the negative health or negative social consequences of smoking. These findings might be related to a desire to experience pleasure or reduce anhedonic aspects of PTSD numbing symptoms.

In contrast to previous findings (Pulvers et al., 2004), gender was unrelated to smoking expectancies. Findings that PTSD was related to increased expectancies associated with social facilitation were also unexpected. Group differences could be attributable to social impairment associated with PTSD. To the extent that those with PTSD become increasingly uncomfortable around others, they may experience and come to expect a greater degree of social facilitation while smoking in comparison to non-PTSD smokers.

An increased understanding of smoking expectancies may help to develop tailored interventions for smokers with PTSD. For example, affect regulation strategies may be particularly important for smokers with PTSD given that they hold strong beliefs that smoking is an effective way to reduce negative affect. Similarly, cognitive interventions that challenge the overly positive expectancies about the consequences of smoking (e.g., stimulation/state enhancement, taste/sensorimotor manipulation, social facilitation) may be particularly important in helping PTSD smokers quit smoking.

This is the first study of which we are aware to examine smoking expectancies among Operation Enduring Freedom/Operation Iraqi Freedom veteran smokers. Strengths of the current investigation also include the use of structured interviews to diagnose PTSD, standardized assessment of smoking expectancies, and analyses that controlled for nicotine dependence and gender. Results are limited by the use of a small sample size and self-reported smoking status. As data are cross-sectional, causation cannot be determined and

effects may be bi-directional. Longitudinal studies are needed to examine the development and maintenance of smoking expectancies following exposure to traumatic events including deployment to warzones. Despite these limitations the current study adds to a growing evidence base that persons with PTSD view smoking as a way to cope with negative affective states. Further, results suggest that smokers with PTSD have more positive expectations about the consequences of smoking which may increase risk for continued smoking. Targeted interventions to reduce smoking in this vulnerable population are needed.

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References

- Beckham JC, Feldman ME, Vrana SR, Mozley SL, Erkanli A, Clancy CP, Rose JE. Immediate antecedents of cigarette smoking in smokers with and without posttraumatic stress disorder: A preliminary study. *Experimental and Clinical Psychopharmacology*. 2005; 13:218–228.10.1037/1064-1297.13.3.219
- Beckham JC, Kirby AC, Feldman ME, Hertzberg MA, Moore SD, Crawford AL, Fairbank JA. Prevalence and correlates of heavy smoking in Vietnam veterans with chronic posttraumatic stress disorder. *Addictive Behaviors*. 1997; 22:637–647.10.1016/S0306-4603(96)00071-8 [PubMed: 9347066]
- Beckham JC, Wiley MT, Miller S, Wilson SM, McClemon FJ, Calhoun PS, Dennis MF. *Ad Lib* smoking in posttraumatic stress disorder: An electronic diary study. *Nicotine and Tobacco Research*. 2008; 10:1149–1157.10.1080/14622200802123302 [PubMed: 18629724]
- Benjamini Y, Hochberg Y. Controlling the false discovery rate: A practical and powerful approach to multiple testing. *Journal of the Royal Statistical Society*. 1995; 57:289–300.
- Brandon TH, Baker TB. The Smoking Consequences Questionnaire: The subjective expected utility of smoking in college students. *Psychological Assessment*. 1991; 3:484–491.10.1037/1040-3590.3.3.484
- Buckley TC, Wolfson B, Mozley SL, Gulliver SB, Holohan DR, Helstrom AW, Kassel JD. A psychometric evaluation of the Smoking Consequences Questionnaire-Adult in smokers with psychiatric conditions. *Nicotine and Tobacco Research*. 2005; 7:739–745.10.1080/14622200500259788 [PubMed: 16191745]
- Calhoun PS, McDonald SD, Eggleston AM, Beckham JC, Straits-Troster K. the Mid-Atlantic Mental Illness Research Education and Clinical Center Registry Workgroup. Clinical Utility of the Primary Care-PTSD Screen Among U.S. Veterans who served since September 11, 2001. *Psychiatry Research*. 2010; 178:330–335.10.1016/j.psychres.2009.11.009 [PubMed: 20483463]
- Cohen LM, McCarthy DM, Brown SA, Myers MG. Negative affect combines with smoking outcome expectancies to predict smoking behavior over time. *Psychology of Addictive Behaviors*. 2002; 16:91–97.10.1037//0893-164X.16.2.91 [PubMed: 12079260]
- Copeland AL, Brandon TH, Quinn EP. The Smoking Consequences Questionnaire-Adult: Measurement of smoking outcome expectancies of experienced smokers. *Psychological Assessment*. 1995; 7:484–494.10.1037/1040-3590.7.4.484
- Davidson JRT, Book SW, Colket JT, Tupler LA, Roth S, David D, Feldman ME. Assessment of a new self-rating scale for posttraumatic stress disorder: The Davidson Trauma Scale. *Psychological Medicine*. 1997; 27:153–160. [PubMed: 9122295]
- Feldner MT, Babson KA, Zvolensky MJ. Smoking, traumatic event exposure, and posttraumatic stress: A critical review of the empirical literature. *Clinical Psychology Review*. 2007; 27:14–45.10.1016/j.cpr.2006.08.004 [PubMed: 17034916]

- Feldner MT, Babson KA, Zvolensky MJ, Vujanovic AA, Lewis SF, Gibson LE, Bernstein A. Posttraumatic stress symptoms and smoking to reduce negative affect: An investigation of trauma-exposed daily smokers. *Addictive Behaviors*. 2007; 32:214–227.10.1016/j.addbeh.2006.03.032 [PubMed: 16644135]
- Fleiss JL. Measuring nominal scale agreement among many raters. *Psychological Bulletin*. 1971; 76:378–382.
- First, MB.; Spitzer, RL.; Gibbon, M.; Williams, JBW. *Structured Clinical Interview for DSM-IV Axis I Disorders*. Washington, D.C: American Psychiatric Press, Inc; 1997.
- Fu S, McFall M, Saxon AJ, Beckham JC, Carmody TP, Baker DG, Joseph AM. Post-traumatic stress disorder and smoking: A systematic review. *Nicotine and Tobacco Research*. 2007; 9:1071–1084.10.1080/14622200701488418 [PubMed: 17978982]
- Heatherton TF, Kozlowski LT, Frecker RC, Fagerström KO. The Fagerström Test for Nicotine Dependence: A revision of the Fagerström Tolerance Questionnaire. *Addiction*. 1991; 86:1119–1127.
- Lasser K, Boyd JW, Woolhandler S, Himmelstein DU, McCormick D, Bor DH. Smoking and mental illness: A population-based prevalence study. *Journal of the American Medical Association*. 2000; 284:2606–2610.10.1001/jama.284.20.2657 [PubMed: 11086367]
- Marshall EC, Zvolensky MJ, Vujanovic AA, Gibson LE, Gregor K, Bernstein A. Evaluation of smoking characteristics among community-recruited daily smokers with and without posttraumatic stress disorder and panic psychopathology. *Journal of Anxiety Disorders*. 2008; 22:1214–1226.10.1016/j.janxdis.2008.01.003 [PubMed: 18282685]
- Miller GA, Chapman JP. Misunderstanding analysis of covariance. *Journal of Abnormal Psychology*. 2001; 11:40–48.10.1037/0021-843X.110.1.40 [PubMed: 11261398]
- McDonald SD, Beckham JC, Morey RA, Calhoun PS. The validity and diagnostic efficiency of the Davidson Trauma Scale in military veterans who have served since September 11th, 2001. *Journal of Anxiety Disorders*. 2009; 23:247–255.10.1016/j.janxdis.2008.07.007 [PubMed: 18783913]
- Pulvers KM, Catley D, Okuyemi K, Scheibmeir M, McCarter K, Jeffries SK, Ahluwalia JS. Gender, smoking expectancies, and readiness to quit among urban African American smokers. *Addictive Behaviors*. 2004; 29:1259–1263.10.1016/j.addbeh.2004.03.028 [PubMed: 15236832]
- Vasterling JJ, Duke LM, Brailey K, Constans JJ, Allain AN Jr, Sutker PB. Attention, learning, and memory performances and intellectual resources in Vietnam veterans: PTSD and no disorder comparisons. *Neuropsychology*. 2002; 16:5–14.10.1037/0894-4105.16.1.5 [PubMed: 11853357]
- Wetter DW, Smith SS, Kenford SL, Jorenby DE, Fiore MC, Hurt RD, Baker TB. Smoking outcome expectancies: Factor structure, predictive validity, and discriminant validity. *Journal of Abnormal Psychology*. 1994; 103:801–811.10.1037/0021-843X.103.4.801 [PubMed: 7822583]

Table 1

Smoking Related Variables and Mean Smoking Expectancies by Group

Variable	PTSD (n = 38)		No PTSD (n = 58)		Effect Size <i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Age first smoked	17.76	5.35	17.46	3.84	0.06
Mean daily cigarettes	14.13	10.16	10.03	7.61	0.46*
Fagerström test of nicotine dependence	4.21	2.74	3.14	2.51	0.41*
SCQ-A scales					
Negative affect reduction	55.00	25.77	39.55	24.99	0.61**
Stimulation/state enhancement	22.08	18.40	12.10	13.85	0.61**
Health risk	29.82	9.89	30.72	9.32	-0.09
Taste/sensorimotor manipulation	36.97	24.50	21.90	15.61	0.73***
Social facilitation	20.68	13.64	12.74	12.29	0.61**
Weight control	15.42	16.29	10.06	12.03	0.37
Craving/addiction	36.34	15.83	30.79	15.44	0.35
Negative physical feelings	8.82	7.87	8.02	7.61	0.10
Boredom reduction	22.53	11.95	16.64	12.45	0.48*
Negative social impressions	14.00	8.87	12.50	9.50	0.16

Note. SCQ-A = Smoking Consequences Questionnaire-Adult. Effects examining SCQ-A scales significant at $p < .05$ remained statistically significant after adjusting significance levels through the application of the Benjamini-Hochberg (1995) correction for multiple comparisons.

* $p < .05$;

** $p < .01$,

*** $p < .001$.

Table 2

Association of Gender, Nicotine Dependence, and PTSD Symptom Severity with Smoking Expectancies

	<i>F</i> Δ	<i>R</i> ² (adj)	<i>t</i>	<i>β</i>	<i>sr</i> ²
Dependent variable: smoking to reduce negative affect					
Step 1	4.76*	.07			
Gender			1.72	0.17	.03
Nicotine dependence			2.49*	0.24	.06
Step 2	13.19***	.18			
Gender			1.48*	0.14	.02
Nicotine dependence			1.82	0.17	.03
PTSD severity			3.63***	0.35	.11
Dependent variable: smoking for stimulation/state enhancement					
Step 1	4.39*	.07			
Gender			0.14	0.01	.00
Nicotine dependence			2.95**	0.29	.09
Step 2	8.87**	.14			
Gender			-0.14	-0.01	.00
Nicotine dependence			2.38*	0.23	.05
PTSD severity			2.98**	0.29	.08
Dependent variable: smoking for sensorimotor manipulation					
Step 1	8.81***	.14			
Gender			-1.35	-0.13	.02
Nicotine dependence			4.02***	0.38	.15
Step 2	21.07***	.30			
Gender			-1.91	-0.17	.03
Nicotine dependence			3.37***	0.30	.09
PTSD severity			4.59***	0.41	.16
Dependent variable: smoking for social facilitation					
Step 1	7.57***	.12			

	<i>F</i> / <i>Δ</i>	<i>R</i> ² (adj)	<i>t</i>	<i>β</i>	<i>sr</i> ²
Gender			-0.78	-0.08	.01
Nicotine dependence			3.84***	0.37	.14
Step 2	13.43***	.23			
Gender			-1.18	-0.11	.01
Nicotine dependence			3.22**	0.30	.09
PTSD severity			3.66***	0.34	.11
Dependent variable: smoking for boredom reduction					
Step 1	5.18**	.08			
Gender			-1.21	-0.12	.01
Nicotine dependence			3.03**	0.30	.09
Step 2	12.87***	.19			
Gender			-1.62	-0.15	.02
Nicotine dependence			2.39*	0.23	.05
PTSD severity			3.59***	0.34	.11

Note. *N* = 96; denominator degrees of freedom for *F* tests = 91; *sr*² = squared semi-partial correlation.

*
p < .05;

**
p < .01,

p < .001