

Original Investigation

Smoking Outcome Expectancies in Military Veteran Smokers With Posttraumatic Stress Disorder

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Abstract

Introduction: Smoking outcome expectancies were investigated in treatment-seeking military Veteran smokers with posttraumatic stress disorder (PTSD). The investigation of smoking outcome expectancies may enhance our understanding of the relationship between PTSD and cigarette smoking.

Methods: Participants were 943 military Veterans with a diagnosis of PTSD who were current smokers enrolled in a randomized multisite effectiveness trial to test whether the integration of smoking cessation treatment into mental health care (integrated care) improves prolonged abstinence rates compared with referral to specialized smoking cessation clinics (usual care). Using confirmatory factor analysis (CFA), we evaluated the conceptual model of smoking outcome expectancies measured on the Smoking Consequences Questionnaire—Adult (SCQ-A) version. The Kraemer method of mediation analysis was used to investigate the role of smoking outcome expectancies in mediating relationships between PTSD symptoms and smoking behavior, tobacco dependence, and abstinence self-efficacy.

Results: The CFA supported the 10-factor structure of the SCQ-A in smokers with PTSD. Relationships between measures of PTSD symptoms and tobacco dependence were mediated by the smoking outcome expectancy regarding negative affect reduction. This same smoking outcome expectancy mediated relationships between PTSD symptoms and smoking abstinence self-efficacy.

Conclusions: The findings support the use of the SCQ-A as a valid measure of smoking outcome expectancies in military Veteran smokers with PTSD. Moreover, they suggest that smoking outcome expectancies may play an important role in explaining the relationship between PTSD and cigarette smoking.

Introduction

The prevalence of cigarette smoking in individuals who suffer from posttraumatic stress disorder (PTSD) is much higher than the national average (45% vs. 19%, respectively; Breslau, Davis, & Schultz, 2003; Breslau, Novak, & Kessler, 2004; Kalman, Morissette, & George, 2005; Lasser et al., 2000). Rates of smoking, heavy smoking, and tobacco dependence are even greater among military Veterans with PTSD (Beckham et al., 1997; Fu et al., 2007). Smokers with PTSD and other anxiety disorders experience more severe withdrawal symptoms and more difficulty quitting than other smokers (Morissette, Tull, Gulliver, Kamholz, & Zimering, 2007). Only 23% of individuals with PTSD who have ever smoked have stopped compared with 50% of Americans without PTSD who have quit (Lasser et al., 2000). Individuals with PTSD also have close to the lowest quit rates in comparison with patients with 13 other mental health disorders (Lasser et al., 2000). Despite the boost in cessation achieved through integrated care in a recent multisite trial (McFall et al., 2010), over 90% failed to maintain prolonged abstinence. Tobacco use likely contributes to increased health problems and higher

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use of medical services among Veterans with PTSD (Calhoun, Bosworth, Grambow, Dudley, & Beckham, 2002).

Despite high rates of smoking and low cessation rates among Veterans with PTSD, little is known about factors provoking relapse in this population. The development of more comprehensive empirically based theories about mechanisms that maintain smoking and promote relapse in Veterans with PTSD could facilitate discovery of more innovative smoking cessation treatments for this high risk population. In particular, such theories could build upon current approaches that emphasize conditioning, coping, and motivational processes (Morissette et al., 2007). Most theories of the multiple pathways linking addiction and anxiety disorders (i.e., conditioning, cognitive, anxiety sensitivity, and stress and coping) emphasize motivational processes. However, empirical studies of motivational processes that mediate the relationship between PTSD and smoking are limited. Motivational processes involved in tobacco use include smoking motives that reflect the degree of interest in smoking to achieve a certain effect and outcome expectancies regarding anticipated consequences of smoking (Brandon, Juliano, & Copeland, 1999; Feldner, Babson, & Zvolensky, 2007; Ickard, Green, & Horn, 1969).

The study of motivational processes in smokers with PTSD has emphasized the reinforcing effects of tobacco use in reducing negative affect and alleviating other symptoms (Beckham et al., 2007, 2008; Feldner, Babson, Zvolensky, Vujanovic, et al., 2007). For instance, Beckham et al. (1997) found an association between PTSD and addictive, automatic, and tension-reduction motives among treatment-seeking combat Veterans. Feldner, Babson, Zvolensky, Vujanovic, et al. (2007) showed that higher levels of PTSD symptoms in trauma-exposed individuals were associated with the desire to smoke to reduce emotional distress. In both laboratory and naturalistic settings, it has been shown that PTSD symptoms serve as significant antecedents for smoking, especially when these symptoms are more severe (Beckham et al., 2008).

Although there is a growing empirical evidence for the role of negative affect reduction in the smoking behavior of individuals with PTSD (Beckham et al., 2007; Feldner, Babson, Zvolensky, Vujanovic, et al., 2007), it remains unclear whether the reduction of negative affect is the primary smoking outcome expectancy among smokers with PTSD. Buckley et al. (2005) found that military Veterans with psychiatric disorders, including PTSD, scored significantly higher than smokers without psychiatric conditions on several smoking outcome expectancies, including negative affect reduction, boredom reduction, social facilitation, and health risks of smoking and scored significantly lower on stimulation/state enhancement and weight control. Marshall et al. (2008) compared smoking outcome expectancies in community-living smokers with PTSD and smokers without any psychiatric disorders. Participants with PTSD had greater expectations for both the positive consequences of smoking (including negative affect reduction) and negative consequences of smoking. In general, a more sophisticated understanding of the mechanisms linking specific PTSD symptoms and smoking behavior could potentially lead to targeted pharmacological and behavioral treatments of specific PTSD symptoms that are particularly strong drivers of tobacco use. For example, behavioral activation might facilitate both the reduction of avoidance and

numbing and smoking cessation. More research is needed to investigate the role of smoking outcome expectancies in the relationship between PTSD and smoking (Feldner et al., 2007).

The Smoking Consequences Questionnaire—Adult (SCQ-A; Copeland, Brandon, & Quinn, 1995) was developed to facilitate the investigation of smoking outcome expectancies in the development and maintenance of cigarette smoking as well as in the process of quitting and relapse prevention. Smoking outcome expectancies have been studied in college-age smokers (Brandon & Baker, 1991), in the general population of smokers (Copeland et al., 1995), and in smokers with psychiatric comorbidities (Buckley et al., 2005). Smoking outcome expectancies are among the most widely studied constructs in smoking research, are among the best predictors of smoking behavior, and have been measured almost exclusively by the SCQ-A. The use of the SCQ-A in the study of smoking outcome expectancies in military Veteran smokers with PTSD seems warranted.

In the present study, we sought to further validate the conceptual model of smoking outcome expectancies by investigating the factor structure of the SCQ-A in a sample of treatment-seeking military Veteran smokers with PTSD. Second, we sought to investigate whether smoking outcome expectancies mediated relationships between PTSD symptom severity and measures of smoking behavior, tobacco dependence, and abstinence self-efficacy. We hypothesized that the smoking outcome expectancy of negative affect reduction would mediate the relationship between PTSD symptom severity and level of tobacco dependence, difficulty refraining from smoking, and self-efficacy for smoking abstinence. We felt that the existing literature on smokers with PTSD justified this hypothesis. Analyses of the other SCQ-A scales were considered exploratory.

Methods

Participants

The data included in this study were derived from the baseline assessments of the 943 participants in a multisite effectiveness trial (McFall et al., 2010) designed to determine whether the integration of smoking cessation treatment within mental health care improves long- and short-term abstinence from smoking in military Veterans with PTSD. Demographic characteristics of the parent study sample have been reported elsewhere (McFall et al., 2010).

In the parent trial, smokers from 10 Veterans Affairs (VA) medical centers were randomized into integrated care or usual care (referral to a VA smoking cessation clinic). Details of this trial have been described elsewhere (McFall et al., 2007, 2010).

Human Subjects

The study was approved by the Human Rights Committee of the Palo Alto Cooperative Studies Program Coordinating Center and the Institutional Review Board at each site (Clinical Trials.gov Identifier: NCT00118534).

Assessments

Demographic Characteristics

The following demographic variables were assessed at baseline and included in the present analyses: age (years), sex, race

(White/non-White), marital status (married, divorced, never-married, widowed), education (>12th grade), and employment (unemployed/retired, employed full-time/part-time).

PTSD Symptom Severity

The Clinician Administered PTSD Scale (CAPS; Weathers, Keane, & Davidson, 2001) was used to confirm the diagnosis of PTSD and symptom clusters (reexperiencing, avoidance, numbing, hyperarousal, and distress). The reliability and validity of this measure has been supported in the literature (Pupo et al., 2011). Based on recent analyses of PTSD symptoms (McWilliams, Cox, & Asmundson, 2005; Pietrzak & Southwick, 2009), the symptom clusters of avoidance and numbing were analyzed together (Criterion C) and separately.

Smoking Outcome Expectancies

The SCQ-A (Copeland et al., 1995) is a 55-item questionnaire that assesses outcome expectancies associated with cigarette smoking. It consists of 10 subscales assessing different domains of smoking expectancies (negative affect reduction, stimulation/state enhancement, health risk, taste/sensorimotor stimulation, social facilitation, weight control, craving/addiction, negative physical feelings, boredom reduction, and negative social impressions). Consistent with previous studies, items on the SCQ-A—assessed probability values only (desirability values were excluded).

Smoking Behavior and Tobacco Dependence

Measures of smoking behavior and history included number of years of smoking regularly and average number of cigarettes smoked per day during the past 30 days. The Fagerström Test for Nicotine Dependence (FTND; Heatherton, Kozlowski, Frecker, & Fagerström, 1991) was used to assess the level of tobacco dependence. The FTND total score was used as well as responses to individual items.

Self-efficacy for Smoking Abstinence

The Smoking Abstinence Self-efficacy Scale (SASES; Velicer, DiClemente, Rossi, & Prochaska, 1990) was used to assess confidence in resisting the urge to smoke in three contexts: (a) positive social interactions, (b) stress/emotional distress, and (c) cravings associated with the habit/addictive qualities of cigarette smoking. The results of structural analysis supported the stability and validity of the SASES as a measure of these three self-efficacy factors (Velicer et al., 1990).

Statistical Analyses

To test the conceptual model of smoking expectancies measured by the SCQ-A, a confirmatory factor analysis (CFA) was conducted using LISREL (Joreskog & Sorbom, 1996), requesting a 10-factor solution with a correlated factor structure and forcing the items identified by Copeland et al. (1995) into the predefined factors. Multiple indices of model fit were examined, including comparative fit index (CFI), normed fit index (NFI), non-normed fit index (NNFI), root mean squared error of approximation (RMSEA), and the ratio of the chi-square value to degrees of freedom. In addition, individual item factor loadings were examined to help interpret model fit, and the internal consistency of each of the SCQ-A subscales was determined using Cronbach's alpha (Table 1).

Table 1. Smoking Consequences Questionnaire—Adult

Subscales	Number of items	Psychometrics		
		<i>M</i>	<i>SD</i>	Cronbach's α
Negative affect reduction	9	6.04	2.35	.96
Stimulation/state enhancement	7	3.43	2.47	.92
Health risk	4	8.21	1.56	.91
Taste/sensorimotor manipulation	9	3.83	2.39	.93
Social facilitation	5	3.91	2.64	.90
Weight control	5	3.65	3.02	.95
Craving/addiction	6	6.80	1.94	.84
Negative physical feelings	3	4.75	2.84	.86
Boredom reduction	4	5.99	2.62	.91
Negative social impression	3	4.92	2.86	.85

To examine the role of smoking outcome expectancies in mediating relationships between PTSD symptoms and smoking behavior, tobacco dependence, and abstinence self-efficacy, we used Kraemer's multistep model of mediation analysis (Kraemer, Lowe, & Kupfer, 2005). We chose to use Kraemer's method rather than Structural Equation Modeling (SEM), considering the former to be more appropriate for exploratory data analysis of pairwise relationships on outcome variables and better suited to determine which smoking outcome expectancies potentially mediate relationships between PTSD symptoms and smoking behavior/dependence/self-efficacy (outcome variables). Although the Kraemer model was designed to investigate mediation of relationships that involve a temporal order and direction of causality, such an assumption was not made in the present study since it was difficult to establish a timeline that clearly separated PTSD, expectancies, and smoking behavior. General linear modeling (SAS PROC GLM) was used to test mediation for continuous smoking behavior/dependence variables, and logistic regression (SAS PROC LOGISTIC) was used for categorical variables. Demographic variables included age, race, marital status, education, and employment status; and PTSD variables included the CAPS total score, CAPS reexperiencing, CAPS avoidance/numbing, CAPS avoidance, CAPS numbing, CAPS hyperarousal, and CAPS distress. Mediator variables included subscale scores for smoking outcome expectancies on the SCQ-A. Outcome variables included measures of smoking behavior (cigarettes per day, years of smoking), tobacco dependence (FTND total, difficulty refraining from smoking), and smoking abstinence self-efficacy (positive affect, negative affect, addiction/habit, and total).

Since the interaction effect was included in the modeling, a "centering" procedure was performed on all the variables before carrying out the Kraemer's method. This "centering" procedure was designed to address the scaling problem when interaction terms are involved in the regression modeling. For continuous variables, we subtracted the mean from the raw value, and for categorical variables, we recoded the variable to have mean coding of zero (e.g., -0.5 and 0.5 for binary variables). Using a conservative approach recommended by Kraemer et al. (2005), we calculated Spearman correlation coefficients to determine possible relationships between outcome variables and each of

the baseline and mediator variables. We required a correlation coefficient with an absolute value of $\geq .15$ at p value $< .01$ to be significant. We used Spearman correlations again to determine which baseline and mediator variables were correlated. Variables that were correlated were tested for mediation by examining the coefficients of the main effects and interactions in the regression models. Only those chi square and t values with $p < .001$ were considered to be significant.

Results

Confirmatory Factor Analysis

The SCQ-A subscales are presented in Table 1. For the CFA, all 55 items were used in the initial model, but the indices of fit were satisfactory: $\chi^2 = 5,972.65$, $df = 1,385$, $p < .0001$, ratio < 2 ; CFI = 0.8805, < 0.9 ; NFI = 0.8502, < 0.9 ; NNFI = 0.8718, < 0.9 , RMR = 0.4372, < 0.1 , RMSEA = 0.0625, < 0.06 . Regarding the loadings of individual items on the expectancy factors, the SEs for individual items ranged from 0.0382 to 0.0998. None of the SEs were close to zero, and the t values were all significant. The standardized loadings ranged from 0.4117 to 0.9510, with four less than 0.6.

Mediation Analysis

The results of the mediation analysis, presented in Table 2, revealed mediating effects of smoking outcome expectancies on relationships between PTSD symptoms and tobacco dependence. As we hypothesized, the association between overall PTSD symptom severity and tobacco dependence was mediated by smoking outcome expectancy for negative affect reduction. In addition, the smoking outcome expectancies for negative affect reduction mediated the positive relationship between the CAPS Criteria C symptom cluster (avoidance and numbing) and tobacco dependence. As shown in Table 2, the proportion of both of these mediation effects was small.

The mediation analysis also revealed mediating effects of smoking outcome expectancies on the relationship between PTSD symptom severity and difficulty refraining from smoking

(the FTND item that asks “do you find it difficult to refrain from smoking in places where it is forbidden?”). The smoking outcome expectancy for negative affect reduction mediated the positive relationship between PTSD symptom severity and difficulty refraining from smoking. In addition, the association between avoidance and numbing and difficulty refraining from smoking was mediated by negative affect reduction. As shown in Table 2, the magnitude of both of these mediation effects was small.

Smoking outcome expectancies also mediated the negative relationships between PTSD symptoms and self-efficacy for smoking abstinence. The expectancy that smoking would help reduce negative affect mediated the negative relationship between overall PTSD symptom severity and self-efficacy for smoking abstinence. Similarly, the negative relationship between avoidance and numbing and self-efficacy for smoking abstinence was mediated by the expectancy that smoking would help reduce negative affect. As shown in Table 2, the proportion of both of these mediation effects exceeded 35%.

Discussion

The results of the CFA supported the 10-factor structure of the SCQ-A, replicating previous findings in samples of adult smokers with and without psychiatric disorders (Buckley et al., 2005; Copeland et al., 1995). There appears to be some consistency in the factor structure of the SCQ-A found in the studies of Copeland et al. (1995) and Buckley et al. (2005), in contrast to an earlier study (Wetter et al., 1994) in which a 4-factor model provided the best fit in a general population of smokers enrolled in a smoking cessation trial. However, the sample size in the latter study was relatively small, only those items retained in the final version of the SCQ developed on college students were used in the analyses, and the authors recommended additional research to confirm their findings. The present findings support the conceptual model of smoking outcome expectancies as measured by the SCQ-A (Copeland et al., 1995) and the use of this 10-factor model in the investigation of motivational

Table 2. SCQ-A Mediation Analysis Summary

Outcome variables and PTSD symptoms ^a	SCQ-A mediator variables	Estimate	t Value/ χ^2 [*]	Proportion of mediation (%) ^b
Tobacco dependence (Fagerström Test for Nicotine Dependence total)				
PTSD symptom total (CAPS)	Negative affect reduction (NAF)	0.16	5.73	15.26
Avoidance and numbing (CAPS criterion C)	Negative affect reduction (NAF)	0.16	5.73	14.57
Difficulty to refrain from smoking				
PTSD symptom total (CAPS)	Negative affect reduction (NAF)	0.21	38.36	8.26
Avoidance and numbing (CAPS criterion C)	Negative affect reduction (NAF)	0.20	38.50	13.08
Abstinence self-efficacy—Negative affect				
PTSD symptom total (CAPS)	Negative affect reduction (NAF)	-0.096	-7.71	40.58
Avoidance and numbing (CAPS criterion C)	Negative affect reduction (NAF)	-0.095	-7.61	36.71

Note. CAPS = Clinician Administered PTSD Scale; PTSD = posttraumatic stress disorder; SCQ-A = Smoking Consequences Questionnaire—Adult.

^aPTSD symptom variables are listed under each smoking-related outcome variable.

^b95% CIs range from $\pm 1.76\%$ – 3.14%

^{*} $p < .0001$ for all t and χ^2 values

processes and, specifically, smoking outcome expectancies involved in the relationship between PTSD and smoking.

A novel finding in the present study was the role of the smoking outcome expectancy involving negative affect reduction in mediating the relationship between PTSD symptom severity and level of tobacco dependence (FTND total score). This was true for both PTSD symptom total and for avoidance/numbing. The size of these mediation effects was small. Consistent with previous studies (Fu et al., 2007; Thorndike, Wernicke, Pearlman, & Haaga, 2006), the level of tobacco dependence (FTND total score) was positively associated with overall PTSD symptom severity and avoidance/numbing. Among smokers with more severe PTSD symptoms and more avoidance/numbing, a stronger smoking outcome expectancy regarding negative affect reduction may partly explain their high level of tobacco dependence, difficulty quitting, and vulnerability to relapse after quitting. However, the small proportion of these mediation effects indicates that this smoking outcome expectancy is not the major factor mediating these relationships.

Smoking outcome expectancies were also shown to play a mediating role in the negative relationship between severity of PTSD and situation-specific smoking abstinence self-efficacy. The expectancy that smoking would reduce negative affect mediated the inverse relationship between PTSD symptoms and confidence in resisting the urge to smoke in situations involving affective distress. This expectancy also mediated the relationship between avoidance and numbing and self-efficacy for smoking abstinence. The magnitude of these mediation effects indicated that the mediating role of this smoking outcome expectancy was substantial. Thus, smoking outcome expectancies partially explained why these military Veteran smokers with more severe PTSD were less confident in resisting the urge to smoke in situations involving affective distress. In previous studies, abstinence self-efficacy and positive smoking outcome expectancies have been shown to be predictive of smoking in response to emotional distress (Cohen, McCarthy, Brown, & Myers, 2002; Gwaltney, Shiffman, Balabanis, & Paty, 2005). The further investigation of the interactive effects of self-efficacy and smoking outcome expectancies on the smoking behavior and quit attempts of smokers with PTSD seems warranted.

The present findings indicated that the smoking outcome expectancy of negative affect reduction mediated relationships between the PTSD symptoms of avoidance and numbing (Criterion C) and three smoking outcome variables: tobacco dependence, difficulty refraining from smoking, and self-efficacy for remaining abstinence in situations involving negative affect. The proportion of mediation was highest for the relationship between the Criterion C symptoms and self-efficacy. Avoidance and numbing may be more closely related to smoking behavior, outcome expectancies, and tobacco dependence than other PTSD symptoms. Kirby et al. (2008) showed that military Veterans with PTSD who smoked were more likely to report emotional numbing than those who did not smoke. In a recent study of combat Veterans with PTSD (Cook, Jakupcak, Rosenheck, Fontana, & McFall, 2009), the relationship between PTSD symptoms and smoking behavior was shown to be largely due to the role of emotional numbing. The investigation of specific symptoms that overlap across psychiatric disorders may reveal important infor-

mation about relationships between those disorders, outcome expectancies, and smoking behavior (Morissette et al., 2007).

Empirical research indicates that individuals' mood states influence smoking outcome expectancies (Brandon, 1994). In laboratory (McKee, Wall, Hinson, Goldstein, & Bissonnette, 2003) and naturalistic settings (Gregor, Zvolensky, McLeish, Bernstein, & Morissette, 2008), negative mood states, loss of perceived control, and increased anxiety have been shown to be associated with heightened smoking outcome expectancies. According to the reformulation of the negative reinforcement model of drug addiction of Baker, Piper, McCarthy, Majeskie, & Fiore (2004), negative affect is the most important motivational factor driving addictive behavior and is conceptualized as a central symptom of withdrawal. Furthermore, empirical data indicate that negative affect (Brandon, 1994; Kenford et al., 2002; Piasecki et al., 2000; Shiffman, Paty, Gnys, Kassel, & Hickcox, 1996) and affective vulnerability (Niaura et al., 1999; Wetter et al., 1994) enhance the risk of relapse. Wetter et al. (1994) found that higher expectancies for the negative affect reduction effects of smoking predicted both withdrawal severity and relapse. In combat Veterans with PTSD, the expectancy regarding the negative affect reduction consequences of smoking may be a major factor driving tobacco dependence and relapse following quit attempts.

Future studies of smoking outcome expectancies in smokers with PTSD need to examine prospective relationships between these motivational processes, quitting, and sustained abstinence. Positive smoking outcome expectancies have been shown to be associated with increased difficulty in quitting and maintaining abstinence (Copeland et al., 1995; Shadel & Mermelstein, 1993). Decreases in abstinence self-efficacy and increases in positive expectancies for smoking have been shown to predict smoking lapses and relapse (Gwaltney et al., 2005). Changes in expectancies have been shown to be associated with changes in smoking behavior and motivation, although the direction of causality is unclear (Brandon et al., 1999).

There are several limitations that need to be considered in interpreting the findings of the present study. The mediation model tested in this study cannot be interpreted to imply a direction of causality in the relationship between PTSD and smoking behavior. Second, in the general population of adult smokers, the role of outcome expectancies in the motivation to smoke has been demonstrated at the general level; however, situation-specific effects of such expectancies likely vary (Brandon, Wetter, & Baker, 1996; Brandon et al., 1999). Another limitation of the present study was that the participants were predominantly male. However, few gender differences have been found in previous studies of smoking outcome expectancies (e.g., Rohsenow et al., 2003). Another limitation was the use of self-report to assess smoking outcome expectancies. Self-report measures do not adequately assess implicit cognitive processes that may be the primary factors underlying such expectancies (Brandon, Herzog, Irvin, & Gwaltney, 2004; Goldman, 1999; Hendricks & Brandon, 2005, 2008; McCarthy & Thompson, 2006). Thus, future research in this area would benefit from new investigative methods to evaluate implicit as well as explicit measures of smoking expectancies among smokers with PTSD.

There are a number of other questions that remain in the investigation of the role of outcome expectancies in tobacco use, cessation, and relapse in smokers with PTSD. For instance, the relative importance of motives and expectancies regarding negative affect reduction versus other positive outcomes of smoking, including boredom reduction, is unknown (Feldner et al., 2007). The magnitude of four of the six mediation effects found in the present study was small. Multiple motivational mediators likely influence smoking behavior and quit attempts in smokers with PTSD. Similarly, it is not clear whether or which smoking-related motivational factors are unique to smokers with PTSD versus those that are common to smokers with other anxiety disorders, smokers with other psychiatric disorders, or smokers who experience heightened negative affective states but do not meet criteria for any of the anxiety disorders.

In general, the way in which the outcome expectancies fit into an overall model of tobacco dependence (e.g., their causal role) has yet to be clarified. The exact mechanisms by which outcome expectancies influence tobacco use, cessation, and relapse are not well understood. Brandon et al. (1999) has proposed a model that includes both general and situational expectancies, but this model has yet to be empirically validated. Second, the stability versus changeability of outcome expectancies continues to be debated and also deserves further empirical investigation. Copeland & Brandon (2000) reported preliminary evidence that it is possible to modify smoking outcome expectancies by means of a video-based educational intervention. Interventions designed to enhance distress tolerance such as those involving interoceptive exposure may facilitate smoking cessation in smokers with PTSD by reducing the role of smoking outcome expectancies involving reduction of negative affect and nicotine withdrawal symptoms (Morissette et al., 2007). Efforts to answer these questions regarding smoking outcome expectancies will provide important information in the development and delivery timing of more effective tobacco use cessation treatments for military and nonmilitary smokers with PTSD.

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Declaration of Interests

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References

Baker, T. B., Piper, M. E., McCarthy, D. E., Majeskie, M. R., & Fiore, M. C. (2004). Addiction motivation reformulated: An affective processing model of negative reinforcement. *Psychological Review*, *111*, 33–51. doi:10.1037/0033-295X.111.1.33

Beckham, J. C., Dennis, M. F., McClernon, F. J., Mozley, S. L., Collie, C. F., & Vrana, S. R. (2007). The effects of cigarette smoking on script-driven imagery in smokers with and without posttraumatic stress disorder. *Addictive Behaviors*, *32*, 2900–2915. doi:10.1016/j.addbeh.2007.04.026

Beckham, J. C., Kirby, A. C., Feldman, M. E., Hertzberg, M. A., Moore, S. D., Crawford, A. L., et al. (1997). Prevalence and correlates of heavy smoking in Vietnam veterans with chronic posttraumatic stress disorder. *Addictive Behaviors*, *22*, 637–647. doi:10.1016/S0306-4603(96)00071-8

Beckham, J. C., Wiley, M. T., Miller, S. C., Dennis, M. F., Wilson, S. M., McClernon, F. J., et al. (2008). Ad lib smoking in post-traumatic stress disorder: An electronic diary study. *Nicotine & Tobacco Research*, *10*, 1149–1157. doi:10.1080/14622200802123302

Brandon, T. H. (1994). Negative affect as motivation to smoke. *Current Directions in Psychological Science*, *3*, 33–37. Retrieved from <http://search.ebscohost.com/>

Brandon, T. H., & Baker, T. B. (1991). The Smoking Consequences Questionnaire: The subjective expected utility of smoking in college students. *Psychological Assessment: A Journal of Consulting and Clinical Psychology*, *3*, 484–491. Retrieved from <http://psycnet.apa.org/journals/pas/>

Brandon, T. H., Herzog, T. A., Irvin, J. E., & Gwaltney, C. J. (2004). Cognitive and social learning models of drug dependence: Implications for the assessment of tobacco dependence in adolescents. *Addiction*, *99* (Suppl. s1), 51–77. doi:10.1111/j.1360-0443.2004.00737.x

Brandon, T. H., Juliano, L. M., & Copeland, A. L. (1999). Expectancies for tobacco smoking. In I. Kirsch (Ed.), *How expectancies shape experience* (pp. 263–299). Washington, DC: American Psychological Association.

Brandon, T. H., Wetter, D. W., & Baker, T. B. (1996). Affect, expectancies, urges, and smoking: Do they conform to models of drug motivation and relapse? *Experimental and Clinical Psychopharmacology*, *4*, 29–36. Retrieved from <http://psycnet.apa.org/journals/pha/>

Breslau, N., Davis, G. C., & Schultz, L. R. (2003). Posttraumatic stress disorder and the incidence of nicotine, alcohol, and other drug disorders in persons who have experienced trauma. *Archives of General Psychiatry*, *60*, 289–294. doi:10.1001/archpsyc.60.3.289

Breslau, N., Novak, S. P., & Kessler, R. C. (2004). Psychiatric disorders and stages of smoking. *Biological Psychiatry*, *55*, 69–76. doi:10.1016/S0006-3223(03)00317-02

Buckley, T. C., Kamholz, B. W., Mozley, S. L., Gulliver, S. B., Holohan, D. R., Helstrom, A. W., et al. (2005). A psychometric evaluation of the Smoking Consequences Questionnaire—Adult in smokers with psychiatric conditions. *Nicotine & Tobacco Research*, *7*, 739–745. doi:10.1080/14622200500259788

Calhoun, P. S., Bosworth, H. B., Grambow, S. C., Dudley, T. K., & Beckham, J. C. (2002). Medical service utilization by veterans seeking help for posttraumatic stress disorder. *American*

- Journal of Psychiatry*, 159, 2081–2086. doi:10.1176/appi.ajp.159.12.2081
- Cohen, L. M., McCarthy, D. M., Brown, S. A., & Myers, M. G. (2002). Negative affect combines with smoking outcome expectancies to predict smoking behavior over time. *Psychology of Addictive Behaviors*, 16, 91–97. doi:10.1037//0893-164X.16.2.91
- Cook, J., Jakupcak, M., Rosenheck, R., Fontana, A., & McFall, M. (2009). Influence of PTSD symptom clusters on smoking status among help-seeking Iraq and Afghanistan veterans. *Nicotine & Tobacco Research*, 11, 1189–1195. doi:10.1093/ntr/ntp123
- Copeland, A. L., & Brandon, T. H. (2000). Testing the causal role of expectancies in smoking motivation and behavior. *Addictive Behaviors*, 25, 445–449. doi:10.1016/S0306-4603(99)00003-9
- Copeland, A. L., Brandon, T. H., & Quinn, E. P. (1995). The Smoking Consequences Questionnaire—Adult: Measurement of smoking outcome expectancies of experienced smokers. *Psychological Assessment*, 7, 484–494. Retrieved from <http://psycnet.apa.org/journals/pas/>
- Feldner, M. T., Babson, K. A., & Zvolensky, M. J. (2007). Smoking, traumatic event exposure, and post-traumatic stress: A critical review of the empirical literature. *Clinical Psychology Review*, 27, 14–45. doi:10.1016/j.cpr.2006.08.004
- Feldner, M. T., Babson, K. A., Zvolensky, M. J., Vujanovic, A. A., Lewis, S. F., Gibson, L., et al. (2007). Posttraumatic stress symptoms and smoking to reduce negative affect: An investigation of trauma-exposed daily smokers. *Addictive Behaviors*, 32, 214–227. doi:10.1016/j.addbeh.2006.03.032
- Fu, S. S., McFall, M., Saxon, A. J., Beckham, J. C., Carmody, T. P., Baker, D. G., et al. (2007). Post-traumatic stress disorder and smoking: A systematic review. *Nicotine & Tobacco Research*, 9, 1071–1084. doi:10.1080/14622200701488418
- Goldman, M. S. (1999). Expectancy operation: Cognitive-neural models and architectures. In I. Kirsch (Ed.), *How expectancies shape experience* (pp. 41–63). Washington, DC: American Psychological Association.
- Gregor, K. L., Zvolensky, M. J., McLeish, A. C., Bernstein, A., & Morissette, S. (2008). Anxiety sensitivity and perceived control over anxiety-related events: Associations with smoking outcome expectancies and perceived cessation barriers among daily smokers. *Nicotine & Tobacco Research*, 10, 627–635. doi:10.1080/14622200801978706
- Gwaltney, C. J., Shiffman, S., Balabanis, M. H., & Paty, J. A. (2005). Dynamic self-efficacy and outcome expectancies: Prediction of smoking lapse and relapse. *Journal of Abnormal Psychology*, 114, 661–675. doi:10.1037/0021-843X.114.4.661
- Heatherington, T. F., Kozlowski, L. T., Frecker, R. C., & Fagerström, K. (1991). The Fagerström Test for Nicotine Dependence: A revision of the Fagerström Tolerance Questionnaire. *British Journal of Addiction*, 86, 1119–1127. doi:10.1111/j.1360-0443.1991.tb01879.x
- Hendricks, P. S., & Brandon, T. H. (2005). Smoking expectancy associates among college smokers. *Addictive Behaviors*, 30, 235–245. doi:10.1016/j.addbeh.2004.05.006
- Hendricks, P. S., & Brandon, T. H. (2008). Smokers' expectancies for smoking versus nicotine. *Psychology of Addictive Behaviors*, 22, 135–140. doi:10.1037/0893-164X.22.1.135
- Ikard, F. F., Green, D. E., & Horn, D. (1969). A scale to differentiate between types of smoking as related to the management of affect. *International Journal of the Addictions*, 4, 649–659. doi:10.3109/10826086909062040
- Joreskog, K. G., & Sorbom, D. (1996). *LISREL 8 user's reference guide*. Chicago, IL: Scientific Software International.
- Kalman, D., Morissette, S. B., & George, T. P. (2005). Co-morbidity of smoking in patients with psychiatric and substance use disorders. *American Journal on Addictions*, 14, 106–123. doi:10.1080/10550490590924728
- Kenford, S. L., Smith, S. S., Wetter, D. W., Jorenby, D. E., Fiore, M. C., & Baker, T. B. (2002). Predicting relapse back to smoking: Contrasting affective and physical models of dependence. *Journal of Consulting and Clinical Psychology*, 70, 216–227. doi:10.1037/0022-006X.70.1.216
- Kirby, A. C., Hertzberg, B. P., Collie, C. F., Yeatts, B., Dennis, M. F., McDonald, S. D., et al. (2008). Smoking in help-seeking veterans with PTSD returning from Afghanistan and Iraq. *Addictive Behaviors*, 33, 1448–1453. doi:10.1016/j.addbeh.2008.05.007
- Kraemer, H. C., Lowe, K. K., & Kupfer, D. J. (2005). *To your health: How to understand what research tells us about risk*. Oxford: Oxford University Press.
- Lasser, K., Boyd, J. W., Woolhandler, S., Himmelstein, D. U., McCormick, D., & Bor, D. H. (2000). Smoking and mental illness: A population-based prevalence study. *Journal of the American Medical Association*, 284, 2606–2610. doi:10.1001/jama.284.20.2606
- Marshall, E. C., Zvolensky, M. J., Vujanovic, A. A., Gibson, L. E., Gregor, K., & Bernstein, A. (2008). Evaluation of smoking characteristics among community-recruited daily smokers with and without posttraumatic stress disorder and panic psychopathology. *Journal of Anxiety Disorders*, 22, 1214–1226. doi:10.1016/j.janxdis.2008.01.003
- McCarthy, D. M., & Thompson, D. M. (2006). Implicit and explicit measures of alcohol and smoking cognitions. *Psychology of Addictive Behaviors*, 20, 436–444. doi:10.1037/0893-164X.20.4.436
- McFall, M., Saxon, A. J., Malte, C. A., Chow, B., Bailey, S., Baker, D. G., et al. (2010). Integrating tobacco cessation into mental health care for posttraumatic stress disorder: A randomized, controlled trial. *Journal of the American Medical Association*, 304, 2485–2493. doi:10.1001/jama.2010.1769
- McFall, M., Saxon, A. J., Thaneemit-Chen, S., Smith, M. W., Joseph, A. M., Carmody, T. P., et al. (2007). Integrating

Smoking outcome expectancies in smokers with PTSD

- smoking cessation into mental health care for post-traumatic stress disorder. *Clinical Trials*, 4, 178–189. doi:10.1177/1740774507076923
- McKee, S. A., Wall, A., Hinson, R. E., Goldstein, A., & Bissonnette, M. (2003). Effects of an implicit mood prime on the accessibility of smoking expectancies in college women. *Psychology of Addictive Behaviors*, 17, 219–225. doi:10.1037/0893-164X.17.3.219
- McWilliams, L., Cox, B., & Asmundson, G. (2005). Symptom structure of posttraumatic stress disorder in a nationally representative sample. *Journal of Anxiety Disorders*, 19, 626–641. doi:10.1016/j.janxdis.2004.06.003
- Morissette, S. B., Tull, M. T., Gulliver, S. B., Kamholz, B. W., & Zimering, R. T. (2007). Anxiety, anxiety disorders, tobacco use, and nicotine: A critical review of interrelationships. *Psychological Bulletin*, 133, 245–272. doi:10.1037/0033-2909.133.2.245
- Niaura, R., Britt, D., Borrelli, B., Shadel, W., Abrams, D., & Goldstein, M. (1999). History and symptoms of depression among smokers during a self-initiated quit attempt. *Nicotine & Tobacco Research*, 1, 251–257. doi:10.1080/14622299050011371
- Piasecki, T. M., Niaura, R., Shadel, W. G., Abrams, D., Goldstein, M., Fiore, M. C., et al. (2000). Smoking withdrawal dynamics in unaided quitters. *Journal of Abnormal Psychology*, 109, 74–86. doi:10.1037//0021-843X.109.1-74
- Pietrzak, R. H., & Southwick, S. M. (2009). The importance of four-factor emotional numbing and dysphoria models in PTSD. *American Journal of Psychiatry*, 166, 726–727. doi:10.1176/appi.ajp.2009.09010032
- Pupo, M. C., Jorge, M. R., Schoedl, A. F., Bressan, R. A., Andreoli, S. B., Mello, M. F., et al. (2011). The accuracy of the Clinician-Administered PTSD Scale (CAPS) to identify PTSD cases in victims of urban violence. *Psychiatry Research*, 185, 157–160. doi:10.1016/j.psychres.2009.11.006
- Rohsenow, D. J., Abrams, D. B., Monti, P. M., Colby, S. M., Martin, R., & Niaura, R. S. (2003). The Smoking Effects Questionnaire for adult populations. Development and psychometric properties. *Addictive Behaviors*, 28, 1257–1270. doi:10.1016/S0306-4603(02)00254-X
- Shadel, W. G., & Mermelstein, R. J. (1993). Cigarette smoking under stress: The role of coping expectancies among smokers in a clinic based smoking cessation program. *Health Psychology*, 12, 443–450. doi:10.1037/0278-6133.12.6.443
- Shiffman, S., Paty, J. A., Gnys, M., Kassel, J. D., & Hickcox, M. (1996). First lapses to smoking: Within-subjects analysis of real time reports. *Journal of Consulting and Clinical Psychology*, 2, 366–379. doi:10.1037/0022-006X.64.2.366
- Thorndike, F. P., Wernicke, R., Pearlman, M. Y., & Haaga, D. A. (2006). Nicotine dependence, PTSD symptoms, and depression proneness among male and female smokers. *Addictive Behaviors*, 31, 223–231. doi:10.1016/j.addbeh.2005.04.023
- Velicer, W. F., DiClemente, C. C., Rossi, J. S., & Prochaska, J. O. (1990). Relapse situations and self-efficacy: An integrative model. *Addictive Behaviors*, 15, 271–283. doi:10.1016/0306-4603(90)90070-E
- Weathers, F. W., Keane, T. M., & Davidson, J. R. T. (2001). Clinician-Administered PTSD Scale: A review of the first ten years of research. *Depression and Anxiety*, 13, 132–156. doi:10.1002/da.1029
- Wetter, D. W., Smith, S. S., Kenford, S. L., Jorenby, D. E., Fiore, M. C., Hurt, R. D., et al. (1994). Smoking outcome expectancies: Factor structure, predictive validity, and discriminant validity. *Journal of Abnormal Psychology*, 103, 801–811. doi:10.1037/0021-843X.103.4.801