Published in final edited form as:

Subst Use Misuse. 2015 February ; 50(3): 394–402. doi:10.3109/10826084.2014.984849.

Smoking Processes, Panic, and Depressive Symptoms among Treatment-Seeking Smokers

Dawn W. Foster, Ph.D., M.P.H., M.A.¹, Kirsten J. Langdon, Ph.D.^{2,3}, Norman B. Schmidt, Ph.D.⁴, and Michael J. Zvolensky, Ph.D.^{5,6}

¹Yale School of Medicine, Department of Psychiatry

²National Center for PTSD, Women's Health Sciences Division, VA Boston Healthcare System

³Boston University School of Medicine

⁴Florida State University, Department of Psychology

⁵The University of Texas MD Anderson Cancer Center, Department of Behavioral Science

⁶University of Houston, Department of Psychology

Abstract

Objectives—The present study evaluated the relative contribution of panic and depressive symptoms in relation to past cessation difficulties and smoking motives among treatment-seeking daily smokers.

Methods—The sample included 392 treatment-seeking daily smokers (47.07% female; $M_{age} = 35.48$; $SD = 13.56$), who reported smoking an average of 10 or more cigarettes daily for at least one year.

Results—Findings indicated that panic and depressive symptoms were significantly associated with quit problems as well as addictive and negative affect motives for smoking. However, depressive symptoms were not associated with habitual smoking motives.

Conclusions—Differential patterns of associations with smoking-based processes imply that although panic and depression are related, there are important distinctions. Such data highlight the need for additional research to examine the putative role of panic and depressive symptoms in relation to smoking behaviors to further elucidate the mechanisms through which panic, depression, and smoking impact one another.

Keywords

Smoking; anxiety; panic; depression; cigarettes; tobacco; motives

There is an increasing and well-documented association between cigarette smoking and anxiety and depressive symptoms and disorders (i.e., emotional disorders; Ameringer &

Please direct all correspondence regarding this manuscript to Dawn W. Foster in the Yale School of Medicine, Department of Psychiatry, Yale University, New Haven CT 06519, Phone: (203)974-7892, dawn.foster@yale.edu.

Author Disclosure: Removed for blind review.

Leventhal, 2010; Grant, Hasin, Chou, Stinson, & Dawson, 2004; Morissette, Tull, Gulliver, Kamholz, & Zimering, 2007). Indeed, numerous studies have demonstrated that smoking is more prevalent among persons with anxiety and depressive psychopathology, compared to the general population (Grant et al., 2004; Lasser et al., 2007). Other work suggests that smoking, particularly at higher rates, increases the risk for experiencing clinically-significant emotional symptoms and disorders (Kandel, Huang, & Davies, 2001). Collectively, these findings highlight dynamic and reciprocal relations between cigarette smoking and emotional disorders.

One line of inquiry within this domain has focused on associations between panic-relevant psychopathology and various aspects of smoking behavior. This work was initially stimulated by the observation that panic attacks, specifically, co-occur with smoking at rates that exceed those found in the general non-psychiatric population (Amering et al., 1999; Breslau & Klein, 1999; Goodwin & Hamilton, 2002). Perhaps most notably, growing evidence suggests that panic-relevant symptoms are associated with cessation difficulties, and may serve to maintain continued smoking (Zvolensky, Schmidt, & Stewart, 2003). For example, panic attacks are related more severe nicotine withdrawal symptoms during quitting (Marshall, Johnson, Bergman, Gibson, & Zvolensky, 2009), shorter durations of abstinence from smoking (Zvolensky, Lejuez, Kahler, & Brown, 2004), and overall lower success rates in quitting (Piper et al., 2010).

Likewise, a robust body of work has focused on the role of depressive symptoms in understanding variability in smoking cessation outcomes (Haas, Munoz, Humfleet, Reus, & Hall, 2004). For example, experiencing depressive symptoms prior to smoking cessation treatment, as well as increases in such symptoms during treatment, have been reliable predictors of relapse (Burgess et al., 2002; Kahler et al., 2002). Other work suggests that a history of major depression may be associated with an increased risk of developing and maintaining more severe nicotine withdrawal symptoms during periods of abstinence (Niaura et al., 1999; C. S. Pomerleau, Mehringer, Marks, Downey, & Pomerleau, 2000).

In addition to relations with smoking behavior and cessation-relevant outcomes, depressive symptoms, and to a lesser degree, anxiety symptoms, have also been studied in the context of smoking motives (e.g., reasons for smoking). Research has shown that smokers with a history of major depressive disorder endorse greater motivation to smoke for a variety of reasons (e.g., automaticity, negative reinforcement; Kahler et al., 2008). Other work has demonstrated that higher depressive symptoms are significantly associated with positive and negative reinforcement motives (Leventhal, Ramsey, Brown, LaChance, & Kahler, 2008) as well as affiliative attachment motives (Vinci, McVay, Copeland, & Carrigan, 2012). Moreover, research has shown that anxiety sensitivity (i.e., fear of anxiety and internal sensations; McNally, 2002), which is a well-established risk factor for developing panic psychopathology (Reiss & McNally, 1985), is related to addictive- and negative-affect-based motives for smoking (Johnson, Farris, Schmidt, Smits, & Zvolensky, 2013; Leyro, Zvolensky, Vujanovic, & Bernstein, 2008). Such data highlight potential links between panic and depressive symptoms and reasons underlying smoking behavior.

Although empirical work suggests that panic and depression are independently associated with various aspects of smoking behavior, to the best of our knowledge, research has yet to concurrently evaluate the relative contribution of each factor in relation to smoking-based processes. Observed variability in emotional disorders may be accounted for by simultaneous examination of these related, yet distinct factors. This may reveal both shared and unique relations with certain cognitive-based smoking processes, and thereby, represent a more ecologically valid model of emotional vulnerability in regard to smoking maintenance. Thus, further elucidation of the etiological processes linking cigarette smoking with emotional vulnerability is needed to better understand these associations and inform and refine mood-targeting smoking interventions.

Together, the present study sought to simultaneously evaluate panic and depressive symptoms in relation to smoking processes among adult treatment-seeking daily smokers. Based on evidence supporting dynamic relations among anxiety, depression and smoking variables (Ameringer & Leventhal, 2010; Zvolensky, Stewart, Vujanovic, Gavric, & Steeves, 2009), we hypothesized that endorsement of both panic and depressive symptoms would be significantly and incrementally related to: a) quit problems as indexed by number of past quit attempts; and, b) underlying motives for smoking (e.g., negative affect, addictive, and habitual smoking motives which may interfere with quit processes). Moreover, we hypothesized that any observed effects for panic and depressive symptoms would be evident above and beyond the variance accounted for by gender, tobacco-related health problems, drinking problems, number of cigarettes smoked per day, and cannabis use. These hypotheses were broadly guided by emotional vulnerability-cigarette smoking models, which propose that panic and depression are important explanatory factors for smoking processes and cessation difficulties (Zvolensky et al., 2009).

Methods

Participants—The present sample consisted of 392 treatment-seeking daily smokers (47.07% female; $M_{age} = 35.48$; $SD = 13.56$). Respondent characteristics can be found in Table 1. Of the sample, 55% met criteria for at least one current (past month) Axis I diagnosis. In order to be eligible for participation in the larger study, individuals had to be at least 18 years of age and report smoking at least 10 or more cigarettes daily for the past year.

Measures

Demographics Questionnaire: The demographic information collected included: gender, age, race, educational level, marital status, and employment status. These data were used for descriptive purposes and gender was entered as a covariate in all analyses.

Structured Clinical Interview-Non-Patient Version for DSM-IV (SCID-I/NP):

Diagnostic assessments of past year Axis I psychopathology were conducted using the SCID-I/NP (Spitzer & Gibbon, 2007), which were administered by trained research assistants or doctoral-level staff and supervised by independent doctoral-level professionals. Interviews were audio-taped and the reliability of a random selection of 12.5% of interviews were checked (MJZ) for accuracy; no cases of diagnostic coding disagreement were noted.

Smoking History Questionnaire (SHQ): The SHQ (Brown, Lejuez, Kahler, & Strong, 2002) is a self-report questionnaire used to assess smoking history (e.g., onset of regular daily smoking) and pattern (e.g., number of cigarettes consumed per day), strategies used to quit and problematic symptoms experienced during past quit attempts (e.g., weight gain, nausea, irritability, and anxiety). In the present study, the SHQ was employed to describe the sample on smoking history and patterns of use (e.g., smoking rate) as well as create the criterion variable representing number of prior quit attempts.

Fagerström Test for Nicotine Dependence (FTND): The FTND (Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991) is a 6-item scale that assesses gradations in tobacco dependence. Scores range from 0-10, with higher scores reflecting high levels of physiological dependence on nicotine. The FTND has adequate internal consistency, positive relations with key smoking variables (e.g., saliva cotinine), and high test-retest reliability (Heatherton et al., 1991; Pomerleau, Carton, Lutzke, Flessland, & Pomerleau, 1994). The FTND total score was used as a covariate in the present study (Cronbach's $\alpha = .37$); it is worth noting that low internal consistency of the FTND is an issue that emerges often with this measure (Korte, Capron, Zvolensky, & Schmidt, 2013).

Medical History Form: A medical history checklist was used to assess current and lifetime medical problems. A composite variable was computed for the present study as an index of tobacco-related medical problems, which was entered as a covariate in all models. Items in which participants indicated having ever been diagnosed (heart problems, hypertension respiratory disease and asthma; all coded 0 = no, 1 = yes) were summed and a total score was created (observed range from 0 - 3), with greater scores reflecting the occurrence of multiple markers of tobacco-related disease.

Alcohol Use Disorders Identification Test (AUDIT): The AUDIT (Saunders, Aasland, Babor, de la Fuente, & Grant, 1993) is a 10-item self-report measure developed to identify individuals with alcohol problems. Total scores range from 0 to 30, with higher scores reflecting more hazardous drinking. The psychometric properties are well documented. In the present study, the AUDIT total score was used as a covariate in all analyses; internal consistency was good (Cronbach's $\alpha = .85$).

Marijuana Smoking History Questionnaire (MSHQ): The MSHQ (Bonn-Miller & Zvolensky, 2009) is a 40-item measure that assesses cannabis use history and patterns of use. One item was used in the current study to determine status of marijuana use in the past 30 days: "Please rate your marijuana use in the past 30 days" (responses ranged from 0 = *No use*, 4 = *Once a week*, to 8 = *More than once a day*). This item was dichotomously coded to reflect a marijuana use status variable (0 = No use; 1 = Past 30-day use), which was entered as a covariate in all analyses.

Inventory of Depression and Anxiety Symptoms (IDAS): The IDAS is a 64-item questionnaire that assesses dimensions of major depression and anxiety disorders (Watson et al., 2007). The IDAS contains 12 subscales indexing criteria related to DSM-IV-TR anxiety and depressive disorders. In the current study, two of the subscales were examined to gauge indices of panic and depressive symptoms: Panic subscale (8 items; e.g. "I was trembling or

shaking”) and General Depression subscale (20 items; e.g. “I felt depressed”). The General Depression subscale contains items regarding dysphoria, suicidality, lassitude, insomnia, appetite loss, and well-being, thereby serving as an overall index of depressive symptoms (Watson et al., 2007). The two IDAS subscales showed good reliability (both Cronbach α 's $> .90$) in the current sample.

The Reasons for Smoking Questionnaire (RFS): The RFS was used to assess the role of different smoking motives. The psychometric properties of this scale, including measures of factor structure, internal consistency, and test-retest reliability, have been well-established (Shiffman, 1993). The version of the RFS used in this study consists of 23 items, which comprise 6 subscales: Habitual (e.g., “I’ve found a cigarette in my mouth and didn’t remember putting it there”), Addictive (e.g., “Between cigarettes, I get a craving only a cigarette can satisfy”), Negative Affect Reduction (e.g., “When I feel uncomfortable or upset about something, I light up a cigarette”), Pleasurable Relaxation (e.g., “I find cigarettes pleasurable”), Sensorimotor (e.g., “Part of the enjoyment of smoking a cigarette comes from the steps I take to light up”), and Stimulation (e.g., “I like smoking when I am busy and working hard”). Items are rated on a 1 (*never*) to 5 (*always*) scale. In the current study, three scales were employed; RFS-Addictive (Cronbach’s $\alpha = .58$), RFS-Negative Affect Reduction (Cronbach’s $\alpha = .55$), and RFS-Habitual (Cronbach’s $\alpha = .49$).

Procedure

The current study is based on secondary analyses of baseline (pre-treatment) data for a subset of the sample, which was on the basis of available data on all studied variables. Adult daily smokers were recruited from the community via flyers, newspaper ads, and radio announcements to a large randomized controlled dual-site clinical trial examining the efficacy of two smoking cessation interventions. Individuals responding to study advertisements were scheduled for an in-person, baseline assessment, to evaluate study inclusion and exclusion criteria. After providing written informed consent, participants were interviewed using the SCID-I/NP and completed a computerized battery of self-report questionnaires. Details regarding the assessments and procedures can be found in previous publications (Johnson et al., 2013; Peasley-Miklus, McLeish, Schmidt, & Zvolensky, 2012). A total of 580 participants completed this initial assessment. Of these, data for study variables were missing for 188 individuals and were thus excluded from present analyses. The final sample was comprised of 392 participants. The study protocol was approved by the Institutional Review Board at each study site; all study procedures and treatment of human subjects were conducted in compliance with ethical standards of the American Psychological Association.

Analysis plan—Zero-order correlations were first obtained to examine relations between the predictor and criterion variables. Subsequently, the incremental validity of panic and depressive symptoms (measured by the IDAS) were examined in relation to the criterion variables using hierarchical multiple regression (Cohen & Cohen, 1983). Separate models were constructed for each of the criterion variables: number of past quit attempts, negative affect, addictive, and habitual smoking motives. At Level 1, tobacco-related health problems, smoking rate, drinking problems, cannabis use, and gender were included as

covariates to ensure any observed effects were not due to these factors. At Level 2, panic and depressive symptoms were simultaneously entered.

Results

Means, standard deviations, and bivariate correlations for all study variables are presented in Table 2. Depression and anxiety were positively correlated with each other and with number of quit problems, drinking, and all three RFS subscales (all p 's < .0001). Depression was positively correlated with drinking (p < .001) and negatively associated with gender (p < .05). Panic was positively correlated with drinking (p < .0001) and cannabis use (p < .05; Table 2).

Table 3 presents details of the multiple hierarchical regression analyses. For number of quit problems, the model at Level 1 accounted for 7% of the variance. Gender (β = -.28, p < .0001) was a significant predictor, indicating that male participants endorsed a greater number of quit problems relative to female participants. The model at Level 2 accounted for 22% of the variance, with both the panic (β = .19, p < .001) and depression (β = .26, p < .0001) as significant predictors (Table 3).

In regard to the addictive subscale of the RFS, the model at Level 1 accounted for 16% of the variance with gender (β = -.21, p < .0001) and number of cigarettes per day (β = .37, p < .0001) as significant predictors. Here, identifying as a male participant and reporting higher number of cigarettes per day were significantly associated with greater endorsement of addictive motives. Level 2 accounted for 20% of the variance, with both panic (β = .12, p < .05) and depression (β = .12, p < .05) as significant predictors (Table 3).

For the negative affect subscale of RFS, the model at Level 1 predicted 13% of the variance, with gender (β = -.29, p < .0001) and number of cigarettes per day (β = .24, p < .0001) as significant predictors. Again, identifying as a male participant and reporting higher number of cigarettes per day were significantly associated with greater endorsement of negative affect motives. The model at Level 2 predicted 24% of the variance, with panic (β = .09, p < .1) emerging as a marginal predictor and depression (β = .28, p < .0001) as a statistically significant predictor (Table 3).

For the habitual subscale of RFS, the model at Level 1 accounted for 15% of the variance, with drinking problems (β = .13, p < .05) and number of cigarettes per day (β = .40, p < .0001) as significant predictors. Here, reporting more drinking problems and higher number of cigarettes per day were significantly associated with greater endorsement of habitual motives. The model at Level 2 accounted for 20% of the variance, with panic (β = .18, p < .001) as the only significant predictor (Table 3).

Discussion

The present study concurrently examined panic and depressive symptoms in relation to a history of past quit problems as well as reasons for smoking, including negative affect, addictive, and habitual motives, among adult treatment-seeking daily smokers. Panic-related symptoms were significantly associated with a variety of smoking-based processes. Here,

more severe symptoms of panic were incrementally associated with greater endorsement of past quit problems as well as addictive and habitual smoking motives. However, panic symptoms were only marginally related to negative affect smoking motives. This finding is somewhat discrepant with past work, which has demonstrated that panic disorder is associated with a greater endorsement of negative affect-based motives (Zvolensky et al., 2005). One possible explanation for the observed differences in these findings is that the present investigation measured current panic symptoms, whereas past work examined a lifetime history of panic disorder. Regarding depressive symptoms, results largely supported study hypotheses with more severe depressive symptoms evidencing significant relations to past quit problems as well as addictive and negative affect smoking motives. However, contrary to hypothesis, depressive symptoms were not associated with habitual smoking motives.

Collectively, these findings are consistent with integrated theoretical models of cigarette smoking and emotional vulnerability, which suggest that anxiety and depressive symptoms are related to numerous aspects of smoking behavior (Ameringer & Leventhal, 2010; Zvolensky & Bernstein, 2005). The observed results are important for at least two reasons. First, the effects for panic and depressive symptoms were apparent over and above the variance accounted for by gender, tobacco-related health problems, drinking problems, number of cigarettes smoked per day, and cannabis use. Thus, the results cannot be attributed to these co-occurring risk factors. Second, the observed effects for panic and depressive symptoms were independent of the shared variance (3.6% shared variance) between these two emotional vulnerability factors. These differential patterns of associations with smoking-based processes imply that although panic and depression are related, there are important distinctions which should be better understood. Such data highlight the need for additional research to examine the putative role of each factor in relation to smoking behaviors in an effort to further elucidate the mechanisms through which panic, depression, and smoking impact one another. Developing a greater understanding of these differences may help to inform future interventions that can address both panic and depression in one overarching smoking cessation treatment module.

The present research is consistent with extant literature demonstrating links between smoking, panic, and depressive symptoms (Kimbrel, Morissette, Gulliver, Langdon, & Zvolensky, 2014). Given that a growing body of literature demonstrates differences in smoking characteristics and anxiety disorders (Morissette et al., 2007), it will be important to understand whether subsets of smokers with certain anxiety disorders may be at greater risk for experiencing smoking-related harm linked with panic and depressive symptoms. Further, there may be subsets for whom certain therapies are more useful (nicotine replacement therapy versus cognitive behavioral therapy), and thus additional efforts are warranted.

A number of limitations of the present investigation and points for future direction should be considered. First, the present sample is limited in that it is comprised of a relatively homogenous (e.g., primarily Caucasian) group of adult smokers who volunteered to participate in smoking cessation treatment. Given that a large percentage of cigarette smokers attempt to quit on their own (Levy & Friend, 2002; Raupach, West, & Brown,

2013), it will be important for researchers to draw from populations other than those included in the present study to rule out potential self-selection bias among persons with these characteristics and increase the generalizability of these findings. Second, the present study was correlational in nature. It is therefore necessarily limited because it cannot shed light on processes over time or isolate causal relations between variables. Further, there may be an inflation of Type 1 error rate. Third, in the present study we modeled a wide range, but naturally only a select number, of smoking-based processes. Thus, it is advisable for future work to explore the relative explanatory utility of panic and depression in terms of other smoking processes such as smoking cessation milestones and the course of nicotine withdrawal symptoms during treatment. Finally, the current investigation focused primarily on symptoms of panic and depression. These emotional factors represent just two of the many potential factors likely to influence smoking behavior. Future work could usefully continue to build multi-risk factor models of smoking maintenance by incorporating other promising affective-relevant variables. It may be clinically important to identify individuals at particularly high risk for panic and depressive symptoms in order to determine for whom interventions may be most beneficial in reducing anxiety and depression. Additionally, examining whether negative affectivity interacts with smoking status to predict panic symptoms may be a potential avenue for research. Further work is also needed to understand temporal relationships in order to elucidate best points to intervene.

Overall, the present study contributes to existing literature by providing novel empirical information concerning panic and depressive symptoms in terms of their relations to past quit problems and certain motives underlying smoking among adult treatment-seeking daily smokers. Results of this investigation suggest that both panic and depressive symptoms are relevant to understanding cessation difficulties as well as additive, habitual, and negative affect smoking motives. Such findings serve to conceptually inform the development of specialized intervention strategies for smokers who have a propensity to smoke for affect-regulatory reasons as well as frequently encounter problems while quitting smoking. Specifically, smokers experiencing more severe symptoms of panic and depression prior to engaging in cessation treatment may benefit from intensive cognitive-behavioral strategies (e.g., interoceptive exposure, cognitive restructuring, and behavioral activation) in an effort to reduce emotional symptoms and promote greater degrees of smoking abstinence.

Acknowledgments

Human Subjects: This study was approved by the institutional review board at the University of Vermont and Florida State University.

References

- Amering M, Bankier B, Berger P, Griengl H, Windhaber J, Katschnig H. Panic disorder and cigarette smoking behavior. *Compr Psychiatry*. 1999; 40(1):35–38. [PubMed: 9924875]
- Ameringer KJ, Leventhal AM. Applying the tripartite model of anxiety and depression to cigarette smoking: an integrative review. *Nicotine Tob Res*. 2010; 12(12):1183–1194.10.1093/ntr/ntq174 [PubMed: 21036959]
- B, FM.; W, WJB.; Spitzer, RL.; Gibbon, M. Structured Clinical Interview for DSM-IV-TR Axis I Disorders, Clinical Trials Version (SCID-CT). New York: Biometrics Research, New York State Psychiatric Institute; 2007.

- Bonn-Miller MO, Zvolensky MJ. An evaluation of the nature of marijuana use and its motives among young adult active users. *Am J Addict.* 2009; 18(5):409–416.10.3109/10550490903077705 [PubMed: 19874161]
- Breslau N, Klein DF. Smoking and panic attacks: an epidemiologic investigation. *Arch Gen Psychiatry.* 1999; 56(12):1141–1147. [PubMed: 10591292]
- Brown, RA.; Lejuez, CW.; Kahler, CW.; Strong, DR. Distress tolerance and duration of past smoking cessation attempts. Vol. 111. US: American Psychological Association; 2002.
- Burgess ES, Brown RA, Kahler CW, Niaura R, Abrams DB, Goldstein MG, Miller IW. Patterns of change in depressive symptoms during smoking cessation: who's at risk for relapse? *J Consult Clin Psychol.* 2002; 70(2):356–361. [PubMed: 11952193]
- Cohen, J.; Cohen, P. Applied multiple regression/correlation analysis for the behavioral sciences. Hillside, NJ: Lawrence Erlbaum Associates, Inc; 1983.
- Goodwin R, Hamilton SP. Cigarette smoking and panic: the role of neuroticism. *Am J Psychiatry.* 2002; 159(7):1208–1213. [PubMed: 12091201]
- Grant BF, Hasin DS, Chou SP, Stinson FS, Dawson DA. Nicotine dependence and psychiatric disorders in the United States: results from the national epidemiologic survey on alcohol and related conditions. *Arch Gen Psychiatry.* 2004; 61(11):1107–1115.10.1001/archpsyc.61.11.1107 [PubMed: 15520358]
- Haas AL, Munoz RF, Humfleet GL, Reus VI, Hall SM. Influences of mood, depression history, and treatment modality on outcomes in smoking cessation. *J Consult Clin Psychol.* 2004; 72(4):563–570.10.1037/0022-006X.72.4.563 [PubMed: 15301640]
- Heatherton, TF.; Kozlowski, LT.; Frecker, RC.; Fagerstrom, KO. The Fagerstrom Test for Nicotine Dependence: A revision of the Fagerstrom Tolerance Questionnaire. Vol. 86. United Kingdom: Blackwell Publishing; 1991.
- Johnson KA, Farris SG, Schmidt NB, Smits JA, Zvolensky MJ. Panic attack history and anxiety sensitivity in relation to cognitive-based smoking processes among treatment-seeking daily smokers. *Nicotine Tob Res.* 2013; 15(1):1–10.10.1093/ntr/ntr332 [PubMed: 22544839]
- Kahler CW, Brown RA, Ramsey SE, Niaura R, Abrams DB, Goldstein MG, et al. Miller IW. Negative mood, depressive symptoms, and major depression after smoking cessation treatment in smokers with a history of major depressive disorder. *J Abnorm Psychol.* 2002; 111(4):670–675. [PubMed: 12428781]
- Kahler CW, Metrik J, LaChance HR, Ramsey SE, Abrams DB, Monti PM, Brown RA. Addressing heavy drinking in smoking cessation treatment: a randomized clinical trial. *J Consult Clin Psychol.* 2008; 76(5):852–862.10.1037/a0012717 [PubMed: 18837602]
- Kandel DB, Huang FY, Davies M. Comorbidity between patterns of substance use dependence and psychiatric syndromes. *Drug Alcohol Depend.* 2001; 64(2):233–241. [PubMed: 11543993]
- Kimbrel NA, Morissette SB, Gulliver SB, Langdon KJ, Zvolensky MJ. The effect of social anxiety on urge and craving among, smokers with and without anxiety disorders. *Drug Alcohol Depend.* 2014; 135:59–64.10.1016/j.drugalcdep.2013.11.002 [PubMed: 24331637]
- Korte, KJ.; Capron, DW.; Zvolensky, M.; Schmidt, NB. The Fagerstrom Test for Nicotine Dependence: Do revisions in the item scoring enhance the psychometric properties?. Vol. 38. Netherlands: Elsevier Science; 2013.
- Lasser RA, Nasrallah H, Helldin L, Peuskens J, Kane J, Docherty J, Tronco AT. Remission in schizophrenia: applying recent consensus criteria to refine the concept. *Schizophr Res.* 2007; 96(1-3):223–231.10.1016/j.schres.2007.05.003 [PubMed: 17765480]
- Leventhal AM, Ramsey SE, Brown RA, LaChance HR, Kahler CW. Dimensions of depressive symptoms and smoking cessation. *Nicotine Tob Res.* 2008; 10(3):507–517.10.1080/14622200801901971 [PubMed: 18324570]
- Levy, DT.; Friend, KB. Strategies for reducing youth access to tobacco: A framework for understanding empirical findings on youth access policies. Vol. 9. United Kingdom: Taylor & Francis; 2002.
- Leyro TM, Zvolensky MJ, Vujanovic AA, Bernstein A. Anxiety sensitivity and smoking motives and outcome expectancies among adult daily smokers: replication and extension. *Nicotine Tob Res.* 2008; 10(6):985–994.10.1080/14622200802097555 [PubMed: 18584462]

- Marshall EC, Johnson K, Bergman J, Gibson LE, Zvolensky MJ. Anxiety sensitivity and panic reactivity to bodily sensations: relation to quit-day (acute) nicotine withdrawal symptom severity among daily smokers making a self-guided quit attempt. *Exp Clin Psychopharmacol*. 2009; 17(5): 356–364.10.1037/a0016883 [PubMed: 19803635]
- McNally RJ. Anxiety sensitivity and panic disorder. *Biol Psychiatry*. 2002; 52(10):938–946. [PubMed: 12437935]
- Morissette SB, Tull MT, Gulliver SB, Kamholz BW, Zimering RT. Anxiety, anxiety disorders, tobacco use, and nicotine: a critical review of interrelationships. *Psychol Bull*. 2007; 133(2):245–272.10.1037/0033-2909.133.2.245 [PubMed: 17338599]
- Niaura R, Britt DM, Borrelli B, Shadel WG, Abrams DB, Goldstein MG. History and symptoms of depression among smokers during a self-initiated quit attempt. *Nicotine Tob Res*. 1999; 1(3):251–257. [PubMed: 11072422]
- Peasley-Miklus CE, McLeish AC, Schmidt NB, Zvolensky MJ. An examination of smoking outcome expectancies, smoking motives and trait worry in a sample of treatment-seeking smokers. *Addict Behav*. 2012; 37(4):407–413.10.1016/j.addbeh.2011.11.037 [PubMed: 22209026]
- Piper ME, Smith SS, Schlam TR, Fleming MF, Bittrich AA, Brown JL, et al. Baker TB. Psychiatric disorders in smokers seeking treatment for tobacco dependence: relations with tobacco dependence and cessation. *J Consult Clin Psychol*. 2010; 78(1):13–23.10.1037/a0018065 [PubMed: 20099946]
- Pomerleau, CS.; Carton, SM.; Lutzke, ML.; Flessland, KA.; Pomerleau, OF. Reliability of the Fagerstrom Tolerance Questionnaire and the Fagerstrom Test for Nicotine Dependence. Vol. 19. Netherlands: Elsevier Science; 1994.
- Pomerleau CS, Mehringer AM, Marks JL, Downey KK, Pomerleau OF. Effects of menstrual phase and smoking abstinence in smokers with and without a history of major depressive disorder. *Addict Behav*. 2000; 25(4):483–497. [PubMed: 10972441]
- Raupach, T.; West, R.; Brown, J. The most “successful” method for failing to quit smoking is unassisted cessation. Vol. 15. United Kingdom: Oxford University Press; 2013.
- Reiss, S.; McNally, RJ. Expectancy model of fear. In: Reiss, S.; Bootzin, RR., editors. Theoretical issues in behavior therapy. San Diego: Academic Press; 1985. p. 107–121.
- Saunders JB, Aasland OG, Babor TF, de la Fuente JR, Grant M. Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO Collaborative Project on Early Detection of Persons with Harmful Alcohol Consumption--II. *Addiction*. 1993; 88(6):791–804. [PubMed: 8329970]
- Shiffman S. Assessing smoking patterns and motives. *J Consult Clin Psychol*. 1993; 61(5):732–742. [PubMed: 8245271]
- Vinci C, McVay MM, Copeland AL, Carrigan MH. The relationship between depression level and smoking motives in college smokers. *Psychol Addict Behav*. 2012; 26(1):162–165.10.1037/a0023772 [PubMed: 21553948]
- Watson D, O'Hara MW, Simms LJ, Kotov R, Chmielewski M, McDade-Montez EA, et al. Stuart S. Development and validation of the Inventory of Depression and Anxiety Symptoms (IDAS). *Psychol Assess*. 2007; 19(3):253–268.10.1037/1040-3590.19.3.253 [PubMed: 17845118]
- Zvolensky, MJ.; Bernstein, A. Cigarette smoking and panic psychopathology. Vol. 14. United Kingdom: Blackwell Publishing; 2005.
- Zvolensky MJ, Lejuez CW, Kahler CW, Brown RA. Nonclinical panic attack history and smoking cessation: an initial examination. *Addict Behav*. 2004; 29(4):825–830.10.1016/j.addbeh.2004.02.017 [PubMed: 15135567]
- Zvolensky, MJ.; Schmidt, NB.; Antony, MM.; McCabe, RE.; Forsyth, JP.; Feldner, MT.; Kahler, CW. Evaluating the role of panic disorder in emotional sensitivity processes involved with smoking. Vol. 19. Netherlands: Elsevier Science; 2005.
- Zvolensky, MJ.; Schmidt, NB.; Stewart, SH. Panic disorder and smoking. Vol. 10. United Kingdom: Blackwell Publishing; 2003.
- Zvolensky MJ, Stewart SH, Vujanovic AA, Gavric D, Steeves D. Anxiety sensitivity and anxiety and depressive symptoms in the prediction of early smoking lapse and relapse during smoking cessation treatment. *Nicotine Tob Res*. 2009; 11(3):323–331.10.1093/ntr/ntn037 [PubMed: 19246426]

Table 1
Respondent characteristics

Overall sample characteristics		<i>N</i>	<i>%</i>
Gender	Male	207	53.97
	Female	185	47.07
Race/Ethnicity	White/Caucasian	329	83.97
	Black/Non-Hispanic	36	9.16
	Black/Hispanic	3	0.76
	Hispanic	12	3.05
	Asian	2	0.51
	Other	10	2.54
Education	High school or less	99	25.19
	College	203	51.72
	Graduate school	52	13.23
Substance use		<i>Age</i>	<i>N</i>
Age of first cannabis use		0-10	8
		11-20	352
		21-30	23
		21+	2
		0-10	32
Age of first cigarette		11-20	339
		21+	22
		<i>Mean</i>	<i>St.Dev.</i>
Number of cigarettes smoked per day		16.08	8.45
Number of years as a daily smoker		17.18	13.19
Avg level of nicotine dependence (FTND)		7.30	2.15
Heavy substance use		<i>Cannabis Use (4+ times per week) N</i>	<i>Nicotine Dependence (5+ on FTND) N</i>
Gender	Male	79	185
	Female	55	166
Ethnicity	Hispanic	6	11
	Non-Hispanic	386	381
	African-American/Black	12	30
Race	Asian	1	2
	Caucasian/White	110	300
	Other	5	8
	Married	23	117
Marital Status	Widowed	1	7
	Separated	2	15
	Divorced	16	53

Overall sample characteristics		<i>N</i>	%
Highest Level of Education	Never Married	92	159
	High School	7	79
	Some College	65	132
	College Graduate	30	109
Smoking rate	Less than 20 cigarettes a day	86	-
	20-30 cigarettes a day	39	-
	More than 30	6	-
Cannabis use	1-3 times in past month	-	232
	1 time/wk in past month	-	26
	5-7 times/wk in past month	-	54
	1+ times/day in past month	-	39

Note. Total N = 392

Table 2
Means, Standard Deviations, and Correlations among Variables

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Panic	-										
2. Depression	0.60***	-									
3. Quit Problems	0.35***	0.38***	-								
4. RFS, Habitual	0.25***	0.18***	0.31***	-							
5. RFS, Addictive	0.23***	0.22***	0.41***	0.53***	-						
6. RFS, Negative Affect	0.30***	0.37***	0.45***	0.46***	0.71***	-					
7. Gender	-0.09 [†]	-0.11*	-0.27***	-0.04	-0.18***	-0.26***	-				
8. Health problems	0.01	-0.04	-0.01	0.03	-0.02	-0.11*	0.04	-			
9. Drinking	0.16**	0.21***	0.01	0.04	-0.002	0.04	0.12*	-0.16**	-		
10. Cigarettes per day	0.05	-0.01	0.001	0.38***	0.34***	0.22***	0.07	-0.03	-0.12*	-	
11. Cannabis use	0.09 [†]	0.11*	-0.09 [†]	-0.04	-0.03	0.02	0.07	-0.04	0.29***	-0.04	-
Mean	10.99	41.58	34.61	2.32	3.30	3.46	0.53	0.36	8.36	0.83	2.29
Std Dev	3.91	13.19	11.26	0.72	0.77	0.82	0.50	0.62	0.23	0.77	2.97
Min	8.00	21.00	17.00	1.00	1.40	1.17	0.00	0.00	0.00	0.00	0.00
Max	29.00	85.00	38.00	4.75	5.00	5.00	1.00	3.00	30.00	3.00	8.00

Note. N = 392

p < .001,

**
p < .01,

*
p < .05,

[†]
p < .10

RFS = Reasons for Smoking

Gender = Dummy coded such that males received a 1 and females a 0

Table 3
Hierarchical regression analysis predicting smoking variables from the panic and depression subscales of the Iowa Depression and Anxiety Scale while controlling for covariates

Criterion	Predictor	B	SE	B	t	p	β	Adj R ²
Quit Problems	Level 1	Covariates	-6.21	1.11	-5.57	<0.0001	-0.28***	0.07
		Health problems	0.20	0.91	0.23	0.82	0.01	
		Drinking	0.14	0.09	1.51	0.13	0.08	
		Cigarettes per day	0.37	0.72	0.52	0.61	0.03	
		Cannabis use	-0.37	0.19	-1.91	0.06	-0.10 [†]	
	Level 2	Panic	0.54	0.16	3.31	0.001	0.19**	0.22
		Depression	0.22	0.05	4.49	<0.0001	0.26***	
	Level 1	Covariates	-0.33	0.07	-4.54	<0.0001	-0.21***	0.16
		Health problems	0.01	0.06	0.19	0.85	0.01	
		Drinking	0.01	0.01	1.61	0.11	0.08	
Reasons for Smoking (Addictive)		Cigarettes per day	0.37	0.05	7.85	<0.0001	0.37***	
		Cannabis use	-0.01	0.01	-0.45	0.65	-0.02	
	Level 2	Panic	0.02	0.01	2.13	0.03	0.12*	0.20
		Depression	0.01	0.003	2.14	0.03	0.12*	
Reasons for Smoking (Negative Affect)	Level 1	Covariates	-0.47	0.08	-5.97	<0.0001	-0.29***	0.13
		Health problems	-0.10	0.06	-1.64	0.10	-0.08	
		Drinking	0.01	0.01	1.86	0.06	0.09 [†]	
		Cigarettes per day	0.25	0.05	4.99	<0.0001	0.24***	
		Cannabis use	0.004	0.01	0.32	0.75	0.02	
	Level 2	Panic	0.02	0.01	1.70	0.09	0.09 [†]	0.24
		Depression	0.02	0.003	5.02	<0.0001	0.28***	
	Level 1	Covariates	-0.12	0.07	-1.72	0.09	-0.08 [†]	0.15
		Gender						

Criterion	Predictor	B	SE B	t	p	β	Adj R ²
Level 2	Health problems	0.07	0.06	1.29	0.20	0.06	0.20
	Drinking	0.01	0.01	2.51	0.01	0.13*	
	Cigarettes per day	0.37	0.04	8.48	<0.0001	0.40***	
	Cannabis use	-0.01	0.01	-1.02	0.31	-0.05	
Level 2	Panic	0.03	0.01	3.21	0.001	0.18**	0.20
	Depression	0.003	0.003	1.01	0.31	0.06	

Note. N = 392

 $p < .001$
**
 $p < .01$
*
 $p < .05$.
†
 $p < .10$

Analysis of the interaction between *Panic* and *Depression* did not reveal significant interactions.