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The Effect of Positive and Negative Affect on Early Treatment Milestones in the Context of Integrated Smoking Treatment

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Abstract

Smoking is the leading cause of preventable death in the US. Efforts have been made to develop effective, integrated smoking cessation treatments for individuals with greater difficulty quitting, including individuals with elevated Anxiety Sensitivity (AS). Despite initial evidence for the efficacy of these treatments, little is understood about pre-treatment predictors of early treatment milestones, including treatment initiation and response. Positive affectivity (PA) and negative affectivity (NA) are unique mood traits that may be related to early treatment milestones. Indeed, PA and NA are related to smoking and mood outcomes generally. Yet, it is presently unknown if pre-treatment PA or NA predict early treatment milestones within the context of an integrated smoking cessation treatment. The current study sought to evaluate the independent effect of PA and NA on early treatment milestones within the context of an integrated smoking-AS treatment protocol. Smoking and AS outcomes were evaluated independently. Participants included 288 (50% female; $M_{age} = 38.66$; $SD = 13.67$) treatment-seeking adult daily cigarette users. Results indicated that higher pre-treatment NA was associated with an increased likelihood of early drop out versus responding to treatment across both outcomes (smoking: Odds Ratio = 0.93, 95% CI: .88 – .99; AS: Odds Ratio = 0.92, 95% CI: .88 – .98). Pre-treatment PA did not significantly differentiate any of the groups. Overall, the present study serves as an initial investigation of the role of pre-treatment NA in identifying those at greatest risk for dropping out of treatment (cf. responding to treatment).

Keywords

Tobacco use; smoking cessation; affect; smoking treatment; treatment milestones

Cigarette smoking is a leading cause of preventable death and disease in the United States (CDCP 2015). Select subgroups of the general population are at greater risk for being

smokers, and therefore, experience higher rates of smoking-related death and illness (Lasser et al. 2000). One such subgroup is individuals with elevated anxiety sensitivity (AS). AS is commonly conceptualized as ‘the fear of fear’ (Reiss and McNally 1985) and is widely recognized as a common transdiagnostic, individual difference factor related to the development of psychopathology and the maintenance/relapse of smoking (Zvolensky et al. 2006; Zvolensky et al. 2009; Langdon et al. 2015).

The unique challenges individuals with elevated AS face when attempting to quit has led researchers to develop specialty care treatments to assist with this vulnerable and large subgroup of cigarette users (Zvolensky et al. 2003; Zvolensky et al. 2014; Smits et al. 2016; Zvolensky et al. in press). These novel treatments integrate traditional smoking cessation treatment with AS reduction methods, typically consisting of psychoeducation, cognitive-behavioral restructuring strategies, and interoceptive exposure exercises (Zvolensky et al. in press). Substantial work has demonstrated the short- and long-term efficacy of these treatments to increase abstinence and reduce AS symptoms (Zvolensky et al. 2008; Zvolensky et al. 2009; Zvolensky et al. 2014). Nevertheless, once deemed eligible, not all persons participate in these programs or respond to these treatments, and little is understood about risk factors related to these ‘early treatment milestones.’ From a phase-based perspective (Hughes 1996; Hughes 2008; Baker et al. 2011), it is clinically necessary to elucidate pre-treatment predictors of early treatment milestones, including pre-treatment drop out (i.e., dropping out of treatment prior to attending a single treatment session; Vendetti et al. 2002) and non-responsiveness (i.e., completing treatment, but not demonstrating significant improvement in outcomes at the end of treatment; Garey et al. 2017). Indeed, understanding pre-treatment factors that may help identify those at greatest risk for pre-treatment drop out and treatment non-response has important clinical implications, including the potential to inform more personalized care and current recommendations for triaging smoking with elevated negative affective states (see Hyer 2013; Knopp et al. 2013). Yet, this work has been overlooked when evaluating the efficacy of integrated AS smoking trials.

Available data implicates *affective processes of smoking* as important risk factors for poorer, early treatment milestones (Wynd 2006; Garey et al. 2017). Broadening this research, more general affective characteristics, such as positive (PA) and negative (NA) affectivity, may be related to early smoking milestones. PA is characterized as the extent to which an individual feels calm, enthusiastic, active, and alert whereas NA reflects states of distress and dissatisfying engagement in one’s environment (Watson et al. 1988). Increased PA is associated with greater persistence and retention in smoking cessation treatment (Bränström et al. 2010b). Conversely, increased NA has been identified as a risk factor for poorer cessation outcomes, including coping-oriented smoking (Carmody et al. 2007). Evidence also suggests lower PA and higher NA are independently associated with smoking urge and relapse (Leventhal et al. 2013a; Piper et al. 2013). Importantly, in models testing the concurrent role of PA and NA on smoking urge, only NA significantly relates to smoking urge (Leventhal et al. 2013a). Thus, NA may potentially serve a more central role in conceptual models of smoking processes and behavior. Despite the relatively strong evidence for the role of PA and NA in smoking treatment outcomes, no work has evaluated

how these factors may differentially predict early smoking milestones, including pre-treatment drop out, smoking treatment non-response, and smoking treatment response.

Beyond smoking outcomes, PA and NA also may be critical to AS treatment initiation and responsiveness. For example, higher PA is theorized to promote creative problem-solving and improve cognitive flexibility (Chiew and Braver 2011). These adaptive qualities may be associated with better early treatment outcomes, particularly when participating in a novel treatment. Drawing from the broaden-and-build theory (Fredrickson 1998; Fredrickson 2004), treatment-seeking individuals with elevated PA may respond to integrated treatment because these cigarette users may be more apt to deeply encode and utilize the novel strategies introduced during treatment. Thus, higher pre-treatment PA may be an indicator of more positive early treatment outcomes, including treatment response. In contrast to higher PA, higher pre-treatment NA may serve as a risk factor for poorer early treatment outcomes, including pre-treatment drop out and treatment non-response. Indeed, robust evidence suggests elevated NA has the potential to negatively impact treatment (Hengartner 2015). Theoretically, individuals who smoke with greater pre-treatment NA may be less likely to initiate or respond to AS treatment because of their tendency to orient toward behaviors that produce immediate reductions in NA symptoms (Shiffman et al. 2007; Langdon et al. 2015). Thus, those with increased NA may be less likely to adhere to treatment protocol (O'Donohue and Levensky 2006), and therefore, evince poorer early AS outcomes.

Despite the empirical and theoretical support for PA and NA as clinically important factors for smoking cessation, no work has evaluated the predictive validity of these constructs across early treatment milestones within an integrated smoking treatment protocol. Elucidating factors that support or impede early treatment milestones has the potential to help clinicians identify individuals at the greatest risk for treatment drop-out and non-response and inform treatment development of specialized, integrated interventions that aim to address the unique needs of individuals with the greatest difficulty quitting. Moreover, evaluating these factors as predictors of smoking and AS treatment responsiveness independently may be particularly important considering the effect of reducing AS during integrated care on smoking outcomes (Zvolensky et al. 2006; Zvolensky et al. in press). Indeed, the timeliness of this work is captured in the growing recognition for specialized smoking cessation treatment to address the unique characteristics of current individuals who smoke (Kalman 1998; Burns et al. 2016). Thus, to accurately inform targeted treatment development and have a formidable impact on future generations of this work, it is necessary to evaluate early treatment milestones in the context of integrated smoking cessation treatment.

Together, the current study evaluated the independent effect of PA and NA on pre-treatment drop out, treatment non-response, and treatment response within the context of an integrated smoking-AS treatment protocol (Schmidt et al. 2015). Pre-treatment drop out was defined as dropping out of the study prior to randomization (Vendetti et al. 2002). Treatment response outcomes were operationalized in terms of smoking (i.e., fail to maintain initial abstinence after completing treatment; Burns et al. 2016) and AS (i.e., at least a 25% reduction in symptom severity; Garey et al. 2017). Smoking and AS outcomes were evaluated independently. Thus, four unique models were examined. Across the three groups that

comprised smoking treatment milestones (treatment drop out, treatment non-response, and treatment response), it was hypothesized that pre-treatment levels of PA would be highest among smoking treatment responders, followed by non-responders, and then, drop outs. It was further hypothesized that decreased PA would place a cigarette user at greatest odds for the poorest early treatment outcome, i.e., pre-treatment drop out. Additionally, it was hypothesized that pre-treatment levels of NA would be lowest among smoking treatment responders, followed by non-responders, and then, drop outs. It was further hypothesized that increased NA would place individuals who smoke at greatest odds for the poorest early treatment outcome, i.e., pre-treatment drop out. A similar pattern of association was hypothesized to emerge for the AS early treatment milestones.

Method

Participants

Participants were 288 (50% female; $M_{\text{age}} = 38.66$; $SD = 13.67$) treatment-seeking individuals who smoke (i.e., interested in obtaining cessation treatment and motivated to quit). All participants were recruited from two sites (University of Vermont and Florida State University; [clinicaltrials.gov](https://clinicaltrials.gov/ct2/show/study/NCT01753141) #NCT01753141). To be eligible for inclusion participants had to be 18 years of age or older, daily cigarette users (e.g., average 8 cigarettes per day for at least 1 year), and report a motivation to quit smoking (e.g., at least 5 on a 10-point scale). Exclusion criteria included, current use of any psychotherapy or pharmacotherapy for smoking cessation not provided by the researchers, current use of other tobacco products, and current suicidality warranting immediate intervention, psychosis, or bipolar disorder.

Procedures

Data were collected during a large, multi-site randomized controlled clinical trial examining the efficacy of two smoking cessation interventions (Schmidt et al. 2015). Briefly, eligible participants were randomized to one of two 4-session smoking cessation treatments: (a) Integrated Smoking Cessation Program or (b) Standard Care for Smoking Cessation Program. The Integrated Smoking Cessation (active) Program integrated (1) interoceptive exposure, cognitive restructuring, and psychoeducation exercises developed for panic prevention and (2) standard of care treatment for standard smoking cessation. The Standard Care for Smoking Cessation Program (control) included the smoking-related component of the Integrated Care Smoking Cessation Program as well as a review of general health information not specific to anxiety or smoking (to maintain equal contact time across the two conditions). It is important to note that although anxiety symptoms were not directly targeted in the Standard Care intervention, it had a stress management component, and across both conditions, a significant average decrease in anxiety related symptoms was observed during the treatment period (Schmidt et al. 2015). In addition to counseling, both treatment groups received nicotine replacement therapy via the transdermal nicotine patch, which was initiated at treatment Session 4 (quit day). Treatment consisted of four 60-minute weekly sessions conducted by trained doctoral-level graduate students. All treatment was supervised by principal investigators (MJZ and NBS) and checked for treatment fidelity by independent reviewers. Data collection began in 2007 and concluded in 2014. The current study is based on secondary analyses of baseline (pre-treatment), quit day, and 1-week

follow-up data for participants who met eligibility criteria (see Figure 1 for overview of the study design). Considering the present investigation focused on pre-treatment drop out, and treatment non-response and response across two outcomes, only those who dropped out prior to initiating treatment and those who provided quit day or 1-week follow-up data were included in the present analyses. The study protocol was approved by the Institutional Review Boards at the University of Vermont and Florida State University.

Measures

Demographics Questionnaire.—Demographic information included participant sex, age, and race/ethnicity.

Diagnostic Interview.—The Structured Clinical Interview for DSM-IV Diagnosis of Axis I Disorders Non-Patient Version (SCID-NP) was used to describe the presence of current psychological disorders among the sample (First et al. 2007). The DSM-IV assesses for mood disorder, anxiety disorders, obsessive-compulsive disorder, substance-use disorders, and alcohol-use disorders; participants meeting criteria for at least one disorder were grouped and compared to those not meeting criteria for any disorder. All interviews were audio-taped and reliability of 12.5% of interviews were checked for accuracy; no cases of disagreement were noted.

Fagerström Test for Cigarette Dependence (FTCD).—The FTCD is a 6-item scale that assesses gradations in tobacco dependence (Heatherton et al. 1991; Fagerstrom 2012). The FTCD has adequate internal consistency and high test-retest reliability (Heatherton et al. 1991; Pomerleau et al. 1994). The FTCD total score was used and internal consistency was low ($\alpha = .63$), which is not uncommon for this measure (Korte et al. 2013).

Positive and Negative Affect Schedule (PANAS).—The PANAS (PANAS; Watson et al. 1988) is a self-report measure used to assess the degree to which respondents currently experience 20 different emotions and feelings (e.g., excited, distressed). The measure yields two factors, positive affect (PANAS-PA) and negative affect (PANAS-NA), which have demonstrated strong psychometric properties (Watson et al. 1988). In the present study, both subscales were included as predictors (PANAS-PA $\alpha = .90$; PANAS-NA $\alpha = .90$).

Smoking Treatment Response.—Self-reported smoking status was assessed in-person at the 1-week follow-up. The Timeline Follow-Back (TLFB; Sobell and Sobell 1992; Brown et al. 1998) procedure was used to assess cigarette consumption at each day since the previous assessment. The assessment has demonstrated good reliability and validity with biochemical indices of smoking (Sobell and Sobell 1996). Self-reported abstinence was verified by expired carbon monoxide (CO) using a CMD/CO Series Carbon Monoxide Monitor (Model 3110; Spirometrics, Inc., Auburn, ME). Self-reported abstinence was overridden by a positive expired CO reading ($> 8\text{ppm}$). Smoking treatment response was defined as self-reported no smoking, not even a puff, in the 7 days prior to the 1-week follow-up assessment and biochemical verification of abstinence.

Anxiety Sensitivity Treatment Response.—The Anxiety Sensitivity Index-3 (ASI-3; Taylor et al. 2007) is a 18-item measure, based in part upon the original Anxiety Sensitivity Index (Reiss et al. 1986), in which participants are asked to respond to the extent they feel concerned about the possible aversive effects of their anxiety related symptoms. The responses are rated on a 5-point Likert scale from 0 (*Very Little*) to 4 (*Very much*). For the current study, the total score (ASI-3 Total) was used to assess AS treatment response (defined as at least a 25% reduction in symptom severity from baseline to quit day; Garey et al. 2017). The ASI-3 has sound psychometric properties among smoking populations (Farris et al. 2015). The ASI-3 demonstrated strong internal consistency in the present study (baseline: $\alpha = .93$; quit day: $\alpha = .91$).

Analytic Strategy

Data analyses were completed using SPSS version 24. First, descriptive and bivariate relations were examined among study variables. Second, multinomial logistic regression models were calculated to independently evaluate the predictive validity of pre-treatment PA and pre-treatment NA on outcome status. Early treatment milestones were defined across three groups: (a) pre-treatment drop outs; (b) treatment non-responders (i.e., participants who complete treatment, but do not demonstrate an improvement in outcomes); and (c) treatment responders (i.e., those who complete treatment and demonstrated an improvement in outcomes). Outcomes were defined in terms of smoking abstinence during the first week post-quit and AS reduction from baseline to quit day. Thus, four models were conducted: (1) pre-treatment PA as a unique predictor of smoking treatment milestones; (2) pre-treatment NA as a unique predictor of smoking treatment milestones; (3) pre-treatment PA as a unique predictor of AS treatment milestones; and (4) pre-treatment NA as a unique predictor of AS treatment milestones; pre-treatment drop outs served as the reference group in analyses. Post hoc tests were conducted to evaluate mean comparisons across groups; tests were subjected to a Bonferroni adjusted alpha for multiple comparisons. Based on prior research (Garey et al. 2017), covariates included sex, presence of psychopathology, FTCD, and treatment condition. All models evinced a non-significant chi-square goodness of fit statistic, suggesting adequate model fit.

Results

Descriptive and Bivariate Correlations

Fifty-six participants dropped out prior to initiating the study. One-hundred and seventy-seven participants provided CO and timeline follow-back information at the 1-week follow-up (non-responders to smoking treatment: $n = 88$; responder to smoking treatment: $n = 89$), and 213 provided quit day data on AS (non-responders to AS treatment: $n = 106$; responder to smoking treatment: $n = 107$).

Most of the sample identified as White (87.7%). On average, participants reported smoking 18 cigarettes per day ($SD = 8.48$) and had been a daily smoker for 20.3 years ($SD = 13.51$). A moderate level of cigarette dependence was observed based on the FTCD ($M = 5.35$, $SD = 2.13$; Heatherton et al. 1991). Table 1 presents descriptive statistics and bivariate correlations for study variables.

Multinomial Logistic Regressions

PA predictor of smoking treatment milestones.—Pre-treatment PA did not significantly distinguish the three groups; see Table 2. Presence of psychopathology emerged as a marginally significant predictor ($X^2 [2] = 5.43, p = .07$).

NA predictor of smoking treatment milestones.—Pre-treatment NA significantly predicted smoking outcome status; see Table 2. Evaluation of parameter estimates suggested an increase in baseline NA was associated with an increased likelihood of being a pre-treatment drop-out relative to a treatment responder (Odds Ratio = 0.93, 95% CI: .88 – .99). Post hoc tests revealed a significant mean difference between pre-treatment drop outs and responders to smoking treatment ($p = .05$); no other pairwise comparisons significantly differed (p 's > .05). Marginal means were highest among participants who dropped out prior to treatment, followed by treatment non-responders, and treatment responders ($M = 20.17, 18.17, 17.71$, respectively).

PA predictor of AS treatment milestones.—Pre-treatment PA did not significantly distinguish the three groups; see Table 3. Gender emerged as a significant predictor of AS outcome status ($X^2 [2] = 6.66, p = .04$); the parameter estimates suggested that men are marginally less likely than women to be a treatment responder than to be a pre-treatment drop out (Odds Ratio = 0.59, 95% CI: .34 – 1.03).

NA predictor of AS treatment milestones.—Pre-treatment NA significantly predicted AS outcome status; see Table 3. Evaluation of parameter estimates suggested an increase in pre-treatment NA was associated with an increased likelihood of being a pre-treatment drop-out relative to a treatment responder (Odds Ratio = 0.92, 95% CI: .88 – .98). Post hoc tests revealed a significant mean difference between pre-treatment drop outs and responders to smoking treatment ($p = .05$); no other pairwise comparisons significantly differed (p 's > .05). Marginal means were highest among participants who dropped out prior to treatment, followed by treatment non-responders, and treatment responders ($M = 20.45, 18.93, 17.57$, respectively). Across smoking and AS outcomes, similar results were obtained when PA and NA were entered as concurrent covariates (the results can be obtained from the authors upon request).

Discussion

The current study examined pre-treatment PA and NA as unique predictors of pre-treatment drop out, treatment non-response, and treatment response within the context of an integrated smoking-AS treatment protocol. Smoking outcomes and AS outcomes were evaluated independently. In partial support of hypotheses, pre-treatment NA emerged as a significant predictor of early outcome status across both smoking and AS outcomes. Specifically, after controlling for sex, presence of psychopathology, tobacco dependence, and treatment, increased pre-treatment NA was associated with an increased likelihood of early drop out versus responding to treatment across both outcomes, and marginally associated with an increased likelihood of early drop out versus not responding to the smoking treatment. Pre-treatment PA did not significantly differentiate the targeted groups.

Although past work has implicated PA and NA as predictors of treatment outcomes (Carmody et al. 2007; Bränström et al. 2010a; Leventhal et al. 2013b), this is the first empirical study to evaluate pre-treatment PA and NA as unique predictors of poor early treatment milestones across a variety of outcomes (i.e., pre-treatment drop out and treatment non-response status). Consistent with extant work on smoking outcomes (Leventhal et al. 2013a), the present evidence suggests that pre-treatment NA may play a central role in identifying those at greatest risk for dropping out versus those most likely to respond to treatment. Importantly, the present study extends prior research by suggesting that in addition to pre-treatment NA serving a unique predictor early treatment outcomes for smoking, pre-treatment NA also is clinically important to early treatment outcomes for AS. Considering the growth in the development of integrated treatments to assist individuals who smoke and are at increased risk for relapse and quit difficulty (Kalman 1998; Burns et al. 2016), this timely investigation provides novel support of pre-treatment NA as a potential risk marker for poorer early treatment outcomes across both substance use and mental health factors.

It is important to note that pre-treatment NA significantly differentiated those at increased risk for pre-treatment drop out and those most likely to respond to treatment. Thus, pre-treatment NA did not significantly differ between pre-treatment drop outs and non-responders or non-responders and responders. Although these findings were inconsistent with hypotheses, they provide further insight into the nuanced correlates of group classifications for early treatment outcomes. Indeed, whereas extant research suggests unique antecedents exist that identify those at greatest risk for dropping out of psychosocial interventions as well as those likely and unlikely to respond to treatment (O'Donohue and Levensky 2006; Hengartner 2015), prior to the current investigation, no work had evaluated pre-treatment drop out to treatment responsiveness status in a comprehensive, independent study. Thus, the current study provides a relatively more holistic investigation for antecedents uniquely related to several different early treatment milestones, and highlights pre-treatment NA as a putative risk factor that distinguishes those at greatest risk for pre-treatment drop out and those most likely to respond to treatment.

Despite the non-significant findings across the associations for pre-treatment drop outs and non-responders, and non-responders and responders, as hypothesized, a tiered mean level of pre-treatment NA was observed, such that the highest values were observed among pre-treatment drop outs, followed by non-responders, and then, treatment responders with the lowest mean levels of pre-treatment NA. Although such findings provide only basic descriptive evidence for differences in pre-treatment NA across early treatment milestones, it supports the continued investigation for the role of pre-treatment NA in early treatment drop out and response status. Moreover, it will be clinically important for future work to investigate additional factors that may discriminate pre-treatment drop outs, treatment non-responders, and treatment responders.

Contrary to hypotheses, pre-treatment PA did not significantly differ across groups within the context of smoking or AS. According to theoretical work (Fredrickson et al. 2008; Fredrickson 2013), one would expect for individuals who smoke and report higher pre-treatment PA to utilize the treatment elements and thereby be more likely to respond to

treatment. Yet, the present data show that pre-treatment PA is not an indicator of early treatment milestones. The lack of a statistically significant pre-treatment difference in PA across groups may have emerged, in part, because of the unique characteristics of the sample. More than 40% of the present sample met criteria for a current psychiatric illness. Thus, their pre-treatment PA may not be as pertinent as their pre-treatment NA. Future investigations may consider the impact of change in PA during the course of treatment on early treatment milestones, as change in PA may be an under recognized but important clinical construct (Taylor et al. 2017).

Clinically, the present data implicate NA as a putative risk factor for pre-treatment drop out. Thus, it may be advisable to clinicians to assess NA at intake. Such assessment would permit early intervention to enhance treatment motivation and increase the likelihood of treatment initiation (Hengartner 2015). Moreover, based on the present data as well as theoretically-driven work indicating NA relief as a primary motivator for substance use (Baker et al. 2004), it may be advisable for integrated smoking cessation treatment to specifically target and monitor NA during the course of treatment. Specifically, providing psychoeducation on the relation between NA states and smoking as well as methods to help manage NA, including mindfulness techniques (Gonzalez et al. 2009), may lead to improved treatment responsiveness. Additionally, assessing NA prior to and during treatment may have the potential to inform individualized treatment planning as well as necessary treatment modifications to increase treatment efficacy.

The study limitations warrant comment. First, the sample consisted of primarily White, community-recruited, treatment-seeking daily cigarette users with moderate levels of cigarette dependence. It will be useful for future studies to replicate the study among a more diverse sample, in terms of ethnicity and smoking behavior. Second, the study examined treatment response at one-week post-treatment. Future work would benefit from examining these relations across a larger post-treatment period to determine long-term treatment responders. Third, the internal consistency of the FTCD items was relatively low, leaving speculation as to the validity of this measure to assess cigarette dependence. It is worth noting that Cronbach's alpha values are fairly sensitive to the number of items in each scale and it is not uncommon to find lower Cronbach values with shorter scales (e.g., scales with fewer than 10 items; DeVellis 2017). Nevertheless, additional work is needed to examine if the tested relations hold while controlling for cigarette dependence that is assessed by a more internally consistent measure. Finally, although the PANAS capture an array of positive and negative emotions, the degree of emotional arousal association within the context of such emotions is limited. In particular, the measure tends to focus on high arousal emotions (i.e., excited, hostile, enthusiastic). Thus, the present finding may be limited to positive and negative affect that is captured by relatively high arousal states. Future work may consider evaluating the positive and negative affective states that consider moderate or low arousal emotional states (i.e., calm, peaceful, isolated).

Conclusion

Overall, the present study serves as an initial investigation on the role of PA and NA across early treatment outcomes for smoking and AS among a sample of treatment-seeking persons

who smoke. The results suggest that greater pre-treatment NA may be a characteristic to identify those at greatest risk for dropping out of treatment versus responding to treatment. This information serves to inform best practices to triaged smoking care and individualized treatment efforts. The current findings address an important gap in the literature in identifying predictors of early treatment outcomes that may have significant clinical utility in the treatment of affectively vulnerable individuals who smoke. Future work may consider evaluating the impact of pre-treatment NA on time to smoking and mood lapse/relapse within the context of integrated mood and smoking treatment.

Reference

- Baker T, Mermelstein R, Collins L, et al. New Methods for Tobacco Dependence Treatment Research. *Annals of Behavioral Medicine* 2011;41:192–207. [PubMed: 21128037]
- Baker TB, Piper ME, McCarthy DE, et al. Addiction motivation reformulated: an affective processing model of negative reinforcement. *Psychological review* 2004;111:33. [PubMed: 14756584]
- Bränström R, Penilla C, Pérez-Stable EJ, et al. Positive affect and mood management in successful smoking cessation. *American journal of health behavior* 2010a;34:553. [PubMed: 20524885]
- Bränström R, Penilla C, Prez-Stable EJ, et al. Positive affect and mood management in successful smoking cessation. *American Journal of Health Behavior* 2010b;34:553–562. [PubMed: 20524885]
- Brown RA, Burgess ES, Sales SD, et al. Reliability and validity of a smoking timeline follow-back interview. *Psychology of Addictive Behaviors* 1998;12:101.
- Burns RJ, Rothman AJ, Fu SS, et al. Longitudinal care improves cessation in smokers who do not initially respond to treatment by increasing cessation self-efficacy, satisfaction, and readiness to quit: a mediated moderation analysis. *Annals of Behavioral Medicine* 2016;50:58–69. [PubMed: 26373657]
- Carmody TP, Vieten C, Astin JA. Negative affect, emotional acceptance, and smoking cessation. *Journal of psychoactive drugs* 2007;39:499–508. [PubMed: 18303707]
- CDCP. Current Cigarette Smoking Among Adults—United States, 2005–2014. *Morbidity and Mortality Weekly Report* 2015;64:1233–1240.
- Chiew KS, Braver TS. Positive affect versus reward: emotional and motivational influences on cognitive control. *Frontiers in psychology* 2011;2:279. [PubMed: 22022318]
- DeVellis RF. *Scale development : theory and applications*. Thousand Oaks, Calif : SAGE, 2017.
- Fagerstrom K Determinants of tobacco use and renaming the FTND to the Fagerstrom Test for Cigarette Dependence. *Nicotine & Tobacco Research* 2012;14:75–8. [PubMed: 22025545]
- Farris SG, DiBello AM, Allan NP, et al. Evaluation of the Anxiety Sensitivity Index-3 among treatment-seeking smokers. *Psychological assessment* 2015;27:1123. [PubMed: 25894700]
- First MB, Spitzer RL, Gibbon M, et al. *Structured clinical interview for DSM-IV-TR Axis I disorders, research version, non-patient edition (SCIDI/NP)*. New York, NY: Biometrics Research, New York State Psychiatric Institute, 2007.
- Fredrickson BL. What good are positive emotions? *Review of general psychology* 1998;2:300. [PubMed: 21850154]
- Fredrickson BL. The broaden-and-build theory of positive emotions. *Philosophical transactions-royal society of london series b biological sciences* 2004;1367–1378.
- Fredrickson BL. Positive emotions broaden and build In: Press A ed. *In Advances in experimental social psychology* 2013:1–53.
- Fredrickson BL, Cohn MA, Coffey KA, et al. Open Hearts Build Lives: Positive Emotions, Induced Through Loving- Kindness Meditation, Build Consequential Personal Resources. *Journal of personality and social psychology* 2008;95:1045–1062. [PubMed: 18954193]
- Garey L, Taha SA, Kauffman BY, et al. Treatment non-response: Associations with smoking expectancies among treatment-seeking smokers. *Addictive behaviors* 2017;73:172–177. [PubMed: 28528227]

- Gonzalez A, Vujanovic AA, Johnson KA, et al. The role of mindful attention in regard to the relation between negative affect reduction outcome expectancies and emotional vulnerability among adult cigarette smokers. *Cognitive therapy and research* 2009;33:645–656.
- Heatherton TF, Kozlowski LT, Frecker RC, et al. The Fagerström Test for Nicotine Dependence: A revision of the Fagerström Tolerance Questionnaire. *British Journal of Addiction to Alcohol and Other Drugs* 1991;86:1119–1127.
- Hengartner MP. The detrimental impact of maladaptive personality on public mental health: a challenge for psychiatric practice. *Frontiers in psychiatry* 2015;6:87. [PubMed: 26106335]
- Hughes J An algorithm for choosing among smoking cessation treatments. *Journal of Substance Abuse Treatment* 2008;34:426–432. [PubMed: 17869475]
- Hughes JR. The future of smoking cessation therapy in the United States. In: Oxford, UK: 1996:1797–1802.
- Hyer L Psychological treatment of older adults: A holistic model. Springer Publishing Company, 2013.
- Kalman D Smoking cessation treatment for substance misusers in early recovery: A review of the literature and recommendations for practice. *Substance use & misuse* 1998;33:2021–2047. [PubMed: 9744841]
- Knopp J, Knowles S, Bee P, et al. A systematic review of predictors and moderators of response to psychological therapies in OCD: do we have enough empirical evidence to target treatment? *Clinical psychology review* 2013;33:1067–1081. [PubMed: 24077387]
- Korte KJ, Capron DW, Zvolensky M, et al. The Fagerstrom test for nicotine dependence: Do revisions in the item scoring enhance the psychometric properties? *Addictive Behaviors* 2013;38:1757–63. [PubMed: 23254226]
- Langdon KJ, Farris SG, Øverup CS, et al. Associations between anxiety sensitivity, negative affect, and smoking during a self-guided smoking cessation attempt. *Nicotine & Tobacco Research* 2015;ntv253.
- Lasser K, Boyd JW, Woolhandler S, et al. Smoking and mental illness: a population-based prevalence study. *Jama* 2000;284:2606–2610. [PubMed: 11086367]
- Leventhal AM, Greenberg JB, Trujillo MA, et al. Positive and negative affect as predictors of urge to smoke: temporal factors and mediational pathways. *Psychology of Addictive Behaviors* 2013a; 27:262. [PubMed: 23506367]
- Leventhal AM, Greenberg JB, Trujillo MA, et al. Positive and Negative Affect as Predictors of Urge to Smoke: Temporal Factors and Mediational Pathways. *Psychology of Addictive Behaviors* 2013b; 27:262–267. [PubMed: 23506367]
- O'Donohue WT, Levensky ER. Promoting treatment adherence: A practical handbook for health care providers. Sage Publications, 2006.
- Piper ME, Rodock M, Cook JW, et al. Psychiatric diagnoses among quitters versus continuing smokers 3 years after their quit day. *Drug and alcohol dependence* 2013;128:148–154. [PubMed: 22995766]
- Pomerleau CS, Carton SM, Lutzke ML, et al. Reliability of the fagerstrom tolerance questionnaire and the fagerstrom test for nicotine dependence. *Addictive Behaviors* 1994;19:33–39. [PubMed: 8197891]
- Reiss S, McNally R. Expectancy model of fear.. S. Reiss, RR Bootzin (Eds). Theoretical issues in behavior therapy inside. In: San Diego, CA: Academic Press, 1985.
- Reiss S, Peterson RA, Gursky DM, et al. Anxiety sensitivity, anxiety frequency and the prediction of fearfulness. *Behaviour research and therapy* 1986;24:1–8. [PubMed: 3947307]
- Schmidt NB, Raines AM, Allan NP, et al. Anxiety sensitivity risk reduction in smokers: A randomized control trial examining effects on panic. *Behaviour research and therapy* 2015;77:138–146. [PubMed: 26752327]
- Shiffman S, Balabanis MH, Gwaltney CJ, et al. Prediction of lapse from associations between smoking and situational antecedents assessed by ecological momentary assessment. *Drug & Alcohol Dependence* 2007;91:159–168. [PubMed: 17628353]
- Smits JA, Zvolensky MJ, Davis ML, et al. The efficacy of vigorous-intensity exercise as an aid to smoking cessation in adults with high anxiety sensitivity: A randomized controlled trial. *Psychosomatic medicine* 2016;78:354. [PubMed: 26513517]

- Sobell LC, Sobell MB. Timeline follow-back In: Measuring alcohol consumption. Springer, 1992:41–72.
- Sobell MB, Sobell LC. Problem drinkers: Guided self-change treatment. Guilford Press, 1996.
- Taylor CT, Lyubomirsky S, Stein MB. Upregulating the positive affect system in anxiety and depression: Outcomes of a positive activity intervention. *Depression and Anxiety* 2017;34:267–280. [PubMed: 28060463]
- Taylor S, Zvolensky MJ, Cox BJ, et al. Robust dimensions of anxiety sensitivity: development and initial validation of the Anxiety Sensitivity Index-3. *Psychological assessment* 2007;19:176. [PubMed: 17563199]
- Vendetti J, McRee B, Miller M, et al. Correlates of pre- treatment drop- out among persons with marijuana dependence. *Addiction* 2002;97:125–134. [PubMed: 12460134]
- Watson D, Clark LA, Tellegen A. Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of personality and social psychology* 1988;54:1063–70. [PubMed: 3397865]
- Wynd CA. Smoking patterns, beliefs, and the practice of healthy behaviors in abstinent, relapsed, and recalcitrant smokers. *Applied Nursing Research* 2006;19:197–203. [PubMed: 17098157]
- Zvolensky M, Bonn-Miller M, Bernstein A, et al. Anxiety sensitivity and abstinence duration to smoking. *Journal of Mental Health* 2006;15:659–670.
- Zvolensky MJ, Bogiaizian D, Salazar PL, et al. An Anxiety Sensitivity Reduction Smoking-Cessation Program for Spanish-Speaking Smokers (Argentina). *Cognitive and Behavioral Practice* 2014;21:350–363.
- Zvolensky MJ, Garey L, Allan NP, et al. Effects of anxiety sensitivity reduction on smoking abstinence: An analysis from a panic prevention program. *Journal of Consulting and Clinical Psychology* in press.
- Zvolensky MJ, Lejuez CW, Kahler CW, et al. Integrating an interoceptive exposure-based smoking cessation program into the cognitive-behavioral treatment of panic disorder: Theoretical relevance and case demonstration. *Cognitive and Behavioral Practice* 2003;10:347–357.
- Zvolensky MJ, Stewart SH, Vujanovic AA, et al. Anxiety sensitivity and anxiety and depressive symptoms in the prediction of early smoking lapse and relapse during smoking cessation treatment. *Nicotine & Tobacco Research* 2009;11:323–331. [PubMed: 19246426]
- Zvolensky MJ, Yartz AR, Gregor K, et al. Interoceptive exposure-based cessation intervention for smokers high in anxiety sensitivity: A case series. *Journal of Cognitive Psychotherapy* 2008;22:346–365.

Figure 1. Treatment Design.

Note: PPA = Point Prevalence Abstinence; CO = Expired Carbon Monoxide.

Table 1.

Descriptive Statistics and Correlations among Study Variables (n=288)

	Mean/n	SD/%	1.	2.	3.	4.	5.	6.
1. Sex (% female)	144	50.0%	1					
2. Psychopathology (% present)	116	40.3%	0.14*	1				
3. FTCD	5.35	2.13	0.03	0.08	1			
4. Condition (% integrated)	153	53.1%	-0.05	0.01	0.06	1		
5. PANAS PA	18.93	6.81	-0.06	-0.24***	-0.11	-0.05	1	
6. PANAS NA	32.07	7.14	0.10	0.37***	-0.01	-0.21***	-0.37***	1

Note. N= 288;

 $p < .001$,

*

 $p < .05$.

Sex: 1=male, 2=female. Psychopathology: 0=no mental illness, 1=mental illness. Condition: 1=integrated treatment, 2=control. PANAS PA=Positive and Negative Affect Schedule-Positive Affect subscale. PANAS NA=Positive and Negative Affect Schedule-Negative Affect subscale.

Table 2.

Multinomial Logistic Regression for Smoking Models

Smoking Model with PANAS PA	B	Std. Error	Exp(B)	95% Confidence Interval for Exp(B)		Sig.
				Lower Bound	Upper Bound	
<i>Smoking Non-Responders vs Pre-Treatment Drop Outs (ref)</i>						
Sex	-.619	.354	.539	.269	1.079	.081
Psychopathology	-.039	.364	.962	.471	1.962	.915
FTCD	.107	.084	1.112	.943	1.312	.205
Condition	-.073	.350	.930	.469	1.845	.835
PANAS PA	.005	.026	1.005	.955	1.058	.840
<i>Smoking Responders vs Pre-Treatment Drop Outs (ref)</i>						
Sex	-.651	.356	.522	.259	1.049	.068
Psychopathology	.673	.379	1.961	.934	4.117	.075
FTCD	.045	.084	1.046	.888	1.232	.592
Condition	.208	.352	1.231	.617	2.455	.556
PANAS PA	.025	.027	1.026	.973	1.082	.348
<i>Smoking Model with PANAS NA</i>						
<i>Smoking Non-Responders vs Pre-Treatment Drop Outs (ref)</i>						
Sex	-.659	.360	.517	.256	1.048	.067
Psychopathology	-.316	.395	.729	.336	1.581	.424
FTCD	.096	.083	1.100	.934	1.296	.252
Condition	.042	.354	1.043	.521	2.087	.905
PANAS NA	-.054	.028	.947	.896	1.002	.057
<i>Smoking Responders vs Pre-Treatment Drop Outs (ref)</i>						
Sex	-.687	.362	.503	.247	1.023	.058
Psychopathology	.374	.409	1.454	.652	3.240	.360
FTCD	.021	.083	1.021	.867	1.203	.800
Condition	.381	.357	1.464	.728	2.944	.285
PANAS NA	-.069	.030	.933	.880	.989	.020

Note. $N = 233$. Sex: 1=male, 2=female. Psychopathology: 0=no mental illness, 1=mental illness. Condition: 1=integrated treatment, 2=control. AS=Anxiety Sensitivity. FTCD= Fagerström Test for Cigarette Dependence. PANAS PA=Positive and Negative Affect Schedule-Positive Affect subscale. PANAS NA=Positive and Negative Affect Schedule-Negative Affect subscale.

Table 3.

Multinomial Logistic Regression for AS Models

AS Model with PANAS PA		B	Std. Error	Exp(B)	95% Confidence Interval for Exp(B)		Sig.
					Lower Bound	Upper Bound	
AS Non-Responders vs Pre-Treatment Drop Outs (ref)	Sex	-.288	.340	.750	.385	1.460	.397
	Psychopathology	.136	.349	1.145	.578	2.267	.697
	FTCD	.032	.079	1.032	.884	1.206	.686
	Condition	.142	.334	1.153	.599	2.217	.671
	PANAS PA	.004	.024	1.004	.958	1.053	.855
AS Responders vs Pre-Treatment Drop Outs (ref)	Sex	-.809	.342	.445	.228	.870	.018
	Psychopathology	.062	.351	1.064	.534	2.118	.860
	FTCD	.061	.080	1.063	.908	1.244	.447
	Condition	.125	.337	1.133	.585	2.194	.711
	PANAS PA	.026	.025	1.027	.979	1.077	.282
AS Model with PANAS NA							
AS Non-Responders vs Pre-Treatment Drop Outs (ref)	Sex	-.341	.345	.711	.362	1.397	.322
	Psychopathology	-.060	.374	.942	.453	1.959	.873
	FTCD	.028	.079	1.029	.881	1.202	.722
	Condition	.279	.348	1.322	.668	2.618	.423
	PANAS NA	-.039	.026	.962	.913	1.013	.138
AS Responders vs Pre-Treatment Drop Outs (ref)	Sex	-.887	.349	.412	.208	.817	.011
	Psychopathology	-.261	.379	.770	.367	1.618	.491
	FTCD	.050	.081	1.052	.897	1.233	.534
	Condition	.394	.355	1.483	.740	2.973	.267
	PANAS NA	-.079	.028	.924	.875	.976	.005

Note. $N = 269$. Sex: 1=male, 2=female. Psychopathology: 0=no mental illness, 1=mental illness. Condition: 1=integrated treatment, 2=control. AS=Anxiety Sensitivity. FTCD= Fagerström Test for Cigarette Dependence. PANAS PA=Positive and Negative Affect Schedule-Positive Affect subscale. PANAS NA=Positive and Negative Affect Schedule-Negative Affect subscale.