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## Suicidality prospectively predicts greater urges to smoke following a cessation attempt: Mediation through perceived barriers to cessation

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### Abstract

Growing interest in developing more effective smoking cessation treatments has facilitated the need to further investigate cognitive-affective factors that inhibit successful smoking cessation, such as urges to smoke. Research has strongly supported an association between suicidality and smoking, yet no work has investigated whether suicidality may increase urges to smoke. The current study sought to evaluate the impact of suicidality on smoking-related cognitive-affective factors predictive of smoking relapse among a community sample of 209 daily smokers engaged in a smoking cessation program. Structural equation modeling (SEM) was used to test the effects of self-reported pre-cessation suicidality on urges to smoke 1 month post-cessation as well as whether this effect was mediated by greater barriers to cessation. Results indicated that internal barriers to cessation significantly mediated the effect of pre-cessation suicidality on greater urges to smoke 1 month following smoking cessation attempt. These findings suggest that elevated suicidality may affect perceived internal barriers to cessation and subsequently urges to smoke 1 month following a quit attempt.

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There is mounting evidence that psychiatric disorders are associated with smoking cigarettes (Control and Prevention, 2013; Grant et al., 2004; Hughes, 2011). Furthermore, studies have determined that elevated depressive and anxiety symptoms and emotional disorders are associated with an increased risk of progression to daily smoking (Leventhal et al., 2012) and the development of nicotine dependence (McKenzie et al., 2010). Daily smoking, in

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### Contributors

Each author materially contributed to the present manuscript. Mr. Albanese conceptualized the analyses, formulated the structure of the manuscript, wrote the discussion section, and provided edits on each section of the manuscript. Mr. Allan performed and wrote the results and provided edits. Mr. Boffa helped prepare the introduction and provided edits. Mr. Chavarria helped prepare the introduction and provided edits. Mrs. Raines helped prepare the methods and provided edits. Dr. Zvolensky and Dr. Schmidt each provided the data necessary for the analyses, and provided helpful feedback at all stages of the development of this manuscript.

turn, has been shown to exacerbate anxiety and depressive symptoms (Zvolensky et al., 2004).

Suicidality represents a critical aspect of many emotional disorders, and may provide further insight into the comorbidity of smoking and psychiatric disorders. Smoking has been consistently related to suicidality (Breslau et al., 2005; Doll et al., 1994; Iwasaki et al., 2005; Leistikow et al., 2000; Leistikow and Shipley, 1999). However, theories differ with regard to the nature of this relationship. Some have postulated that those with suicidality may engage in coping oriented smoking (Markou and Kenny, 2002). In support of this, studies have found nicotine to have anti-depressant effects (McClernon et al., 2006; Semba et al., 1998). A second idea suggests that smoking causes suicide directly or indirectly through the impact of smoking on negative mood (Newhouse et al., 1988; Olausson et al., 2002; Parrott, 2003).

Less is known about how suicide relates to smoking cessation. It has been suggested that suicidality may increase with smoking cessation through negative affect experienced in the context of withdrawal symptoms (Hughes, 2008). For example, there is evidence that individuals with a history of depression are at increased risk for developing another depressive episode in the wake of smoking cessation (Bock et al., 1996; Glassman et al., 2001; Tsoh et al., 2000). Moreover, two case reports have identified increases in suicidality amongst previously depressed individuals after smoking cessation (Bock et al., 1996; Stage et al., 1996). For this particular subset of smokers, it is certainly plausible that the negative experience of withdrawal symptoms could induce or increase suicidality. This may be more relevant to a subset of quitters, however, as some studies have found a decrease in depressive symptoms with successful cessation attempts (Health and Services, 1990; McClave et al., 2009; Prochaska et al., 2008).

Although extant literature has clearly demonstrated a link between suicidality and smoking, no research to date has investigated the effects of suicidality on cognitive-affective processes related to smoking and smoking cessation, such as urges to smoke (Allen et al., 2008; Baer et al., 1989; Doherty et al., 1995; Fidler et al., 2011). There is reason to believe that suicidality may increase urges to smoke, a cognitive-affective factor characterized by intent and/or desire to smoke as well as the belief that smoking will provide immediate relief from nicotine withdrawal or negative affect. Individuals who report elevated suicidality may have greater urges to smoke to cope with withdrawal and depressive symptoms during and after a smoking cessation attempt (Bock et al., 1996; Glassman et al., 2001; Markou and Kenny, 2002; Tsoh et al., 2000). Additionally, empirical studies have demonstrated that depressed mood can increase urges to smoke, suggesting that this cognitive-affective factor is malleable to current mood (Spring et al., 2003; Vinci et al., 2012). These results, coupled with research indicating an important relationship between suicidality and depressed mood, posits the need for the evaluation of a specific effect of suicidality on smoking urges.

Suicidality may impact urges to smoke through greater perceived barriers to cessation. Barriers to cessation have been described as internal (i.e., dealing with negative emotions), external (i.e., lack of social support to quit), or addictive (i.e., withdrawal symptoms) aspects or costs associated with smoking cessation that an individual perceives to be threatening, or

beyond their ability to cope with (Macnee and Talsma, 1995). Theoretically, those with greater suicidal symptoms may report greater levels of each of these barriers to cessation as a result of their desire to use nicotine to cope (Markou and Kenny, 2002), lack of social support that often accompanies heightened suicidality (Joiner, 2009), and experience of withdrawal symptoms during cessation that may escalate suicidality (Bock et al., 1996; Glassman et al., 2001; Tsoh et al., 2000). Despite some knowledge of how depression and suicidality are impacted by smoking and smoking cessation, no research to date has investigated the impact suicidality may have on quit week barriers to cessation and subsequent post-cessation urges to smoke.

The current study is the first to address important gaps in the smoking-suicide literature by evaluating the effect of pre-cessation suicidality on one-month follow-up smoking urges through barriers to cessation during the week of a quit attempt. In accordance with literature suggesting that suicidality may relate to greater urges to smoke (Spring et al., 2003; Vinci et al., 2012), it is hypothesized that pre-cessation suicidality will increase urges to smoke one month following a cessation attempt. Additionally, those experiencing current suicidality are likely to use nicotine to cope with depressed symptoms (i.e., internal barriers to cessation; Markou and Kenny, 2002), interpersonal disruptions (i.e., external barriers to cessation; Joiner, 2009), and withdrawal symptoms (i.e., addictive barriers to cessation; Hughes, 2008). Therefore, it is hypothesized that suicidality will predict greater internal, external, and addictive barriers to cessation reported during a quit attempt. Lastly, in line with data demonstrating barriers to cessation to predict relapse, it is hypothesized that greater quit week barriers to cessation will mediate the proposed relationship between pre-cessation suicidality and urges to smoke at a one month follow-up.

## Methods

### Participants

Participants included 209 adult daily smokers recruited from the community to participate in a larger study examining the effects of an anxiety-based treatment on smoking cessation and who presented for a 1-month post-treatment follow-up. To be eligible for inclusion, participants had to be 18 years of age or older, a daily smoker for at least 1 year (minimum of 8 cigarettes per day), and demonstrate elevated levels of anxiety sensitivity. No individuals were excluded for expressing severe current suicidal ideation, plans, or preparations that warranted immediate treatment. Additionally, psychotic individuals, those using another smoking cessation program or tobacco product, and those with a significant medical condition were excluded. Ages of participants ranged from 18 to 68 ( $M = 39.27$ ,  $SD = 14.21$ ) and gender was fairly evenly distributed (52.6% female). The racial/ethnic composition of the sample was distributed as such: 85.2% were Caucasian, 7.2% Black/Non-Hispanic, 3.8% Hispanic, 1.0% Asian, .5% Black/Hispanic, and 2.4% other (e.g., bi-racial). At quit week, 66 participants had abstained from smoking, 111 had not abstained from smoking, and 32 were unable to be classified. At month-one follow-up, 81 participants had abstained from smoking, 55 participants had not abstained from smoking, 25 participants were unable to be classified, and abstinence data were unavailable for 48 participants.

## Procedure

Initial eligibility was determined during a brief telephone screen. Individuals who were deemed potentially eligible were scheduled to come in for a baseline appointment during which they completed various demographic, anxiety, substance use, and smoking assessments as well as a structured clinical interview. Upon completion of the baseline assessment, participants were randomly assigned to either a standard smoking cessation program or an anxiety-based smoking cessation program (see Capron et al., 2014 for more details regarding the intervention). Both interventions consisted of four 90-minute sessions with a trained therapist. Following the treatment phase, participants were followed up periodically over a 2-year period. The current investigation utilizes data collected at the baseline, quit week, and month-one follow-up. The study was approved by the university's Institutional Review Board and informed consent was obtained from all participants prior to the collection of data.

## Measures

### Clinician-Administered

**Major Depressive Disorder (MDD):** MDD diagnoses were ascertained using the Structured Clinical Interview for the DSM-IV Axis I Disorders (SCID-I; First et al., 2007). In the current study, MDD diagnosis was used to control for putative relationship between Major Depression and smoking cessation outcomes. All SCIDs were administered by highly-trained clinical psychology doctoral-level graduate students and reviewed by a licensed clinical psychologist to confirm accurate diagnoses. Additionally, diagnostic interviews were audiotaped and the reliability of a random selection of 12.5% of interviews were checked for accuracy. No cases of diagnostic disagreement were noted.

### Self-Report

**Cessation Barriers:** Barriers to smoking cessation were assessed at the beginning of the quit week using the Barriers to Cessation Scale (BCS). The BCS is a 19-item self-report measure assessing stressors associated with smoking cessation (Macnee and Talsma, 1995). In addition to a total score, three subscale scores including addictive, external, and internal barriers can be computed. Psychometric research has demonstrated good content and predictive validity as well as internal consistency for the total score and subscale scores (Macnee and Talsma, 1995). In the current investigation, the internal barriers to cessation subscale ( $\alpha = .83$ ), external barriers to cessation ( $\alpha = .87$ ), and addiction barriers to cessation ( $\alpha = .89$ ) demonstrated good internal consistency.

**Smoking Urges:** Smoking urges and cravings were assessed at month 1 using the 12-item version of the Questionnaire on Smoking Urges (QSU; Toll et al., 2004) (QSU; Toll et al., 2004). The 12-item QSU is composed of two factors: Intention/desire to smoke and relief of negative affect/withdrawal. Previous research has found that the 12-item QSU is both a valid and reliable measure of cravings and urges to smoking (Toll et al., 2004). In the present investigation the 12-item QSU total score ( $\alpha = .91$ ), intention/desire to smoke factor ( $\alpha = .87$ ), and relief of negative affect/withdrawal factor ( $\alpha = .90$ ) demonstrated good to excellent internal consistency.

**Suicide:** Symptoms of suicidality were assessed prior to smoking cessation using the Inventory of Depression and Anxiety Symptoms (IDAS) scale (Watson et al., 2007). The IDAS is a 64-item self-report measure assessing symptoms of major depression and anxiety-related disorders. The measure yields two broad subscales of general depression and dysphoria. In addition, 10 specific symptom dimension subscales can be calculated including Suicidality. Previous research on the IDAS subscales has indicated that they display good internal consistency, content validity, and convergent validity (Watson et al., 2007). In the current investigation, only the Suicidality subscale was used and internal consistency for this subscale was adequate ( $\alpha = .73$ ).

**Nicotine Dependence:** Symptoms of nicotine dependence were assessed prior to smoking cessation using the Fagerstöm Test for Nicotine Dependence (FTND; Heatherton et al., 1991). The FTND has shown good internal consistency and positive relations with key smoking variables (e.g., salivary cotinine; Heatherton et al., 1991; Payne et al., 1994). In the current study, the FTND showed lower internal consistency ( $\alpha = .67$ ), though this is consistent with the literature (Korte et al., 2013).

### Data Analytic Plan

Descriptive statistics and correlations were first computed for all variables. Because baseline FTND (used as a control variable) was treated as a manifest variable in all analyses, this variable was examined for outliers as well as skew and kurtosis. If necessary, outliers were corrected to be within  $\pm 3$  standard deviations (SDs) of the mean. Scores on the FTND were considered skewed or kurtotic if skew/kurtosis over standard error exceeded 1.98 (Tabachnick and Fidell, 2007). Whereas it is now generally agreed that the only requirement necessary for mediation is a significant indirect pathway (Preacher and Hayes, 2008; Zhao et al., 2010), structural equation models (SEMs) were examined to determine the direct effects of baseline suicidality on 1) quit week barriers to cessation scales and 2) month 1 smoking urges, controlling for treatment condition, FTND, MDD diagnosis, and gender. SEMs were conducted in Mplus version 7.1 (Muthén and Muthén). Because of the ordinal response style and the skew that would have resulted from treating IDAS Suicidality items as continuous, all analyses were conducted using the robust weighted least squares estimator (WLSMV in Mplus), treating IDAS Suicidality items as categorical. For all SEM models, model fit was assessed using the likelihood ratio test (LRT), which is based on the  $\chi^2$  value. A nonsignificant  $\chi^2$  is indicative of excellent model fit. However, the LRT is often considered too restrictive for practical purposes when conducting SEM with scales composed of many items (Kenny and McCoach, 2003; Moshagen, 2012). Therefore, fit indices were examined as well with agreement among fit indices considered as evidence of adequate model fit (Chen et al., 2008; Kline, 2011). The comparative fit index (CFI; Bentler, 1990), Tucker-Lewis Index (TLI; Tucker and Lewis, 1973), and the root mean square error of approximation (RMSEA; Steiger, 1990) with accompanying 90% confidence intervals (CIs) were used to assess model fit. In general, CFI and TLI values greater than .90 indicate adequate fit. RMSEA values below .05 indicate good fit and values below .08 indicate adequate fit. Further, a CI containing .05 indicates that good fit cannot be ruled out and a CI containing .10 indicates that poor fit cannot be ruled out (Bentler, 1990; Hu and Bentler, 1999; MacCallum et al., 1996).

Following the main effects SEMs, three separate mediation models were examined, including 1) the BCS Addiction factor mediating the effect of the baseline Suicidality factor on the smoking urges factors (i.e., Intent to Smoke and Relief from NA factors), 2) the BCS External factor mediating the effect of the baseline Suicidality factor on the smoking urges factors (i.e., Intent to Smoke and Relief from NA factors), and finally, 3) the BCS Internal factor mediating the effect of the baseline Suicidality factor on the smoking urges factors (i.e., Intent to Smoke and Relief from NA factors). Because traditional fit indices are not provided for these models, model fit was assessed by fitting a model including all main effects but excluding the indirect pathway. Mediation models were conducted using 5,000 bias-corrected bootstrapped CIs to provide consistent and replicable results (Preacher and Hayes, 2008).

## Results

### Sample Descriptives and Correlations

Descriptive statistics and correlations between all variables used in the present analyses are provided in Table 1. No outliers were present for baseline FTND. Further, this variable demonstrated acceptable levels of skew and kurtosis. No other variables were examined for skew or kurtosis given that they were either dichotomous control variables (i.e., condition, gender, MDD diagnosis) or were modeled as latent variables. Baseline IDAS Suicidality was significantly associated with all quit week BCS subscales and with the QSU subscales. In addition, all BCS subscales were correlated with all QSU subscales.

### Structural Equation Models Examining the Effects of Baseline Suicidality on Quit Week Barriers to Cessation and Month 1 Smoking Urges

An SEM including the effects of the baseline Suicidality factor as well as the baseline control variables on (i.e., condition, baseline FTND, MDD, and gender) on the quit week BCS factors (i.e., Addiction, External, and Internal) provided adequate fit to the data ( $\chi^2 = 316.15, p = .01, CFI = .93, TLI = .92, RMSEA = .03, 90\% CI [.02, .05]$ ).<sup>1</sup> Model parameters are provided in Table 2. In this model, the Suicidality factor was a significant predictor of the Quit Week External factor ( $B = .18, p < .05$ ) as well as the Quit Week Internal factor ( $B = .42, p < .001$ ).

An SEM including the effects of the baseline Suicidality factor as well as the baseline control variables (i.e., condition, baseline FTND, MDD, and gender) on the month 1 QSU factors (i.e., Intent to Smoke, Relief from NA) also provided adequate fit to the data ( $\chi^2 = 199.83, p = .02, CFI = .95, TLI = .94, RMSEA = .04, 90\% CI [.02, .05]$ ). Model parameters are provided in Table 2. In this model, the baseline Suicidality factor was a significant predictor of the month 1 Intent to Smoke factor ( $B = .27, p < .01$ ) as well as the month 1 Relief from NA factor ( $B = .23, p < .01$ ).<sup>2</sup>

<sup>1</sup>In this and all subsequent models, items 9 (“I hurt myself purposely”) and 41 (“I cut or burned myself on purpose”) were removed from analysis because of convergence problems due to empty cells. There were only two and three people respectively who responded beyond the first (i.e., “Not at all”) response option. In this and all subsequent models including the BCS External factor, item 17 (i.e., “Seeing things or people which remind you of smoking”) was dropped from the BCS External factor as this item loaded poorly on this factor and modification indices indicated that it cross-loaded on the two other BCS factors.

## Mediation Effects of Baseline Suicidality on Month 1 Smoking Urges through Quit Week Barriers to Cessation

The fit of the models including baseline Suicidality predicting either 1) the quit week Addiction factor, 2) the quit week External factor, and 3) the quit week Internal factor and the smoking urges factors as well as the barriers to cessation factor predicting the smoking urges factors were first examined prior to conducting mediation models. The model including the quit week Addiction factor provided adequate fit to the data ( $\chi^2 = 397.43$ ,  $p = .01$ , CFI = .94, TLI = .93, RMSEA = .03, 90% CI [.02, .04]). Model parameters including the indirect effect of the Suicidality factor on the smoking urges factors through the Addiction factor are provided in the top panel of Table 4. The direct effect of baseline Suicidality on the month 1 Intent to Smoke factor was significant ( $B = .28$ , 95% CI [.05, .63]) as was the effect of the quit week Addiction factor ( $B = .58$ , 95% CI [.37, .83]). The direct effect of baseline Suicidality on the month 1 Relief from NA factor was also significant ( $B = .22$ , 95% CI [.02, .44]) as was the effect of the quit week Addiction factor ( $B = .42$ , 95% CI [.25, .63]). The indirect effects from baseline Suicidality to the Month 1 smoking urges factors were not significant.

The model including the quit week External factor as the mediator provided adequate fit to the data ( $\chi^2 = 333.35$ ,  $p = .02$ , CFI = .94, TLI = .94, RMSEA = .03, 90% CI [.01, .04]). Model parameters are provided in the middle panel of Table 4. The direct effect of the baseline Suicidality factor on the month 1 Intent to Smoke factor was significant ( $B = .24$ , 95% CI [.04, .57]). The direct effect of the quit week External factor on the month 1 Relief from NA factor was significant ( $B = .23$ , 95% CI [.06, .45]). There were no significant indirect effects.

Finally, the model including the quit week Internal factor as the mediator also provided adequate fit to the data ( $\chi^2 = 258.01$ ,  $p = .02$ , CFI = .95, TLI = .94, RMSEA = .03, 90% CI [.01, .05]). Model parameters are provided in the bottom panel of Table 4. The direct effect of the quit week Internal factor on the month 1 Intent to Smoke factor ( $B = .32$ , 95% CI [.05, .60]) and on the month 1 Relief from NA factor ( $B = .30$ , 95% CI [.11, .53]) were significant. In addition, the indirect effect from the baseline Suicidality factor was significant on the month 1 Intent to Smoke factor ( $B = .14$ , 95% CI [.02, .32]) as well as on the month 1 Relief from NA factor ( $B = .13$ , 95% CI [.05, .28]).

## Discussion

The present study is the first to establish a clear link between suicidality at the time of a quit attempt and smoking-related cognitive-affective factors. These results demonstrate that internal barriers to cessation reported during a quit week mediate the relationship between suicidality and urges to smoke one month following a cessation attempt among daily smokers who are motivated to quit when accounting for MDD diagnosis, nicotine withdrawal, and gender. Taken together, these results further the widely cited association

<sup>2</sup>All analyses were also conducted, controlling for smoking status at month 1. The effect of the Suicidality factor on the quit week and month 1 factors remained significant. However, because 45 participants were unable to be classified due to absence of cotinine data this limited the sample size to 164 participants. Given these lack of differences it was decided to report on the full sample.

between suicidality and smoking by providing evidence of a causal effect of suicidality on smoking-related cognitive-affective factors.

Epidemiological and empirical evidence has demonstrated those with suicidality to have greater difficulties regulating and tolerating emotional experiences (e.g., Lynch et al., 2004). For example, Anestis et al. (2011) investigated the influence of emotional dysregulation in suicidality among undergraduate students and found emotional dysregulation to predict greater suicidal desire. Although suicidality predicted both internal and external barriers to cessation after controlling for relevant variables, internal barriers to cessation was the only significant mediator of the relationship between suicidality and one-month follow-up urges to smoke. These findings suggest that the perceived inability to tolerate negative emotions during a smoking cessation attempt may be the most potent barrier to cessation for those with elevated suicidality.

Suicidality also significantly predicted greater external barriers to smoking cessation during a quit attempt when stringently controlling for relevant covariates. These results may be interpreted within the framework of the Interpersonal Theory of Suicide (Joiner, 2009; Van Orden et al., 2010). This theory posits that suicidality is proximally caused by two salient interpersonal factors: perceived burdensomeness and thwarted belongingness. Suicidality may be related to external barriers (e.g., “No encouragement or help from family members or significant others”) due to disturbances in interpersonal factors that may yield the perception of an environment that is unsupportive to smoking cessation.

The present results have important clinical implications. The current finding that pre-cessation suicidality impacts smoking-related cognitive-affective factors that proximally predict smoking relapse (Allen et al., 2008; Baer et al., 1989; Doherty et al., 1995; Fidler et al., 2011; Macnee and Talsma, 1995) when accounting for relevant covariates highlights the importance of assessing suicidality prior to smoking cessation. Moreover, tailoring smoking cessation programs to target suicidality and the perception of internal barriers to cessation may improve outcomes. Brief, effective treatments shown to reduce suicidality (e.g., Schmidt et al., 2014) may reduce internal barriers to cessation during a quit attempt, thereby reducing subsequent urges to smoke.

There are several limitations to the current study. First, individual’s presenting for this study represented a highly nicotine dependent sample. Although nicotine dependence was controlled for, high levels of nicotine dependence can impact perceived barriers to cessation (Asher et al., 2003). Future studies should investigate this relationship among mild to moderate smokers. Second, these findings do not reflect quit attempt status. Rather, it assessed a cognitive-affective factor, urges to smoke, that has been associated with heightened risk for relapse following a quit attempt. Assessing quit status one month following a cessation attempt may not capture individuals who have not relapsed but are likely to. Thus, assessing urges to smoke, a well-established proximal predictor of relapse, provides the opportunity to investigate the impact of suicidality on a cognitive-affective factor related to smoking and smoking cessation. Lastly, both conditions in the current study received smoking cessation aid. Although the impact of suicidality on barriers to cessation and smoking urges in the presence of smoking cessation treatments is compelling, future



studies should assess this relationship among smokers attempting to quit in a more naturalistic setting.

There are also notable strengths to the current study. First, data were collected from two diverse community samples, enhancing the potential that these findings will prove to be generalizable to the larger population of smokers. Second, this is the first study to directly examine the relationships between suicidality and smoking-related cognitive-affective processes. Lastly, the current study utilized a longitudinal design to examine the causal relationships between suicidality, quit week barriers to cessation, and smoking urges one month following a quit attempt. Future studies should evaluate the efficacy of smoking cessation treatments aimed at targeting suicidality along with other relevant, smoking-related cognitive factors.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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## References

1. Allen SS, Bade T, Hatsukami D, Center B. Craving, withdrawal, and smoking urges on days immediately prior to smoking relapse. *Nicotine & Tobacco Research*. 2008; 10:35–45. [PubMed: 18188743]
2. Anestis MD, Bagge CL, Tull MT, Joiner TE. Clarifying the role of emotion dysregulation in the interpersonal-psychological theory of suicidal behavior in an undergraduate sample. *Journal of Psychiatric Research*. 2011; 45:603–611. [PubMed: 21092986]
3. Asher MK, Martin RA, Rohsenow DJ, MacKinnon SV, Traficante R, Monti PM. Perceived barriers to quitting smoking among alcohol dependent patients in treatment. *Journal of substance abuse treatment*. 2003; 24:169–174. [PubMed: 12745034]
4. Baer JS, Karmack T, Lichtenstein E, Ransom CC. Prediction of smoking relapse: Analyses of temptations and transgressions after initial cessation. *Journal of Consulting and Clinical Psychology*. 1989; 57:623. [PubMed: 2794182]
5. Bentler PM. Comparative fit indexes in structural models. *Psychological bulletin*. 1990; 107:238. [PubMed: 2320703]
6. Bock BC, Goldstein MG, Marcus BH. Depression following smoking cessation in women. *Journal of substance abuse*. 1996; 8:137–144. [PubMed: 8743774]
7. Breslau N, Schultz LR, Johnson EO, Peterson EL, Davis GC. Smoking and the risk of suicidal behavior: a prospective study of a community sample. *Archives of General Psychiatry*. 2005; 62:328–334. [PubMed: 15753246]
8. Capron DW, Allan NP, Norr AM, Zvolensky MJ, Schmidt NB. The effect of successful and unsuccessful smoking cessation on short-term anxiety, depression, and suicidality. *Addictive Behaviors*. 2014; 39:782–788. [PubMed: 24457901]

9. Chen F, Curran PJ, Bollen KA, Kirby J, Paxton P. An empirical evaluation of the use of fixed cutoff points in RMSEA test statistic in structural equation models. *Sociological Methods & Research*. 2008; 36:462–494. [PubMed: 19756246]
10. Control, C.f.D., Prevention. Vital signs: current cigarette smoking among adults aged 18 years with mental illness-United States, 2009–2011. *MMWR Morbidity and mortality weekly report*. 2013; 62:81. [PubMed: 23388551]
11. Doherty K, Kinnunen T, Militello FS, Garvey AJ. Urges to smoke during the first month of abstinence: relationship to relapse and predictors. *Psychopharmacology*. 1995; 119:171–178. [PubMed: 7659764]
12. Doll R, Peto R, Wheatley K, Gray R, Sutherland I. Mortality in relation to smoking: 40 years' observations on male British doctors. *Bmj*. 1994; 309:901–911. [PubMed: 7755693]
13. Fidler JA, Shahab L, West R. Strength of urges to smoke as a measure of severity of cigarette dependence: comparison with the Fagerström Test for Nicotine Dependence and its components. *Addiction*. 2011; 106:631–638. [PubMed: 21134020]
14. First MB, Spitzer RL, Gibbon M, Williams JB. *SCID-I/P*. 2007
15. Glassman AH, Covey LS, Stetner F, Rivelli S. Smoking cessation and the course of major depression: a follow-up study. *The Lancet*. 2001; 357:1929–1932.
16. 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. *Archives of General Psychiatry*. 2004; 61:1107–1115. [PubMed: 15520358]
17. Health, U.D.o., Services, H. The health benefits of smoking cessation: a report of the Surgeon General. 1990 Publication No(CDC), 90-8416.
18. Heatherton TF, Kozlowski LT, Frecker RC, Fagerstrom K. The Fagerström test for nicotine dependence: a revision of the Fagerstrom Tolerance Questionnaire. *British journal of addiction*. 1991; 86:1119–1127. [PubMed: 1932883]
19. Hu, Lt; Bentler, PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*. 1999; 6:1–55.
20. Hughes JR. Smoking and suicide: a brief overview. *Drug and alcohol dependence*. 2008; 98:169–178. [PubMed: 18676099]
21. Hughes JR. The hardening hypothesis: Is the ability to quit decreasing due to increasing nicotine dependence? A review and commentary. *Drug and alcohol dependence*. 2011; 117:111–117. [PubMed: 21411244]
22. Iwasaki M, Akechi T, Uchitomi Y, Tsugane S. Cigarette smoking and completed suicide among middle-aged men: a population-based cohort study in Japan. *Annals of epidemiology*. 2005; 15:286–292. [PubMed: 15780776]
23. Joiner, T. *Why people die by suicide*. Harvard University Press; 2009.
24. Kenny DA, McCoach DB. Effect of the number of variables on measures of fit in structural equation modeling. *Structural equation modeling*. 2003; 10:333–351.
25. Kline, RB. *Principles and practice of structural equation modeling*. Guilford press; 2011.
26. Korte KJ, Capron DW, Zvolensky M, Schmidt NB. The Fagerström Test for Nicotine Dependence: Do revisions in the item scoring enhance the psychometric properties? *Addictive Behaviors*. 2013; 38:1757–1763. [PubMed: 23254226]
27. Leistikow BN, Martin D, Samuels S. Injury death excesses in smokers: a 1990–95 United States national cohort study. *Injury Prevention*. 2000; 6:277–280. [PubMed: 11144627]
28. Leistikow BN, Shipley MJ. Might stopping smoking reduce injury death risks? A meta-analysis of randomized, controlled trials. *Preventive medicine*. 1999; 28:255–259. [PubMed: 10072743]
29. Leventhal AM, Ray LA, Rhee SH, Unger JB. Genetic and environmental influences on the association between depressive symptom dimensions and smoking initiation among Chinese adolescent twins. *Nicotine & Tobacco Research*. 2012; 14:559–568. [PubMed: 22180578]
30. Lynch TR, Cheavens J, Morse JQ, Rosenthal M. A model predicting suicidal ideation and hopelessness in depressed older adults: The impact of emotion inhibition and affect intensity. *Aging & Mental Health*. 2004; 8:486–497. [PubMed: 15724830]

31. MacCallum RC, Browne MW, Sugawara HM. Power analysis and determination of sample size for covariance structure modeling. *Psychological methods*. 1996; 1:130.
32. Macnee CL, Talsma A. Development and testing of the barriers to cessation scale. *Nursing research*. 1995; 44:214–219. [PubMed: 7624231]
33. Markou A, Kenny PJ. Neuroadaptations to chronic exposure to drugs of abuse: relevance to depressive symptomatology seen across psychiatric diagnostic categories. *Neurotoxicity research*. 2002; 4:297–313. [PubMed: 12829420]
34. McClave AK, Dube SR, Strine TW, Kroenke K, Caraballo RS, Mokdad AH. Associations between smoking cessation and anxiety and depression among US adults. *Addictive Behaviors*. 2009; 34:491–497. [PubMed: 19217720]
35. McClernon FJ, Hiott FB, Westman EC, Rose JE, Levin ED. Transdermal nicotine attenuates depression symptoms in nonsmokers: a double-blind, placebo-controlled trial. *Psychopharmacology*. 2006; 189:125–133. [PubMed: 16977477]
36. McKenzie M, Olsson CA, Jorm AF, Romaniuk H, Patton GC. Association of adolescent symptoms of depression and anxiety with daily smoking and nicotine dependence in young adulthood: findings from a 10-year longitudinal study. *Addiction*. 2010; 105:1652–1659. [PubMed: 20707783]
37. Moshagen M. The model size effect in SEM: Inflated goodness-of-fit statistics are due to the size of the covariance matrix. *Structural Equation Modeling: A Multidisciplinary Journal*. 2012; 19:86–98.
38. Muthén L, Muthén BBO. *Mplus user's guide*. 1998–2012
39. Newhouse PA, Sunderland T, Tariot PN, Blumhardt C, Weingartner H, Mellow A, Murphy D. Intravenous nicotine in Alzheimer's disease: a pilot study. *Psychopharmacology*. 1988; 95:171–175. [PubMed: 3137593]
40. Olausson P, Engel JA, Söderpalm B. Involvement of serotonin in nicotine dependence: processes relevant to positive and negative regulation of drug intake. *Pharmacology Biochemistry and Behavior*. 2002; 71:757–771.
41. Parrott AC. Cigarette-derived nicotine is not a medicine. *World journal of biological psychiatry*. 2003; 4:49–55. [PubMed: 12692774]
42. Payne TJ, Smith PO, McCracken LM, McSherry WC, Antony MM. Assessing nicotine dependence: A comparison of the Fagerström Tolerance Questionnaire (FTQ) with the Fagerström Test for Nicotine Dependence (FTND) in a clinical sample. *Addictive Behaviors*. 1994; 19:307–317. [PubMed: 7942248]
43. Preacher KJ, Hayes AF. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior research methods*. 2008; 40:879–891. [PubMed: 18697684]
44. Prochaska JJ, Spring B, Nigg CR. Multiple health behavior change research: an introduction and overview. *Preventive medicine*. 2008; 46:181–188. [PubMed: 18319098]
45. Schmidt NB, Capron DW, Raines AM, Allan NP. Randomized clinical trial evaluating the efficacy of a brief intervention targeting anxiety sensitivity cognitive concerns. 2014
46. Semba, Ji; Matakai, C.; Yamada, S.; Nankai, M.; Toru, M. Antidepressant like effects of chronic nicotine on learned helplessness paradigm in rats. *Biological Psychiatry*. 1998; 43:389–391. [PubMed: 9513755]
47. Spring B, Pingitore R, McChargue DE. Reward value of cigarette smoking for comparably heavy smoking schizophrenic, depressed, and nonpatient smokers. *American Journal of Psychiatry*. 2003; 160:316–322. [PubMed: 12562579]
48. Stage KB, Glassman AH, Covey LS. Depression after smoking cessation: case reports. *The Journal of clinical psychiatry*. 1996; 57:467–469. [PubMed: 8909333]
49. Steiger JH. Structural model evaluation and modification: An interval estimation approach. *Multivariate behavioral research*. 1990; 25:173–180. [PubMed: 26794479]
50. Tabachnick B, Fidell L. *Multivariate analysis of variance and covariance. Using multivariate statistics*. 2007; 3:402–407.
51. Toll BA, McKee SA, Krishnan-Sarin S, O'Malley SS. Revisiting the factor structure of the questionnaire on smoking urges. *Psychological Assessment*. 2004; 16:391. [PubMed: 15584799]

52. Tsoh JY, Humfleet GL, Muñoz RF, Reus VI, Hartz DT, Hall SM. Development of major depression after treatment for smoking cessation. *American Journal of Psychiatry*. 2000; 157:368–374. [PubMed: 10698811]
53. Tucker LR, Lewis C. A reliability coefficient for maximum likelihood factor analysis. *Psychometrika*. 1973; 38:1–10.
54. Van Orden KA, Witte TK, Cukrowicz KC, Braithwaite SR, Selby EA, Joiner TE Jr. The interpersonal theory of suicide. *Psychological Review*. 2010; 117:575. [PubMed: 20438238]
55. Vinci C, Copeland AL, Carrigan MH. Exposure to negative affect cues and urge to smoke. *Experimental and clinical psychopharmacology*. 2012; 20:47. [PubMed: 21875222]
56. Watson D, O'Hara MW, Simms LJ, Kotov R, Chmielewski M, McDade-Montez EA, Gamez W, Stuart S. Development and validation of the Inventory of Depression and Anxiety Symptoms (IDAS). *Psychological Assessment*. 2007; 19:253. [PubMed: 17845118]
57. Zhao X, Lynch JG, Chen Q. Reconsidering Baron and Kenny: Myths and truths about mediation analysis. *Journal of consumer research*. 2010; 37:197–206.
58. Zvolensky MJ, Lejuez C, Kahler CW, Brown RA. Nonclinical panic attack history and smoking cessation: An initial examination. *Addictive Behaviors*. 2004; 29:825–830. [PubMed: 15135567]

**Highlights**

- We examine the effect of pre-cessation suicidality on quit week barriers to cessation and month 1 urges to smoke.
- Greater suicidality predicted greater urges to smoke through greater perceived internal barriers to cessation.
- Results highlight the importance of assessing for suicidality prior to smoking cessation attempt.

Descriptive Statistics for Potential Mediators and Anxiety and Depression at Pre-Intervention, Week 1, and Month 1 Follow-up

Table 1

	1	2	3	4	5	6	7	8	9	10
1. BL Suicidality	--									
2. Condition	-.02	--								
3. BL FTND	-.03	-.01	--							
4. MDD	.06	.03	.10	--						
5. Gender	.06	-.004	-.01	.05	--					
6. QW Addiction	.08	-.06	.24*	.07	.23*	--				
7. QW External	.15*	-.08	.08	.04	.05	.44*	--			
8. QW Internal	.28*	-.09	.12	.08	.22	.61*	.53*	--		
9. MI QSU Intent	.19*	-.03	.01	-.04	.03	.39*	.16*	.28*	--	
10. MI QSU NA Relief	.18*	-.01	.13	-.03	-.02	.35*	.23*	.30*	.63*	--
Mean (%)	6.85	59.8% <sup>a</sup>	4.93	6.2% <sup>b</sup>	47.4% <sup>c</sup>	12.15	6.20	3.83	17.99	6.17
SD	1.78		2.30			5.92	5.38	2.78	9.28	1.78

Note. N = 178–209 across variables.

BL = Baseline. Suicidality assessed using Inventory of Depression and Anxiety Scale Suicidality subscale. Condition = Treatment condition (1 = active, 2 = control). FTND = Fagerstrom Test for Nicotine Dependence. MDD = Major Depressive Disorder diagnosis. Gender (1 = male, 2 = female). QW = Quit week. Addiction, External, Internal = Barriers to Cessation Addiction, Internal, and External subscales. MI = Month 1. QSU Intent = Questionnaire on Smoking Urges Intention to Smoke scale. NA Relief = Relief of Negative Affect scale.

<sup>a</sup> Percentage in treatment condition.

<sup>b</sup> Met diagnostic criteria for MDD.

<sup>c</sup> Male.

\* p < .05.

Structural Equation Model Examining the Effects of Baseline Suicidality on Quit Week Barriers to Cessation

Table 2

Variables	QW Addiction Factor			QW External Factor			QW Internal Factor		
	B	SE	$\beta$	B	SE	$\beta$	B	SE	$\beta$
BL Suicidality	.05	.09	.04	.18*	.09	.18	.42***	.13	.37
Condition	-.15	.17	-.07	-.15	.17	-.07	-.24	.19	-.10
BL FTND	.11	.04	.24	.03	.04	.07	.07	.04	.15
MDD	.27	.27	.06	.28	.32	.07	.39	.36	.08
Gender	.52***	.17	.24	.08	.16	.04	.53***	.18	.23

Note.

BL = Baseline. Condition = Treatment condition (1 = active, 2 = control). FTND = Fagerström Test for Nicotine Dependence. MDD = Major Depressive Disorder diagnosis. Gender (1 = male, 2 = female).

QW = Quit week. SE = Standard error.

\*\*\*  $p < .001$ .

\*\*  $p < .01$ .

\*  $p < .05$ .

Structural Equation Model Examining the Effects of Baseline Suicidality on Month 1 Smoking Urges

Table 3

	M1 Intent Factor		M1 Relief from NA Factor	
	B	SE	B	SE
BL Suicidality	.27**	.09	.26	.08
Condition	-.10	.17	-.05	.16
BL FTND	.03	.04	.06	.03
MDD	-.07	.36	-.02	.32
Gender	.08	.17	.04	.16

Note.

BL = Baseline. Condition = Treatment condition (1 = active, 2 = control). FTND = Fagerström Test for Nicotine Dependence. MDD = Major Depressive Disorder diagnosis. Gender (1 = male, 2 = female). M1 = Month 1. SE = Standard error.

\*\*\*  
p < .001.

\*\*  
p < .01.

\*  
p < .05.



Mediation Model from Suicidality to Month 1 Smoking Urges through Quit Week Barriers to Cessation

Table 4

Variables	Month 1 Intent to Smoke		Month 1 Relief from NA			
	B	95% CI	B	95% CI		
BL Suicidality	<b>.28</b>	<b>.05</b>	<b>.63</b>	<b>.22</b>	<b>.02</b>	<b>.44</b>
Condition	-.02	-.37	.37	.04	-.26	.34
BL FTND	-.04	-.13	.05	.03	-.04	.10
MDD	-.23	-1.13	.60	-.22	-.93	.51
Gender	-.21	-.57	.15	-.26	-.52	.06
BCS Addiction	<b>.58</b>	<b>.37</b>	<b>.83</b>	<b>.42</b>	<b>.25</b>	<b>.63</b>
Indirect	.03	-.13	.18	.02	-.10	.12
BL Suicidality	<b>.24</b>	<b>.04</b>	<b>.57</b>	.19	-.02	.40
Condition	-.07	-.40	.26	-.14	-.48	.21
BL FTND	.02	-.06	.11	.03	-.04	.10
MDD	-.11	-.80	.61	.25	-.41	.95
Gender	.07	-.24	.42	.09	-.24	.42
BCS External	.17	-.06	.39	<b>.23</b>	<b>.06</b>	<b>.45</b>
Indirect	.03	-.02	.12	.04	-.01	.14
BL Suicidality	.14	-.12	.49	.11	-.13	.34
Condition	-.02	-.35	.35	.05	-.24	.34
BL FTND	.004	-.08	.10	.05	-.02	.12
MDD	-.20	-.88	.45	-.22	-.81	.48
Gender	-.09	-.45	.28	-.20	-.48	.13
BCS Internal	<b>.32</b>	<b>.05</b>	<b>.60</b>	<b>.30</b>	<b>.11</b>	<b>.53</b>
Indirect	<b>.14</b>	<b>.02</b>	<b>.32</b>	<b>.13</b>	<b>.05</b>	<b>.28</b>

Note.

BL = Baseline. Condition = Treatment condition (1 = active, 2 = control). FTND = Fagerström Test for Nicotine Dependence. MDD = Major Depressive Disorder diagnosis. Gender (1 = male, 2 = female). BCS Addiction = Barriers to cessation Addiction factor. External = External factor. Internal = Internal factor. CI = Confidence interval.

Significant effects are in bold.