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Smoking Consequences Questionnaire: A Reevaluation of the Psychometric Properties Across Two Independent Samples of Smokers

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Abstract

Drug use outcome expectancies are a central construct to psychosocial theories of addictive disorders. In tobacco literature, the Smoking Consequences Questionnaire (SCQ; Brandon & Baker, 1991) is a tool used to assess this construct. Despite its common use, the SCQ has received little psychometric evaluation. In the current report, samples from two studies were employed to examine the assumed SCQ structure, develop a novel truncated scale, and evaluate the psychometric properties of the novel scale. In Study 1, the four-factor SCQ structure was examined using data from 343 (32.4% female; M_{age} = 43.7; SD = 10.8) adult non-treatment-seeking smokers. Results from Study 1 indicated that the four-factor SCQ structure did not adequately explain covariance between items. Instead, results provided evidence for a five-factor structure that tapped into outcome expectancies related to (1) immediate negative consequences, (2) long-term negative consequences, (3) sensory satisfaction, (4) negative affect reduction, and (5) appetite-weight control. In Study 2, the five-factor structure of the SCQ was confirmed and the construct validity was evaluated in 582 (48.2% female; M_{age} = 36.9; SD = 13.5) treatment-seeking adult smokers. Study 2 found evidence for measurement invariance across sex and overtime of the five-factor structure as well as substantial construct validity. Results from two independent samples challenge the traditional four-factor model of the SCQ, and instead, provide evidence for a novel five-factor SCQ structure with strong validity and reliability. Alternate scoring algorithms for the SCQ, including a five-subscale scheme, warrant consideration to ensure optimal measurement precision and construct differentiation.

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Keywords

Psychometric Properties; Smoking Consequences Questionnaire; Measurement Invariance; Smokers

In the past two decades, there has been a growing interest to better understand cognitive processes that influence smoking behavior (King, Marcus, Pinto, Emmons, & Abrams, 1996; Schwarzer, 2008). Smoking outcome expectancies are beliefs about the positive and negative consequences or effects of smoking (Gwaltney, Shiffman, Balabanis, & Paty, 2005) and have been among the most promising cognitive processes identified thus far (Brandon, Juliano, & Copeland, 1999). Several influential theories and empirical studies underscore the importance of outcome expectancies as a key proximal mediator of smoking motivation (Brandon et al., 1999; Goldman, Brown, & Christiansen, 1987; Marlatt & Donovan, 2005; Niaura et al., 1988).

One measure used to assess smoking outcome expectancies is the Smoking Consequences Questionnaire (SCQ; Brandon & Baker, 1991). The original SCQ contains 50 self-report items assessing subjective positive and negative expectancies of smoking (Brandon & Baker, 1991); these items were retained from a pool of 80 items. Measure development work identified four SCQ factors: Negative Consequences (18 items that describe negative consequences of smoking), Negative Reinforcement/Negative Affect Reduction (12 items that assess expectancies that smoking will reduce negative affect), Positive Reinforcement/ Sensory Satisfaction (15 items that evaluate expectancies for smoking to provide sensory satisfaction and promote positive consequences, such as alleviate boredom), and Appetite–Weight Control (5 items that assess beliefs for smoking to suppress one's appetite). Brandon and Baker (1991) tested the psychometric properties of the SCQ across multiple score types. Specifically, participants reported the desirability and likelihood of each item; these score were used to derive (a) subjective expectancy unit score desirability, which were calculated by multiplying the desirability and likelihood ratings, and (b) likelihood ratings alone. Findings suggested that likelihood scores were better at discriminating smoking status and identifying sex differences than the subjective expectancy unit score (Brandon & Baker, 1991); this model was subsequently cross validated (Copeland, Brandon, & Quinn, 1995). Based on this data, with rare exception (Brandon, Wetter, & Baker, 1996), subsequent work has assessed SCQ items using a single Likert scale of likelihood.

The original four SCQ factors have a high degree of clinical utility, being related to smoking initiation (Doran et al., 2013), tobacco dependence (Myers, MacPherson, McCarthy, & Brown, 2003), tobacco withdrawal (Langdon & Leventhal, 2014; Wetter et al., 1994), and cessation outcome (Kenford et al., 2002; Wetter et al., 1999; Wetter et al., 1994). The SCQ factors also are associated with affective vulnerabilities that undergird problematic use and impede cessation, including anxiety sensitivity (Johnson et al., 2008; Zvolensky et al., 2004), negative affectivity (Johnson et al., 2008; Wetter et al., 1994), and smoking-specific experiential avoidance (Farris, Zvolensky, DiBello, & Schmidt, 2015). Although the original SCQ factors were extracted with an orthogonal rotation because they were believed to tap into unrelated dimensions of smoking expectancies (Brandon & Baker, 1991), extensive

scientific data provide evidence that they are unique, although related, factors that assess different dimensions of smoking expectancies (Gonzalez, Hogan, McLeish, & Zvolensky, 2010; Gregor, Zvolensky, McLeish, Bernstein, & Morissette, 2008).

Despite the SCQ's wide use and clinical utility, surprisingly little work has evaluated the psychometric properties of the original SCQ. Indeed, only three studies have evaluated the psychometric properties of the proposed four-factor SCQ structure (Brandon & Baker, 1991; Vidrine et al., 2009; Wetter et al., 1994)[1] and one study has attempted to shorten the SCQ using a sample of adolescents and young adults (Myers et al., 2003). This work, although promising, has been limited in several key ways. First, confirmatory work on the SCQ has utilized less-than-ideal analytic approaches. Wetter et al. (1994) examined the SCQ structure using a confirmatory factor analysis (CFA). These researchers employed parcels when evaluating the assumed structure of the SCQ, which is potentially problematic because it carries the assumption that items within parcels are unidimensional. To the extent that item parcels are not unidimensional, their use is likely to result in inflated model fit (Kline, 2015). Consequently, beyond this single study, no work has successfully replicated the four-factor SCQ structure. For example, Vidrine et al. (2009) attempted to replicate the SCQ structure using item-level data among a sample of Latino smokers, but found poor model fit. The model misfit may have resulted from poor item loadings (Matsunaga, 2015). Unfortunately, Vidrine et al. (2009) did not provide item-level data in their report, making this assertion speculative and an important area for research, particularly because misspecification at the item level may lead to poor models comprised of less precise constructs bombarded with error (Matsunaga, 2015).

Second, extant work has found sex differences across the SCQ factors (Brandon & Baker, 1991; Wetter et al., 1999; Wetter et al., 1994). Specifically, Brandon and Baker (1991) reported sex differences on Negative Reinforcement/Negative Affect Reduction and Appetite-Weight Control subscales, whereas Wetter et al. (1994) reported sex differences on these two subscales as well as Negative Consequences subscale. The latter finding was replicated in another sample of treatment seeking smokers (Wetter et al., 1999). Yet, measurement invariance, or stability of the measure, across sex has not been empirically evaluated with the SCQ. Measurement invariance (Vandenberg & Lance, 2000) assesses if indicators load onto underlying factors the same way across groups and provides empirical evidence that the fundamental meaning of a construct is not confounded by differences in perceptions of the construct (Little, Preacher, Selig, & Card, 2007; Vandenberg & Lance, 2000). Without establishing measurement invariance, bias may be introduced (McHorney & Fleishman, 2006) and differences cannot be unambiguously interpreted (Horn & McArdle, 1992). Thus, testing and establishing measurement invariance is necessary for future researchers to accurately conclude that observed differences in the SCQ across sex are the result of true changes in the construct.

[1]Brandon and Baker (1991) and Wetter et al. (1994) both employed likelihood scores to assess the SCQ; Vidrine et al. (2009) did not explicitly indicate response options for the SCQ, but considering that this group compared variations of the SCQ that were derived from likelihood scores, it is assumed they also employed likelihood scores.

In addition to testing measurement invariance across sex, it is clinically useful to evaluate measurement invariance across time with the SCQ. Indeed, recent work suggests that smoking outcome expectancies fluctuate in response to several internal and external factors (Doran, Schweizer, & Myers, 2011). Theoretically, smoking outcome expectancies may change in response to treatment. For example, expectancies for the health risks of smoking may increase during the study as participants learned new information about the negative effects of smoking on health (Vidrine et al., 2009). Yet, little work has focused on examining change in the SCQ over time. One potential reason for this lack of research may be that the comparability of the SCQ measured at two time points has not been established. Thus, an important 'next-step' is to evaluate measurement invariance across time with the SCQ. Providing evidence for the stability of the structure over time may encourage researchers to employ this measure more often when evaluating change in smoking expectancies.

Third, Brandon and Baker (1991) demonstrated validity for the measure to distinguish between groups of smokers and non-smokers. However, little to no attention has been given to examining the convergent/discriminant validity of the SCQ factors with constructs theorized to maintain smoking or interfere with quitting. As reviewed, other work provides evidence for correlates of the SCQ factors (Doran et al., 2013; Langdon & Leventhal, 2014; Myers et al., 2003; Wetter et al., 1994). Nevertheless, these relations have not been evaluated in the context of psychometric testing of the SCQ. Rigorous scientific work to validate the relations between the SCQ factors and other constructs related to smoking is central to (a) demonstrate that SCQ factors measure the psychological attributes they were developed to measure; and (b) to understand the meaningfulness of the measure in clinical work (Adcock, 2001). As work with the SCQ continues to develop, there is a need to demonstrate convergent/discriminant validity between the SCQ factors and affective vulnerabilities or other cognitive processes that may be involved in maintenance and relapse processes.

Finally, to add to the construct validity argument for the original SCQ structure, Wetter and colleagues (1994) examined the predictive validity of the SCQ subscales on withdrawal symptoms among participants who had successfully quit. All subscales except Negative Consequences predicted withdrawal. One limitation of this work, however, was that abstinence was defined as an expired carbon monoxide rating of less than 10 parts per million (PPM). Recent work suggests that such a high cutoff may not adequately differentiate abstainers from non-abstainers. Indeed, current guidelines recommend defining abstinence as less than 5 PPM (Perkins, Karelitz, & Jao, 2013). Thus, Wetter and colleagues (1994) may have erroneously classified smokers as abstinent. To respond to this limitation, it would be useful to investigate the predictive validity of SCQ factors on withdrawal among a sample of successful quitters defined using contemporary recommendations (i.e., PPM <5; Perkins et al., 2013).

It is important to note that alternative versions of original SCQ measure are currently in circulation. Specifically, the SCQ-Adult was developed from the original 80 item pool which proposed 10-factors across 55 items (see Copeland et al., 1995). Additionally, an adolescent version of the SCQ has been developed from the original 80 items (Adolescent-SCQ; (Adolescent-SCQ; Lewis-Esquerre, Rodrigue, & Kahler, 2005) as well as a shortened version of the original SCQ 50-item measure with adolescents and young adults (S-SCQ;

Myers et al., 2003), a shortened version of the SCQ-Adult (Brief SCQ-Adult; Rash & Copeland, 2008), and a Spanish version derived from the SCQ-Adult (SCQ-Spanish; Cepeda-Benito & Reig Ferrer, 2000). Despite the development of alternative versions of the SCQ, the original 50-item measure continues to be the most highly used instrument to examine smoking outcome expectancies (Aguirre et al., 2016; Garey et al., 2016; Goldenson, Pang, & Leventhal, 2016). The continued use of the SCQ may stem from its appropriateness with today's smoker. Specifically, the alternative adult version, namely, the SCQ-Adult, was developed among a sample of heavy smokers who smoked roughly 27 cigarettes per day, whereas the original SCQ was developed among a more general sample of smokers who smoked 11 cigarettes per day. Because the average cigarettes per day smoked in the U.S. has been declining since 1995 to the 2015 average of 14 cigarettes per day (Jamal, 2016), the original factor structure developed by Brandon and Baker (1991) may be more applicable to today's smokers. Thus, this issue may partly explain its popularity, and adds further justification to examine the psychometric properties of the original SCQ using refined methodology in a sample of general smoker.

Together, the current study addressed several notable, clinically-relevant gaps related to the psychometric evaluation of the SCQ. Study 1 examined the four-factor SCQ structure using item-level data on a sample of community-recruited non-treatment seeking smokers. Based on model fit indices, the structure of the SCQ was reevaluated and refined in a theoretically and empirically informed exploratory manner. Ultimately, a novel, truncated five-factor structure was supported. To encourage and support the use of this novel measure in clinical and research setting, the five-factor model underwent rigorous psychometric evaluation in Study 2 to assess its construct validity. Indeed, many of the shortcomings outlined above related to the original SCQ measure were addressed using the novel, truncated measure. Specifically, Study 2 used a confirmatory analytic method to evaluate the novel five-factor scale in an independent sample of treatment-seeking smokers. The stability (i.e., measurement invariance) of the five-factor structure was examined across sex and over two time points (baseline and quit-week). In both studies, factors of the five-factor structure were evaluated for convergent and discriminant validity. In Study 2, factors were evaluated for internal consistency and more extensive construct validity, including convergent and discriminant validity across a wider range of variables as well as predictive validity.

METHOD

Study 1

Participants—A sample of 343 (32.4% female; M_{age} = 43.7; SD = 10.8) adult smokers who responded to study advertisements for a study on personality and smoking were included in the study. Inclusion criteria were (a) age≥18 years old; (b) daily cigarette smoking for≥2 years; (c) currently smoking≥10 cigarettes/day; and (d) fluency in English. Exclusion criteria were (a) current DSM–IV dependence on substances other than nicotine in the past 30 days (to prevent modulation of responses due to withdrawal from other substances); (b) current DSM–IV mood disorder, psychotic symptoms, or use of psychiatric medications (to prevent cognitive or behavioral impairment that might interfere with completing a behavioral smoking task or modulation of tobacco abstinence effects by

psychiatric medication); (c) breath carbon monoxide (CO) levels <10 ppm at intake (to exclude individuals who may be over reporting their smoking level); (d) use of non-cigarette tobacco or nicotine products; and (e) currently pregnant. The racial/ethnic distribution of this sample was as follows: 51.9% Black, 34.4% White, 7.0% Hispanic, 1.2% American Indian/ Alaskan Native, 0.9% Asian, 0.3% Middle Eastern, 4.1% Multi-racial. On average, participants reported being a regular smoker since age 19.2 years old (SD = 5.5) and currently smoke an average of 16.7 cigarettes per day (SD = 6.9). A moderate level of tobacco dependence was observed within the sample based on the Fagerström Test for Cigarette Dependence (M = 5.3, SD = 1.9; Heatherton, Kozlowski, Frecker, & Fagerström, 1991).

Procedures—The data for the current study was taken from a larger study on personality and smoking (Leventhal, Piper, Japuntich, Baker, & Cook, 2014). Interested persons responding to community-based advertisements contacted the research team via phone. During the initial telephone interaction, research staff provided participants a detailed description of the study and administered a preliminary phone screener. Participants deemed eligible at the preliminary phone screener were scheduled for a baseline appointment. At the baseline appointment, participants provided written informed consent, were screened for study eligibility and completed self-report baseline measures. Eligible participants then attended two experimental visits (one 16-hr smoking abstinent and one nonabstinent) that began at 12 p.m. and were conducted within 2 to 14 days of each other; abstinence condition order was counterbalanced across participants. The current study is based on secondary analyses of baseline data collected from participants who were eligible for the larger trial and who provided data for the SCQ. All study procedures were approved by the Institutional Review Board.

Measures

Demographics: Demographic information included sex, age, and race. Participants provided smoking history information, including number of cigarettes per day and age when they became a regular smoker.

Carbon Monoxide: Biochemical verification of smoking status was assessed by expired carbon monoxide (CO) analysis of breath samples collected using a CMD/CO Carbon Monoxide Monitor (Model 3110; Spirometrics, Inc.). In the present study, baseline CO was used to demonstrate convergent validity.

Fagerström Test for Cigarette Dependence (FTCD): The FTCD is a 6-item scale that assesses gradations in tobacco dependence (Fagerström, 2012; Heatherton et al., 1991). Scores range from 0–10, with higher scores reflecting high levels of physiological dependence on cigarettes. The FTCD 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). In the current study, the FTCD total score was used to characterize tobacco dependence across the sample (α = .58).

Anxiety Sensitivity Index (ASI): The ASI (Reiss & McNally, 1985) is a 16-item self-report measure of the sensitivity to and fear of the potential negative consequences of anxiety-related symptoms and sensations. Respondents are asked to indicate, on a 5-point Likert-type scale (0 = “very little” to 4 = “very much”), the degree to which they are concerned about these possible negative consequences. The ASI has sound psychometric properties and has good test-retest reliability and high levels of internal consistency (Brown, Kahler, Zvolensky, Lejuez, & Ramsey, 2001; Reiss & McNally, 1985). The ASI demonstrated excellent internal consistency in the present study (α = .91).

Mood and Anxiety Symptom Questionnaire-Short Form (MASQ): The MASQ (Clark & Watson, 1991) is a 62-item self-report measure of emotional symptoms based upon the tripartite model of anxiety and depression. Participants rate how much they experienced each symptom in the previous week (1 = not at all; 5 = extremely). The MASQ contains four symptom scales: (a) general distress-anxiety, which assesses anxious/tense mood and other nonspecific anxiety symptoms (11 items; e.g., “felt nervous,” “felt uneasy”); (b) anxious arousal, which assesses somatic tension and arousal (17 items; e.g., “was trembling or shaking,” “felt dizzy or lightheaded”) specific to anxiety; (c) general distress-depression, which assesses depressed/sad mood other non- specific depressive symptoms (12 items; e.g., “felt sad,” “felt like a failure”); and (d) anhedonic depression, which assesses low interest, pleasure, and positive affect (22 items; e.g., “felt like there wasn’t anything interesting or fun to do,” “felt like nothing was very enjoyable”), specific to depression. In the current study, the general distress-anxiety (α = .87), anxious arousal (α = .88), general distress-depression (α = .86) and anhedonic symptoms (α = .90) subscales were used.

Smoking Consequences Questionnaire (SCQ): The SCQ (Brandon & Baker, 1991) is a 50-item self-report measure that assesses tobacco use outcome expectancies believed to underlie smoking motivation on a Likert-type scale, ranging from 1 (*not true of me at all*) to 7 (*very true of me*). The measure consists of four key factors: Positive Reinforcement/ Sensory Satisfaction (PR; 15 items), Negative Reinforcement/Negative Affect Reduction (NR; 12 items), Negative Consequences (NC; 18 items), and Appetite-Weight Control (AW; 5 items).

Data Analytic Strategy—The four-factor SCQ structure was examined via confirmatory factor analysis (CFA) within a structural equation modeling framework (Brown, 2015). Analyses were conducted using Mplus 7.31(Muthén & Muthén, 2012). The distribution of SCQ items was outside the range of normal (skewness range: |0.05|–|2.45|; kurtosis range: |0.02|–|5.99|); therefore, maximum likelihood robust estimation was employed (Muthén & Muthén, 2012). Against considerable empirical evidence for correlations across factors (Brandon & Baker, 1991; Gonzalez et al., 2010; Gregor et al., 2008; Wetter et al., 1994), factors could correlate. Model fit was examined using the following criteria: root mean square error of approximation (RMSEA), with values less than .06 indicating excellent fit, values less than .08 indicating acceptable fit, and values above .10 suggesting poor fit; the Comparative Fit Index (CFI), with values between 0.95 and 1.00 indicating excellent fit and values between .90 and .94 indicating acceptable fit; and the standardized root mean square residual (SRMR), with values less than .08 indicating acceptable fit (Awang, 2012; Hu &

Bentler, 1999). Full information maximum likelihood was employed to handle missing data (Allison, 2012). At baseline, SCQ had the most missing data (4.1%–4.7%); missingness across other baseline variables ranged from 1.2% to 4.4%. Convergent and discriminant validity across the subscales was examined with anxiety sensitivity (ASI), mood and anxiety symptoms (MASQ-SF subscales), and expired CO at baseline. Based on prior research (Guillot, Zvolensky, & Leventhal, 2015; Leyro, Zvolensky, Vujanovic, & Bernstein, 2008; Pang, Khoddam, Guillot, & Leventhal, 2014; Wetter et al., 1994), ASI and mood and anxiety symptoms were hypothesized to positively and significantly relate to positive and negative smoking expectancy outcome subscales, whereas expired CO at baseline was hypothesized to relate only to positive-reinforcing properties associated with smoking outcome expectancies.

RESULTS AND DISCUSSION

Four-Factor Confirmatory Factor Analysis: The factor structure proposed by Brandon and Baker (1991) demonstrated poor model fit ($X^2[1169] = 4405.25$, $p < .001$; RMSEA = .09 [90% CI: .09, .10]; CFI = .69; SRMR = .14). Factor loadings were evaluated to determine item appropriateness. Inspection of standardized factor loadings indicated that several items loaded poorly on the NC and PR factors (see Table 1). For each of these factors, items that loaded strongly and those that loaded poorly appeared to form unique theoretical factors. To provide evidence for an alternative structure, an exploratory factor analysis (EFA) using all 50 items from the SCQ was employed.

Exploratory Factor Analysis: Results from a parallel analysis (Horn, 1965) with 1000 repetitions and an oblique rotation supported a six-factor structure. Standardized factor loadings were examined to evaluate item appropriateness, and number of item was used to evaluate strength and stability of factors. Criterion for an adequate loading ranges from .40 (Matsunaga, 2015) to .70 (Kline, 2015). For the current study, items with a significant factor loading of at least .50 were considered meaningful indicators of the underlying construct. Regarding strength and stability of factors, recommendations for best practices in exploratory factor analysis suggest that a factor with three or fewer items is generally weak and unstable (Costello & Osborne, 2005). Therefore, only factors with four or more items with significant loadings of at least .50 were retained. Based on this criterion, 35 items were retained that constituted five factors (see Table 2); one of the six factors supported by the parallel analysis had only one item that loaded at greater than .50 and therefore was not retained. The revised five-factor structure included the following subscales: (1) Long Term Negative Consequences [LT], (2) Immediate Negative Consequences [IC], (3) Sensory Satisfaction [SS], (4) the original NR, and (5) the original AW.

Construct Validity: LT was positively associated with anxiety sensitivity ($r = .14$, $p = .01$). IC was positively related to baseline measures of anxiety sensitivity ($r = .25$, $p < .001$), general distress related to anxiety ($r = .25$, $p < .001$), anxious arousal ($r = .30$, $p < .001$), general distress related to depression ($r = .20$, $p < .001$), and anhedonic symptoms ($r = .16$, $p = .004$). SS negatively related to anhedonic symptoms ($r = -.14$, $p = .02$) and expired CO ($r = -.10$, $p = .05$). The NR and AW factors were both positively correlated with anxiety

sensitivity (r = .36, p < .001 and r = .21, p = .001, respectively), general distress related to anxiety (r = .24, p < .001 and r = .14, p = .01, respectively), anxious arousal (r = .24, p < .001 and r = .20, p < .001, respectively), and anhedonic symptoms (r = .12, p = .04 and r = .11, p = .04, respectively). Additionally, NR was positively correlated with general distress related to depression (r = .17, p = .001).

Discussion: Findings failed to provide evidence for the proposed four-factor SCQ solution using the original 50-items. Instead, the current data supported a novel, truncated five-factor solution consisting of 35-items. The observed associations across the proposed five factors and constructs believed to interfere with quit success and maintain smoking provides initial evidence for the construct validity of these factors. Importantly, results indicated unique factor- affective/mood construct associations. For example, all factors, except SS, positively related to anxiety sensitivity. These associations ranged from small to moderate. Further, the IC and NR subscales were positively associated with all affective constructs, and AW as positively associated with all except general distress related to depression; relations ranged from small to moderate in effect. SS was the only construct related to an index of smoking behavior. Thus, the differential pattern and strength of associations provide initial evidence for the uniqueness of the factors. Yet, considering that measurement invariance across sex was not tested prior to evaluating the construct validity of the newly proposed structure, findings should be interpreted with caution. Indeed, it is only after measurement invariance has been demonstrated that the current findings can be considered an unbiased, true reflection of the observed associations.

To provide further evidence for the five-factor SCQ structure using 35-items, address the limitations of the current study (i.e., lack of tests for measurement invariance), and more compressively evaluate the construct validity of these factors, Study 2 was conducted. Based on current findings, all SCQ factors, except SS, were hypothesized to positively relate to anxiety sensitivity, negative affectivity, smoking specific experiential avoidance, and tobacco dependence. The IC, NR, and AW were hypothesized to positively relate to dysphoria, panic, and social anxiety; whereas LT and SS were expected to be unrelated to these variables. Lastly, positive smoking expectancy outcome (i.e., SS, NR and AW) subscales were hypothesized to negatively relate to positive affect and well-being; negative smoking expectancies (i.e., LT and IC) were expected to be unrelated to positive affectivity and well-being. Prior research informed the selection of variables used to evaluate convergent and discriminant validity (Guillot et al., 2015; Leventhal, Zvolensky, & Schmidt, 2011; Leyro et al., 2008).

Study 2

Participants—A sample of 582 treatment-seeking adult smokers who responded to study advertisements (e.g., flyers, newspaper ads, radio announcements; 48.2% female; M_{age} = 36.9; SD = 13.5) were included in the current study. Exclusion criteria included suicidality and psychosis. The racial/ethnic distribution of this sample was as follows: 82.9% White/Caucasian; 9.8% Black/Non-Hispanic; 0.9% Black/Hispanic; 2.6% Hispanic; 1.0% Asian; and 2.8% ‘Other.’At least one current (past year) Axis I diagnosis was endorsed by 54.8% of the sample, most commonly social anxiety disorder (10.1%), generalized anxiety disorder

(5.4%), current major depressive episode (4.7%), and posttraumatic stress disorder (3.0%). On average, participants reported smoking 16.7 cigarettes per day (*SD* = 10.0), had been a daily smoker for 18.6 years (*SD* = 13.4), and had an average expired carbon monoxide level of 19.4 parts per million (*SD* = 12.3). A moderate level of tobacco dependence was observed within the sample based on the FTCD (M= 5.2, SD= 2.3; Heatherton et al., 1991).

Procedures—Data for the present study was collected during a large, multi-site randomized controlled clinical trial examining the efficacy of two smoking cessation interventions described in detail elsewhere (Schmidt, Raines, Allan, & Zvolensky, 2016). Interested persons responding to community-based advertisements (e.g., flyers, newspaper ads, radio announcements) contacted the research team and were provided with a detailed description of the study via phone. Participants were then screened for initial eligibility, and if eligible, scheduled for an appointment. Inclusion criteria included: (a) being between ages 18–65, (b) reporting smoking 8 or more cigarettes per day, and (c) reporting motivation to quit rated as at least 5 or higher on a 10-point scale. Exclusion criteria included: (a) current suicidal ideation requiring immediate intervention or (a) active psychosis. After providing written informed consent, participants were interviewed using the SCID-I/NP and completed a computerized self-report assessment battery as well as biochemical verification of smoking status. After completing the baseline assessment, participants were informed of their eligibility. For the current study, baseline data was included from all participants regardless of eligibility for the larger trial. Participants eligible for the larger trial were randomized to one of two treatment conditions. Each treatment was delivered across four intervention sessions with session four being quit day.

The current study is based on secondary analyses of baseline and quit day data from the larger trial. Of the 582 participants who provided data on the variables of interest at baseline, 486 were randomized to treatment. Of those randomized, 262 provided quit day data. Inclusion of participants regardless of eligibility for the larger trial is consistent with past psychometric work conducted in the context of a smoking cessation trial (see Farris, DiBello, et al., 2015). All study procedures were approved by the Institutional Review Boards.

Measures

Demographics Questionnaire: Demographic information collected included sex, age, and race. Items from this measure were used to describe the sample.

Carbon Monoxide: Biochemical verification of smoking status was assessed by expired carbon monoxide (CO) analysis of breath samples collected using a CMD/CO Carbon Monoxide Monitor (Model 3110; Spirometrics, Inc.). In the present study, baseline CO was used to describe the sample and to demonstrate convergent validity. CO collected at quit day was used to classify quitters (e.g., nonsmokers) and non-quitters (e.g., smokers). A cut-off of 4 ppm has demonstrated excellent properties at distinguishing smokers from nonsmokers (Perkins et al., 2013).

Smoking History Questionnaire (SHQ): The SHQ is used to assess smoking rate, years of daily smoking, and other characteristics (Brown, Lejuez, Kahler, & Strong, 2002). Smoking rate was obtained from the question, “Since you started regular daily smoking, what is the average number of cigarettes you smoked per day?” Furthermore, years as a daily smoker was assessed by the question, “For how many years, altogether, have you been a regular daily smoker?”.

Fagerström Test for Cigarette Dependence (FTCD): Please see description above. In the current study, the FTCD total score was used to characterize tobacco dependence (α = .65). FTCD was used to describe the sample and to demonstrate convergent validity.

Structured Clinical Interview-Non-Patient Version for DSM-IV (SCID-I/NP): Diagnostic assessments of past year Axis I psychopathology was conducted using the SCID-I/NP (First, Spitzer, Gibbon, & Williams, 1994). All SCID-I/NP interviews 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 was checked (MJZ) for accuracy; there were no cases of disagreement. Data from the SCID-I/NP was used to describe psychopathology among the sample.

Anxiety Sensitivity Index-3 (ASI-3): The ASI-3 is an 18-item self-report measure of the sensitivity to and fear of the potential negative consequences of anxiety-related symptoms and sensations. Respondents are asked to indicate, on a 5-point Likert-type scale (0 = “very little” to 4 = “very much”), the degree to which they are concerned about these possible negative consequences. The ASI-3, derived in part from the original ASI (Reiss & McNally, 1985), has sound psychometric properties, including excellent internal consistency, predictive validity, and reliability among smokers (Farris, DiBello, et al., 2015). In the present study, we utilized the total ASI-3 score (α = .93).

Positive and Negative Affect Schedule (PANAS): The PANAS (Watson, Clark, & Tellegen, 1988) measured the extent to which participants experienced 20 different feelings and emotions on a scale ranging from 1 (*Very slightly or not at all*) to 5 (*Extremely*). The measure yields two factors, negative affect (NA) and positive affect (PA), and has strong documented psychometric properties (Watson et al., 1988). Both factors were utilized in the current study (NA α = .92; PA α = .90).

Smoking-specific Avoidance and Inflexibility Scale (AIS): The AIS assessed avoidance and inflexibility related to smoking (Gifford & Lillis, 2009). Participants responded to 13-items according to a Likert-type scale ranging from 1 (*Not at all*) to 5 (*Very much*). Items included “How likely is it that these feelings will lead you to smoke?” and “To what degree must you reduce how often you have these thoughts in order not to smoke.” The AIS has demonstrated good internal consistency (Gifford & Lillis, 2009). Higher scores represent more smoking-based avoidance or inflexibility in the presence of uncomfortable or difficult sensations or thoughts, whereas lower scores suggest more ability to accept difficult feelings or thoughts without allowing them to trigger smoking. Past work has found good convergent and predictive validity of the AIS for smoking processes (Farris, Zvolensky, DiBello, et al.,

2015; Zvolensky, Farris, Schmidt, & Smits, 2014). In the present study, we utilized the total AIS score (α = .93).

Inventory of Depression and Anxiety Symptoms (IDAS): The IDAS (Watson et al., 2007) is a 64-item self-report instrument that assesses distinct affect symptom dimensions within the past two weeks. Items are answered on a 5-point Likert scale ranging from "not at all" to "extremely." The IDAS subscales show strong internal consistency, convergent and discriminant validity with psychiatric diagnoses and self-report measures; and short-term retest reliability (r = 0.79) with both community and psychiatric patient samples (Buckner et al., 2015; Capron, Allan, Norr, Zvolensky, & Schmidt, 2014; Leventhal et al., 2011; Watson et al., 2007). In the present study, we employed the well-being subscale (8 items; α = .91), dysphoria (9 items; α = .91), panic (8 items; α = .88), and social anxiety (5 items; α = .87).

Minnesota Nicotine Withdrawal Scale (MNWS): The Minnesota Nicotine Withdrawal Scale (Hughes & Hatsukami, 1986) is an 8-item measure of nicotine withdrawal symptoms, which are rated on a 4-point Likert-type scale, ranging from 0 = *Not present* to 3 = *Severe* (e.g., insomnia, irritability/frustration, difficulty concentrating, and restlessness). The MNWS was administered on quit-day (α = .83).

Smoking Consequences Questionnaire (SCQ): Please see description above. For the current study, response options ranged from 0 (*completely unlikely*) to 9 (*completely likely*).

Data Analytic Strategy—To corroborate findings from Study 1, the novel, truncated five-factor SCQ structure was examined with a CFA using the identified 35-items (i.e., LT [7 items], IC [7 items], SS [4 items], NR [12 items], AW [5 items]; Brown, 2015). Analyses were conducted using Mplus 7.31 (Muthén & Muthén, 2012). The distribution of select SCQ items was determined to be outside the range of normal (skewness range: |0.04|–|3.82|; kurtosis range: |0.10|–|18.57|); therefore, maximum likelihood robust estimation was used (Muthén & Muthén, 2012). Factors were allowed to correlate; however, a higher-order factor structure was deemed inappropriate given theoretical and conceptual support for the uniqueness of the different facets of the substance use expectancies (Brandon & Baker, 1991). Model fit and model comparison was examined using the same criteria as outlined for Study 1. Full information maximum likelihood was employed to handle missing data (Allison, 2012). At baseline, SCQ had the most missing data (12.7%) followed by FTND (12.5%); missingness across other baseline variables ranged from <1% to 12.2%.

Measurement invariance (Meredith, 1993) was assessed across sex and time from baseline to quit-week with the best fitting model. Specifically, configural, metric, and scalar invariance were assessed by constraining parameters and comparing nested models. Configural invariance assesses for similar factor-indicator patterns across sex. Metric invariance assesses for consistency in the strength of the association between items and factors across groups. Scalar invariance assesses for consistency in item means. CFI change of less than 0.010 and RMSEA change of less than 0.015 (Chen, 2007) provide statistical evidence for invariance between the less and more constrained model.

Factor determinacy coefficients were estimated as a measure of factor internal consistency, with values ranging from 0 to 1 and larger values indicating better measurement of the factor by the observed items. A factor determinacy coefficient of≥0.80 suggests strong correlation among items with their respective factor denoting high internal consistency (Gorsuch, 1983). Consistent with prior work (Barbaranelli, Lee, Vellone, & Riegel, 2014; Tabachnick, Fidell, & Osterlind, 2001), a factor determinacy coefficient of .70 indicated adequate reliability.

A series of zero-order correlations between baseline variables were conducted to demonstrate convergent and discriminant validity. Variables to evaluate convergent and discriminant validity included anxiety sensitivity, negative affectivity, smoking specific experiential avoidance, expired baseline CO, tobacco dependence, positive affect, well-being, dysphoria, panic, and social anxiety. Lastly, a path model was conducted to assess the predictive validity of the SCQ factors at baseline on withdrawal symptoms reported at quit week. Consistent with past work (Wetter et al., 1994), only those who met abstinence criteria were included in analyses (n = 76). Covariates included sex, tobacco dependence, presence of an Axis I disorder, and treatment condition.

RESULTS

Confirmatory Factor Analysis: The five-factor, 35-item SCQ structure identified in Study 1 provided acceptable fit for the data ($X^2[550] = 1393.95$, $p < .001$; RMSEA = .06 [90% CI: .05, .06]; CFI = .89; SRMR = .06). Thus, this model was employed in all subsequent analyses (see Table 3).

Attrition Analyses: Participants who provided quit day data for variables of interest ($n = 262$) and those who did not ($n = 320$) significantly differed in terms of sex ($X^2[1] = 5.66$, $p = .02$). Specifically, more men did not provide quit day data ($n = 179$) compared to women ($n = 139$). Participants who did not provide quit day data were significantly younger than those who did ($M = 34.86$; $SD = 12.77$ versus $M = 39.37$; $SD = 13.90$; $t[577] = 4.07$, $p < .001$). Participants who did not provide quit day data reported being a regular, daily smoker for significantly fewer years than those who provided quit day data ($M = 16.37$; $SD = 12.48$ versus $M = 21.02$; $SD = 13.83$; $t[510] = 4.00$, $p < .001$). Moreover, participants who did not provide quit day data reported significantly greater negative affectivity ($M = 20.20$; $SD = 8.04$ versus $M = 18.07$; $SD = 6.68$, respectively) and anxiety sensitivity ($M = 17.10$, $SD = 13.55$ versus $M = 13.87$; $SD = 11.70$) at baseline relative to participants who provided quit day data (PANAS-NA: $t[567] = -3.40$, $p = .001$; ASI-3: $t[576] = -3.04$, $p = .003$).

Measurement Invariance: The five-factor structure demonstrated configural invariance across sex ($X^2[1100] = 2323.56$, $p < .001$; RMSEA = .07 [90% CI: .06, .07]; CFI = .86; SRMR = .07). Results provided evidence for metric and scalar invariance for the five-factor structure across sex (see Table 3). Regarding configural invariance from baseline to quit-week, the five-factor structure demonstrated acceptable fit ($X^2[2265] = 4197.05$, $p < .001$; RMSEA = .04 [90% CI: .04, .04]; CFI = .88; SRMR = .06), as well as metric and scalar invariance (see Table 4).

Construct Validity: Internal consistency of the five factors at baseline was excellent across all factors (LT = .96; IC = .90; SS = .97; NR = .97, AW = .96). Table 5 presents results from tests of convergent and discriminant validity using scales from the SCQ and measures of interest. LT was positively associated with smoking-specific experiential avoidance, expired CO at baseline, and positive affectivity. IC was positively related to baseline measure of anxiety sensitivity, negative affectivity, smoking-specific experiential avoidance, expired CO, tobacco dependence, dysphoria, panic, and social anxiety. SS positively related to smoking-specific experiential avoidance and tobacco dependence. The NR and AW were both positively correlated with anxiety sensitivity, negative affect, smoking-specific experiential avoidance, tobacco dependence, dysphoria, and social anxiety, and negatively correlated with positive affectivity and well-being. The path model wherein withdrawal severity at quit week was regressed on the five SCQ factors and covariates accounted for significant variance in the outcome (R^2 = 18.5%, p = .02). Only NR at baseline predicted withdrawal severity at quit day (b = 0.64, SE = 0.31, p = .04).

GENERAL DISCUSSION

The current study evaluated the structure and psychometric properties of the SCQ in two independent samples of smokers. Findings suggested poor fit for the assumed four-factor structure and acceptable fit for a novel, truncated five-factor structure. The five-factor SCQ structure demonstrated stability across sex and from baseline to quit day as well as excellent internal consistency at baseline. Lastly, low to moderate factor correlations and unique predictive validity provided preliminary evidence that the five factors represented distinct, yet related, dimensions of smoking expectancies in a sample of treatment seeking smokers.

Despite previous evidence for a four-factor SCQ structure (Brandon & Baker, 1991; Wetter et al., 1994), the current study provides more convincing empirical support for a five-factor SCQ structure across two independent samples. Although this is the first investigation to isolate potential confounds that contribute to the poor fitting SCQ four-factor structure, it is noteworthy that another research group was unable to validate the four-factor structure in a sample of Latino smokers (Vidrine et al., 2009). The observed misfit of the four-factor structure across multiple studies may be a direct artifact of the original scale validation. Specifically, Brandon and Baker (1991) utilized scores that considered subjective expected utility scores (i.e., the cross-product of desirability and likelihood scores) to derive the original structure; yet, the SCQ is most commonly assessed with a single rating of likelihood on a Likert scale, as presented in Study 1 & 2. Moreover, Wetter et al. (1994) utilized parcels when they examined the four-factor structure in a CFA. The use of parcels over item-level data often results in improved model fit (Bandalos, 2002) and carries untested assumptions of unidimensionality among items within parcels, which can result in inflated model fit (Kline, 2015). In this case, improved model fit may have contributed to early conclusion that the SCQ is best modeled by a four-factor structure. Thus, the observed structural differences between past and present SCQ models illustrate that, as one explanation, assessment alterations and/or utilizing non-item-level data may have contributed to model misspecification.

Of the original 50 SCQ items, 35 items met cutoff recommendations to be included in the five-factor structure (See Costello & Osborne, 2005; Matsunaga, 2015). Therefore, 15 items were discarded. The discarded items, which included, for example, “The longer I smoke, the harder it will be to quit” and “I like to watch the smoke from my cigarette,” may be indicative of substantive cultural shift in how ‘today’s’ smokers perceive and report expectancies (Chassin, Presson, Sherman, & Kim, 2003). To illustrate, whereas the rate of smoking has decreased significantly since the initial development of the SCQ, current smoking among adults with some form of psychiatric distress or disorders has remained relatively stable (Control & Prevention, 2013). As such, current smokers may suffer from more global distress relative to smokers from the early 1990’s. The unique characteristics of ‘today’s’ smokers may have influenced item-factor relations and possibly contributed to the five-factor structure. Moreover, other factors, such as social/cultural awareness or individual smoking histories, may have contributed to the complexity of the currently proposed structure. Based on present results, future work using the SCQ should score the measure according to the five-factor structure using 35 of the original 50 SCQ items.

Factors that comprise the proposed five-factor structure are unique from and similar to the original factors in several fundamental ways. First, the original negative consequences factor assessed both immediate and long-term negative consequences of smoking. Underlying this factor construction is an assumption that negative consequence with differential time development tapped into the same unidimensional construct. Yet, research suggests that immediate and long-term negative consequences of smoking may be related, but unique, constructs that provide differential insight into smoking behavior and beliefs about the addictiveness of cigarettes (Slovic, 2000; Smith & Stutts, 2003). Consistent with this perspective, the newly proposed immediate (IC) and long-term negative consequences (LT) factors tap into multiple dimensions of smoking-related negative consequences which is overlooked when time-dependent negative consequences are culled into one factor.

Second, the originally proposed positive reinforcement/sensory satisfaction factor evaluated one’s expectancies for positive reinforcement properties of smoking as well as positive influences to the senses. Treating these two, seemingly unique, dimensions of smoking as a unidimensional construct is discordant with recent theoretical and empirical data that suggest that positive reinforcement aspects of smoking and taste/sensory properties are disparate facets of cognitive aspects of smoking (Piper et al., 2004). The proposed factor (i.e., SS), however, corroborates extant work implicating sensory satisfaction properties of smoking as unique dimensions of smoking expectancies. In addition, current findings did not support a unique factor to capture positive reinforcement smoking expectancies. The overlap in item content between items assumed to tap into positive reinforcement properties of smoking and negative reinforcement properties of smoking (i.e., NR subscale) may have contributed to this finding; thus, there may have been a concern of singularity had both subscales been preserved.

Third, the negative reinforcement and appetite-weight control factors are consistent across the original and newly proposed factor structures. Indeed, these factors demonstrated strong item-factor relations across all confirmatory factor analyses. Based on this empirical data as well as a concerted effort by the researchers to preserve continuity between the proposed

SCQ factor structure and the original SCQ structure as theoretically and empirically supported, these factors were modeled as proposed by Brandon and Baker (1991). As a result, factor means for the negative reinforcement and appetite-weight control factors from the current study can be reliably compared to extant work with these factors.

Although the currently proposed newly specified factors warrant further validation, these factors have clear theoretical and clinical implications. Theoretically, smoking expectancies are conceptualized as a complex network of interrelated, yet distinct facets that may be limited by a four-factor structure (Copeland et al., 1995). The current structure addresses this limitation by expanding the structure of the SCQ to include additional theoretically-relevant facets of smoking outcome expectancies. In addition, each of the newly proposed factors taps into a more uniform, specific aspect of smoking expectancies relative to the originally proposed factors, as detailed above. This finding provides an improved opportunity for clinical symptom specificity and refined treatment planning. For example, the refined factors may provide slightly more nuanced insight into how specific expectancies relate to other smoking constructs and interfere with quit behavior.

The five-factor structure demonstrated full measurement invariance across sex and between baseline and quit day. These findings carry important interpretations and implications. First, the five-factor SCQ measure is similar in structure across sex and over time (e.g., the same factor-indicator pattern); therefore, the SCQ is conceptualized similarly across men and women, as well as if it is assessed at baseline or at quit-day following a smoking cessation treatment. Second, the strengths of the relations between each indicator and its associated factor is equal across sex and over time (e.g., the factor loading for each item did not significantly differ across sex or time); thus, men and women and participants at a baseline and quit-day assessment respond to the SCQ items in the same way. More specifically, scores on items can be compared across groups. Third, item means are equivalent across sex and over time (e.g., the item intercepts did not differ). This finding provides evidence that observed scores are related to latent scores; specifically, that participants with the same score on the latent construct have the same score on the observed items that constitute the latent construct. Conceptually, these findings provide strong empirical evidence to examine mean differences across sex and over time for each of the five proposed SCQ factors (Meredith, 1993). It is important to highlight that because the negative reinforcement and appetite-weight control factors were modeled in accordance with prior work, current findings can be extended to serve as initial evidence that reported differences in these factors across sex or over time are a result of true differences in the construct.

Beyond evidence for the stability of the five-factor structure, observed associations between the five SCQ factors and affective and smoking processes as well as indices of smoking behavior provide evidence of construct validity. All factors, except LT and SS, positively correlated with constructs known to be related to processes and psychopathological symptoms that maintain and impede quit success (Farris, Zvolensky, & Schmidt, 2015; Johnson, Stewart, Rosenfield, Steeves, & Zvolensky, 2012; Lasser et al., 2000; Leventhal et al., 2013). The observed association ranged from small to large in effect size. The LT and SS were positively associated with smoking-specific experiential avoidance with a medium and small effect size, respectively, but unrelated to anxiety sensitivity and negative affectivity.

The specificity introduced with the newly constructed LT and SS factors may have contributed to their relation with a smoking-specific construct (i.e., smoking-specific experiential avoidance), and the lack of an association with more general measures of overall distress (i.e., anxiety sensitivity and negative affectivity). Second, the two consequences factors (LT and IC) positively related to baseline levels of expired carbon monoxide; both effect sizes were in the small range. Additionally, all factors, except LT, were positively correlated with tobacco dependence. The effect sizes were in the small to medium range. Thus, each factor related to some aspect of smoking severity. Third, all SCQ factors, except LT, were negatively correlated with or unrelated to constructs theorized to promote smoking cessation success (Barros, Kozasa, Formagini, Pereira, & Ronzani, 2015; Piper, Kenford, Fiore, & Baker, 2012). Unique to the LT, a positive, small/medium sized association emerged between this factor and positive affect. Importantly, although observed relations were identical across factors, the magnitude of these associations varied as discussed above. Thus, while the factors may relate to similar constructs, the strength of their associations identifies the unique contribution of each. Moreover, slightly different observations were observed regarding the LT and SS factors, providing evidence for the additional uniqueness of these factors. Together, findings provide initial evidence that general affective processes and smoking-specific processes share unique variance with each of the five SCQ factors.

The NR factor emerged as the only SCQ factor to significantly predict withdrawal severity. This finding is, in part, consistent with extant work (Langdon & Leventhal, 2014; Wetter et al., 1994). Despite the non-significant association between the other SCQ factors and withdrawal severity at quit week, the positive relation between NR and withdrawal severity at quit week provides further evidence for construct validity and the clinical utility of the NR subscale. Given the robust association between drug use to avoid or escape negative mood or affective states, such as withdrawal symptoms, and cessation (see Baker, Piper, McCarthy, Majeskie, & Fiore, 2004), elucidating pre-treatment predictors of withdrawal severity provides important information that has the potential to impact treatment development and could be used to help clinicians identify treatment seeking smokers who may be at greater risk for increased withdrawal severity and subsequently quit failure.

Clinically, the psychometric properties demonstrated by the SCQ suggest that it may be advisable for clinicians to administer a modified version of the SCQ to inform treatment and track smoking expectancies, particularly for smokers interested in or attempting to quit. Given that the proposed SCQ taps into a wider array of smoking outcome expectancies, clinicians may be able to isolate specific expectancies that may interfere with quitting with greater specificity. This approach would allow for a more individualized treatment plan that may promote greater quit success. Additionally, because both the original SCQ and presently proposed SCQ were developed among samples that parallel typical smoking behaviors among smokers today, there may be greater utility in administering the current modified measure over alternative forms of the SCQ.

There are several study limitations. First, the sample size and estimated parameters ratio across both studies may have impacted findings. Prior work suggests participant to parameter-estimated ratio of 20:1 (Kline, 2015), which was not met in either of the current studies. Importantly, results indicated interpretable, reliable estimates; yet, considering the

number of parameters required to be estimated for the SCQ, future work may benefit from employing a Monte Carlo sample size estimation technique (Wolf, Harrington, Clark, & Miller, 2013) to inform appropriate sample size for 'next stage' evaluations of the SCQ. Second, consistent with extant work (Pang, Zvolensky, Schmidt, & Leventhal, 2014), both studies utilized a Likert response option scale for the SCQ that tapped into likelihood. However, the two studies differed in response anchors, such that Study 1 queried on how true the statement was for the respondent and Study 2 queried on how likely the statement was for the respondent. Along similar lines, factors could correlate in the current study, which is a deviation from the original testing of this measure considering that an orthogonal rotation was employed (Brandon & Baker, 1991). Yet, this is consistent with theoretical and recent analytic approaches used to evaluate smoking outcome measures (Lewis-Esquerre et al., 2005). Nevertheless, these are important considerations for future work that may attempt to cross-validate or extent the present findings in an independent sample of smokers. Third, the current study did not test the SCQ across ethnoracial factors. This limitation was due, in part, to an artifact of the sample size in Study 1 and limited diversity in Study 2. Thus, future research would benefit from employing strategic recruitment efforts to enroll a larger sample of ethnically/racially diverse smokers and evaluate the psychometric properties of the SCQ across ethnoracial factors. Fourth, as reviewed, several other factor structures for the SCQ have been developed. Unfortunately, different items included in the four-factor structure relative to alternative structures did not permit examination of previously proposed alternative model structures. Although each of the distinct SCQ measures have added uniquely to our understanding of the impact of smoking outcome expectancies on smoking behavior (for example: Gwaltney et al., 2005; Zvolensky et al. (2004), to allow for a more direct comparison of smoking outcome expectancies across studies, future research may benefit from evaluating the original SCQ, SCQ-Adult, Adolescent-SCQ, S-SCQ, Brief SCQ-Adult, and SCQ-Spanish, and the currently proposed novel, truncated scale, as well as other potential models including a hierarchical model, in a single study. Such work would permit a direct evaluation of the commonality in structure and may facilitate a more definitive consensus on the most appropriate measure/structure to evaluate smoking outcome expectancies. Finally, as the 35 items retained were not evaluated independently of the 50-items, additional work is needed to validate the proposed structure with a measure that only included the selected 35 items.

Findings from the current study offer a unique and necessary contribution to the smoking literature considering that the SCQ has been in circulation for more than 20 years and its use in clinical research settings is still ongoing alongside modified/revised version of the SCQ, including the SCQ-Adult (Brandon & Baker, 1991; Copeland et al., 1995). Indeed, work using this measure has contributed extensively to the current understanding of the role of smoking outcome expectancies in smoking maintenance and quit processes. Nevertheless, sociocultural shifts in society, specifically within the smoking community as well as in the broader population (Burns, 2014), may have contributed to changes in the structure and necessity of all original 50 items. Yet, prior to the present study, the construct validity argument for the SCQ-50 item measure has been relatively stagnate and may, potentially, be antiquated to the point of making the original measure arguably obsolete. To a degree, this is substantiated by the various versions of the SCQ that have been proposed since the

development of the original scale as well as the currently proposed novel, truncated scale. The currently proposed scale offers a revitalized and novel analysis of this influential and widely used measure as well as a strong bridge to connect current, past, and future research;, particularly because two of the originally proposed scales are retained in their original form (i.e., NR and AW; Brandon & Baker, 1991). It is important to note, however, that the extant literature on smoking expectancies could benefit from further work devoted to evaluating and recommending a single measure of this construct to permit greater continuity across studies. The current findings provide a centrally important empirical road to stimulate such research in a more focused and timely manner.

Overall, the present findings provide initial evidence for a novel, truncated five-factor model structure of the SCQ that may prove helpful for elucidating individual, social, and contextual factors that are related to smoking behavior. As such, collective evidence from the current report proposes that future research utilize a 35-item SCQ measure with a scoring algorithm that models five unique factors (see Table 2 for factor items). Furthermore, these recommendations are derived from current findings that the five-factor SCQ structure demonstrated measurement invariance across sex and time, and the observation that each factor had excellent internal consistency. Current findings also highlight that the five SCQ factors are theoretically relevant facets of smoking expectancies that uniquely relate to processes posited to interfere with quitting or promote more problematic use. Together, the five-factor SCQ structure evinced properties that suggest it is a stable construct that assesses multiple domains of smoking outcome expectancies and is related to several affective and smoking processes the may interfere with smoking maintenance and relapse.

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Public Significance Statements

The present study provides initial evidence for the construct validity of a shorter, multifaceted Smoking Consequences Questionnaire. This briefer measure that taps into more specific smoking outcome expectancies may be easier to administer and score in clinical and research settings, and will assist clinicians in developing more accurate personalized treatment plans for smokers.

Table 1

Standardized factor loadings from confirmatory factor analysis in Study 1.

Item	Loading	Item	Loading
Factor 1: Negative Consequences		**Factor 2: Positive Reinforcement Cont.**	
Smoking is taking years off my life.	0.71	Cigarettes are good for dealing with boredom.	0.34
I will probably die earlier if I continue to smoke.	0.70	I like to watch the smoke from my cigarette.	0.34
Each cigarette I smoke maintains my addiction.	0.67	I feel more at ease with other people if I have a cigarette.	0.32
I become more addicted the more I smoke.	0.67	Smoking temporarily reduces those repeated urges for cigarettes.	0.25
I will become more dependent on nicotine if I continue smoking.	0.65	If I'm feeling irritable, a smoke will help me relax.	0.24
The more I smoke, the more I risk my health.	0.64	If I have nothing to do, a smoke can help kill time.	0.24
Smoking is hazardous to my health.	0.63	Cigarettes give me something to do with my hands.	0.16
By smoking I risk heart disease and lung cancer.	0.62	**Factor 3: Negative Reinforcement**	
Cigarettes control me more and more, the longer I smoke.	0.62	Cigarettes help me deal with anger.	0.88
Smoking makes me seem less attractive.	0.59	Smoking reduces my anger.	0.87
Smoking will make me cough.	0.59	Cigarettes help me deal with anxiety or worry.	0.87
Smoking irritates my mouth and throat.	0.59	Cigarettes help me reduce or handle tension.	0.86
My mouth tastes bad after smoking.	0.57	When I'm upset with someone, a cigarette helps me cope.	0.86
Cigarettes make my lungs hurt.	0.57	If I'm tense, a cigarette helps me to relax.	0.81
I look ridiculous while smoking.	0.55	When I'm angry, a cigarette can calm me down.	0.80
People think less of me if they see me smoking.	0.53	Smoking calms me down when I feel nervous.	0.79
The longer I smoke, the harder it will be to quit.	0.52	Smoking helps me deal with depression.	0.78
My throat burns after smoking.	0.49	If I'm disappointed in myself, a good smoke can help.	0.77
Factor 2: Positive Reinforcement		When I am sad, smoking makes me feel better.	0.74
When I smoke, the taste is pleasant.	0.92	Cigarettes help me concentrate.	0.65
I will enjoy the flavor of a cigarette.	0.90	**Factor 4: Appetite/Weight Control**	
Cigarettes taste good.	0.85	Cigarettes keep me from eating more than I should.	0.94
I enjoy the taste sensations while smoking.	0.83	Smoking controls my appetite.	0.93
I enjoy feeling the smoke hit my mouth and the back of my throat.	0.57	Cigarettes keep me from overeating.	0.92
I will enjoy feeling a cigarette on my tongue and lips.	0.57	Smoking keeps my weight down.	0.91
I really enjoy a cigarette when I'm relaxed and feeling good.	0.52	Smoking helps me control my weight.	0.86
I enjoy parties more when I am smoking.	0.35		

Table 2

Standardized factor loadings from exploratory factor analysis in Study 1.

Item	Loading	Item	Loading
Factor 1: Long Term Negative Consequences		**Factor 4: Negative Reinforcement**	
By smoking I risk heart disease and lung cancer.	0.87	Cigarettes help me deal with anger.	0.95
Smoking is hazardous to my health.	0.87	Smoking reduces my anger.	0.93
The more I smoke, the more I risk my health.	0.79	When I'm upset with someone, a cigarette helps me cope.	0.85
Smoking is taking years off my life.	0.60	Cigarettes help me deal with anxiety or worry.	0.81
Each cigarette I smoke maintains my addiction.	0.58	Cigarettes help me reduce or handle tension.	0.81
I will become more dependent on nicotine if I continue smoking.	0.54	When I'm angry, a cigarette can calm me down.	0.79
I will probably die earlier if I continue to smoke.	0.53	Smoking helps me deal with depression.	0.77
Factor 2: Immediate Negative Consequences		If I am disappointed in myself, a good smoke can help.	0.70
Cigarettes make my lungs hurt.	0.79	If I'm tense a cigarette helps me to relax.	0.67
Smoking irritates my mouth and throat.	0.79	Smoking calms me down when I feel nervous.	0.67
My throat burns after smoking.	0.76	When I am sad, smoking makes me feel better.	0.65
Smoking will make me cough.	0.64	Cigarettes help me concentrate.	0.51
I look ridiculous while smoking.	0.61	**Factor 5: Appetite-Weight Control**	
People think less of me if they see me smoking.	0.58	Cigarettes keep me from eating more than I should.	0.94
Smoking makes me seem less attractive.	0.52	Smoking controls my appetite.	0.92
Factor 3: Sensory Satisfaction		Smoking keeps my weight down.	0.91
When I smoke, the taste is pleasant.	0.95	Cigarettes keep me from overeating.	0.90
I will enjoy the flavor of a cigarette.	0.89	Smoking helps me control my weight.	0.84
Cigarettes taste good.	0.84		
I enjoy the taste sensations while smoking.	0.83		

Table 3

Standardized factor loadings from confirmatory factor analysis in Study 2.

Item	Loading	Item	Loading
Factor 1: Long Term Negative Consequences		**Factor 4: Negative Reinforcement**	
The more I smoke, the more I risk my health.	0.83	When I'm upset with someone, a cigarette helps me cope.	0.80
Smoking is hazardous to my health.	0.83	Cigarettes help me deal with anger.	0.80
Each cigarette I smoke maintains my addiction.	0.79	Cigarettes help me deal with anxiety or worry.	0.79
By smoking I risk heart disease and lung cancer.	0.77	Cigarettes help me reduce or handle tension.	0.79
Smoking is taking years off my life.	0.75	When I'm angry, a cigarette can calm me down.	0.78
I will probably die earlier if I continue to smoke.	0.68	Smoking calms me down when I feel nervous.	0.78
I will become more dependent on nicotine if I continue smoking.	0.63	When I am sad, smoking makes me feel better.	0.77
Factor 2: Immediate Negative Consequences		Smoking reduces my anger.	0.72
Smoking irritates my mouth and throat.	0.66	If I'm tense, a cigarette helps me relax.	0.72
Cigarettes make my lungs hurt.	0.62	If I'm disappointed in myself, a good smoke can help.	0.71
Smoking will make me cough.	0.60	Cigarettes help me concentrate.	0.65
I look ridiculous while smoking.	0.56	Smoking helps me deal with depression.	0.64
Smoking makes me seem less attractive.	0.56	**Factor 5: Appetite-Weight Control**	
People think less of me if they see me smoking.	0.55	Cigarettes keep me from eating more than I should.	0.86
My throat burns after smoking.	0.52	Smoking keeps my weight down.	0.85
Factor 3: Sensory Satisfaction		Smoking helps me control my weight.	0.84
When I smoke, the taste is pleasant.	0.93	Cigarettes keep me from overeating.	0.82
I will enjoy the flavor of a cigarette.	0.89	Smoking controls my appetite.	0.71
I enjoy the taste sensations while smoking.	0.85		
Cigarettes taste good.	0.80		

Table 4

Measurement invariance of the six-factor SCQ model across sex and over time.

Models	χ^2	*df*	CFI	RMSEA	SRMR	ΔCFI	ΔRMSEA
Across Sex							
1. Configural	2323.56	1100	.86	.07	.07	--	--
2. Metric	2343.06	1130	.86	.07	.08	.001	.005
3. Scalar	2423.12	1165	.85	.07	.08	.005	.000
Across Time (Baseline to Quit Week)							
1. Configural	4197.05	2265	.88	.04	.06	--	--
2. Metric	4269.52	2295	.88	.04	.07	.003	.001
3. Scalar	4378.42	2323	.88	.04	.07	.004	.000

Note. N = 508 baseline, 523 quit week; 15 participants who provided Smoking Consequences Questionnaire data at quit week only were included in tests of measurement invariance test over time. χ^2 = Chi-square test; *df* = degrees of freedom; CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root-mean-square residual; ΔCFI = change in comparative fit index from previous model; ΔRMSEA = change in root mean square error of approximation from previous model.

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Table 5

Associations across the SCQ and convergent/discriminant constructs.

Variable	Mean (SD)	Range	LT	IC	SS	NR	AW
Convergent/Discriminant							
ASI-3	15.64 (12.83)	0–72	0.01	0.22***	0.03	0.30***	0.15**
PANAS-NA	19.23 (7.52)	10–48	0.04	0.22***	0.05	0.39***	0.14**
AIS	44.97 (10.71)	13–65	0.38***	0.36***	0.15**	0.47***	0.23***
Baseline Expired CO	19.34 (12.27)	0–90.5	0.09*	0.14*	0.04	0.03	0.01
FTCD	5.24 (2.29)	0–10	0.08	0.16**	0.16***	0.18***	0.18***
PANAS-PA	32.25 (7.42)	10–50	0.16**	0.07	−0.01	−0.13*	−0.14**
Well-Being	22.66 (6.99)	8–40	0.08	0.04	0.02	−0.22***	−0.16**
Dysphoria	19.36 (8.00)	10–50	0.07	0.25***	0.04	0.40***	0.14**
Panic	11.19 (4.37)	8–39	−0.01	0.23***	0.01	0.25***	0.14**
Social Anxiety	8.07 (3.24)	5–25	−0.01	0.21***	0.05	0.28***	0.12*
Inter-Factor Correlations							
LT	7.96 (1.33)	0–9	--	0.54***	0.12*	0.34***	0.14**
IC	4.40 (1.48)	0–9	--	--	−0.12^{t}	0.29***	0.33***
SS	5.25 (2.34)	0–9	--	--	--	0.29***	0.16**
NR	5.63 (1.82)	0–9	--	--	--	--	0.45***
AW	4.15 (1.82)	0–9	--	--	--	--	--

Note.

^{t}p=.06,

$^{*}p$<.05,

$^{**}p$<.01,

$^{***}p$<.001.

SCQ scales were employed for tests of convergent/discriminate validity and factors were implored for inter-factor correlations. ASI-3 = Anxiety Sensitivity Index 3 (Taylor et al., 2007). PANAS-NA = Positive and Negative Affect Scale-Negative Affect subscale (Watson et al., 1988). Well-Being = Inventory of Depression and Anxiety Symptoms Well-Being Subscale (Watson et al., 2007). Dysphoria = Inventory of Depression and Anxiety Dysphoria subscale (Watson et al., 2007). Panic = Inventory of Depression and Anxiety Panic subscale (Watson et al., 2007). Social Anxiety = Inventory of Depression

and Anxiety Social Anxiety subscale (Watson et al., 2007). AIS = Avoidance and Inflexibility Scale (Gifford & Lillis, 2009). FTCD= Fagerström Test for Cigarette Dependence (Fagerström, 2012). CO = Carbon Monoxide. LT = Long Term Negative Consequences. IC = Immediate Negative Consequences. SS = Sensory Satisfaction. NR = Negative Reinforcement. AW = Appetite-Weight Control.