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Validation of the Avoidance and Inflexibility Scale (AIS) Among Treatment-Seeking Smokers

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The Avoidance and Inflexibility Scale (AIS; Gifford et al., 2004) was derived as a smoking-specific measure of experiential avoidance. However, there has been little investigation of the psychometric proprieties of the AIS and no published work on the topic. The current study aimed to test the reliability and validity of the AIS among a sample of adult treatment-seeking daily smokers (n = 465; 48.2% female, 17.8 [SD = 9.60] cigarettes per day). The AIS was administered at 3 time points (baseline, quit-day, and 1 month postquit) as part of a larger smoking cessation trial. An exploratory factor analysis indicated a 2-factor solution, described by inflexibility and avoidance because of smoking related "thoughts/feelings" (9 items) and "somatic sensations" (4 items). Results revealed that the AIS-total and factor scores demonstrated high internal consistency and test–retest reliability. The AIS total and factor scores also displayed high convergent, discriminant, and incremental predictive validity with theoretically relevant smoking and affective variables. The present data suggest that the AIS measure appears to be a valid and reliable smoking-specific index of experiential avoidance.

Keywords: psychological inflexibility, avoidance, affective inflexibility, experiential avoidance, exploratory factor analysis

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Experiential avoidance reflects a cognitive-affective regulatory process whereby individuals are unwilling to experience or remain in contact with aversive internal experiences (e.g., thoughts, emotions, memories, bodily sensations, and images) and attempt to control the frequency or form of the experiences and the contexts in which they occur (Hayes et al., 2004; Hayes, Wilson, Gifford, Follette, & Strosahl, 1996). Experiential avoidance is theorized to lead to increased salience and functional importance of the avoided experiences, which contribute to increased cognitive control efforts to avoid expected negative outcomes (Hayes, Luoma, Bond, Masuda, & Lillis, 2006). Experiential avoidance is theorized to be a broad-based diathesis for psychopathology (see review by Chawla & Ostafin, 2007), and encompasses specific cognitive/affective regulatory strategies, including thought suppression, avoidant coping, worry, and distraction (Chawla & Ostafin, 2007); although it is conceptualized as a broad-based (transdiagnostic) process.

Historically, the initial and vast majority of measurement approaches have sought to tap experiential avoidance at a domain-general level. Such measurement approaches have been successful and clinically informative (Trafton & Gifford, 2011). One of the most commonly used self-report measures of experiential avoidance is the Acceptance and Action Questionnaire (the AAQ and AAQ-II; Bond et al., 2011; Hayes et al., 2006; Hayes et al., 2004). The AAQ-II contains seven items that assess one's ability to pursue goals despite negative feelings and acceptance of aversive feelings (e.g., "When I feel depressed or anxious, I am unable to take care of my responsibilities"; "If I could magically remove all the painful experiences I've had in my life, I would do so"). Scores on these measures are associated with greater levels of depression, anxiety, poorer physical health, and impaired adaptive functioning (Bond et al., 2011; Hayes et al., 2004). In addition, the Multidimensional Experiential Avoidance Questionnaire (Gámez, Chmielewski, Kotov, Ruggero, & Watson, 2011) is a 62-item self-report measure of multiple facets of experiential avoidance,

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including distress aversion (e.g., "Happiness involves getting rid of negative thoughts"), behavioral avoidance (e.g., "I go out of my way to avoid uncomfortable situations"), distraction and suppression (e.g., "I work hard to keep out upsetting feelings"), repression and denial (e.g., "People have told me I'm not aware of my problems"), procrastination (e.g., "I try to put off unpleasant tasks for as long as possible"), and distress endurance (e.g., "When working on something important, I won't quit even if things get difficult"). The Multidimensional Experiential Avoidance Questionnaire demonstrates convergence with other measures of experiential avoidance (Gámez et al., 2011).

In an effort to further enhance explanatory power, a number of domain-specific approaches for measuring experiential avoidance have been developed for specific populations and behaviors. This type of approach is consistent with research that suggests that the degree of congruity between a pathogenic process and phenotypic behavior offers greater precision in the prediction of behavior (Cox, 1996). For example, measures of experiential avoidance related to chronic pain (Chronic Pain Acceptance Questionnaire—Revised; McCracken, Vowles, & Eccleston, 2004), diabetes (Acceptance and Action Diabetes Questionnaire; Gregg, Callaghan, Hayes, & Glenn-Lawson, 2007), and weight (Acceptance and Action Questionnaire for Weight-Related Difficulties, AAQ-W; Lillis & Hayes, 2008) have been developed, which that examine experiential avoidance in relation to phenomena specific to these content domains.

Cigarette smoking is one arena where a domain-specific measurement approach for experiential avoidance may be warranted. Indeed, cigarette smoking continues to be the leading cause of preventable disease and death in the United States accounting for approximately 443,000 deaths annually (Centers for Disease Control and Prevention [CDCP], 2010), and despite reductions in the prevalence in smoking over the past 50 years, 45.3 million Americans are still smokers (19.3% of U.S. population; CDCP, 2010). Although more than half of current smokers report wanting to quit (68.8%), the overall prevalence of successful cessation (≥6 months) is low (6.2%; CDCP, 2010).

Reliance on cigarettes and difficulty successfully achieving cessation are thought to be, in part, because of the highly negatively reinforcing nature of smoking (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004; McCarthy, Curtin, Piper, & Baker, 2010). Specifically, smokers often report smoking to reduce negative affect states and to manage stress, and expect smoking to have anxiolytic properties (see review by Kassel, Stroud, & Paronis, 2003). Additionally, higher levels of negative affect predict lapse and relapse (e.g., Shiffman, 2005). It is posited that the perceived mood enhancing effects of smoking actually reflect relief from the aversive mood and interoceptive effects of acute periods of withdrawal (e.g., McCarthy et al., 2010). Thus, smokers may be particularly prone to seek out opportunities to escape, avoid, or reduce distressing smoking-relevant thoughts, feelings, and bodily sensations and frequently may do so by (re)engaging in smoking. Indeed, the recruitment of "cognitive control" is thought to be an important factor in the adaptive regulation of drug use behavior (Curtin, McCarthy, Piper, & Baker, 2006; McCarthy et al., 2010), and one's individual difference in the ability to flexibly respond to smoking urges, negative mood, or interoceptive states is implicated in the maintenance of smoking. For example, one's inability to persist in task engagement in the context of distressing personal experiences is associated with inability to maintain even short-term smoking abstinence (Brown, Lejuez, Kahler, & Strong, 2002) whereas greater ability to tolerate such distress is associated with greater likelihood of smoking abstinence (Brown, Lejuez, Kahler, Strong, & Zvolensky, 2005). Together, these data highlight the relative importance of considering smoking-specific experiential avoidance in the maintenance of this problem health behavior.

The Avoidance and Inflexibility Scale (AIS; Gifford, 2001; 2002; Gifford et al., 2002) is a smoking-specific measure of experiential avoidance that was specifically developed for process-based smoking cessation research. This measure is a 13-item self-report assessment that appears to be associated with broad-based experiential avoidance (Gifford et al., 2004) and smoking-specific constructs, including higher levels of nicotine dependence, greater perceived barriers to smoking cessation, prior smoking cessation quit difficulties, and stronger expectancies that smoking will result in a reduction of negative affect (Zvolensky, Farris, Schmidt, & Smits, 2014). The AIS is associated with nonsmoking specific measures of emotional vulnerability among daily smokers, including negative affect and anxiety sensitivity (fear of internal anxiety-relevant sensations; Zvolensky et al., 2014). Moreover, smoking-specific experiential avoidance appears to be modifiable through acceptance and commitment therapy-based smoking cessation treatment (Bricker, Mann, Marek, Liu, & Peterson, 2010; Gifford et al., 2004; 2011). In one study, lower posttreatment AIS scores (reflective of greater acceptance and less avoidance) were associated with an increased likelihood of abstinence 1-year post-treatment (Gifford et al., 2004). A recent study also found that a reduction in smoking-specific experiential avoidance before quitting smoking is related to the experience of less severe nicotine withdrawal, negative affect, and craving on quit-day, and greater likelihood of quit-day smoking abstinence (Farris, Zvolensky, & Schmidt, 2014).

Although work on the AIS has been promising thus far, the psychometric properties of this scale have not been comprehensively evaluated among smokers. In fact, to the best of our knowledge, there have only been three *unpublished works* that have been cited in reference to the development and validation of this measure (Gifford, 2001, 2002; Gifford et al., 2002). Given the underdeveloped investigation of the validity and potential factor structure underlying the AIS, the current study aimed to provide a comprehensive test of the factor structure, internal consistency, convergent/discriminant validity, known groups validity, and predictive validity of the AIS measure among a sample of treatment-seeking daily cigarette smokers.

Method

Participants and Procedure

Adult daily smokers were recruited from the community (via flyers, newspaper ads, and radio announcements) to participate in a large randomized controlled trial examining the efficacy of two smoking cessation interventions (clinicaltrials.gov NCT01753141; overlapping sample as reported in Farris, Zvolensky, Blalock, & Schmidt, 2014; Farris et al., 2014; Zvolensky et al., 2014). Participants included in the current study were between ages 18–65 who reported smoking eight or more cigarettes per day, with motivation to quit rated as at least 5 or higher on a 10-point scale.

Individuals responding to study advertisements were scheduled for an in-person, baseline assessment. After providing written informed consent, participants were interviewed using the Structured Clinical Interview of *Diagnostic and Statistical Manual for Mental Disorders-Fourth Edition* (*DSM-IV*) disorders (SCID-I/NP; First, Spitzer, Gibbon, & Williams, 2007) and completed a computerized battery of baseline (pretreatment) self-report questionnaires.

Eligible participants were randomly assigned to one of two smoking cessation treatment programs and scheduled for treatment initiation approximately 1–2 weeks after the baseline assessment. Smoking cessation treatment consisted of either (a) Smoking Cessation Program, which consisted of standard cognitive–behavioral strategies (recommended by Fiore et al., 2008) including self-monitoring of cigarette consumption, psychoeducation about smoking and health, review of high-risk situations and management of smoking cues, smoking reduction, planning for quit-day (e.g., enlisting social support, having a lapse plan, provision of self-help materials, etc.), and relapse prevention; or (b) Panic-Smoking Prevention Program (Zvolensky, Yartz, Gregor, Gonzalez, & Bernstein, 2008), which consisted of cognitive–behavioral strategies for addressing both anxiety and smoking cessation, including self-monitoring of anxiety and cigarette consumption, use of interoceptive exposure exercises to address maladaptive cognitions related anxiety and ability to quit smoking, smoking reduction, planned periods of nicotine deprivation, planning for quit-day, and relapse prevention (including discussion of reduced risk for developing anxiety-related psychopathology via smoking cessation). Both treatment groups received nicotine replacement therapy via the transdermal nicotine patch, which was initiated at treatment Session 4 (quit-day). Treatment consisted of four 60-min weekly sessions conducted by trained doctoral-level graduate students. All treatment was supervised by study authors (MJZ and NBS) and checked for treatment fidelity by independent reviewers. Posttreatment (quit-day) and follow-up assessments were conducted. All participants provided informed consent before participation and the study protocol was approved by the Institutional Review Boards at the University of Vermont and Florida State University, where the study was conducted.

Measures

Avoidance and Inflexibility Scale. The AIS (Gifford et al., 2004) is a 13-item self-report assessment in which respondents are asked to consider how they respond to difficult *thoughts* that encourage smoking (e.g., "I need a cigarette," "I wish I could have a cigarette now!"), different *feelings* that encourage smoking (e.g., stress, fatigue, boredom, enjoyment, satisfaction, etc.), and *bodily sensations* that encourage smoking (e.g., "physical cravings or withdrawal symptoms"). Items are rated on a 5-point Likert scale (1 = *Not at all* to 5 = *Very much*), with higher scores reflecting more inflexibility/avoidance in the presence of difficult smoking-related thoughts, feelings, and sensations.

Measure Used for Descriptive Purposes

Structured Clinical Interview for *DSM-IV* Disorders. Diagnostic assessments of past-year Axis I psychopathology were conducted using the SCID-I/NP (First et al., 2007), which were administered by trained research assistants or doctoral level staff and supervised by independent doctoral-level professionals. Interviews were audio-taped and the reliability of a random selection of 12.5% of interviews was checked for diagnostic accuracy; no disagreements were noted. The SCID-I/NP was used for descriptive purposes in the current study and known-group validity.

Smoking Measures Used for Convergent Validity

Smoking History Questionnaire. The Smoking History Questionnaire (Brown, Kahler, Zvolensky, Lejuez, & Ramsey, 2001) is a self-report questionnaire used to assess smoking history (e.g., onset of regular daily smoking), pattern (e.g., number of cigarettes consumed per day), and quit history. In the present study, the Smoking History Questionnaire was used to describe the sample on smoking history and patterns of use (e.g., smoking rate, years as a regular smoker).

Fagerström Test for Nicotine Dependence. The Fagerström Test for Nicotine Dependence (FTND; Heatherton, Kozlowski, Frecker, & Fagerström, 1991) is a six-item scale that assesses gradations in tobacco dependence. Scores range from 0 to 10, with higher scores reflecting high levels of physiological dependence on nicotine. The FTND has adequate internal consistency, positive relations with key smoking variables (e.g., saliva cotinine), and high test–retest reliability (Heatherton et al., 1991; Pomerleau, Carton, Lutzke, Flessland, & Pomerleau, 1994). Internal consistency for the FTND items was $\alpha = .62$.[1]

Smoking Consequences Questionnaire. The Smoking Consequences Questionnaire (SCQ; Brandon & Baker, 1991) is a 50-item self-report measure that assesses smoking expectancies on a 10-point scale for likelihood of occurrence (0 = *Completely unlikely* to 9 = *Completely likely*). The SCQ yields four subscales: Negative Reinforcement/Negative Affect Reduction (e.g., "Smoking calms me down when I feel nervous"), Negative Consequences (e.g., "The more I smoke, the more I risk my health"), Appetite/Weight Control (e.g., "Smoking keeps my weight down"), and Positive Reinforcement/Sensory Satisfaction (e.g., "When I smoke, the taste is pleasant"). The entire measure and its factors have demonstrated sound psychometric properties. In the current study, internal consistency for the full measure items and subscales items were as follows: Total Score ($\alpha = .94$), Negative Consequences ($\alpha = .89$), Positive Reinforcement ($\alpha = .89$), Negative Reinforcement ($\alpha = .94$), and Appetite/Weight Control ($\alpha = .91$). The SCQ was also used for tests of convergent validity.

Other Substance Use Measures Used for Discriminant Validity

Alcohol Use Disorders Identification Test. The Alcohol Use Disorders Identification Test (AUDIT; Babor, de la Fuente, Saunders, & Grant, 1992) is a 10-item self-report measure developed to identify individuals with alcohol problems. Total scores range from 0 to 30, with higher scores reflecting more hazardous drink-

[1] The internal consistency of the FTND items was relatively low, which is an issue often apparent with this measure (Korte, Capron, Zvolensky, & Schmidt, 2013). However, it is worth noting that Cronbach's α values are fairly sensitive to the number of items in each scale and it is not uncommon to find lower Cronbach values with shorter scales (e.g., scales with fewer than 10 items; DeVellis, 2003).

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ing. The psychometric properties of the AUDIT are well documented, including high internal consistency, test–retest reliability, and construct and predictive validity (de Meneses-Gaya, Zuardi, Loureiro, & Crippa, 2009). In the present study, internal consistency for the AUDIT items was $\alpha = .84$.

Marijuana Problems Scale. The Marijuana Problems Scale (MPS; Stephens, Roffman, & Curtin, 2000) is a self-report questionnaire that evaluates problems experienced in the past 90 days related to cannabis use. Respondents are asked to rate 19 different problems based on being "never a problem," a "minor problem," or a "major problem." A total numeric score was computed based on the number of problems endorsed (either minor or major), with a possible range of 0–19. The MPS has strong internal consistency and has been frequency used to assess cannabis dependence severity (Stephens et al., 2000). The internal consistency for the MPS items in the current study was $\alpha = .89$.

Domain-General Measure for Convergent Validity

Difficulties in Emotion Regulation Scale. The Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) is a 36-item self-report measure that assesses the degree to which respondents experience dysregulated emotional states. Items are rated on a 5-point Likert-type scale (1 = *Almost never* to 5 = *Almost always*). The DERS yields a total score as well as six subscale scores. The Nonacceptance of Emotional Responses subscale (e.g., "When I'm upset, I feel ashamed with myself for feeling that way") was used as a domain-general emotion regulatory index in the current study. The DERS demonstrates strong psychometric properties, including internal consistency, test–retest reliability, as well as construct and predictive validity (Gratz & Roemer, 2004). In the current study, internal consistency of the Nonacceptance of Emotional Responses subscale scores was $\alpha = .91$.

Measure of Positive and Negative Affect

Positive and Negative Affect Scale. The Positive and Negative Affect Scale (Watson, Clark, & Tellegen, 1988) is a self-report measure that requires participants to rate the extent to which they experience each of 20 different feelings and emotions (e.g., nervous, interested) based on a Likert-scale that ranges from 1 (*Very slightly or not at all*) to 5 (*Extremely*). The measure yields two factors, negative and positive affect, and has strong documented psychometric properties (Watson et al., 1988). In the current study, the internal consistency for the subscale items was as follows: Positive Affect ($\alpha = .90$) and Negative Affect ($\alpha = .91$).

Measures of Predictive Validity

Inventory of Depression and Anxiety Symptoms. The Inventory of Depression and Anxiety Symptoms (IDAS; Watson et al., 2007) is a 64-item self-report measure of symptoms of depression and anxiety. Respondents are asked to rate the degree to which they have experienced symptoms in the past 2 weeks, scored on a 5-point Likert-type scale (1 = *Not at all* to 5 = *Extremely*). This measure yields a global General Depression score (20 items), which was used as a quit-day index of depressive symptoms. Internal consistency for the items in the General Depression subscale in the current study was $\alpha = .92$.

The Minnesota Nicotine Withdrawal Scale. The Minnesota Nicotine Withdrawal Scale (MNWS; 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. Internal consistency of the MNWS items in the current sample was $\alpha = .86$.

The Questionnaire of Smoking Urges. The Questionnaire of Smoking Urges (QSU; Tiffany & Drobes, 1991) is a 32-item self-report measure of smoking urges and cravings in which respondents rate the extent to which they agree or disagree with each item based on a 7-point Likert scale (1 = *Strongly disagree* to 7 = *Strongly agree*). The QSU-Desire subscale (comprised of eight items) was used as an index of quit-day craving. In the current sample, the internal consistency of the QSU items was $\alpha = .88$.

Carbon monoxide. Biochemical verification of smoking status was completed by carbon monoxide (CO) analysis of breath samples. Expired air CO levels were assessed using a CMD/CO Carbon Monoxide Monitor (Model 3110; Spirometrics, Inc., Grey, ME). CO breath samples at each time point as an indicator of abstinence (expired CO $\leq$4 ppm, as abstinent; per Perkins, Karelitz, & Jao, 2013).

Data Analytic Plan

The current study is based on data collected at baseline, quit-day, and Months 1, 3, 6 postquit. Of the 724 participants who were evaluated for the trial, 574 participants completed the baseline assessment to determine study eligibility. We retained 465 cases for analyses in the current study: 63 were missing the AIS or other self-report assessments at baseline, 45 were excluded because of low smoking rate, and 1 was above age cutoff (i.e., latter two categories were those participants who were ineligible for the parent study). Of the 465 cases, 399 were randomized to treatment, 231 provided data at quit-day, 184 provided Month 1 postquit data, 133 provided Month 3 postquit data, and 120 provided Month 6 postquit data. Available cases, regardless of treatment condition, were used in the current analyses.

Descriptive statistics were first examined to characterize the sample in terms of smoking, health, and psychopathology. Next, a series of tests were conducted to assess the psychometric properties of the AIS: (a) As the psychometric properties of this measure have not been empirically evaluated and there were no a priori hypotheses regarding the underlying factor structure, an exploratory factor analysis (EFA) was conducted. The EFA was conducted in SAS version 8.0 to examine underlying dimensions of the AIS. The minimum average partial test was used to confirm the number of factors retain (O'Connor, 2000; Velicer, Eaton, & Fava, 2000). (b) Cronbach's α was used to document internal consistency of any identified factor items and total AIS items. (c) Intercorrelations were computed to assess test–retest reliability at all study time points to assess reliability of AIS scores over repeated administrations. Given the nature of the current sample (treatment-seeking smokers undergoing a quit attempt), test–retest reliability was assessed for the total sample and split in terms of abstinence-status. (d) Zero-order correlations were computed between the AIS total and factor scores in relation to the smoking, substance use, and positive/negative affect variables to evaluate

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convergent and discriminant validity. (e) *t* tests were used to test known-group validity for gender and psychopathology in terms of the AIS scores given experiential avoidance has been documented to be higher among females (Hayes et al., 2004) and is implicated in the development/maintenance of various forms of psychopathology (Hayes et al., 1996). (f) A multivariate regression was conducted to examine the incremental predictive validity of the AIS scores in terms of theoretically relevant quit-day factors including negative reinforcement smoking outcome expectancies, depressive symptoms, nicotine withdrawal and craving, controlling for gender, baseline smoking rate, and prequit negative affectivity.

Results

Sample Characteristics

Participants averaged 37.4 years of age (SD = 13.40) and were 48.2% female. The sample was predominately White (84.9%); a smaller percent identified as Black (9.2%), Hispanic (2.2%), Asian (1.1%), and other (2.6%). Participants reported marital status as never married (41.7%), married or cohabiting (34.8%), divorced (17.2%), separated (4.1%), or widowed (2.2%). Educational attainment for the sample was as follows: less than high school degree (5.8%), high school degree or equivalent (22.4%), completion of part college (34.4%), graduated from 2-year college (9.5%), graduation from 5-year college (14.2%), completed part graduate/professional school (5.6%), and completed graduate/professional school (8.2%).

The average daily smoking rate of this sample was 17.8 (SD = 9.60), and on average, participants reported regular daily smoking for 19.1 years (SD = 13.29). More than one quarter of the sample (29.7%) reported living with a smoker. On average, participants reported 3.4 (SD = 2.43) previous quit attempts; 6.9% (n = 32) reported never having made a previous attempt to quit smoking. Self-reported tobacco-related medical problems were reported among 29.9% of the sample: hypertension (13.8%), asthma (12.7%), heart problems (6.7%), and respiratory disease (3.4%). Regarding Axis I psychopathology, 42.4% met criteria for at least one current (past year) disorder that included major depressive disorder (7.8%), dysthymia (4.1%), bipolar disorder (0.4%), depressive disorder not otherwise specified (1.3%), alcohol use disorder (7.1%), cannabis use disorder (6.3%), cocaine use disorder (0.6%), opioid use disorder (0.6%), poly/other substance use disorder (0.6%), panic disorder without agoraphobia (3.7%), social anxiety disorder (14.4%), agoraphobia without panic (0.2%), specific phobia (9.9%), obsessive–compulsive disorder (2.8%), posttraumatic stress disorder (5.6%), generalized anxiety disorder (8.2%), anxiety disorder not otherwise specified (1.7%), and other Axis I disorder (2.6%).

Exploratory Factor Analysis

To identify the underlying factor structure of the AIS measure, an EFA using maximum likelihood factor extraction was performed on the 13 AIS items. Promax rotation (a nonorthogonal rotation method) was used. To identify how many factors would be extracted, the scree plot of the eigenvalues was examined. Factor analyses provided results that suggested a two-factor or three-factor solution. The first two factors had eigenvalues of 24.42 and 4.97, respectively, and combined accounted for 95% of the variance. The third factor had an Eigenvalue of 1.6 and uniquely accounted for 5% of the variance. The third factor included only two items, thus, the two-factor solution was selected for both parsimony and scree. To confirm the number of factors to retain, the minimum average partial test was utilized (Velicer et al., 2000). The results confirmed the results from the EFA, indicating that two factors should be retained (O'Connor, 2000; Velicer et al., 2000).

All items and their respective standardized factor loadings are shown in Table 1. Items with standardized factor loadings above .4 were retained (thus, we retained all items) and there were no cross loaders. The two subscales were significantly correlated with each other, r = .62, $p < .001$, lending further support to the nonorthogonal rotation method.

Internal Consistency

Cronbach's α was used to assess internal consistency for the AIS total score and two factor subscale scores as assessed at all time points. Results revealed high internal consistency for the items in the AIS total (α range = .93–.97), AIS-Factor 1 (thoughts/feelings; α range = .91–.96), and AIS-Factor 2 (somatic; α range = .89–.95) at all time points (see Table 2).

Table 1
Standardized Factor Loadings for the AIS

Item	Respective factor	Thoughts/feelings β	Somatic sensations β
How likely is it that these *thoughts* will lead you to smoke?	T/F	.90	.00
How much are you struggling to control these *thoughts*?	T/F	.84	.07
To what degree must you reduce how often you have these *thoughts* in order not to smoke?	T/F	.73	−.01
To what degree must you reduce the intensity of these *thoughts* in order to not smoke?	T/F	.71	−.02
How likely is it that these *feelings* will lead you to smoke?	T/F	.64	.15
How important is getting rid of these *feelings*?	T/F	.62	.16
How much are you struggling to control these *feelings*?	T/F	.56	.05
To what degree must you reduce how often you have these *feelings* in order not to smoke?	T/F	.53	.12
To what degree must you reduce the intensity of these *feelings* in order not to smoke?	T/F	.46	.10
How likely is it that these *bodily sensations* will lead you to smoke?	S	.02	.94
How much are you struggling to get rid of these *bodily sensations*?	S	.02	.94
To what degree must you reduce how often you have these *bodily sensations* in order not to smoke?	S	.05	.76
To what degree must you reduce the intensity of these *bodily sensations* in order not to smoke?	S	.13	.63

Note. AIS = Avoidance and Inflexibility Scale; T/F = thoughts/feelings; S = somatic sensations.

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Table 2
AIS Means, SDs and Internal Consistency From Baseline Through Month 6 Follow-Up

Sample	Baseline $n = 465$	Quit-day $n = 235$	Month 1 $n = 194$	Month 3 $n = 141$	Month 6 $n = 125$
AIS-total					
Mean (*SD*)	45.2 (10.73)	38.4 (11.11)	33.8 (13.79)	33.6 (14.83)	34.11 (15.32)
Cronbach α	α = .925	α = .930	α = .954	α = .961	α = .967
AIS-Factor 1					
Mean (*SD*)	32.0 (7.47)	27.4 (7.83)	24.4 (9.82)	24.4 (10.75)	24.4 (10.66)
Cronbach α	α = .906	α = .912	α = .941	α = .952	α = .956
AIS-Factor 2					
Mean (*SD*)	13.2 (4.33)	11.0 (4.17)	9.4 (4.55)	9.2 (4.84)	9.7 (5.20)
Cronbach α	α = .920	α = .891	α = .926	α = .936	α = .951

Note. AIS = Avoidance and Inflexibility Scale; *SD* = standard deviation.

Test–Retest Reliability

Bivariate associations were examined across study time points to assess test–retest reliability over repeated administrations (presented in Table 3). Intercorrelations from baseline to quit-day for the AIS total score and factors were statistically significant but small in size (rs = .25 to .35, ps < .05). This pattern of finings is not unexpected given the AIS was developed as a process-level measure, which has been shown to change from pre- to posttreatment (see means, *SD*s in Table 2).[2] At all subsequent time points, test–retest reliability for the AIS was adequate for the total test score (rs = .54 to .75, ps < .05), AIS-Factor 1 scores (rs = .53 to .76, ps < .01), and AIS-Factor 2 scores (rs = .50 to .61, ps < .01). To examine the effects of smoking abstinence on reliability over multiple administrations, biochemically verified point-prevalence smoking abstinence (expired CO breath sample ≤4 ppm) at each test–retest time point was examined in terms of test score reliability. Results indicated that the effect of smoking abstinence appeared to impact test score reliability most notably in the months after quit-day; and, it is most marked for AIS-Factor 2 scores (somatic). For example, higher intercorrelations in AIS-Factor 2 scores were observed from quit-day to Month 1 follow-up for those who were abstinent, $r = .61$, $p < .01$ relative to nonabstinent, $r = .46$, $p < .01$.

Table 3
Test–Retest of AIS Total and Factor Scores by Abstinence Status

Sample	BL–Quit[a]	Quit–M1[b]	M1–M3[c]	M3–M6[d]
		AIS-total		
Total sample	.320*	.543*	.643**	.751**
Abstinent	.404**	.533**	.729**	.604**
Nonabstinent	.319**	.474**	.650**	.626**
AIS-Factor 1				
Total sample	.346**	.530**	.619**	.756**
Abstinent	.467**	.501**	.675**	.646**
Nonabstinent	.338**	.434**	.632**	.568**
AIS-Factor 2				
Total sample	.245**	.496**	.524**	.607**
Abstinent	.244*	.605**	.668**	.466*
Nonabstinent	.241**	.462**	.522**	.540**

Note. AIS = Avoidance and Inflexibility Scale; BL = baseline; Quit = quit-day; M1 = Month 1 postquit-day; M3 = Month 3 postquit-day; M6 = Month 6 postquit-day.
[a] Total sample ($n = 231$), abstinent ($n = 68$), nonabstinent ($n = 136$). [b] Total sample ($n = 164$), abstinent ($n = 33$), nonabstinent ($n = 100$). [c] Total sample ($n = 121$), abstinent ($n = 34$), nonabstinent ($n = 48$). [d] Total sample ($n = 98$), abstinent ($n = 28$), nonabstinent ($n = 40$).
* $p < .05$. ** $p < .01$; abstinence verified by CO ≤4 ppm.

Convergent and Discriminant Validity

Associations between the AIS total and factor scores in relation to smoking, substance use and affective variables are presented in Table 4. Significant positive associations between the AIS total and factors scales were found for nicotine dependence (FTND), cigarettes smoked per day, and years as a daily smoker. The strength of correlations were strongest for AIS-Factor 2 scores. The AIS total and factors scores were also significantly correlated with expectancies about the outcome effects of smoking (per the SCQ). Specifically, the Negative Reinforcement/Negative Affect Reduction subscale scores (e.g., "Smoking calms me down when I feel nervous") was most strongly associated with the AIS total and factors scores, with the strongest associations with AIS-Factor 1 scores. Similarly, the Negative Consequences subscale score and Appetite/Weight Control subscale score were significantly associated with the AIS total score and both factor scores; again, most strongly correlated with AIS-Factor 1 score. The Positive Reinforcement subscale score was significantly correlated with the AIS total and factor scores; the strongest associations were found with the AIS total score. The tendency to be nonaccepting of general negative emotions (DERS-NA) was associated with the AIS total and factor scores. All associations were in the expected direction. The nonsignificant correlations between the AIS total and factor scores with alcohol and marijuana use problems (per the AUDIT and MPS) support discriminant validity. In addition, the AIS total and factor scores were not correlated with positive affect. As expected, the AIS total and factor scores were positively associated with negative affect, with the strongest associations noted with AIS-Factor 1 scores.

[2] Paired sample t tests indicated statistically significant reductions in mean AIS scores from baseline to quit-day for the total score ($t = 8.991$, $p < .0001$), Factor 1 ($t = 8.662$, $p < .0001$), and Factor 2 ($t = 7.280$, $p < .0001$).

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Table 4
Descriptive Statistics and, Convergent and Discriminant Validity Between AIS Total and Factor Scores in Terms of Smoking, Substance Use, and Mood Characteristics

Variable	Mean (*SD*)	AIS total	AIS-Factor 1	AIS-Factor 2
Smoking				
Nicotine dependence (FTND)	5.4 (2.19)	.255**	.199**	.286**
Cigarettes per day	17.8 (9.60)	.158**	.119*	.186**
Years daily smoker	19.1 (13.29)	.154**	.111*	.188**
SCQ-Negative Consequences	6.6 (1.31)	.453**	.460**	.327**
SCQ-Positive Reinforcement	5.7 (1.53)	.315**	.301**	.258**
SCQ-Negative Affect Reduction	5.7 (1.84)	.468**	.488**	.315**
SCQ-Appetite/Weight Control	4.2 (2.34)	.210**	.228**	.125**
Substance use				
Alcohol use problems (AUDIT)	6.0 (5.79)	.037	.052	.002
Marijuana use problems (MPS)	2.2 (3.95)	−.020	−.034	.009
Mood				
Positive affect (PANAS-PA)	32.2 (7.36)	−.044	−.043	−.035
Negative affect (PANAS-NA)	19.1 (7.31)	.244**	.280**	.121**
Domain general				
Emotion nonacceptance (DERS-NA)	11.9 (5.23)	.234**	.242**	.164**

Note. AIS = Avoidance and Inflexibility Scale; *SD* = standard deviation; FTND = Fagerström Test for Nicotine Dependence; SCQ = Smoking Consequences Questionnaire; AUDIT = Alcohol Use Disorders Identification Test; MPS = Marijuana Problems Scale; PANAS-PA = Positive and Negative Affect Scale - Positive Affect; PANAS-NA = Positive and Negative Affect Scale - Negative Affect; DERS-NA = Difficulties in Emotion Regulation Scale - Nonacceptance.
* $p < .05$. ** $p < .01$.

Known Groups Validity: Psychopathology and Gender

Among those with current Axis I psychopathology, relative to without, significantly higher AIS total scores were reported, $M = 46.9$ ($SD = 9.90$) versus $M = 43.7$ ($SD = 11.21$), $t = -3.180$, $p = .001$. Regarding the factor scores, a significant difference between those with and without psychopathology was noted with AIS-Factor 1, $M = 33.3$ ($SD = 6.86$) versus $M = 30.8$ ($SD = 7.78$), $t = -3.517$, $p < .001$, but not AIS-Factor 2, $M = 13.6$ ($SD = 4.10$) versus $M = 12.9$ ($SD = 4.48$), $t = -1.824$, $p = .069$. In addition, at baseline, AIS total and factor scores appear to vary by gender, such that females had significantly higher AIS total scores relative to males, $M = 47.2$ ($SD = 10.17$) versus $M = 43.4$ ($SD = 10.94$), $t = -3.914$, $p < .001$. A similar pattern was observed with scores on the AIS-Factor 1, $M = 33.5$ ($SD = 7.01$) versus $M = 30.5$ ($SD = 7.60$), $t = -4.422$, $p < .001$, and AIS-Factor 2, $M = 13.7$ ($SD = 4.29$) versus $M = 12.8$ ($SD = 4.34$), $t = -2.087$, $p = .037$.

Incremental Predictive Validity

To examine the incremental predictive validity of the AIS factor scores, a multivariate multiple regression was conducted with four quit-day factors (please see Table 5). Reinforcement smoking expectancies (SCQ-NR) and depressive symptoms (IDAS-Depression) on quit-day were expected to be uniquely predicted by AIS-Factor 1 (thoughts/feelings). Nicotine withdrawal (Minnesota Withdrawal Symptom Checklist) and craving (QSU-Desire) on quit-day were expected to be uniquely predicted by AIS-Factor 2 (somatic sensations). Gender, baseline smoking rate, and prequit negative affect were entered as covarying predictors; both AIS-Factor 1 and 2 scores were entered simultaneously. Canonical correlations revealed a moderate to strong association ($r = .63$), of which predictors accounted for 39.3% of variability in the four outcomes. Results indicated that the overall model was significant, Wilks' $\Lambda = .53$, $F(20, 727.3) = 7.64$, $p < .0001$. Specifically, AIS-Factor 1, Wilks' $\Lambda = .91$, $F(4, 219) = 5.14$, $p = .001$, and AIS-Factor 2, Wilks' $\Lambda = .95$, $F(4, 219) = 2.94$, $p = .021$, scores were both significant multivariate predictors; baseline negative affect was the only covariate that was a significant multivariate predictor, Wilks' $\Lambda = .68$, $F(4, 219) = 26.40$, $p < .0001$. Univariate results indicated that higher baseline AIS-Factor 1 scores uniquely predicted

Table 5
Test of Incremental Predictive Validity of the AIS Factor Scores in Terms of Quit-Day Smoking and Affective Processes

Predictor	*b*	*SE*	*t*	Sig.
Negative reinforcement expectancies (SCQ-NR)				
AIS-Factor 1	.090	.025	3.566	.000
AIS-Factor 2	−.031	.043	−.724	.470
Depressive symptoms (IDAS-Depression)				
AIS-Factor 1	.231	.117	1.968	.050
AIS-Factor 2	.229	.197	1.167	.244
Nicotine withdrawal severity (MNWS)				
AIS-Factor 1	.081	.053	1.511	.132
AIS-Factor 2	.152	.089	1.699	.091
Smoking craving (QSU-Desire)				
AIS-Factor 1	−.112	.137	−.817	.415
AIS-Factor 2	.664	.230	2.885	.004

Note. AIS = Avoidance and Inflexibility Scale; *SE* = standard error; Sig. = significance; SCQ-NR = Smoking Consequences Questionnaire - Negative Reinforcement; IDAS = Inventory of Depression and Anxiety Symptoms; MNWS = Minnesota Nicotine Withdrawal Scale; QSU = Questionnaire of Smoking Urges; PANAS-NA = Positive and Negative Affect Scale - Negative Affect. Outcome variables are measured on quit-day. Multivariate model included gender (coded 0 = male; 1 = female), smoking rate (daily smoking rate at baseline), and negative affect (measured per the PANAS-NA at baseline) as model covariates.

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significant variance in greater quit-day negative reinforcement smoking expectancies and depressive symptoms. In contrast, higher baseline AIS-Factor 2 scores uniquely predicted significant variance in craving, but not nicotine withdrawal.

Discussion

There is growing research that suggests that an *inflexible* and *avoidant* response to smoking-related aversive thoughts, feelings, or interoceptive states is of notable theoretical and clinical importance in regard to better understanding processes underlying the maintenance and relapse of cigarette smoking (Gifford et al., 2004; 2011). However, there has been no formal evaluation of the AIS, which represents the assessment tool used to index smoking-specific experiential avoidance. Therefore, the current study aimed to provide a test the reliability and validity of the AIS scores among a sample of treatment-seeking daily cigarette smokers.

In the current sample, the average prequit AIS total scores were comparable with scores reported among other samples of treatment-seeking smokers (Gifford et al., 2004; 2011; Schloss & Haaga, 2011). Additionally, consistent with the current findings AIS scores were significantly lower among smokers who achieved abstinence after smoking cessation treatment, relative to those who continued smoking (Gifford et al., 2004; 2011). The evaluation of the factor structure of this measure suggests that the AIS contains two underlying factors, represented by (a) thoughts/feelings related to smoking and (b) internal/somatic sensations related to smoking. Both the AIS total and factor scores demonstrated higher internal consistency over five time points. High internal consistencies have been previously documented for the AIS total score, which is consistent with the present findings (αs = .93–.96; Gifford et al., 2004; 2011).

The AIS total and two factor scores also demonstrated adequate test–retest reliability over repeated administrations. Specifically, test–retest reliability was highest for the full scale (.75) and factors (.61–.76) after the cessation attempt (Months 3–6). The lower correlations between administrations from baseline to quit-day likely reflect the malleability of AIS (conceptualized as a process variable) during the course of treatment/cessation attempt given reduction in mean scores from baseline to quit-day. Given the stability of the test–retest reliability after quitting, it is unlikely that the lower test–retest reliabilities reflect measurement error or construct instability. Indeed, this process-level construct appears to be impacted by smoking status, as illustrated by the higher intercorrelations for the AIS total and factors scores among abstinent smokers, relative to nonabstinent. These effects emerged primarily between quit-day to Month 1, and Month 1 to Month 3 postquit. It is likely that this smoking-specific experiential avoidance among smokers who are struggling to maintain abstinence after a quit attempt are experiencing and reporting varying levels of smoking-related distress/avoidant responding, whereas those who are abstinent report more consistently about their response styles to smoking-related distress. Again, these findings underscore the importance of experiential avoidance related to smoking in terms of cessation (Farris et al., 2014; Gifford et al., 2004; Zvolensky, Farris, Schmidt, & Smits, 2014).

In support of convergent validity, the AIS total and factor scores were positively associated with higher levels of nicotine dependence, smoking rate, and years spent as a daily smoker; these associations were small in size. Additionally, expectancies about the different outcome effects of smoking were also associated with the AIS total and factors scores. Strongest associations across subscales were noted for the first factor score (thoughts/feelings), which is not surprising given the cognitive-affective nature of both smoking *expectancies* and avoidance of *thoughts/feelings* (per AIS-Factor 1). Although all smoking expectancies subscales were associated with the AIS total and factor scores, the Negative Reinforcement subscale demonstrated the strongest associations. Given experiential avoidance is conceptualized as a negative-reinforcement function, this finding is conceptually and theoretically consistent models of this pathogenic process (Hayes et al., 1996). Additionally, the AIS total and factor scores were associated with a general index of emotional nonacceptance. The AIS and factor scores were not associated with measures of alcohol and cannabis use problems, suggesting discriminant validity of the smoking-specific nature of the AIS (i.e., this measure assesses content unique to smoking, not other substance use). Moreover, positive and negative affect were examined in terms of their associations with the AIS, and as expected, negative affect, but not positive, was significantly associated with the AIS total and factor scores. Negative affect was most strongly associated with avoidance of smoking-related thoughts/feelings (Factor 1), which is conceptually consistent with the derivation of this factor. Notably, while the AIS-Factor 1 and negative affect were correlated, their shared variance was only 28% suggesting that the smoking-specific experiential avoidance to thoughts/feelings (specifically) is related to negative affect, is conceptually distinct.

Known-group validity was also examined. Findings revealed that female smokers, relative to male, reported higher levels of experiential avoidance. This finding is consistent with other work that has documented higher domain-general levels of experiential avoidance among females relative to males (Hayes et al., 2004). In addition, smokers with current Axis I psychopathology scored significantly higher on the AIS total and factor scores, relative to smokers without psychopathology, which parallels other domain-general empirical findings (Hayes et al., 2004).

Finally, the incremental predictive validity of the AIS factor scores were examined in terms of quit-day levels of smoking and affective processes. Baseline scores on the AIS factors were tested as predictors of negative reinforcement smoking expectancies, depressive symptoms, nicotine withdrawal symptom severity, and smoking craving on quit-day. As expected, smoking-related thoughts/feelings uniquely predicted smoking expectancies and depressive symptoms on quit-day, whereas smoking-related somatic sensations did not. In contrast, avoidance of smoking-related somatic sensations uniquely predicted smoking craving on quit-day. It was expected that somatic sensations would also uniquely predict quit-day levels of nicotine withdrawal, however this effect was nonsignificant. The nonsignificant effect of quit-day nicotine withdrawal may reflect the timing of the assessment (i.e., withdrawal assessed on quit-day rather 1–7 days postcessation when symptoms are typically highest; Hughes, 2007). Overall, the AIS factors appear to differentially predict quit-day experiences. Although both factors were highly correlated and shared variance, they were found to account for unique portions in the variance in the respective outcomes.

There are some study limitations. One limitation is the lack of racial diversity in the current sample. Specifically, the sample

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comprised of mostly White smokers individuals that potentially limits the generalizability of the present findings to other groups. This is of note given non-White individuals report significantly higher levels of general experiential avoidance (Hayes et al., 2004) and given the documented broad disparities in cigarette smoking by race/ethnicity (Caraballo, Yee, Gfroerer, & Mirz, 2008). It would be important to further examine the factor structure and psychometric properties of the AIS in a more diverse sample of smokers. Second, while smoking rates in the current sample were comparable with other samples investigating the AIS (Gifford et al., 2004; 2011), rates of nicotine dependence were moderate (FTND: $M = 5.4$, $SD = 2.19$). Given experiential avoidance is associated with the maintenance of problem health behaviors, including substance use disorders (Chawla & Ostafin, 2007), it is possible that individuals with higher levels of physiological dependence on nicotine may be particularly avoidant or tend to inflexibly respond to smoking-related distress. Additionally, while the current study examined the test–retest of the AIS across multiple time points (spanning 6 months), the relatively high study attrition at follow-up assessments (approximately 58% at the Month 6 postquit) should be considered when interpreting these reliability indices. Last, while the AIS was related to an index of emotional nonacceptance (per the DERS), it would be important to directly examine this measure and its factors scores to domain-general measure experiential avoidance specifically. These data were unavailable in the current sample.

Overall, the current study provides an initial test of the reliability and validity of the AIS, a domain-specific measure of experiential avoidance. This measure appears to yield two related yet distinct aspects of experiential avoidance to smoking; specifically, distressing thoughts/feelings related to smoking and distressing somatic sensations related to smoking. The current study suggests these factors differentially predict quit-day smoking-relevant cognitive-affective experiences and some physical aspects of smoking (e.g., craving). Emerging work suggests that reductions in smoking-specific experiential avoidance (specifically cognitive aspects) after acceptance and commitment-based smoking cessation treatment are associated with better cessation outcomes (Gifford et al., 2004). Such interventions including treatment components that address both emotional/cognitive aspects of smoking (e.g., cognitive defusion, mindfulness) and physical/somatic sensations (e.g., scheduled smoking, graduated exposure). Based on the conceptualization of smoking-specific experiential avoidance as a two-factor construct, it appears important to *specifically* address both aspects of experiential avoidance. Future work is needed to more comprehensively examine the impact of these dimensions of smoking-specific experiential avoidance in terms of cessation outcomes.

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