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Intolerance for Smoking Abstinence Questionnaire: Psychometric Properties and Relationship to Tobacco Dependence and Abstinence

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Abstract

While smokers' ability to tolerate emotional or physical distress has been associated with length of smoking cessation, there is no measure of ability to tolerate smoking abstinence discomfort specifically, which may be more heuristic than a measure of tolerance of general emotional stress or physical discomfort.

Methods—Questionnaires completed by 300 smokers assessed inability to tolerate smoking abstinence discomfort (IDQ-S), general physical discomfort (IDQ-P), and general emotional discomfort (IDQ-E), so that shared variance among these measures could be assessed.

Results—The IDQ-S has three reliable components: Withdrawal Intolerance, Lack of Cognitive Coping, and Pain Intolerance. The 14-item IDQ-P and 9-item IDQ-E each consist of one reliable component. Intercorrelations suggest only modest shared variance. Support for construct and discriminant validity was seen. Two scales of the IDQ-S showed excellent convergent validity, correlating with smoking use, dependence, motivation, and length of past smoking cessation, while IDQ-P and IDQ-E correlated with few indices of use or dependence and not with smoking cessation.

Conclusions—The final 17-item IDQ-S with two scales is reliable and valid, and more heuristic than measures of general physical or emotional discomfort intolerance as a correlate of motivation and past success with smoking cessation.

Keywords

Nicotine withdrawal; smoking abstinence; distress tolerance; assessment; psychometrics

1. Introduction

1.1. Most smoking cessation attempts do not lead to lasting abstinence (Fiore et al., 2000). Rapid relapse may occur in part because tobacco withdrawal symptoms are aversive, pervasive and persistent (Hughes 2007). However, the variability in success rates within

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treatment type (Fiore et al., 2000) indicates that some characteristics of the individual smokers must in part account for differential success in smoking cessation. The high degree of variability in the course of tobacco withdrawal symptoms is one factor, given that this variability strongly predicted relapse to smoking (Piasecki et al., 2003b). However, even when experiencing withdrawal, inability to endure or tolerate the discomfort of smoking abstinence could affect success. In our smoking cessation treatment programs, some patients report that they “can’t stand” the feelings whereas others seem more stoic in their ability to suffer the discomfort, or rationalize that the outcome will be worth the suffering. Some people may appraise the same level of withdrawal as more or less tolerable than other people.

In recent years, a few researchers have been investigating a related but more general trait-like construct in relationship to smoking, ability to tolerate physical or emotional distress in general (Brandon et al., 2003; Brown et al., 2002, 2005; Hajek et al., 1987). This approach grew out of clinical observations that difficulty providing a breath sample seemed associated with less success with smoking treatment (Hajek et al., 1987). In the empirical studies, distress tolerance has been conceptualized as persistence in physically or cognitively stressful and/or frustrating behavioral laboratory tasks. Such tasks have included the physical stressors of inhalation of carbon-dioxide (CO₂) enriched air or breath-holding, and the psychological stressors of solving paced serial mental arithmetic problems, an anagram task, and a mirror tracing task. This approach has been heuristic, with studies demonstrating that task persistence in breath-holding or inhaling CO₂-enriched air are correlated with past early smoking lapse or relapse (Brown et al., 2002; Hajek et al., 1987; Hajek, 1991; West et al., 1989), except in a study by Zvolensky et al. (2001), a study with low power. Persistence in the serial mental arithmetic or mirror tracing tasks but not the frustrating anagram task also correlated with past (Brown et al., 2002) or future (Brandon et al., 2003) early return to smoking. Thus, low persistence on physical or emotional stressors may indicate shorter persistence with the physical and emotional discomforts of smoking abstinence or of treatment. Learned industriousness has been proposed as a construct underlying both these tasks and quitting smoking (Quinn, Brandon & Copeland, 1996).

The few questionnaire measures are focused on tolerating emotions in general (Simons & Gaher, 2005) or just anxiety specifically (Zvolensky et al., 2006), derived from research on affect as a relapse precipitant. However, while relevant to relapse, these measures are specific to the emotions assessed and are not designed to tap the set of specific physical and affective symptoms involved in smoking abstinence. Since anxiety is only one of eight or nine valid categories of smoking withdrawal symptoms (Hughes et al., 1999; Hughes 2007), the anxiety sensitivity measure provides a narrow measure of the desired construct with less relevance for individuals who are more concerned about the depression, insomnia, anger, difficulty concentrating, fatigue, or other symptoms they experience. Notably, about half of the valid withdrawal symptom clusters identified by Hughes (2007) and his colleagues (1999) are physical or cognitive. While negative affect has important motivational properties (e.g., Baker, Sherman, & Morse 1987), the ability to tolerate all of the physical, cognitive and withdrawal-specific emotional sequelae of smoking abstinence may be of more relevance for predictions than a measure that is limited to emotional distress alone. Furthermore, craving is not assessed in the existing measures yet, while not necessarily a withdrawal symptom (e.g., Hughes, 2007; Hughes & Hatsukami, 1998) or emotional state, craving is considered important in making abstinence difficult to sustain (e.g., Niaura et al., 1988). While it is possible that ability to tolerate negative emotions in general would be highly correlated with ability to tolerate the physical, cognitive and abstinence-specific emotional symptoms of smoking abstinence, this is an empirical question.

Most of the laboratory distress tolerance tasks, while useful in laboratory investigations, do not translate well to the clinical setting because of the need for specific equipment, staff training, and/or extra time required. Furthermore, the question remains as to whether more specifically assessing degree of ability to endure smoking withdrawal might show a stronger relationship with past or future success with smoking abstinence than degree of ability to tolerate more general physical or emotional stressors. No measure of distress tolerance that is specific to smoking abstinence distress exists, nor have we found any questionnaire assessing tolerance of physical discomfort. Furthermore, no one has assessed ability to tolerate the distress when the distress is in the service of a goal such as quitting smoking, yet such a cognitive set may change willingness to tolerate distress.

1.2. For these reasons, we developed a self-report instrument based on our experience with smokers in treatment to provide an easily portable and disseminable way to assess intolerance for the discomfort of smoking abstinence specifically. We simultaneously developed broader brief measures of intolerance for general physical or emotional discomfort for comparison purposes. This first study reports the development and psychometric properties of these instruments on current smokers from the community. First, the component structure and reliabilities were established, with item-reduction procedures to optimize these. Second, construct validity was established by comparison with other measures of distress, and discriminant validity was investigated. Finally, a major purpose of the study was to determine whether the smoking-specific measure correlated more strongly with measures of smoking history and motivation to quit smoking than did the physical and emotional distress measures that were not smoking-specific. In this way, we were using the same approach to validation that was used for the other measures that were considered relevant for smoking.

1.3. The hypotheses were that the smoking-specific measure of intolerance for discomfort was expected to correlate more highly than the measures of inability to tolerate more general physical or emotional stressors with measures of smoking rate, nicotine dependence, number of quit attempts, length of longest past attempt to quit smoking, and motivation to quit smoking (convergent validity). Greater intolerance was predicted to correlate with shorter and fewer previous quit attempts and with less current motivation to quit (primary measures of convergent validity), and with higher number of cigarettes per day and smoking dependence (as hypothesized determinants of inability to tolerate abstinence discomfort). The specific and non-specific intolerance measures were all expected to correlate positively with current depression, since people with more depressive symptoms should have less ability to tolerate discomfort both in general and from smoking abstinence specifically, and with the only other measure of distress intolerance that was available when this study started (construct validity). Our emotional intolerance measure was predicted to correlate most highly, followed by the smoking-specific and then the physical intolerance measures, with both depressed state and the existing measure of tolerance of emotional discomfort. While we anticipated that older people would be better able to tolerate all kinds of discomfort due to greater life experience and that more-educated people would have better ability to reframe discomfort, such correlations should be low since they involve different constructs (discriminant validity). We did not assess predictive validity because demonstrating initial reliability and validity is necessary before a study of predictive validity is warranted.

2. Methods

2.1. Participants

The participants were 300 adult current smokers recruited from the community by means of newspaper advertisements, flyers in workplace smoking areas, and posters given to participants completing other smoking studies or waiting to start a smoking cessation group

at the Providence Veterans Affairs Medical Center (VAMC). Community rather than university smokers were selected so as to be more representative of smokers in general. Participants must have smoked 10 or more cigarettes per day for at least the past year. Ex-smokers were excluded since they would no longer have direct experience with abstinence distress. People in the midst of a smoking quit attempt were also excluded to decrease variability within the sample due to current elevated withdrawal symptoms. All procedures were approved by the Institutional Review Board of the Providence VAMC.

2.2. Procedures and Measures

2.2.1. Procedures—Initial screening and explanations were conducted by telephone. Participants received a packet of questionnaires and informed consent form to return by mail. A \$5 gift certificate to a preferred store was mailed to them when the packet was returned. In addition to the Intolerance for Discomfort questionnaire items, the packet included the following measures.

2.2.2. Descriptive and discriminant validity variables—A demographic questionnaire assessed age, sex, ethnicity, education, employment, income, and marital status. Age and education were used for discriminant validity; the other measures were included for descriptive purposes but not expected to correlate significantly with the new measures.

2.2.3. Measures of convergent validity—A smoking history questionnaire assessed number of cigarettes smoked per days in the last week and last month, years of regular smoking, age of onset of smoking and of daily smoking, number of times they had quit smoking for at least 12 hours, and length of longest quit attempt. The Fagerström Test for Nicotine Dependence (FTND; Heatherton et al., 1991), a reliable and valid 8-item measure of tobacco dependence, was scored for the total score and for minutes to the first cigarette of the day, a measure of smoking urgency that can index ability to quit smoking (Center, Transdisciplinary Tobacco Use Research, 2007). To replicate methods of Brown et al. (2002), past quit attempts were also dichotomized into those who had quit for 3 or more months vs. those who had never quit for 24 hours. The 5-item Smoking Stage of Change questionnaire (DiClemente et al., 1991) classified smokers into stages of Precontemplation, Contemplation and Preparation to change smoking. Stages of Change were dichotomized into Precontemplation (unmotivated) versus the Contemplation or Preparation (some motivation) stages.

2.2.4. Measures of construct validity—The Rudd Emotional Vulnerability Scale (REVS; Rudd, 2002)¹ was included to examine construct validity of the measures given that withdrawal includes some affective content. This measure of inability to tolerate emotional discomfort has 25 items (e.g., “I can’t stand this emotional pain any longer; When I get upset, my pain is overwhelming; I can’t tolerate the way I feel”) that form one scale designed to assess the content areas of emotional reactivity, emotional sensitivity, distress tolerance, emotional coping, and distress chronicity. Each item is Likert-rated on a 5-point scale rated from 1 (strongly disagree) to 5 (strongly agree), with two items reverse-scored. A measure of state depression, the Center for Epidemiologic Studies – Depressed Mood Scale (CES-D; Radloff, 1977), was also used to examine construct validity for the same reason. The CES-D is a widely used reliable and valid 20-item measure of level of depressive symptoms in the past week that was developed by the National Institute of Mental Health.

¹At the time this study was started (early 1999), no other distress tolerance questionnaire had been published or become available for use.

Each item is rated on a 4-point fully anchored frequency scale from 0 (Rarely or none of the time (less than 1 day)) to 3 (Most or all of the time (5-7 days)).

2.2.5. Measure of intolerance for smoking-specific discomfort—The 38-item Intolerance for Smoking Abstinence Discomfort questionnaire (IDQ-S) was developed using the following process. First, a team of smoking experts (most of the authors) decided on domains that items should cover based both on literature concerning symptoms during smoking abstinence and reports heard from smokers in our cessation treatment groups over the years. These domains included (1) ability/inability to endure the intensity and duration of the physical discomfort of withdrawal (withdrawal-specific headaches and other pains or aches, sleep impairment, feeling lousy), (2) ability/inability to endure the intensity and duration of the emotional discomfort involved (cognitive impairment, depressed mood, anxiety, restlessness, anger, irritability), and (3) use of some general coping methods (e.g., pain killers, cognitive coping involving reinterpreting symptoms such as “no pain, no gain”, and acceptance statements such as telling oneself “I just have to wait it through”) since having or using few coping methods might make discomfort more difficult to tolerate. Second, the team of smoking experts generated the final set of 38 items, with 16 of the items worded in the direction of tolerance (e.g., “It’s OK for me to feel depressed when I’m quitting cigarettes”) and 22 worded in the intolerant direction (e.g., “I can’t stand that restless, jittery feeling I get if I go too long without a cigarette”).

2.2.6. Measure of intolerance for physical discomfort—The 64-item Intolerance for Physical Discomfort questionnaire (IDQ-P) was developed using a similar process, but with a focus on inability to endure physical discomfort in general. The domains for physical discomfort items included: (1) physical illness (e.g., flu, cold, sick, nausea), (2) physical pain (e.g., headaches, injuries, injections, toothache, sore muscles), (3) other physical discomfort (e.g., lack of sleep, constipation, diarrhea, rapid heart beat, sweating, heat, fatigue, itch, loud noises, bad smells), (4) immediate or frequent coping methods for physical pain or discomfort (use of medications or taking an action such as lying down). The 64 items included 15 worded for tolerance and 49 in the intolerant direction.

2.2.7. Measure of intolerance for emotional discomfort—The 21-item Intolerance for Emotional Discomfort questionnaire (IDQ-E), developed the same way, focused on ability or inability to endure the discomfort caused by emotional experience. The items areas included: (1) unpleasant emotions named specifically (e.g., angry, sadness, uncertainty, disappointment), and (2) some situations associated with irritation (i.e., wait in line, stuck in traffic, sent an incorrect bill). Of these, 12 were worded in the intolerant direction and 9 in the tolerant direction.

2.2.8. Format—The IDQ-S, IDQ-P and IDQ-E items were intermixed prior to administration to avoid a bias based on specific content. The response format for all items was a 5-point anchored Likert rating of agreement: 1 *Strongly disagree*, 2 *Disagree*, 3 *Neutral*, 4 *Agree*, and 5 *Strongly agree*.

3. Results

3.1. Data Analysis Approach

Each IDQ questionnaire was analyzed separately in the following manner. First, principal components analysis² (PCA) was conducted on a randomly split half of the sample ($n =$

²To best determine a new measure’s structure, exploratory analysis is a more conservative approach than are confirmatory analyses, are less biased, and do not force a theory-driven approach prematurely (Velicer & Jackson, 1990).

150) for exploratory analysis. The number of components to be retained was initially determined by parallel analysis (PA; Horn, 1965) and the minimum average partial method (MAP; Velicer, 1976), reported to be the most accurate methods by Zwick & Velicer (1986). A PCA with Varimax rotation was then conducted to determine component loadings. Second, internal consistency reliabilities (Cronbach's alpha) and factor loadings were used to reduce the number of items in each scale. Items that loaded $> .40$ on a component and $< .40$ on secondary components were retained. Third, confirmatory factor analysis was conducted on the second half of the sample using structural equation modeling (SEM) conducted with the EQS computer package (Bentler, 1995). Correlated and uncorrelated factor models were compared for the number of components identified via PCA. Model fit was assessed with several fit indices, including the ratio of chi square to degrees of freedom, Comparative Fit Index (CFI; Bentler, 1990), Normed Fit Index (NFI; Bentler & Bonnet, 1980) Average Absolute Standardized Residual (AASR), and the Largest Standardized Residual (LSR). Since all indices produced the same pattern of results, only the chi square, degrees of freedom, CFI and AASR are reported. Fourth, final internal consistency reliabilities were calculated on each subsample and the total sample. Fifth, scale intercorrelations were examined on the total sample. The component structure, internal consistency and construct validity of the REVS total score was checked since its psychometric properties are unpublished. Sixth, validity of the measures was investigated using the REVS and CES-D for construct validity and smoking history and motivation items for convergent validity. Correlations were used for continuous variables and t-tests for dichotomous variables. Multiple regressions were not used because the purpose is to validate the individual scales, not to test hypotheses about common relationships. The alpha for significance was set to .01 for validity analyses to avoid capitalizing on chance. Seventh, relationships to demographic variables were explored for discriminant validity.

3.2. Preliminary Analyses

All variables were checked for skewness and kurtosis. The following variables were significantly skewed and log-transformed to correct the skewness: latency to first cigarette of the day in minutes, number of cigarettes per day in the past week, length of longest past abstinence from cigarettes, and number of past 12 hour quit attempts. Latency to first cigarette data were missing for 28 people because an incorrect form had been used. Stage of change data were missing for 44 people because this measure was added later in the study. Dichotomizing past quit attempts into extreme groups as described resulted in a lower n of 175 since other quit lengths were excluded from this variable.

The psychometric properties of the REVS were checked on these smokers. A PCA on the REVS items on half the sample supported a single-factor solution with 20 items that loaded acceptably. The SEM on the second half sample showed a fit to the 1-component model that was acceptable for two of the three indices used to assess model fit (AASR = .04; CFI = .87; $\chi^2 (170, N = 150) = 662.97$). The internal consistency reliabilities of this 20-item measure were outstanding: $\alpha = .92$ for Half 1, .96 for Half 2, and .96 for the total sample. The correlation between the REVS and the CES-D was $r = .72, p < .001$, indicating outstanding construct validity but without more than 50% of variance in common. REVS was not significantly related to gender, was significantly ($p < .05$) higher with lower age ($r = -.15$) and education ($r = -.25$), and was higher for non-whites ($M = 2.69, SD = 1.04$) than whites ($M = 2.14, SD = 0.79$; $t (28.28) = 2.60, df$ adjusted for unequal variances, $p < .05$).

3.3. Subject characteristics

The characteristics of the participants are shown in Table 1. The racial breakdown is consistent with Rhode Island state demographics. The random subsamples did not differ significantly in demographic or smoking variables.

3.4. Principal Components and Confirmatory Analyses

3.4.1. For IDQ-S, PA indicated four components and MAP indicated three components could be retained; three components were more interpretable. Based on loadings, 20 items were retained. SEM showed good fit to the 3 correlated factors model (AASR = .06; CFI = .92; χ^2 (167, N = 150) = 252.6). A chi square test on the difference between the correlated and uncorrelated factors models revealed a significant difference (χ^2 (3) = 38.6, $p < .05$), indicating the presence of factor correlations added significantly to model fit.

The three final components for IDQ-S were (1) Withdrawal Intolerance (12 items), involving intolerance of affective, cognitive and physical symptoms commonly reported for nicotine withdrawal, (2) Cognitive Coping (5 items), reflecting various cognitive ways to cope with withdrawal, and (3) Pain Intolerance (3 items), reflecting a wish to rapidly escape from physical pain (e.g., headache) caused by nicotine withdrawal. See Table 2 for items, loadings and percent of variance accounted for.

3.4.2. For IDQ-P, MAP and PA indicated three components, but the third component had inadequate reliability and was eliminated. A 1-component and a 2-component model were compared for fit. When the 20 items that loaded .55 or better were used, the SEM showed good fit to the 1-component model (AASR = .04; CFI = .94; χ^2 (77, N = 150) = 105.31). The fit was not acceptable for the 2-component correlated or uncorrelated factors model. The final 14 items include intolerance of a variety of unpleasant physical states. See Table 3 for items, loadings and percent of variance accounted for.

3.4.3. For the IDQ-E, MAP indicated 2 components and PA indicated 3 components, with the third component uninterpretable. In the PCA, the second component had an insufficient number of items that met the loading criteria. The nine items that met the loading criteria were analyzed with a 1-component SEM model and showed good fit for this model (AASR = .04; CFI = .93; χ^2 (27, N = 150) = 53.96). The final 9 items include intolerance of a variety of unpleasant emotional states. Table 4 shows items, loadings and percent of variance accounted for.

3.4.4. Final scale internal consistency reliabilities were calculated for each half and the total sample. See Table 5 for Cronbach's alphas. No item's removal would improve the internal consistency of any scale measurably.

3.5. Scoring Method

Since all items retained except the coping items were phrased in the direction of intolerance, the final names for the measures refer to intolerance rather than tolerance. So that a total score could be easily computed and all scores would reflect the same direction (more intolerance), the second component of the IDQ-S was reverse scored and renamed Lack of Cognitive Coping. Scores were computed as means to ease interpretability within and between scales. Mean scores were computed for each component and for the total of each measure. Table 5 displays the means and SDs on each half sample and the total sample.

3.6. Intercorrelations

The intercorrelations of the three IDQ-S scales, the IDQ-P scale, and the IDQ-E scale are shown in Table 6. No two IDQ-S scales share more than 16% of common variance, indicating considerable unique variance. Also, IDQ-S shares only 25 to 30% of variance with IDQ-P and IDQ-E, indicating some common variance but considerable unique variance. The common variance is generally accounted for by shared variance with the first component of the IDQ-S (32 to 34% shared variance), with only 10-14% shared variance between the IDQ-S Pain Intolerance scale and the IDQ-P or IDQ-E, and 1% variance shared

with the IDQ-S Lack of Cognitive Coping scale. The IDQ-P and IDQ-E share 42% of variance with each other, indicating some common underlying construct but considerable unique variance.

3.7. IDQ-S Validity

3.7.1. Discriminant Validity—Table 7 displays the validity analyses for IDQ-S. Age and education were not significantly related to IDQ-S scores except for the following: more educated people reported being better able to tolerate withdrawal symptoms (5% of variance) and older people reported more use of cognitive coping (2% of variance shared). No significant differences by sex, race or marital status were found.

3.7.2. Construct Validity—Correlations with CES-D and REVS scores showed that all three scales were significantly correlated with both measures, accounting for between 5 and 29% shared variance. The highest correlations were between the Withdrawal Intolerance scale and both the REVS (27% shared variance) and CES-D (18% shared variance), as would be expected because of the common negative affective content. The lowest correlations were with Lack of Cognitive Coping (only 5% shared variance), reasonable given that this scale adds coping strategies to the discomfort items, unlike the REVS and CES-D. That the IDQ-S scales share no more than 29% variance with CES-D and REVS supports the idea that the IDQ-S is contributing unique content in addition to the shared content. Thus, there is some support for construct validity.

3.7.3. Convergent Validity—Correlations with smoking history measures provide convergent validity support for two of the three scales. The pattern indicates that Withdrawal Intolerance is more strongly related to smoking history than is Lack of Cognitive Coping or Pain Intolerance. Greater reported intolerance of withdrawal was associated with higher smoking rate and dependence, with shorter previous smoking cessation attempts, and with a trend for being in the Precontemplation stage of change. Lack of Cognitive Coping with withdrawal was significantly higher for people with fewer and shorter past serious quit attempts and for those in the Precontemplation stage of motivation to quit smoking, and tended to be higher for people with higher smoking dependence scores as assessed by the FTND and minutes to first cigarette. Abstinence-related Pain Intolerance only showed non-significant trends ($p < .05$) for being related to fewer past serious quit attempts, greater dependence and lower motivation.

3.8. IDQ-P and IDQ-E Validity

3.8.1. Discriminant Validity—Table 8 displays the results of the validity analyses for IDQ-P and IDQ-E. People with higher education reported more tolerance of physical and emotional discomfort (8-9% shared variance). Age, sex and marital status were not significantly correlated with IDQ-P or IDQ-E scores. Scores were higher for IDQ-P and tended to be higher for IDQ-E (more intolerance) for non-whites (IDQ-P $M = 3.79$, $SD = 0.56$; IDQ-E $M = 3.41$, $SD = 0.73$) than for whites (IDQ-P $M = 3.46$, $SD = 0.60$; IDQ-E $M = 3.14$, $SD = 0.62$).

3.8.2. Construct Validity—Correlations with CES-D and REVS scores showed highly significant correlations with both measures, indicating that 18-24% of variance in IDQ-P and 21-31% of variance in IDQ-E was shared with depression and emotional vulnerability.

3.8.3. Convergent Validity—Correlations with smoking history measures showed that IDQ-P was significantly related to only one indicator of dependence: time to first cigarette of the day, with more rapid initial smoking by those reporting more intolerance of physical discomfort. Significant relationships were found between IDQ-E and only two indicators of

nicotine dependence: time to first cigarette of the day and FTND score, with more dependent scores (shorter latency to smoke, higher FTND) associated with more intolerance of emotional discomfort. Neither measure was significantly associated with number of length of past quit attempts. A trend was found for Precontemplators to report higher intolerance of physical or emotional discomfort (IDQ-P $M = 3.64$, $SD = 0.62$; IDQ-E $M = 3.33$, $SD = 0.65$) than smokers who were more motivated to change (IDQ-P $M = 3.46$, $SD = .59$; IDQ-E $M = 3.13$, $SD = 0.64$).

4. Discussion

4.1. Overview and discussion of findings

The Intolerance for Smoking Abstinence Discomfort questionnaire provides a reliable and valid way to assess inability to handle the discomfort involved in smoking cessation. This is the first study to report the development of a self-report measure of tolerance or intolerance of smoking abstinence discomfort specifically and the first to show dimensions underlying this construct. Intolerance for Smoking Abstinence Discomfort was found to consist of three confirmed components that shared no more than 16% of variance with each other: (1) intolerance of affective and cognitive symptoms of tobacco withdrawal, (2) intolerance of aches and pain resulting from abstinence, and (3) use of cognitive coping methods to make abstinence more tolerable (reverse scored). Two of these components showed strong convergent validity with measures of smoking use, dependence, duration of past success with quit attempts, and current motivation to quit smoking. People who relapsed more rapidly to smoking in their longest past quit attempt reported more intolerance of the discomfort of tobacco withdrawal and less use of cognitive coping with smoking abstinence than did people whose longest quit attempts lasted longer. Furthermore, people who reported fewer past serious quit attempts endorsed less use of cognitive coping with abstinence. Being currently more motivated to quit smoking was associated with significantly more cognitive coping with abstinence with a trend for less intolerance of smoking withdrawal. However, reporting more intolerance of the pain that can result from tobacco abstinence only showed a statistical trend for an association with nicotine dependence, number of quit attempts and current motivation to change. Therefore, the Pain Intolerance scale does not appear heuristic in relation to smoking-related variables and will not be retained, leaving a final two-component 17-item measure.

The component structure of the measure was supported by confirmatory factor analysis, as was the unifactorial structure of the measures of intolerance of emotional and physical discomfort. Construct validity of all three measures was supported by significant and strong correlations with measures of state depression and emotional reactivity, while the correlations are low enough to indicate separation of the constructs (Anastasi, 1988). No more than 12% of variance was shared between any IDQ-S scale and the concurrent validity measures of nicotine dependence and smoking rate, indicating that IDQ-S is conceptually considerably different from smoking rate or dependence although these may be partial determinants of inability to tolerate abstinence discomfort. No significant effects of gender, marital status or white versus non-white race were found, indicating that the measure can be used without regard to these variables. Older people reported somewhat more cognitive coping, probably due to more life experience involving needing to cope with negative events, and more educated people reported better ability to tolerate withdrawal; however, less than 6% of variance was accounted for by age or education.

4.2. Implications and utility

The measure of intolerance for smoking abstinence discomfort may be more useful as an indicator of people's patterns of having past difficulty with quitting smoking and history of

rapid relapse than are our measures of intolerance of general physical or emotional discomfort. While the physical and emotional discomfort intolerance measures were reliable and valid, they showed weaker relationships to two indicators of tobacco dependence than did the IDQ-S, and they were not significantly related to smoking cessation motivation, number of past quit attempts, or length of past smoking cessation. As expected, a measure that is more specific to ability to tolerate smoking abstinence shows a stronger relationship with past smoking success than the non-specific measures do. While the measure still needs to be tested prospectively, the IDQ-S is likely to have more clinical utility than any measure of general distress intolerance.

It is still possible that a general ability to tolerate both physical and emotional discomfort may underlie the ability to tolerate the discomfort of smoking abstinence specifically, as argued by Brown et al. (2005) and Simons and Gaher (2005). However, the ultimate question will be which types of measures are more heuristic and account for more variance in smoking cessation. Future research needs to investigate the degree of shared and separate variance not only among these various measures but of each with smoking cessation variables. No study has as yet compared self-report measures to behavioral measures of distress tolerance for shared variance and relative relationship to past or future smoking cessation. Future work needs to do so.

The IDQ-S was designed to provide a measure that could be more easily used by clinicians than are the laboratory tasks tested in previous studies. Possibly clinicians will be able to use this measure to identify smokers who need more pharmacologic or psychosocial assistance with tolerating the discomfort of smoking abstinence. These smokers may need higher doses (e.g., Hughes et al., 1999) or a lengthier course of pharmacotherapy. Possible approaches to helping them learn ways to increase their ability to tolerate the discomfort of smoking cessation include teaching cognitive and behavioral coping strategies, or teaching smokers that accepting discomfort may be necessary for success (a form of cognitive restructuring). Further research is needed to indicate how ability to tolerate the discomfort of smoking cessation may best be increased, and the extent to which this measure prospectively predicts duration of smoking cessation after motivational interventions or smoking cessation treatment.

4.3. Limitations

One limitation is the use of only this one pool of urban smokers to date; replication is needed in other populations. Second, the measure was administered in the non-abstinent state. Reactions to non-specific behavioral distress tolerance measures did not differ significantly as a function of abstinent versus non-abstinent state (e.g., Brown, et al., 2002) so IDQ-S is likely to be unaffected by abstinence, but this needs study. Third, the measure has not been compared to more recently validated self-report measures of general distress tolerance. Fourth, IDQ-S has not yet been used prospectively to predict smoking relapse or quit attempts. Despite these limitations, the IDQ-S may provide a useful tool for clinicians in identifying individuals who might need extra assistance in dealing with withdrawal discomfort and it warrants further research.

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Abbreviations that are not standard in this field

VAMC	Veterans Affairs Medical Center
REVS	Rudd Emotional Vulnerability Scale
IDQ-S	Intolerance for Smoking Abstinence Questionnaire
IDQ-P	Intolerance for Physical Discomfort Questionnaire
IDQ-E	Intolerance for Emotional Discomfort Questionnaire
PA	Parallel analysis
MAP	Minimum average partial method
CFI	Comparative fit index
AASR	Average absolute standardized residual
LSR	largest standardized residual

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Table 1
Characteristics of Participants

	Mean (S.D.)	n (%)
Age	47.6 (12.4) (range 20-77)	
Education	13.0 (2.3) (range 4-25)	
Male		142 (47.6)
White		267 (89.9)
Black		20 (6.7)
Hispanic		5 (1.7)
American Indian or mixed race		5 (1.7)
Married or living together		118 (39.9)
Employed (full or part time)		128 (42.6)
Unemployed but student or retired		96 (32.0)
Unemployed other		74 (24.7)
Cigarettes per day past week	21.3 (10.4) (median = 20.0)	
Minutes to first cigarette	28.5 (78.2) (median = 10.0)	
FTND score	5.6 (2.0)	
Number of past 12 hr quit attempts	4.7 (9.4) (median = 3.0)	
Never quit at least 24 hr		38 (12.7)
Ever quit at least 3 mo		142 (47.3)
Length of longest quit attempt (days)	422.5 (1107.3) (median = 61.0)	
Precontemplation Stage		84 (32.8)
Contemplation Stage		119 (46.5)
Preparation Stage		53 (20.7)
CES-D score	17.2 (13.4)	
REVS (20-item) score	2.15 (0.82)	

Note: When distribution is significantly skewed, median is provided as additional information.

Table 2
IDQ-S Component Structure, Percentage of Explained Variance, Component Loadings^a
and Items

Scales and Items	Loading
<u>Withdrawal Intolerance</u> (% of variance = 32.27)	
I hate that anxious feeling I get when I haven't had a cigarette in a while.	.78
I can't tolerate being irritable from not smoking.	.70
I cannot stand how I feel when I need a cigarette.	.72
I hate it when my mind doesn't feel sharp if I haven't had a cigarette in a while.	.64
I can't stand that restless, jittery feeling I get if I go too long without a cigarette.	.75
When trying to quit smoking, my desire for a cigarette is more than I can handle.	.74
It really bothers me if I have trouble concentrating when I've gone without a cigarette for a while.	.66
I can't tolerate feeling dragged out or fatigued when I go without smoking.	.64
When I go too long without a cigarette, I feel depressed and I can't stand feeling that way.	.66
Going through nicotine withdrawal is more stress than I can tolerate.	.65
When I have an urge to smoke, I have to do something about it.	.58
I can't stand the boredom that goes along with quitting cigarettes.	.53
<u>Cognitive Coping</u> (% of variance = 11.45)	
I just have to tolerate how I feel in order to quit cigarettes.	.73
The pain I experience when quitting smoking won't go away right away but I just have to wait it through.	.72
I will feel irritable when quitting smoking but it will be temporary and I can deal with it.	.67
It's OK if I have to feel lousy for a while in order to quit smoking.	.65
To get through a day without a cigarette, I think to myself, "no pain, no gain".	.54
<u>Pain Intolerance</u> (% of variance = 8.22)	
When I get a headache from quitting cigarettes, I have to take something for the pain as soon as possible.	.83
I use aspirin, Tylenol, or Advil whenever I have aches or pains from nicotine withdrawal.	.83
When I have a bad headache from quitting cigarettes, I have to lie down or go to a quiet place.	.64

^aComponent loadings are from the confirmatory factor analysis

Table 3
Tolerance for Physical Discomfort Component Structure, Percentage of Explained
Variance, Component Loadings^a and Items

Items (% of variance = 32.01)	Loading
I can't stand feeling nauseous.	.72
It really bothers me to feel wet or clammy.	.70
I can't tolerate feeling light-headed.	.67
The feeling of my heart pounding is very distressing to me.	.67
I can't tolerate having diarrhea.	.67
Feeling restless or jittery is awful to me.	.65
I hate it when my eyes tear or are irritated.	.64
I hate feeling tired.	.63
Feeling short of breath is intolerable to me.	.63
It really bothers me if I have trouble concentrating.	.63
The sensation of having a lump in my throat is impossible to bear.	.61
I hate feeling dragged out or fatigued.	.60
I can't ignore the sensation of a full bladder.	.58
I can't stand it if I sweat excessively.	.51

^aComponent loadings are from the confirmatory factor analysis

Table 4
Tolerance for Emotional Discomfort Component Structure, Percentage of Explained
Variance, Component Loadings^a and Items

Items (% of variance = 39.71)	Loading
I need to avoid feeling lonely at all costs.	.70
I avoid anything that leads to me being irritable.	.66
I can't tolerate feeling nervous.	.64
I need to avoid anything that makes me fearful.	.63
I can't tolerate being sent a bill that is incorrect.	.62
I cannot tolerate feeling really down in the dumps.	.58
I avoid any stressful situations.	.56
I hate being stuck in traffic.	.55
Boredom is intolerable to me.	.53

^aComponent loadings are from the confirmatory factor analysis

Table 5
Means, Standard Deviations, and Cronbach's Alpha Reliabilities for the Smoking Abstinence, Physical and Emotional IDQ Scales

Scale	Subsample 1 (n = 150)			Subsample 2 (n = 150)			Total Sample (n = 300)		
	Mean	SD	Alpha	Mean	SD	Alpha	Mean	SD	Alpha
Withdrawal									
Intolerance	3.44	.70	.90	3.27	.72	.90	3.36	.71	.90
Lack of Cognitive									
Coping	2.56	.63	.68	2.61	.67	.72	2.58	.65	.70
Pain									
Intolerance	2.76	.88	.79	2.72	.81	.71	2.74	.84	.75
IDQ-S									
Total	3.12	.54	.87	3.02	.56	.87	3.07	.55	.87
IDQ-P	3.52	.60	.89	3.47	.60	.85	3.49	.60	.87
IDQ-E	3.20	.61	.79	3.15	.67	.83	3.17	.64	.81

Table 6
Scale Intercorrelations within IDQ-S and between IDQ-S, IDQ-P and IDQ-E

	IDQ-S 2	IDQ-S 3	IDQ-P	IDQ-E
	<i>r</i>	<i>r</i>	<i>r</i>	<i>r</i>
IDQ-S 1: Withdrawal Intolerance	.27	.40	.57	.58
IDQ-S 2: Lack of Cognitive Coping		.23	.05	.09
IDQ-S 3: Pain Intolerance			.32	.37
IDQ-S Total			.52	.55
IDQ-P				.65

Table 7
Construct, Convergent and Discriminant Validity: Correlations of IDQ-S Scales with Validity Measures

	Withdrawal Intolerance	Lack of Cognitive Coping	Pain Intolerance	IDQ-S Total
	<i>r</i> or <i>t(df)</i>	<i>r</i> or <i>t(df)</i>	<i>r</i> or <i>t(df)</i>	<i>r</i> or <i>t(df)</i>
Sex	0.11 (297)	1.30(297)	0.93 (297)	0.68 (297)
White vs. nonwhite	1.56 (294)	1.68 (294)	1.47 (294)	2.03 (294) *
Married/living together vs. no	− 0.34 (294)	−0.09 (294)	1.18 (294)	−0.18 (294)
Age	−.04	−.15 **	−.04	−.08
Education	−.24 ***	−.07	−.13 *	−.23 ***
Cigarettes/day (log)	.21 ***	.06	.06	.19 ***
Minutes to 1st cigarette (log)	−.28 ***	−.14 *	−.11 *	−.28 ***
FTND score	.34 ***	.12 *	.11 *	.32 ***
No. of past >12-h quits (log)	−.07	−.18 ***	−.13 *	−.14 **
Longest quit attempt	−.21 ***	−.16 **	−.03	−.22 ***
Longest quit 24 h vs. 3 mo.	2.87 (173) **	2.35 (173) *	1.62 (173)	3.22 (173) **
Stage (Precontemplation vs. other)	2.32 (254) *	3.94 (254) ***	2.16 (254) *	3.40 (254) ***
CES-D score	.43 ***	.22 ***	.31 ***	.47 ***
REVS score	.52 ***	.24 ***	.34 ***	.54 ***

* $p < .05$ (trend)

** $p < .01$

*** $p < .001$.

Table 8
Construct, Convergent and Discriminant Validity: Correlations of IDQ-P and IDQ-E with Validity Measures

	Physical Intolerance		Emotional Intolerance	
	<i>r</i>	<i>t(df)</i>	<i>r</i>	<i>t(df)</i>
Sex		1.22 (297)		1.12 (297)
White vs. nonwhite		2.85 (294) **		2.17 (294) *
Married or living together vs. not		1.54 (294)		1.05 (294)
Age	-.05		.00	
Education	-.30 ***		-.28 ***	
Cigarettes per day past week (log)	-.04		.06	
Minutes to first cigarette (log) (n = 224)	-.19 **		-.20 **	
FTND score	.09		.18 ***	
Number of past 12-h quit attempts (log)	-.03		-.05	
Length of longest quit attempt	-.11		.01	
Past quit length 24 h vs. 3 mo. (n = 175)		0.69 (58.0) ^a		1.16 (173)
Stage (Precontemplation vs. other)		2.24 (254) *		2.31 (254) *
CES-D score	.43 ***		.46 ***	
REVS score	.49 ***		.56 ***	

*
 $p < .05$ (trend)

**
 $p < .01$

 $p < .001$.

^a
df corrected for unequal variances