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Evaluation of anxiety sensitivity among daily adult smokers using item response theory analysis

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ABSTRACT

The present investigation applied Item Response Theory (IRT) methodology to the 16-item Anxiety Sensitivity Index (ASI) [Reiss, S., Peterson, R. A., Gursky, M., & McNally, R. J. (1986). Anxiety sensitivity, anxiety frequency, and the prediction of fearfulness. *Behaviour Research and Therapy*, *24*, 1–8] for a sample of 475 daily adult smokers (52% women; M_{age} = 26.9, S.D. = 11.1, range = 18–65). Using non-parametric item response analysis, all 16 ASI items were evaluated. Evaluation of the option characteristic curves for each item revealed 4 poorly discriminating ASI items (1: "It is important not to appear nervous;" 5: "It is important to me to stay in control of my emotions;" 7: "It embarrasses me when my stomach growls;" 9: "When I notice my heart beating rapidly, I worry that I might be having a heart attack"), which were dropped from analysis. Upon repeat analysis, the remaining items appeared to make adequate separations within levels of anxiety sensitivity in this sample. Graded response modeling data indicated important differences in ASI items' capacity to discriminate between, and provide information about, latent levels of anxiety sensitivity. Specifically, three items best discriminated and provided the most information regarding latent levels of AS—items 3, 15, and 16. Items 1, 5, 7, and 9 were omitted due to their limited capacity to discriminate between latent levels of anxiety sensitivity; items 8, 12, and 13 also performed poorly. Overall, current findings suggest that evaluation of anxiety sensitivity among adult smokers using the 16-item ASI may usefully choose to focus on items that performed well in these IRT analyses (items: 2, 3, 4, 6, 10, 11, 14, 15, and 16).

Anxiety sensitivity reflects individual differences in the fear of anxiety and arousal-related sensations (McNally, 2002; Taylor, 1999). When anxious, individuals high in anxiety sensitivity become acutely fearful due to beliefs that these interoceptive sensations have harmful physical, psychological, or social consequences (Taylor et al., 2007). Anxiety sensitivity is conceptually and empirically unique from, and demonstrates incremental validity relative to, trait anxiety (Rapee & Medero, 1994) as well as negative affectivity/neuroticism (Zvolensky, Kotov, Antipova, & Schmidt, 2005).

Anxiety sensitivity has been predominantly studied in relation to better understanding the etiology and maintenance of anxiety and its disorders (Feldner, Zvolensky, Schmidt, & Rose, 2008; Hayward, Killen, Kraemer, & Taylor, 2000; Li & Zinbarg, 2007; Maller & Reiss, 1992; Schmidt, Lerew, & Jackson, 1997; Schmidt, Lerew, & Jackson, 1999; Schmidt, Zvolensky, & Maner, 2006), although this cognitive construct has been increasingly linked to substance use disorders (Lejuez, Paulson, Daughters, Bornovalova, & Zvolensky, 2006; Norton, Rockman, Luy, & Marion, 1993; Stewart, Karp, Pihl, & Peterson, 1997; Stewart & Kushner, 2001). Of the substance use disorders, anxiety sensitivity has most frequently been studied in relation to cigarette smoking (Brown, Kahler, Zvolensky, Lejuez, & Ramsey, 2001; Morissette, Tull, Gulliver, Kamholz, & Zimering, 2007; Zvolensky & Bernstein, 2005; Zvolensky, Schmidt, & Stewart, 2003).

There is a number of interrelated streams of empirical work that have highlighted the clinical and theoretical relevance of anxiety sensitivity to the study of cigarette smoking and nicotine dependence. For example, cigarette smokers with higher compared to lower levels of anxiety sensitivity are more apt to endorse smoking motives principally aimed at negative affect reduction (Brown et al., 2001; Comeau, Stewart, & Loba, 2001; Gonzalez,

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Zvolensky, Vujanovic, Leyro, & Marshall, in press; Leyro, Zvolensky, Vujanovic, & Bernstein, 2008; Novak, Burgess, Clark, Zvolensky, & Brown, 2003; Stewart, Karp, et al., 1997; Stewart, Taylor, & Baker, 1997; Zvolensky, Bonn-Miller, Feldner, et al., 2006). A conceptually similar and related line of work has indicated that anxiety sensitivity is related to outcome expectancies for negative affect reduction (beliefs smoking will reduce negative affect; Brown et al., 2001; Gregor, Zvolensky, McLeish, Bernstein, & Morissette, 2008; Zvolensky, Feldner, et al., 2004). Additionally, smokers high compared to low in anxiety sensitivity report perceiving quitting as more of a personally threatening and stressful experience (Gonzalez et al., in press; Zvolensky, Vujanovic, et al., 2007). Other work suggests that high relative to low AS smokers may be hypersensitive to aversive internal sensations that routinely occur during the early stages of a quit attempt (e.g., negative affect, nicotine withdrawal; Mullane et al., in press; Zvolensky, Baker, et al., 2004). And finally, anxiety sensitivity is associated with an increased rate of smoking lapse (any smoking behavior) and relapse during quit attempts (Brown et al., 2001; Mullane et al., in press; Zvolensky, Bernstein, et al., 2007; Zvolensky, Bonn-Miller, Bernstein, & Marshall, 2006; Zvolensky, Stewart, Vujanovic, Garvic, & Steeves, in press).

Anxiety sensitivity has most commonly been measured with the 16-item Anxiety Sensitivity Index (ASI; Reiss, Peterson, Gursky, & McNally, 1986) among smokers and other populations. Although a number of other anxiety sensitivity scales have appeared in recent years (Taylor & Cox, 1998; Taylor et al., 2007), the 16-item ASI has been, and continues to be, the most commonly employed measure to assess the construct (Bernstein & Zvolensky, 2007; Taylor, 1999). The 16-item ASI has generally well-established psychometric properties, as exemplified by research involving the application of classical test theory methods (Peterson & Reiss, 1992). Factor analytic work on the 16-item ASI, for example, has suggested that the construct is multi-dimensional and hierarchical in nature; comprised of a higher-order factor with a number of specific lower-order facets (Zinbarg, Mohlman, & Hong, 1999). Though many different factor solutions have been previously reported, generally ranging from two to four lower-order dimensions (e.g., Carter, Miller, Sbrocco, Suchday, & Lewis, 1999; Cox, Parker, & Swinson, 1996; Schmidt & Joiner, 2002; Telch, Schermis, & Lucas, 1989; Vujanovic, Arrindell, Bernstein, Norton, & Zvolensky, 2007; Zinbarg, Barlow, & Brown, 1997), the most compelling evidence has supported a hierarchical three-factor structure. The 16-item ASI is typically conceptualized as being comprised of one higher-order factor (ASI Total Score) and three lower-order factors: physical (e.g., "It scares me when my heart beats rapidly"), psychological (e.g., "When I cannot keep my mind on a task, I worry that I might be going crazy), and social Concerns (e.g., "Other people notice when I feel shaky") (Rodriguez, Bruce, Pagano, Spencer, & Keller, 2004; Stewart, Taylor, et al., 1997; Zinbarg et al., 1997). The 16-item ASI total and subfactor scores have shown adequate internal consistency, test–retest reliability, and construct validity (McNally & Lorenz, 1987; Reiss et al., 1986; Rodriguez et al., 2004; Zinbarg et al., 1997). More recently, latent structural study integrating Coherent Cut Kinetic taxometric procedures and factor analysis has indicated that individual differences in anxiety sensitivity may best be characterized by first deciding whether individuals belong to a high or low anxiety sensitivity subgroup and then indexing variability within these latent classes (Bernstein, Zvolensky, Norton, et al., 2007; Bernstein, Zvolensky, Stewart, & Comeau, 2007). Specifically, the distribution of anxiety sensitivity scores may demonstrate both a dichotomous latent class structure (taxonic) as well as continuous within-class continuity (taxonic-dimensionality; Bernstein, Zvolensky, Norton, et al., 2007). Consequently, there may be taxonic group differences in anxiety sensitivity between individuals and continuous differences between individuals along a dimension(s) within each anxiety sensitivity group (Bernstein, Zvolensky, Stewart, & Comeau, 2007).

Although the 16-item ASI has indeed been a promising instrument, it is noteworthy that extant work has principally evaluated this instrument using classical test theory methodologies, which have yielded somewhat discrepant findings regarding the factor structure of the instrument (Taylor et al., 2007). As another example, the validity of inferences from taxometric research is dependent on the validity of observable indicators to index the latent construct (e.g., Bernstein, Zvolensky, Norton, et al., 2007; Bernstein, Zvolensky, Stewart, et al., 2007). Classical test theory has a number of limitations, including item-dependent estimates, unconditional standard errors of measurement, among others (see Emberston, 1996; Embretson & Reise, 2000, for expanded discussions). Similarly, taxometric methodology is not designed to identify the psychometric capacity of observable indicators (at the item-level) to best discriminate between anxiety sensitivity taxonic groups or continuously across the range of the latent anxiety sensitivity dimension(s) (Embretson & Reise, 2000).

To address these types of concerns, Item Response Theory (IRT) has proven valuable. Indeed, IRT has been successfully employed to refine the assessment of a number of psychopathological constructs (e.g., Beevers, Strong, Meyer, Pilkonis, & Miller, 2007; Cole, Rabin, Smith, & Kaufman, 2004; Gomez, Cooper, & Gomez, 2005; Kahler, Strong, Read, Palfai, & Wood, 2004). Compared to class test theory, IRT offers some unique advantages (see Emberston, 1996). For example, IRT defines a true score on the basis of the latent trait (e.g., anxiety sensitivity), whereas classical test theory defines a true score on the basis of the test itself (Emberston, 1996). As another example, IRT has led to development of useful tools for evaluating the performance of items within an established measure through item bias analysis. Thus, there is the ability to evaluate a given item of a measure (e.g., 16-item ASI) in terms of its performance across diverse groups of individuals (e.g., males/females). As a final example, methods based in IRT allow efficient evaluation of the adequacy of response options and facilitate identification of effective scaling for each specific item of a scale to increase reliable discriminations among individuals (Emberston, 1996). Thus, with regard to the 16-item ASI, methods based in IRT may be utilized to isolate items that are less than ideally useful in terms of defining the latent construct, and thereby, may facilitate a more efficient and targeted assessment of anxiety sensitivity.

With this background, the aim of the current investigation was to employ IRT methods to examine the 16-item ASI among a large sample of adult daily smokers. Due to the growing volume of research focused on the theoretically and clinically pertinent associations between anxiety sensitivity and nicotine use and dependence (Bernstein & Zvolensky, 2007; Zvolensky & Bernstein, 2005), the need for more refined assessment of anxiety sensitivity is increasingly apparent. When modeling psychological constructs, such as anxiety sensitivity, responses to items can be modeled using either parametric (cf. Birnbaum, 1968; Rasch, 1960) or non-parametric approaches (cf. Mokken, 1982; Molenaar, 1997; Ramsey, 2000). These two broad classes of models differ primarily in the assumptions about the underlying relationship between levels of anxiety sensitivity and the probability of responding to higher response options for each item. Non-parametric approaches are much less restrictive and do not require that response probabilities conform to a particular model or that all items 'behave' in the same way. Non-parametric methods can be used to examine item response characteristics prior to fitting parametric models. Parametric models begin with an assumption of how the