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Anxiety Sensitivity Profile: Predictive and Incremental Validity

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Abstract

Anxiety sensitivity (AS) is a well-researched risk factor for the development of anxiety psychopathology. AS is typically measured using the Anxiety Sensitivity Index (ASI) but limitations have led to the creation of second generation measures of AS including the Anxiety Sensitivity Profile (ASP). The ASP has not been used very extensively, however, and we believe this may be due to two important issues: (1) the ASP is lengthy, and (2) the predictive validity of the ASP is unexplored in relation to critical outcomes such as anxiety psychopathology. The purpose of the present report was to address these two issues. We evaluated whether an abbreviated form of the ASP was viable and also conducted tests of the scale's predictive validity. Findings suggest that a 22-item version of the ASP (i.e., ASP-22) is comparable to the original 60-item ASP. Moreover, the ASP-22 was predictive of anxious responding to a CO_2 challenge. In fact, the ASP-22 outperformed the ASI as a predictor of CO_2 reactivity. Also, the ASP-22 was a significant longitudinal predictor of incidence of Axis I diagnoses. In regard to predictive validity, the ASP-22 was comparable to the original ASP. In summary, the ASP-22 appears to represent a viable measure of AS that may complement the ASI.

Keywords

Anxiety; panic; validity; prospective; carbon-dioxide; anxiety sensitivity; anxiety diagnoses; panic attacks; longitudinal; assessment

1. Anxiety Sensitivity

Expectancy theory (Reiss, 1991) posits that anxiety-sensitivity (AS) could be a critical factor in the development and maintenance of anxiety conditions (McNally, 1990). AS was initially conceptualized as a trait-like cognitive characteristic that predisposes individuals to the development of anxiety problems (Taylor, 1999). Those possessing relatively high levels of AS are theorized to perceive bodily sensations associated with autonomic arousal as a sign of imminent personal harm and, as a result, to potentially react to them with anxiety, panic attacks and/or the development of an anxiety disorder. Individual differences in AS are hypothesized to emerge from the combined influences of genetic variation along with any number of experiences that ultimately lead to the acquisition of beliefs about the potentially aversive consequences of arousal and anxiety-related states (Reiss & Havercamp, 1998). Research conducted across diverse populations has supported the AS model, providing strong evidence of cross-cultural and developmental specificity in terms of the latent structure and stability of the construct (Chorpita & Daleiden, 2000; Muris, Schmidt, Merckelbach, & Schouten, 2001;

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Zinbarg, Brown, Barlow, & Rapee, 2001; Zvolensky, Feldner, Eifert, & Stewart, 2001; Zvolensky, Kotov, Antipova, Leen-Feldner, & Schmidt, 2005). AS is also unique from, and demonstrates incremental validity to, trait anxiety (Rapee & Medoro, 1994) as well as negative affectivity (Zvolensky, Kotov, Antipova, & Schmidt, 2005).

Unlike many other cognitive conceptualizations of anxiety, AS is believed to be a dispositional characteristic that may precede the development of clinical anxiety symptoms or diagnoses. Empirical studies provide converging evidence that AS does indeed act as a risk factor for anxiety problems. First, laboratory studies indicate that baseline AS predicts fear responses to bodily sensations (Rabian, Embry, & MacIntyre, 1999; Unnewehr, Schneider, Margraf, & Jenkins, 1996; Zvolensky, McNeil, Porter, & Stewart, 2001). Second, AS levels are elevated among individuals with anxiety disorders compared to those without anxiety disorder (Kearney, Albano, Eisen, Allan, & Barlow, 1997; Rabian, Peterson, Richters, & Jensen, 1993; Taylor, Koch, & McNally, 1992). Perhaps more convincingly, prospective studies with healthy adults (Schmidt, Lerew, & Jackson, 1997, 1999) and adolescents (Hayward, Killen, Kraemer, & Taylor, 2000) indicate that AS predicts the future occurrence of anxiety symptoms and panic attacks. Finally, recent work has shown that AS increases risk for anxiety disorder diagnoses (Schmidt, Zvolensky, & Maner, 2006).

Although AS is one of the best-studied and most promising psychological risk factors for anxiety disorders, measurement instruments germane to AS are still relatively limited. The vast majority of this work in this area has utilized the Anxiety Sensitivity Index (ASI), which is a 16-item self-report measure of AS. Although AS was originally conceptualized as a unitary construct (Reiss & McNally, 1985), later studies have suggested that AS may be multidimensional and hierarchical in nature (Zinbarg, Barlow, & Brown, 1997) with the first order factors typically representing fear of physical concerns, mental catastrophe, and publicly observable symptoms. However, there have been a number of concerns raised about the ASI including the fact that this measure was not designed to measure multiple factors, the extent to which the ASI has sufficient items to assess various AS domains, and the limited number of domains that the scale assesses (Taylor & Cox, 1998a). Consider also that the ASI, while often predictive of important outcomes, accounts for only a limited amount of variance in such outcomes like incidence of panic attacks or fearful responding to biological challenge (Schmidt et al., 1999; Schmidt et al., 2000).

As a result of these concerns, several expanded measures of the AS construct have been developed. Taylor and Cox created two measures in an attempt to deal with some of these limitations. Their first expanded assessment of AS was a 36-item index called the Anxiety Sensitivity Index-Revised (ASI-R). However, due to some psychometric and conceptual problems with the ASI-R (Deacon, Abramowitz, Woods, & Tolin, 2003; Taylor & Cox, 1998a), Taylor and Cox later created the 60-item Anxiety Sensitivity Profile (ASP). The ASP was designed to assess six features of AS including fears of publicly observable anxiety reactions, cardiovascular, respiratory, dissociative/neurological, and cognitive dyscontrol symptoms. Factor analyses, however, by both Taylor and Cox (1998b) and Olatunji et al. (2005), as well as Ayvasik & Tutarel-Kislak (2004) in a Turkish sample, indicate that the ASP may possess only four primary-order factors including fears of: (1) respiratory, (2) cognitive dyscontrol, (3) gastrointestinal (GI), and (4) cardiac symptoms.

Despite the appeal of an expanded measure of AS, there have been very few studies of the ASP. Apart from the reports noted above, we are aware of one other factor analytic focused on the ASP. Van der Does, Duijsens, Eurelings-Bontekoe, Vershuur, and Spinhoven (2003) used exploratory and confirmatory factor analyses in both psychiatric and nonclinical samples to examine the latent structural properties of the measure. EFA findings from this study suggested that the ASP could be viewed unidimensionally. CFA showed some support for the

intended six-factor solution though it appears that they did not compare the six-factor model with the four-factor model. Other reports suggest that the ASP is associated with pain (Keogh, Barlow, Mounce, & Bond, 2006) and depression symptoms (Cox, Taylor, & Enns, 1999). Also, Alvarenga, Richards, Lambert, and Esler (2006) reported that the ASP was elevated in patients with panic disorder and reductions in ASP were found following treatment for panic disorder (Klein, Richards, & Austin, 2006).

Given the limitations of the original ASI along with the apparent advantages of a more fine-grained measure of AS, an important issue is attempting to account for the paucity of studies that have adopted the ASP. One consideration is that in the quest to expand our assessment of AS, we have created measures that may be too lengthy to be easily incorporated in most studies. Van der Does et al. (2003) address this issue to some extent and in fact conducted some analyses suggesting that the 60-item ASP could be reduced to 24 items without a loss in reliability (i.e., scale reduction was based on retaining the four items loading highest on the six factors). Perhaps another reason for poor utilization of the ASP is likely related to the limited data related to validity, particularly predictive validity of this measure. The ASP has not been assessed in regard to outcomes that have been critical to the AS risk factor literature such as the prediction of fear responding, panic attacks, and anxiety problems. In this regard, it would be important to demonstrate that the ASP could outperform or complement the predictive capacity of the ASI.

Inasmuch as the length and relatively unknown predictive properties of the ASP may have interfered with its general use, the current study was designed to facilitate research in this area by evaluating a more user-friendly (i.e., brief) version of the measure, and evaluating the performance of the measure with regard to important predictive outcomes (e.g., panic attacks). The present report was designed to address these two related issues. The first aim of this study was framed in terms of providing additional psychometric evaluation of the ASP to ascertain whether it can be shortened without a significant impact on reliability or validity. The second aim was to provide important validity information with regard to whether the ASP is able to predict anxiety-relevant outcomes. In terms of predictive validity, we were especially interested in the performance of the ASP relative to the ASI, to the extend that the ASP may provide incrementally greater predictive variance above and beyond the ASI.

2. Method

2.1. Overview of Study Design

Data are derived from a primary prevention study that included both an experimental and a prospective design. “At risk” participants (i.e., those with high AS) with no current or recent psychiatric illness were randomly assigned to a risk reduction or control condition and followed for approximately 24 months. The experimental manipulation was modeled after educational and behavioral procedures commonly used with patients with anxiety disorders (Schmidt & Woolaway-Bickel, 2000). This video presentation described the nature of stress and the effects of stress on the body. The goal of the presentation was to emphasize the benign nature of stress in regard to its immediate effects on the body. This presentation also taught participants that they may have developed a conditioned fear to certain bodily cues (i.e., interoceptive conditioning). This process was explained along with a description of behavioral exercises designed to correct interoceptive conditioning. These exercises involve repeated exposure to internal bodily cues that are commonly connected to fears (Schmidt & Trakowski, 2004). Upon completion of the video, an experimenter reviewed the material and answered any questions. Approximately half of the participants were randomized to a health and nutrition condition designed to control for any effects of general education and time spent with the experimenter. These participants received a computer-based presentation of equal length. This control presentation focused on health and nutrition and was conceptually similar to the experimental

condition, which was framed in terms of stress and health (see Schmidt et al., (2007) for more details). In the present report, we statistically control for experimental condition in all relevant analyses.

2.2. Participant Sampling and Recruitment

The present study utilized a multi-stage recruitment process to target high-risk individuals from the Columbus, OH metropolitan area school system (n = 46), the Ohio State University (n = 263), and the Columbus, OH community (n = 96). The ASI was used as a screening instrument for the initial determination of eligibility. This screening instrument also included several questions about prior psychiatric treatment. Interested participants with no current or recent psychiatric history (no diagnoses in the past 12 months and no current Axis I diagnosis) and scoring > 1.5 standard deviations above the mean for a nonclinical community sample of AS (Schmidt & Joiner, 2002) were eligible for the study.

The demographic makeup of the sample at entry was as follows: by design the sample was relatively young (age M = 19.3, SD = 3.9) with the majority being female (61%). The sample was also primarily White (74%) with 10% African-American, 9% Asian-American, 2% Hispanic, and 3% Other. Completion of college was the most frequently reported level of parental education with 30% of mothers and 29% of fathers finishing college.

2.3. Assessments

A multi-modal assessment battery was administered to all participants at baseline. This battery consisted of clinician-rated measures as well as self-rated measures. In addition, participants completed a 20% CO_2 challenge. During follow-up, the clinician and self-report measures were repeated. Clinician raters were unaware of the participant's treatment condition.

2.3.1. Diagnostic Interview—Psychiatric diagnoses were made using structured diagnostic interviews (SCIDNP; First, Spitzer, Gibbon, & Williams, 1994). Interviews were conducted by advanced graduate students in clinical psychology who had received extensive training in SCID administration and scoring. This training included reviewing SCID training tapes, observing taped SCID administration, observing live SCID administration, and conducting SCID interviews with a trained interviewer. Interviewers received feedback throughout this process until they demonstrated high reliability. These same training procedures have been used in other projects in our laboratory that have consistently generated high inter-rater reliability for all Axis I diagnoses (Schmidt, Trakowski, & Staab, 1997). A consensus method of diagnosis was used at weekly staff meetings where positive diagnostic findings were reviewed. For some follow-up evaluations, the SCID was conducted over the telephone. The typical inter-rater reliability evaluation was not conducted for this study for two reasons: (1) reliability would be inflated due to participant selection criteria at baseline (i.e., absence of any Axis I psychopathology), and (2) relatively few cases receiving a diagnosis at follow-up were videotaped. However, other inter-rater reliability projects conducted in the laboratory over the same time frame showed high levels of reliability among these raters (Schmidt, Eggleston, Trakowski, & Smith, 2005).

2.3.2. Self-Report Measures

Acute panic inventory (API): The API is a commonly used inventory for assessing symptoms of arousal associated with panic attacks (Liebowitz, Gorman, Fyer, Dillon, & Klein, 1984). The API has been used extensively in panic provocation studies (Fyer et al., 1987; Gorman et al., 1994; Harrison et al., 1989; Schmidt, Eggleston, et al., 2005). Participants rate the severity of each symptom from 0 (absent) to 3 (severe). The API includes a SUDS (subjective units of distress scale) rating of self-reported anxiety (0, no anxiety; 100, extreme anxiety).

Anxiety Sensitivity Index (ASI): The ASI (Reiss, Peterson, Gursky, & McNally, 1986) is a 16 item self-report measure of the fear of bodily sensations associated with arousal. Each item consists of a possible negative consequence of anxiety symptoms. The structure of the ASI is hierarchical and consists of three first-order factors (i.e., AS-physical concerns, AS-cognitive concerns, and AS-social concerns) (Zinbarg et al., 1997). The scale showed good internal consistency in the present sample ($\alpha = .87$). Because the experimental manipulation led to changes in ASI scores, in the present study, post-intervention ASI was used as the predictor variable.

Anxiety Sensitivity Profile (ASP): The ASP (Taylor & Cox, 1998b) is a 60-item expanded assessment of AS. The ASP was designed to evaluate six relevant AS domains though factor analytic studies suggest four first-order factors tapping fears of (1) respiratory, (2) cognitive dyscontrol, (3) gastrointestinal (GI), and (4) cardiac symptoms.

Trait Anxiety: Trait anxiety was assessed with the trait anxiety scale of the State Trait Personality Inventory (STPI; Spielberger et al., 1979). This scale is a well-validated self-report inventory that measures chronic (trait) anxiety. A composite measure of trait anxiety was calculated by averaging responses to this scale (after reverse scoring negatively-worded items). The trait anxiety scale exhibited good reliability in the current sample ($\alpha = .83$).

2.3.3. Behavioral measure

20% CO_2 challenge: A 20% CO_2-enriched (balance O_2) biological challenge provided a behavioral index of fear responding to a novel stimulus. To control for different expectancies regarding the consequences of breathing CO_2-enriched air, all participants were informed of several possible symptomatic consequences of breathing CO_2-enriched air including: breathlessness, dizziness, chest pain, and tachycardia. Participants were not informed regarding the onset, timing, dose, or offset of the inhalation of CO_2. Participants underwent a 20-s gas inhalation (20% CO_2, 80% O_2) administered through a continuous positive air pressure Downs C-Pap Mask with nose clip and head strap. Attached to one free port of a manually controlled 3-Way Stop Cock valve (Hans Rudolph, Inc.) was a 30-L meteorological balloon, which was inflated with the CO_2 mixture. Participants breathed the CO_2 gas directly from the balloon reservoir to minimize detection from pressurized CO_2 to nonpressurized room air. The C-Pap mask was connected to a free 22-mm port of the Stop Cock Valve via 1.8-m of aerosol tubing and the remaining port was left unattached and fed room air. A remote device was used to control of the 3-Way Stop Cock valve for unobtrusive switching between CO_2-enriched air and room air.

2.4. Procedure

Participants initially completed the SCID and, if eligible, a battery of self-report measures including the ASI and ASP. These baseline measures were used for the factor analytic analyses. Eligible participants were then randomly assigned to one of two conditions (treatment or control). Both conditions involved information delivered via an audio-visual computer presentation lasting approximately 30 minutes followed by 10 minutes spent with an experimenter. Those assigned to the treatment condition received the ASAT—an intervention designed to reduce AS levels whereas control participants received an intervention focused on health and nutrition but did not directly address AS. Due to the fact that ASAT was found to reduce AS (see Schmidt et al., 2007, for details), we used post-experimental manipulation ASI and ASP scores for the predictor analyses (i.e., predicting response to CO_2 as well as anxiety psychopathology during follow-up). We also entered experimental condition as a covariate for relevant analyses. Following the intervention, participants completed a CO_2 challenge. At this point, participants were led to a comfortable recliner in a dimly lit sound attenuated chamber and fitted with the CO2 apparatus (e.g., mask). Participants completed an API following a 5-

minute adaptation period. After approximately 3 minutes, participants received a 20-second inhalation of CO_2-enriched air. Immediately following the inhalation, participants returned to breathing normal room air and completed another API. Community and high school participants received $25 as compensation for the baseline assessment whereas college students received course credit.

Participants were followed for up to 24-months. During the follow-up evaluations, the SCID was readministered to assess the occurrence of panic attacks and Axis I disorders. Some of the interviews were conducted in person and others were completed over the phone; studies comparing phone versus in-person interviews have shown negligible differences (Fenig, Levav, Kohn, & Yelin, 1993; Sobin et al., 1993). Participants received $25 for completion of a follow-up evaluation. During the follow-up SCID evaluations, only current diagnoses (i.e., those occurring following the baseline assessment) were evaluated.

3. Results

3.1. Factor Structure of the ASP

Similar to Olatunji et al. (2005), a parallel analysis suggested a four-factor solution. PCA and PAF forcing 4 factors yielded a fairly coherent solution. The fourfactor solution accounted for 64% of the variance. The first factor accounted for 49% of the variance with the remaining factors accounting for 8, 4, and 3% respectively.

Each factor consisted of an adequate number of items with salient loadings (>.30) but, similar to Olatanji et al. (2005) and Taylor and Cox (1998b), there were a substantial number of items with complex loadings (i.e., salient loadings on more than one factor). Evaluation of the factor stability criteria suggested by Guadagnoli and Velicer (1988) (Guadagnoli & Velicer, 1988) indicated that all four factors appeared to be reasonably stable. The content of items in these four factors is highly similar to that produced by Olatanji et al. (2005) and Taylor and Cox (1998b). In our sample, factor 1 = fear of respiratory sensations/dyspnea; factor 2 = fear of cognitive dyscontrol; factor 3 = fear of gastrointestinal symptoms; and factor 4 = fear of cardiac symptoms. The consistency of findings across studies suggests this represents a reasonable replication of factors produced in two other reports.

After eliminating items with complex loadings, this yields a scale with 22 items (factor 1 items = 15, 17, 30, 47, 59, 60); factor 2 items = 7, 25, 36, 41, 44, 46, 56); factor 3 items = 11, 27, 32, 49, 50); and factor 4 items = 1, 8, 14, 31), which were used to create a brief version of the ASP (ASP-22). To evaluate the comparability of the unit-weighted abbreviated ASP with the original, as well as to evaluate associations among the subscales, correlations were computed (see Table 1). Notably, the ASP-22 was almost perfectly correlated with the 60-item original (r = .99). The ASP-22 was also internally consistent as were the four subscales (overall scale α = .94; Factor 1: .92; Factor 2: .94; Factor 3: .86; Factor 4: .90).

Evaluation of content would suggest that the ASP scales may yield incremental differences relative to the ASI. The ASP and ASI total scale and subscales were correlated (see Table 1). As expected, these analyses indicated that the total scales were significantly correlated. The ASI subscales were also significantly correlated with the ASP total score in an expected manner with the physical concerns subscale being the most associated followed by the cognitive and social concerns subscales. Also, the ASI total score was correlated fairly comparably among the ASP subscales (r range = .49 – .58). This pattern of correlations is expected for scales assessing the same construct. Despite the patterns of significant correlations, the ASI and ASP are not so highly associated such that we should be able to assess incremental predictive capabilities.

3.2. ASP prediction of Anxious Responding to a 20% CO_2 challenge

We evaluated the unique contributions of the ASP-22 total score in predicting responding to the challenge. After controlling for experimental condition, trait anxiety and the relevant baseline variable, the ASP-22 total score was incrementally predictive of challenge-induced symptoms and SUDS (see Table 2). Using the same analytic strategy, we also found that the original ASP was also predictive, but less strongly than the ASP-22 (symptoms: $\beta = .11$, $t = 2.25$, $p < .05$; SUDS: $\beta = .14$, $t = 3.13$, $p < .01$). We completed similar analyses using each of the ASP subscales separately (see Table 3). Fear of respiratory sensations, gastrointestinal and cardiac sensations were all significant predictors of symptoms and SUDS. As might be predicted based on prior specificity analyses with the CO_2 challenge (Schmidt, 1999), fear of respiratory sensations appeared to be the strongest predictor of response to challenge.

In order to ascertain whether the ASP and ASI uniquely predict challenge responding, we simultaneously regressed these variables after controlling for experimental condition, trait anxiety and the baseline variable to be predicted. Interestingly, these findings suggest that the ASP is a relatively stronger predictor of subjective response to the challenge. When both variables were in the model, the ASP was the only significant predictor of SUDS ($\beta = .14$, $t = 2.25$, $p < .05$) with a similar pattern but nonsignificant trend predicting API symptoms ($\beta = .11$, $t = 1.77$, $p = .08$).

3.3. ASP Prediction of the Incidence of Panic Attacks and Diagnoses during the Followup Period

During the 24-month follow-up period, there was a total incidence of 8.1% ($n = 24$) for Axis I disorders and an incidence of 5.1% ($n = 15$) for anxiety disorder diagnoses. The incidence of panic attacks during follow-up was 7.5% ($n = 22$). A series of hierarchical logistic regression analyses were used to predict diagnostic outcomes. In the first step, experimental condition was entered to statistically control for any intervention effects. In the second step, the post-intervention ASP-22 score and the trait anxiety score were simultaneously entered. Thus, any observed effects of the predictor variables at level 2 are unique and cannot be attributed to variance with factors in level 1 (Cohen & Cohen, 1983). The ASP-22 was predictive of the incidence of any new diagnosis (*Wald* = 5.90, *Exp (β)* = 1.02, 95% *CI* = 1.00–1.04, $p < .05$) with nonsignificant trends in predicting panic attacks (*Wald* = 3.62, *Exp (β)* = 1.02, *95% CI* = 1.00–1.04, $p = .06$) and anxiety diagnoses (*Wald* = 2.55, *Exp (β)* = 1.02, *95% CI* = 1.00–1.04, $p = .11$).

We repeated these analyses with the 60-item ASP original scale and found a very comparable pattern of predictions except that the prediction of anxiety diagnoses was now significant (*Wald* = 3.93, *Exp (β)* = 1.01, *95% CI* = 1.00–1.02, $p < .05$). We also repeated the analyses using both the ASI and the ASP-22 as simultaneous predictors (see Table 4). Tolerance values indicated that multicollinearity was not a problem (Tabachnick & Fidell, 1996). These analyses indicated that the ASI was a significant predictor of panic, anxiety diagnoses, and all diagnoses, whereas the ASP was not.

Four hierarchical logistic regression analyses, similar to the analysis using the ASP-22, were conducted to evaluate the extent to which each of the ASP first order factors predicted each of the outcome variables. Evaluation of the ASP subfactors revealed many trends that approached significance but the only statistically significant finding was that the GI concerns subscale predicted of incidence of all diagnoses (*Wald* = 5.64, *Exp (β)* = 1.10, *95% CI* = 1.02–1.18, $p < .05$).

4. Discussion

Expectancy theory proposed that AS may serve as a premorbid risk factor for the development of anxiety pathology (Reiss, 1991). Later empirical evidence has supported the idea that AS acts as a risk factor for anxiety psychopathology (Schmidt et al., 2007; Schmidt et al., 2006). Concern has been raised, however, regarding limitations of the most widely used measure of AS. As a result, alternative measures have been developed though these have not been widely adopted due in part to pragmatic issues as well as empirical questions. The present report appears to resolve at least some of these issues and suggests that the ASP is a viable measure of AS that is likely to complement the ASI.

In regard to the practical issue of measure length, data suggest that the ASP-22 performs comparably to the original 60-item version. There is some suggestion, based on one CFA, that the original six factors may be viable (Van der Does et al., 2003). However, most of the factor analytic findings are fairly consistent across the studies that have assessed the ASP in indicating four primary factors (Olatunji et al., 2005; Taylor & Cox, 1998b). We believe that the abbreviated ASP-22 assessing these four factors is more likely to be adopted by researchers and, for many purposes, there are likely to be few incremental benefits to using the original scale. On the other hand, we recognize that there is still relatively little work available with the ASP. Therefore, we want to be somewhat cautious in implying that the original be abandoned at this point in time.

In terms validity considerations, we hypothesized that some of the reticence in utilizing the ASP was due to a lack of literature clearly indicating this scale shows predictive validity and, in fact, predictive incremental validity beyond the ASI. One of the primary aims of the current report was to assess this issue and we found some support, to the extent that anxious responding to the CO_2 stressor was significantly predicted by the ASP-22. In fact, the ASP-22 was a relatively better predictor of subjective responding compared to the ASI. We noted that this finding is not surprising given the ASP subscale assessing fear of respiratory symptoms that are prominent in the CO_2 challenge and consistent with some prior reports (Schmidt, 1999).

The ASP-22 was also a significant predictor of the development of anxiety diagnoses over time. Unfortunately, the ASP-22 did not significantly predict panic attacks or overall Axis I diagnoses. Also, the ASI appears to be a relatively stronger predictor of panic and anxiety psychopathology over time (Schmidt et al., 2006). However, additional tests of predictive validity with the ASP-22 are warranted. Future work may benefit from extending such types of tests to the maintenance of psychopathology. To the extent that AS increases the risk for maladaptive emotional problems, it would not be surprising if it also facilitated the maintenance of psychopathology among individuals with pre-existing clinical conditions, or increased the probability of relapse among treated individuals.

There has been considerable interest in evaluating the three subscales of the original ASI to provide additional clarity regarding the components of anxiety sensitivity (Lambert et al., 2004; Zvolensky & Forsyth, 2002). Similar to the findings reported by Olatunji et al. (2005) and Taylor and Cox (1998), we found that the subscales of the ASI and the ASP differed in two primary ways. Although the original 60-item ASP was composed of 10 items designed to assess socially observable anxiety reactions, factor analyses including the current investigation did not include a social factor. As previously suggested (Taylor & Cox, 1998), the ASP social items absorption into other factors may indicate that social concerns do not represent an independent factor and instead the other factors may each include a social component. Alternatively, lack of a social factor may highlight the difference in wording between the ASI and ASP (Olatunji et al., 2005). The ASI items included a social consequence such as embarrassment whereas the ASP only items included a socially observable anxiety reaction.

Additionally, the ASI physical concern factor was represented by three ASP factors (respiratory, gastrointestinal and cardiac) rather than one ASI physical subfactor. Some studies suggest that an evaluation of specific sensitivities may yield better predictions depending on the outcomes of interest (Schmidt, 1999; Zinbarg et al., 2001). For example, Schmidt et al. (1999) found that the cognitive concerns subscale of the ASI was particularly predictive of panic attacks during acute stress. The present report provides some additional support for this notion in regard to ASP subscales particularly in terms of predicting subjective response to the CO_2 challenge. As discussed above, the respiratory symptoms subscale appears to be a potent predictor of CO_2 responding and in fact is somewhat more strongly associated with responding compared to the overall ASP-22.

As with any study, conclusions must be considered in light of study limitations. In regard to the psychometric component of the study, our four-factor model was consistent with other reports. Some additional work is needed to clarify the structure of the ASP as well as an expanded view of AS generally. In terms of the longitudinal predictions, despite a substantial initial sample, the study yielded a relatively low incidence of psychopathology during the follow-up interval. We were able to assess for overall incidence of diagnoses and incidence of all anxiety diagnoses, but power was limited in regard to predictions of specific diagnoses. For example, only some of the anxiety disorders were represented during follow-up. Also, this study utilized individuals participating in a primary prevention study with above average ASI scores. While we statistically controlled for experimental condition, a naturalistic design would be more ideal to rule out any confounding effects of the intervention on outcomes or a restriction of range in AS scores. On the other hand, analyses using only the control condition participants yielded the same pattern of significant findings, which helps to assure us that the experimental component of the study design did not interfere with the reported effects.

In conclusion, the present findings add to the existing knowledge base regarding the measurement and conceptualization of AS. These findings suggest that AS may be usefully assessed with alternative measures, which appear to perform at least as well if not better than existing indices on some relevant outcomes. An expanded and reliable assessment of AS is a significant step as we seek to clarify this risk factor for the development of panic, anxiety and other forms of psychopathology.

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Table 1

Bivariate Correlations among Anxiety Sensitivity Scales.

	1	2	3	4	5	6	7	8	9	10
1. ASP-22	-									
2. ASP Dyspnea	.79	-								
3. ASP Cognitive	.85	.45	-							
4. ASP GI	.80	.51	.64	-						
5. ASP Cardio	.83	.56	.66	.57	-					
6. ASI	.66	.49	.59	.51	.58	-				
7. ASI Physical	.63	.52	.47	.51	.56	.92	-			
8. ASI Cognitive	.49	.24	.61	.31	.41	.71	.55	-		
9. ASI Social	.36	.29	.32	.26	.30	.60	.35	.27	-	
10. ASP Original	.99	.79	.83	.80	.82	.67	.64	.49	.36	-
Mean	56.8	20.2	16.3	9.8	10.7	17.0	8.0	1.2	5.9	151.8
SD	24.4	9.2	9.4	5.3	5.9	8.7	5.3	1.8	2.3	65.7

Note. All correlations are significant at the 0.01 level (2-tailed). ASP = Anxiety Sensitivity Profile; ASI = Anxiety Sensitivity Index.

Table 2

ASP predicting Subjective Responding to a 20% CO_2 Challenge

Predicted Variable	Predictors in Set	ΔR^2	*t* for each predictor	β	p
API-Symptom Total					
	Step 1	0.21			
	Trait Anxiety		2.57	.12	.01*
	Baseline-API-Sxs		9.35	.42	.00***
	Condition		−2.12	−.10	.03*
	Step 2	0.01			
	ASP		2.25	.11	.02*
API-SUDS					
	Step 1	0.29			
	Trait Anxiety		2.40	.10	.02*
	Baseline-API-SUDS		11.63	.50	.00***
	Condition		−2.29	−.10	.02*
	Step 2	0.02			
	ASP		3.13	.14	.02*

Note. Trait Anxiety = State Trait Anxiety Inventory; ASI = Anxiety Sensitivity Index; ASP = Anxiety Sensitivity Profile; API-Sxs = Acute Panic Inventory, Symptom Total; API-SUDS = Acute Panic Inventory, Subjective Units of Distress.

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Table 3

Summary of ASP Subscales predicting Subjective Responding to a 20% CO_2 Challenge

Predicted Variable	*t*	β	p
Post API-Symptom Total			
Respiratory/Dyspnea Fears	3.07	.14	.002
Cognitive Dyscontrol Fears	0.93	.04	.35
Gastrointestinal Fears	2.41	.11	.02
Cardiac Fears	2.41	.11	.02
Post API-SUDS			
Respiratory/Dyspnea Fears	4.86	.21	.000
Cognitive Dyscontrol Fears	1.71	.08	.09
Gastrointestinal Fears	2.34	.11	.02
Cardiac Fears	2.69	.12	.007

Note. These analyses control for Trait Anxiety and baseline API for each relevant outcome variable; ASI = Anxiety Sensitivity Index; ASP = Anxiety Sensitivity Profile; API-Sxs = Acute Panic Inventory, Symptom Total; API-SUDS = Acute Panic Inventory, Subjective Units of Distress.

Table 4

Risk Factor Prediction of Incidence of Anxiety Pathology during Follow-up

	Exp(β)	95% CI	Wald	p
Dependent Variable: Spontaneous Panic Attacks				
Step 1				
Condition	0.46	0.19–1.14	2.80	.09
Trait Anxiety				
Step 2				
ASI	1.05	1.01–1.09	4.11	<.05
ASP	1.05	0.95–1.15	0.88	ns
Dependent Variable: Anxiety Diagnoses				
Step 1				
Condition	0.48	0.17–1.11	1.76	ns
Trait Anxiety				
Step 2				
ASI	1.06	1.01–1.11	4.26	<.05
ASP	1.05	0.94–1.17	0.71	ns
Dependent Variable: All Diagnoses				
Step 1				
Condition	0.57	0.25–1.32	1.70	ns
Trait Anxiety				
Step 2				
ASI	1.06	1.02–1.11	7.11	<.01
ASP	1.00	0.91–1.09	0.01	ns

Note: ASI = Anxiety Sensitivity Index; ASP = Anxiety Sensitivity Profile.