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Dimensions of anxiety sensitivity in the anxiety disorders: Evaluation of the ASI-3

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ABSTRACT

Anxiety sensitivity (AS), the fear of sensations of anxious arousal based on beliefs about their harmful consequences, is increasingly recognized as a multidimensional construct. The recently developed Anxiety Sensitivity Index-3 [ASI-3; Taylor, S., Zvolensky, M., Cox, B., Deacon, B., Heimberg, R., Ledley, D. R., et al. (2007). Robust dimensions of anxiety sensitivity: Development and initial validation of the Anxiety Sensitivity Index-3 (ASI-3). *Psychological Assessment, 19*, 176–188] measures three dimensions of AS: physical concerns, social concerns, and cognitive concerns. The ASI-3 shows promise, although further evaluation of its psychometric properties and validity in independent samples is needed. We evaluated the ASI-3 in a mixed sample of anxiety disorder patients ($N = 506$) and undergraduate student controls ($N = 315$). The measure demonstrated a stable 3-factor structure and sound psychometric properties, with the three factors showing theoretically consistent patterns of associations with anxiety symptoms and diagnoses. ASI-3 total scores were less discriminative. Implications for conceptual models of anxiety are discussed.

1. Introduction

Anxiety sensitivity (AS) refers to the tendency to fear body sensations associated with anxious arousal because of their perceived physical, psychological or social consequences (Reiss & McNally, 1985). Theoretically, AS intensifies the symptoms of anxiety disorders as individuals find their own arousal response to be aversive and therefore experience amplified anxiety in response to fear-eliciting stimuli. Accordingly, this construct plays an important role in the development and maintenance of anxiety disorders (Taylor, 1999). A meta-analysis (Olatunji & Wolitzky-Taylor, 2009) found a large effect size indicating greater AS among anxiety disorder patients (particularly those with panic disorder), compared to undergraduate student controls, and experimental and prospective studies have found that it is a risk factor for the development of clinical anxiety problems.

The first, and most widely used, measure of AS is the Anxiety Sensitivity Index (ASI; Reiss, Peterson, Gursky, & McNally, 1986). The ASI was constructed as a unidimensional measure in accordance with the original conceptualization of AS as a unitary construct (Reiss & McNally, 1985). Subsequent analysis of the ASI, however, and refinement of the AS construct itself, suggest a multidimensional structure. Indeed, there are multiple components to the anxiety response (e.g., increased respiration, trembling, racing thoughts) and these sensations may be feared for different reasons. For example, certain physical sensations (e.g., a racing heart) might be misinterpreted as indicating medical calamity (e.g., heart attack) while other anxiety symptoms (e.g., sweating) are feared because of the potential social consequences if they are observed by others. Some individuals fear that anxiety symptoms (e.g., racing thoughts) indicate loss of cognitive control. Accordingly, factor analyses of the ASI have not supported the intended unifactorial structure, with most studies finding between 2 and 4 factors (see Taylor, 1999 for review).

Current conceptualizations of AS and its dimensions propose a hierarchical multidimensional structure with a superordinate factor (i.e., general AS) and three lower order factors: (a) fear of physical sensations (physical concerns), (b) fear of publically observable symptoms (social concerns), and (c) fear of cognitive dyscontrol (cognitive concerns). This conceptualization has important implications for how AS relates to anxiety psychopathology. For example, whereas AS in general might be a trait-like vulnerability factor common to many anxiety problems, the lower-order dimensions of AS may specifically relate to particular types of anxiety symptoms. For example, the physical concerns dimension is strongly related to panic attacks and panic disorder (Deacon & Abramowitz, 2006; Rector, Szacun-Shimizu, & Leybman, 2007; Rodriguez, Bruce, Pagano, Spencer, & Keller, 2004; Zinbarg, Barlow,

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& Brown, 1997) and social concerns are most strongly related to the fear of negative evaluation and the diagnosis of social phobia (Deacon & Abramowitz, 2006; McWilliams, Stewart, & MacPherson, 2000; Rector et al., 2007; Rodriguez et al., 2004; Zinbarg & Barlow, 1996). Findings pertaining to cognitive concerns have been inconsistent, with some results suggesting no specific relationship to particular forms of anxiety, but rather to general distress and depression (Blais et al., 2001; Cox, Enns, Murray, Freeman, & Walker, 2001; Deacon & Abramowitz, 2006; Taylor, Koch, Woody, & McLean, 1996). Other findings however, have linked cognitive AS to generalized anxiety disorder (GAD; Rector et al., 2007; Rodriguez et al., 2004).

Although the conceptualization of AS has been refined to include a multidimensional structure, the ASI is not well suited to assess the lower-order dimensions. Half of the ASI items assess physical concerns, leaving too few items to tap into the other AS dimensions (Deacon & Valentiner, 2001). In addition, several items are not explicitly linked to AS (e.g., "It is important for me to stay in control of my emotions"), detracting from the scale's construct validity (Blais et al., 2001). Accordingly, to better assess the lower order AS dimensions, Taylor and Cox (1998a, 1998b) developed a 36-item revised scale—The ASI-R—and the 60-item Anxiety Sensitivity Profile. Yet studies of these instruments have yielded inconsistent results regarding their factor solutions (e.g., Deacon, Abramowitz, Woods, & Tolin, 2003; Taylor et al., 2007; Zvolensky et al., 2003).

To remedy these issues and provide a valid and briefer multidimensional measure of AS, Taylor et al. (2007) developed the ASI-3, an 18-item measure of the three domains of AS: physical, social and cognitive concerns. These authors conducted a comprehensive psychometric analysis of the ASI-3 which has subsequently been replicated in nonclinical populations (Osman et al., 2009). However, further evaluation of the ASI-3 in patients with anxiety disorders is warranted for a number of reasons. First, it is a newly developed measure; and second, validation of its factor structure is important because it is the first measure of AS explicitly designed to tap the three empirically derived AS dimensions. Third, although the ASI-3 is intended for use with individuals with anxiety disorders in both clinical and research settings, only one previous study has examined this measure in a clinical population. Thus, one aim of the present study was to examine the psychometric properties and factor structure of the ASI-3 in a mixed sample of anxiety disorder and nonclinical participants.

Another aim of the present study was to further investigate the relationship between the dimensions of AS, as measured by the ASI-3, and specific forms of anxiety psychopathology. In their initial paper on the ASI-3, Taylor et al. (2007) reported differences on the AS dimensions between patients diagnosed with obsessive–compulsive disorder (OCD), GAD, social phobia and panic disorder. Specifically, physical concerns were highest among panic disorder patients, while social concerns were elevated among those with social phobia. Cognitive concerns were elevated in both panic disorder and GAD patients. In the present study, we sought to replicate and extend these findings in two ways as described next.

First, we included a larger sample of anxiety disorder patients with more diverse diagnoses. Specifically, our sample included patients with specific phobia, a diagnostic group not included in Taylor et al.'s (2007) study, but which might be associated with AS (e.g., McNally & Steketee, 1985) although this association has not been consistently reported (Taylor, Koch, & McNally, 1992). We also included patients diagnosed with hypochondriasis, which is being considered for inclusion as an anxiety disorder (i.e., illness anxiety disorder) in *DSM-5* (Asmundson, Abramowitz, Richter, & Whedon, 2010; Olatunji, Deacon, & Abramowitz, 2009) and has also been associated with AS (particularly the physical dimension; e.g., Cox, Borger, & Enns, 1999; Deacon & Abramowitz, 2008; Wheaton, Berman, Franklin, & Abramowitz, 2010). Importantly, no investigation has evaluated the ASI-3 in a sample of health anxious individuals, which represents an important omission given the apparent importance of AS in health anxiety.

While comparing across anxiety disorder diagnoses can be informative, these analyses do not provide information about the relationship between AS dimensions and particular anxiety *symptoms*. Accordingly, the second way in which the present study extended the work of Taylor et al. (2007) was by including continuous measures of anxiety symptoms (e.g., worry, social anxiety, healthy anxiety) to examine how the AS dimensions relate to these phenomena across the continuum of severity and regardless of diagnostic boundaries. Indeed, many have begun to question the usefulness of diagnostic labels in favor of a dimensional approach to problematic anxiety, especially given findings from taxometric studies (e.g., Kollman, Brown, Liverant, & Hofmann, 2006; Olatunji, Broman-Fulks, Bergman, Green, & Zlomke, 2010; Olatunji, Williams, Haslam, Abramowitz, & Tolin, 2008; Ruscio, Ruscio, & Keane, 2002).

Consistent with Taylor et al. (2007), we hypothesized that the ASI-3 would show excellent psychometric properties (i.e., internal consistency and factor structure) in our mixed clinical and nonclinical sample. We also predicted a specific pattern of relationships between the dimensions of AS and disorder-specific anxiety symptoms. In particular, we hypothesized that the social concerns AS dimension would be most strongly associated with fears of social interactions and with a diagnosis of social phobia, and that the physical concerns dimension would be strongly associated with health anxiety and panic symptoms (e.g., panic attacks, agoraphobic avoidance) as well as with a diagnosis of panic disorder and hypochondriasis. Given the mixed findings regarding the AS cognitive concerns dimension, we did not have an a-prori hypothesis, but instead considered our analyses of this subscale to be exploratory.

2. Method

2.1. Participants

The total study sample consisted of 821 adults, including 506 with DSM-IV anxiety disorders and 315 unselected undergraduate students. Patients with anxiety disorders had presented for evaluation and treatment at the following sites: OCD and Related Disorders Program at Alexian Brothers Behavioral Health Hospital (Hoffman Estates, IL; $n = 192$), Mayo Clinic (Rochester, MN; $n = 287$),[1] and Anxiety and Stress Disorders Clinic at the University of North Carolina (Chapel Hill, NC; $n = 27$). Diagnoses were made according to DSM-IV-TR criteria as assessed by a structured or semistructured interview such as the Anxiety Disorders Interview Schedule (ADIS; Di Nardo, Brown, & Barlow, 1994; used in the NC site) and the Mini International Neuropsychiatric Interview (MINI; Sheehan et al., 1998 used at the MN site). Patients from the three sites were combined in order to increase sample size and the generalizability of the results.[2]

[1] ASI-3 data from 235 (46.4%) of the 506 anxiety disorder patients were included in the original report on the development of the ASI-3 (Taylor et al., 2007). In order verify the psychometric properties and factor structure of the ASI-3 in an independent sample, these patients were excluded from those analyses. Data from these patients, however, were included in our other analyses which were novel in three respects: First, Taylor et al. did not include continuous measures of any anxiety symptoms in their study; second, Taylor et al.'s comparison across patient groups did not include patients diagnosed with specific phobia or hypochondriasis; third, Taylor et al. did not examine the role of comorbid anxiety diagnoses on their results.

[2] The three study sites did not differ with respect to ASI-3 total scores $F(2, 505) = 0.62$, $p > .05$. At the subscale level, no site differences were observed in either ASI-3 Physical Concerns, $F(2, 500) = 0.14$, $p > .05$ or ASI-3 Cognitive Concerns, $F(2, 502) = 2.25$, $p > .05$. However, significant differences were observed for ASI-3 Social Concerns, $F(2, 502) = 3.90$, $p < .05$, with Tukey's HSD post hoc testing indicating that

The procedures for diagnosis, assessment, and inclusion in the study were consistent across sites and were as follows: Participants underwent a 1.5 h interview with a trained assessor who administered the diagnostic assessment. Interviewers had received training in the assessment of anxiety disorders by attending didactic seminars, observing the administration of the measures by an experienced clinician, and then administering the interview under observation by a more senior investigator who provided constructive feedback. Although interrater reliability for diagnoses was not formally examined, all assessors met with their site's clinic director to discuss diagnostic impressions, case conceptualization, and to formulate treatment recommendations for each patient. Patients were only included in the present study if there was 100% interrater agreement on their primary diagnosis. Patients also completed the self-report questionnaires described further below as part of their assessment.

Within the patient group, 109 (21.3%) had a diagnosis of panic disorder (with or without agoraphobia), 198 had a diagnosis of OCD (39.1%), 73 (14.4%) had a diagnosis of social phobia, 53 (10.5%) had a diagnosis of generalized anxiety disorder, 28 (5.5%) had a diagnosis of specific phobia, 29 (5.7%) had a diagnosis of hypochondriasis (conceptualized as health anxiety), 4 (0.8%) had a diagnosis of posttraumatic stress disorder, and 12 (2.4%) had a diagnosis of Anxiety Disorder NOS. This group was 52.7% female, 88% Caucasian, and had a mean age of 32.9 (SD = 13.8). The proportion of this group that completed high school was 85.8%. A two- or four-year college degree was attended by 54.1%, and 11.7% had completed a graduate degree.

Data were also collected from 315 unscreened undergraduate students recruited from introductory psychology courses at the North Carolina site. These participants were 73.7% female, 73.3% Caucasian, and had a mean age of 20.02 (SD = 1.75). Undergraduate participants completed an online packet of self-report questionnaires that included the ASI-3 and received course credit for their participation.

2.2. Measures

Anxiety Sensitivity Index-3 (ASI-3; Taylor et al., 2007) is an 18-item version of the original ASI (Reiss et al., 1986) that measures beliefs about the feared consequences of symptoms associated with anxious arousal (e.g., "It scares me when I become short of breath"). Respondents indicate their agreement with each item from "very little" (coded as 0) to "very much" (coded as 4). Total scores range from 0 to 72. The ASI-3 contains three empirically established subscales relating to fears of social concerns (e.g., It is important for me not to appear nervous), fears of physical symptoms (e.g., It scares me when my heart beats rapidly), and fears of cognitive dyscontrol (e.g., It scares me when I am unable to keep my mind on a task). The measure possesses excellent psychometric properties, performing well on various indices of reliability and validity (Taylor et al., 2007). We calculated subscale scores for each of the three factors: Social, Physical and Cognitive. Internal consistency estimates for these subscales in the current study ranged from adequate to good (α = .80, .88 and .90, respectively). Reliability for the total score was excellent (α = .93).

Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger, & Borkovek, 1990). The PSWQ is a 16-item scale that measures the tendency to worry excessively without regard to its specific content. The PSWQ is a reliable and valid measure of worry that is commonly used in research (Molina & Borkovek, 1994). Reliability in the present sample was good (α = .92).

Short Health Anxiety Inventory (SHAI; Salkovskis, Rimes, Warwick, & Clark, 2002). The SHAI contains 18 items that assess health anxiety independently of physical health status. Items assess worry about health, awareness of bodily sensations or changes, and feared consequences of having an illness. The SHAI has demonstrated good reliability and validity in clinical and nonclinical samples (Abramowitz, Deacon, & Valentiner, 2007; Salkovskis et al., 2002). Reliability in the present sample was excellent (α = .95).

Obsessive–Compulsive Inventory-Revised (OCI-R; Foa et al., 2002). The OCI-R is an 18-item self-report questionnaire that assesses six dimensions of OCD symptoms: (a) washing, (b) checking/doubting, (c) obsessing, (d) neutralizing, (e) ordering, and (f) hoarding. Participants rate the degree to which they are bothered or distressed by OCD symptoms in the past month on a 5-point scale from 0 (not at all) to 4 (extremely). OCI-R total scores have demonstrated excellent psychometric properties and validity (Foa et al., 2002). Reliability in the present sample was good (α = .91).

Panic and Agoraphobia Scale (PAS; Bandelow, 1995). The PAS is a 13-item measure of panic disorder symptoms. Items assess panic attacks, agoraphobic avoidance, anticipatory anxiety, disability and functional impairment. The self-report version of the PAS has been shown to possess good internal consistency, treatment sensitivity, and construct validity (Bandelow, 1999). Reliability in the present sample was good (α = .87).

Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998). The SIAS is a widely used self-report measure of social anxiety. Scores on the SIAS are reliable and valid indicators of the cognitive, affective, and behavioral aspects of social phobia (Mattick & Clarke, 1998). Respondents indicate the extent to which each of 20 items (e.g., "I have difficulty talking with other people") is true of them on a five-point Likert scale. Internal consistency in the present sample was excellent (α = .96).

2.3. Data analytic strategy

Our data analytic strategy consisted of four steps. First, we examined the factor structure of the ASI-3 (using only data that was not included in Taylor et al.'s 2007 report) in order to confirm the appropriateness of the three-factor model of AS dimensions and the use of the ASI-3 subscales. Second, we examined the correlations between the ASI-3 total and subscale scores and continuous measures of anxiety symptoms. Third, we compared mean ASI-3 total and subscale scores across the anxiety disorder and undergraduate participant groups using a series of one-way ANOVA's. Fourth, we examined whether the results of our group comparisons were influenced by the presence of comorbid anxiety disorders.

3. Results

3.1. Factor structure

We conducted a confirmatory factor analysis (CFA) in which we specified the same three-factor solution previously found to fit the ASI-3 (Taylor et al., 2007). This analysis used only ASI-3 data not included in Taylor et al.'s previous analyses (n = 271 anxiety disorder patients and n = 315 undergraduate students) and was conducted with Mplus (Muthén & Muthén, 2007) using a diagonally weighted least squares estimator (WLSMV) from the polychoric correlation matrix in order to account for the categorical nature of the ASI-3 responses. Chi-square is often used for examining the adequacy of model fit; yet this statistic often overestimates lack of fit as sample size increases (Bollen, 1989). Therefore we used multiple complementary fit indices to evaluate model fit (Bentler,

patients from the North Carolina site scored higher than those from the Illinois site on this subscale. This difference might be due to the higher proportion of individuals diagnosed with social phobia at the North Carolina site (20%) compared to the Illinois site (16.3%).

1990). Specifically, goodness of fit was evaluated using the standardized root mean square residual (SRMR), root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the Tucker–Lewis index (TLI). Good model fit was defined by the following criteria (Hu & Bentler, 1999): RMSEA ≤ .06; SRMR ≤ .08; CFI ≥ .95; and TLI ≥ .95. The use of multiple indices provides a conservative and reliable evaluation of model fit relative to the use of a single fit index.

Results of the goodness of fit tests were as follows: As expected, the Chi-square value ($\chi^2(132) = 530.27$) was significant ($p < .001$); although this value is misleading as it is sensitive to sample size (Brown, 2006). The TLI (.963), CFI (.968), and SRMR (.055) all met criteria for good fit as described above. The RMSEA value we obtained (.075) indicated adequate model fit (<.08; Browne & Cudeck, 1993), but exceeded Hu and Bentler's (1999) criteria for good model fit. Chen, Curran, Bollen, Kirby, and Paxton (2008) recommended that RMSEA values be considered in the context of other fit indices. On this basis, and considering that the other fit indices consistently indicated a good fit, we concluded that the three factor model had acceptable fit in this sample.

As a further test of the suitability of the three factor solution we next compared the fit of the three-factor model to that of one- and two-factor models (as in Taylor et al., 2007). The fit indices for the one-factor model (in which all 18 items load on a single factor) were CFI = .923, TLI = .913, SRMR = .085, and RMSEA = .116. The two-factor model consisted of a Physical Concerns factor and a combined Social/Cognitive Concerns factor, as tested previously (Taylor et al., 2007). The fit indices for the two-factor model were as follows: CFI = .949, TLI = .941, SRMR = .07, and RMSEA = .095. Thus, the three-factor model had better fit values on each of the fit indices, and neither the one- or two-factor model fit the data well. We also directly compared the fit of the models using the Chi-square test for difference testing. Results revealed that the three-factor model significantly improved on both the one-factor (Chi-squareDiff = 181.3, $p < .001$), and two-factor models (Chi-squareDiff = 91.56, $p < .001$). These results support the three-factor model for the AS-3.

3.2. Scale performance

We examined the performance of total and subscale scores for the ASI-3 again using only the data not included in Taylor et al.'s (2007) report. We elected to use unit-weighted subscale totals rather than factor scores to ease interpretability and better approximate how the ASI-3 is used in clinical and research practice. Cronbach's alpha for the Social Concerns ($\alpha = .80$), Physical Concerns ($\alpha = .88$), and Cognitive Concerns ($\alpha = .90$) subscales all suggested good reliability. The total score evidenced excellent internal consistency ($\alpha = .93$). The three subscales were highly correlated with the total score (range in rs = .85–.88) and were moderately intercorrelated with one another (range in rs = .61–.67).

3.3. Correlational analyses

We computed Pearson correlation coefficients to explore the associations between ASI-3 total and subscale scores and continuous measures of anxiety-related psychopathology as shown in Table 1. These analyses were conducted with the entire patient sample and did not include the undergraduate participants since they did not complete the other anxiety symptom measures. Due to missing data and slightly different assessment packets across the three sites the sample size differed slightly for each measure. The exception was the SHAI, which was only administered at one site and therefore had a smaller sample ($N = 176$; see note in Table 1).

Table 1
Pearson correlations between the Anxiety Sensitivity Index-3 (ASI-3; total and subscales) and continuous measures of anxiety psychopathology.

Measure	ASI-3 total	ASI-3 subscale		
		Social	Physical	Cognitive
PSWQ	.42**	.23**	.35**	.45**
SHAI	.35**	.05	.58**	.16*
OCI-R	.28**	.18**	.23**	.28**
PAS	.48**	.30**	.50**	.36**
SIAS	.41**	.50**	.17**	.33**

Note. *N*s for analyses involving the PSWQ ($N = 368$), SHAI ($N = 176$), OCI-R ($N = 497$), PAS ($N = 344$), and SIAS ($N = 383$). PSWQ: Penn State Worry Questionnaire; SHAI: Short Health Anxiety Inventory; OCI-R: Obsessive Compulsive Inventory-Revised; PAS: Panic and Agoraphobia Scale; and SIAS: Social Interaction and Anxiety Inventory.

* $p < .05$.

** $p < .01$.

3.3.1. Correlates of the ASI-3 total score

As can be seen in Table 1, the ASI-3 total score was significantly correlated with all of the continuous measures of anxiety symptoms. To compare the magnitudes of these associations, we used Steiger's equation for comparing correlation coefficients (Cohen & Cohen, 1983). Results revealed that the ASI-3 total score was correlated more strongly with the PSWQ ($p < .01$), PAS ($p < .01$) and SIAS ($p < .05$) than with the OCI-R, indicating, stronger associations between AS and measures of panic symptoms, worry, and social anxiety, compared to with OCD symptoms.

3.3.2. Correlates of the ASI-3 subscales

As is also shown in Table 1, the ASI-3 subscales demonstrated specific and theoretically consistent patterns of associations with the continuous measures of anxiety symptoms. Specifically, the ASI-3 Social Concerns subscale was moderately correlated with the SIAS, weakly correlated with the OCI-R, PAS, and PSWQ and not significantly correlated with the SHAI. Steiger's equation revealed that ASI-3 Social Concerns scores were more strongly correlated with the SIAS compared to each of the other measures (all ps < .01).

The ASI-3 Physical Concerns subscale was moderately correlated with the PAS and SHAI, and weakly to moderately correlated with each of the other measures. Steiger's equation revealed no difference in the magnitude of the correlation between the ASI-3 Physical and the SHAI and PAS ($p > .05$). However, correlations with these measures were significantly stronger than with the other measures (all ps < .01).

The ASI-3 Cognitive Concerns subscale was moderately correlated with the PSWQ, and the magnitude of this relationship was significantly stronger than that between the Cognitive Concerns subscale and the SHAI ($p < .01$), OCI-R ($p < .01$) and SIAS ($p < .05$). Steiger's equation revealed no significant difference in the strength of the association between the ASI-3 Cognitive Concerns subscale and the PSWQ and PAS ($p > .05$). In addition, ASI-3 Cognitive Concerns were more strongly correlated with the PAS than with the SHAI ($p < .05$).

3.4. Group comparisons

We conducted a series of one-way ANOVAs in which we compared patients with panic disorder, OCD, social phobia, GAD, specific phobia, hypochondriasis, as well as the undergraduate students on the ASI-3 total and subscale scores. Participants diagnosed with PTSD and Anxiety Disorder NOS were excluded from this analysis because of the extremely small sample sizes for these groups.

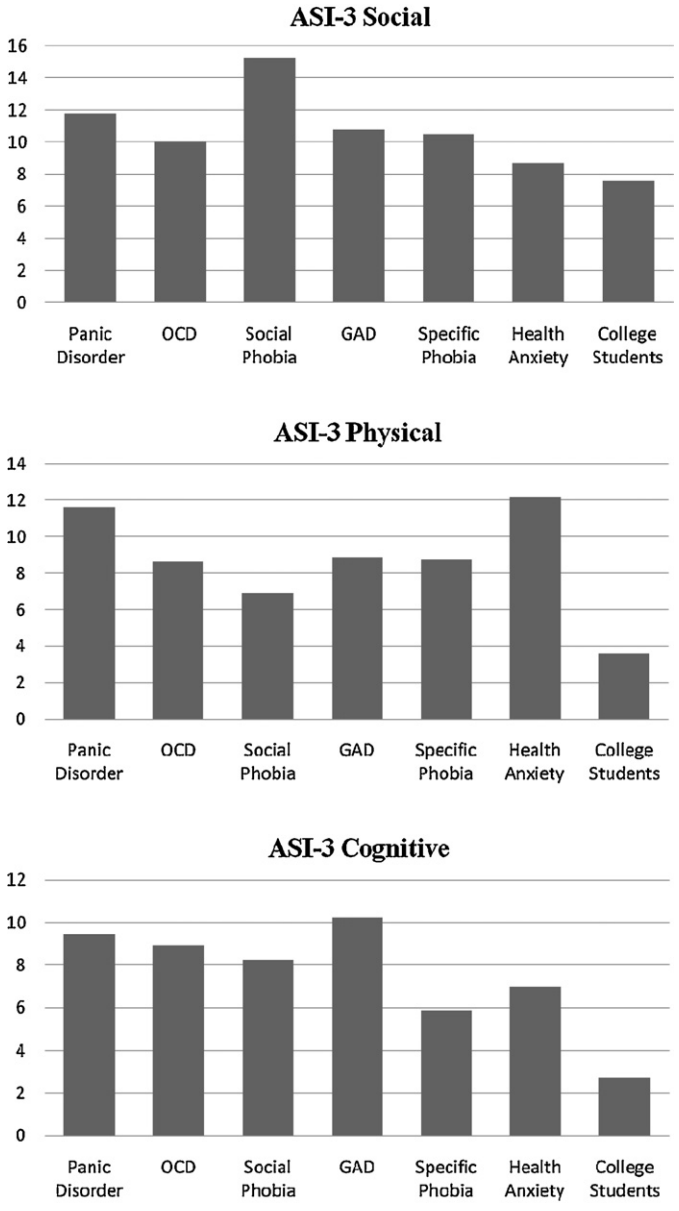

Fig. 1. ASI-3 subscale totals by group.

3.4.1. *ASI-3 total score*

Group means, standard deviations, and the results of ANOVA and post hoc Tukey HSD tests are presented in Table 2. As can be seen, ASI-3 total scores were significantly higher in each patient group compared to the undergraduate student group (all *p*s < .01). Among the patient groups, individuals with panic disorder had significantly higher ASI-3 total scores compared to OCD patients ($p < .05$), but no other significant differences emerged.

3.4.2. *ASI-3 subscales*

As shown in Table 2 and graphically depicted in Fig. 1, a theoretically meaningful pattern of results emerged when comparing groups at the ASI-3 subscale level. With regard to the Social Concerns subscale, patients diagnosed with social phobia scored significantly higher than each of the other patient groups, as well as the undergraduate students (all *p*s < .01). In addition, OCD, GAD, and panic disorder patients also had higher Social Concerns scores compared to the student group (all *p*s < .01).

All five patient groups also had higher Physical Concerns subscale scores compared to the undergraduate students (all *p*s < .01),

Table 2
Group means (standard deviations) on ASI-3 total and subscale scores.

ASI-3 scale	Group 1: panic disorder ($n = 109$)	Group 2: OCD ($n = 198$)	Group 3: social phobia ($n = 73$)	Group 4: GAD ($n = 53$)	Group 5: specific phobia ($n = 28$)	Group 6: health anxiety ($n = 29$)	Group 7: college students ($n = 315$)	$F(6, 804)$	Post hoc Tukey HSD tests of group differences
Total score	32.69 (15.21)	27.57 (17.27)	30.4 (13.05)	29.91 (16.0)	25.18 (15.1)	27.9 (17.39)	13.83 (10.79)	39.92*	1 > 2; 1, 2, 3, 4, 5, 6 > 7
Social	11.8 (5.88)	10.02 (6.53)	15.21 (5.84)	10.81 (6.65)	10.54 (6.34)	8.72 (7.03)	7.56 (4.77)	21.34*	3 > 1, 2, 4, 5, 6, 7; 1, 2, 4 > 7
Physical	11.62 (6.56)	8.67 (6.54)	6.88 (5.01)	8.85 (5.72)	8.75 (6.24)	12.21 (6.08)	3.63 (4.14)	40.52*	1, 2, 3, 4, 5, 6 > 7; 1, 6 > 2, 3; 1 > 4
Cognitive	9.44 (6.83)	8.98 (6.17)	8.28 (6.2)	10.25 (6.82)	5.89 (5.56)	6.97 (7.55)	2.72 (4.02)	39.86*	1, 2, 3, 4, 6 > 7; 1, 4 > 5

* $p < .001$.

yet the panic disorder and hypochondriasis groups both scored significantly higher than the OCD ($p < .05$) and social phobia ($p < .01$) groups. In addition, the panic disorder group scored significantly higher than the GAD patient group ($p < .05$).

With regard to the Cognitive Concerns subscale, the OCD, GAD, panic disorder, health anxiety and social phobia groups all scored significantly higher than the undergraduate student group (all $ps < .01$), but the specific phobia patient group did not significantly differ from the student group ($p > .05$). In addition, both the Panic disorder and GAD groups scored higher than the specific phobia group ($ps < .05$). No other significant differences emerged on this subscale.

3.5. Comorbidity analyses

Of the 506 anxiety disorders patients in our sample, 119 (23.5%) received a comorbid diagnosis of another DSM-IV anxiety disorder; and it is possible that the presence of such comorbidity influenced the results of the analyses reported above. A comparison revealed that relative to patients without an additional anxiety disorder ($M = 27.56$, SD = 15.89), those with a comorbid anxiety diagnosis ($M = 34.18$, SD = 15.93) had higher mean ASI-3 total scores, $t(504) = 3.97$, $p < .001$. In addition, those with comorbid anxiety diagnoses scored significantly higher on the Physical Concerns $t(499) = 5.09$, $p < .001$ and Cognitive Concerns subscales, $t(501) = 3.22$, $p = .001$. No differences were observed on the Social Concerns subscale, $t(502) = 1.49$, $p > .05$.

We next sought to verify the disorder-specific associations of the ASI-3 and its subscales by re-running the ANOVA analyses restricting the sample to only those patients without comorbid anxiety disorders. The pattern of results was generally similar in this reduced sample to the larger sample that included patients with comorbid anxiety disorders. Analysis of ASI-3 total scores revealed a significant main effect of group, $F(6, 690) = 30.36$, $p < .001$. Tukey's HSD post hoc tests revealed no significant differences comparing among the anxiety disorders patient groups, but all six groups scored higher on the total score compared to the undergraduate student group ($ps \leq .01$).

A main effect of group was also evident for the ASI-3 Social Concerns subscale, $F(6, 686) = 20.49$, $p < .001$, with post hoc testing demonstrating that the social phobia group scored higher than each of the other anxiety disorder groups as well as the undergraduate students (all $ps < .01$). In addition, the panic disorder and OCD patient groups both scored higher than the undergraduate student group ($ps < .01$). Significant group differences were also evident on the ASI-3 Physical Concerns subscale, $F(6, 676) = 28.76$, $p < .001$, with each of the anxiety disorder groups scoring higher than the undergraduate group on this subscale ($ps < .01$). In addition, on this subscale the panic disorder group also scored higher than the OCD ($p < .01$), GAD ($p < .05$) and social phobia ($p < .01$) groups and the health anxiety group scored higher than the social phobia group ($p < .01$). Finally, a main effect of group was also observed on the ASI-3 Cognitive Concerns subscale, $F(6, 682) = 32.69$, $p < .001$, with the GAD, OCD, panic, and social phobia groups each scoring higher than the student group ($ps < .01$). In addition, the GAD group scored significantly higher than the specific phobia group ($p < .01$).

4. Discussion

We evaluated the ASI-3's performance in a mixed sample of patients with anxiety disorders and unselected undergraduate students. As hypothesized, and in line with previous findings, the ASI-3 demonstrated a stable three-factor structure in the present sample. Subscales based on this solution were highly reliable and moderately intercorrelated, suggesting that they represent related but separate constructs. We also investigated the relationship between AS and anxiety disorder symptoms, both at the superordinate (i.e., general AS) and dimensional levels (i.e., ASI-3 subscales).

Group comparisons of the ASI-3 total scores revealed that all patient groups scored higher than the undergraduate group, suggesting that general AS is broadly applicable to all of those anxiety conditions. Comparisons across anxiety disorders revealed that those with panic disorder had higher ASI-3 total scores compared to OCD patients, but no other significant differences were observed. A similar pattern emerged in our correlational analyses, as the ASI-3 total score was moderately and significantly correlated with all anxiety symptom measures used in the current study. The lone exception was obsessive–compulsive symptoms, which were related to ASI-3 total scores to a lesser degree. Together, these results suggest that global AS is broadly related to many forms of anxiety psychopathology, and does not differentiate well between specific anxiety symptoms and disorders, except perhaps for OCD. Given the dimensional nature of OCD (e.g., Abramowitz et al., 2010), additional research should examine the relationship between AS and OCD symptom dimensions.

Differential patterns of association, however, were observed at the level of AS dimensions. In concert with our hypotheses, the fear of socially observable anxiety symptoms (i.e., AS social concerns) was particularly strongly related to social interaction anxiety and having a diagnosis of social phobia. On the other hand, concerns about physical catastrophe resulting from anxious arousal (i.e., AS physical concerns) were highest among patients with panic disorder and hypochondriasis and most strongly associated with the symptoms of panic attacks, agoraphobic avoidance, and health anxiety. We also found that concerns about anxious arousal leading to failures of mental or cognitive control (i.e., AS cognitive concerns) were most strongly correlated with worry symptoms and with a diagnosis of GAD. However, AS cognitive concerns were also associated with the diagnosis of panic disorder and the experience of panic and agoraphobic symptoms. Taken together, these results support a multidimensional conceptualization of AS (Taylor, 1999). At a broad level (i.e., as represented by total scores on the ASI-3), AS appears to relate to many different anxiety symptoms. However, analyses at the level of AS dimensions provide additional clarity, as the ASI-3 subscales show a specific pattern of associations consistent with thematically-related anxiety symptoms. Thus, consideration of specific AS dimensions provides useful information above and beyond AS as a unitary construct.

Our results also have bearing on conceptual accounts of anxiety disorders and could have implications for cognitive-behavioral treatment. The finding that the physical concerns dimension of AS is particularly related to panic disorder is consistent with previous research (e.g., Deacon & Abramowitz, 2006) and in line with conceptual accounts that panic results from the catastrophic misinterpretation of arousal-related body sensations as indicating a serious medical problem such as a heart attack (Clark, 1986). Our results also suggest an association between cognitive concerns and panic symptoms, as in some previous reports (Rector et al., 2007; Zinbarg et al., 1997). This finding is in line with the notion that a subgroup of panic disorder patients primarily fears the potential cognitive consequences of panic attacks (e.g., "going crazy"; Cox, Swinson, Endler, & Norton, 1994). We also found a specific association between the cognitive AS dimension and GAD and worry symptoms. This finding is in line with meta-cognitive models of GAD (Wells, 2005), which emphasize dysfunctional beliefs about the dangerousness of uncontrollable repetitive thoughts. Conceptual models of social anxiety emphasize the fear of negative evaluations as well as self-focused attention (Rapee & Heimberg, 1997). The social dimension of AS is relevant to this model, as socially anxious individuals appear to also fear that they will be

evaluated by others on the basis of their observable anxiety symptoms.

One previous study reported that the AS physical concerns dimension was strongly predictive of health anxiety symptoms in a nonclinical population (Wheaton et al., 2010), and the present results corroborate this finding in a clinical sample of individuals with hypochondriasis. Cognitive-behavioral accounts of hypochondriasis have conceptualized the disorder as a severe form of health anxiety, related to health-related dysfunctional beliefs (e.g., "Cancer runs in my family") that predispose individuals to be especially attentive to illness-related stimuli and their own body sensations (Warwick and Salkovskis, 1990). AS appears to play a role in this model, as health anxious individuals also attend to and fear the physical components of their anxiety responses. The role of AS in health anxiety suggests overlap in the cognitive and behavioral mechanisms involved in hypochondriasis and some anxiety disorders, supporting the idea that it be re-classified as an anxiety disorder (Olatunji et al., 2009).

ASI-3 scores differentiated patients diagnosed with OCD and specific phobia from undergraduate controls, but not from the other anxiety disorders. This suggests that AS is related to these conditions on a general level, rather than showing a specific relationship with any particular AS dimension. An alternative explanation is that the concerns in both OCD and specific phobia tend to be highly heterogeneous. As such, AS may be involved in some presentations of these conditions, but not others. For example, Deacon and Abramowitz (2006) suggested that fear of suffocation (physical AS) relates more to claustrophobia than to other phobias. In the present study our specific phobia group was relatively small, precluding us from fully investigating this possibility. In the case of OCD, conceptual models of some symptom dimensions emphasize meta-cognitive beliefs (i.e., the need to control one's thoughts; Wells & Matthews, 1994), which would suggest an association with the cognitive dimension of AS. Other OCD symptoms relate more to concerns about contracting a disease, which might relate more to physical AS based on the similarity to health concerns. However, our study did not consider specific dimensions of OCD symptoms, leaving this as an important gap to be addressed in future research.

The different dimensions of AS also represent unique treatment targets in exposure-based therapy. For example, exposure treatment for panic disorder often involves confronting the physical sensations associated with anxiety through exercises such as hyperventilation or CO_2 challenges (Barlow & Craske, 2000). It is possible to conceive of how the specific associations between other dimensions of AS and anxiety symptoms could be exploited for treatment benefit. For example, in social phobia, sweating could be induced prior to a speech challenge. In GAD, caffeine could be administered to make thoughts race and prime concerns about loss of cognitive control during a worry exposure. Research is needed to better integrate specific AS dimensions into the conceptualizations of the various anxiety disorders and their treatment approaches. The present study supports the use of the ASI-3 as a valid measure of AS dimensions to further this line of research.

Several limitations of the present study should be noted. First, although this study expanded on the original evaluation of the ASI-3 by including patients with specific phobia and hypochondriasis, our sample was also limited in that the number of PTSD patients was inadequate to constitute a separate group in our comparisons. In addition, we did not include self-report measures of PTSD symptoms. Given that research has demonstrated the importance of AS in PTSD (e.g., Olatunji & Wolitzky-Taylor, 2009), further evaluation of the ASI-3 in this population is warranted. Second, all symptom-level data in the current study were collected via self-report; thus, shared method variance may have inflated the relationships among study variables, which is especially important as there may be some item content overlap between the ASI-3 and measures of anxiety symptoms. Future studies might benefit from the use of multiple modalities to assess anxiety symptoms (e.g., behavioral approach tasks). Finally our use of a cross-sectional design precludes drawing causal inferences. As such the present results cannot determine whether the dimensions of AS represent vulnerability factors that predispose individuals to develop specific forms of anxiety, or if increased AS develops subsequently. Future studies would benefit from different assessment modalities of these constructs across multiple time points in order to shed further light on these issues.

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