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Anxiety sensitivity and its dimensions across the anxiety disorders

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Abstract

Anxiety sensitivity (AS) refers to the fear of anxiety-related sensations, which is thought to arise from beliefs about their harmful consequences. AS is a multidimensional construct that consists of fears of somatic, social, and cognitive aspects of anxiety. In the present study, we examined the relationship between AS dimensions, assessed by factor-analytically derived subscales of the Anxiety Sensitivity Index—Revised (ASI-R), and anxiety-related psychopathology in a sample of 232 treatment-seeking patients with anxiety disorders. Correlational analyses and comparisons among anxiety disorder patient groups and undergraduate students revealed a specific pattern of relationships between ASI-R subscale scores and anxiety-related psychopathology. In contrast, ASI-R total scores evidenced less discriminant validity. Implications for theoretical models of anxiety and directions for future research are discussed.

Keywords: Anxiety sensitivity; Anxiety disorders; Panic disorder; Factor analysis

Since its introduction, the construct of anxiety sensitivity (AS; Reiss & McNally, 1985) has received considerable attention in research on the nature and treatment of anxiety disorders (see Taylor, 1999, for a review). AS refers to the tendency to fear anxiety-related sensations and is thought to arise from beliefs

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about their harmful physical, cognitive, or social consequences. An individual with elevated AS might, for example, fear palpitations because of concerns about a heart attack or fear sweating in public based on concerns about negative social evaluation. According to AS theory (Reiss, 1991), individuals with elevated AS experience amplified fear in response to stimuli that elicit anxiety and find their own anxiety symptoms to be particularly aversive. Consistent with this view, AS appears to play an important role in the development and maintenance of anxiety-related disorders, particularly panic disorder (Cox, Borger, & Enns, 1999).

The Anxiety Sensitivity Index (ASI; Reiss, Peterson, Gursky, & McNally, 1986) is the most commonly used measure of AS. The ASI was constructed to assess what was originally believed to be a unitary construct (Reiss & McNally, 1985). However, factor analytic research on the ASI demonstrated that AS is both hierarchical and multidimensional, consisting of a higher order factor (i.e., global AS) and lower order dimensions pertaining to fears of physical, cognitive, and social anxiety symptoms (see Zinbarg, Mohlman, & Hong, 1999, for a review). Thus, individuals may be afraid of anxiety-related symptoms in general, specific aspects of the anxiety response (e.g., respiratory symptoms), or both. A multidimensional conceptualization of AS raises important questions about the nature of this construct and its role in anxiety-related psychopathology. For instance, to what extent do different levels of the AS hierarchy (i.e., global vs. dimensional) contribute to anxiety-related psychopathology? Can researchers and clinicians obtain more useful information from subscale scores than total scores on measures of AS?

Research on AS dimensions has helped elucidate the relationship between AS and various forms of anxiety-related psychopathology. The ASI fear of somatic sensations factor is most strongly associated with panic-related phenomena such as response to laboratory panic challenges and a diagnosis of panic disorder (Taylor, Koch, Woody, & McLean, 1996; Zinbarg, Barlow, & Brown, 1997; Zinbarg, Brown, Barlow, & Rapee, 2001). Alternatively, the ASI fear of cognitive dyscontrol factor is moderately associated with depression and appears to be a relatively nonspecific measure of general distress (Blais et al., 2001; Taylor et al., 1996; Zinbarg et al., 1997). The ASI social concerns factor is most strongly related to the fear of negative evaluation and a diagnosis of social phobia (McWilliams, Stewart, & MacPherson, 2000; Zinbarg & Barlow, 1996; Zinbarg et al., 1997). Taken together, these studies underscore the value of multidimensional assessment of AS and highlight the need for continued research on the extent to which established relationships between AS and anxiety-related variables are attributable to specific AS dimensions.

Most investigations into the factor structure of AS and the validity of its dimensions have used the ASI (Reiss et al., 1986). Despite this measure's popularity and well-established psychometric properties as a measure of general AS (see Peterson & Plehn, 1999, for a review), empirical research suggests that it is not well suited for the multidimensional assessment of AS. The ASI contains 16 items, most of which measure fears of somatic sensations, and is too abbreviated to assess the construct's somatic, cognitive, and social domains with sufficient

reliability and content validity. To illustrate, only two items reliably serve as markers on the ''social concerns'' factor (e.g., Deacon & Valentiner, 2001). Furthermore, the ASI contains several items that do not explicitly assess anxiety-related symptoms (e.g., ''Unusual body sensations scare me'') or the fear of such symptoms (e.g., ''It is important for me to stay in control of my emotions''). Accordingly, Blais et al. (2001) showed that five conceptually and psychometrically problematic ASI items (31% of the scale) detracted from the scale's construct validity.

To address the need for an improved multidimensional measure of AS, Taylor and Cox (1998) published the 36-item Anxiety Sensitivity Index—Revised (ASI-R). Exploratory factor analysis of the ASI-R in a clinical sample yielded four reliable lower order factors: (a) fear of respiratory symptoms, (b) fear of publicly observable anxiety reactions, (c) fear of cardiovascular symptoms, and (d) fear of cognitive dyscontrol. Each factor had at least six items with salient loadings and theoretically consistent relationships were demonstrated with criterion variables such as anxiety symptoms and a diagnosis of panic disorder (Taylor & Cox, 1998). In a subsequent study of the ASI-R in two nonclinical samples, Deacon, Abramowitz, Woods, and Tolin (2003) found generally similar factor analytic results (i.e., two somatic factors, a cognitive factor, and a social factor). These findings indicate that compared to the original ASI, the ASI-R provides a more thorough and reliable assessment of AS dimensions. Therefore, the ASI-R may be particularly useful in research on AS dimensions and anxiety-related psychopathology.

The importance of reliable and valid assessment of AS is highlighted by the prominence of this construct in contemporary theories of various anxiety disorders (see Cox et al., 1999, for a review). In addition to the well-established role of AS in the development and maintenance of panic disorder (McNally, 2002), the fear of anxiety-related sensations has been implicated in theoretical formulations of PTSD (e.g., Taylor, 2003), specific phobias (e.g., McNally & Steketee, 1985), and social phobia (e.g., Rapee & Heimberg, 1997). Although comparatively less research has examined the role of AS in other anxiety disorders, elevated AS has been found in patients with generalized anxiety disorder (GAD) and obsessive–compulsive disorder (OCD) relative to individuals without an anxiety disorder (Zinbarg et al., 1997). A multidimensional perspective of AS has the potential to clarify relationships between the fear of anxiety and various forms of anxiety-related psychopathology. These relationships have potentially important implications for theory and practice. For example, if specific AS dimensions are related to the development and maintenance of specific anxiety disorders, then clinical techniques that address specific AS domains (e.g., exposure to feared somatic sensations) can be used to treat these disorders or even help prevent them. While such work has already been done with respect to panic disorder (e.g., Barlow & Craske, 2000; Gardenschwartz & Craske, 2001), additional research is needed to determine whether this work can be extended to other anxiety problems.

To a large extent, existing AS research is limited by two factors. First, most investigators have used ASI total scores to examine associations between AS and psychopathology, leaving unclear whether global AS or specific AS dimensions are responsible for observed relationships. Second, most studies have not assessed AS dimensions using measures such as the ASI-R that adequately assess these domains. Accordingly, the present study was conducted to address these limitations with the primary aim of elucidating the relationship between AS and anxiety-related psychopathology. First, we conducted an exploratory factor analysis of the ASI-R in a sample of anxiety disorder patients. Consistent with the results of Taylor and Cox (1998), we expected the ASI-R to consist of four factors assessing fears of respiratory, cardiovascular, social, and cognitive anxiety reactions. Next, we examined relationships between ASI-R total and subscale scores and indices of anxiety-related psychopathology (self-report symptom measures and clinical diagnosis). We predicted that (a) physical AS would be most strongly related to panic symptoms and panic disorder; (b) social AS would be most strongly related to social anxiety and social phobia; (c) cognitive AS would be unrelated to specific domains of anxiety symptoms; and (d) specific AS domains would demonstrate greater specificity with anxiety-related psychopathology than global AS.

1. Method

1.1. Participants

Study participants included 232 treatment-seeking patients with a primary anxiety disorder diagnosis (diagnostic and assessment procedures are described below). Ninety-two patients had a principal diagnosis of obsessive–compulsive disorder (OCD), followed by 52 with panic disorder, 35 with social phobia, 23 with generalized anxiety disorder (GAD), 18 with specific phobia, and 12 with other anxiety disorders (PTSD = 5, Anxiety Disorder NOS = 5, Agoraphobia = 2). Many patients had additional Axis I diagnoses (34.1%), including 49 (21.1%) with major depressive disorder. The mean age of the sample was 36.3 (S.D. = 12.7) and about half of the patients were women (n = 105, 56.5%). The sample was predominately Caucasian (n = 169, 90.9%). Nearly all participants had earned a high school diploma (97.4%) and many had at least a 2-year college degree (47.4%). About half the sample was married (51.3%), and the median family income was between $50,000 and $60,000 per year.

Data were also collected from 453 undergraduate students recruited from introductory psychology courses at a midsized Midwestern University. About half of these participants were women (52.1%) and the mean age was 19.2 (S.D. = 1.9). Two hundred and eighty-seven participants (63.4%) identified themselves as Caucasian, followed by 93 African Americans (23.5%), 37 Asian Americans (8.2%), 20 Hispanics (4.4%), and 16 participants (3.5%) of other

or unreported ethnicities. Undergraduate participants completed a packet of self-report questionnaires that included the ASI-R and received course credit for their participation.

1.2. Measures

Anxiety Sensitivity Index—Revised (ASI-R; Taylor & Cox, 1998). The ASI-R is a 36-item, expanded version of the original ASI (Reiss et al., 1986) and measures the fear of anxiety-related sensations based on beliefs about their harmful consequences. Total scores range from 0 to 144. The ASI-R has demonstrated excellent internal consistency and adequate validity in preliminary studies (Deacon et al., 2003; Taylor & Cox, 1998).

Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998). The SIAS measures cognitive, affective, and behavioral reactions to social interactions. 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. The SIAS has demonstrated adequate psychometric properties and validity (Mattick & Clarke, 1998).

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, 2004; Salkovskis et al., 2002).

Obsessive–Compulsive Inventory—Revised (OCI-R; Foa et al., 2002). The OCI-R is an 18-item self-report questionnaire based on the earlier 84-item Obsessive–Compulsive Inventory (Foa, Kozak, Salkovskis, Coles, & Amir, 1998). Respondents rate the degree to which they have been bothered or distressed by 18 common symptoms of OCD in the past month. The OCI-R assesses six symptom domains: (a) washing, (b) checking/doubting, (c) obsessing, (d) mental neutralizing, (e) ordering, and (f) hoarding. OCI-R total scores have demonstrated excellent psychometric properties and validity (Foa et al., 2002).

Panic and Agoraphobia Scale (PAS; Bandelow, 1995). The PAS is a 13-item measure of panic disorder symptoms that is available in an observer-rated version and the self-report version used in the present study. Items assess panic attacks, agoraphobic avoidance, anticipatory anxiety, disability and functional impairment, and health concerns. The self-report version of the PAS has been shown to possess good internal consistency, treatment sensitivity, and concurrent validity with other measures of panic (Bandelow, 1999; Bandelow et al., 1998).

Beck Depression Inventory (BDI; Beck, Ward, Mendelsohn, Mock, & Erlbaugh, 1961). The BDI is a 21-item self-report scale that assesses the severity of depressive symptoms experienced during the past week. The BDI has excellent reliability and validity and is widely used in clinical research (Beck, Steer, & Garbin, 1988).

Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990). The PSWQ is a 16-item scale that measures the tendency to worry excessively. The scale assesses the intensity and excessiveness of worry without regard to its specific content. The PSWQ is a reliable and valid measure of worry (Molina & Borkovec, 1994).

State-Trait Anxiety Inventory—Trait version, Form Y (STAI-T; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). The STAI-T is a 20-item scale that measures the stable propensity to experience anxiety and the tendency to perceive stressful situations as threatening. The STAI-T has demonstrated high test–retest reliability, internal consistency, and concurrent validity with other anxiety questionnaires (Spielberger et al., 1983).

1.3. Procedure

Prior to their evaluation, patients completed the self-report measures described above.[1] Evaluation took place in a multidisciplinary anxiety disorders clinic within a large academic medical center and included a 1.5-h interview performed by a psychologist who conducted a functional assessment of the patient's anxiety symptoms and administered the anxiety and mood disorders sections of the Mini International Neuropsychiatric Interview (MINI; Sheehan et al., 1998). The assessment also included a 1-h diagnostic interview conducted by a psychiatrist who examined the patient's medical and pharmacological history. All assessors met together with the second author to discuss diagnostic impressions, case conceptualization, and to formulate a treatment plan for each patient. Patients were then presented with this information in a case conference format with all assessors and the second author present. Although inter-rater reliability for the primary diagnosis was not formally examined, patients were only included in the present study if there was 100% inter-rater agreement on the patient's principal diagnosis.

1.4. Analytic strategy

We elected to examine the ASI-R's factor structure using an exploratory rather than confirmatory factor analytic approach. This decision was based on two considerations: (a) only two studies have published detailed factor analyses of the ASI-R (Deacon et al., 2003; Taylor & Cox, 1998), and (b) the four-factor solutions reported in these studies were not sufficiently replicable to warrant confidence in a particular pattern of item-factor loadings necessary to specify a measurement model in confirmatory factor analysis. We examined the replicability of our factor

[1] Because our clinic specializes in the study and treatment of OCD, patients with this disorder generally complete a different set of self-report measures than do those with other anxiety disorders. These different questionnaire packets both contain the ASI-R, BDI, OCI-R, and STAI-T. As a result, scores on the SIAS, SHAI, PAS, and PSWQ were unavailable for 79 of the 92 patients with OCD.

analytic results by computing coefficients of congruence (Gorsuch, 1983) between the ASI-R factor loadings from the present study and those reported in previously published studies. Principal-axis factor analysis was used instead of principal components analysis because we were interested in identifying latent constructs rather than data reduction (Floyd & Widaman, 1995). Since we were primarily interested in examining the ASI-R's psychometric properties and validity among individuals with anxiety disorders, the factor analytic and correlational analyses included only data from the patient sample. Data from the undergraduate participants was included in our final series of analyses exploring group differences in ASI-R total and subscale scores.

2. Results

2.1. Reliability and item-level analyses

The mean ASI-R total score for the patient sample was 55.6 (S.D. = 30.0, range = 1–141). ASI-R total scores were not significantly associated with age ($r = -.08$, $P > .10$) or gender, $t\,(229) = -1.53$, $P > .10$. The ASI-R demonstrated excellent internal consistency ($\alpha = .95$). Each of the 36 items evidenced acceptable corrected item-total correlations ($M = .57$, range = .41–.71) based on the criterion of .30 recommended by Nunnally and Bernstein (1994).

2.2. Exploratory factor analysis of the ASI-R

The lower order factor structure of the ASI-R was examined using principal-axis factor analysis (i.e., common factor analysis). Factors were rotated using an oblique (Oblimin) transformation based on previous research indicating that ASI-R factors are moderately correlated (e.g., Taylor & Cox, 1998). Parallel analysis (Longman, Cota, Holden, & Fekken, 1989) and factor interpretability were used to determine the number of factors to retain.

The first seven eigenvalues were 13.32, 3.98, 2.50, 1.83, 1.50, 1.14, and 0.97. Parallel analysis indicated a clearly interpretable four-factor solution for both the mean and 95th percentile eigenvalues. Table 1 presents the pattern matrix (i.e., factor loadings) and communalities for the four-factor solution. The first factor contained 11 items with salient factor loadings (i.e., $\geq$.40) and explained 37.0% of the ASI-R item variance. The pattern of item loadings indicates that this factor primarily measures the *fear of respiratory symptoms*. The second factor explained 11.1% of the item variance and contained eight items that assess the *fear of publicly observable anxiety reactions*. The third factor explained 6.9% of the variance and consisted of six items that measure the *fear of cognitive dyscontrol*. Finally, the fourth factor contained eight items with salient factor loadings and explained 5.1% of the ASI-R item variance. Items with the highest loadings on this factor-assessed fears of a variety of physical symptoms and catastrophes,

Table 1
The Anxiety Sensitivity Index—Revised: factor loadings and communalities for the four-factor solution

ASI-R item	ASI-R factor				
	I	II	III	IV	h^2
1. When I feel like I'm not getting enough air I get scared that I might suffocate.	**.71**	−.22	.02	.05	.50
2. Smothering sensations scare me.	**.77**	.02	.13	−.21	.55
3. It scares me when I become short of breath.	**.81**	.03	.03	−.04	.65
4. When my chest feels tight, I get scared that I won't be able to breathe properly.	**.73**	.01	.01	.12	.64
5. It scares me when I feel faint.	**.60**	.22	−.12	.15	.52
6. When my throat feels tight, I worry that I could choke to death.	**.71**	−.04	.05	.08	.58
7. It scares me when my heart beats rapidly.	**.55**	.36	−.08	.13	.59
8. When my breathing becomes irregular, I fear that something bad will happen.	**.63**	.11	−.11	.27	.62
9. It scares me when I feel "shaky" (trembling).	**.40**	**.48**	.01	.02	.51
10. When I have trouble swallowing, I worry that I could choke.	**.58**	−.08	.22	.05	.48
11. It frightens me when my surroundings seem strange or unreal.	.29	.39	.27	−.12	.43
12. It scares me when my body feels strange or different in some way.	.35	.12	.33	.14	.49
13. It is important for me not to appear nervous.	−.02	**.83**	.00	−.03	.67
14. I believe it would be awful to vomit in public.	.04	**.72**	.05	−.13	.53
15. I think it would be horrible for me to faint in public.	.15	**.71**	.00	−.02	.58
16. I worry that other people will notice my anxiety.	−.06	**.89**	.00	−.04	.76
17. When I tremble in the presence of others I fear what people might think of me.	.02	**.58**	.12	.08	.46
18. When I begin to sweat in a social situation, I fear people will think negatively of me.	−.11	**.53**	.12	.27	.45
19. It scares me when I blush in front of people.	−.12	**.50**	.09	.25	.38
20. When I feel a strong pain in my stomach, I worry it could be cancer.	.00	−.18	.03	**.78**	.60
21. When my head is pounding I worry I could have a stroke.	.20	−.08	.07	**.68**	.65
22. When I notice that my heart is beating rapidly, I worry that I might have a heart attack.	.39	−.12	.06	**.53**	.63
23. When my face feels numb, I worry that I might be having a stroke.	.39	−.11	.16	**.42**	.56
24. When I feel pain in my chest, I worry that I'm going to have a heart attack.	**.51**	.10	−.01	.24	.48
25. When I feel dizzy, I worry there is something wrong with my brain.	.27	.27	.12	.34	.52
26. When my stomach is upset, I worry that I might be seriously ill.	.08	.19	.07	**.59**	.55
27. When I notice my heart skipping a beat, I worry that there is something seriously wrong with me.	.30	.29	.01	**.43**	.58
28. When I get diarrhea, I worry that I might have something wrong with me.	−.06	.07	.14	**.59**	.43

Table 1 (*Continued*)

ASI-R item	ASI-R factor				
	I	II	III	IV	h^2
29. It scares me when I am nauseous.	.06	.20	.07	**.59**	.53
30. It scares me when I feel tingling or prickling sensations in my hands.	.27	.05	.19	.36	.44
31. When I feel "spacey" or spaced out I worry that I may be mentally ill.	.03	−.08	**.71**	.12	.56
32. When my thoughts seem to speed up, I worry that I might be going crazy.	.04	.24	**.57**	−.01	.50
33. When I have trouble thinking clearly, I worry that there is something wrong with me.	−.03	.34	**.63**	−.08	.61
34. When I cannot keep my mind on a task, I worry that I might be going crazy.	−.01	−.22	**.90**	.07	.76
35. It scares me when I am unable to keep my mind on a task.	.01	.13	**.63**	.02	.49
36. When my mind goes blank I worry there is something terribly wrong with me.	.00	.01	**.82**	.03	.70

Note. Factor loadings $\geq|.40|$ are listed in boldface type.

including cancer, stroke, heart attack, diarrhea, and nausea. Accordingly, we deemed this factor to assess the *fear of physical catastrophe*. The ASI-R factors were significantly correlated with each other, with *r*s ranging from .22 (publicly observable and physical catastrophe factors) to .49 (respiratory and physical catastrophe factors).

The four-factor ASI-R solution demonstrated excellent psychometric characteristics. The four rotated ASI-R factors explained a substantial portion of the item variance (60.1%), and the magnitude of the communalities indicates that these factors accounted for a moderately large portion of the variance in most items. The solution also evidenced adequate excellent simple structure (Thurstone, 1947) as only one item loaded on more than one factor at the $\geq|.40|$ level, four items failed to load on any factor, and each factor had an adequate number of items with salient loadings. The four-factor solution also satisfied Guadagnoli and Velicer's (1988) criteria for stability since each factor had at least six items with loadings above .60. Finally, to determine each factor's internal consistency we created subscales based on the pattern of factor loadings in Table 1 (excluding the two items without salient loadings on any factor). Each subscale showed good internal consistency (αs for Factors I–IV = .92, .89, .89, and .90, respectively).

To examine the replicability of the four ASI-R factors obtained in the present study, we computed coefficients of congruence (Gorsuch, 1983) between our factor loadings and loadings from the principal-axis factor analyses of the ASI-R reported by Zvolensky et al. (2003), Deacon et al. (2003), and Taylor and Cox (1998). These results are displayed in Table 2. The *fear of cognitive dyscontrol* and *fear of publicly observable anxiety reactions* factors from the present study were adequately replicable across other four-factor solutions, with coefficients of

Table 2
Coefficients of congruence between Anxiety Sensitivity Index—Revised factors from the present study and factors from previously published studies

Study (sample) and ASI-R factor	ASI-R factor from the present study			
	Respiratory Fears	Social Fears	Cognitive Fears	Physical Fears
Zvolensky et al. (2003; 2786 nonclinical volunteers from 6 countries)				
Fear of physical sensations	.85	.11	.36	.67
Social–cognitive concerns	.10	.81	.58	.19
Deacon et al. (2003)—Study 1 (558 undergraduate students)				
Beliefs about the harmful consequences of somatic sensations	.73	.00	.21	.70
Fear of publicly observable anxiety reactions	.36	.76	.22	.09
Fear of cognitive dyscontrol	.00	.20	.87	.18
Fears of somatic sensations without explicit consequences	.53	.44	.13	.38
Deacon et al. (2003)—Study 2 (444 undergraduate students)				
Beliefs about the harmful consequences of somatic sensations	.75	.01	.24	.66
Fear of publicly observable anxiety reactions	.25	.83	.23	.00
Fear of cognitive dyscontrol	.03	.16	.85	.23
Fears of somatic sensations without explicit consequences	.62	.36	.13	.42
Taylor and Cox (1998; 155 patients with mostly anxiety disorders)				
Fear of respiratory symptoms	.94	.19	.19	.14
Fear of publicly observable anxiety reactions	.09	.89	.22	.18
Fear of cardiovascular symptoms	.50	.12	.18	.92
Fear of cognitive dyscontrol	.21	.23	.90	.16

Note. Coefficients of congruence were derived using loadings from the factor pattern matrix. Respiratory Fears, *fear of respiratory symptoms* factor; Social Fears, *fear of publicly observable anxiety reactions* factor; Cognitive Fears, *fear of cognitive dyscontrol* factor; Physical Fears, *fear of physical catastrophe factor.*

congruence for corresponding factors ranging from .73 to .93. In contrast, the *fear of respiratory symptoms* and *fear of physical catastrophe* factors from the present study were only moderately reproduced in the two four-factor solutions reported by Deacon et al. (2003). The fear of physical sensations factor reported by Zvolensky et al. (2003) appears to reflect a blend of the respiratory and physical catastrophe factors from the present study. Similarly, Zvolensky et al.'s social–cognitive concerns factor was similar to the cognitive and social factors reported in our study. Finally, the present four-factor solution corresponded highly to the four-factor solution reported by Taylor and Cox (1998), with coefficients of congruence for corresponding factors (range = .89–.95) indicating that the four-factor solutions in these two studies are essentially equivalent.

2.3. Correlates of the ASI-R and its subscales

We computed Pearson correlation coefficients to explore the associations between ASI-R total and subscale scores and other measures of anxiety-related

psychopathology. Subscales were created by assigning items to factors based on their highest salient factor loading in Table 1; four items that did not load on any factor were not included in the subscales. We elected to use subscale scores rather than factor scores due to their greater interpretability and to approximate the way the ASI-R might be used in clinical practice. Because of missing data in the OCD group (see Footnote 1), the sample size for the correlational analyses was 151.

2.3.1. Correlates of the ASI-R total score

Table 3 presents correlations between ASI-R total scores and anxiety-related psychopathology measures. As can be seen, the ASI-R evidenced good convergent validity but only modest divergent validity. More specifically, the total score was moderately correlated with measures of health anxiety, panic symptoms, and worry, and less strongly (but significantly) associated with measures of OCD and social anxiety.

2.3.2. Correlates of the ASI-R subscales

Correlations between the ASI-R subscales and anxiety-related psychopathology measures are also presented in Table 3. As shown in the table, three of the four ASI-R subscales demonstrated theoretically consistent patterns of convergent and divergent validity with the criterion variables. The *fear of respiratory symptoms* subscale was most highly correlated with measures of health anxiety and panic symptoms. In addition, the *fear of physical catastrophe* subscale was most strongly related to the SHAI, a measure of cognitive biases associated with severe health anxiety. As expected, the ASI-R *fear of publicly observable anxiety reactions* subscale was most strongly related to social interaction anxiety. Finally, the *fear of cognitive dyscontrol* subscale demonstrated the least specificity of the ASI-R subscales and was significantly correlated with each criterion measure.

Table 3
Correlations between Anxiety Sensitivity Index—Revised total and subscale scores and psychopathology measures ($n = 151$)

Measure	ASI-R total	ASI-R subscale			
		Respiratory Fears	Social Fears	Cognitive Fears	Physical Fears
SIAS	.30***	.07	.48***	.30***	.13
SHAI	.53***	.48***	.21*	.26**	.54***
OCI-R	.34***	.33***	.09	.25**	.43***
PAS	.52***	.46***	.22**	.28**	.45***
PSWQ	.47***	.31**	.22**	.39**	.46***

SIAS, Social Interaction Anxiety Scale; SHAI, Short Health Anxiety Inventory; OCI-R, Obsessive–Compulsive Inventory—Revised; PAS, Panic and Agoraphobia Scale, PSWQ, Penn State Worry Questionnaire.

* $P < .05$.
** $P < .01$.
*** $P < .001$.

2.4. Group comparisons

To address the discriminative validity of the ASI-R and its subscales, we examined differences in total and subscale scores between undergraduate students and patients with panic disorder, OCD, social phobia, GAD, and specific phobia. We hypothesized that (a) patients with panic disorder would evidence higher ASI-R total scores, *fear of respiratory symptoms* subscale scores, and *fear of physical catastrophe* scores than the other patient and nonpatient groups; (b) patients with social phobia would have the highest scores on the *fear of publicly observable anxiety reactions* subscale; (c) no differences between anxiety patient groups would be evident on the *fear of cognitive dyscontrol* subscale; and (d) nonpatient controls would have the lowest scores on each ASI-R scale.

Prior to conducting these analyses we sought to determine whether group differences in ASI-R scores might be influenced by group differences in trait anxiety and/or depression. Accordingly, we conducted a series of one-way ANOVAs examining group differences in STAI-T and BDI scores. Both of these analyses were statistically significant ($F(5,635) = 37.48$, $P < .001$, and $F(5,665) = 41.06$, $P < .001$, for the STAI-T and BDI, respectively) and were followed up by post hoc Tukey HSD tests, which use a Bonferroni-corrected alpha level to control for inflated Type I error due to multiple comparisons. These analyses indicated that the undergraduate sample had significantly lower STAI-T and BDI scores than each of the anxiety disorder groups. However, none of the anxiety disorder groups differed significantly from each other on either measure (all Ps $> .10$). These results suggest that observed differences among anxiety disorder groups on the ASI-R are unlikely to be attributable to group differences in trait anxiety and depression. Accordingly, we elected not to treat STAI-T and BDI scores as covariates, and instead used a series of one-way ANOVAs to examine differences between nonpatients and anxiety disorder patient groups in ASI-R total and subscale scores. Fig. 1 graphically depicts the mean scores on each ASI-R scale for each group.

2.4.1. ASI-R total score

Significant between-group differences were detected on ASI-R total scores, $F(5, 667) = 38.97$, $P < .001$. Tukey HSD post hoc using a Bonferroni correction to control for Type I error indicated that panic disorder patients had significantly higher scores than patients with social phobia ($P < .05$) and GAD ($P < .05$). Each patient group had significantly higher scores than the undergraduate sample (all Ps $< .01$).

2.4.2. Fear of respiratory symptoms

Significant between-group differences were detected on the ASI-R *fear of respiratory symptoms* subscale, $F(5, 667) = 24.11$, $P < .001$. Post hoc tests revealed that panic disorder patients had significantly higher scores than patients

with social phobia ($P < .001$) and GAD ($P < .01$). OCD patients also had significantly higher scores than those with social phobia ($P < .001$). The panic disorder, OCD, and specific phobia patient groups each had significantly higher scores than the undergraduate sample (all Ps $< .001$).

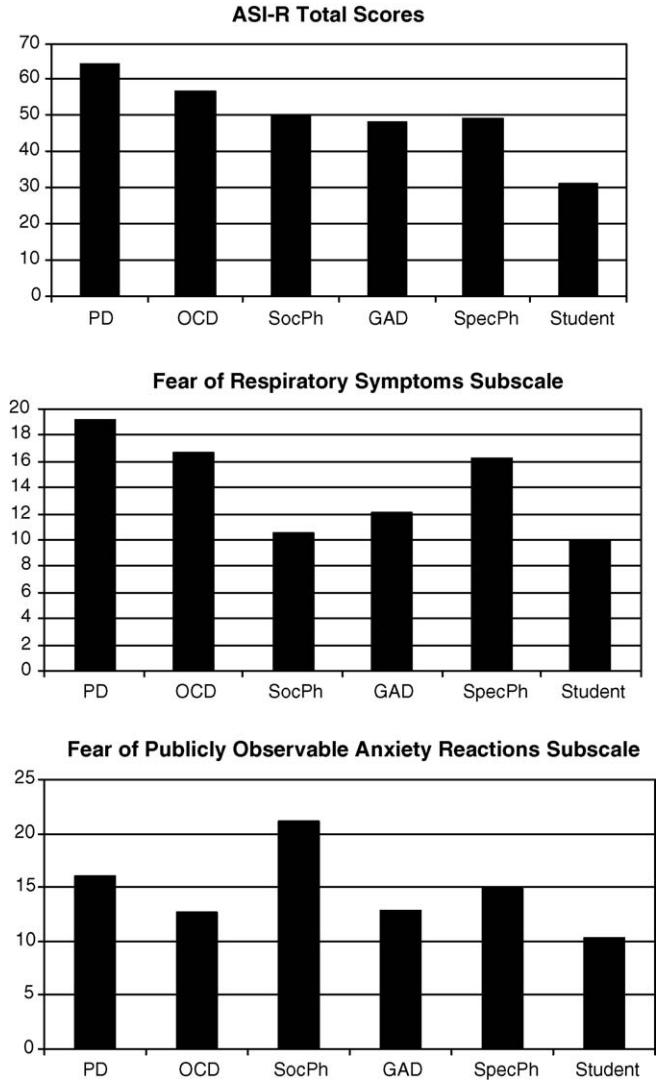

Fig. 1. Mean scores on ASI-R total and subscale scores for patient groups and nonpatients. *Note.* PD, panic disorder; OCD, obsessive–compulsive disorder; SocPh, social phobia; GAD, generalized anxiety disorder; SpecPh, specific phobia; Student, undergraduate student.

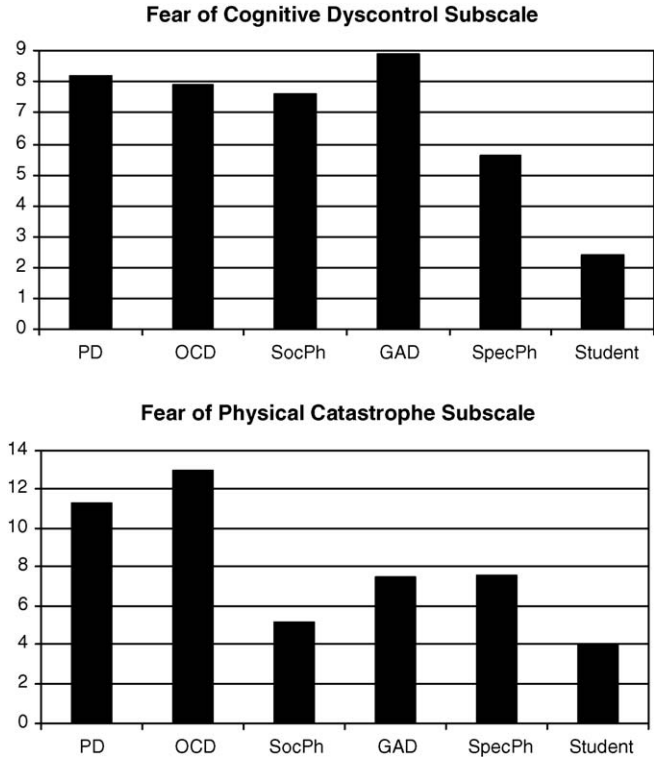

Fig. 1. (*Continued*).

2.4.3. Fear of publicly observable anxiety reactions

Significant between-group differences were detected on the ASI-R *fear of publicly observable anxiety reactions* subscale, $F(5, 667) = 23.57$, $P < .001$. Patients with social phobia had significantly higher scores than all other groups (all Ps $< .01$). Patents with panic disorder had significantly higher scores than patients with OCD ($P < .05$) and undergraduate students ($P < .001$). OCD patients also had significantly higher scores than the undergraduate sample ($P < .05$).

2.4.4. Fear of cognitive dyscontrol

Significant between-group differences were detected on the ASI-R *fear of cognitive dyscontrol* subscale, $F(5, 667) = 40.38$, $P < .001$. Post hoc tests failed to reveal any significant differences between the anxiety patient groups, but each patient group had significantly higher scores than the undergraduate sample (all Ps $< .001$).

2.4.5. Fear of physical catastrophe

Significant between-group differences were detected on the ASI-R *fear of physical catastrophe* subscale, $F(5, 667) = 47.96$, $P < .001$. Patients with OCD had higher scores than each patient and nonpatient group (all Ps $< .01$) with the exception of panic disorder. Panic disorder patients evidenced higher scores than patients with social phobia ($P < .001$).

2.5. Diagnostic comorbidity

To examine the influence of diagnostic comorbidity on AS, we compared ASI-R total and subscale scores between patients with ($n = 79$) or without ($n = 153$) a comorbid anxiety or mood disorder. *T*-tests for each ASI-R scale were significant at the $P < .001$ level and indicated higher mean scores among patients with a comorbid diagnosis. Estimates of effect size, defined as the difference in group means divided by the pooled standard deviation, indicated moderate between-group effects for the ASI-R *fear of respiratory symptoms, fear of publicly observable anxiety reactions*, and *fear of physical catastrophe* subscales (effect sizes = .47, .50, and .51, respectively). Larger effects were observed on the *fear of cognitive dyscontrol* subscale and the ASI-R total score (both effect sizes = .73).

3. Discussion

The present study was conducted to examine the psychometric properties of the ASI-R and to elucidate relationships between AS and anxiety-related psychopathology in a large sample of patients with anxiety disorders. Our findings are consistent with previous research indicating that the ASI-R is a reliable and psychometrically sound measure of AS and its dimensions (Deacon et al., 2003; Taylor & Cox, 1998). In accord with our hypotheses, ASI-R total and subscale scores evidenced theoretically consistent associations with measures of anxiety-related psychopathology and clinical diagnoses. Our findings help to clarify the association between AS and anxiety-related phenomena and highlight the importance of multidimensional assessment of AS.

The ASI-R was highly internally consistent and did not contain any psychometrically unacceptable items. This result stands in contrast to research indicating that the original ASI contains numerous items with problematic reliability and validity (Blais et al., 2001). An exploratory factor analysis indicated that the ASI-R assesses the somatic, cognitive, and social dimensions of AS identified in factor analytic studies of the ASI (Zinbarg et al., 1999). Each ASI-R factor was stable, highly internally consistent, and contained an adequate number of items with salient factor loadings. Factors assessing the *fear of cognitive dyscontrol* and the *fear of publicly observable anxiety reactions* were replicable across factor analytic studies of the ASI-R in clinical and nonclinical samples (Deacon et al., 2003; Taylor & Cox, 1998). The *fear of respiratory*

symptoms and the *fear of physical catastrophe* factors were replicated in Taylor and Cox's (1998) clinical sample but less closely resembled the two ASI-R somatic factors obtained by Deacon et al. (2003) in their undergraduate samples. In concert with previous research, our results suggest the ASI-R is an improved measure of AS and its dimensions that should be used in place of the ASI for the multidimensional assessment of AS.

The two ASI-R somatic factors we obtained were distinguished primarily by whether their items assess fears of respiratory-related sensations (e.g., dyspnea) or fears about the occurrence of physical catastrophe (e.g., cancer). Accordingly, ASI-R items that explicitly assess affect (e.g., ''It scares me when I become short of breath'') and beliefs (e.g., ''When I feel like I'm not getting enough air I get scared that I might suffocate'') loaded together onto the same factor. In contrast, these items loaded onto different factors in Deacon et al. (2003), where undergraduate participants were found to endorse items not according to their domain, but rather based on whether they assessed affect or beliefs. Moreover, the nonclinical respondents in the present study and the Deacon et al. (2003) study only minimally endorsed the items assessing feared catastrophic consequences of anxiety (e.g., heart attack). These findings suggest qualitative and quantitative differences in AS between individuals with and without anxiety disorders. Future research is needed to clarify the association between the fear of anxiety and beliefs about its harmful consequences among individuals without clinical anxiety. Such research might help to answer lingering questions about whether AS is a cognitive or affective construct (Lilienfeld, Jacob, & Turner, 1989; McNally, 1999).

In our correlational analyses, the ASI-R total score showed good convergent validity with anxiety-related measures but only modest discriminant validity. Moderately strong associations with a range of psychopathology measures suggest that the ASI-R total score is a relatively nonspecific measure of the fear of anxiety. Our comparisons between diagnostic groups and nonpatients indicated that, as hypothesized, nonpatients scored lower than all patient groups and individuals with panic disorder had the highest mean ASI-R total scores. However, while panic patients had higher scores than patients with social phobia and GAD, no other statistically significant differences were detected among the anxiety disorder groups. Taken together, our results suggest that the ASI-R total score measures a construct that is broadly applicable to a range of anxiety-related phenomena.

An important goal of the present study was to clarify the extent to which a dimensional approach to AS conveys more information about anxiety-related psychopathology than a global approach. As hypothesized, our correlational analyses and between-group comparisons converged to reveal a generally specific pattern of relationships between AS dimensions and anxiety-related psychopathology. The best example of this specificity is the *fear of publicly observable anxiety reactions* subscale, which demonstrated a near-exclusive relationship with social interaction anxiety and a diagnosis of social phobia. The two somatic

subscales (fears of respiratory symptoms and physical catastrophe) were primarily related to panic symptoms, health anxiety, and a diagnosis of panic disorder. Finally, as predicted, the *fear of cognitive dyscontrol* subscale demonstrated a nonspecific pattern of relationships across the criterion measures and diagnostic groups. Taken together, our results suggest that multidimensional assessment of AS provides valuable information beyond the calculation of ASI-R total scores. Our findings also highlight a number of important relationships between AS dimensions and anxiety-related problems.

AS is considered a key factor in the development and maintenance of panic disorder (McNally, 2002). Results from the present study and previous investigations of AS dimensions (e.g., Blais et al., 2001; Hayward, Killen, Kraemer, & Taylor, 2000; Zinbarg et al., 1997, 2001) indicate that the association between AS and panic is largely attributable to the somatic aspects of AS. Put another way, it is not the fear of anxiety in general but the fear of physical sensations in particular that contributes to panic-related psychopathology. This observation is consistent with cognitive models of panic disorder that emphasize the panicogenic role of catastrophic misinterpretations of arousal-related body sensations (e.g., Clark, 1986). It is important to note, however, that AS is broader than the enduring tendency to catastrophically misinterpret anxiety-related body sensations postulated by Clark (1986, 1988). While elevated AS may indeed be associated with catastrophic misinterpretations of anxiety symptoms, AS theory does not require that such symptoms be misconstrued as something else in order for them to be highly aversive (McNally, 1994). Further, the feared consequences of anxiety might be imminent (e.g., suffocation) or longer term events (e.g., cancer; Taylor & Cox, 1998), and might concern feared physical, social, or cognitive outcomes. Given the breadth of the AS construct and the highly specific relationship between its somatic domains and panic-related phenomena, theoretical accounts of panic disorder could benefit from accentuating the panicogenic role of fears of physical sensations as opposed to the fear of anxiety in general.

Our findings indicate that patients with social phobia differ markedly from those with other anxiety disorders in terms of their feared consequences of anxiety symptoms. Social phobics appear to fear anxiety-related sensations not because of concerns about physical or cognitive catastrophes, but rather due to the potential for negative social evaluation. To illustrate, a person with social phobia might fear sweating in public based on the possibility of inviting disapproval from others. Social AS can thus be considered a component of the fear of negative evaluation that reflects a specific tendency to fear the social consequences of publicly observable anxiety symptoms (McWilliams et al., 2000). In addition, social AS may contribute to several important information processing mechanisms present in social phobia such as self-focused attention (Heinrichs & Hofmann, 2001) and taking an observer's perspective (Clark, 1999). Future research using the ASI-R would help elucidate the role social AS plays in the psychopathology and treatment of social phobia.

Some theorists have proposed that the fear of cognitive dyscontrol accounts for elevated AS in patients with OCD (Cox et al., 1999; Sexton, Norton, Walker, & Norton, 2003). This hypothesis is consistent with contemporary cognitive-behavioral models of OCD that emphasize inflated responsibility for controlling one's mental activities (Rachman, 1993) leading to catastrophic appraisals of intrusive thoughts (Salkovskis, 1999). However, in our sample, the ASI-R *fear of cognitive dyscontrol* subscale was no more elevated in OCD than in other anxiety disorders. In contrast, fears of somatic sensations in this group were higher than expected. These findings are consistent with those of Zinbarg et al. (1997) and suggest that elevated AS in OCD may have multiple underpinnings. For example, health concerns among OCD patients (Abramowitz, Brigidi, & Foa, 1999) might contribute to fears of somatic symptoms among such individuals. Given the heterogeneity of symptom presentation in OCD, future research might examine relationships between AS and symptom subtypes.

Consistent with previous research (e.g., Zinbarg et al., 1997), we found that GAD and specific phobia do not stand out among the anxiety disorders with respect to elevations on particular AS dimensions. One possible explanation for this finding is that these disorders may be associated with a more heterogeneous array of fears as compared to panic disorder and social phobia. For example, some presentations of specific phobia are likely associated with elevated AS (e.g., suffocation fears in claustrophobia; Rachman & Taylor, 1993), whereas this relationship may be absent in other types of phobias (e.g., fear of flying; McNally & Louro, 1992). Likewise, AS might contribute to certain worry themes in GAD (e.g., health concerns), but may be far removed from other themes (e.g., finances). The likely heterogeneity in our specific phobia and GAD groups may have obscured meaningful relationships between AS and subgroups of these patients.

In the present study, patients were classified into diagnostic groups based on their principal anxiety disorder diagnosis. However, given that approximately one-third of these individuals had a comorbid anxiety or mood disorder diagnosis, this heuristic likely diminished our ability to detect specific relationships between AS domains and anxiety disorders. Compared to patients with a single anxiety disorder diagnosis, those with additional diagnoses scored substantially higher on each ASI-R scale in the present study. This observation raises the possibility that especially high levels of AS may place individuals at risk for multiple anxiety disturbances. Alternatively, the high levels of AS seen in such individuals may be a product of experiencing a broader array of anxiety symptoms. Future research is needed to address the relationship between diagnostic comorbidity and AS.

A number of limitations of the present study should be considered. First, although previous research has reliably found elevated AS among individuals with PTSD (e.g., Taylor, Koch, & McNally, 1992), we were not able to include a group of patients with this diagnosis in the present study because our clinic serves very few people with PTSD. Second, all measures used in our study were self-report inventories, which might have inflated relationships among study variables

due to questionnaire-specific method variance. Third, the cross-sectional nature of our data prohibits causal inferences regarding the role of AS in anxiety disorders. Only data from experimental (e.g., Zinbarg et al., 2001) and longitudinal studies (e.g., Hayward et al., 2000) can address issues of causality.

In summary, the present study contributes to the growing literature on AS by demonstrating that assessment of AS dimensions is necessary to understand the relationship between AS and anxiety-related psychopathology. We recommend the routine use of the ASI-R in future studies on the psychopathology of anxiety disorders to facilitate reliable and valid assessment of AS dimensions. In addition, conceptual models of anxiety disorders can acquire greater precision by highlighting the contribution of specific AS dimensions as opposed to global AS. For example, research indicating that panic disorder is characterized by fears of somatic sensations, but not cognitive or publically observable anxiety reactions, suggests the need for refinement in models of the relationship between AS and panic. From a clinical standpoint, consideration of AS dimensions in assessment and treatment planning might also facilitate the delivery of more individually tailored cognitive-behavioral interventions.

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