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## Behavioural Assessment

# The anxiety sensitivity index for children: factor structure and relation to panic symptoms in an adolescent sample

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### Abstract

This study examines the factor structure underlying the Anxiety Sensitivity Index for Children (ASIC, *J Anxiety Disord*, 12 (1998) 307) in an adolescent sample. Three-hundred-and-eight adolescents, aged 12 to 18, completed the ASIC and measures of anxiety and depression. Factor analysis of the ASIC items resulted in a two-factor structure that is similar to that reported by Laurent et al. These two factors included a physical concerns dimension and a mental concerns dimension similar to those found in studies of adult anxiety sensitivity. Subscales measuring these two factors demonstrated concurrent validity, showing particularly close associations with measures of panic symptoms. In addition, both of these subscales showed incremental validity in predicting panic symptoms after controlling for the other anxiety sensitivity subscale and a measure of depression. These results provide evidence that the anxiety sensitivity construct is applicable during adolescence and support the use of the ASIC. Published by Elsevier Science Ltd.

*Keywords:* Anxiety sensitivity; Panic symptoms; Adolescence

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### 1. Introduction

Anxiety sensitivity (AS) refers to the fear of anxiety symptoms based on the belief that these symptoms have harmful somatic, psychological, or social consequences (Reiss & McNally, 1985; Taylor, 1995). A person high in AS might, for example, believe that shortness of breath signifies impending suffocation, or that the inability to think clearly is a sign that he or she is going crazy. AS is believed to be a dispositional trait that may be acquired through a variety of mechanisms including direct experience with anxiety, observational learning, verbal transmission of misinformation, and biological predisposition (Goldstein & Chambless, 1978; Reiss & McNally, 1985;

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Stein, Lang, & Livesley, 1999; Watt, Stewart, & Cox, 1998). Reiss (1987) suggested that individuals with elevated AS may experience increasing anxiety in response to the aversiveness of their anxiety reactions, resulting in a positive feedback cycle that may produce panic attacks and the development of panic disorder or other anxiety disorders. In support of this claim, research with adults has consistently demonstrated positive associations between AS and anxiety disorders (Taylor, Koch, & Crockett, 1991), response to laboratory panic challenges (Donnell & McNally, 1989), and the prospective development of panic (Schmidt, Lerew, & Jackson, 1997). Indeed, anxiety sensitivity plays a central role in contemporary models of panic disorders (McNally, 1990). Since AS appears to be a vulnerability factor for the development of anxiety disorders, particularly panic disorder, studies of AS with younger populations are needed to better understand how these disorders develop (Rachman, 1998).

Although we have many studies of AS with adult samples, relatively few studies have examined AS among children and adolescents. Two measures of AS have been developed specifically for use with children and adolescents: the Childhood Anxiety Sensitivity Index (CASI; Silverman, Fleisig, Rabian, & Peterson, 1991) and the Anxiety Sensitivity Index for Children (ASIC; Laurent, Schmidt, Catanzaro, Joiner, & Kelley, 1998). The CASI was developed by modifying the language used in a measure of AS in adults, the Anxiety Sensitivity Index (ASI; Reiss, Peterson, Gursky, & McNally, 1986), to make the items more understandable to children. The CASI's 18 items include modified versions of the ASI's 16 items, plus two additional items. In the initial validation study of the CASI, Silverman et al. (1991) administered the CASI to two samples, including a nonclinical sample of 76 children aged 11.4–15.8 years and a clinical sample of 33 children aged 8–15 years. Silverman et al. (1991) reported that the CASI showed adequate internal consistency (Cronbach's  $\alpha=0.87$ ) and test–retest reliabilities (0.76 and 0.79).

Results from several studies support the construct validity of the CASI. The CASI is strongly correlated with, but distinct from trait anxiety (Muris, Schmidt, Mereckelbach, & Schouten, 2001), and predicts state anxiety and subjective fear in response to a physical challenge task (Rabian, Embry, & MacIntyre, 1999). Elevated CASI scores were found to be associated with an increased risk of experiencing panic attacks in a nonclinical adolescent sample (Lau, Calamari, & Waraczynski, 1996), and panic symptom severity in both child and adolescent clinical samples (Chorpita & Daleiden, 2000). Kearney, Albano, Eisen, Allan, and Barlow (1997) found that children diagnosed with panic disorder score significantly higher on the CASI than children diagnosed with other anxiety disorders. Chorpita and Lilienfeld (1999) suggest that this finding may be due to the fact that the comparison groups were gathered from different sites. In addition, Chorpita and Lilienfeld (1999) point out that the State-Trait Anxiety Inventory for Children — Trait Version (Spielberger, 1973) actually differentiated groups better than the CASI.

Chorpita, Albano, and Barlow (1996) found evidence that the CASI's ability to uniquely predict trait anxiety beyond physical distress and fear depended on a child's age. The CASI uniquely predicted trait anxiety in children aged 12 and above, but not in children aged 7–11. The authors suggested that younger children may lack the cognitive sophistication necessary to make catastrophic interpretations of body sensations characteristic of individuals with elevated AS. Finally, similar to research on the factor structure of AS in adults (Zinbarg, Mohlman, & Hong, 1999), factor analytic studies of the CASI (Chorpita and Daleiden, 2000; Muris et al., 2001; Silverman, Ginsburg, & Goedhart, 1999) suggest that AS among children and adolescents can be conceptualized as a hierarchical construct consisting of a general factor (i.e. global AS), and either two,

three, or four lower-order factors (e.g. fears of physical sensations, fears of mental incapacitation). Overall, the results with the CASI are consistent with the research with adults and support the construct validity of AS with adolescents.

The ASIC (Laurent et al., 1998), the other published measure of AS among children, has received less empirical attention than the CASI. Like the CASI, the ASIC was created by retaining and modifying the items from the most commonly used measure of AS in adults, i.e. the ASI. In developing the ASIC, Laurent et al. (1998) described results from three samples of children and adolescents ranging from grades four to eight. After initially constructing a 16-item scale highly similar to the ASI, Laurent et al. opted to eliminate four items based on their poor psychometric properties. The resulting 12-item scale showed good internal consistency in all three samples, with Cronbach's  $\alpha$  ranging from 0.85 to 0.90. Laurent et al. (1998) reported that the 12-item ASIC demonstrated a single factor structure in one nonclinical sample, and a two-factor structure consisting of fears of physiological arousal and fears of mental catastrophe in two samples of children exhibiting problem behaviors. The failure of Laurent et al. (1998) to find a social AS factor in the ASIC appears to be due to the fact that the four items they eliminated are typically described as assessing a 'social concerns' component of AS in the adult literature. Despite some inconsistency in the pattern of items comprising each factor, Laurent et al. (1998) concluded that the ASIC is best described as hierarchical in nature and that it assesses dimensions of fear of physiological arousal and fear of mental catastrophe. The only other published investigation using the ASIC was performed by Laurent and Stark (1993), who found that ASIC scores were significantly higher among 43 children with anxiety and depressive diagnoses relative to 18 children with no mental disorder. Because the results of Laurent and Stark (1993) do not permit conclusions to be drawn about the relationship between ASIC scores and specific anxiety disturbances, more research is clearly needed to establish the scale's convergent and discriminant validity.

Because the item wordings on the ASIC and CASI are highly similar, the question naturally arises about whether any meaningful differences exist between the two scales. The most salient difference in the content of the two scales is that the ASIC consists of fewer items than the CASI (12 compared to 18). The authors of the ASIC chose to omit four psychometrically problematic items, each of which is often viewed as assessing the social concerns dimension of AS. Rather than being viewed as a limitation of the ASIC, the omission of these items may actually enhance the scale's reliability and validity, as the corresponding ASI items often show poor psychometric properties (Deacon & Valentiner, 2001). Factor analytic research on the CASI supports the notion that items measuring fears of publicly observable anxiety reactions do not perform as well as items measuring fears of physical sensations and fears of mental incapacitation factors (Muris et al., 2001; Silverman et al., 1999).

Clearly, more research needs to be conducted to establish the psychometric properties of the ASIC and the applicability of AS theory to adolescents and children. For example, do adolescents have the cognitive sophistication to differentiate between fears of physical arousal and mental catastrophe? In addition to considerations of factor structure, little is known about the relationship between scores on the ASIC and theoretically related variables, such as anxiety and panic symptoms.

The present study was conducted to examine the factor structure underlying the ASIC, and the psychometric properties and concurrent validity of the ASIC subscales among adolescents. First, we examined the psychometric properties and factor structure of the ASIC. We expected that the

12-item ASIC would demonstrate a two-factor structure consisting of fears of physical arousal and mental catastrophe. Second, we examined the reliability of the ASIC subscales and their concurrent validity with respect to anxious and depressive symptomatology. We expected the ASIC to show particularly strong associations with panic symptoms assessed by the Spence Children's Anxiety Scale (SCAS; Spence, 1997) and Multidimensional Anxiety Scale for Children (MASC; March, Parker, Sullivan, Stallings, & Conners, 1997), and less strong associations with symptoms of other anxiety disorders and depression (assessed with the Reynolds Adolescent Depression Scale, RADS; Reynolds, 1987). We also expected ASIC scores to uniquely predict panic symptoms after controlling for depression symptoms.

## **2. Method**

### *2.1. Participants and procedure*

Participants were recruited from an ethnically diverse high school in a mid-sized Midwestern city. Parents learned of the study through school newsletters and/or in-person contacts with researchers during school open houses in which parent-teacher conferences were to take place. Parental consent for their adolescents' participation was obtained via these mechanisms. Students whose parents had consented to their participation were provided with information about the study at later dates. Students interested in participating in the study completed adolescent assent forms at the time of their participation.

A total of 308 high school students participated in the study. The mean age was 16.2 years old ( $SD=1.4$ , range=12–18); 44.4% were freshmen, 16.4% were sophomores, 12.8% were juniors, and 26.3% were seniors. Boys and girls were represented fairly equally (47.2 and 52.8%, respectively). The sample was predominantly Caucasian (63.2%), followed by 15.6% African American, 8.1% Asian American, 7.1% Hispanic, 4.5% biracial, 1.0% Native American, and 0.3% other.

### *2.2. Measures*

#### *2.2.1. ASIC*

The ASIC (Laurent et al., 1998) is a 12-item scale designed to assess AS in children. Responses are provided on a four-point scale (0=not true, 1=sometimes true, 2=mostly true, 3=true).

#### *2.2.2. SCAS*

The SCAS (Spence, 1997) is a 44-item self-report measure of anxiety symptoms. Children rate the frequency with which they experience anxiety symptoms on a four-point scale ranging from never (0) to always (4). Six of the items are filler items; the remaining 38 items are used to construct six scales assessing panic-agoraphobia (e.g. "I suddenly feel as if I can't breathe when there is no reason for this"), social phobia (e.g. "I feel afraid that I will make a fool of myself in front of people"), separation anxiety (e.g. "I would feel afraid of being on my own at home"), obsessive-compulsive disorder (e.g. "I can't seem to get bad or silly thoughts out of my head"), generalized anxiety (e.g. "I worry about things"), and fears of physical injury (e.g. "I'm scared

of insects or spiders”). Muris et al. (2001) found that the SCAS and its subscales demonstrated adequate reliability and strong correlations with other anxiety measures.

### 2.2.3. MASC

The MASC (March et al., 1997) is a 39-item self-report scale that assesses anxiety symptoms in children and adolescents. Responses to each item are provided on a four point scale ranging from 0 (never true about me) to 3 (often true about me). The MASC can be used to construct several different indices, including a total score, four main scales, seven subscales, and a lie scale. Since we were primarily interested in prediction of panic symptoms, and for economy of presentation, we conducted analyses using only the four main scales. The first of the main MASC scales, named physical symptoms, is a measure of panic symptoms (e.g. “I have pains in my chest”); the second scale, harm avoidance, was designed to measure obsessive compulsive disorder symptoms (e.g. “I keep my eyes open for danger”); the third scale, social anxiety, to measure social phobia symptoms (“I worry about other people laughing at me”); and the fourth scale, separation anxiety, to measure separation anxiety disorder symptoms (e.g. “I get scared when my parents go away”). March et al. (1997) reported generally adequate internal consistencies and test–retest reliabilities, as well as adequate convergent and divergent validity, for the MASC scales (cf. Valentiner, Gutierrez, and Blacker, in press). Scores for each of these four MASC scale scores were computed by summing responses to items on the scale.

### 2.2.4. RADS

The RADS (Reynolds, 1987) is a 30-item self-report measure of depressive symptomatology in adolescents. Items are rated on a four-point scale from 1 (almost never) to 4 (most of the time). The RADS has demonstrated good internal consistency, test–retest reliability, and convergent validity (Davis, 1990; Reynolds, 1987). RADS total scores were computed by summing responses to each item.

## 2.3. Procedure

Participants completed a questionnaire packet which included the ASIC, SCAS, MASC, and RADS during a 50-minute class period. Participants signed assent forms prior to data collection and were informed that their responses would be kept completely confidential and that they were free to withdraw at any time without penalty.

## 3. Results

### 3.1. Initial analyses

Following Laurent et al. (1998), we first conducted several item-level analyses of the ASIC. All items demonstrated corrected item-total correlations above 0.30 (range=0.43–0.58) and each inter-item correlation was significant, indicating that the ASIC items were sufficiently similar in content. Next, we calculated internal consistency coefficients (i.e. Cronbach’s  $\alpha$ ) for each of the measures used in the study. The ASIC demonstrated good internal consistency ( $\alpha=0.84$ ). The

SCAS and MASC scales generally demonstrated adequate reliability. Within the SCAS, the panic/agoraphobia scale showed the highest internal consistency ( $\alpha=0.74$ ), while the separation anxiety scale ( $\alpha=0.56$ ) and the physical injury fears scale ( $\alpha=0.50$ ) showed the lowest internal consistencies. Three of the four MASC scales demonstrated good internal consistencies, with the physical symptoms scale ( $\alpha=0.87$ ) and social phobia scale ( $\alpha=0.86$ ) demonstrating the highest internal consistency. The RADS demonstrated good internal consistency ( $\alpha=0.89$ ). Lastly, we examined whether gender differences were present for scores on the study measures. To control for multiple comparisons, we used a Bonferroni correction and set the  $\alpha$  necessary for statistical significance equal to 0.004 (0.05 divided by 12 comparisons). Significant gender differences were found for ASIC total scores ( $t [305]=-3.19, p<0.002$ ), SCAS separation anxiety scale scores ( $t [303]=-3.61, p<0.001$ ), SCAS generalized anxiety disorder scale scores ( $t [303]=-3.74, p<0.001$ ), SCAS physical injury fears scale scores ( $t [303]=-4.00, p<0.001$ ), and MASC separation anxiety scale scores ( $t [305]=-4.44, p<0.001$ ). For all scales, girls scored higher than boys. Age was not significantly correlated with any study variable. Using one way ANOVA's, no mean differences in any measure were found between students at different grade levels. Table 1 presents descriptive statistics for the ASIC, SCAS scales, MASC scales, and RADS for boys, girls, and the total sample.

### 3.2. Factor structure of the ASIC

The factor structure of the 12-item ASIC was examined using the principal components analysis (PCA) and principal axis factor analysis (PAF). Debate exists as to which exploratory factor

Table 1

Descriptive statistics (means, standard deviations, gender differences, and Cronbach's alphas) of the study questionnaires<sup>a</sup>

Scale	Total sample ( <i>N</i> =308)	Boys ( <i>n</i> =145)	Girls ( <i>n</i> =162)	$\alpha$
ASIC	6.5 (5.6)	5.5 (4.9)	7.5 (6.1)	0.84
SCAS				
Panic/agoraphobia	2.4 (2.9)	2.1 (2.6)	2.8 (3.2)	0.74
Social phobia	5.2 (3.1)	4.9 (2.8)	5.5 (3.3)	0.70
Separation anxiety	2.0 (1.9)	1.6 (1.6)	2.3 (2.0)	0.56
Obsessive-compulsive disorder	3.4 (2.7)	3.6 (2.9)	3.2 (2.5)	0.67
Generalized anxiety disorder	5.2 (2.7)	4.6 (2.5)	5.7 (2.8)	0.70
Physical injury fears	2.7 (2.3)	2.2 (2.1)	3.2 (2.4)	0.50
MASC				
Physical symptoms	0.8 (0.6)	0.7 (0.5)	0.9 (0.6)	0.87
Harm avoidance	1.7 (0.5)	1.6 (0.6)	1.8 (0.5)	0.75
Social anxiety	1.2 (0.6)	1.1 (0.6)	1.3 (0.6)	0.86
Separation anxiety	0.5 (0.4)	0.4 (0.3)	0.6 (0.4)	0.67
RADS	65.2 (15.9)	63.4 (15.6)	66.9 (16.0)	0.89

<sup>a</sup> Note: one participant did not report his or her gender. ASIC = Anxiety Sensitivity Index for Children. SCAS = Spence Child Anxiety Scales. MASC = Multidimensional Anxiety Scales for Children. RADS = Reynolds Adolescent Depression Scale.

analytic procedure is preferable (Velicer & Jackson, 1990), and the AS literature has been characterized by the use of varying factor analytic methods. In recognition of the pros and cons associated with PCA and PAF, we conducted the factor analysis of the ASIC items using both approaches. In both cases we rotated the items using an oblique (i.e. oblimin) rotation based on previous research suggesting that AS dimensions are substantially correlated (Silverman et al., 1999). The number of factors to be retained was determined by parallel analysis (Horn, 1965; Longman, Cota, Holden, & Fekken, 1989) and consideration of factor interpretability. Parallel analysis has been shown to be one of the most accurate methods for identifying the number of factors to retain across varying sample conditions (Zwick & Velicer, 1986).

The first four eigenvalues were 4.41, 1.59, 1.03, and 0.85. Parallel analysis using both the mean and 95th percentile eigenvalues indicated a two-factor solution. Table 2 displays the pattern matrices, communalities, and percentage of variance accounted for by each factor for the obliquely-rotated two-factor solutions following PCA and PAF extraction. The two-factor solution accounted for 50.0% of the variance following PCA and 41.3% of the variance following PAF. Correlations between factors were 0.40 ( $p < 0.001$ ) for PCA and 0.47 ( $p < 0.001$ ) for PAF. Table 2 shows that the solution had good simple structure, as indicated by the facts that each item loaded on only one factor and there were an adequate number of items with salient loadings on each factor (Factor I had eight, Factor II had four). The pattern of loadings was very similar across the different factor analytic methods, indicating that PCA and PAF produced essentially the same factor structure. The pattern of salient loadings suggests that Factor I assesses fears of physical arousal and Factor II assesses fears of mental catastrophe. Accordingly, a ‘physical concerns’ subscale was created by summing each item with its highest factor loading on the first factor, and a ‘mental concerns’

Table 2

Anxiety sensitivity index for children pattern matrices and communalities for the two-factor solution<sup>a</sup>

ASIC item	I	II	$h^2$
4. It scares me when I feel like I'm going to faint.	<b>0.78 (0.69)</b>	0.17 (0.14)	0.53 (0.41)
6. It scares me when my heart beats rapidly.	<b>0.69 (0.59)</b>	0.10 (0.06)	0.43 (0.31)
14. When my body feels strange it scares me.	<b>0.66 (0.61)</b>	-0.11 (-0.09)	0.50 (0.43)
10. It scares me when I can't catch my breath.	<b>0.66 (0.60)</b>	0.00 (0.00)	0.44 (0.36)
8. It scares me when I am sick to my stomach.	<b>0.65 (0.59)</b>	0.00 (0.01)	0.42 (0.34)
3. It scares me when I feel "shaky" (trembling).	<b>0.59 (0.55)</b>	-0.16 (-0.13)	0.45 (0.38)
9. When I notice that my heart is beating fast, I worry that something really bad is going to happen.	<b>0.59 (0.54)</b>	-0.11 (-0.08)	0.41 (0.34)
11. When my stomach is upset, I worry that I might be seriously ill.	<b>0.39 (0.37)</b>	-0.25 (-0.18)	0.29 (0.23)
15. When I am nervous, I worry that I might be crazy.	-0.07 (-0.10)	<b>-0.91 (-0.94)</b>	0.77 (0.80)
2. When I cannot keep my mind on what I'm doing I worry that I might be going crazy.	-0.10 (-0.05)	<b>-0.86 (-0.75)</b>	0.67 (0.53)
16. It scares me when I am nervous.	0.21 (0.26)	<b>-0.65 (-0.52)</b>	0.57 (0.46)
12. It scares me when I am unable to keep my mind on what I'm doing.	0.13 (0.19)	<b>-0.65 (-0.49)</b>	0.51 (0.37)
% Variance of rotated factors	36.7 (32.0)	13.2 (9.3)	

<sup>a</sup> Note: salient factor loadings (>0.30) are listed in boldface type. Factor loadings outside of parenthesis pertain to PCA; those inside parentheses pertain to PAF.

subscale was created by summing all items that loaded most highly on the second factor. The two subscales were significantly correlated ( $r=0.47$ ,  $p<0.01$ ). Both subscales showed adequate internal consistency (physical concerns subscale  $\alpha=0.80$ ; mental concerns subscale  $\alpha=0.79$ ). Gender differences were evident on the physical concerns subscale ( $t [305]=-3.73$ ,  $p<0.01$ ), with girls (Mean=5.9, SD=4.6) scoring higher than boys (Mean=4.2, SD=3.7). Boys and girls did not differ on the mental concerns subscale ( $t [305]=-0.96$ ,  $p>0.05$ ). Neither age nor year in school were significantly related to either ASIC subscale.

### 3.3. Correlates of the ASIC and its subscales

ASIC total and subscale scores showed adequate convergent and divergent validity with respect to theoretically related and unrelated variables. ASIC total scores were most strongly related to the SCAS generalized anxiety disorder and panic/agoraphobia scales ( $r$ 's=0.58 and 0.54, respectively) and the MASC physical symptoms scale ( $r=0.52$ ). The strong relationship between ASIC total scores and the SCAS generalized anxiety disorder scale may have been attributable in part to several items in the SCAS generalized anxiety disorder scale that assess symptoms of physical arousal (e.g. "When I have a problem, my heart beats really fast."). The ASIC physical concerns and mental concerns subscales demonstrated their strongest correlations with the same three variables as the ASIC total scores.

Of greatest interest in terms of the ASIC's construct validity is the observation that each ASIC scale was most highly correlated with indices of panic and closely-related symptoms. It should be noted, however, that the ASIC also showed moderate zero-order correlations with several less theoretically related scales (e.g.  $r=0.44$  with the SCAS OCD scale). This observation highlights the importance of examining the extent to which the ASIC and its subscales are uniquely associated with panic indices after controlling for other anxiety variables. Table 3 displays the correlations between the ASIC total and subscale scores, the SCAS scales, the MASC scales, and the RADS.

### 3.4. Unique contribution of the ASIC and its subscales to panic symptoms

In order to assess the unique contributions of the ASIC and its subscales to the prediction of panic symptoms, we conducted a series of hierarchical multiple linear regressions with a panic symptom composite as the dependent variable. The panic symptom composite was calculated by summing standardized scores on the SCAS panic/agoraphobia scale and the MASC physical symptoms scale. A series of hierarchical tests were conducted to examine the incremental validity of ASIC total scores and the two ASIC subscales above the amount of variance predicted by depression symptoms and general anxiety symptoms. A general anxiety composite was computed by summing participants' standardized scores on all SCAS and MASC scales excluding the panic indices. This methodology was chosen to provide a key test of the construct validity of the ASIC, namely that ASIC total and subscale scores will uniquely predict panic symptoms after controlling for both depression and general anxiety.

Table 4 displays the results of the multiple regression analyses with ASIC total scores as a predictor of panic symptoms. After being entered simultaneously in the first step, both ASIC total scores (partial  $r=0.48$ ,  $p<0.001$ ) and RADS scores (partial  $r=0.44$ ,  $p<0.001$ ) predicted significant unique variance in the panic symptom composite. Together, these variables explained 46.1% of

Table 3  
Pearson correlations among anxiety sensitivity index for children scales and related variables<sup>a</sup>

Scale	1	2	3	4	5	6	7	8	9	10	11	12	13
1. ASIC total	1.00												
2. ASIC physical concerns	0.94	1.00											
3. ASIC mental concerns	0.74	0.47	1.00										
4. SCAS panic/agoraphobia	0.54	0.43	0.56	1.00									
5. SCASsocial phobia	0.41	0.32	0.43	0.35	1.00								
6. SCAS separation anxiety	0.47	0.41	0.43	0.35	0.39	1.00							
7. SCAS OCD	0.44	0.36	0.44	0.50	0.34	0.37	1.00						
8. SCAS GAD	0.58	0.53	0.46	0.60	0.48	0.50	0.46	1.00					
9. SCAS physical injury fears	0.22	0.27	0.05	0.32	0.28	0.23	0.22	0.28	1.00				
10. MASC physical symptoms	0.52	0.45	0.48	0.72	0.35	0.41	0.47	0.65	0.23	1.00			
11. MASC harm avoidance	0.24	0.28	0.08	0.07	0.16	0.22	0.12	0.15	0.13	0.08	1.00		
12. MASC social anxiety	0.43	0.37	0.38	0.30	0.71	0.36	0.27	0.42	0.23	0.41	0.29	1.00	
13. MASC separation anxiety	0.29	0.31	0.14	0.36	0.22	0.48	0.24	0.29	0.47	0.32	0.36	0.35	1.00
14. RADS	0.37	0.28	0.43	0.47	0.34	0.28	0.42	0.47	0.23	0.55	-0.10	0.34	0.17

<sup>a</sup> Note: ASIC = Anxiety Sensitivity Index for Children. SCAS = Spence Child Anxiety Scales. MASC = Multidimensional Anxiety Scales for Children. RADS = Reynolds Adolescent Depression Scale.

the variance in panic symptoms,  $F(2, 283)=120.87$ ,  $p<0.001$ . Adding general anxiety composite scores in the second step produced a significant increase in variance explained in panic symptoms,  $R^2=0.07$ ,  $F(1, 282)=39.48$ ,  $p<0.001$ . All three variables explained significant unique variance in panic symptoms. After controlling for depression and general anxiety, global anxiety sensitivity (i.e. ASIC total scores) remained a unique predictor of the panic symptom composite (partial  $r=0.27$ ,  $p<0.001$ ).

Results of the multiple regression analyses with the ASIC subscales as predictors of the panic symptom composite mirror those from ASIC total scores. When entered together in the first step, the ASIC physical concerns subscale (partial  $r=0.29$ ,  $p<0.001$ ), ASIC mental concerns subscale (partial  $r=0.30$ ,  $p<0.001$ ), and the RADS (partial  $r=0.41$ ,  $p<0.001$ ) each accounted for significant

Table 4  
Global anxiety sensitivity as a predictor of the panic attack symptom composite

Step and scale	<i>B</i>	<i>SE B</i>	$\beta$	<i>t</i>	<i>p</i>	Partial <i>r</i>
Step 1						
RADS	0.04	0.01	0.39	8.17	<0.001	0.44
ASIC Total	0.14	0.02	0.43	9.23	<0.001	0.48
Step 2						
RADS	0.04	0.01	0.31	6.80	<0.001	0.38
AISC Total	0.08	0.02	0.25	4.79	<0.001	0.27
General Anxiety	0.12	0.02	0.34	6.28	<0.001	0.35

Note.  $R^2 = 0.46$  for Step 1;  $\Delta R^2 = 0.07$  for Step 2 ( $p < 0.001$ ). RADS = Reynolds Adolescent Depression Scale, General Anxiety = General Anxiety Composite, ASIC = Anxiety Sensitivity Index for Children.

unique variance in panic symptoms (see Table 5). The three variables in step 1 explained 47.0% of the variance in panic symptoms,  $F(3, 282)=83.53, p<0.001$ . After adding general anxiety composite scores in step 2, all variables in the regression equation explained significant, unique variance in panic symptoms. After controlling for depression, general anxiety, and the other ASIC subscale, both the ASIC physical concerns subscale (partial  $r=0.12, p<0.05$ ) and the ASIC mental concerns subscale (partial  $r=0.25, p<0.001$ ) significantly predicted panic symptoms. This finding is particularly impressive because each ASIC subscale demonstrated incremental validity over the related constructs of depression and general anxiety, but also over another dimension of the same construct (i.e. AS).

#### 4. Discussion

This study examined the factor structure of the ASIC and the concurrent validity of the ASIC scales among adolescents. The present study's findings suggest that AS can be adequately measured in adolescents using the ASIC, that AS has a factor structure in adolescents that is similar to its structure in adults, and that dimensions of AS show incremental validity in predicting panic symptoms during adolescence.

The 12-items of the ASIC appear to have a two-factor structure, including dimensions related to fears of physical arousal and fears of mental catastrophe. Chorpita and Daleiden (2000) found similar results in their study of the CASI, including the absence of a social consequences factor. These results are similar to those from studies with adults. For example, Deacon and Valentiner (2001) reported that there are three dimensions underlying the ASI. Two of those dimensions closely resemble those found in the current study. The lack of a third dimension in the current study is apparently due to the omission of the four items that tap fear of social consequences in the ASIC. Some researchers have argued that the ASI items do not adequately tap the social concerns dimension (Taylor & Cox, 1998). This deficit associated with the original ASI item pool is apparently magnified when working with the ASIC items, which are slightly modified versions

Table 5  
Anxiety sensitivity dimensions as predictors of the panic attack symptoms composite

Step and Scale	<i>B</i>	<i>SE B</i>	$\beta$	<i>t</i>	<i>p</i>	Partial <i>r</i>
Step 1						
RADS	0.04	0.01	0.36	7.45	<0.001	0.4
ASIC Physical Concerns	0.11	0.02	0.25	5.02	<0.001	0.29
ASIC Mental Concerns	0.24	0.05	0.28	5.28	<0.001	0.30
Step 2						
RADS	0.03	0.01	0.28	6.03	<0.001	0.34
ASIC Physical Concerns	0.04	0.02	0.10	2.00	<0.05	0.12
ASIC Mental Concerns	0.19	0.04	0.22	4.35	<0.001	0.25
General Anxiety	0.13	0.02	0.34	6.44	<0.001	0.36

Note.  $R^2 = 0.47$  for Step 1;  $\Delta R^2 = 0.07$  for Step 2 ( $p < 0.001$ ). RADS = Reynolds Adolescent Depression Scale, General Anxiety = General Anxiety Composite, ASIC = Anxiety Sensitivity Index for Children, Physical Concerns Subscale, ASIC Mental Concerns = ASIC Mental Concerns Subscale.

of the ASI items, and an adolescent sample. Although the results of the current study of the ASIC with adolescents show similarities with the results of studies of the ASI with adults, future research will be needed to determine whether these similarities cover the full domain of AS (Taylor & Cox, 1998). Some investigation of a possible social domain of AS in adolescents is needed.

The ASIC item-factor loadings in this study were similar to those reported by Laurent et al. (1998), and the two subscales of the AS used in this study were identical to those used by Laurent et al. (1998). In addition, the ASIC subscales items correspond to the ASI subscale items from which they were taken. Like the ASI subscales, the ASIC physical concerns and mental concerns subscales showed adequate internal consistencies. These factor analysis and reliability results are not surprising given the rather minor differences between the ASI and ASIC items and the relatively small difference between the mean age of our sample and those of adult samples. These results are consistent with other research, suggesting that the factor structure of AS is similar in adolescents and adults, at least across the domain of AS covered by the ASIC. Also consistent with the research findings with adults (Stewart, Taylor, & Baker, 1997), we found slightly higher levels of AS for females than for males.

This study also examined the concurrent validity of the ASIC and its subscales in predicting panic and other anxiety symptoms. Global AS (i.e. ASIC total scores) and both dimensions of the ASIC appear to be closely related to panic symptoms during adolescence. These results are clearly consistent with expectations based on past research (Deacon & Valentiner, 2001). ASIC total scores showed incremental validity, predicting panic symptoms after controlling for both depression and general anxiety symptoms. The ASIC physical and mental concerns subscales both evidenced incremental validity in predicting panic symptoms above the effects of depression, general anxiety, and the other AS dimension. These results differ somewhat from those of Chorpita and Daleiden (2000), who found evidence of incremental validity for an autonomic subscale of the CASI, but not for a non-autonomic subscale. The results of the current study indicate that AS is not simply a redundant facet of negative affect or trait anxiety (Lilienfeld, 1997), and that measuring dimensions of AS may help us to better understand and predict panic symptoms (Deacon & Valentiner, 2001).

The ASIC scores also showed substantial relationships with the SCAS GAD scale used in this study. We note, however, that this scale shows poor construct validity, with a tendency to converge with measures of panic symptoms (Valentiner, Gutierrez, & Blacker, *in press*). Other researchers have used a revision of this scale, dropping autonomic arousal items, as a more pure measure of GAD (Chorpita, Yim, Moffitt, Umemoto, & Francis, 2000). Thus, the relationship of AS measures with the SCAS GAD scale in the current study and in other studies (Muris et al., 2001) may not be due to a particularly strong relationship between AS and GAD (Chorpita & Daleiden, 2000), but is likely to be a function of the SCAS GAD scale's lack of distinctiveness from the panic symptom measures.

The present findings also highlight the importance of depression in understanding panic symptoms. Depression symptoms uniquely predicted panic symptoms after controlling for the effects of AS and general anxiety. Our results are consistent with those from studies of children and adults (Kearney et al., 1997; Taylor, Koch, Woody, & McLean, 1996) in demonstrating the positive contributions of both depression and AS to panic symptoms. Additional research has shown that AS and depression are significantly related after controlling for levels of general anxiety (Taylor et al., 1996; Weems, Hammond-Laurence, Silverman, & Ferguson, 1997), although Muris

et al. (2001) found that the relationship between depression and the CASI became non-significant after controlling for the effects of trait anxiety. Schmidt, Lerew, and Joiner (1998) suggested that the AS mental concerns dimension is likely to account for the relationship between AS and depression because it is associated with aspects of both anxiety and depression. The results of the present study reaffirm the association between fears of mental catastrophe and depression, and suggest that both variables uniquely contribute to the experience of panic symptoms among adolescents.

The main limitations associated with this study concern the reliance of self-report measures and the use of a cross-sectional design. The reliance on self-report questionnaires raises the likelihood that the magnitude of the relationships reported here are inflated. However, self-report may be the most valid method to assess anxiety symptoms (Cole, Truglio, & Peeke, 1997) and private cognitions. In addition, examining the partial correlations controlling for other self-report scales provides some reduction in the role of method variance on our findings.

The use of a cross-sectional design limits the degree to which our results can provide an understanding of the direction of effect. We recognize that there are other interpretations for the associations that we found. For example, while we choose to emphasize that AS predicts panic, other anxiety researchers have noted that panic symptoms appear to contribute to the development of AS (Watt et al., 1998). It is beyond the scope of the current study to investigate the causality between AS and panic, which is likely to be bi-directional in nature. This study provides evidence that there is an association between AS and panic in adolescents. We believe that this association during adolescence is likely to be understood in much the same way that it is understood during adulthood.

Further research is needed to examine other AS dimensions and the relationships of AS to anxiety phenomena (e.g. anxiety disorder diagnosis, response to challenge tasks, prospective development of panic attacks) among children and adolescents. This line of research in the adult literature has produced important findings about the unique roles of different AS dimensions in contributing to anxiety and panic (Schmidt, 1999; Schmidt, Lerew, & Jackson, 1999; Zinbarg, Barlow, & Brown, 1997). Research on AS during adolescence may help us to better understand psychological functioning during adolescence as well as helping us understand the development of anxiety conditions found in adults.

Overall, the present study provides evidence that the ASIC is an economical, psychometrically sound, and valid measure of AS in adolescents. The ASIC, like the CASI, appears appropriate for use with adolescents. The CASI, however, appears to tap a somewhat broader part of the domain of AS. This difference is not surprising as the CASI has 18 items, and the ASIC has only 12. The ASIC and CASI were both derived from the ASI, and thus are likely to share the ASI's psychometric limitations, such as having too few items and having items that do not target specific factors. Adult researchers have recently developed revised and expanded measures of AS aimed at providing a broader and more psychometrically sound assessment of AS (Taylor & Cox, 1998). Future research might benefit from the use of an expanded measure of AS in children and adolescents that allows for more thorough measurement of various AS dimensions. Both the ASIC and CASI appear to be reliable and valid measures of AS. They appear to adequately assess AS at the global level and several dimensions of AS, but appear somewhat limited in assessing the full domain of AS at the dimensional level.

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