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Unique relations among anxiety sensitivity factors and anxiety, depression, and suicidal ideation

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ABSTRACT

Anxiety sensitivity (AS) is composed of three lower-order dimensions, cognitive concerns, physical concerns, and social concerns. We examined the relations between AS dimensions using a more adequate assessment of subscales (ASI-3) than has previously been used, and measures of anxiety and mood disorders as well as suicidal ideation in a sample of 256 (*M* age = 37.10 years, *SD* = 16.40) treatment-seeking individuals using structural equation modeling. AS cognitive concerns was uniquely associated with generalized anxiety disorder (GAD), obsessive–compulsive disorder (OCD), major depressive disorder (MDD), post-traumatic stress disorder (PTSD), and suicidal ideation. AS physical concerns was uniquely associated with OCD, social anxiety disorder (SAD), panic disorder (PD), and specific phobia. AS social concerns was uniquely associated with SAD, GAD, OCD, and MDD. These results highlight the importance of considering the lower-order AS dimensions when examining the relations between AS and psychopathology.

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Anxiety sensitivity (AS) is the fear of experiencing anxiety or anxiety related physiological sensations and the potential cognitive, physiological, and social consequences associated with these experiences (McNally, 2002; Reiss, 1997; Taylor & Cox, 1998). This construct is a trait-like characteristic, unique from other traits such as negative affectivity or trait anxiety in that AS reflects a fear of the consequences of anxiety whereas negative affectivity reflects a general predisposition to experience multiple negative emotions and trait anxiety reflects a predisposition to experience anxiety specifically (Lilienfeld, 1997; Taylor, 1999). Numerous studies have implicated AS as a risk-factor for not only anxiety disorders, but also major depressive disorder (MDD), and suicidality (e.g., Capron, Cougle, Ribeiro, Joiner, & Schmidt, 2012; Olatunji & Wolitzky-Taylor, 2009). Further, AS is best classified as a malleable risk factor, as several interventions have effectively targeted this construct (e.g., Keough & Schmidt, 2012; Schmidt et al., 2007). Numerous studies have also identified an underlying multidimensional structure of AS (e.g., Taylor et al., 2007; Zinbarg, Barlow, & Brown, 1997). However, most studies examining the relations between AS and associated psychopathology have not examined these associations at a more refined level by including the lower-order AS dimensions.

Whereas AS was originally conceptualized as a unidimensional construct (Reiss, 1991; Reiss & McNally, 1985), and measures such as the Anxiety Sensitivity Index (ASI; Reiss, Peterson, Gursky, & McNally, 1986) were developed to reflect this, studies employing factor analytic methods have repeatedly demonstrated that AS is best conceived as a hierarchical construct, comprised of a single higher-order AS factor and several lower-order factors representing different facets of AS (e.g., Lilienfeld, Turner, & Jacob, 1993; Taylor et al., 2007; Zinbarg et al., 1997). Most researchers agree that there are three lower-order dimensions, cognitive concerns, physical concerns, and social concerns (e.g., Taylor et al., 2007; Wheaton, Deacon, McGrath, Berman, & Abramowitz, 2012; Zinbarg et al., 1997), though some researchers have found one- to four-factor solutions to best represent AS (see Taylor, 1999 for review). The cognitive concerns dimension reflects fear of cognitive dyscontrol. The physical concerns dimension reflects fear of the physical sensations that accompany anxiety. Finally, the social concerns dimension reflects fear that publicly observable anxiety reactions will lead to social rejection or ridicule (Taylor et al., 2007).

Extant empirical work has provided some evidence that lower-order AS dimensions are differentially related to certain anxiety disorders as well as depression (e.g., Naragon-Gainey, 2010; Wheaton et al., 2012; see Olatunji & Wolitzky-Taylor, 2009 for review). Consideration of AS at the lower-order level has provided incremental validity above and beyond AS as a unitary construct (Olatunji & Wolitzky-Taylor, 2009; Wheaton et al., 2012). Based on the nature of the AS physical concerns dimension (i.e. fear of physical anxiety symptoms) and early empirical work, AS physical

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concerns has been most clearly associated with panic disorder (PD) and agoraphobia (Olatunji & Wolitzky-Taylor, 2009; Zinbarg, Brown, Barlow, & Rapee, 2001), although there is some evidence to indicate an association between AS physical concerns and PTSD as well (Asmundson & Stapleton, 2008). Studies have indicated that, for PD, the relation with lower-order AS dimensions may be specific to AS physical concerns (Rector, Szacun-Shimizu, & Leybman, 2007; Rodriguez, Bruce, Pagano, Spencer, & Keller, 2004; Zinbarg et al., 1997).

The cognitive concerns dimension of AS has most often been identified with generalized anxiety disorder (GAD). Olatunji and Wolitzky-Taylor's (2009) conceptual model of the lower-order AS dimensions linked AS cognitive concerns with GAD based on the phrenophobic nature of the construct as well as empirical evidence of a moderate relation between AS cognitive concerns and GAD (Blais et al., 2001; Rector et al., 2007; Rodriguez et al., 2004; Zinbarg et al., 2001). However, empirical evidence suggests that, of the lower-order AS dimensions, AS cognitive concerns may be the most related to depression (Deacon, Abramowitz, Woods, & Tolin, 2003; Rector et al., 2007) and post-traumatic stress disorder (PTSD; Lang, Kennedy, & Stein, 2002; Vujanovic, Zvolensky, & Bernstein, 2008).

AS social concerns have been most associated with social anxiety disorder (SAD) in conceptual models of AS dimensions (Olatunji & Wolitzky-Taylor, 2009). This is consistent with the nature of the construct (i.e. fear of publicly observable anxiety symptoms) and extant empirical work (McWilliams, Stewart, & MacPherson, 2000; Zinbarg & Barlow, 1996). At face value, AS social concerns appear to be predominantly related to SAD. However, extant work has found that AS social concerns were associated with other anxiety disorders as well as major depressive disorder (MDD; Naragon-Gainey, 2010; Wheaton et al., 2012), suggesting that AS social concerns may be a broader risk factor for mood and anxiety disorders than has previously been suggested.

A recent meta-analysis conducted by Naragon-Gainey (2010) has helped clarify the relations between lower-order AS dimensions and mood and anxiety disorders. This meta-analysis explored relations between lower-order AS dimensions (measured primarily by the ASI) and symptom measures of MDD, PD, agoraphobia, SAD, PTSD, obsessive–compulsive disorder (OCD), GAD, and specific phobia. Although this meta-analysis only examined zero-order relations, and therefore cannot address the unique relations between lower-order AS dimensions and mood and anxiety disorders, the findings are mostly in line with prior claims of specificity between lower-order AS dimensions and mood and anxiety disorders. For example, MDD was most associated AS cognitive concerns. SAD was most associated with AS social concerns, and GAD was more associated with AS cognitive concerns. However, for other mood and anxiety disorders, less specific conclusions could be drawn. PD was more associated with both AS cognitive and physical concerns than with AS social concerns. Although there were few studies (n = 4–5) that examined the relations between lower-order AS dimensions and OCD and specific phobia, tentative conclusions were available. For OCD and specific phobia, all three AS dimensions were similarly related, suggesting that these symptoms are related to AS generally, and not to one specific facet of AS.

Studies have also implicated AS in other forms of psychopathology. For example, Schmidt, Woolaway-Bickel, and Bates (2001) found that AS cognitive concerns were strongly associated with suicidal ideation in a sample of outpatients with PD. Recent work has replicated and extended the finding that AS cognitive concerns are associated with suicidal ideation in a number of populations with elevated suicidality including cigarette smokers, Russian citizens, and psychology outpatients (Capron, Blumenthal, et al., 2012; Capron, Allan, Norr, Zvolensky, & Schmidt, 2013; Capron, Kotov, & Schmidt, 2013). This same line of research has found

a less consistent association between AS physical concerns and suicidality. AS physical concerns appear to moderate the relationship between AS cognitive concerns and suicide attempt history (Capron, Cougle, et al., 2012; Capron, Kotov, et al., 2013), but not suicidality (Capron, Blumenthal, et al., 2012). AS social concerns were significantly associated with suicide attempt history in a large outpatient sample (Capron, Fitch, et al., 2012) but this result was not replicated in other samples (Capron, Kotov, et al., 2013).

Although the differential relations between lower-order AS dimensions and psychopathology has been explored, there are several notable limitations of past research. Primarily, most studies have used the ASI to assess these relations. There are several issues associated with using the ASI in this context. Because the ASI was created as a global measure of AS (Peterson and Reiss, 1992), items designed to measure the lower-order dimensions were not balanced, with most items assessing AS physical concerns (Deacon & Valentiner, 2001; Taylor, Rabian, & Federoff, 1999), limiting the reliability and content validity of the AS cognitive concerns and social concerns dimensions (Taylor et al., 2007). The ASI-3 was specifically designed to address reliability and validity concerns of the ASI and other similar measures (Taylor et al., 2007). Therefore, research using the ASI-3 to measure the lower-order AS dimensions is needed to verify and expand on findings from research using the ASI as the limited validity of AS cognitive concerns and social concerns dimensions may have masked or attenuated specific relations between these dimensions and psychopathology. For example, there is some debate as to whether PTSD is specifically associated with AS cognitive concerns or AS physical concerns (e.g., Asmundson & Stapleton, 2008; Lang et al., 2002). This discrepancy might be partially attributable to the limited reliability of the AS cognitive concerns dimensions. Of the few studies using the ASI-3 to examine the relations between the lower-order AS dimensions and psychopathology (e.g., Taylor et al., 2007; Wheaton et al., 2012), none have examined the unique relations between lower-order AS dimensions, controlling for the other AS dimensions.

1. Current study

There is increasing evidence that the lower-order AS dimensions differentially operate as risk factors for various forms of psychopathology (e.g., Naragon-Gainey, 2010; Rector et al., 2007; Wheaton et al., 2012). A central aim of this study was to provide information regarding the unique relations between lower-order ASI-3 dimensions and psychopathology using a measure better suited to evaluate AS dimensions. There has been one prior study that has examined the relations between psychopathology and lower-order AS dimensions using the ASI-3 (e.g., Wheaton et al., 2012); however, this report only evaluated a subset of disorders associated with AS (i.e., GAD, OCD, PD, and SAD). Further, they did not examine whether the relations between lower-order AS dimensions and psychopathology were specific to particular lower-order dimensions. A greater understanding of the *specific* and *unique* relations between lower-order AS dimensions and psychopathology can aid in refining conceptual models of the relation between AS and mood and anxiety disorders as well as other forms of psychopathology. We examined the relations between lower-order ASI-3 dimensions and several anxiety disorder symptoms, including GAD symptoms, SAD symptoms, and OCD symptoms as well as other dimensionally measured forms of psychopathology that AS has been deemed a risk factor for, including MDD symptoms and suicidal ideation. Latent variable techniques (i.e., structural equation modeling) were used because they easily allow for the examination of whether the path estimates from specific AS dimensions were stronger for some disorders than for others and for the examination of whether the path estimates to specific disorders were stronger in some dimensions as compared to others (Cheung

& Chan, 2004). Regarding specific symptoms, it was hypothesized that, based on past findings (e.g., Capron, Blumenthal, et al., 2012; Rector et al., 2007), AS cognitive concerns would be the only lower-order dimension related to GAD symptoms, MDD symptoms, and suicidal ideation. It was further hypothesized that AS social concerns would be the only lower-order dimension related to SAD (e.g., McWilliams et al., 2000). Given that prior research has found associations for OCD and all three lower-order AS dimensions (e.g., Naragon-Gainey, 2010), it was hypothesized that there would be unique relations between OCD and AS cognitive, physical, and social concerns.

A further aim of this study was to provide additional convergent and discriminant validity for the lower-order ASI-3 factors through examination of their unique relations with diagnostic status. Whereas prior studies have examined the relations between lower-order AS dimensions as measured by the ASI-3 and clinical diagnoses (e.g., Taylor et al., 2007; Wheaton et al., 2012), these studies did not examine whether diagnostic status was *specifically* and *uniquely* associated with specific lower-order AS dimensions. Diagnostic information was available for certain diagnoses in addition to dimensional symptom measures, providing an opportunity to validate the dimensional findings within sample (i.e., GAD, SAD, OCD, and MDD). In addition, for several anxiety disorders, only clinical diagnoses were available (i.e., PD, specific phobia, and PTSD). Our specific hypotheses regarding the unique relations between lower-order ASI-3 factors and diagnoses were identical to our hypotheses regarding dimensional measures for those measures for which both dimensional measures and diagnostic status were available (i.e., GAD, SAD, OCD, and MDD). Based on past findings (e.g., Asmundson & Stapleton, 2008; Lang et al., 2002; Naragon-Gainey, 2010; Rodriguez et al., 2004; Zinbarg et al., 1997), it was hypothesized that both AS physical concerns and AS cognitive concerns would be associated with PD and PTSD diagnoses. Finally, it was hypothesized that specific phobia would be related to all three lower-order AS dimensions (e.g., Naragon-Gainey, 2010).

2. Method

2.1. Participants

Participants consisted of 256 outpatients receiving treatment services at the Florida State University (FSU) Anxiety and Behavioral Health Clinic (ABHC). The ABHC is an outpatient clinic that serves individuals in the local community. The ABHC has minimal exclusionary criteria. Individuals are referred elsewhere only if they are suffering from psychotic and/or bipolar-spectrum disorders, if they are not stabilized by medications, or if they are an immediate threat to themselves or others. Approximately half of the participants in the current study were female (56%) with ages ranging from 18 to 87 ($M = 37.10$, $SD = 16.40$). 64.8% of the sample were Caucasian, 21.9% African-American, 1.6% Asian, .8% Native American, .4% Pacific Islander, and 10.5% other (e.g., bi-racial). The mean level of education was "some college/two-year degree." Income was assessed across seven categories, ranging from "less than \$10,000" to "greater than \$150,000." Mean and modal income level was approximately "\$40,000 to \$75,000."

2.2. Procedure

All individuals were informed of and agreed to the research and training nature of the clinic. Following informed consent, participants completed a structured clinical interview and a battery of self-report questionnaires. The self-report questionnaires included those used in the current investigation, as well as other questionnaires used for on-going research. Collection of these data has been approved by the FSU institutional review board.

2.3. Measures

2.3.1. Clinician administered

2.3.1.1. Liebowitz Social Anxiety Scale-Clinician Administered (LSAS-CA). The LSAS-CA is a 24-item clinician-administered questionnaire assessing fears and avoidance of various social interaction and performance situations. Respondents are asked to rate their fear/anxiety and avoidance separately for each situation using a 4-point Likert-type scale ranging from 0 to 3. Separate scores are provided for fear/anxiety and avoidance. In addition, an overall total score can be derived by summing these two scales. The overall score was used in the present analysis. Previous research has demonstrated that the LSAS is a reliable and valid measure of social phobia (Heimberg et al., 1999). The LSAS demonstrated excellent internal consistency in the present investigation ($\alpha = .96$).

2.3.1.2. Structured Clinical Interview for DSM-IV-TR (SCID). The SCID is a widely administered and well validated semi-structured interview designed to assess the presence of lifetime and current Axis I conditions (First, Spitzer, Gibbon, & Williams, 1996). All SCIDs were administered by highly trained, advanced doctoral students. The standardized training protocol included reviewing SCID training tapes, observing live SCID administrations, and conducting SCID interviews with other trained individuals. All trainees received ongoing feedback until they demonstrated a high level of reliability. Additionally, all SCIDs were reviewed by a licensed clinical psychologist at a weekly supervision meeting to ensure accurate diagnoses. Rates of agreement between clinical interviewers within the ABHC have been found to be over 80% with a kappa of .77 (Timpano & Schmidt, 2013). Relevant to the current study, diagnoses of GAD, SAD, OCD, MDD, PD, specific phobia, and PTSD were obtained.

2.3.2. Self-report

2.3.2.1. Anxiety Sensitivity Index-3 (ASI-3). The ASI-3 is an 18-item self-report questionnaire designed to measure the physiological, cognitive, and social factors of AS. Respondents were asked to indicate the degree to which they agree with each item on a 5-point Likert-type scale ranging from 0 (*very little*) to 4 (*very much*). The ASI-3 is composed of three subscales corresponding to the three lower-order factors of AS. The physical concerns subscale contains six items related to fear of autonomic arousal (e.g., "It scares me when my heart beats rapidly"). The cognitive concerns subscale contains six items related to fear of the cognitive aspects of anxiety (e.g., "When my thoughts seem to speed up, I worry that I might be going crazy"). Finally, the social concerns subscale comprises six items related to the potential social consequences associated with anxiety (e.g., "I worry that other people will notice my anxiety"). The ASI-3 has been demonstrated to be a psychometrically sound and valid measure of AS (Taylor et al., 2007). Within the current investigation, the ASI-3 demonstrated excellent internal consistency ($\alpha = .92$).

2.3.2.2. Beck Depression Inventory-II (BDI-II). The BDI-II is a self-report questionnaire containing 21 items that measure depression symptoms. Respondents are asked to select which statement from a group of statements best represents how they have felt over the past two weeks. The BDI-II is scored using a 4-point Likert-type scale ranging from 0 to 3, with higher scores indicating greater levels of depression. The BDI-II has demonstrated good internal consistency and test-retest reliability (Dozois, Dobson, & Ahnberg, 1998; Sprinkle et al., 2002). In the current study, the BDI-II demonstrated excellent internal consistency ($\alpha = .93$). The BDI-II was used as a dimensional assessment of MDD symptoms.

2.3.2.3. Depressive Symptom Inventory-Suicide Subscale (DSI-SS). The DSI-SS is a 4-item self-report questionnaire assessing

Table 1
Prevalence rates of current mood, anxiety, and axis I disorders.

Axis I disorder	Prevalence n (%)
Panic disorder	38 (14.8%)
Specific phobia	25 (9.8%)
Social anxiety disorder	77 (30.1%)
Obsessive compulsive disorder	22 (8.6%)
Post-traumatic stress disorder	30 (11.7%)
Generalized anxiety disorder	41 (16.0%)
Anxiety disorder-NOS	21 (8.2%)
Major depressive disorder	65 (25.4%)
Dysthymic disorder	11 (4.3%)
Depressive disorder-NOS	2 (0.8%)
Any axis I disorder	197 (77.0%)
Multiple axis I disorders	116 (45.3%)

Note: N = 256. NOS = not otherwise specified.

suicidal ideation and impulses over the past two weeks (Metalsky & Joiner, 1997). The frequency and intensity of suicidal thoughts are reported on a 4-point Likert-type scale ranging from 0 to 3. Higher scores on this measure indicate more severe suicidal symptoms. The DSI-SS has been shown to have good internal consistency and validity (Joiner & Rudd, 1995). In the present investigation, the DSI-SS demonstrated excellent internal consistency (α = .90). The DSI-SS was used as a dimensional measure of suicidal ideation.

2.3.2.4. Obsessive Compulsive Inventory-Revised (OCI-R). The OCI-R is an 18-item self-report measure of obsessive–compulsive symptoms. The OCI-R yields a total score for OCD symptoms as well as six subscale scores including hoarding, checking, neutralizing, obsessing, ordering, and washing. This measure has been shown to have good internal consistency, test-retest reliability, and convergent validity within both clinical and non-clinical samples (Foa et al., 2002). The OCI-R also demonstrated good internal consistency within the current investigation (α = .93). The OCI-R was used as a dimensional assessment of OCD symptoms.

2.3.2.5. Penn State Worry Questionnaire (PSWQ). The PSWQ is a 16-item self-report measure that assesses ones tendency to worry. Items are rated using a 5-point Likert-type response scale ranging from 1 (*Not at all typical of me*) to 5 (*Very typical of me*). The PSWQ has been shown to be a valid measure of GAD, with the capability to distinguish between individuals with and without GAD (e.g., Brown, Antony, & Barlow, 1992). It has also demonstrated good internal consistency and test re-test reliability across clinical and college samples (Meyer, Miller, Metzger, & Borkovec, 1990). Within the present investigation, the PSWQ demonstrated excellent internal consistency (α = .94). The PSWQ was used as a dimensional assessment of GAD symptoms.

2.4. Data analytic strategy

Descriptive statistics using scale scores were first computed and reported. Following this, confirmatory factor analysis (CFA) using Mplus version 7 (Muthén & Muthén, 1998–2012) was conducted to determine the best-fitting model of ASI-3. Because ASI-3 items are categorical (i.e., responses ranging from 0 to 4), CFAs and all additional analyses were conducted using the robust weighted least squares estimator (WLSMV in Mplus). Overall model fit was assessed using the likelihood ratio test (LRT), for which a nonsignificant chi-square (χ^2) value indicated excellent model fit. However, because there is disagreement about whether the LRT is too restrictive as well as the influence that sample size has on the LRT (see Hu & Bentler, 1999; Mulaik, 2007; Yuan, 2005 for reviews), multiple additional fit indices were included. Agreement across several fit indices is considered the optimal approach to determine the best-fitting model (e.g., Chen, Curran, Bollen, Kirby, & Paxton, 2008). Additional fit indices included the comparative fit index (CFI), the root mean square error of approximation (RMSEA), and the Tucker–Lewis Index (TLI). CFI values greater than .90 and TLI values greater than .95 indicate adequate model fit. A range of values for the RMSEA have been suggested, with values less than .06 indicating good fit, values less than .08 indicating adequate fit, and values greater than .10 indicating poor fit (Brown, 2006; Browne & Cudeck, 1992; Hu & Bentler, 1999; Yu, 2002). Comparison of nested models was conducted in Mplus using the DIFFTEST function. Although multiple studies have determined that the three-factor solution consisting of Cognitive Concerns, Physical Concerns, and Social Concerns factors fits the data best, this was verified in the current study by comparing the model to alternate one- (a global AS factor) and two-factor (a Physical Concerns factor and a factor combining Cognitive Concerns and Social Concerns) solutions that had previously been tested in Taylor et al. (2007) and Wheaton et al. (2012). Further, although a hierarchical model has been proposed to best represent AS, the equivalent lower-order correlated traits model was analyzed instead as the purpose of this study was to examine the unique relations between the lower-order factors and outcome variables.

Following determination of the best-fitting model, structural equation modeling was conducted including the latent factors from the best-fitting model of the lower-order ASI-3 factors as predictors of GAD, SAD, OCD, and MDD symptoms as well as suicidal ideation. Gender (coded as 1 = male, 2 = female) was included in the models as a predictor of all symptom measures to control for potential moderating effects (e.g., McLean, Asnaani, Litz, & Hofmann, 2011; Van Dam, Earleywine, & Forsyth, 2009). Including item-level data of all the outcome variables would have resulted in a limited capacity to detect important model parameter estimates (Yang et al., 2010). To overcome this, CFAs for each outcome variable were

Table 2
Descriptive statistics for ASI-3 subscales, anxiety and depression symptoms, and suicidal ideation.

	1	2	3	4	5	6	7	8
ASI-3 cognitive	1							
ASI-3 physical	.55[*]	1						
ASI-3 social	.53[*]	.49[*]	1					
GAD symptoms	.46[*]	.32[*]	.54[*]	1				
SAD symptoms	.45[*]	.37[*]	.66[*]	.44[*]	1			
OCD symptoms	.58[*]	.56[*]	.46[*]	.49[*]	.47[*]	1		
MDD symptoms	.59[*]	.46[*]	.54[*]	.58[*]	.48[*]	.55[*]	1	
Suicidal ideation	.28[*]	.24[*]	.21[*]	.10	.21[*]	.18[*]	.40[*]	1
Mean	8.88	8.62	11.83	55.63	51.90	16.96	20.74	.64
SD	6.79	5.87	6.23	15.41	30.25	14.65	12.47	1.54

Note: N = 242–256 across variables. ASI-3, Anxiety Sensitivity Index-3; GAD, generalized anxiety disorder symptoms subscale; SAD, social anxiety disorder symptoms subscale; OCD, obsessive compulsive disorder symptoms subscale; MDD, major depressive disorder symptoms subscale.
[*] p < .05.

Table 3
Confirmatory factor analyses of one-, two-, and three-factor models of the ASI-3.

Models	χ^2	$\Delta \chi^2$	Δ df	CFI	TLI	RMSEA
One-factor	1177.46	–	–	.83	.83	.17
Two-factor	793.11	113.15[***]	1	.91	.89	.14
Three-factor	*300.61*	*111.54[***]*	*2*	*.98*	*.97*	*.07*

Note: CFI, comparative fit index; TLI, Tucker–Lewis Index; RMSEA, root mean square error of approximation. Nested models were compared sequentially and are listed in the order that they were compared. Best fitting model in italics.

[***] $p < .001$.

conducted separately, and the latent factor score was extracted for use in the final structural equation model (SEM). Yang et al. (2010) have demonstrated that this approach provides viable, unbiased parameter estimates. Equality constraints were imposed across paths from pairs of ASI-3 factors to each disorder to determine whether the relation between ASI-3 factors and symptoms was stronger for some factors as compared to others. Finally, ASI-3 factor scores were created and exported from Mplus and logistic regression was used to determine the influence of lower-order ASI-3 factors on the presence of an Axis I diagnosis. To determine the unique influence of each lower-order ASI-3 factor, all factors were included in the model simultaneously with gender as a covariate.

3. Results

3.1. Descriptive statistics

Overall diagnostic rates, rates of individuals with more than one Axis I diagnosis, and rates of mood and anxiety disorders for the sample are provided in Table 1. There was a high degree of Axis I disorders diagnosed in this sample (77% of individuals met for at least one Axis I disorder) as well as a high degree of individuals meeting for more than one Axis 1 disorder (45%). Descriptive statistics and correlations between variables for the lower-order ASI-3 factors (dimensional scores were used for descriptives despite the use of latent dimensional factors), anxiety, depression, and suicidal ideation are provided in Table 2. Bivariate correlations revealed significant correlations between all lower-order ASI-3 factors as well as between all ASI-3 factors and GAD symptoms, SAD symptoms, OCD symptoms, MDD symptoms, and suicidal ideation.

3.2. Confirmatory factor analysis of the ASI-3

Fit indices for CFA models are provided in Table 3. Results indicated that the three-factor model of the ASI-3, comprising Cognitive Concerns, Physical Concerns, and Social Concerns factors, provided the best fit to the data, although there was some room for model improvement as the LRT revealed a significant chi-square value. Examination of modification indices indicated that model fit could have improved by allowing factor cross-loadings for several AS Physical Concerns items (i.e., items 7, 8, and 12 on Social Concerns and item 8 on Cognitive Concerns). However, because modification indices take advantage of chance variance in the data and do not necessarily represent empirical model improvement (Herting and Costner, 2000), the three-factor model with no item cross-loadings was accepted as the best fitting model for further analyses.[1] Further, face validity supported these items as AS Physical Concerns

items, as all referred to physiological concerns (i.e., chest tightness, heart palpitations). Factor loadings were all significant across factors, ranging from .78 to .89 for the Cognitive Concerns factor, from .73 to .85 for the physical concerns factor, and from .62 to .90 for the Social Concerns factor. All factors were significantly inter-correlated. The Cognitive Concerns factor was correlated with the Physical Concerns factor at .64, and with the Social Concerns factor at .61, and the Physical Concerns factor was correlated with the Social Concerns factor at .59.

3.3. Structural equation models predicting anxiety, depression, and suicidal ideation from ASI-3 factors

The structural equation model with Cognitive Concerns, Physical Concerns, and Social Concerns factors predicting GAD, SAD, OCD, and MDD symptoms as well as suicidal ideation and including gender as a covariate demonstrated adequate fit to the data. Although the χ^2 value (419.98, $p < .05$) was significant, the CFI of .97, RMSEA of .06, and TLI of .96 were within acceptable range for adequate model fit. Model fit parameters are provided in Fig. 1. For GAD symptoms, 53% of the variance was accounted for, and the Cognitive Concerns and Social Concerns factors and gender were significant predictors of this variance. For SAD symptoms, 48% of the variance was accounted for; only the Social Concerns factor was a significant predictor. For OCD symptoms, 49% of the variance was accounted for and all three ASI-3 factors were significant predictors. For MDD symptoms, 51% of the variance was accounted for, and the Cognitive Concerns and Social Concerns factors as well as gender were significant predictors. For suicidal ideation, only 9% of the variance was accounted for, and only the Cognitive Concerns factor was a significant predictor.

Table 4 contains path estimates from lower-order AS factors to outcome variables as well as comparisons between lower-order factors across outcome variables and comparisons between outcome variables across lower-order factors. For lower-order AS factors, there were no significant differences in path estimates to specific outcome variables between AS factors when path estimates were significant for both factors. Comparing significant to nonsignificant path estimates revealed that all significant path estimates were significantly stronger than their nonsignificant counterparts, with the exception of the path from Cognitive Concerns to suicidal ideation, which, though significant, was not significantly stronger than the path estimates from Physical Concerns and Social Concerns to suicidal ideation.

Regarding comparisons between outcome variables, the path estimate to MDD symptoms was stronger than path estimates to all other outcome variables with the exception of OCD symptoms. The path estimates to GAD and OCD symptoms were significantly stronger than the path estimate to SAD symptoms and suicidal ideation. For AS Physical Concerns, the path estimate to OCD was significantly stronger than the nonsignificant path estimates to all other outcome variables. For AS Social Concerns, the path estimate to SAD symptoms was significantly stronger than the path estimates to all other outcome variables. The path estimate to GAD symptoms was significantly stronger than the path estimates to all remaining outcome variables. The path estimate to MDD symptoms was significantly stronger than the path estimates to OCD symptoms and suicidal ideation. Finally, the path estimate to OCD symptoms was significantly stronger than the path estimate to suicidal ideation.

3.4. Logistic regression predicting anxiety and depression diagnoses from lower-order ASI-3 dimensions

Logistic regression models were examined for GAD, SAD, OCD, and MDD. Additional diagnoses were available for PD, specific

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[1] Exploratory analysis supported this conclusion. Although model fit statistics were improved allowing items 7 and 12 to cross-load on AS Social Concerns and allowing item 8 to cross-load on AS Social and Cognitive Concerns, item 8 did not load significantly on AS Cognitive Concerns, items 7 and 8 loaded negatively on AS Social Concerns, and loaded greater than 1 on AS Physical Concerns.
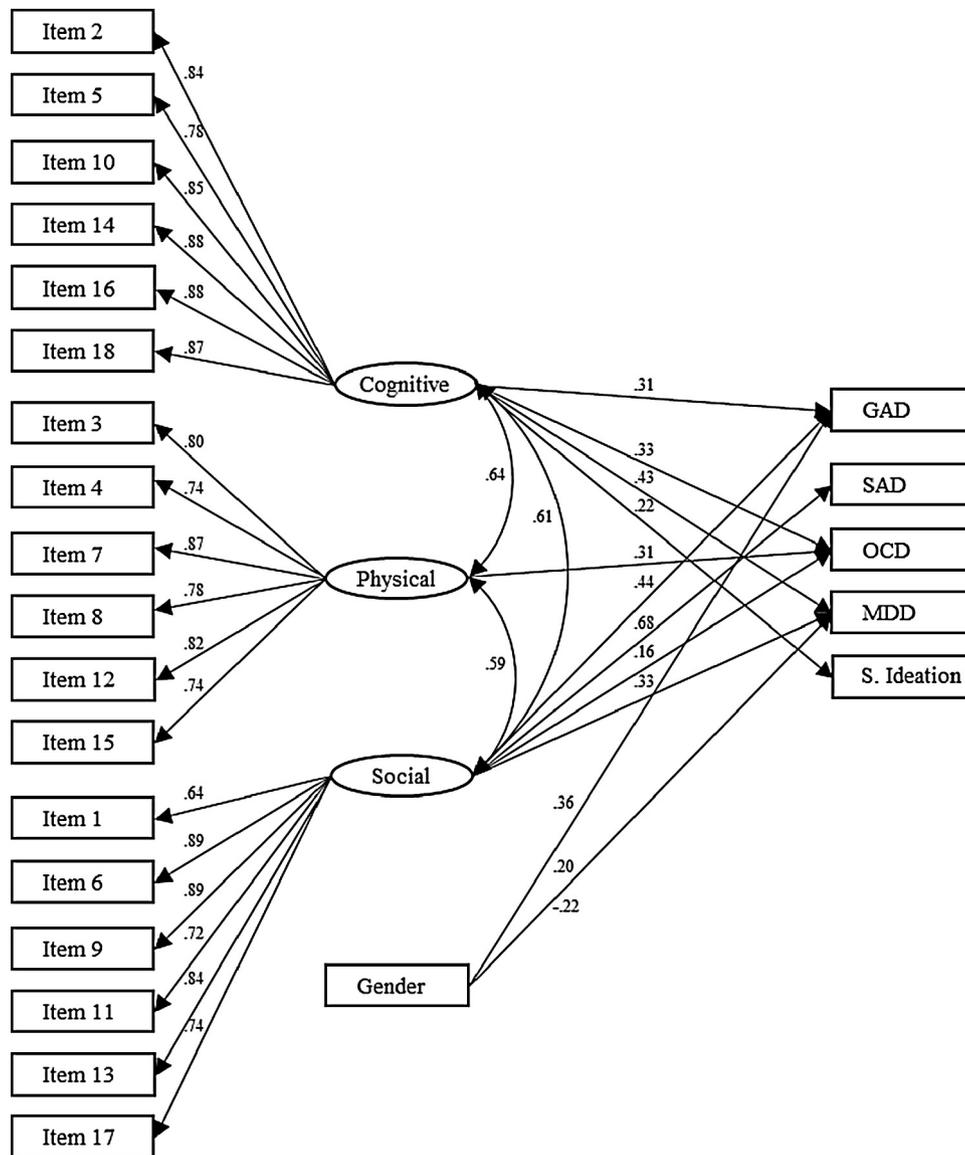
Fig. 1. Structural equation model predicting continuous measures of anxiety, depression, and suicidal ideation. Non-significant path estimates (at $p < .05$) and error terms for the items and latent variables are omitted. Cognitive = ASI-3 cognitive concerns. Physical = ASI-3 physical concerns. Social = ASI-3 social concerns. GAD, generalized anxiety disorder; SAD, social anxiety disorder; OCD, obsessive–compulsive disorder; MDD, major depressive disorder; S. ideation, suicidal ideation.

phobia, and PTSD, and logistic regression models with these diagnoses were also examined (see Table 5). All ASI-3 factors as well as gender (coded 1 for male and 2 for female) were entered simultaneously as predictors. Higher levels of Cognitive Concerns were associated with increased odds of meeting diagnostic criteria for GAD (Odds Ratio [OR] = 1.81, 95% Confidence Interval [CI] = 1.06–3.12). Females were more likely to meet criteria for GAD than were males (OR = 2.23, CI = 1.05–4.76). Higher levels of Social Concerns were associated with increased odds of meeting diagnostic criteria for SAD (OR = 6.30, CI = 3.56–11.14). In opposition to the expected direction of the relations between ASI-3 factors and psychopathology, lower levels of Physical Concerns were associated with increased odds of meeting diagnostic criteria for SAD (OR = .54, CI = .32–.90). There were no significant predictors of an OCD diagnosis. Higher levels of Cognitive Concerns were associated with an increased odds of meeting diagnostic criteria for MDD (OR = 1.69, CI = 1.04–2.75). Higher levels of Physical Concerns were associated with an increased odds of meeting diagnostic criteria for PD (OR = 1.95, CI = 1.11–3.43). Higher levels of Physical Concerns were associated with meeting diagnostic criteria for

specific phobia (OR = 3.41, CI = 1.71–6.79). Finally, higher levels of Cognitive Concerns were associated with meeting diagnostic criteria for PTSD (OR = 1.96, CI = 1.03–3.70).

To summarize by specific ASI-3 predictor, the Cognitive Concerns factor was a significant predictor of the odds of meeting diagnostic criteria for GAD, MDD, and PTSD. The Physical Concerns factor was a significant predictor of the odds of meeting diagnostic criteria for SAD (opposite of the expected direction), PD, and SP. Finally, the Social Concerns factor was a significant predictor of the odds of meeting diagnostic criteria for SAD only.

4. Discussion

The current study is the first to examine the unique relations between all three lower-order dimensions of AS as assessed by the ASI-3 and psychopathology using structural equation modeling. Most mood and anxiety disorders were related to specific lower-order AS dimensions, and most relations were consistent with conceptual models and past empirical findings. In addition, suicidal ideation was related to AS cognitive concerns. Altogether,

Table 4
Path estimates and comparisons from ASI-3 factors to outcomes.

	Path estimates			Comparisons across ASI-3 factors		
	Cognitive	Physical	Social	Cognitive		Physical
	β	β	β	Physical	Social	Social
GAD	.31*	−.06	.44*	9.34*	2.40	20.27*
SAD	.11	−.11	.68*	–	20.42*	39.15*
OCD	.33*	.31*	.16*	.07	3.67	2.49
MDD	.43*	−.003	.33*	13.76*	.87	11.51*
S. ideation	.22*	.10	.01	1.58	1.85	–
Comparisons across symptoms						
		GAD				
SAD	5.35*	–	6.28*			
OCD	.003	18.70*	19.36*			
MDD	5.18*	–	2.40			
S. Ideation	4.43*	–	21.66*			
		SAD				
OCD	6.24*	21.31*	32.15*			
MDD	15.20*	–	10.24*			
S. Ideation	.27	–	53.62*			
		OCD				
MDD	3.53	12.15*	8.13*			
S. ideation	5.23*	7.35*	3.89*			
		MDD				
S. ideation	15.08*	–	18.64*			

Note: Comparisons made were χ^2 difference tests with 1 degree of freedom. Paths were not compared if both estimates were nonsignificant. All tests were conducted with one degree of freedom. GAD, generalized anxiety disorder symptoms; SAD, social anxiety disorder symptoms; OCD, obsessive–compulsive disorder symptoms; MDD, major depressive disorder symptoms; S. ideation, suicidal ideation.

* $p < .05$.

these findings underlie the importance of considering the specific lower-order AS dimensions when examining the role of AS in the development and maintenance of psychopathology as well as when considering preventative and intervention strategies.

Specific patterns, mostly consistent with our hypotheses, were found between lower-order AS dimensions and mood and anxiety disorders in this study. The AS cognitive concerns dimension was uniquely associated with GAD symptoms and diagnoses, OCD symptoms, MDD symptoms and diagnoses, and PTSD diagnoses. Further, the relations between AS and GAD, MDD, and PTSD were specific to the AS cognitive concerns dimension. Prior studies have also found relations between AS cognitive concerns and these particular mood and anxiety disorders (e.g., Deacon et al., 2003; Lang et al., 2002; Naragon-Gainey, 2010; Rector et al., 2007). This study extended past research by using a psychometrically sound measure of AS cognitive concerns to demonstrate that this lower-order AS dimension was uniquely associated with several mood and anxiety disorders.

In this study, the AS social concerns dimension was uniquely associated with SAD symptoms and diagnoses. Further, the relation AS shared with SAD symptoms was unique to the AS social concerns dimension. This replicates the findings of past studies indicating that AS social concerns is an important correlate of SAD (e.g., McWilliams et al., 2000). Although AS social concerns were also associated with GAD, OCD, and MDD symptoms, the relation between AS social concerns and SAD symptoms was significantly stronger than between AS social concerns and GAD, OCD, and MDD symptoms. In addition, AS social concerns was not significantly related to GAD, OCD, and MDD diagnoses. Therefore, whereas AS social concerns may be associated with other mood and anxiety disorders, these findings suggest that this AS dimension demonstrates a relatively high degree of specificity in its relation with SAD.

The AS physical concerns dimension was uniquely associated with OCD symptoms and diagnoses of SAD, PD, and specific phobia. Further, the relations AS shared with PD and specific phobia were unique to AS physical concerns. Although symptom data were not available for PD and specific phobia in this study, past studies using symptom-level data support the specific relations AS physical concerns shares with PD and specific phobia (e.g., Naragon-Gainey, 2010; Wheaton et al., 2012; Zinbarg et al., 2001). There was one inconsistent finding, in that AS physical concerns was actually associated with lower rates of SAD diagnoses, controlling for gender and the other lower-order AS dimensions. Given that no prior studies have reported such a finding, this relation may be spurious, especially given that AS social concerns is the most related to SAD symptoms, and AS physical concerns was not significantly associated with SAD symptoms.

The pattern of relations found in this study support the conceptual model of AS and mood and anxiety disorders proposed by Olatunji and Wolitzky-Taylor (2009). In their model, they propose that AS develops as a function of genes and learning experiences (Stewart et al., 2001) and that potential learning experiences lead to specific associations between lower-order AS dimensions and mood and anxiety disorders. In their model, AS physical concerns is linked to PD. We extend this to include specific phobia. Naragon-Gainey (2010) offers support for this, as she reports that the relation between specific phobia and AS (as well as AS physical concerns) is primarily due to the relation between the fear of bodily harm and physical confinement facets of specific phobia and AS. The conceptual model of Olatunji and Wolitzky-Taylor (2009) also links AS social concerns to SAD, and AS cognitive concerns to MDD and GAD. Our study extends this further by implicating AS cognitive concerns as a specific risk factor for PTSD as well. This suggests that, AS serves as a risk factor, not because of exacerbation of the physical symptoms that accompany PTSD, but due to the

Table 5
Associations between ASI-3 factors and anxiety and depression diagnoses.

Diagnosis	Point-biserial r	B	SE B	OR	CI	$R^{2\sim}$
GAD						.06
Cognitive	.21***	.60	.28	1.81*	1.06–3.12	
Physical	.15*	.02	.29	1.02	.58–1.78	
Social	.14*	−.01	.28	1.00	.58–1.72	
Gender	.16*	−.80	.39	2.23*	1.05–4.76	
SAD						.22
Cognitive	.16**	−.27	.26	.76	.46–1.27	
Physical	.12	−.62	.26	.54*	.32–.90	
Social	.42***	1.84	.29	6.30***	3.56–11.14	
Gender	.09	−.36	.32	1.43	.76–2.66	
OCD						.03
Cognitive	.15*	.22	.36	1.25	.62–2.53	
Physical	.16**	.41	.36	1.51	.74–3.06	
Social	.13*	.13	.36	1.14	.57–2.31	
Gender	.08	−.44	.49	1.55	.60–4.03	
MDD						.15
Cognitive	.35***	.53	.25	1.69*	1.04–2.75	
Physical	.33***	.35	.25	1.42	.87–2.33	
Social	.33***	.45	.25	1.57	.97–2.55	
Gender	.07	−.12	.32	1.13	.60–2.11	
PD						.04
Cognitive	.08	−.22	.29	.81	.45–1.43	
Physical	.17*	.67	.29	1.95*	1.11–3.43	
Social	.08	−.04	.28	.96	.55–1.66	
Gender	.11	−.58	.38	1.79	.85–3.79	
SP						.06
Cognitive	.08	−.35	.37	.70	.34–1.44	
Physical	.22***	1.23	.35	3.41***	1.71–6.79	
Social	.07	−.27	.35	.76	.38–1.51	
Gender	.06	−.26	.46	1.29	.53–3.17	
PTSD						.05
Cognitive	.19**	.67	.33	1.96*	1.03–3.70	
Physical	.17**	.47	.32	1.60	.85–3.02	
Social	.08	−.43	.33	.65	.34–1.24	
Gender	−.02	.32	.41	.73	.33–1.62	

Note: $N = 256$ for all diagnoses. OR, odds ratio; CI, 95% confidence interval; $R^{2\sim}$, Cox and Snell (1989) pseudo-R^2 adjusted for sample size; cognitive, ASI-3 cognitive concerns; physical, ASI-3 physical concerns; social, ASI-3 social concerns; SAD, social anxiety disorder; OCD, obsessive–compulsive disorder; MDD, major depressive disorder; PD, panic disorder; SP, specific phobia; PTSD, post-traumatic stress disorder.
  * $p < .05$.
  ** $p < .01$.
  *** $p < .001$.

exacerbation of the cognitive concerns that accompany PTSD (e.g., Vujanovic et al., 2008).

Whereas most mood and anxiety disorders were related to specific lower-order AS dimensions in this study, OCD symptoms had similar modest relations with all three lower-order AS dimensions. Further, OCD was the only anxiety disorder for which none of the lower-order AS dimensions predicted diagnostic status. This reflects the conceptual difficulties researchers have had in identifying the role of lower-order AS dimensions as a risk factor for OCD (e.g., Naragon-Gainey, 2010; Olatunji & Wolitzky-Taylor, 2009). This also mirrors the difficulty researchers have found in attempts to incorporate OCD into models of mood and anxiety disorders, with speculation that OCD may be a stand-alone disorder, part of a different spectrum altogether (Sellbom, Ben-Porath, & Bagby, 2008; Watson, 2005), or heterogeneous between individuals (Nestadt et al., 2009). Although our findings do not provide support for a particular model explaining how OCD is different from other anxiety disorders, our findings are consistent with evidence that OCD is distinct from other DSM-IV anxiety disorders (Stein et al., 2010).

An additional finding beyond the relations between AS and mood and anxiety disorders was the unique relation found between AS cognitive concerns and suicidal ideation. This is consistent with the extant empirical literature that has found a relation between AS cognitive concerns and suicidal ideation in outpatients with PTSD symptomatology (Capron, Cougle, et al., 2012), cigarette smokers (Capron, Blumenthal, et al., 2012), individuals with HIV (Capron, Gonzalez, Parent, Zvolensky, & Schmidt, 2012), anxiety outpatients (Capron, Allan, et al., 2013; Schmidt et al., 2001) and Russian citizens (Capron, Kotov, et al., 2013). Fears of cognitive dyscontrol are implicated in two extant models of the onset of suicidal ideation. The positive feedback model of suicidality posits that catastrophic cognitions (such as those experienced by individuals with elevated AS cognitive concerns) mutually activate and amplify limbic autonomic arousal. According to the model, the resulting state of physical and cognitive distress is so aversive that suicidal behavior results (Katz, Yaseen, Mojtabai, Cohen, & Galynker, 2011). In the depression distress amplification model (Capron, Allan, et al., 2013), AS cognitive concerns amplify distress over emerging or existing dysphoric symptoms (lack of concentration, insomnia, anhedonia). According to the model, suicidal ideation emerges when distress caused by the amplified depression reaches severe levels.

There are potential treatment implications based on the results of this study. Researchers have already demonstrated that interventions targeting AS are effective, not only in reducing levels of AS, but also in reducing incidence of PD and psychopathology at follow-up (e.g., Gardenswartz & Craske, 2001; Keough & Schmidt, 2012; Schmidt et al., 2007). If specific lower-order AS dimensions were implicated in the development and maintenance of particular mood and anxiety disorders, then targeting these dimensions in intervention and prevention efforts could prove particularly useful (Olatunji & Wolitzky-Taylor, 2009). This study demonstrated that specific AS dimensions are associated with particular mood and anxiety disorders. Therefore, it might be useful to design interventions designed

to target particular elevated lower-order AS dimensions, and to explore the effects of targeting lower-order AS dimensions specifically on multiple mood and anxiety problems.

4.1. Limitations and conclusions

There were several limitations in this study that also speak to opportunities for future research. This study was conducted on individuals who sought treatment at a clinic specializing in the treatment of anxiety disorders, which means these findings might not necessarily generalize to individuals in the community or individuals seeking treatment for psychopathology not specific to anxiety. There is some support for generalizability in that these findings are consistent, to the degree that they overlap, with results from past studies conducted in community and more general treatment seeking samples (e.g., Taylor et al., 2007; Wheaton et al., 2012). This study was cross-sectional in design. Therefore, it was not possible to disentangle causality in the relations between AS and psychopathology. Although prospective and experimental studies have implicated AS as an important risk factor in the development of anxiety (e.g., Schmidt et al., 2007; Schmidt, Zvolensky, & Maner, 2006), it remains to be seen whether the lower-order AS dimensions predict psychopathology prospectively. In addition, because the ASI-3 and most dimensional measures of psychopathology were assessed by self-report, shared method variance may have inflated the reported estimates. However, most of the relations between AS dimensions and psychopathology were robust to clinical diagnoses, effectively limiting the concern that these results were primarily due to shared method variance. In spite of this, it would be worthwhile to examine the relations between AS dimensions and psychopathology using multi-trait multi-method approaches, although we know of no well-validated alternative methods of assessing AS.

The current study demonstrated that the lower-order AS dimensions are uniquely and specifically associated with multiple psychopathology symptoms and diagnoses. The pattern of findings provides support for and extends the conceptual model linking lower-order AS dimensions and mood and anxiety disorders as proposed by Olatunji and Wolitzky-Taylor (2009). The current study expanded on the importance of AS, as the lower-order dimensions also demonstrated specific relations with suicidal ideation. In the future, prospective studies are needed to examine whether these specific relations between lower-order AS dimensions and psychopathology implicate these lower-order AS dimensions as specific risk factors.

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