

Anxiety Sensitivity and Its Factors in Relation to Generalized Anxiety Disorder among Adolescents

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Published online: 1 March 2015
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Abstract Anxiety psychopathology, one of the most prevalent classes of disorder among youth, is linked to detrimental outcomes. Accordingly, identifying factors that influence vulnerability to anxiety disorders is important. One promising factor, given emerging evidence for its transdiagnostic nature, is anxiety sensitivity (AS); however, relatively little is known about the linkage between AS and indicators of generalized anxiety disorder (GAD), particularly among youth. The aim of the current investigation was to address this gap in the literature using a community-based sample of adolescents aged 10–17 years ($n=165$; $M_{age}=14.49$ years, $SD=2.26$). Results indicated global AS and the AS-physical concerns dimension were significantly associated with worry, generalized anxiety symptoms, and GAD diagnosis assessed via a structured clinical interview, above and beyond key theoretically-relevant covariates. These findings add to a growing body of work underscoring the relevance of AS for multiple types of anxiety-related disorders among youth.

The views expressed in this article are those of the authors and do not necessarily reflect the position or policy of the Department of Veterans Affairs or the United States government.

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Keywords Anxiety sensitivity · Worry · Generalized anxiety disorder · Adolescents

Anxiety disorders are among the most common classes of adolescent psychopathology, with nearly a quarter of youth meeting 12-month diagnostic criteria (Kessler et al. 2012). The presence of anxiety disorders negatively impact functioning (e.g., school performance, physical health) and increase risk for other psychological problems (Craske and Zucker 2002; Mychailyszyn, Mendez, and Kendall 2010). Indeed, numerous studies suggest that anxiety disorders have a lasting impact for many youth into their adult lives (Greenberg et al. 1999; Last, Hansen, and Franco 1997; Messer and Beidel 1994; Vasey and Dadds 2001). For example, in a large, community-based prospective study, Essau, Lewinsohn, Olaya, and Seeley (2014) found that the presence of anxiety disorders during adolescence was predictive of an array of negative psychosocial outcomes in adulthood (e.g., poor work adjustment, family relationships, coping skills). Indeed, adolescent anxiety disorders were linked with more problematic outcomes than were childhood anxiety disorders. These data underscore the importance of identifying factors that, when targeted in the context of intervention, will have the most powerful impact on anxiety-related problems, as well as the particular value of focusing on the developmental period of adolescence. A promising anxiety-relevant vulnerability factor for such intervention work is anxiety sensitivity, reflecting fearful beliefs about the negative consequences of anxiety (Reiss 1991; Reiss and McNally 1985). Research suggests anxiety sensitivity may have value as a transdiagnostic factor, given its association with a number of disorders (Boswell et al. 2013; Schmidt, Zvolensky, and Maner 2006). However, relatively little is known about the relation between anxiety sensitivity and outcomes related to generalized anxiety disorder,

particularly among youth. The current study is designed to extend our understanding of the linkage among these factors.

Anxiety Sensitivity

Anxiety sensitivity is a well-established cognitive vulnerability factor that prospectively predicts anxiety problems among adults (Schmidt et al. 2006) and youth (Schmidt et al. 2010). While anxiety sensitivity was initially conceptualized as specific to panic-related problems (McNally 2002; Schmidt et al. 1999), emerging research suggests it may usefully be conceptualized as a transdiagnostic factor (Boswell et al. 2013). In other words, the tendency to fear the consequences of anxiety may cut across anxiety-related diagnoses, marking enhanced risk for multiple types of anxiety (e.g., Calkins et al. 2009; Dixon, Sy, Kemp, and Deacon 2013; Hayward, Killen, Kraemer, and Taylor 2000; Maller and Reiss 1992; Schmidt et al. 2006; Taylor, Koch, and McNally 1992; Verreault et al. 2012; Weems, Hayward, Killen, and Taylor 2002). Consistent with this idea, Boswell et al. (2013) evaluated change in anxiety sensitivity across the treatment of adults with an array of anxiety disorders (e.g., panic disorder, generalized anxiety disorder, etc.). Pre-treatment anxiety sensitivity scores, as well as the relation between change in anxiety sensitivity and post-treatment clinical functioning, were comparable across all diagnostic groups, highlighting the relevance of anxiety sensitivity across anxiety disorders. These data accord with other work completed with adults, including findings from experimental anxiety sensitivity amelioration programs in which interventions designed to reduce anxiety sensitivity resulted in a lower likelihood of developing Axis I disorders 2 years later (Schmidt et al. 2007), as well as recent meta-analytic work linking anxiety sensitivity to several types of anxiety disorders (Naragon-Gainey 2010; Olatunji and Wolitzky-Taylor 2009).

While promising, comparatively less is known about the linkage between anxiety sensitivity and other (non-panic disorder) anxiety-related problems among youth. We focus on generalized anxiety disorder for several reasons. First, adolescence is a period of “core risk” for generalized anxiety disorder, with prevalence rates increasing steadily across this developmental phase (Beesdo, Knappe, and Pine 2009). Additionally, the nature of worry, which is the hallmark feature of generalized anxiety disorder, changes substantially during adolescence (e.g., content and frequency; Henker, Whalen, and O’Neil 1995), and up to 15 % of youth describe their worry episodes as excessive and uncontrollable (Bell-Dolan, Last, and Strauss 1990). For these reasons, we sought to expand the research base pertinent to factors related to enhanced vulnerability for generalized anxiety disorder among adolescents.

Global Anxiety Sensitivity Factor From a conceptual perspective, anxiety sensitivity may be linked to generalized anxiety disorder in a number of ways, including a proclivity for individuals with high anxiety sensitivity to respond with greater distress to stressful events (e.g., Isyanov and Calamari 2004). In line with this perspective, adult work suggests an association between the global factor of anxiety sensitivity and generalized anxiety disorder indicators (e.g., Naragon-Gainey 2010; Viana and Rabian 2008). Although the literature base is comparatively smaller, research with adolescents also suggests the global factor of anxiety sensitivity relates positively to the number, frequency, and intensity of worries (Leen-Feldner, Feldner, Tull, Roemer, and Zvolensky 2006; Silverman, La Greca, and Wasserstein 1995) as well as concurrently (e.g., McLaughlin, Stewart, and Taylor 2007; Muris, Schmidt, Merckelbach, and Schouten 2001) and prospectively (Schmidt et al. 2010; Waszczuk, Zavos, and Eley 2013) assessed generalized anxiety disorder symptoms.

Lower-Order Anxiety Sensitivity Factors In addition to a global dimension, factor analytic work with both youth and adults suggest anxiety sensitivity is comprised of three lower-order factors reflecting fear of the specific consequences of anxiety, such as cognitive dyscontrol (i.e., cognitive concerns), social rejection or embarrassment (i.e., social concerns), and serious physical illness (i.e., physical concerns; Brown et al. 2012; Reiss and McNally 1985; Walsh, Stewart, McLaughlin, and Comeau 2004; Wright et al. 2010). In a recent meta-analysis, Naragon-Gainey (2010) suggested all three of the lower-order factors may be expected to relate to generalized anxiety disorder among adults. From a theoretical perspective, it stands to reason that an individual with elevated fear of cognitive dyscontrol might be particularly distressed by the uncontrollable worry episodes that characterize generalized anxiety disorder (Naragon-Gainey 2010; Taylor 1999; Viana and Rabian 2008). Similarly, youth who fear the physical sequelae of anxiety may be unusually sensitive to the physiological arousal that accompanies worry episodes (Newman and Llera 2011). Finally, given the developmental pressures that characterize adolescence (Bukowski, Buhrmester, and Underwood 2012), youth who fear the social consequences of anxiety may be particularly upset by worry episodes related to social interactions and stimuli.

While empirical work somewhat aligns with this perspective, the research base, particularly among adolescents, is small. First, adult work suggests the social and mental concerns dimensions evidence the most consistent relations with generalized anxiety disorder-relevant outcomes (Allan, Capron, Raines, and Schmidt 2014; Naragon-Gainey 2010; Olatunji and Wolitzky-Taylor 2009; Rodriguez, Bruce, Pagano, Spencer, and Keller 2004). In the only paper to examine these associations among youth, McLaughlin et al. (2007) administered the Childhood Anxiety Sensitivity

Index (Silverman, Fleisig, Rabian, and Peterson 1991) to a large, non-clinical sample of children and adolescents. The three subscales were derived using a sample-specific principle components analysis. In separate analyses, findings suggested that the physical and social concerns dimensions related positively to self-reported generalized anxiety disorder symptoms while controlling for the other AS subscales and trait anxiety.

Rationale for the Current Study

While promising, the extant literature pertinent to the global anxiety sensitivity factor, the lower-order factors, and indicators of generalized anxiety disorder, is sparse. The relative absence of such research is unfortunate for several reasons. First, intervention efforts are optimized if they target factors that cut across disorders (O’Connell et al. 2009). While there is some evidence that anxiety sensitivity may be such a transdiagnostic factor, research pertinent to its linkage with generalized anxiety disorder, particularly among youth, is limited. Findings from the current study will thus provide a more developmentally informed transdiagnostic conceptualization of anxiety sensitivity. Second, at this point in research development, the evidence base is too under-developed to draw confident inferences regarding the lower-order factors of anxiety sensitivity as they relate to generalized anxiety disorder among youth. The preponderance of work has been conducted with adults, leaving open questions regarding potential developmental differences (Cicchetti and Rogosch 1999). Indeed, in the only relevant study conducted with youth (McLaughlin et al. 2007), findings were different from patterns observed in adult work. Data pertinent to the lower-order factors of anxiety sensitivity would help refine intervention efforts by speaking to the relative utility of targeting specific dimensions of anxiety sensitivity in the context of intervention (e.g., targeting cognitive distortions regarding fears that anxiety may cause loss of cognitive control).

With this backdrop, the goal of the current manuscript was to address the noted gaps in the existing literature. Specifically, drawing from empirical work conducted to date with adults (e.g., Viana and Rabian 2008) and youth (e.g., McLaughlin et al. 2007), it was expected that the global anxiety sensitivity factor indexed using the Childhood Anxiety Sensitivity Index (Silverman et al. 1991) would predict the generalized anxiety disorder indicators of a) worry, b) generalized anxiety symptoms, and c) generalized anxiety disorder diagnosis. While the literature is inconsistent with regard to the lower-order anxiety sensitivity factors (e.g., Allan et al. 2014; McLaughlin et al. 2007), we hypothesized that all three lower-order factors would also relate to the outcomes relevant to generalized anxiety disorder based on the available theoretical and empirical evidence. Finally, given a) a spate of work linking female gender and elevated negative affectivity to

anxiety-related problems, including generalized anxiety disorder (Craske 2003; Kessler et al. 2012), and b) the fact that rates of generalized anxiety disorder increase considerably across youth (Beesdo et al. 2009), gender, negative affectivity, and age were included as covariates in order to evaluate the incremental predictive validity of the global and lower-order anxiety sensitivity factors in relation to the selected indicators of generalized anxiety disorder.

Methods

Participants

One hundred and sixty-five adolescents aged 10–17 years ($M_{age}=14.49$ years, $SD=2.26$; $n=86$ boys) were recruited from the local community to participate in a larger study investigating affective vulnerability among youth ($n=225$). Due to the inclusion of a voluntary hyperventilation challenge in the larger investigation, exclusionary criteria for participation in the study were as follows: (a) respiratory problems (e.g., asthma; bronchitis), (b) cardiovascular problems (e.g., elevated blood pressure), (c) pregnancy (females only), (d) inability to provide written informed assent/parental consent, and (e) current or past diagnosis of panic disorder. All participants with complete data (i.e., completed all measures of interest to the primary hypotheses of the current study) from the larger sample were included in the current investigation; no differences were observed between these completers and non-completers in terms of gender, $\chi^2(1)=0.08$, $p=0.780$ and race, $\chi^2(4)=7.47$, $p=0.113$; however, completers, $M=14.49$; $SD=2.26$, were slightly older than non-completers, $M=12.99$; $SD=2.05$; $t(215)=4.28$, $p<0.001$. The ethnic (i.e., Hispanic/Latino; not Hispanic/Latino) and racial composition generally reflected the locale (southern Midwest United States; U.S. Census Bureau 2010): 4.8 % Hispanic/Latino, 86.1 % White/Caucasian, 5.5 % Asian, 1.2 % Black/African American, 1.2 % American Indian, and 6.0 % other or response not endorsed.

Measures

Anxiety Sensitivity The *Child Anxiety Sensitivity Index* (CASI; Silverman et al. 1991; Wright et al. 2010) is an 18-item measure utilizing a 3-point Likert-type scale (1 *None* to 3 *A Lot*) to index anxiety sensitivity. The CASI was used to measure the single, higher-order factor of anxiety sensitivity (AS) as well as the three lower-order factors of physical concerns (12 items; example: “It scares me when I feel like I am going to faint”), social concerns (3 items; example: “I don’t like to let my feelings show”), and mental concerns (3 items; example: “When I cannot keep my mind on my schoolwork, I worry that I might be going crazy”; Brown et al. 2012; Silverman

et al. 1991; Walsh et al. 2004; Wright et al. 2010). This scale has adequate psychometric properties (Wright et al. 2010); internal consistency estimates for the current sample are very similar to published work (Walsh et al. 2004): global score ($\alpha=0.84$), physical concerns subscale ($\alpha=0.85$); mental concerns subscale ($\alpha=0.50$); social concerns subscale ($\alpha=0.60$).

Worry The Penn State Worry Questionnaire for Children (PSWQ-C; Chorpita, Tracey, Brown, Colica, and Barlow 1997) is a 16-item measure that is used to assess trait worry among youth. Participants use a 4-point Likert-type scale (0 = *not true* to 3 = *always true*) to respond to statements such as “My worries really bother me.” The PSWQ-C is a well-established measure with good psychometric properties, including good reliability ($\alpha=0.92$ in the present sample) and convergent validity (Chorpita et al. 1997).

Generalized Anxiety Symptoms The Revised Child Anxiety and Depression Scale (RCADS; Chorpita, Yim, Moffitt, Umemoto, and Francis 2000) is a 47-item measure used to index anxiety and depression symptomatology. While the complete RCADS was administered, the generalized anxiety subscale was utilized to measure generalized anxiety symptomatology. Participants indicated the frequency with which they experience the six items on this subscale (e.g., “I worry that bad things will happen to me”) by using a four-point Likert-type scale (*Never* to *Always*). The RCADS evidences good psychometric properties (e.g., GA subscale $\alpha=0.87$ in the current sample; Chorpita et al. 2000). Raw RCADS scores, rather than standardized t-scores, were employed because gender and age were examined as covariates in analyses.

Generalized anxiety disorder diagnosis The Anxiety Disorders Interview Schedule-IV: Child Version (ADIS-C; Silverman and Albano 1996) is a structured clinical interview validated with children and adolescents that covers anxiety and other common childhood disorders included in the DSM-IV (American Psychiatric Association 1994). The complete ADIS-C was administered to adolescents; however, the generalized anxiety disorder (GAD) module was used to index GAD diagnosis. The GAD module contains four sections that yield a dichotomous diagnosis of generalized anxiety disorder. The first section defines worry for the adolescent, asks if s/he “has been worried a lot about things like this lately,” and then asks the adolescent to indicate the specific domains about which s/he worries. In the second section, the adolescent is given a list of domains (e.g., school, performance, health) and is asked to verbally report (a) if s/he worries about the particular domain more than other adolescents his/her age, (b) the severity of his/her worry (using an 8-point scale), and (c) if it is difficult to stop worrying about the endorsed domain. Sections three and four of this module evaluate the frequency of endorsed worry domains (e.g., “Do you usually worry

about these things every day?”), associated physical symptoms (“Do your muscles ache, like in your legs, arms, or neck?”), and clinical interference using an 8-point scale (i.e., “How much has [endorsed worries] messed things up for you? How much does it stop you from doing the things you would like to do?”). To receive diagnosis of GAD, the adolescent must report a) one or more worries with severity rating of four or greater, b) that the worry is uncontrollable, c) that s/he worries about endorsed domain(s) almost every day for at least 6 months, d) one or more associated physical symptom(s), and e) clinical interference of four or greater. The ADIS-C evidences good reliability and validity (Wood, Piacentini, Bergman, McCracken, and Barrios 2002). Research personnel were doctoral level graduate students trained to mastery in the use of the ADIS-C; training involved intensive didactic sessions, direct observation of administrations, and diagnostic comparison until 100 % reliability was reached. In addition, ongoing supervision (e.g., to resolve diagnostic questions) was provided throughout the study. This training procedure is routinely employed by this research team and random reliability checks have resulted in >96 % diagnostic agreement.

Negative Affectivity The negative affect subscale of the Positive and Negative Affect Schedule for Children (PANAS-CN; Laurent et al. 1999) was employed to index generalized negative affectivity. Participants endorsed the degree to which they had experienced 15 different affective states (e.g., nervous, angry, gloomy, etc.) within the “past few weeks” by specifying 1 (*very slightly or not at all*), 2 (*a little*), 3 (*moderately*), 4 (*quite a bit*), or 5 (*extremely*). The PANAS-CN is psychometrically sound (e.g., $\alpha=0.91$ for the current sample; Wilson, Gullone, and Moss 1998).

Procedure

The University Institutional Review Board approved the current study prior to participant contact. Interested participants who contacted the laboratory in response to community-based recruitment efforts were informed of the study protocol and administered a brief telephone screener to evaluate eligibility. A laboratory visit was scheduled for eligible adolescents and their parents. Upon arrival, a parent and/or legal guardian provided written, informed consent for their adolescent’s participation, and the adolescent provided written, informed assent. Participants were informed of the study protocol, limits to confidentiality, as well as the option to withdraw at any time without penalty or prejudice; one participant chose to withdraw from the study. Parents provided informed consent for child participation, but did not complete any questionnaires or interviews. In a

quiet, private space, participants completed a randomized battery of self-report questionnaires including those utilized in the current study. A trained researcher was on hand to address any questions during this time, and then administered the ADIS-C upon completion of the questionnaires. Finally, the adolescents engaged in laboratory-based tasks not pertinent to the current investigation (including the aforementioned voluntary hyper-ventilation challenge). At the completion of the study protocol, participants were thanked, fully debriefed, and compensated \$40 for the 2 1/2 h protocol.

General Analytic Strategy

Descriptive statistics first were conducted. Specifically, zero-order correlations were computed with each of the continuous variables, and independent samples *t*-tests were employed to investigate whether means for continuous variables differed as a function of gender and GAD diagnosis. With the exception of the CASI social concerns subscale, worry, and age, all continuous variable distributions evidenced a positive skew; accordingly, data from these measures were transformed using square root transformation prior to the primary hypothesis testing utilizing hierarchical linear regression (Field 2009).

Hierarchical linear regression was employed to examine dimensional outcomes (i.e., worry and generalized anxiety symptoms). Logistic regression was utilized to evaluate categorical outcomes (i.e., generalized anxiety disorder diagnosis). All analyses included gender, age, and negative affectivity as covariates at Step 1. Separate analyses were conducted to examine each outcome in relation to the global anxiety sensitivity factor or the three lower-order factors (i.e., social concerns, physical concerns, and mental concerns factors) in Step 2. This approach allows for the evaluation of the incremental predictive validity of the global anxiety sensitivity factor or lower-order factors above and beyond the variance accounted for by the theoretically-relevant covariates (Sechrest 1963). Squared semi-partial correlations (sr^2) and odds ratios (*OR*) were used as indices of effect size for those variables retained in the equation (Field 2009; Cohen 1988); coefficient of determination (R^2) and Nagelkerke R^2 (Nagelkerke 1991) were used as indices of effect size for each model step. One case was detected as an outlier regarding the logistic regression analyses utilizing generalized anxiety diagnostic status as the dependent variable and excluded from relevant analyses. Finally, the significance criterion for the primary hypothesis testing was set at 0.008 to control for familywise error rate (Field 2009).

Results

Descriptive and Bivariate Analyses

Please see Table 1 for the reported means, standard deviations, and zero-order correlations concerning continuous predictor and outcome variables and Table 2 for analyses as a function of generalized anxiety disorder diagnostic status. While generalized anxiety disorder diagnoses were higher than observed in national samples (e.g., Kessler et al. 2012) with 12 % of adolescents meeting diagnostic criteria, descriptive statistics were generally comparable to previous published work (e.g., negative affectivity [PANAS-CN]: $M=26.97$, $SD=10.58$; Laurent et al. 1999; anxiety sensitivity-total [CASI]: $M=26.53$, $SD=5.81$; Silverman et al. 1991; generalized anxiety symptoms [RCADS-GA]: $M=5.05$, $SD=3.84$; Chorpita, Moffitt, and Gray 2005; worry [PSWQ-C]: $M=15.44$, $SD=7.38$; Leen-Feldner et al. 2006). With regard to continuous variables, negative affectivity and generalized anxiety symptom scores related positively to all variables except for age, and worry correlated positively with all variables; age was unrelated to all of the variables except worry scores and anxiety sensitivity- social concerns. The global factor of anxiety sensitivity, as well as the physical, social, and mental concerns factors, correlated positively with worry and generalized anxiety symptom scores (see Table 1).

In terms of gender differences, as compared to boys, girls evidenced elevated generalized anxiety symptoms [$t(163)=-2.43$, $p=0.016$], anxiety sensitivity- physical concerns [$t(163)=-2.23$, $p=0.027$], worry [$t(163)=-2.79$, $p=0.006$], and negative affectivity [$t(163)=-3.30$, $p=0.001$] scores (please see Table 1). Girls ($n=14$; 18 %) were more likely to meet diagnostic criteria for generalized anxiety disorder diagnosis compared to boys [$n=5$; 6 %]; $\chi^2(1)=5.60$, $p=0.018$. With the exception of anxiety sensitivity- social concerns, adolescents who met generalized anxiety disorder criteria evidenced significantly higher scores on all other indicators (see Table 2).

Primary Hypothesis Testing

Worry See Tables 3, 4, and 5 regarding the results of the primary regression analyses. In Step 1 of both the CASI total and CASI subscales regression models, negative affectivity, gender, and age significantly predicted worry scores [$F(3, 161)=29.49$, $p<0.001$] and accounted for 36 % of the variance. After inclusion of covariates in the first step, CASI total scores explained an additional 10 % of the total variance in worry [$F(4, 160)=33.57$, $p<0.001$]. In the model evaluating the anxiety sensitivity dimensions, the three CASI subscales explained an additional 13 % of the total variance in worry [$F(6, 158)=24.31$, $p<0.001$]. Partially consistent with predictions, the CASI physical concern subscale was the only dimension significantly associated with worry scores ($sr^2=0.05$,

Table 1 Descriptive Data for Continuous Predictor and Criterion Variables

Variable	1	2	3	4	5	6	7	8	M _{girls} (SD)	M _{boys} (SD)	M _{total} (SD)
1. Age	–	0.10	0.19*	0.11	0.11	0.04	0.22**	0.05	14.30 (2.15)	14.67 (2.35)	14.49 (2.26)
2. Negative Affectivity (PANAS-CN)	–	–	0.57**	0.63**	0.51**	0.48**	0.25**	0.33**	28.92 (11.47) ^a	23.98 (7.56)	26.35 (9.92)
3. Worry (PSWQ-C)	–	–	–	0.75**	0.58**	0.57**	0.18*	0.45**	19.75 (10.45) ^a	15.69 (8.23)	17.63 (9.55)
4. GAD Symptoms (RCADS-GA)	–	–	–	–	0.64**	0.65**	0.21**	0.40**	5.11 (3.75) ^a	3.86 (2.85)	4.46 (3.36)
5. CASI-Total	–	–	–	–	–	0.95**	0.50**	0.65**	27.19 (6.19)	25.93 (4.64)	26.53 (5.46)
6. CASI-Physical	–	–	–	–	–	–	0.23**	0.54**	17.56 (4.90) ^a	16.07 (3.62)	16.78 (4.33)
7. CASI- Social	–	–	–	–	–	–	–	0.20*	6.03 (1.46)	6.49 (1.60)	6.27 (1.55)
8. CASI-Mental	–	–	–	–	–	–	–	–	3.61 (1.04)	3.37 (0.70)	3.48 (0.89)

N=165. *PANAS-CN* Positive and Negative Affect Scale for Children, Negative Affect subscale, *PSWQ-C* Penn State Worry Questionnaire-Child version, *RCADS-GA* Revised Child Anxiety and Depression Scale – Generalized Anxiety subscale, *GAD* Generalized Anxiety Disorder, *CASI* Childhood Anxiety Sensitivity Index

^a Girls significantly higher than boys

* $p < 0.05$, ** $p < 0.01$

$p < 0.001$). Notably, though the adjusted significance criterion was not met, the CASI mental concern subscale was a modest predictor in step 2 ($sr^2 = 0.02$, $p = 0.017$).

Generalized Anxiety Symptoms In both the CASI total and CASI subscales regression models utilizing generalized anxiety symptomatology as the outcome variable, Step 1 including negative affectivity, gender, and age was significant [$F(3, 161) = 27.95$, $p < 0.001$], accounting for 34 % of the total variance. In the first model, the CASI total score explained an additional 14 % of the total variance in generalized anxiety symptoms after inclusion of covariates, [$F(4, 160) = 36.71$, $p < 0.001$]. The inclusion of the CASI subscales in the second model explained an additional 15 % of the total variance in generalized anxiety symptoms [$F(6, 158) = 25.57$, $p < 0.001$]. Partially consistent with hypotheses, the CASI physical concerns subscale was the only dimension to significantly predict generalized anxiety symptoms ($sr^2 = 0.11$, $p < 0.001$).

Generalized Anxiety Disorder Diagnosis With respect to the first model, negative affectivity, gender, and age significantly predicted generalized anxiety disorder diagnostic status [$\chi^2(3, N = 164) = 36.04$, $p < 0.001$, Nagelkerke $R^2 = 0.39$], and an elevated CASI total score was associated with slightly increased odds of having a generalized anxiety disorder diagnosis after accounting for covariates [$\chi^2(1, N = 164) = 17.02$, $p < 0.001$, Δ Nagelkerke $R^2 = 0.16$]. Similarly, the CASI subscales were predictive of diagnostic status after accounting for covariates [$\chi^2(3, N = 164) = 20.28$, $p < 0.001$, Δ Nagelkerke $R^2 = 0.18$] in the second model. Elevated CASI physical concerns subscale was, again, the only factor significantly associated with an increased likelihood of being diagnosed with generalized anxiety disorder ($OR = 1.32$).

Post-Hoc Analyses

To examine the specificity of the relation of anxiety sensitivity and generalized anxiety disorder, a series of post-hoc analyses

Table 2 Continuous Factors as a Function of Generalized Anxiety Disorder Diagnostic Status (ADIS-C)

Variable	<i>t</i>	<i>p</i>	M _{GAD+} (SD)	M _{GAD-} (SD)
Age	-2.93	0.004	15.90 (1.62)	14.32 (2.27)
Negative Affectivity (PANAS-CN)	-6.28	< 0.001	38.47 (10.88)	24.77 (8.68)
Worry (PSWQ-C)	-9.71	< 0.001	33.63 (7.65)	15.54 (7.64)
GAD Symptoms (RCADS-GA)	-8.06	< 0.001	9.42 (3.73)	3.81 (2.73)
CASI-Total	-7.05	< 0.001	33.84 (4.71)	25.58 (4.81)
CASI-Physical	-6.96	< 0.001	22.53 (3.96)	16.03 (3.81)
CASI-Social	-1.75	0.083	6.84 (1.12)	6.19 (1.59)
CASI-Mental	-5.60	< 0.001	4.47 (1.43)	3.36 (0.70)

N=164 (*n*=19 GAD+; *n*=145 GAD-). *GAD+* Diagnosis of Generalized Anxiety Disorder. *GAD-* No Diagnosis of Generalized Anxiety Disorder. *PANAS-CN* Positive and Negative Affect Scale for Children, Negative Affect subscale, *PSWQ-C* Penn State Worry Questionnaire-Child version, *RCADS-GA* Revised Child Anxiety and Depression Scale – Generalized Anxiety subscale, *CASI* Childhood Anxiety Sensitivity Index

Table 3 CASI Total Score and Subscales Predicting the Outcome Variable of Worry (PSWQ-C)

	ΔR^2	<i>t</i> (each predictor)	β	<i>p</i>	<i>sr</i> ²
Dependent Variable: Worry (PSWQ-C)					
Step 1	0.36				
Gender		1.40	0.09	0.163	0.01
Age		2.20	0.14	0.029	0.02
Negative Affectivity (PANAS-CN)		8.16	0.54	< 0.001	0.27
Step 2	0.10				
CASI-Total		5.47	0.37	< 0.001	0.10
Step 2	0.13				
CASI-Physical		4.08	0.30	< .0001	0.05
CASI-Social		-0.56	-0.04	0.576	0.00
CASI-Mental		2.42	0.17	0.017	0.02

N=165. ΔR^2 : change in coefficient of determination; β =standardized beta, *PSWQ-C* Penn State Worry Questionnaire-Child version, *PANAS-CN* Positive and Negative Affect Scale for Children, Negative Affect subscale, *CASI* Childhood Anxiety Sensitivity Index

were conducted. Only CASI total scores (cf., lower-order factors) were employed to limit the number of analyses. First, associations between anxiety sensitivity and the interview-assessed anxiety disorders (i.e., social phobia, separation anxiety disorder, obsessive-compulsive disorder, posttraumatic stress disorder, and specific phobia) were examined utilizing logistic regression analyses. Next, the link between anxiety sensitivity and generalized anxiety disorder was explored while co-varying for the presence of disorders that had demonstrated significant associations with anxiety sensitivity in the first set of post-hoc analyses. Then, as social phobia was the most common co-occurring condition among adolescents who met diagnostic criteria for generalized anxiety disorder in the current sample, the relation between anxiety sensitivity and generalized anxiety symptoms was further examined by including self-reported social phobia symptoms as a covariate.

Finally, because panic disorder served as an exclusionary criterion, it was not indexed via structured clinical interview. The link between anxiety sensitivity and self-reported generalized anxiety symptoms was therefore evaluated by partialing out the variance accounted for by self-reported panic symptoms. Gender, negative affectivity, and age were included as covariates in all analyses.

Anxiety Disorders Of the 19 adolescents who met diagnostic criteria for generalized anxiety disorder, 8 also met criteria for social phobia, 0 for separation anxiety disorder, 1 for obsessive-compulsive disorder, 5 for posttraumatic stress disorder, and 2 for specific phobia. Of these anxiety disorders, anxiety sensitivity was associated with significantly increased odds of posttraumatic stress disorder [$\chi^2(1, N=165)=9.73, p=0.002, \Delta$ Nagelkerke $R^2=0.15$] and social phobia [$\chi^2(1,$

Table 4 CASI Total Score and Subscales Predicting the Outcome Variable of Generalized Anxiety Symptomatology (RCADS-GA)

	ΔR^2	<i>t</i> (each predictor)	β	<i>p</i>	<i>sr</i> ²
Dependent Variable: GAD Symptoms (RCADS-GA)					
Step 1	0.34				
Gender		0.82	0.05	0.415	0.00
Age		1.15	0.07	0.253	0.01
Negative Affectivity (PANAS-CN)		8.39	0.56	< 0.001	0.29
Step 2	0.14				
CASI-Total		6.46	0.43	< 0.001	0.14
Step 2	0.15				
CASI-Physical		5.82	0.42	< 0.001	0.11
CASI-Social		0.09	0.01	0.927	0.00
CASI-Mental		0.58	0.04	0.565	0.00

N=165. ΔR^2 : change in coefficient of determination; β : standardized beta, *GAD* Generalized Anxiety Disorder, *RCADS-GA* Revised Child Anxiety and Depression Scale – Generalized Anxiety subscale, *PANAS-CN* Positive and Negative Affect Scale for Children, Negative Affect subscale, *CASI* Childhood Anxiety Sensitivity Index

Table 5 CASI Total Score and Subscales Predicting the Outcome Variable of Generalized Anxiety Disorder Diagnosis (ADIS-C)

	ΔR^2	<i>B</i>	Wald	Odds Ratio	<i>p</i>	95 % CI
Dependent Variable: GAD Diagnosis (ADIS-C)						
Step 1	0.39					
Gender		0.89	1.96	2.42	0.161	0.70 8.35
Age		0.45	7.34	1.57	0.007	1.13 2.17
Negative Affectivity (PANAS-CN)		0.11	15.94	1.11	< 0.001	1.06 1.17
Step 2	0.16					
CASI-Total		0.24	12.20	1.27	< 0.001	1.11 1.45
Step 2	0.18					
CASI-Physical		0.28	8.97	1.32	0.003	1.10 1.58
CASI-Social		-0.20	0.64	0.82	0.425	0.50 1.34
CASI-Mental		0.38	1.27	1.47	0.259	0.75 2.86

N=164. ΔR^2 : change in Nagelkerke R^2 ; *B*: unstandardized beta; *GAD* Generalized Anxiety Disorder, *ADIS-C* Anxiety Disorders Interview Schedule-IV: Child Version, *PANAS-CN* Positive and Negative Affect Scale for Children, Negative Affect subscale, *CASI* Childhood Anxiety Sensitivity Index

N=165)=8.16, $p=0.004$, Δ Nagelkerke $R^2=0.09$] after accounting for covariates. Notably, however, this relation was slightly stronger for the model predicting generalized anxiety disorder (Δ Nagelkerke $R^2=0.16$). To further evaluate the incremental predictive validity of anxiety sensitivity in regard to generalized anxiety disorder, we next controlled for the presence of either social phobia or posttraumatic stress disorder in two separate logistic regression analyses. Here, after accounting for covariates, anxiety sensitivity remained significantly associated with increased odds of generalized anxiety disorder diagnosis when accounting for the presence of social phobia [$\chi^2(1, N=164)=11.71, p=0.001, \Delta$ Nagelkerke $R^2=0.10$] as well as posttraumatic stress disorder [$\chi^2(1, N=164)=15.33, p<0.001, \Delta$ Nagelkerke $R^2=0.14$]

Generalized Anxiety Symptoms In the series of analyses utilizing continuous (RCADS) indices of symptomatology, anxiety sensitivity remained significantly associated with generalized anxiety symptoms, after controlling for panic symptoms and covariates, accounting for an additional 5 % of the total variance in generalized anxiety symptoms, [$F(5, 156)=33.85, p<0.001$]. Additionally, after inclusion of social phobia symptoms and covariates, anxiety sensitivity remained a significant predictor of generalized anxiety symptoms [$F(5, 159)=40.76, p<0.001$], explaining an additional 3 % of the total variance.

Discussion

The extant literature suggests AS is a vulnerability variable for multiple anxiety disorders (e.g., GAD, PD, PTSD; Naragon-Gainey 2010; Olatunji and Wolitzky-Taylor 2009). However, a paucity of research has examined linkages between AS and

GAD-relevant indicators among youth, and no work has examined the lower-order dimensions of AS in this context. The current study was designed to address this gap in the literature.

First, as expected, total AS scores related positively to all GAD-relevant indicators (i.e., worry, generalized anxiety symptoms, and diagnosis) within the current sample of youth aged 10–17 years. Importantly, effects were significant even after taking into consideration gender, age, and negative affectivity. These factors were utilized as covariates in light of theoretical and empirical work linking them to anxiety-related psychopathology generally (e.g., Craske 2003) and GAD-type outcomes specifically (Craske 2003; Kessler et al. 2012; Wittchen and Hoyer 2001). With regard to the covariates, the current pattern of findings was generally similar to prior work, with elevated negative affectivity and female gender being associated with all GAD-relevant indicators. Age, however, only related positively to worry and diagnosis of GAD (cf., GAD symptoms). Nonetheless, inclusion of gender, age, and negative affectivity as covariates provide evidence for the incremental predictive validity of AS, over and above these theoretically relevant constructs, in terms of GAD-related outcomes. The associations between the global AS factor and GAD-relevant indicators are consistent with prior work linking AS to worry (Leen-Feldner et al. 2006; Silverman et al. 1995), generalized anxiety symptoms (McLaughlin et al. 2007; Muris et al. 2001; Schmidt et al. 2010; Waszczuk et al. 2013), and clinical severity ratings among adolescents diagnosed with GAD (Chorpita and Daleiden 2000). By linking AS to interview-assessed GAD in a community-based sample, the current study uniquely extends the extant literature base suggesting AS may be important in better understanding GAD among youth. Specifically, youth who endorse a generalized fear of the consequences of anxiety also evidence elevated vulnerability to GAD.

Post-hoc analyses also provided initial evidence of a specific relation between AS and GAD; this association was greater in magnitude than the linkage between AS and social phobia as well as AS and PTSD in the current sample. Moreover, AS remained a significant predictor of GAD diagnosis even after controlling for variance accounted for by these conditions. As panic disorder (PD) was an exclusionary criterion for the current study, the specificity of the AS-GAD relation was not evaluated after accounting for variance associated with PD. Given the strong evidence base linking AS to panic-related problems among youth (e.g., Hayward et al. 2000), this represents a key future direction. However, the current findings suggest that AS was associated with GAD symptoms after accounting for panic symptoms. While these data meaningfully extend the extant literature, the current study was not designed to address the influence of comorbid conditions. Future work utilizing clinical samples would usefully extend our understanding of the transdiagnostic utility of AS across individual and co-occurring conditions. Relatedly, the current cross-sectional design precluded temporally oriented conclusions. A critical next step will be to undertake prospective research focused on the interplay between AS and GAD-relevant factors across time.

Second, as predicted, AS-physical concerns significantly and uniquely correlated with worry, generalized anxiety symptoms, and GAD diagnosis among adolescents in this sample. These findings are consistent with prior work with youth (i.e., McLaughlin et al. 2007), suggesting adolescents evidencing a higher propensity to fear the *physical* consequences of anxiety (e.g., “It scares me when I feel ‘shaky’”) also report greater levels of worry as well as GAD symptoms and more likely than those low in AS-physical concerns to be diagnosed with GAD. Interestingly, after accounting for gender, age, and negative affectivity, as well as the variance accounted for the remaining lower-order CASI factors (at the same step), the mental and social concerns subscales were not significantly associated with any of the GAD-relevant variables. This pattern suggests a relative level of specificity with regard to linkages between the lower-order AS factors and GAD-relevant indicators. On the one hand, these data may be interpreted as underscoring the primacy of physical concerns in the context of GAD symptoms (e.g., catastrophizing the somatic arousal associated with worry episodes), which may be particularly important for adolescents given the profound biological changes they are experiencing (e.g., puberty; Reardon, Leen-Feldner, and Hayward 2009). If future work converges on the presently observed findings, interventions designed at reducing AS-physical concerns (e.g., interoceptive exposure) may prove to be a key component at efforts to target GAD among youth.

On the other hand, it is surprising that individual differences in fear of the social and cognitive consequences of anxiety were unrelated to indicators of GAD in the current

sample, in light of the fact that theoretical and empirical work conducted with adults support these associations (e.g., Allan et al. 2014; Naragon-Gainey 2010). Developmental differences may account for this discrepancy; perhaps because relevant cognitive competencies are still emerging during adolescence (e.g., meta-cognition, elaboration on catastrophic possibilities; Vasey, Crnic, and Carter 1994; Szabó 2009), the cognitive consequences of anxiety are less prominent than in adulthood. It also merits mention in this context that AS-mental concerns related positively to self-reported worry in the current sample, but the association did not meet adjusted significance levels ($p=0.017$). Future research could further investigate this linkage as well as possible developmental differences by utilizing more sophisticated indices of cognitive stage to address developmental questions related to emerging cognitive competencies, AS-mental concerns, and GAD-relevant indicators (e.g., Muris, Mayer, Vermeulen, and Hiemstra 2007). The absence of a link between AS-social concerns and GAD-type outcomes is more difficult to explain, given prior adult work as well as the prominence of social processes during adolescence (Bukowski et al. 2012). Measurement-related concerns may be at play. The measure used to index AS in adults (i.e., Anxiety Sensitivity Index [ASI]-3; Taylor et al. 2007), includes equal items on the three subscales. Additionally, McLaughlin et al. (2007) observed a significant linkage between AS-social concerns and self-reported GAD symptoms in their sample of youth aged 7 to 15 years, which was not replicated here. Notably, however, McLaughlin and colleagues derived a sample-specific factor structure that included two additional items on the social concerns factor as compared to the structure derived in more recent factor analyses and employed here (i.e., three items on the both the social and cognitive concerns subscales; Brown et al. 2012; Walsh et al. 2004; Wright et al. 2010). Indeed, the relatively small number of items on both the social and cognitive concerns subscales of the CASI is an issue of considerable concern as it likely contributes to the relatively low internal consistencies observed for these subscales as well as the strong correlation between the global AS factor and the lower-order factor of physical concerns in the current study and prior youth work (McLaughlin et al. 2007; Walsh et al. 2004). The over-representation of physical concerns items on the CASI represents an important measurement problem with this instrument. Future research could usefully be aimed at constructing and validating an index of AS with more comprehensive, internally consistent indicators of cognitive and social concerns for youth. Such an instrument would allow for a compelling replication and extension of the current findings.

In addition to those discussed above, a few other limitations warrant mention. First, the adolescents in the current sample primarily identified as Caucasian and were paid to take part in a laboratory-based investigation. Further, as the current

data were drawn from a larger study involving a breathing challenge, adolescents with panic disorder were excluded from the study. Recruiting a more heterogeneous sample, in terms of ethnicity and anxiety-related diagnoses, as well as using more diverse compensation strategies would enhance generalizability. Second, the non-experimental study design precludes causally-oriented hypothesis testing. Building on work conducted with adults (e.g., Keough and Schmidt 2012; Schmidt et al. 2007), future work could administer an AS amelioration program to high AS youth to examine whether attenuation of this factor decreases vulnerability to, and incidence of, GAD. Finally, the current investigation was limited to a mono-method (self-report), mono-informant approach to measuring the constructs of interest. Inclusion of parent report on child symptoms (e.g., Revised Child Anxiety and Depression Scale-Parent Version) and diagnoses (e.g., Anxiety Disorders Interview Schedule-Parent Module) in future studies would help to attenuate biases introduced by this assessment approach. Additionally, employment of laboratory-based approaches (e.g., adolescent worry induction; Frala, Mischel, Knapp, Autry, and Leen-Feldner 2014) would allow for controlled, multi-modal assessments of key questions related to this line of work.

The current study extended the existing literature by examining AS global and lower-order factors in relation to worry, self-reported GAD symptoms, and interviewer-assessed GAD diagnostic status. Findings suggested that AS, and particularly concerns about the physical consequences of anxiety, may be particularly relevant to GAD-related outcomes among youth. In light of the malleable nature of AS, targeting AS-physical concerns specifically (e.g., via interoceptive exposure [IE]; Keough and Schmidt 2012; Schmidt et al. 2007) may therefore represent a promising intervention in the context of treatment and/or prevention efforts for GAD. Further, the current findings strengthen the scientific foundation for treatments targeting factors common across disorders (e.g., Unified Protocol for the Treatment of Emotional Disorders in Youth; Ehrenreich, Goldstein, Wright, and Barlow 2009). These approaches have a great deal of promise in terms of improving treatment effectiveness as well as enhancing dissemination and implementation by focusing clinician training on a “unified protocol” in which processes that cut across disorders are addressed in a single treatment approach (Seager, Rowley, and Ehrenreich 2014). Emerging data, including in the context of the current study, support targeting AS in this context. Collectively, the current study sets the stage for exciting new work aimed at clarifying the potential impact of AS amelioration.

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Standards As indicated in the text, the research team received approval by the University Institutional Review Board prior to participant contact and obtained written, informed consent as well as assent prior to participant inclusion in the study. Finally, the research study was conducted in accordance with the ethical standards as indicated by the American Psychiatric Association.

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