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Anxiety Sensitivity and Suicidal Ideation/Suicide Risk: A Meta-Analysis

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Abstract

Objective: Suicide is a global public health concern. To inform the prevention and treatment of suicidality, it is crucial to identify transdiagnostic vulnerability factors for suicide and suicide-related conditions. One candidate factor is anxiety sensitivity (AS)—the fear of anxiety-related sensations— which has been implicated in the pathogenesis of a host of mental health outcomes, including suicidal thoughts and behaviors. Importantly, AS is distinct from trait anxiety and negative affectivity, highlighting its potential incremental utility in the understanding of psychopathology. Despite a burgeoning body of literature demonstrating that AS is linked to suicidal thoughts and behaviors, this research has yet to be synthesized.

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Method: This meta-analysis includes 33 articles representing 34 nonredundant samples (N = 14,002) that examined at least one relationship between AS global or subfactor (i.e., cognitive, physical, social) scores and suicidal ideation and/or suicide risk.

Results: Findings revealed small-to-moderate and moderate associations between global AS and suicidal ideation (r = .24, 95% confidence interval (CI): [.21, .26], p < .001) and suicide risk (r = .35, 95% CI [.31, .38], p < .001), respectively. All AS subfactors evinced significant associations with suicidal ideation (rs = .13–.24) and suicide risk (rs = .22–32).

Conclusions: AS is related to suicidal ideation and global suicide risk. Research is needed to disentangle AS from other indices of distress in the prediction of suicidal thoughts and behaviors. Theoretical and clinical implications of these findings are discussed.

Keywords

anxiety sensitivity; suicidal ideation; suicide risk; suicidality

Across the globe, over 800,000 individuals die by suicide annually (World Health Organization, 2014). In the United States alone, each year, approximately 44,000 individuals die by suicide,1.4 million make a suicide attempt, and 9.8 million seriously consider suicide (Centers for Disease Control and Prevention, 2018; Piscopo, Lipari, Cooney, & Glasheen, 2016). Thus, there is considerable public health import for identifying factors that increase risk for the development of suicidal thoughts and behaviors.

Anxiety sensitivity (AS) is one individual difference factor that has been linked to suicidal thoughts and behaviors. AS is defined as the extent to which an individual fears anxiety-related sensations because of misinterpretations that these sensations have negative ramifications that span cognitive, physical, and social domains (Reiss, Peterson, Gursky, & McNally, 1986; Taylor, 1999; Taylor et al., 2007). Simply put, AS reflects the “fear of fear.” AS amplifies existing stress and anxiety as a result of faulty interpretations about the consequences of anxiety-related sensations. AS is conceptualized regarding its general factor as well as its lower-order cognitive, physical, and social subfactors. AS cognitive concerns refer to the belief that concentration and other cognitive difficulties, ipso facto, mean that one is “going crazy.” AS physical concerns refer to the belief that one’s anxiety-related physical symptoms (e.g., heart skipping a beat) are convincing evidence of impending poor health or death. AS social concerns refer to the belief that observable anxiety-related symptoms (e.g., trembling, sweating) will lead to social rejection (Taylor et al., 2007).

Early accounts of the AS construct conceptualized AS as a risk and maintaining variable primarily for panic attacks and panic disorder (Taylor, 1999); however, subsequent research has highlighted its applicability to a range of mental health outcomes, including suicidal thoughts and behaviors. A meta-analysis examining AS among the anxiety disorders found that, across 38 published studies spanning 20,146 participants, AS symptoms are elevated among individuals with an anxiety disorder compared with nonclinical controls (Olatunji & Wolitzky-Taylor, 2009). Strikingly, in this meta-analysis, there were no significant differences observed in AS levels between anxiety disorders and mood disorders, with one exception (i.e., panic disorder exhibiting significantly higher AS levels; Olatunji &

Wolitzky-Taylor, 2009), positioning AS as a transdiagnostic cognitive-affective vulnerability factor for psychopathology.

Extant research has demonstrated that higher levels of AS are also related to the presence and/or severity of suicidal ideation and suicide risk—and that this association persists across samples, including psychiatric outpatients (Allan et al., 2015), primary care patients (Zvolensky et al., 2016), military service members (Capron, Cougle, Ribeiro, Joiner, & Schmidt, 2012), and firefighters (Stanley, Hom, Spencer-Thomas, & Joiner, 2017). Research has also highlighted that the AS subfactors (i.e., cognitive, physical, social) demonstrate differential associations with distinct forms of psychopathology (Naragon-Gainey, 2010); thus, it is plausible that the same may be true for suicidal thoughts and behaviors. Indeed, some evidence suggests that the impact of cognitive AS concerns on suicidal thoughts and behaviors is robust relative to the physical and social AS subfactors (Allan, Capron, Raines, & Schmidt, 2014; Allan et al., 2015; Capron, Cougle, et al., 2012).

There is also a theoretical rationale for the existence of a link between AS and suicidal thoughts and behaviors. Regarding AS cognitive concerns, drawing from research demonstrating that AS amplifies distress responses (Reiss, 1991), Capron, Norr, Macatee, and Schmidt (2013) proposed a depression-distress amplification model of AS. Briefly, recognizing that mood pathology confers a particularly potent risk for suicide (e.g., Cavanagh, Carson, Sharpe, & Lawrie, 2003), the researchers proposed that AS cognitive concerns potentiate the effects of mood and related pathology on suicidality. That is, the model posits that individuals who simultaneously experience mood and related pathology alongside concomitant fears that they are losing control (i.e., catastrophic reactions to these symptoms; cf. cognitive AS concerns) will experience even greater distress and, in turn, greater suicide risk. This model has received empirical support (e.g., Capron et al., 2016; Capron, Lamis, & Schmidt, 2014). Regarding AS physical and AS social concerns, the interpersonal theory of suicide (Chu et al., 2017; Joiner, 2005; Van Orden et al., 2010) offers a plausible explanation for their relations with suicidality. The interpersonal theory of suicide proposes that individuals will desire suicide if they experience *thwarted belongingness* (i.e., loneliness, absence of reciprocal care) and *perceived burdensomeness* (i.e., liability, self-hate) and perceive these states as intractable (Van Orden et al.,2010). Individuals with higher levels of social AS concerns may withdraw from others due to fears of manifest anxiety symptoms. In this regard, it is unsurprising that individuals with elevated social AS concerns might experience high levels of thwarted belongingness and perceived burdensomeness, and, in turn, increased risk for suicide-related outcomes (Capron, Fitch, et al.,2012). Moreover, the interpersonal theory states that individuals will not engage in lethal or near-lethal suicidal behavior unless they also possess the *capability for suicide*, which manifests in part through genetic contributions, lowered fear of death, and elevated physical pain tolerance (Van Orden et al., 2010). As observed by Capron, Fitch, et al. (2012), low levels of physical AS concerns might reflect fearless appraisals of pain and elevated pain tolerance; in this regard, theory would suggest that low levels of physical AS concerns might relate to the transition from suicidal thoughts to behaviors (Klonsky & May, 2014). Indeed, previous research has suggested that the effects of cognitive AS concerns on suicide attempts may be potentiated in the presence of low physical AS concerns (Capron, Cougle,

et al., 2012). Together, there is theoretical rationale for examining AS and its subfactors as correlates of suicidal ideation/suicide risk.

In so doing, it is important to note that, despite the initial debate about whether AS provides information incremental to other indices of distress (i.e., trait anxiety and negative affectivity; Lilienfeld, 1996; McNally, 1989, 1996; Reiss, 1997), subsequent evidence has consistently demonstrated that AS accounts for unique variance in psychopathology that is unexplained by trait anxiety and negative affectivity (Reiss et al., 1986; Schmidt, Lerew, & Jackson, 1999; Taylor et al., 2007; Zinbarg, Barlow, & Brown,1997) as well as specific mood and anxiety symptoms (Olthuis, Watt, & Stewart, 2014). Indeed, AS is a traitlike construct indexing how an individual is likely to respond to distressing emotions (Reiss et al., 1986). AS, therefore, functions by amplifying existing distress (Schmidt, Lerew, & Jackson, 1997; Schmidt et al., 1999). That AS accounts for unique variance in psychiatric symptoms suggests that its presence alongside constructs such as mood and anxiety pathology may signal increased suicide risk. Thus, the evidence exists to justify the study of AS as a distinct construct.

The Present Study

Together, the existing research suggests that AS may serve as a vulnerability factor for suicidality. However, this literature has yet to be synthesized. The purpose of this study was to conduct a meta-analysis of studies examining the associations of AS and suicidal ideation and suicide risk. *Suicide risk* is a heterogeneous construct that represents an amalgamation of suicidal ideation, suicide attempts, and suicidal intent (i.e., the self-reported likelihood of engaging in future suicidal behavior; e.g., Osman et al., 2001). While a suicide risk variable may not differentiate between suicidal ideation and suicide attempts, suicide risk represents a useful clinical index that may inform risk-level categorization and clinical decision making (Batterham et al., 2015; Chu et al., 2015). We examined and compared the associations of AS globally as well as its subfactors (i.e., cognitive, physical, and social) with each suicide-related outcome. We also conducted moderation analyses to determine if findings differed based on one or more of the following characteristics, either because the characteristics have been shown to be associated with AS (Taylor, 1999) and/or suicidal ideation/suicide risk (Van Orden et al., 2010), or because they are commonly assessed as moderators in meta-analyses (Borenstein, Hedges, Higgins, & Rothstein, 2009): (a) demographic variables (i.e., age, gender, race), (b) year of publication, (c) sample type (i.e., clinical vs. community), (d) research design (i.e., cross-sectional vs. longitudinal), (e) AS scale utilized (i.e., Anxiety Sensitivity Index [ASI]; Reiss et al., 1986 vs. Anxiety Sensitivity Index—3 [ASI-3]; Taylor et al., 2007), (f) mean levels of sample negative affectivity, (g) mean levels of sample trait anxiety symptoms, and (h) mean levels of sample depression symptoms. We additionally conducted several tests of publication bias.

Method

We comprehensively and systematically searched PsycINFO and PubMed for articles published in English (searches were queried on March 5, 2018). The following search terms were used: anxiety sensitivit*; ASI; ASI-3; phrenophobia; suicid*. The asterisk allows for

multiple permutations of the root word to be searched: “anxiety sensitivit*” returns results for “anxiety sensitivity” and “anxiety sensitivities;” and “suicid*” returns results for “suicide;” “suicidal;” and “suicidality.” Phrenophobia, the fear of cognitive incapacitation, is synonymous with the cognitive AS subfactor (see Cox, Borger, & Enns, 1999; Schmidt, Woolaway- Bickel, & Bates, 2001) and was included as a search term. No other synonyms of AS or its subfactors were identified after consulting a landmark textbook on AS (Taylor, 1999) as well as the relevant literature. Thus, the present set of keywords includes all known appropriate keywords. We also utilized the “Suicide” medical subject headings (MeSH) within PubMed, searched Google Scholar, and examined the reference lists of identified review articles utilizing a forward/backward approach.

Inclusion and Exclusion Criteria

Articles were included based on the following criteria: (a) written in English, (b) included any measure assessing AS, (c) included a measure assessing suicidal ideation and/or suicide risk, and (d) quantitatively examined and presented results of the relationship between AS and suicide-related outcomes (e.g., correlations). Notably, to be included in this meta-analysis, it was not necessary for studies to explicitly endeavor to test the association between AS and suicidality; for instance, if an AS and suicide-related outcome variable were both included in a correlation matrix, the study was included. Articles were excluded if they focused exclusively on death ideation and/or nonsuicidal self-injury (NSSI); while these constructs are related to suicide risk, their phenomenologies are distinct. Studies focused on death ideation and/or NSSI were excluded if full-text review determined that the study did not assess suicidal ideation and/or suicide risk. Although NSSI is associated with suicidal behaviors (Chu et al., 2018), it is not typically included in measures of global suicide risk (e.g., the Suicidal Behaviors Questionnaire—Revised [SBQ-R]; Osman et al., 2001), in part, because NSSI, by definition, does not include the *intent* to die (Crosby, Ortega, & Melanson, 2011). There were no age, gender, or race exclusions. When articles did not fully report the necessary information to include the study in the meta-analysis, efforts were made to contact the authors to obtain the information. The authors of three articles were contacted and all responded with the requested information. There were too few studies examining and presenting meta-analyzable effect sizes for suicide attempts; thus, the present meta-analysis does not examine suicide attempts as an outcome.

Figure 1 presents the study selection process per PRISMA guidelines (Moher, Liberati, Tetzlaff, Altman, & the PRISMA Group, 2009). A total of 234 papers were identified through the computerized search (127 through PsycINFO, 80 through PubMed, 27 through MeSH subject headings; no additional articles were identified through the Google Scholar or reference list search). Two authors, advanced PhD candidates in clinical psychology, independently reviewed the titles and abstracts for duplicates and potential relevance to this meta-analysis. A total of 68 articles were excluded because they represented duplicates. An additional 106 were excluded because the titles/abstracts were not relevant; agreement regarding exclusion was good ($\kappa = .88$) and discrepancies were resolved by discussion and consensus. This process resulted in 60 articles to potentially include. The same authors then independently reviewed the full-length version of each article.

Studies presenting redundant samples were identified and triaged based on the following parameters, with preference for inclusion presented in sequential order: (a) includes correlations examining AS subfactors as opposed to only the general AS factor, (b) includes more than one metric of suicidality (i.e., suicidal ideation, suicide risk), and (c) has a larger sample size. For example, if two articles presented on the same sample and both examined suicide risk as the outcome, but Article A included subfactor AS scores and Article B did not, Article A was selected for inclusion. In cases where more than one article utilized the same sample, the articles were considered nonredundant if they reported on different criterion variables (e.g., suicidal ideation vs. suicide risk); the inclusion of a duplicate sample within these parameters would likely not artificially inflate or deflate individual effect sizes because distinct domains of suicidality were examined. When one study presented two samples and one sample was redundant with the sample of another study, the study was retained for analysis of the nonredundant sample. Authors of three articles were contacted to resolve ambiguities about potentially redundant samples; all confirmed nonredundancy. At this stage, an additional 27 articles were excluded because they represented a redundant sample ($k = 10$; see Part A in the online supplemental materials), did not examine suicidality ($k = 13$), or did not present comparisons of AS and suicidality ($k = 4$). Thus, we included a total of 33 articles examining 34 nonredundant samples ($N = 14{,}002$). Of note, articles were included if they examined at least one relationship between (a) AS global and/or subfactor scores and (b) suicidal ideation and/or suicide risk. In this regard, not all 34 samples examined all possible permutations.

Data Extraction

Data from the full-length versions of the studies that were identified for inclusion in this meta-analysis were extracted. Effect sizes (e.g., Pearson's *r*, unstandardized beta coefficient, odds ratios) of the relationship between AS global as well as subfactor scores and suicidality were coded. Consistent with past research (Rogers & Joiner, 2017), for longitudinal studies with multiple assessment time points, to derive the most conservative estimate, we used the association between baseline AS scores and follow-up suicidality scores (i.e., furthest time point from baseline). In instances in which a study presented multiple measures assessing suicidal ideation (e.g., the Beck Scale for Suicide Ideation [BSS]; Beck & Steer, 1991, or the Depressive Symptom Inventory- Suicidality Subscale [DSI-SS]; Joiner, Pfaff, & Acres, 2002), the DSI-SS was a priori chosen to be utilized in analyses for two primary reasons.[1] First, it was most commonly utilized across studies examining AS and suicidality. Second, a recent systematic review of measures assessing suicidal thoughts and behaviors identified the DSI-SS as an exemplar measure, in part because, unlike the BSS, it is available in the public domain (Batterham et al., 2015).

To facilitate moderation analyses, we extracted the following characteristics: (a) sample demographic variables (age [mean, *SD*], proportion of the sample identifying as female and as White/ Caucasian), (b) publication year, (c) sample type (i.e., clinical vs. community), (d) research design (i.e., cross-sectional vs. longitudinal), and (e) AS scale utilized (i.e., ASI vs.

[1]There were two instances in which the DSI-SS and BSS were both presented and the DSI-SS value was selected a priori (Podlogar et al., 2017; Ringer et al., 2018).

ASI-3). We examined ASI versus ASI-3 as a moderator variable because the original 16-item ASI was designed to measure AS as a unidimensional construct (Reiss et al., 1986). The 18-item ASI-3 was developed to assess the hierarchical structure of AS (Taylor et al., 2007). Of note, the ASI and ASI-3 are strongly correlated (*rs* = .47–.99; Taylor et al., 2007).

We also extracted sample mean and *SD* values, when available, for scales assessing (f) negative affectivity (i.e., the Positive and Negative Affect Schedule [PANAS]; Watson, Clark, & Tellegen, 1988), (g) trait anxiety symptoms, and (h) depression symptoms (e.g., the Beck Depression Inventory—II [BDI-II]; Beck, Steer, & Brown, 1996). In instances in which a study presented multiple measures assessing trait anxiety symptoms (e.g., Beck Anxiety Inventory [BAI]; Beck & Steer, 1990, or the Penn State Worry Questionnaire [PSWQ]; Meyer, Miller, Metzger, & Borkovec, 1990), the BAI was a priori chosen to be utilized in analyses because it was most commonly utilized across studies examining AS and suicidality.[2] For this reason, the BAI was used in analyses examining trait anxiety sample means as a moderator. The BDI-II was selected as the measure of depression symptoms to be utilized in moderation analyses, given its commonality in included studies. We offer an important caution in interpreting these analyses:examining mean levels of these constructs in each sample as a moderator is *not* equivalent to examining if AS is associated with suicide-related outcomes controlling for these constructs at the individual level (i.e., between-study vs. between-subjects). Nevertheless, the examination of these sample means as a moderator at the between-study level provides a first step, with due caution, into understanding factors that might affect the association between AS and suicide-related outcomes.

We also coded whether the first author of the study is a current student, former student, and/or faculty member of the Department of Psychology at Florida State University (FSU). FSU is a hub of research for both suicide and suicide-related conditions, including AS. It is a natural extension that FSU would also be at the forefront of research examining the interplay between AS and suicidality. However, this also presents the potential for bias. Thus, we examined whether the presence/absence of FSU affiliation of the first author moderated results; this approach is similar to that of Chu et al. (2017) and Starr and Davila (2008).

Data Analysis Strategy

We utilized the *Q* test to determine if substantial heterogeneity exists across effect sizes (Huedo-Medina, Sánchez-Meca, Marín- Martínez, & Botella, 2006). We also derived the I^2 statistic to describe the degree to which the variability across studies is a result of heterogeneity as opposed to chance due to sampling error (Huedo-Medina et al., 2006). Higgins, Thompson, Deeks, and Altman (2003) suggest that, generally, I^2 values between 0 and 25%, 26–50%, and 51–100% represent small, moderate, and large heterogeneity, respectively. A random effects model was utilized because we expected that effect sizes would vary across studies, given the diverse samples assessed and methodologies employed. A random effects model accounts for systematic heterogeneity (i.e., between-study variance) by weighting and calculating each case. Cohen (1988) suggested that effect sizes of .10, .30,

[2]There was one instance in which the BAI and PSWQ were both presented and the BAI value was selected a priori (Podlogar et al., 2017).

and .50 represent small, moderate, and large effects, respectively. Forest plots presenting effect sizes and 95% confidence intervals (CIs) were constructed.

We employed moderation analyses, when data were available and there was significant heterogeneity in our effect sizes, to determine whether effect sizes depended on the values of proposed moderating variables. We utilized a random effects metaregression to examine the relationships between effect sizes and each proposed moderator. Corrections were made to standard errors and significance testing. Categorical moderator variables were only examined if each subgroup had at least six effect sizes, consistent with recommendations by Borenstein et al. (2009).

We assessed multiple indicators of publication bias. First, we examined Orwin's (1983) Fail-safe *N*, a metric of the number of additional studies with an effect size of 0 that would be required to bring the meta-analytic total effect down to an irrelevant value of .05 (Orwin, 1983). While the Fail-safe *N* provides useful information, it is limited in its focus on statistical (rather than clinical) significance. Thus, we also examined Egger's test, for which a significant value suggests potential publication bias (Egger, Smith, & Phillips, 1997). Further, we utilized Duval and Tweedie's (2000a, 2000b) trim-and-fill method, which assesses possible publication bias through an iterative procedure of removing the smallest studies from the positive side of the funnel plot and computing effects at each iteration until the funnel plot is symmetrical; this procedure calculates an overall effect estimate that is corrected for potential bias. Studies located near the top of the funnel plot represent more precise estimates (i.e., smaller standard errors). Finally, as noted, we tested if an FSU affiliation of the first author moderated results.

Results

A total of 33 studies examining the association of AS and suicidality among 34 nonredundant samples were included in this meta-analysis (N = 14,002; Table 1; see also Part B in the online supplemental material). As noted, each sample examined at least one relationship between (a) AS global or subfactor (i.e., cognitive, physical, social) scores and (b) suicidal ideation and/or suicide risk; not all permutations of AS and suicide-related associations were examined across all 34 samples (see Table 1). The mean age was 27.93 years (SD = 7.32 years). On average, 51.14% identified as female and 74.42% identified as White/Caucasian. Of the 34 samples, 50.0% (k = 17) examined suicidal ideation and 55.9% (k = 19) examined suicide risk as the outcome variables; these values exceed 100% because two samples examined more than one effect size domain (i.e., suicidal ideation *and* suicide risk). Of the 34 samples, 28 (82.4%) were cross-sectional designs and six (17.6%) were longitudinal designs.

Regarding measures, across studies, AS was assessed through the family of ASI instruments. Of the 34 samples, 32.4% (k = 11) used the original ASI (Reiss et al., 1986), 64.7% (k = 22) of samples used the ASI-3 (Taylor et al., 2007), and 2.9% (k = 1) of samples utilized the Childhood Anxiety Sensitivity Index (Silverman, Fleisig, Rabian, & Peterson, 1991). Of the 17 samples examining suicidal ideation, 52.9% (k = 9) used the DSI-SS (Joiner et al., 2002),[3] 23.5% (k = 4) used the BSS (Beck & Steer, 1991),11.8% (k = 2) used Item 9 from the

BDI-II (Beck et al., 1996), 5.9% (k = 1) utilized the Suicide Probability Scale—Suicidal Ideation subscale (Cull & Gill, 1988), and 5.9% (k = 1) used the NIMH Diagnostic Interview Schedule for Children IV (Shaffer, Fisher, Lucas, Dulcan, & Schwab-Stone, 2000). Of the 19 samples examining suicide risk, 47.4% (k = 9) used the Inventory of Depression and Anxiety Symptoms Suicidality subscale (Watson et al., 1988), 26.3% (k = 5) used the SBQ-R (Osman et al., 2001), 10.5% (k = 2) used the Suicide Anger Expression Inventory—28 Suicidality subscale (Osman, Gutierrez, Wong, et al., 2010), 5.3% (k = 1) used the SBQ (Linehan, 1981), 5.3% (k = 1) used the M.I.N.I. International Neuropsychiatric Interview (Sheehan et al.,1998), and 5.3% (k = 1) used the Treatment Outcome Package (Kraus, Seligman, & Jordan, 2005). It is common practice in meta-analyses for constructs to be assessed via multiple theoretically consistent scales (Borenstein et al., 2009).

Suicidal Ideation Prediction

Global AS.—Thirteen study samples examined the relationship between global AS and suicidal ideation. Effect sizes and related 95% CIs are presented in a forest plot (Figure 2). The Q test was significant (36.88), and the I^2 value (67.46) indicated that a large amount of variability was due to heterogeneity rather than chance. The test of the null was significant, with a small-to-moderate effect size (r = .24, p < .001, 95% CI [.21, .26]). This finding indicates that the association between global AS and suicidal ideation is significant and small to moderate in magnitude. Results of a series of metaregressions indicated that age (Z = 8.59, p < .001) and gender (Z = −2.51, p < .05) moderated this association, such that samples with a higher mean age and a greater proportion of male participants had stronger effects. Effects were also stronger for studies utilizing the ASI-3 versus the ASI (Z = 46.03, p < .001). Of the four studies that assessed trait anxiety symptoms, the relationship between global AS and suicidal ideation was stronger at higher sample mean levels of trait anxiety (Z = 5.06, p < .001). None of the following significantly moderated this relationship: race (Z = −.16), publication year (Z = .78), mean level of negative affectivity (Z = .91), or mean level of depression symptoms (Z = −.02). There was insufficient moderator variability to examine sample type and study design as moderators. Regarding the publication bias tests, Egger's regression test did not indicate publication bias (B = .19, SE = .10, $t(1,11)$ = .27, p = .789); Orwin's Fail-safe N suggested that a total of 44 studies with an effect size of 0 would be needed to bring the total effect down to an irrelevant value of .05; one study was trimmed per Duval and Tweedie's trim-and-fill procedure; and there was insufficient moderator variability to examine the effect of FSU affiliation.

Cognitive AS.—Thirteen study samples examined the relationship between cognitive AS and suicidal ideation (see Part C in the online supplemental material). The Q test was significant (55.43), and the I^2 value (78.35) indicated that a large amount of variability was due to heterogeneity rather than chance. The test of the null was significant, with a small-to-moderate effect size (r = .24, p < .001, 95% CI [.21, .27]). This indicates that the association

[3]Item 2 of the DSI-SS includes information about suicide plans. Although in some instances the presence of a suicide plan is assessed distinct from suicidal ideation, the DSI-SS assessment of the concomitant presence of suicidal ideation and suicide plans is consistent with the *DSM–5* operationalization of suicidal ideation (American Psychiatric Association, 2013, p. 830).

between cognitive AS and suicidal ideation is significant and small- to-moderate in magnitude. Gender moderated this association ($Z = 16.52$, $p < .001$), such that samples with a greater proportion of females had stronger effects. AS measure was a significant moderator ($Z = 4.54$, $p < .001$), such that studies utilizing the ASI-3 compared with the ASI had stronger effects. None of the following significantly moderated this relationship: age ($Z = .80$), race ($Z = -.60$), publication year ($Z = -.15$), mean level of trait anxiety symptoms ($Z = -.02$), or mean level of depression symptoms ($Z = -.07$). There was insufficient moderator variability to examine sample type, study design, and mean level of negative affectivity as moderators. Regarding the publication bias tests, Egger's regression test did not indicate publication bias ($B = .07$, $SE = .27$, $t(1,11) = .73$, $p = .479$); Orwin's Fail-safe N suggested that a total of 57 studies with an effect size of 0 would be needed to bring the total effect down to an irrelevant value of .05; one study was trimmed per Duval and Tweedie's trim-and-fill procedure; and there was insufficient moderator variability to examine the effect of FSU affiliation.

Physical AS.—Eleven study samples examined the relationship between physical AS and suicidal ideation (see Part C in the online supplemental material). The Q test was significant (14.05), and the I^2 value (28.84) indicated that a moderate amount of variability was due to heterogeneity rather than chance. The test of the null was significant, with a small effect size ($r = .13$, $p < .001$, 95% CI [.09, .17]). This indicates that the association between physical AS and suicidal ideation is significant and small in magnitude. Samples with a greater proportion of females had stronger effects ($Z = 15.23$, $p < .001$). Studies published in earlier years also evinced stronger effects ($Z = -3.74$, $p < .001$). None of the following moderated this relationship: age ($Z = -14$), race ($Z = .00$), mean level of trait anxiety symptoms ($Z = 1.16$), or mean depression symptom severity (Z = −.14). There was insufficient moderator variability to examine sample type, study design, AS measure, and mean level of negative affectivity as moderators. Regarding the publication bias tests, Egger's regression test did not indicate publication bias ($B = .07$, $SE = .22$, $t(1,9) = .75$, $p = .470$); Orwin's Fail-safe N suggested that a total of 42 studies with an effect size of 0 would be needed to bring the total effect down to an irrelevant value of .05; one study was trimmed per Duval and Tweedie's trim-and-fill procedure; and FSU affiliation was not a significant moderator of the meta-analytic association between physical AS and suicidal ideation ($Z = .00$).

Social AS.—Ten study samples examined the relationship between social AS and suicidal ideation (see Part C in the online supplemental material). The Q test was significant (17.47), and the I^2 value (48.49) indicated that a moderate amount of variability was due to heterogeneity rather than chance. The test of the null was significant, with a small effect size ($r = .14$, $p < .001$, 95% CI [.06, .23]). This finding indicates that the association between social AS and suicidal ideation is significant and small in magnitude. Age ($Z = 12.02$, $p < .001$) and gender (Z = −9.97, $p < .001$) moderated this association, such that samples with a higher mean age and a greater proportion of males had stronger effects. Studies published in earlier years had stronger relationships ($Z = -5.66$, $p < .001$). Depression symptoms also moderated this association, such that effects were stronger in samples with a higher mean level of depression symptoms ($Z = 6.66$, $p < .001$). Race did not significantly moderate this relationship ($Z = .00$). There was insufficient moderator variability to examine sample type,

study design, AS measure, mean level of trait anxiety symptoms, and mean level of negative affectivity as moderators. Regarding the publication bias tests, Egger's regression test did not indicate publication bias ($B = .01$, $SE = .11$, $t(1,8) = 1.10$, $p = .304$); Orwin's Fail-safe N suggested that a total of 17 studies with an effect size of 0 would be needed to bring the total effect down to an irrelevant value of .05; two studies were trimmed per Duval and Tweedie's trim-and-fill procedure; and FSU affiliation was a significant moderator of the meta-analytic association between social AS and suicidal ideation ($Z = 19.85$, $p < .001$), with FSU samples demonstrating stronger effects.

Suicide Risk Prediction

Global AS.—Seventeen study samples examined global AS and suicide risk (Figure 3). The Q test was significant (31.61), and the I^2 (49.39) indicated that a moderate amount of variability was due to heterogeneity as opposed to chance. The test of the null was significant, with a moderate effect size ($r = .35$, $p < .001$, 95% CI [.31, .38]), indicating that the relationship between global AS and suicide risk is significant and moderate in magnitude. Age ($Z = 14.37$, $p < .001$) and gender ($Z = -8.67$, $p < .001$) moderated this association, such that samples with a higher mean age and a greater proportion of males had stronger effects. Studies published in more recent years had stronger relationships ($Z = 20.11$, $p < .001$). Neither race ($Z = .14$) nor mean level of negative affectivity ($Z = .00$) moderated this relationship. There was insufficient moderator variability to examine sample type, study design, AS measure, trait anxiety symptoms mean, and depression symptoms mean as moderators. Regarding the publication bias tests, Egger's regression test did not indicate publication bias (B = −.36, $SE = .09$, $t(1,15) = -.12$, $p = .907$); Orwin's Fail-safe N suggested that a total of 102 studies with an effect size of 0 would be needed to bring the total effect down to an irrelevant value of .05; one study was trimmed per Duval and Tweedie's trim-and-fill procedure; and FSU affiliation was a significant moderator of the meta- analytic association between global AS and suicide risk ($Z = 12.50$, $p < .001$), with FSU samples demonstrating stronger effects.

Cognitive AS.—Twelve study samples examined cognitive AS and suicide risk (see Part C in the online supplemental material). The Q test was significant (38.65), and the I^2 (71.54) indicated that a large amount of variability was due to heterogeneity as opposed to chance. The test of the null was significant, with a moderate effect size ($r = .32$, $p < .001$, 95% CI [. 24, .40]), indicating that the relationship between cognitive AS and suicide risk is significant and moderate in magnitude. Age ($Z = -3.26$, $p < .001$) and gender ($Z = 7.27$, $p < .001$) moderated this association, such that samples with a lower mean age and a greater proportion of females had stronger effects. Studies with a more recent publication year also demonstrated stronger effects ($Z = 5.22$, $p < .001$). Samples with a lower mean level of negative affectivity had stronger effects ($Z = -6.92$, $p < .001$). Race did not significantly moderate this relationship ($Z = 1.83$). There was insufficient moderator variability to examine sample type, study design, AS measure, mean level of trait anxiety symptoms, and mean level of depression symptoms as moderators. Regarding the publication bias tests, Egger's regression test indicated possible publication bias ($B = -.82$, $SE = .21$, $t(1,10) = -2.38$, $p = .039$); Orwin's Fail-safe N suggested that a total of 68 studies with an effect size of 0 would be needed to bring the total effect down to an irrelevant value of .05; zero studies

were trimmed per Duval and Tweedie's trim-and-fill procedure; and FSU affiliation was not a significant moderator of the meta-analytic association between cognitive AS and suicide risk ($Z = -.47$).

As noted, research suggests that the effects of cognitive AS concerns on suicide attempts are potentiated in the presence of low physical AS concerns (Capron, Cougle, et al., 2012). Meta-analytically examining this interaction model utilizing a suicide risk variable is a close approximation, although we caution that here, too, sample mean levels of cognitive and physical AS are tested in this model. Consistent with expectations, samples with lower levels of physical AS evinced stronger associations between cognitive AS and suicide risk ($Z = -5.35$, $p < .001$).

Physical AS.—Twelve study samples examined physical AS and suicide risk (see Part C in the online supplemental material). The Q test was significant (12.74), and the I^2 (13.68) indicated that a small amount of variability was due to heterogeneity as opposed to chance. The test of the null was significant, with a small-to-moderate effect size ($r = .22$, $p < .001$, 95% CI [.18, .27]), indicating that the relationship between physical AS and suicide risk is significant and small to moderate in magnitude. Age ($Z = -6.48$, $p < .001$), gender ($Z = 2.57$, $p < .05$), and race ($Z = 6.38$, $p < .01$) moderated this association, such that samples with a lower mean age, a greater proportion of female participants, and a greater proportion of White/Caucasian participants had stronger effects. Effects were stronger for studies with a higher mean level of negative affectivity ($Z = 8.54$, $p < .001$). Study publication year was not a significant moderator ($Z = 1.29$). There was insufficient moderator variability to examine sample type, study design, AS measure, trait anxiety symptoms mean, and depression symptoms mean as moderators. Regarding the publication bias tests, Egger's regression test indicated possible publication bias ($B = -.34$, $SE = .04$, $t(1,10) = -3.05$, $p = .012$); Orwin's Fail-safe N suggested that a total of 44 studies with an effect size of 0 would be needed to bring the total effect down to an irrelevant value of .05; four studies were trimmed per Duval and Tweedie's trim-and-fill procedure; and FSU affiliation was a significant moderator of the meta-analytic association between physical AS and suicide risk ($Z = -4.12$, $p < .001$), with effects stronger in non-FSU samples.

Social AS.—Twelve study samples examined social AS and suicide risk (see Part C in the online supplemental material). The Q test was significant (20.12), and the I^2 (45.34) indicated that a moderate amount of variability was due to heterogeneity as opposed to chance. The test of the null was significant, with a small-to-moderate effect size ($r = .25$, $p < .001$, 95% CI [.20, .31]), indicating that the relationship between social AS and suicide risk is significant and small to moderate in magnitude. Age moderated this association ($Z = 16.35$, $p < .001$), such that samples with a higher mean age had stronger effects. Stronger effects were detected in studies published more recently ($Z = 2.96$, $p < .01$). Moreover, negative affectivity moderated this association ($Z = -6.05$, $p < .001$), such that studies with a lower sample mean of negative affectivity had stronger effects. Neither gender ($Z = .38$) nor race ($Z = .67$) moderated this relationship. There was insufficient moderator variability to examine sample type, study design, AS measure, mean level of trait anxiety symptoms, and mean level of depression symptoms as moderators. Regarding the publication bias tests,

Egger's regression test did not indicate publication bias (B = .33, SE = .11, $t(1,10) = -.67$, p = .518); Orwin's Fail-safe N suggested that a total of 50 studies with an effect size of 0 would be needed to bring the total effect down to an irrelevant value of .05; zero studies were trimmed per Duval and Tweedie's trim-and-fill procedure; and FSU affiliation was not a significant moderator of the meta-analytic association between social AS and suicide risk ($Z = -.51$).

Discussion

This meta-analysis endeavored to synthesize the literature regarding AS and suicidal ideation/suicide risk. Across a total of 33 studies presenting data from 34 nonredundant samples (N = 14,002), AS demonstrated small-to-moderate and moderate associations between (a) AS and suicidal ideation and (b) AS and suicide risk, respectively. The associations between AS and suicidal ideation/suicide risk were significant for global AS as well as each of its subfactors. There was modest evidence of publication bias, discussed in detail below. Together, the results of this meta-analysis suggest that the links between AS and suicidality are robust and have implications for theory and clinical practice.

The meta-analytic finding that AS and suicidality are robustly linked is notable and consistent with theoretical accounts that AS amplifies stress responses, and, in turn, augments suicidality (Capron, Norr, et al., 2013). Further, as mentioned above, the suicide risk variable represents an amalgamation of suicidal ideation, past suicide attempts, and a self-reported future likelihood of making a suicide attempt. This collection of information has considerable clinical import (Chu et al., 2015). It may be that catastrophic interpretations of overarousal (cf. elevated AS concerns) transition one from thinking about suicide to engaging in suicidal behaviors, in part because the overarousal is perceived as intractable and inescapable (Allan et al., 2015). Nevertheless, a suicide risk variable that collapses across suicide-related constructs presents methodological challenges for researchers, especially in light of the call to conduct research within the ideation-to-action framework (Klonsky & May, 2014). That is, given that suicidal ideation and suicidal behaviors have distinct etiological pathways (Van Orden et al., 2010), a criterion variable that aggregates across suicide-related constructs does not allow for specificity—an important measurement consideration to which we return below.

Regarding subfactor analyses, we have described how research studies, individually, have suggested that cognitive AS concerns are most robustly associated with suicidality (Allan et al., 2014, 2015; Capron, Cougle, et al., 2012; Oglesby, Capron, Raines, & Schmidt, 2015). Indeed, our meta-analysis found that, although all AS subfactors demonstrated significant associations with suicidality, the effect sizes were descriptively strongest in magnitude for the cognitive AS concerns subscale. We caution, however, that overlap in the 95% CIs for the meta-analytic effects across sub-factors suggest that they are not statistically different from each other, per the approach outlined in Higgins and Green (2011). Nevertheless, the central import of cognitive AS concerns in suicidality is highlighted by intervention trials, described in detail below, that specifically reduce cognitive AS concerns and, in turn, have demonstrable effects on suicidality. Further, it is worth contextualizing the present findings within the interpersonal theory of suicide. As noted, the interpersonal theory of suicide states

that *fearlessness* about death is necessary for the emergence of lethal or near-lethal suicidal behavior (Van Orden et al., 2010). AS cognitive concerns, by contrast, are characterized by *fearfulness* that one might be going "crazy." In this sense, two heretofore largely disparate lines of research have implicated (a) fearlessness about death, and (b) fearfulness about losing control of one's mind as risk markers for suicidality. Even more, research has found that cognitive AS concerns may predict suicide attempts only among those with low levels of physical AS concerns (Capron, Cougle, et al., 2012); here, low levels of physical AS concerns are hypothesized to reflect fearlessness about physical harm (cf. fearlessness about death). This meta-analysis supports this assertion in that the sample mean of physical AS concerns moderated the association between cognitive AS concerns and suicide risk. Future research is needed to understand how the AS subscales may interact to confer risk for suicide. Moving forward, it will also be important to understand the association between AS and suicidality within the context of theoretical frameworks (Selby, Joiner, & Ribeiro, 2014). One approach might be to examine if AS cognitive concerns interact with the fearlessness about death in the prediction of suicidal behavior.

Regarding moderation analyses findings, there was no replicable pattern regarding the moderating effect of sample age, sex, or race/ethnicity. This pattern is especially interesting considering past research suggesting that the effects of AS on psychopathology may be more robust for females compared with males (Norr, Albanese, Allan, & Schmidt, 2015; Olatunji & Wolitzky-Taylor, 2009). We additionally examined if the measure utilized to assess AS moderated results. As noted, the ASI was developed to measure AS as a unidimensional construct and thus subfactor scores, though derivable, may be unstable (Zinbarg et al., 1997). By contrast, the ASI-3 was specifically designed to measure AS as a hierarchical construct (Taylor et al., 2007). Our meta-analysis revealed that effects were generally found to be stronger for studies utilizing the ASI-3. This finding is important for at least two reasons. First, given that the ASI-3 was designed to measure AS as a hierarchical construct, it may be that utilizing the original ASI for subfactor analyses may, in some cases, underestimate effects. Second, the association of cognitive AS and suicidality appears most robust; thus, it is crucial to utilize appropriate assessment instruments (i.e., ASI-3). Notably, we were unable to examine if study design (e.g., cross-sectional, longitudinal) and sample type (e.g., clinical, undergraduate) moderated results because at least six effect sizes are needed in each group for categorical moderators (Borenstein et al., 2009).

Possible Publication Bias

A single indicator of possible publication bias is not sufficiently probative; thus, we considered multiple indicators in combination. The Egger's tests were significant and suggestive of publication bias for the relation of physical and cognitive AS concerns and suicide risk. However, while the trim-and-fill procedure resulted in four trimmed studies for the model examining physical AS and suicide risk, no studies were trimmed for the model examining cognitive AS and suicide risk—a finding that mitigates, to an extent, the significant Egger's tests. Of note, for the other models, the Egger's tests were nonsignificant. The other models, too, evinced minimal need for imputed studies per the trim-and-fill procedure; this suggests minimal publication bias (Duval & Tweedie, 2000a, 2000b). Moreover, across models, the Fail-safe *N* values were all sufficiently large. Further,

64.7% of samples were first-authored by a current student, former student, or faculty member of the FSU Department of Psychology; as noted, we examined FSU affiliation as a moderator of results. Here, findings were inconsistent, such that when there was sufficient variability in the moderator to examine moderation effects, FSU-affiliated studies evinced stronger effects for the associations between social AS and suicidal ideation and global AS and suicide risk, but weaker effects for physical AS and suicide risk. By contrast, FSU affiliation did not significantly moderate the associations between physical AS and suicidal ideation, social AS and suicide risk, or, perhaps most importantly, cognitive AS and suicide risk. This pattern suggests that FSU-affiliated studies did not systematically produce larger effects, strengthening confidence in the veracity of findings. Nevertheless, we encourage additional research in this area led by diverse research groups, including research groups not represented in the present meta-analysis, and we additionally encourage the presentation of null effects to reduce the emergence of publication bias.

Clinical Implications

The robust associations between AS and suicidality uncovered by this meta-analysis suggest potential clinical implications. Notably, AS-specific interventions have demonstrated efficacy in affecting suicide-related outcomes. For example, Schmidt, Capron, Raines, and Allan (2014) tested a computerized intervention designed to reduce cognitive AS concerns (i.e., cognitive anxiety sensitivity treatment [CAST]). CAST consisted of psychoeducation regarding the physical and psychological nature of stress and anxiety, as well as a brief interoceptive demonstration that physical and cognitive symptoms of anxiety are unpleasant but not necessarily dangerous. The researchers randomized 104 nontreatment-seeking community adults to receive either CAST or a physical health (e.g., sleep hygiene, exercise, nutrition) psychoeducation control. CAST produced decreases in ASI-3 total and cognitive subscale scores at 1-month postintervention as compared with a stringent control group. Importantly, prepost intervention changes in cognitive AS concerns mediated the relationship between intervention condition and two separate measures of suicidal ideation at the 1-month follow-up appointment (i.e., BSS, DSI-SS).

A separate study was conducted by Schmidt, Norr, Allan, Raines, and Capron (2017) in a sample of 74 treatment-seeking community outpatient adults, all of whom reported current suicidal ideation and met *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM—5*; American Psychiatric Association,2013) diagnostic criteria for a primary anxiety disorder or depressive disorder with anxious distress. In this trial, CAST was supplemented with two sessions of an AS-specific cognitive bias modification for interpretations program (CBM-I for AS; Capron, Norr, Allan, & Schmidt, 2017; Capron & Schmidt, 2016). CAST + CBM-I for AS produced notable changes in ASI-3 total scores and ASI-3 cognitive subscale scores from baseline to the end of the third intervention session. Lower postintervention ASI-3 total, cognitive, and social scores were directly related to lower suicidality (i.e., DSI-SS scores) at 1-month follow-up; ASI-3 total, cognitive, and physical scores were directly related to DSI-SS scores at Month 4 follow-up. Finally, there was evidence that postintervention AS global scores and lower-order factors mediated the effect of condition on suicidality at follow-up Months 1 and 4. Together, these trials suggest that AS is malleable and that changes in cognitive AS concerns, specifically, may be a reliable

mechanism through which suicidality can be reduced over extended periods. These computerized trials are particularly noteworthy considering their brevity (i.e., <1 hr), which present a potential solution for reaching rural and other underserved populations (Norr, Gibby, Fuller, Portero, & Schmidt, 2017). Indeed, factors such as access and cost prevent a remarkable number of individuals from receiving mental health care (Mojtabai et al.,2011). Further, CAST is rated favorably by users (Short, Fuller, Norr, & Schmidt, 2017), potentially circumventing help-seeking stigma. In sum, brief computerized interventions for AS appear to provide secondary reductions in suicide risk and may hold potential for dissemination among underserved or hard-to-reach populations.

We would be remiss if we did not highlight the importance of not relying solely on AS-focused interventions for suicide risk mitigation efforts. One important approach is the routinized assessment and documentation of suicide risk (Chu et al., 2015). Additionally, a promising clinical approach for suicide risk reduction—which can be delivered alongside AS-focused interventions—is safety planning (Stanley & Brown, 2012). A safety plan involves the patient and clinician collaboratively generating (and writing on an easily accessible modality, such as an index card or smartphone application) steps that the patient can take to reduce risk, especially if a crisis were to develop. These steps include the generation of coping strategies that, for instance, are social, involve physical activity, and occur in nature (cf. behavioral activation; e.g., go for a walk in the park with a neighbor). Safety plans also include the identification of specific individuals and/or organizations (e.g., 1–800–273-TALK) that can be contacted for support. One step on the safety plan might be focused on the reduction of AS, such as using the aforementioned computerized programs grounded in cognitive-behavioral principles.

Limitations and Future Directions

This meta-analysis identified several limitations of the extant literature as well as areas in need of further empirical inquiry. First and foremost, it will be important for studies to assess the interplay between AS and other affect sensitivity/tolerance variables, such as distress tolerance (DT), in the prediction of suicide-related outcomes. Although AS is distinct from these factors (Bernstein, Zvolensky, Vujanovic, & Moos, 2009) and the association between cognitive AS concerns and suicidal ideation persists even after accounting for the effects of DT (Capron, Norr, et al., 2013), it is possible that DT moderates the effect of AS on suicide-related outcomes. Examining other indicators of distress within regression models when predicting suicide-related outcomes—and reporting standardized beta coefficients—will also allow for the shared variance between AS and other distress factors to be partitioned out in future meta-analytic work.

Further, due to the limitations of the existing data, we did not examine suicide attempts as an outcome. It is imperative for future research to examine the degree to which AS concerns are implicated in suicide attempts, specifically, rather than suicidal ideation and a more nebulous suicide risk variable. In this regard, it is imperative that researchers examine suicidal ideation and suicide attempts as distinct outcomes rather than merely utilizing suicide risk variables that collapse suicidal ideation and suicide attempts (Klonsky & May, 2014), although global suicide risk remains a clinically relevant outcome. Moreover, although

prospective research will be most useful in delineating temporality, for studies examining suicide attempts retrospectively, it will be important to consider the time that has elapsed since the suicide attempt. Indeed, one's current levels of AS may be unrelated to a suicide attempt that occurred, for example, 10 years prior. Additionally, although conducting research examining suicide mortality as an outcome is difficult because suicide is a low base rate event, no studies have examined if AS predicts suicide mortality. Past research has implicated states of overarousal in death by suicide (Ribeiro, Yen, Joiner, & Siegler, 2015); therefore, future research might investigate if AS has any utility in predicting death by suicide, perhaps through its configurations with other risk factors (Franklin et al., 2017; Walsh, Ribeiro, & Franklin, 2017).

Further, Kleiman et al. (2017) found that suicidal ideation changes over short periods of time and its risk factors also change considerably in just a matter of hours. To our knowledge, the dynamic nature of suicidal ideation and its risk factors has not been examined specifically regarding AS. However, it would be clinically useful to know if fluctuations in AS correspond with fluctuations in suicidal ideation. Alternatively, AS may act as a more stable, traitlike risk factor that could amplify acute changes in emotionality, thereby contributing to acute manifestations of suicidality.

Extant work linking AS with suicidal ideation and suicide risk has relied exclusively on self-report methodologies, despite evidence suggesting that both AS (Poletti et al., 2015) and suicidality (Mann, 1998) have physiological and genetic bases. The integration of neurophysiological investigations into the rich self-report literature linking AS with suicidality may help illuminate the mechanisms via which AS and suicidality are associated and mitigate the limitations of self-report (e.g., stigma, bias). For instance, recent work has established the utility of event-related potential (ERP) methodology for examining information processing aberrations in AS (Allan et al., 2018) and suicide risk (Weinberg, Perlman, Kotov, & Hajcak, 2016), underscoring the potential promise for future research to utilize ERPs to elucidate how AS elevates suicidal ideation and suicide risk. Future research may also benefit from identifying classes of cognitive AS concerns at highest risk for suicide. Prior studies utilizing taxometric data analytic techniques have found distinct classes of AS (e.g., high AS, normative AS; Bernstein et al., 2006, 2007; Kotov, Schmidt, Lerew, Joiner, & Ialongo, 2005). Incidentally, cognitive AS concerns appear to comprise a plurality of items in the "high AS" class (e.g., Zvolensky, Forsyth, Bernstein, & Leen-Feldner, 2007). Therefore, it is plausible that distinct classes of cognitive AS concerns may emerge and that such techniques have utility for identifying suicide risk. Additionally, regarding the number of moderation analyses we conducted, there carries an elevated risk for Type I error. Finally, it is also important to note that there were considerable inconsistencies in our moderation findings across analyses. While it is possible that these inconsistencies reflect heterogeneity in the samples included, a common artifact of meta-analyses (Borenstein et al., 2009), it will be important for future research to parse apart theoretically relevant factors that might influence the relationship between AS and suicidal ideation/suicide risk.

Limitations of This Review

This review is subject to several limitations. Our search strategy was limited to studies written in English. It is possible that our findings may not generalize to non-English speakers. Relatedly, we elected to only include studies that were published in peer-reviewed journals. Although this approach allows for increased confidence in the veracity of the methodologies—and, in turn, the results—additional, unpublished data may be available. This meta-analysis also included studies of varying ages. Although we examined age as a moderator of analyses, that only two studies examined adolescents (Bilgiç, Yilma, & Hergüner, 2017; Capron, Allan, Ialongo, Leen-Feldner, & Schmidt, 2015) underscores the need for more research with youth. Further, as in any meta-analysis, our findings may have been influenced by publication bias.

Conclusions

This study meta-analyzed 33 studies representing 34 nonredundant samples (N = 14,002) examining AS and suicidal ideation/ suicide risk. Findings revealed small-to-moderate and moderate associations between (a) AS and suicidal ideation and (b) AS and suicide risk, respectively. Given the robust associations between AS and suicidality, additional research is needed to: (a) disentangle AS from other indices of distress in the prediction of suicidal thoughts and behaviors, (b) delineate the temporal relationship of AS and suicidal ideation/ suicide risk, and (c) examine the effects of AS-focused interventions on suicide-related outcomes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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What is the public health significance of this article?

This meta-analysis suggests that anxiety sensitivity is related to suicidal thoughts and global suicide risk. Interventions focused on mitigating anxiety sensitivity demonstrably reduce suicidal ideation, suggesting that anxiety sensitivity may be a promising intervention target for suicide risk reduction efforts alongside other empirically informed efforts.

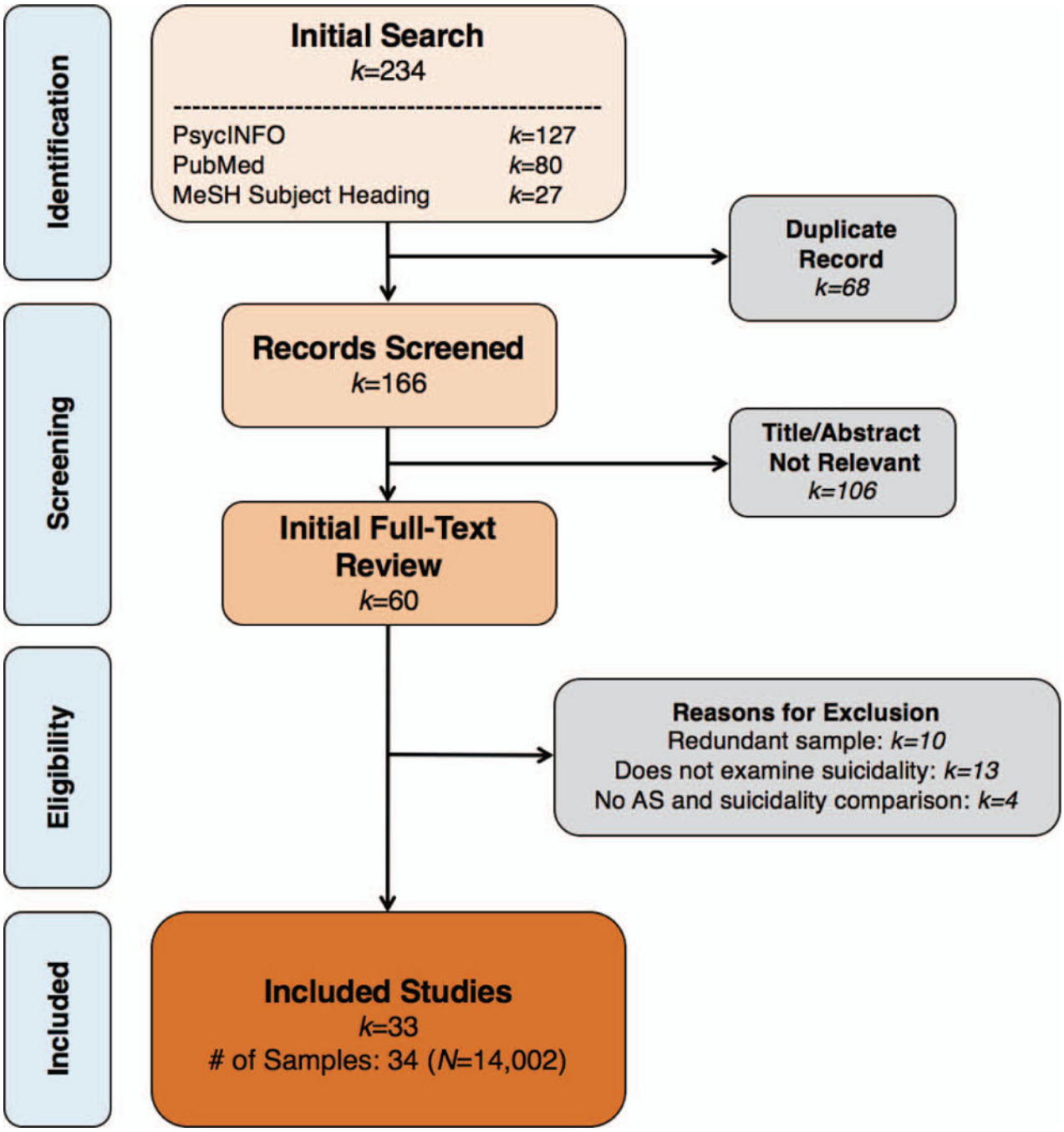

Figure 1.

PRISMA flowchart for study selection process. AS = anxiety sensitivity; MeSH = medical subject headings. See the online article for the color version of this figure

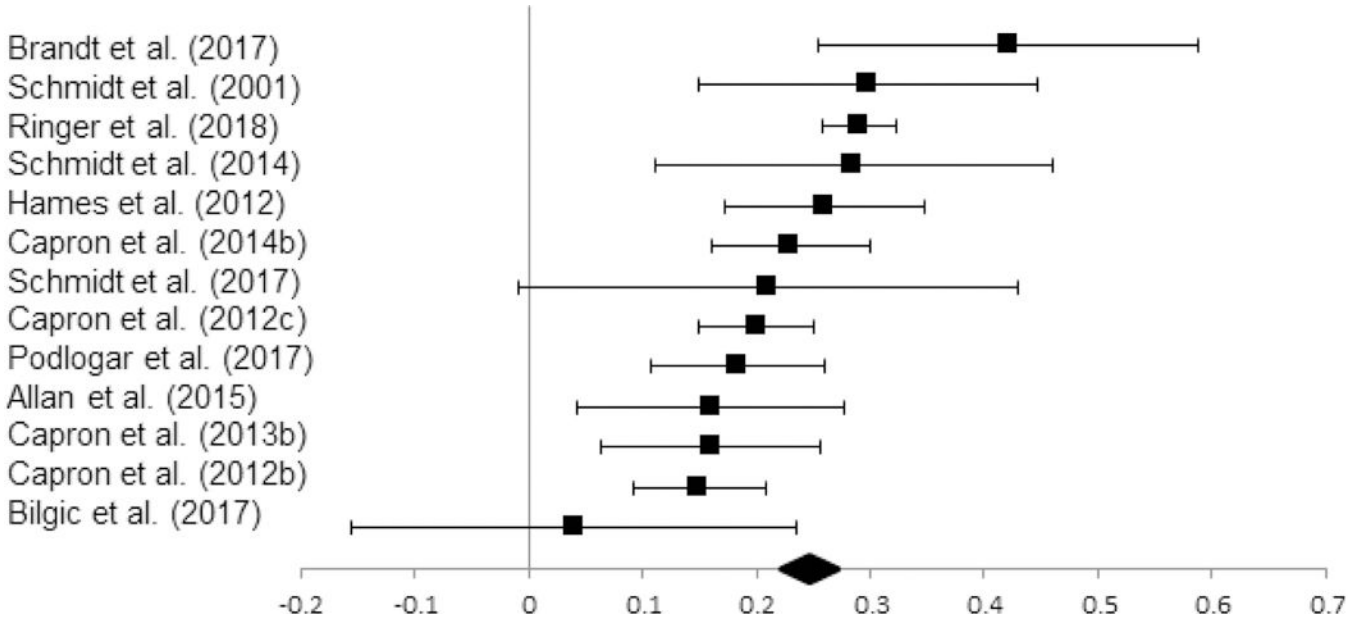

Figure 2.

Forest plot of effect sizes included in the meta-analysis examining global anxiety sensitivity and suicidal ideation.

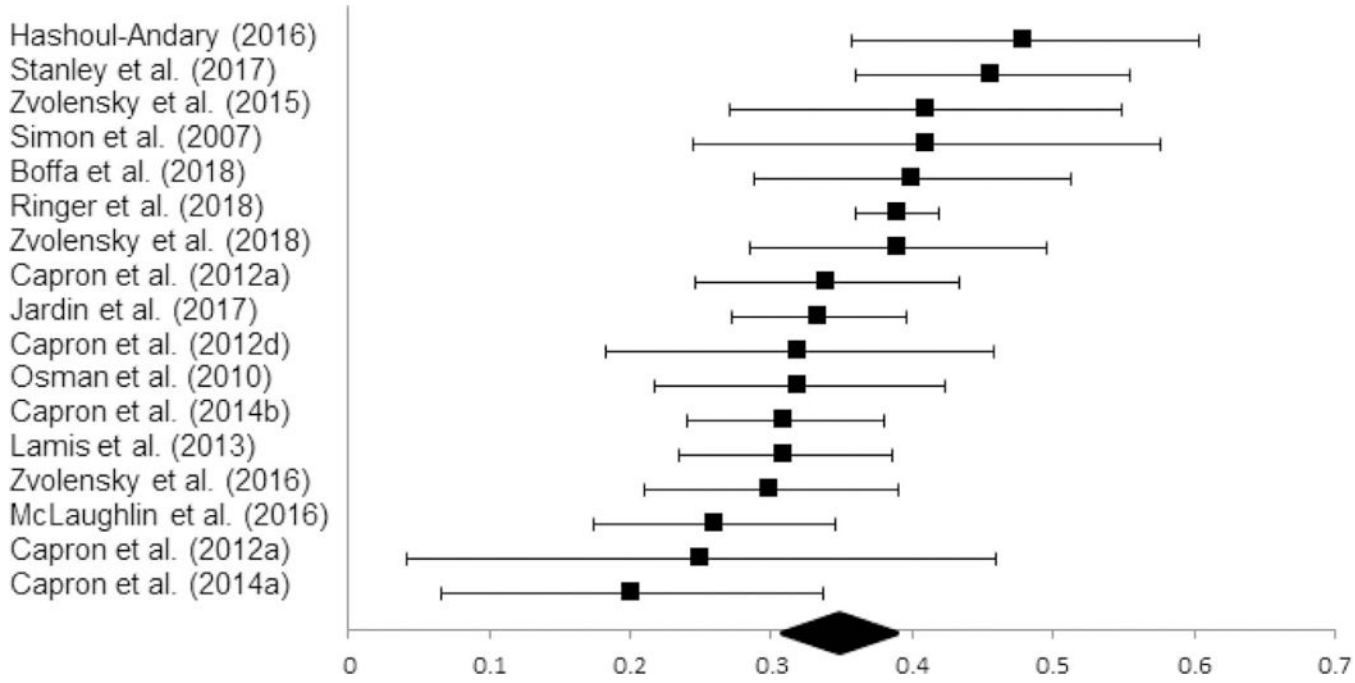

Figure 3.
Forest plot of effect sizes included in the meta-analysis examining global anxiety sensitivity and suicide risk.

Table 1

Included Study Information

No.	Citation	*N*	Age (*M*)	Age (*SD*)	F (%)	W (%)	Effect(s) analyzed	AS and SI and/or SR correlation (*r*)			
								Global	Cog	Phys	Soc
1	Allan et al. (2015)	267	35.45	16.53	52.1	63.7	SI	.16	.24	.06	.17
2	Boffa et al. (2018)	214	39.05	8.94	0	80.1	SR	.40	.39	.26	.33
3	Bilgif, Yilma, and Hergiiner (2017)	101	15.4	1.2	75.2	NR	SI	.04	.22	-.01	-.11
4	Brandt et al. (2017)	94	48.3	7.5	35.5	29.2	SI	.42	NR	NR	NR
5	Capron, Blumenthal, et al. (2012): Samples 1 and 2	343	35.96	13.04	44.3	85	SR	.34	.36	.30	.25
		78	31.25	11.97	24.4	86.5	SR	.25	.22	.18	.23
6	Capron, Cougle, et al. (2012): Sample 2	1,081	18.02	.93	18.3	83.7	SI	.15	.19	.13	NR
7	Capron, Fitch, et al. (2012)	1,378	27.27	10.01	55.2	NR	SI	.20	.23	.17	.15
8	Capron, Gonzalez, Parent, Zvolensky, and Schmidt (2012)	164	48.4	9.57	17.1	40.9	SR	.32	.39	.25	.2
9	Capron, Kotov, and Schmidt (2013)	390	43.55	16.4	50.5	NR	SI	.16	.27	.09	.08
10	Capron, Norr, Zvolensky, and Schmidt (2014)	169	42.22	12.81	58	85	SR	.20	.02	.09	.30
11	Capron, Lamis, et al. (2014)	721	20	1.23	77.5	75	SI, SR	SI: .23; SR: .31	SI: .32; SR: .38	SI: .17; SR: .23	SI: .09; SR: .17
12	Capron, Allan, Ialongo, Leen-Feldner, and Schmidt (2015)	524	NR	NR	NR	NR	SI	NR	.02	.04	.09
13	Capron et al. (2016)	111	34	10.47	0	54	SR	NR	.16	.05	.04
14	Hames, Ribeiro, Smith, and Joiner (2012)	431	19.44	2.59	65.4	84	SI	.26	NR	NR	NR
15	Hashoul-Andary et al. (2016)	151	27.73	10.03	76.8	NR	SR	.48	NR	NR	NR
16	Jardin et al. (2018)	788	20.83	1.93	80.9	NR	SR	.33	.37	.26	.24
17	Lamis and Jahn (2013)	552	19.85	1.66	77.2	79.2	SR	.31	NR	NR	NR
18	McLaughlin, McLeish, and O'Bryan (2016)	452	19.06	2.5	72.3	84.1	SR	.26	NR	NR	NR
19	Oglesby, Capron, Raines, and Schmidt (2015)	106	40.8	17.45	53.8	67.9	SR	NR	.29	.09	.28
20	Osman, Gutierrez, Smith, et al. (2010)	293	NR	NR	64.8	86	SR	.32	.32	.22	.27
21	Podlogar et al. (2017)	616	26.8	10.4	62.3	76.6	SI	.18	NR	NR	NR
22	Raines et al. (2017)	60	45.2	12.47	0	35	SI	NR	.43	.25	.34
23	Ringer et al. (2018)	3,140	NR	NR	24.4	66.2	SI, SR	SI: .29; SR: .39	NR	NR	NR
24	Rogers et al. (2016): Sample 1	186	19.81	4.16	79.6	83.3	SI	NR	.41	NR	NR
25	Schmidt, Woolaway-Bickel, and Bates (2001)	146	36.3	11.3	69	82	SI	NR[a]	NR[a]	NR[a]	NR[a]

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No.	Citation	*N*	Age (*M*)	Age (*SD*)	F (%)	W (%)	Effect(s) analyzed	AS and SI and/or SR correlation (*r*)			
								Global	Cog	Phys	Soc
26	Schmidt, Capron, Raines, and Allan (2014)	108	40.8	17.45	53.8	67.9	SI	.29	.31	.19	.22
27	Schmidt, Norr, Allan, Raines, and Capron (2017)	74	30.77	14.16	75.6	78.4	SI	.21	.13	.23	.27
28	Simon et al. (2007)	98	44.8	13.9	57.1	95.9	SR	.41	NR	NR	NR
29	Stanley, Horn, Spencer-Thomas, and Joiner (2017)	254	37.66	9.4	100	93.3	SR	.46	.51	.25	.39
30	Tucker et al. (2016)	131	19.7	NR	74.8	79	SI	NR	.41	NR	NR
31	Zvolensky et al. (2015)	138	38.4	10.8	86.2	NR	SR	.41	NR	NR	NR
32	Zvolensky et al. (2016)	390	38.7	11.3	86.9	NR	SR	.30	.32	.22	.28
33	Zvolensky et al. (2018)	253	39.1	11.1	86.6	NR	SR	.39	NR	NR	NR

Note. NR = data not reported; F (*%*) = percent female; W (*%*) = percent White/Caucasian; AS = anxiety sensitivity; Cog = cognitive AS concerns; Global = global AS concerns; Phys = physical AS concerns; SI = suicidal ideation; Soc = social AS concerns; SR = suicide risk.

[a]Correlation coefficients not presented; instead, mean (*SD*) values for ideator and nonideator groups utilized to derive effect sizes. See the online supplemental material for additional included study information.