



The depression distress amplification model in adolescents: A longitudinal examination of anxiety sensitivity cognitive concerns, depression and suicidal ideation



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ARTICLE INFO

Article history:

Available online 6 March 2015

Keywords:

Comorbidity

Cognitive vulnerability factors

Anxiety

ABSTRACT

Adolescents with comorbid anxiety and depression are at significantly increased risk of suicide. The recently proposed depression distress amplification model appears to have promise for explaining the relations between anxiety, depression, and suicidality, but it has not been tested in adolescents. Participants were 524 adolescents followed over two years. Baseline data for the current report were collected by trained interviewers while the adolescents were in eighth grade. Data were obtained in the same manner when the adolescents were in tenth grade. Baseline anxiety sensitivity cognitive concerns significantly predicted suicidal ideation two years later, above and beyond baseline suicidal ideation and depression. Further, consistent with the depression distress amplification model, anxiety sensitivity cognitive concerns interacted with depressive symptoms to predict suicidal ideation. This report extends the empirical and theoretical support for a relationship between anxiety sensitivity cognitive concerns and suicidality.

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Completed and attempted adolescent suicides have a major impact on the public health care system (Burke et al., 2010; Eaton et al., 2010). According to recent data reported by the Centers for Disease Control, suicide is the third leading cause of death in individuals 10–24 years of age and attempted suicides among adolescents increased 20% from 2009 to 2011 (CDC, 2013). Further, the rate of suicide increases drastically across adolescence, from .86 deaths per 100,000 in 12 year olds to 7.31 deaths per 100,000 in 17 year olds (CDC, 2013). Kessler, Borges, and Walters (1999) reported that age-of-onset for suicidal ideation and suicide attempts rapidly increase from about the age of 12 years, peaking around the age of 16 years. Given the consequences of suicide-related behavior in adolescents, the identification of risk factors for adolescent suicidal ideation is an important area for further research.

Diagnosis of a psychiatric disorder has been implicated as an important risk factor for suicide attempts as well as suicidal ideation in adolescents (Beautrais, Joyce, & Mulder, 1998; Fergusson, Woodward, & Horwood, 2000). However, research exploring the impact of anxiety on suicidal ideation in adolescents is limited. Hill, Castellanos, and Pettit (2011) recently

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summarized extant work in this area in an attempt to determine whether anxiety acts as a causal agent for suicide attempts and suicidal ideation. Hill et al. (2011) reported that anxiety was associated with suicidal ideation across several studies (Ruchkin, Schwab-Stone, Kuposov, Vermeiren, & King, 2003; Woods, Silverman, Gentilini, Cunningham, & Grieger, 1991). However, they also reported that other studies did not find a link between anxiety and suicidal ideation (D'Eramo, Prinstein, Freeman, Grapentine, & Spirito, 2004; Goldston et al., 1996). There were also mixed findings as to whether the relation between anxiety and suicidal ideation is robust when depression and other forms of psychopathology, demographic variables, or both are covaried (Ghaziuddin, King, Naylor, & Ghaziuddin, 2000; Prinstein, Boergers, Spirito, Little, & Grapentine, 2000; Steer, Kumar, & Beck, 1993; Valentiner, Gutierrez, & Blacker, 2002).

Despite the generally equivocal findings in this area, one thing seems to be consistent; anxiety in the presence of comorbid depression appears to be associated with elevated suicidality in adolescents. An epidemiological study of 1420 youth (ages 9–16 years) found that comorbid anxiety and depression was one of the strongest predictors of suicide risk (Foley, Goldston, Costello, & Angold, 2006). Another study of adolescent suicide attempters found high rates of anxiety disorders among those with a past suicide attempt. A closer look at these findings reveals this is likely due to anxiety and depression comorbidity, as 95% of adolescents with an anxiety disorder who attempted suicide had a comorbid depressive disorder (Pawlak, Pascual-Sanchez, Raè, Fischer, & Ladame, 1999). Hill et al. (2011) concluded that children and adolescents presenting with a coexisting mood and anxiety disorder may be at a higher risk of suicidal behaviors than those with either a mood or anxiety disorder individually. Examining cognitive vulnerability factors that are associated with anxiety, depression, and suicide may elucidate this phenomenon.

Anxiety sensitivity, a cognitive vulnerability factor related to a number of psychological conditions, is also associated with elevated suicidality (Capron, Cogle, Ribeiro, Joiner, & Schmidt, 2012; Capron, Fitch, et al., 2012; Schmidt, Woolaway-Bickel, & Bates, 2001). Anxiety sensitivity reflects fear of anxiety and panic related sensations or a “fear of fear” (Reiss, Peterson, Gursky, & McNally, 1986) and is made up of three subfactors related to fear of physical, cognitive, and social consequences of anxiety (Zinbarg, Barlow, & Brown, 1997). Global anxiety sensitivity amplifies distress responses in the context of general stress and anxiety symptoms (Taylor, 2003). Most research on anxiety sensitivity has focused on the relationship between anxiety sensitivity and panic attacks and panic disorder (Schmidt, Lerew, & Jackson, 1997; Schmidt, Zvolensky, & Maner, 2006). However, other research has shown a relationship between anxiety sensitivity and non-anxiety conditions such as depression (Taylor, Koch, Woody, & McLean, 1996) and substance use disorders (Lejuez, Paulson, Daughters, Bornoalova, & Zvolensky, 2006; Schmidt, Buckner, & Keough, 2007; Zvolensky et al., 2006).

The cognitive concerns subfactor of anxiety sensitivity appears to account for the relationship between anxiety sensitivity and suicide. Anxiety sensitivity cognitive concerns refer specifically to fears of cognitive dyscontrol or mental incapacitation. AS cognitive concerns differ from negative affect because they represent a fear of some negative affect symptoms (i.e. depersonalization, racing thoughts, lack of concentration) versus the symptoms themselves. In addition, AS physical concerns and AS social concerns are most strongly associated with anxiety psychopathology (Olatunji & Wolitzky-Taylor, 2009). However, anxiety sensitivity cognitive concerns are the only AS subfactor that uniquely predicts mood disorders (Naragon-Gainey, 2010; Tull & Gratz, 2008). In emerging empirical work, anxiety sensitivity cognitive concerns have been associated with elevated suicidal ideation in patients with panic disorder (Schmidt et al., 2001), clinical outpatients (Capron, Fitch, et al., 2012), air force cadets (Capron, Cogle, et al., 2012), individuals with HIV (Capron, Gonzalez, Parent, Zvolensky, & Schmidt, 2012) and cigarette smokers (Capron, Blumenthal, et al., 2012). In addition, early evidence suggests this relationship is cross-cultural (Capron, Kotov, & Schmidt, 2013) and that anxiety sensitivity reduction programs may reduce suicide risk (Capron, Norr, Raines, Zvolensky, & Schmidt, 2014; Schmidt, Capron, Raines, & Allan, 2014).

Although extant research indicates a consistent association between anxiety sensitivity cognitive concerns and suicidality in adults, there has been no empirical work investigating this relationship in adolescents. Further, despite findings that comorbid anxiety and depression place adolescents at greater risk for suicide related behaviors, mechanisms explaining this risk have not been tested. The recently proposed *depression distress amplification model* (Capron, Lamis, & Schmidt, 2014; Capron, Norr, Macatee, & Schmidt, 2012) may explain the interplay between anxiety and depression that creates elevated suicidal risk in adolescents.

The depression distress amplification model (Capron, Norr, et al., 2012) explains how depressive symptoms may be amplified by anxiety sensitivity cognitive concerns. Anxiety sensitivity cognitive concerns appear to predispose individuals to show increased distress in the context of aversive physical and mental *mood* symptoms. In the depression-distress amplification model, suicidal ideation is considered a symptom of depression corresponding to the severity of the depression. Just as anxiety sensitivity increases distress responses in the context of uncomfortable physical sensations (Schmidt, Maner, & Zvolensky, 2007), the depression-distress amplification model posits that anxiety sensitivity cognitive concerns amplify distress brought on by the uncomfortable sensations experienced in the context of emerging or existing dysphoria (e.g. lack of concentration, insomnia, anhedonia). Suicidal ideation emerges when the distress caused by the amplified depression reaches severe levels. This model has been evaluated in college students (Capron et al., 2014) and adult outpatients (Capron, Norr, et al., 2012); findings suggest the model predicts suicidal ideation above and beyond theoretically relevant covariates. Further, depression amplification appears to be specific to anxiety sensitivity cognitive concerns (Capron, Norr, et al., 2012).

There are a number of gaps/limitations in the current literature on the relations among anxiety, depression, and suicidality in adolescents. Primarily, there has been no previous research on the role of anxiety sensitivity cognitive concerns in adolescent suicidality. Extant work indicates elevated anxiety sensitivity cognitive concerns are associated with increased psychopathology (Taylor et al., 1996), and anxiety sensitivity cognitive concerns have been repeatedly found to be related to

suicidality in adult samples (Capron, Cogle, et al., 2012; Schmidt et al., 2001). Extending this work to adolescents is a logical progression of this research, particularly given findings observed with adults cannot be assumed to characterize other developmental periods (e.g., Cicchetti & Rogosch, 1999). Relatedly, no empirical tests have assessed whether the depression-distress amplification model applies to non-adult populations. Finally, anxiety sensitivity is known to amplify psychopathological distress (Schmidt, Maner, et al., 2007; Taylor, 2003). Therefore, it is important to test whether suicidal ideation is the specific result of depression amplification or is merely related to general distress amplification. The finding that amplifying anxiety is not associated with increased suicidal ideation would further refine the depression distress amplification model.

The primary aim of the current study was to test whether anxiety sensitivity cognitive concerns are a prospective predictor of suicidal ideation in a large, school-based sample of adolescents. Based on prior work, we hypothesized that anxiety sensitivity cognitive concerns, but not the other anxiety sensitivity subfactors, would be a significant predictor of suicidal ideation. A second aim was to test if the depression distress amplification model applies to adolescents. Based on extant work in adults, we hypothesized that the depression distress amplification model (i.e. an interaction between anxiety sensitivity cognitive concerns and depressive symptoms) would also predict suicidal ideation. The final aim of the study was to test the specificity of the mood aspect of the depression distress amplification model by substituting anxiety for depression. Based on the theoretical considerations underlying the depression distress amplification model, we hypothesized that the model would be specific to depression (i.e. an interaction of anxiety sensitivity cognitive concerns and anxiety symptoms would not predict suicidal ideation).

Methods

Participants

Data were drawn from a longitudinal study conducted by the Baltimore Prevention Research Center. The original study population consisted of 798 children, representative of entering first graders in nine Baltimore City public elementary schools. Children were recruited, with written parental consent, for participation in two school-based, preventive intervention trials targeting early learning and aggression (Ialongo, Werthamer, & Kellam, 1999). Three first grade classrooms in each of the nine schools were randomly assigned to one of the two intervention conditions or a control condition. The interventions were provided during the first grade year.

Of the 798 first grade children, 613 provided complete data in grade eight for this study. Of these, 44.4% were female and 85.6% were African-American. For the prospective (Grade 10) suicidal ideation data, 524 (85.5%) of these participants provided complete data and were included in final analyses. Chi-square tests showed no differences in gender and race between the participants included in this study and the remainder of the participants who were lost to follow-up. Therefore, the participants included in the current study were assumed to be representative of the population defined by the original epidemiological Baltimore Prevention Research Center Preventive Intervention Trial from which data were drawn. Descriptions of the methods used to assess first grade variables may be found in Ialongo, Werthamer, et al. (1999).

Measures

Anxiety sensitivity

The Anxiety Sensitivity Index (Reiss et al., 1986) is a 16-item measure designed to assess respondents' fears of anxious symptoms. Responses are rated on a 5-point scale ranging from "very little" (0) to "very much" (4). The Anxiety Sensitivity Index was designed for respondents aged 12 years and older and has shown good reliability and validity in adolescent and adult samples (Hayward, Killen, Kraemer, & Taylor, 2000). For example, Hayward et al. (2000) report a Cronbach α value of 0.84 and a 3-day test–retest reliability of 0.59 for a sample of ethnically diverse high school students. The Anxiety Sensitivity Index is hierarchical in structure with one higher-order factor (anxiety sensitivity) and three sub-factors (physical concerns, cognitive concerns, and social concerns) (Zinbarg et al., 1997). The current study was primarily interested in the cognitive concerns subfactor, which includes items related to potential mental health implications of sensations (e.g. "It scares me when I am nervous" and "When I cannot keep my mind on a task, I worry that I might be going crazy").

Depressive symptoms

The Baltimore How I Feel scale (Ialongo, Kellam, & Poduska, 1999) is a 45-item, youth self-report scale of depressive and anxious symptoms developed at the Baltimore Prevention Research Center for use in longitudinal prevention studies. Children report the frequency of depressive and anxious symptoms over the past 2 weeks on a 4-point scale ranging from never (0) to most times (3). The mean of 19 of the items yields a Depression subscale score; the mean of the remaining 26 items constitutes an Anxiety subscale score.

The Baltimore How I Feel scale was designed as a first-stage measure in a two-stage epidemiological investigation of the prevalence of child and adolescent mental disorders as defined in the *Diagnostic and Statistical Manual-III-Revised* (American Psychiatric Association, 1987). Accordingly, the item content was constructed to map onto *Diagnostic and Statistical Manual-III-Revised* criteria for the disorders of interest. Items were drawn from existing child self-report measures, including the Children's Depression Inventory (Kovacs, 1985), the Depression Self-Rating Scale (Asarnow & Carlson, 1985), the Hopelessness Scale for Children (Kazdin, Rodgers, & Colbus, 1986), the Revised Children's Manifest Anxiety Scale (Reynolds & Richmond,

1979), and the Spence Children's Anxiety Scale (Spence, 1998). Two-week test–retest reliability coefficients were 0.76 and 0.83 for the Anxiety and Depression subscales, respectively, in middle school (Ialongo, Kellam, et al., 1999). In terms of concurrent validity, youth self-reports on the Baltimore How I Feel depression subscale in middle school were significantly associated with a diagnosis of major depressive disorder on the computerized Diagnostic Interview Schedule for Children Version 4 (Shaffer, Fisher, Lucas, Dulcan, & Schwab-Stone, 2000).

Suicidal ideation

Past year suicidal ideation was assessed dichotomously via the question “in the last year did you ever think seriously about killing yourself?” from the major depression section of the Diagnostic Interview Schedule for Children Version 4 (Shaffer et al., 2000). Although the psychometric properties of this version of the Diagnostic Interview Schedule for Children have not been published, researchers have found that earlier versions of the Diagnostic Interview Schedule for Children have adequate test–retest reliability (Jensen, 1995) and validity (Schwab-Stone et al., 1996).

Design

All baseline measures were administered during the spring of 2001, the participants' eighth grade school year, and the prospective measures of suicidal ideation were gathered in 2003 in the participants' tenth grade school year. Individual interviews were conducted with youth, and trained members of the research staff read items and responses aloud to participants who recorded their responses on a laptop computer.

Results

Means, standard deviations, and bivariate correlations for the variables of interest are shown in Table 1. As expected, baseline suicidal ideation was the strongest predictor of prospective suicidal ideation. Suicidal ideation was observed in $n = 19$ (3.1%) of the sample at grade eight and $n = 19$ (3.4%) of the sample at grade 10.

A direct logistic regression was performed to assess the impact of baseline (grade eight) anxiety sensitivity subfactors on the likelihood that adolescents would report presence of suicidal ideation at grade 10. The model contained 5 predictor variables (baseline suicidal ideation, depressive symptoms, and Anxiety Sensitivity Index physical, cognitive, and social subfactors). Among covariates, baseline suicidal ideation (OR = 7.95, 95% CI = 1.94–32.54, $p = .004$) and baseline depressive symptoms (OR = 1.10, 95% CI = 1.04–1.17, $p = .002$) were significantly associated with Grade 10 suicidal ideation, whereas Anxiety Sensitivity Index physical ($p = .213$) and Anxiety Sensitivity Index social were not ($p = .521$). As predicted, baseline Anxiety Sensitivity Index cognitive concerns (OR = 1.19, 95% CI = 1.01–1.40, $p = .046$) were significantly associated with Grade 10 suicidal ideation.

To test the depression distress amplification model in adolescents, another direct logistic regression was performed. The model contained 4 predictor variables (baseline suicidal ideation, baseline Anxiety Sensitivity Index cognitive concerns, grade 10 depressive symptoms, and the baseline Anxiety Sensitivity Index cognitive concerns X grade 10 depressive symptoms interaction). After covarying for the effects of baseline suicidal ideation (OR = 7.81, 95% CI = 1.72–35.57, $p = .008$), baseline anxiety sensitivity cognitive concerns (OR = .88, 95% CI = .66–1.17, $p = .369$), and grade 10 depressive symptoms (OR = 1.14, 95% CI = 1.01–1.49, $p < .001$), the Anxiety Sensitivity Index cognitive X depressive symptoms interaction (OR = 1.02, 95% CI = 1.01–1.04, $p = .043$), was a statistically significant predictor of grade 10 suicidal ideation. In the next step, we probed the hypothesized 2-way interaction between baseline anxiety sensitivity cognitive concerns and grade 10 depressive symptoms (See Fig. 1). As predicted by the depression distress amplification model, the effect of anxiety sensitivity cognitive concerns on suicidal ideation only exists among those with high levels of grade 10 depressive symptoms (OR = 1.22, 95% CI = 1.11–1.34, $p < .001$). In contrast, the effect of anxiety sensitivity cognitive concerns at low levels of depressive symptoms was not significantly associated with prospective suicidal ideation ($p = .102$).

Next, we tested the alternative hypothesis that suicidal ideation emerges via anxiety symptom amplification to determine whether the anxiety sensitivity amplification effects are specific to depressive symptoms (in line with the depression distress amplification model). In other words, we tested whether the interaction of anxiety sensitivity cognitive concerns X grade 10 anxiety symptoms would also predict the presence of grade 10 suicidal ideation. The model contained 4 predictor variables

Table 1
Means, standard deviations and intercorrelations.

Measure	<i>M</i>	<i>SD</i>	1	2	3	4	5	6
1. ASI physical – G8	18.99	8.15	–					
2. ASI cognitive – G8	7.03	3.27	.60*	–				
3. ASI social – G8	12.04	3.55	.43*	.35*	–			
4. HIF depression – G8	12.33	8.25	.29*	.15*	.38*	–		
5. HIF depression – G10	11.78	8.95	.13*	.06	.19*	.51*	–	
6. Suicidal ideation – G8	.03	.17	.13*	.11*	.12*	.25*	.17*	–
7. Suicidal ideation – G10	.03	.18	.04	.02	.09*	.20*	.27*	.24*

* $p < .05$. ASI = Anxiety Sensitivity Index; G8 = Grade 8; G10 = Grade 10; HIF – How I Feel Scale.

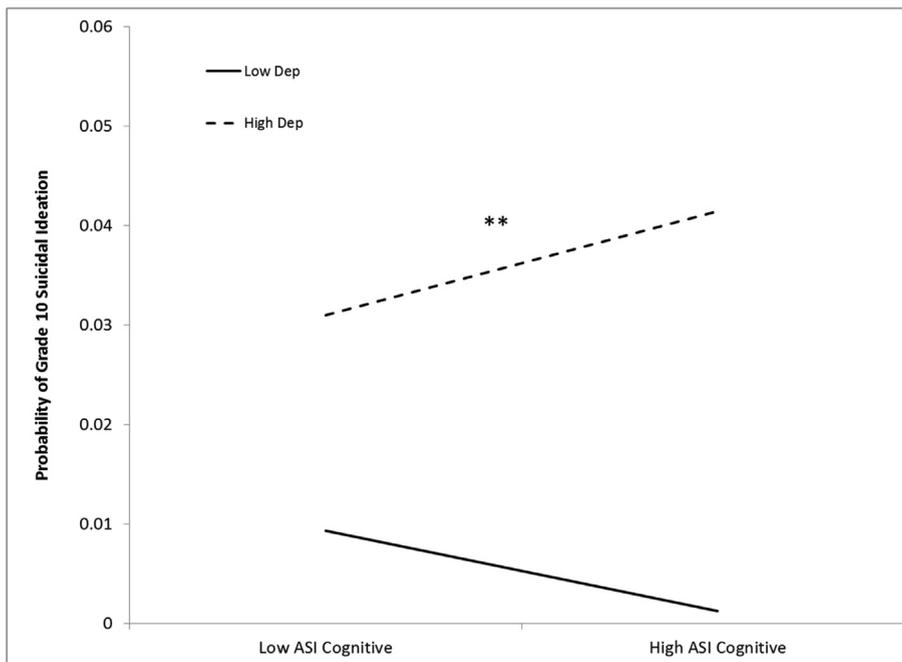


Fig. 1. Interaction of baseline (Grade 8) anxiety sensitivity cognitive concerns X grade 10 depressive symptoms predicting presence of grade 10 suicidal ideation. This analysis covaried for baseline suicidal ideation. ASI = Anxiety sensitivity index. Dep = depressive symptoms. $**p < .01$.

(baseline suicidal ideation, baseline Anxiety Sensitivity Index cognitive concerns, grade 10 anxiety symptoms, and the baseline Anxiety Sensitivity Index cognitive concerns X grade 10 anxiety symptoms interaction). As predicted, the anxiety sensitivity cognitive concerns X grade 10 anxiety symptoms interaction was not significantly associated with grade 10 suicidal ideation ($OR = 1.01, p = .080$).

Discussion

The current findings implicate a relationship between anxiety sensitivity cognitive concerns (i.e. a fear of cognitive dys-control) and elevated suicidal ideation in adolescents. This is the first study of the linkage between anxiety sensitivity cognitive concerns and suicidality among adolescents. As such, this study adds to a growing literature indicating anxiety sensitivity cognitive concerns are associated with suicidal ideation in clinical (Capron, Coughle, et al., 2012; Capron, Fitch, et al., 2012; Schmidt et al., 2001) and non-clinical (Capron, Blumenthal, et al., 2012; Capron, Gonzalez, et al., 2012; Capron et al., 2013) adult samples.

This study also clarifies some aspects of the relationship among adolescent anxiety, depression, and suicidality. First, we found that anxiety sensitivity cognitive concerns, but not anxiety sensitivity physical or anxiety sensitivity social concerns, significantly predicted future suicidal ideation above and beyond depressive symptoms and baseline suicidal ideation. Second, the results indicate that the depression distress amplification model is applicable to adolescents. In addition, the specificity analysis suggests that increased suicidality is the result of amplified *depression* symptoms, not amplified anxiety symptoms. Although a direct test is now indicated, this finding suggests that increased suicidality among adolescents with comorbid anxiety and depression may not solely be attributable to simple comorbidity or more overall psychopathology but rely on specific mechanisms. This study also adds to previous work indicating that this amplification model is associated with suicidal ideation in college students (Capron et al., 2014) and clinical outpatients (Capron, Norr, et al., 2014).

The depression distress amplification model is compatible with other current theories of suicide. One such model, Katz's positive feedback model of suicidality (Katz, Yaseen, Mojtabai, Cohen, & Galynker, 2011), posits that catastrophic cognitions in response to anxiety represent a specific vulnerability to the development of suicidal ideation. In this model, limbic-autonomic arousal leads to catastrophic ideation, which in turn perpetuates and heightens arousal. Within this positive feedback loop, catastrophic cognition is amplified, eventually activating suicidal ideation. We feel the depression-distress amplification model has a number of advantages compared to the Katz et al. (2011) positive feedback model. Primarily, the depression distress amplification model posits a specific mechanism (i.e. anxiety sensitivity cognitive amplification of depressive symptoms) that contributes to suicidal ideation whereas the positive feedback model describes a more generic process by which anxious/agitated distress is increased, and the model does not explicitly posit how suicidal ideation is triggered. In addition, the depression distress amplification model is both more specific and more parsimonious.

Anxiety sensitivity has been shown to be amenable to rapid amelioration. Therefore, we believe that targeting anxiety sensitivity is a particularly promising strategy of mitigating suicide risk. In adults, the utilization of brief interventions featuring psychoeducation and interoceptive exposure exercises have consistently reduced total anxiety sensitivity and anxiety sensitivity subfactors (Feldner, Zvolensky, Babson, Leen-Feldner, & Schmidt, 2008; Keough & Schmidt, 2012; Schmidt et al., 2014; Schmidt, Eggleston, et al., 2007). Currently, there is limited empirical work evaluating the efficacy of targeting anxiety sensitivity among children and adolescents. A brief (six session) school based group intervention targeting anxiety sensitivity in adolescents (aged 11–17) reduced anxiety symptoms post-intervention (Balle & Tortella-Feliu, 2009). However, these differences were not significantly different than a wait-list control group until a six month follow-up. Additional work on comparable programs is needed because targeted programs for adolescents, such as those that would target anxiety sensitivity reduction, show larger effects than universal prevention programs (Lau & Rapee, 2011).

It is important to note limitations of the present study. Primarily, there were low rates of suicidal ideation in our sample. However, there are a number of compelling explanations for these rates. First, the majority of the participants were African-American and the rates of suicidality observed in this study are in line with epidemiological findings that African-Americans (especially females) have very low rates of suicidality compared to overall averages or European Americans (CDC, 2013). Another possibility is that symptoms may have been underreported if interviewers were perceived as being from a different cultural background. Also, the suicidal ideation question was worded, “in the last year did you ever think seriously about killing yourself?”. Other studies reporting higher rates of suicidal ideation may have omitted the word *seriously*, which could artificially inflate superficial endorsement of suicidal ideation. Therefore, we believe the low rates of suicidal ideation are not a problem for the current study because it is unlikely to have systematically affected the sample. The result is endorsement of suicidal ideation only from the most suicidal adolescents. Another limitation is that anxiety sensitivity was only measured at baseline. Therefore, we were unable to test if current anxiety sensitivity cognitive concerns interacted with current depression to predict suicidal ideation at Grade 10. However, previous work on anxiety sensitivity has shown it to be stable over time unless treated (Maller & Reiss, 1992). Finally, the assessment of suicide-relevant behaviors was limited in the current report. It is not known, for example, whether the results of this study would generalize to death by suicide. However, past suicidal ideation is a strong predictor of future suicidal ideation and suicide related behaviors, such as suicidal ideation, are strong predictors of eventual death by suicide (Suominen et al., 2004).

The current study also had some notable characteristics. This was a prospective design with a rather large sample and an extended period between baseline and follow-up. Also, data for this study were the result of interviews with highly trained research staff. In addition, this study provided the first test of the depression distress amplification model in adolescents, which may clarify the pernicious relationships among anxiety, depression and suicidality. Although this study is an important first step, much more work is needed to elucidate the role of anxiety in suicidality across the lifespan.

Acknowledgments

This study was supported by National Institute of Mental Health R37 DA11796 and P30 MH 086043.

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