

Predicting Adolescent Risky Behavior Engagement: The Role of Cognitive Vulnerability and Anxiety

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To date, the relation between anxiety and risky behavior engagement among adolescents is unclear. While some research has shown a positive association, other research has indicated that anxious symptoms and such engagement are inversely related. In the current multi-wave, longitudinal study, the prospective relationship between stress, anxiety symptom clusters, and risky behavior engagement is explored among a sample of adolescents ($N = 151$). Moreover, the study also examined the role of stress-reactive rumination as a potential moderator between the stress and anxiety mediational pathway. Preliminary analyses indicated that whereas boys' anxiety predicted subsequent risky behavior engagement, this relationship was not significant among girls. Additionally, results of time-lagged, idiographic multilevel models indicate that in boys, but not girls, total, physical, and social anxiety symptoms mediate the relationship between stress and risky behavior engagement. Further, stress-reactive rumination moderated the mediational pathway between stress and anxiety for the total and physical anxiety symptom scales. These findings suggest that among boys anxious symptoms may be the path through which stress predicts risky behavior engagement, particularly in total and physical symptoms, and moreover, stress-reactive rumination moderates the mediational pathway between stress and anxiety.

Presently, there are two opposing theories regarding the association between anxiety and risky behavior engagement among adolescents, and overall, empirical findings have been largely inconsistent. Whereas some research suggests that anxiety is associated with risk avoidance (e.g., Nicholson, Soane, Fenton-O'Creevy, & Willman, 2005; Suhr & Tsanadis, 2007), other research has found that adolescents utilize risky behaviors as a means of attenuating the cognitive, affective, and physiological arousal associated with anxiety (e.g., Haegler et al., 2010; van Hamel, Derevensky, Takane,

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Dickson, & Gupta, 2007). As adolescents engage in a greater number and frequency of risky behaviors as compared to younger and older individuals (Fergus, Zimmerman, & Caldwell, 2007; Hasin, Stinson, Ogburn, & Grant, 2007; Lahey et al., 2000), research is warranted to better understand factors that potentiate such engagement.

Notably, the risk avoidance hypothesis suggests attentional and cognitive biases associated with anxiety influence decision-making in such a way that risks are likely to be avoided (e.g., Lorian & Grisham, 2010). Moreover, the tendency to avoid perceived risk plays an important role in the development and maintenance of anxiety (Maner & Schmidt, 2006). In support of this hypothesis, several temperamental characteristics, including behavioral inhibition and neuroticism, have been linked with risk-avoidant behavior (Gladstone, Parker, Mitchell, Willhelm, & Malhi, 2005; Nicholson et al., 2005; Paulus, Rogalsky, Simmons, Feinstein, & Stein, 2003; Suhr & Tsanadis, 2007). For example, a longitudinal study found that high behavioral inhibition in infancy protected against substance-related problems in adolescent girls (Williams et al., 2010). Further, trait anxiety, worry, and social anxiety have each been associated with risk avoidance in undergraduate samples (Maner et al., 2007; Maner & Schmidt, 2006), and clinically anxious patients have been shown to exhibit greater risk aversion compared to other clinical patients as well as nonclinical controls (Maner et al., 2007). As a whole, these studies suggest that greater anxiety may reduce the likelihood of risky behavior engagement.

Alternatively, past research suggests that anxiety increases the likelihood of engaging in risky behaviors. Kashdan, Collins, and Elhai (2006) suggest that engaging in such behaviors might temporarily increase perceptions of control over external and internal events and reduce dependence on avoidance behaviors as responses to threat. Others hypothesize that engaging in high-risk behaviors might reduce physiological arousal associated with anxiety (van Hamel et al., 2007). Along these lines, high trait anxiety is associated with greater risk-taking behavior in decision-making tasks (e.g., de Visser, van der Knaap, van de Loo, van der Weerd, Ohl, & van den Bos, 2010; Miu, Heilman, & Houser, 2008), and further, anxiety-inducing conditions increased risk-taking behavior compared to exercise and control conditions (Haegler et al., 2010). In light of these findings, it seems that anxious symptoms may be predictive of risky behavior engagement among adolescents.

Part of the difficulty in disentangling the relationship between anxiety and risky behavior engagement may be related to the examination of specific or singular behaviors versus broad-based engagement. Importantly, adolescents tend to engage in clusters of risky behaviors (Auerbach, Abela, & Ho, 2007; Fergusson, Horwood, & Lynskey, 1994), and Jessor and Jessor's (1977) *Problem Behavior Theory* suggests that the robust intercorrelations among deviant behaviors are the result of a common cause, often stemming from underlying emotional problems (McMahon & Luthar, 2006) or internalizing disorders (Bradley & Corwyn, 2002). Additionally, adolescent risky behaviors are shaped by environmental factors including age, financial means, parenting style, and peer influences (Auerbach et al., 2007; Jessor & Jessor, 1977; Racz, McMahon, & Luthar, 2011), underscoring the importance of focusing on clusters versus specific behaviors, as a given behavior may not be readily available following an anxiety-provoking situation. While research has found that adolescent anxiety promotes risk avoidance (Lorian & Grisham, 2010), the majority of such research has examined specific types of behaviors without exploring the spectrum of co-occurring behaviors utilized by adolescents. Critically, adolescents use an array of risky behaviors (Auerbach, Tsai, & Abela, 2010), and a focus on singular versus broad-based engage-

ment may not best represent, and in fact may underestimate, a given youth's pattern of engagement. Consequently, consistent with the *Problem Behavior Theory*, we hypothesized anxiety symptoms may potentiate broad-based risky behavior engagement in youth.

Stress, Anxiety, Risky Behavior Engagement, and Rumination

Research has also demonstrated that stressful life events have a robust association with both anxiety (e.g., Grant, Compas, Thurm, McMahon, & Gipson, 2004) and risky behaviors (e.g., Steinberg, 2008), and thus, it seems plausible that acute or chronic stressors in adolescents' lives may trigger anxiety. Moreover, once anxiety is elicited, some adolescents may use risky behaviors as a way to attenuate the negative affect associated with such anxiety. Such a conceptualization would be consistent with avoidance theories of anxiety as these behaviors may become positively reinforced given the temporary relief they provide, increasing the likelihood of using such behaviors in the future. Prolonged engagement in risky behaviors, however, may also result in negative consequences or additional stressors, which could serve to intensify the anxiety. In time, this pattern may initiate a vicious cycle involving stress, anxious symptoms, and risky behavior engagement (e.g., Auerbach et al., 2010), which ultimately, diminishes adolescents' distress tolerance of anxiety as well as their capacity to effectively attenuate anxiety using adaptive skills (Keough, Riccardi, Timpano, Mitchell, & Schmidt, 2010).

In addition to external stressors, underlying cognitive vulnerability factors also play a role in contributing to anxious symptoms. Specifically, rumination, operationalized as the tendency to engage in repetitive thinking about negative emotions, may be important to consider, as it is strongly associated with both anxiety and stress in adolescents (Garnefski, Legerstee, Kraaij, Van Den Kommer, & Teerds, 2002) and adults (Martin & Dahlen 2005; Muris, Roelofs, Meesters, & Boomsma, 2004). Rumination is recognized as a central cognitive vulnerability factor for both depression and anxiety (Nolen-Hoeksema, 2000) and moreover, rumination prospectively predicts anxiety (Calmes & Roberts, 2007; Nolen-Hoeksema, 2000; Roelofs et al., 2009). For example, Blagden and Craske (1996) demonstrated that emotion-focused rumination perpetuates anxiety in a laboratory-based task. Findings indicated that participants who completed a rumination task maintained anxious mood as opposed to attenuating such symptoms following a distraction task. Recently, Marks, Sobanski, and Hine (2010) found that dispositional rumination moderates the relationship between life hassles and anxiety symptoms and explains unique variance in anxiety and perceived stress after controlling for life hassles. However, Morrison and O'Connor (2005) found that neither rumination nor its interaction with stress predicted anxiety 6 months later. Given the inconsistency of rumination as a moderator of the stress-anxiety relationship, further research is warranted.

More recently, researchers have also begun to delineate the role of stress-reactive rumination, which focuses on repetitive thinking about negative inferences following stressful life events (Robinson & Alloy, 2003; Rood, Roelofs, Bogels, & Alloy, 2010). To date, most studies have focused on stress-reactive rumination in the context of depression. Alloy et al. (2000) reported that undergraduate students with a high cognitive risk for depression were more likely to have experienced a depressive episode in their lifetime if they endorsed higher levels of stress-reactive rumination. Similarly,

Skitch and Abela (2008) found that stress-reactive rumination moderates the pathway between stress and depression in a sample of adolescents. Moreover, Robinson and Alloy (2003) asserted that stress-reactive rumination may be a more robust predictor of depressive episodes as compared to more emotion-focused rumination. Although Rood and colleagues (2010) found that stress-reactive rumination among adolescents is as strongly related to anxiety as it is to depression, no research has explored whether stress-reactive rumination moderates the relationship between stress and anxiety.

Goals of the Current Study

The current study addresses important theoretical and empirical gaps in the extant literature among a sample of adolescents using a multi-wave, longitudinal design. Given the lack of clarity in the literature, we first examined the temporal relationship between anxious symptoms and risky behavior engagement and hypothesized that anxious symptoms would precede broad-based risky behavior engagement. Second, we hypothesized that the occurrence of stress would trigger anxiety, and further, anxious symptoms would mediate the relationship between stress and risky behavior engagement over time. As past preliminary research has shown an association among physical symptoms (van Hamel et al., 2007), separation/panic anxiety (Kaplow, Curran, Angold, & Costello, 2001), social anxiety (e.g., Hofmann, Richey, Kashdan, & McKnight, 2009), and risky behavior engagement, we also conducted exploratory analyses to determine if these symptom domains would differentially impact the proposed mediation model. Third, research has indicated that stress-reactive rumination is associated with higher levels of anxious symptoms (Rood et al., 2010); however, to our knowledge, research has not found that stress-reactive rumination moderates the relationship between stress and anxiety. In the current study, we hypothesized that stress-reactive rumination would moderate the mediational pathway between stress and total anxiety, and additionally, we believed that anxiety would mediate the relationship between stress and risky behavior engagement. Similar to our mediation model proposed above, we also explored whether specific symptom domains affected the moderated-mediation model. Last, adolescent boys engage in a greater number and frequency of risky behaviors as compared to girls, (e.g., Auerbach et al., 2010; Eaton et al., 2009), and therefore, we hypothesized that the mediation effect would be stronger for boys as compared to girls.

METHOD

Participants

The study included 151 adolescents (68 male and 83 female) from Montreal, Quebec, and ages ranged between 12–18 (Mean = 15.14 and $SD = 1.23$). The ethnic distribution of our participants included the following: 80.7% Caucasian, 5.3% Asian, 3.3% African American, 3.3% East Indian, 2.7% Native American, 1.3% Hispanic, and 3.3% Other.

Procedure

The study was granted approval by the university IRB committee, and treatment of participants was in accordance with APA guidelines. Prior to the initial assessment, letters were sent home to parents describing the general aims of the study examining the relationship between thoughts, feelings, and behaviors, and requesting consent for their child to participate. In order to participate in the study, all participants needed to provide both parental consent and personal assent. All assessments occurred on school grounds during the course of the regular school day. During the initial assessment, participants completed the following: (a) Demographics Form, (b) Multidimensional Anxiety Scale for Children (MASC; March, 1997), (c) Adolescent Life Event Questionnaire (ALEQ; Hankin & Abramson, 2002), and (d) the Responses to Stress Scale (RSS; Connor-Smith, Compas, Wadsworth, Thomsen, & Saltzman, 2000). Follow-up assessments occurred every six weeks for 4.5 months (Times 2–4), and participants completed self-report forms assessing stressful life events, anxious symptoms, and risky behavior engagement. The average rate of retention across assessments was 79%, and each participant completed a minimum of 3 out of 5 assessments, which ensured a reliable mean for repeated measures.

Measures

The Multidimensional Anxiety Scale for Children. The MASC (March, 1997) is a 39-item measure that assesses severity of anxious symptoms in the past week. Examples of questions include “I feel restless or on edge” or “I worry about what other people think of me” which respondents rate on a four-point Likert-type scale ranging from 1 (never applies to me) to 4 (often applies to me). The MASC included four subscales: (1) physical symptoms, (2) social anxiety, (3) separation anxiety, and (4) harm avoidance. Cronbach’s alphas ranged from .90 to .93 across assessments indicating strong internal consistency.

Adolescent Life Events Questionnaire–Revised. The ALEQ (Hankin & Abramson, 2002) is a self-report questionnaire developed to assess a broad range of negative life events (e.g., school/achievement problems, friendship and romantic problems, and family problems) occurring in the past month. Examples of questions include: “You fought with your parents over your personal goals, desires, or choice of friends,” “You did poorly on or failed a test or class project,” and “You had an argument with a close friend.” Participants indicated how often such events occurred on a Likert scale ranging from 0 (never) to 4 (always), with higher scores reflecting a greater number of negative life events. Past research has found that the ALEQ is both reliable and valid (Hankin & Abramson, 2002). In the current study, the Cronbach’s alphas ranged from .91 to .93, indicating high internal consistency.

Risky Behavior Questionnaire–Adolescents. The RBQ-A (Auerbach & Gardiner, in press) is a 20-item self-report measure that was created to assess frequency of engagement in the following types of risky behaviors in the past month: (1) unsafe sexual practices; (2) aggressive and/or violent behaviors; (3) rule breaking; (4) dangerous, destructive; and/or illegal behaviors; (5) self-injurious behaviors; and (6) alcohol and/or drug use. Examples of questions include “Have you had unsafe sex,” “Have you destroyed property (other than your own),” and “Have you used illegal drugs.” Respondents reported the frequency of their behaviors using the following scale (0–4):

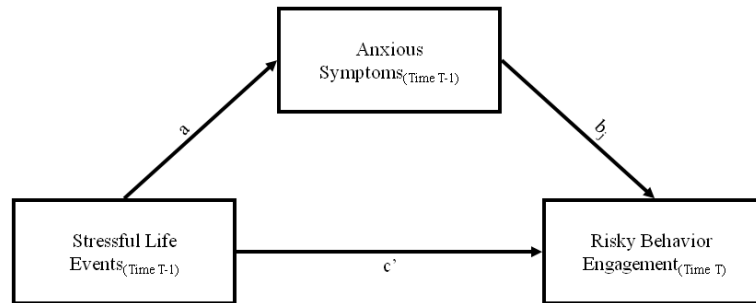


FIGURE 1. Anxious Symptoms as a Mediator between Stressful Life Events and Risky Behavior Engagement

never, 1 time per month, 2–4 times per month, 2–3 times per week, and 4 times or more per week. Past research using the RBQ has found that greater engagement in risky behavior is associated with diminished perceived control, lower emotion regulation, and higher levels of depressive and anxious symptoms (Auerbach et al. 2007; Auerbach et al., 2010). Additionally, the Cronbach's alpha ranged from .84 to .86 across administrations indicating strong internal consistency.

Responses to Stress Scale. The RSS (Connor-Smith et al., 2000) is a 57-item self-report measure that assesses a broad range of voluntary and involuntary coping strategies that adolescents employ in response to stressful life events. Item scores on the RSS range from 1–4 with higher scores indicating a greater propensity to employ a given coping strategy following a negative life event. While there are 19 factor analytically derived subscales on the RSS, the current study focused on the Rumination subscale. Specifically, the subscale operationalizes the tendency to ruminate in response to negative life events, and the items include, “When problems with other people come up, I can’t stop thinking about how I am feeling,” “When I have problems with other kids I can’t stop thinking about what I did or said,” and “When I have problems with other kids, I can’t stop thinking about why they happened to me.” Past research has utilized the RSS Rumination subscale, and results indicated that it is positively associated with depressive symptoms (Skitch & Abela, 2008). In the current study, the Cronbach's alpha for the RSS Rumination subscale was .77 indicating moderate internal consistency.

Overview of Data Analytic Approach

To examine our proposed mediation models, we utilized idiographic (i.e., within-person), time-lagged multilevel modeling in which time was nested within individuals (see Bauer, Preacher, & Gil, 2006). Bauer and colleagues (2006) designed the approach to examine mediation in the context of a repeated measures design, and in doing so, the model is estimated in a single equation, which estimates the variance of random effects from different Level 1 and Level 2 variables (see Figures 1 and 2). We also conducted a test of the indirect effect, and in doing so, used the formula provided

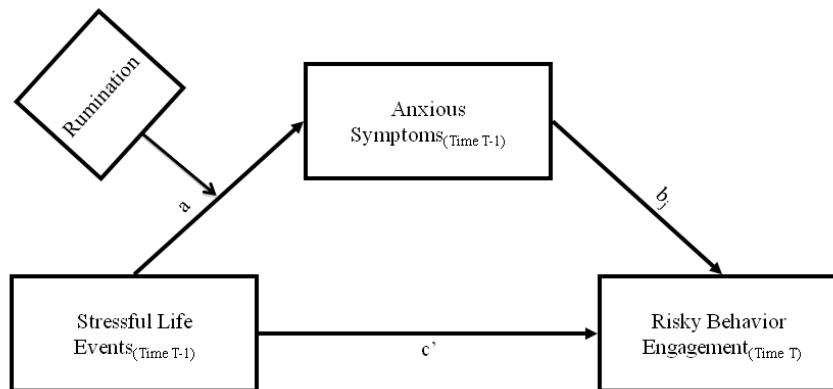


FIGURE 2. A Moderated-Mediation Approach to Understanding Risky Behavior Engagement in Adolescence

by Bauer et al. (2006) to compute the 95% confidence interval (CI). It is important to note that the mediation effect ($a*b_j$) is considered statistically significant if zero is not included in the CI. Analyses were carried out using SAS (version 9.2) MIXED procedure and maximum likelihood estimation. Given the non-normal distribution of risky behavior engagement, we also conducted analyses using a Poisson distribution (i.e., GLIMMIX). However, preliminary analyses indicated that regardless of whether we included a MIXED or GLIMMIX procedure, results remained the same. Moreover, in light of our idiographic approach coupled with the normal distribution of stress, anxiety, and rumination, a MIXED procedure for all model estimations was applied.

Our initial models examined whether anxious symptoms_(Time T-1) mediated the relationship between stress_(Time T-1) and risky behavior engagement_(Time T). Our subsequent models examined whether a ruminative response style moderated the mediational pathway between stress_(Time T-1) and anxious symptoms_(Time T-1). Further, the model explored whether anxious symptoms_(Time T-1) then mediated the relationship between stress_(Time T-1) and risky behavior engagement_(Time T). Importantly, in order to provide a more conservative test of the proposed hypotheses, we utilized a significance cutoff of $p < .01$ for all mediation models. Four additional effects were also included in this initial mean structure. First, in order to control for individual differences in baseline levels of risky behavior engagement, initial risky behavior scores were included in the model. Second, in order to account for individual variability of one's mean level of anxious symptoms, a random effect for intercept was included in the model. Third, given that anxious symptoms is a within-subject predictor whose effect is expected to vary from participant to participant, a random effect for slope was included in the model. Last, age was included as a covariate in all estimated models.

RESULTS

Descriptive Statistics

Bivariate Pearson correlations for the total sample as well as matrices separated by gender are included in Tables 1 and 2, respectively. Mean differences in risky behavior engagement during the course of the study are provided in Table 3.

TABLE 1. Pearson Correlations, Means, Standard Deviations, and Range for Baseline Instruments in the Total Sample

Variables	1.	2.	3.	4.	5.	6.	7.	8.
1. Age	—							
2. Rumination	-.05	—						
3. Risky Behavior Engagement	.20*	.02	—					
4. Total Anxiety Symptoms	-.05	.44***	-.07	—				
5. Physical Symptoms	.08	.35***	.24**	.76***	—			
6. Social Anxiety Symptoms	-.07	.39***	-.10	.82***	.49***	—		
7. Separation Anxiety Symptoms	-.13	.26**	-.24**	.62***	.29***	.36***	—	
8. Stressful Life Events	.08	.31***	.55***	.42***	.53***	.40***	.05	—
Mean	15.17	6.59	8.60	77.58	21.67	19.65	13.25	104.30
Standard Deviation	1.22	2.50	8.60	15.97	6.71	6.40	3.45	25.35
Low	12	3	0	41	12	9	9	61
High	18	12	50	131	42	35	23	183
Range	6	9	50	90	30	26	14	122

Note. * $p < .05$; ** $p < .01$; *** $p < .001$.

Examining the Temporal Relationship Between Anxious Symptoms and Risky Behavior Engagement

Idiographic, multilevel modeling was utilized in order to examine the temporal relationship between anxious symptoms and risky behavior engagement. When examining the total sample, anxious symptoms_(Time T-1) were not associated with changes in risky behavior engagement_(Time T), $b = 0.03$, $SE = 0.02$, $t(287) = 1.67$, ns . In light of the findings above, we also conducted gender-specific analyses, and results indicated that while the relationship was significant in boys, $b = 0.09$, $SE = 0.03$, $t(117) = 3.38$, $p < .01$, it was not significant in girls, $b = -0.01$, $SE = 0.02$, $t(168) = -0.60$, ns . Analyses were also conducted to examine whether risky behavior engagement_(Time T-1) preceded higher levels of anxious symptoms_(Time T) over time. For the total sample, results indicated that risky behavior engagement_(Time T-1) was not associated with changes in anxious symptoms_(Time T), $b = 0.07$, $SE = 0.11$, $t(280) = 0.66$, ns .¹ Moreover, irrespective of whether we examined boys, $b = -0.06$, $SE = 0.13$, $t(116) = -0.47$, ns , or girls, $b = 0.25$, $SE = 0.17$, $t(162) = 1.46$, ns , risky behavior engagement_(Time T-1) did not predict changes in anxious symptoms_(Time T).

1. Analyses were also conducted to examine the association between risky behavior engagement_(T-1) and anxiety symptom subscales_(Time T). Results indicated that whereas risky behavior engagement_(T-1) predicted (a) physical symptoms_(T), $b = 0.27$, $SE = 0.05$, $t(278) = 6.18$, $p < .001$, there was no association with (b) separation anxiety symptoms_(T), $b = -0.01$, $SE = 0.03$, $t(278) = -0.23$, ns , or (c) social anxiety symptoms_(T), $b = 0.003$, $SE = 0.04$, $t(278) = 0.09$, ns . Importantly, risky behavior engagement did not mediate the relationship between stress and subsequent physical anxiety symptoms.

TABLE 2. Pearson Correlations, Means, Standard Deviations, and Range for Baseline Instruments in Boys and Girls

Variables	1.	2.	3.	4.	5.	6.	7.	8.	
1. Age	—	.04	.25*	-.07	.05	-.18	-.04	.02	
2. Rumination	-.21	—	-.17	.42***	.25*	.40***	.19	.23*	
3. Risky Behavior Engagement	.25*	.19	—	-.03	.24*	-.04	-.23*	.47***	
4. Total Anxiety Symptoms	-.18	.42***	-.05	—	.78***	.84***	.64***	.48***	
5. Physical Symptoms	.05	.42***	.34**	.70***	—	.55***	.34**	.51***	
6. Social Anxiety Symptoms	-.07	.32**	-.16	.78***	.38***	—	.36**	.47**	
7. Separation Anxiety Symptoms	-.33**	.28*	-.23	.50***	.07	.32**	—	.11	
8. Stressful Life Events	.08	.37**	.65***	.33**	.58***	.27*	-.07	—	
Mean	Boys	14.75	6.02	9.42	73.35	20.28	18.54	12.33	100.22
	Girls	15.43††	6.95†	7.34†	80.38††	22.93††	20.64†	14.02††	106.97
Std. Dev.	Boys	1.47	2.48	10.21	13.59	6.85	5.20	3.03	25.55
	Girls	0.94	2.43	6.04	17.39	6.34	7.13	3.61	24.16
Low	Boys	12	3	0	43	12	9	9	61
	Girls	14	3	0	41	12	9	9	62
High	Boys	17	12	50	108	38	31	22	183
	Girls	18	12	23	131	42	35	23	166
Range	Boys	5	9	50	65	26	22	13	122
	Girls	4	9	23	90	30	26	14	104

Note. * $p < .05$; ** $p < .01$; *** $p < .001$; Pearson correlations for girls on the top portion of the diagonal and on the bottom portion of the matrix for boys; Independent Sample t -Test for gender differences.

† $p < .05$, †† $p < .01$.

Prospective Relationship between Stressful Life Events and Risky Behavior Engagement

Similar to the analyses described above, main effect analyses examined whether stress_(Time T-1) predicted changes in risky behavior engagement_(Time T) over time. The results of main effect analyses indicated that for the total sample, higher stress_(Time T-1) did not predict greater engagement in risky behaviors_(Time T) over time, $b = 0.02$, $SE = 0.01$, $t(287) = 1.27$, ns . When examining whether the relationship varied as a function of gender, the relationship was significant in boys, $b = 0.06$, $SE = 0.02$, $t(117) = 2.58$, $p < 0.01$, but not in girls, $b = -0.01$, $SE = 0.02$, $t(169) = -0.60$, ns .

Mediation Model: Stressful Life Events, Anxious Symptoms, and Risky Behavior Engagement

In light of the association between stress and risky behavior engagement in boys, we examined the prospective relationship between stress, anxious symptoms, and subsequent risky behavior engagement. However, as a significant relationship between

TABLE 3. Independent Sample t-Test of Risky Behavior Engagement in Boys and Girls

RBQ-A	Total	Boys Mean ± SD	Girls Mean ± SD	t-Value
Initial	8.47 ± 8.51	9.82 ± 10.64	7.34 ± 6.04	1.76
Follow-Up #1	7.24 ± 7.89	8.03 ± 9.01	6.60 ± 6.85	1.08
Follow-Up #2	6.46 ± 7.50	7.51 ± 8.91	5.72 ± 6.27	1.33
Follow-Up #3	5.83 ± 7.32	5.69 ± 7.86	5.93 ± 6.92	-0.19
Follow-Up #4	6.66 ± 6.38	5.53 ± 4.88	7.35 ± 7.13	-0.98

Note. * $p < .05$; ** $p < .01$; *** $p < .001$; Risky Behavior Questionnaire for Adolescents administered at the initial assessment and each follow-up assessment.

stress and risky behavior engagement is a critical part of mediation, mediation models in girls were not explored. Additionally, as research has indicated that stress is associated with different patterns of anxious symptoms (see Auerbach, Richardt, Kertz, & Eberhart, 2012), we estimated separate models for total, physical, separation, and social anxiety symptoms. All models included an autoregressive covariance structure as well as random effects for slope and intercept. First, consistent with our hypothesis, higher levels of stress predicted higher levels_(Time T-1) of total anxiety_(Time T), path a: $b = 0.21$, $SE = 0.04$, $t(348) = 5.06$, $p < 0.001$. When controlling for the proportion of variance accounted for by total anxious symptoms_(Time T-1) in predicting changes in follow-up risky behavior engagement_(Time T), path b_j: $b = 0.07$, $SE = 0.02$, $t(348) = 3.08$, $p < 0.01$, high levels of total anxious symptoms_(Time T-1) fully mediated the relationship between higher levels of stress_(Time T-1) and high levels of risky behavior engagement_(Time T), path c': $b = 0.02$, $SE = 0.01$, $t(348) = 0.93$, *ns*. The 95% CI (path a*b_j: $b = 0.02$, $SE = 0.01$; 0.003, 0.03) suggests that the mediation effect is significant. Second, a greater occurrence of stressful life events_(Time T-1) predicted higher levels of physical symptoms_(Time T-1), path a: $b = 0.10$, $SE = 0.02$, $t(344) = 6.24$, $p < 0.001$, and moreover, when controlling for the relationship between physical symptoms_(Time T-1) and risky behavior engagement_(Time T), path b_j: $b = 0.24$, $SE = 0.06$, $t(344) = 3.69$, $p < 0.001$, physical symptoms_(Time T-1) fully mediated the relationship between stress and risky behavior engagement_(Time T), path c': $b = 0.01$, $SE = 0.02$, $t(344) = 0.30$, *ns*. When examining the indirect effect, the 95% CI (path a*b_j: $b = 0.02$, $SE = 0.01$; 0.01, 0.04) suggests that the mediation model is significant. Third, an examination of social anxiety symptoms revealed that higher levels of stress_(Time T-1) predicted greater social anxiety_(Time T-1), path a: $b = 0.21$, $SE = 0.04$, $t(348) = 5.06$, $p < 0.001$, and further, social anxiety_(Time T-1) predicted higher levels of risky behavior engagement_(Time T), path b_j: $b = 0.07$, $SE = 0.02$, $t(348) = 3.08$, $p < 0.01$. After controlling for the relationship between social anxiety_(Time T-1) and risky behavior engagement_(Time T), the pathway between stress_(Time T-1) and risky behavior engagement_(Time T) was no longer significant, path c': $b = 0.01$, $SE = 0.02$, $t(344) = 0.30$, *ns*, indicating full mediation. An examination of the 95% CI (path a*b_j: $b = -0.02$, $SE = 0.01$; -0.03, -0.003) suggests that the mediation effect is significant. Last, when examining separation anxiety_(Time T-1), path b_j: $b = 0.23$, $SE = 0.23$, $t(344) = 1.91$, *ns*, symptoms did not predict changes in risky behavior engagement_(Time T) over time. Consequently, the mediation model including separation anxiety symptoms was not significant.

Moderated-Mediation: Examining the Role of Rumination

Following our initial analyses, we sought to explore whether a ruminative response style moderated the mediational pathway between stress and anxiety in the context of our broader mediation model delineated above. Again, all analyses were explored in boys as compared to girls given that main effect analyses indicated that stress_(Time T-1) did not predict changes in risky behavior engagement_(Time T) among adolescent girls. First, the interaction between rumination and stress predicted greater total anxiety_(Time T-1), path a: $b = 0.05$, $SE = 0.01$, $t(333) = 3.49$, $p < 0.001$, and greater total anxiety_(Time T-1) predicted subsequent risky behavior engagement_(Time T), path b_j: $b = 0.07$, $SE = 0.02$, $t(333) = 2.67$, $p < 0.01$. Mediation analyses also revealed that total anxiety_(Time T-1) fully mediated the relationship between stress_(Time T-1) and risky behavior engagement_(Time T), path c': $b = 0.02$, $SE = 0.02$, $t(333) = 0.99$, ns . When testing the indirect effect, the 95% CI suggests that the mediation effect is significant (path a*b_j: $b = 0.003$, $SE = 0.001$; 0.002, 0.01). Second, results indicated that stress_(Time T-1) interacted with a ruminative response style to predict changes in physical anxious symptoms_(Time T-1), path a: $b = 0.03$, $SE = 0.01$, $t(333) = 4.47$, $p < 0.001$. Additionally, physical anxious symptoms_(Time T-1) predicted subsequent risky behavior engagement_(Time T), path b_j: $b = 0.23$, $SE = 0.06$, $t(333) = 3.59$, $p < 0.001$, and such symptoms fully mediated the relationship between stress_(Time T-1) and risky behavior engagement_(Time T) in boys, path c': $b = 0.01$, $SE = 0.02$, $t(333) = 0.27$, ns . The 95% CI (path a*b_j: $b = 0.01$, $SE = 0.002$; 0.002, 0.01) suggests that the mediation model is significant. Third, rumination moderated the mediational pathway between stress_(Time T-1) and separation anxiety_(Time T-1), path a: $b = 0.01$, $SE = 0.003$, $t(333) = 3.08$, $p < 0.01$, and separation anxiety_(Time T-1) predicted subsequent risky behavior engagement_(Time T), path b_j: $b = 0.27$, $SE = 0.12$, $t(333) = 2.29$, $p < 0.05$. Moreover, separation anxiety_(Time T-1) mediated the relationship between stress_(Time T-1) and risky behavior engagement_(Time T), path c': $b = 0.01$, $SE = 0.02$, $t(333) = 0.95$, ns . At the same time, 95% CI suggests that the mediation model is not significant (path a*b_j: $b = 0.002$, $SE = 0.001$; -0.0002, 0.005). Last, social anxiety_(Time T-1), path b_j: $b = 0.11$, $SE = 0.07$, $t(329) = 1.71$, ns , symptoms did not predict prospective fluctuations in risky behavior engagement_(Time T). Consequently, the mediation models including social anxiety symptoms were not significant.

DISCUSSION

Adolescence is a period marked by developmental and social change, and for many, mood-related difficulties and risky behavior engagement often co-occur (Auerbach et al., 2010). The current study sought to delineate the temporal relationship between stress, anxiety symptoms, and risky behavior engagement. When examining the sample as a whole, anxious symptoms did not prospectively predict greater risky behavior engagement. However, gender-specific analyses found that for boys, but not girls, higher levels of anxiety were associated with subsequent risky behavior engagement. Similarly, results indicated that in boys, but not girls, total and physical anxiety symptoms mediated the relationship between stress and subsequent risky behavior engagement. Expanding on these findings, the current model also found that for boys stress-reactive rumination moderated the mediational pathway between stress and total and

physical anxious symptoms suggesting that underlying cognitive vulnerability factors may potentiate risky behavior engagement. Taken together, our findings suggest that the anxiety–risky behavior association may be stronger in boys as compared to girls, which may, in part, account for the inconsistent findings of past research.

Understanding Risky Behavior Engagement Among Boys

Equivocal data has “muddied the waters” with respect to the anxiety–risky behavior relationship. The current study examined broad-based engagement, and results indicated that anxious symptoms among boys, but not girls, potentiated greater risky behavior engagement. These findings are interesting to consider in that no gender differences emerged when comparing risky behavior engagement over time, and moreover, girls reported higher levels of anxious symptoms (see Tables 2 and 3). Expanding on these findings within boys, results also indicated that anxious symptoms, in particular total and physical anxious symptoms, mediated the relationship between the occurrence of stress and subsequent engagement in risky behaviors. These findings suggest that stress triggers the onset of anxious symptoms, and such symptoms increase the likelihood of boys engaging in risky behaviors. Consistent with van Hamel and colleagues (2007), adolescent boys may be using these behaviors as a means of managing the physical discomfort associated with anxiety. Substance use research has often referred to this approach as “self-medication” (e.g., Cooper, Frone, Russell, & Mudar, 1995), and these findings suggest that broad-based risky behavior engagement may serve a similar function.

Importantly, the results also found that stress-reactive rumination moderated the mediational pathway between stress and total/physical anxious symptoms in boys. These findings are an important extension over past research as it delineates the role that self-focused attention plays in potentiating anxious symptoms. Specifically, the majority of past research has examined the role of emotion-focused rumination (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008); however, there is a growing body of literature that has begun to disentangle the role that stress-reactive rumination plays in increasing susceptibility to anxious and depressive symptoms (e.g., Robinson & Alloy, 2003). The current findings suggest that heightened self-focus on a given negative life event may exacerbate anxious symptoms as stress-reactive rumination may increase the salience of the negative event and potentially, intensify cognitive distortions related to the event (Skitch & Abela, 2008). As stress-reactive rumination strengthens the association between stress and anxious symptoms, these heightened symptoms seem to be triggering greater risky behavior engagement.

Adolescent Girls and Risky Behavior Engagement

Our results indicate that in adolescent girls, stress is associated with anxious symptoms; however, stress did not prospectively predict risky behavior engagement. While these null findings are in contrast to our hypothesis, it is consistent with findings from adults in which negative life events predicted alcohol-related problems in men but not women (Cooper, Russell, Skinner, Frone, & Mudar, 1992), and men were more likely than women to report using alcohol (Cooper et al., 1992) and substances (Nolen-Hoeksema, 2000) to cope with their problems. Similar studies in adolescents

have generated mixed results. Notably, whereas Wills and colleagues (Wills, Sandy, Yaeger, Cleary, & Shinar, 2001) reported that stress is a stronger predictor of substance use in girls than in boys, Laurent, Catanzaro, and Callan (1997) found no gender difference in the relationship between negative life events and alcohol use. One possibility for our null findings is that anxiety may contribute to more risk-averse or -avoidant behaviors (e.g., Maner et al., 2007; Maner & Schmidt 2006), behavioral inhibition (Hirshfeld et al., 1992; Muris, Merckelbach, Schmidt, Gadet, & Bogie, 2001), and diminished sensation-seeking tendencies (e.g., Zuckerman, Kolin, Price, & Zoob, 1964). In the current study, compared to boys, girls report a higher level of anxiety across domains. Moreover, girls in our sample also reported higher levels of stress-reactive rumination as compared to boys (see Table 2). Wills et al. (2001) posit reflective coping styles, such as rumination, may prevent risk behavior as they limit impulsivity. Alternatively, relative to boys, girls may be more constrained in their range of risky behaviors, which may limit the magnitude of associations with anxiety. Taken together, it seems plausible that greater anxiety and stress-reactive rumination may differentially impact the likelihood of girls' risky behavior engagement. At the same time, as these findings were not hypothesized, this difference warrants more critical attention in future research.

Limitations

Despite a number of strengths in the current study, it is not without limitations. First, the current study employed self-report measures, which did not allow us to draw conclusions regarding anxiety disorders. Rather, the study focused on examining symptom fluctuations as a function of domain (i.e., physical, social, and separation anxiety symptoms). Future research would benefit from exploring how anxiety diagnoses differentially affect prospective risky behavior engagement. Second, the study examined broad-based risky behavior engagement; however, the instrument is not exhaustive. While the strength of the measure is that it explores monthly frequency across domains, it does not capture the complete breadth of adolescent risky behavior engagement. Moreover, while there is benefit in examining broad-based risky behavior engagement, there are also critical advantages to examining specific behaviors, which is an important limitation of the study. Third, while the RBQ-A has been used in a number of studies, it is currently an unpublished instrument, and it is not clear if the RBQ-A is associated with other measures of risk-taking. Moreover, given that only self-report as opposed to third-party report (peer and/or parent) was utilized to assess risky behavior engagement, the findings may be susceptible to mono-method bias pertaining to reports of inappropriate conduct (i.e., risky behavior engagement). Fourth, in the current study we utilized a negative event checklist, which examines stressors across achievement and interpersonal domains. At the same time, adolescent girls experience a greater number of interpersonal stressors as compared to boys (Rudolph, 2009). As interpersonal stressors may be more salient for girls, it could trigger emotion dysregulation and impulsivity, which may then lead to subsequent risky behavior engagement (e.g., Adrian, Zeman, Erdley, Lisa, & Sim, 2011). In the current study, we found that stress was not prospectively associated with such engagement in girls, and thus, it may be important for future research to utilize a more fine-grained measure of stress in order to better assess and understand this phenomenon. Last, similar to the symptom measures, the current study used a self-report instrument to assess

stress-reactive rumination. While the scale is reliable and valid, future research would benefit from using more sophisticated behavioral instruments, which capture implicit versus explicit functioning. As many cognitive vulnerability factors exist outside of conscious awareness, it is important to integrate tools that unpack these constructs using more objective approaches.

Clinical Implications

The findings provide insight into a destructive pathway that leads to greater risky behavior engagement among boys, and moreover, underscores the importance of examining broad-based versus specific behaviors in adolescents. Ultimately, these findings have important clinical implications. Specifically, psychoeducation about these potentially harmful patterns of behavior during the course of psychotherapy may offer adolescent boys an understanding of both the onset and maintenance of anxiety in their lives. Further, clinicians may provide adolescents with adaptive alternatives to better manage stress and anxiety, which may reduce the short- and long-term negative consequences of risky behavior engagement.

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