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Multi-wave Prospective Examination of the Stress-Reactivity Extension of Response Styles Theory of Depression in High-Risk Children and Early Adolescents

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Abstract

The current study tested the stress-reactivity extension of response styles theory of depression (Nolen-Hoeksema Journal of Abnormal Psychology 100:569-582, 1991) in a sample of high-risk children and early adolescents from a vulnerability-stress perspective using a multi-wave longitudinal design. In addition, we examined whether obtained results varied as a function of either age or sex. During an initial assessment, 56 high-risk children (offspring of depressed parents; ages 7-14) completed measures assessing rumination and depressive symptoms. Children were subsequently given a handheld personal computer which signalled them to complete measures assessing depressive symptoms and negative events at six randomly selected times over an 8-week follow-up interval. In line with hypotheses, higher levels of rumination were associated with prospective elevations in depressive symptoms following the occurrence of negative events. Sex, but not age, moderated this association. Rumination was more strongly associated with elevations in depressive symptoms following the occurrence of negative events in girls than in boys.

Keywords

Response styles theory; Rumination; Depressive symptoms; Children

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While it was once believed that childhood depression is either rare or a transitory developmental phenomenon, evidence has accumulated regarding its high prevalence rate, chronic course, and debilitating consequences (Avenevoli et al. 2008). Childhood depression often represents the start of a chronic disorder, with a substantial proportion of depressed youth exhibiting continuity into adulthood and experiencing recurrent depression in adulthood (Rutter et al. 2006). In addition, depression in children and adolescents has been found to be associated with impairment in multiple domains of functioning as well as with a wide range of psychiatric and physical health problems in adulthood (Harrington 1996). Due to an increasing awareness of the high rates of depression among youth, as well as of its many debilitating consequences, researchers have begun to place a greater emphasis on understanding the etiology of depression in children and adolescents.

One prominent cognitive theory of depression that has received considerable attention in the adult literature is Nolen-Hoeksema's (1991) response styles theory (RST). RST posits that the way in which individuals respond to their symptoms of depression influences the severity and duration of such symptoms. Central to this theory is the concept of rumination. Rumination involves focusing passively and repetitively on one's depressive symptoms, as well as on their causes, meanings, and consequences, without actively taking steps either to alleviate such symptoms or to correct the problems that triggered them. RST posits that individuals who respond to their depressive symptoms by engaging in rumination will experience more severe and longer lasting symptoms. Nolen-Hoeksema (1991) posits three mechanisms by which rumination serves to increase the severity and duration of depressive symptoms. First, rumination is hypothesized to amplify the negative effects of depressed mood on thinking leading individuals to make more negative attributions and inferences which in turn contribute to more depressed mood. Second, rumination is posited to interfere with instrumental behaviours that could potentially alleviate depressive symptoms by providing opportunities for both positive reinforcement and the development of a sense of control. Last, rumination is proposed to hinder effective problem-solving by making negative cognitions more accessible and by inhibiting the initiation of problem-solving behaviour. RST was originally developed in order to explain the sex difference in depression that emerges during adolescence. Specifically, Nolen-Hoeksema posits that females are more likely to experience severe and longer lasting depressive episodes due to their greater tendency to ruminate as compared to males (Nolen-Hoeksema 1990).

RST has received strong support in studies examining the theory utilizing adult samples. Such studies have shown that higher levels of rumination are associated with both greater increases in and longer duration of depressive symptoms (Nolen-Hoeksema et al. 2008; Watkins 2008). In addition, women are more likely than men to ruminate in response to depressed mood, and rumination has mediated the association between sex and depression (see Nolen-Hoeksema et al. 2008 for review).

Relatively fewer prospective studies, however, have examined whether rumination is associated with increases in depressive symptoms over time in child and adolescent samples. Results from the studies that have been conducted have consistently supported the hypothesis that rumination is associated with greater increases in depressive symptoms over time (Abela et al. 2007, 2002, 2009; Broderick and Korteland 2004; Hankin 2008a; Shwartz and Koenig 1996; see Abela and Hankin 2008 for review) and onset of clinical depression in adolescence (Abela and Hankin 2011). Support for the hypothesis that girls exhibit greater rumination than boys, however, has been mixed. The majority of studies using child and early adolescent samples failed to obtain support for this hypothesis (Abela et al. 2007, 2002, 2004; Abela and Hankin 2011; Broderick and Korteland 2004; for exception, see Ziegert and Kistner 2002), and studies using middle to late adolescent samples obtain the

hypothesized sex difference (Abela et al. 2009; Hankin 2008a, 2009; Shwartz and Koenig 1996).

The primary goal of the current study was to provide a prospective examination of Nolen-Hoeksema's (1991) RST in a sample of children and early adolescents. Moreover, we sought to test an extension of the original RST that focuses on whether the association between rumination and depressive symptoms over time is moderated by the occurrence of negative events (Nolen-Hoeksema et al. 1999). Individuals who exhibit a tendency to ruminate in response to feelings of sadness may be particularly likely to engage in rumination following the occurrence of stressors in their lives (Robinson and Alloy 2003). Such stress-reactivity rumination may lead individuals to focus on the negative inferences that they have made in response to the stressors that have occurred, leading them to make additional depressogenic attributions and inferences as well as to elaborate upon existing ones. Compared to research examining the main effects model of RST, which focuses exclusively on rumination as a predictor of depression (symptoms or disorder), relatively few studies have tested the stress-reactive extension of RST. Preliminary studies show that higher levels of rumination interact with increased levels of stress to predict elevated levels of depressive symptoms in adult samples (Nolen-Hoeksema et al. 1999) and prospectively in adolescent samples (Abela and Hankin 2011; Hankin 2009; for exception see Abela et al. 2009). At the same time, however, no study has examined the stress-reactive extension of RST in a younger aged and high-risk sample.

The second goal of the current study was to examine whether age moderates the association between rumination and depressive symptoms. Some researchers have hypothesized that cognitive vulnerability factors, such as a ruminative response style, do not begin to moderate the association between negative events and increases in depressive symptoms until the transition from middle childhood to early adolescence. Such researchers have hypothesized that cognitive constructs begin to show greater stability once increases in abstract reasoning and formal operational thinking begin to emerge (Nolen-Hoeksema et al. 1992; Turner and Cole 1994). Contrary to this developmental hypothesis, however, preliminary research examining cognitive vulnerability theories in child and early adolescent samples has failed to obtain support for age as a moderator of the association between rumination and changes in depressive symptoms over time (Abela et al. 2002, 2007). Moreover, longitudinal research with early to middle adolescents shows that rumination exhibits trait-like, stable properties (Hankin 2008b), contrary to the earlier views that cognitive constructs, such as rumination, would show increased stability in adolescence with emergence of formal operational thinking. Due to continued debate on this topic, we examined age as amoderator of the longitudinal association between a ruminative response style and depressive symptoms following the occurrence of negative events in a younger aged sample.

The final goal of the current study was to examine two possible explanations for the sex difference in depression (see Hankin and Abramson 1999; Nolen-Hoeksema and Girgus 1994) from the perspective of RST. First, a moderation model of sex differences in depression posits that the strength of the association between risk/vulnerability factors and depression varies as a function of sex. With respect to the current study, such a model would hypothesize that the strength of the association between a ruminative response style and increases in depressive symptoms following the occurrence of negative events is stronger in girls than in boys. Second, a mediation model suggests that girls would report higher levels of rumination and/or a greater frequency of negative events than boys. Consistent with a mediation perspective for the stress-reactive RST model, Hankin (2009) found that the interaction of rumination with stressors over time partially accounted for the sex difference in adolescent depression. We examined both a moderation and mediation model in this multi-wave study.

In order to provide a powerful test of our hypotheses, we utilized a multi-wave design with relatively short follow-up intervals. Specifically, participants were provided with handheld personal computers (HP Jordana 720) that were programmed to signal them to complete questionnaires assessing depressive symptoms and the occurrence of negative events at six randomly selected times over the course of a two-month follow-up interval. One advantage of this approach is that it allows for the assessment of negative events and depressive symptoms in a naturalistic setting, thereby minimizing the impact that timing and context have on such assessments. An additional advantage is that participants must complete questionnaires in real time and with a relatively short-term follow-up, both of which minimize recall biases potentially associated with depressed mood. Last, we tested hypotheses with this approach and among a sample of children of parents with a history of major depressive episodes. Given that such children are four to six times more likely to develop depressive symptoms than are other children (Goodman and Gotlib 2002), the use of such a sample maximized the number of participants who experienced increases in depressive symptoms over the course of the study. In sum, this approach with a high-risk sample should provide a strong test of the primary hypothesis that rumination enhances the stress reactivity effect on depressive symptoms when youth encounter stressful events and secondary hypotheses exploring age and gender influences.

Method

Participants

Participants were recruited from a sample participating in a larger research project examining vulnerability to depression in children of parents with a history of depression (e.g., Abela et al. 2005, 2006). Participants in the larger project were recruited via advertisements in local English newspapers as well as through flyers that were posted around the greater Montreal area. The advertisements and flyers specifically targeted parents with a history of Major Depressive Disorder with children between the ages of 6 and 14 years old. Parents who responded to the advertisements and who met criteria for current or past Major Depressive Disorder using the Structured Clinical Interview for the DSM-IV (SCID-I; First et al. 2001) were invited to participate in the study. The initial sample consisted of 102 parents and 140 children. Of the initial sample, 56 children (25 girls, 31 boys) consented to participate in the in-depth, multi-wave assessment portion of the study. These children ranged in age from 7 to 14 (m=10.6 years). The final sample of 56 children did not consist of any sibling pairs. The ethnic distribution of the final sample was 78.8% Caucasian, 1.9% Native American, 1.9% Asian and 17.3% multi-ethnic. Of the parents who participated in the current study, 56.9% were married, 25.5% were divorced, 9.8% were separated, 2.0% were single and 5.9% were in the category “other”. Participants had a median family income of $30,000 to $45,000. The highest level of education completed by parents was distributed as follows: some high school education (3.9%), high school diploma (3.9%), some community college (7.8%), community college diploma (11.8%), some university (23.5%), university diploma (25.5%) and graduate diploma (23.5%). Those children who chose to participate in this portion of the study did not significantly differ from children, based on the initial baseline, who did not participate in terms of age (t(101)=1.31, ns), gender (t(101)=0.48, ns), parental education (t(101)=-0.53, ns), family income (t(94)=-1.03, ns) or level of child’s depressive symptoms at initial assessment (t(101)=1.40, ns).

Procedure

All participants were recruited during the final lab-based assessment performed as part of the larger research study mentioned above. During this assessment, children and parents were asked if they would like to participate in this more in-depth portion of the study. Those

who agreed to participate signed consent forms for this portion of the study. A research assistant then read the following questionnaires to the child: (1) Children's Depression Inventory (CDI; Kovacs 1981) and (2) Children's Response Styles Questionnaire (CRSQ; Abela et al. 2002). Each child was then given an HP Jornada 720 handheld computer which was programmed to signal the child to complete self-report measures assessing the occurrence of negative events and the presence of depressive symptoms every 5-9 days over a period of eight weeks. The handheld computers were programmed to signal the child at random times while he/ she was not at school. Each time the alarm sounded, the child opened the handheld computer and the questionnaires were read aloud while response options appeared on the screen. The child was instructed to select the response that best described him/her *at the time*. Each time the alarm sounded, two questionnaires were completed: (1) Children's Depression Inventory (CDI; Kovacs 1981) and (2) Hassles Scale for Children (HASC; Kanner et al 1987). For each child, six assessments of both depressive symptoms and negative events occurred over the course of the study. As expected, not all youth completed every assessment (see Table 2 for *N*'s at different times). Analyses to examine the pattern of missing data showed it to be missing at random (Schafer and Graham 2002).

Measures

Structured Clinical Interview of the DSM-IV (SCID-I; First et al. 2001) The SCID-I is a semi-structured clinical interview commonly used to assess current as well as lifetime DSM-IV diagnoses. The study employed the affective disorders module and psychotic screen, allowing for diagnosis of all DSM-IV mood disorders. The SCID-I is frequently used to assess depression and has yielded reliable results in past clinical studies of adult depression (Klein et al. 2005). The SCID-I interviews were administered by the principal investigator (JRZA), doctoral students in clinical psychology, and the project coordinator. All diagnosticians completed intensive training in administering the SCID-I interviews and for assigning DSM-IV diagnoses. The training program consisted of 40 h of instruction, listening to recorded interviews, conducting practice interviews, and passing exams with a minimum grade of 85%. In order to conduct interviews, all interviewers had to listen to three recorded interviews and demonstrate 100% agreement with the PI on the presence or absence of a diagnosis of a depressive disorder. In addition, there had to be at least 85% agreement on the severity ratings of each depressive symptom. The PI held weekly meetings with the diagnosticians and reviewed their notes and tapes in order to confirm diagnoses.

Children's Depression Inventory (CDI; Kovacs 1981) The CDI is a self-report questionnaire that assesses cognitive, affective and behavioral symptoms of depression. For each of the 27 items contained within the questionnaire, children are asked whether it describes their thoughts and feelings in the past week. Each item is rated on a scale of 0 to 2 with higher scores representing a higher severity of symptoms. The scores from each item are summed with total scores on the CDI ranging from 0 to 54 points. The CDI yielded high internal consistencies (α's ranged from 0.80 to 0.87) and has good validity (Klein et al. 2005).

Children's Response Styles Questionnaire (CRSQ; Abela et al. 2002) The CRSQ is a self-report questionnaire used to assess children's responses to their depressive symptoms. The CRSQ is modelled after Nolen-Hoeksema's Response Style Questionnaire (Nolen-Hoeksema and Morrow 1991). Only the rumination subscale of the CRSQ was used in this study. The CRSQ-Rumination subscale contains 13 items describing responses to depressed mood that are self-focused. For each item, the child must indicate how often he/she responds to sadness in this way on a scale from 0 to 3 (almost never= 0, sometimes=1, often=2, or almost always=3). Scores on the CRSQ-Rumination subscale range from 0 to 39 with higher scores indicating a greater tendency to ruminate in response to depressed mood. Past research has shown the CRSQ-Rumination subscale to be reliable and valid (Abela et al.

2002) and exhibit good test-retest reliability and stability over time (Hankin 2008b). Coefficient alpha was 0.80.

Hassles Scale for Children (HASC; Kanner et al. 1987) The HASC is a self-report questionnaire assessing life stressors that children experience. It consists of 39 hassles that children typically experience (e.g., parents separate or divorce, a close friend moves away). In the current study, children were asked to rate how often they experienced each hassle since the last administration of the questionnaire on a scale from 1 (*never*) to 4 (*all the time*). The scores of each item are summed to obtain a total score on the questionnaire ranging from 0 to 156, with higher scores indicating the occurrence of a greater number of hassles.

Results

Descriptive Statistics

Means, standard deviations, and intercorrelations between all Time 1 measures are presented in Table 1. Means and standard deviations for CDI and HASC scores across the six follow-up assessments are presented in Table 2. Given that each child completed the CDI at multiple follow-up assessments, each child has his/her own mean level of depressive symptoms as well as his/her own degree of variation in depressive symptoms during the follow-up interval. Within-subject means on the CDI ranged from 0.00 to 21.83 (m=7.64; SD=5.87) while within-subject standard deviations ranged from 0.55 to 16.92 (m=3.00; SD=2.76). With respect to hassle scores, within-subject means on the HASC ranged from 3.00 to 90.00 (m=32.91; SD=18.62) while within-subject standard deviations ranged from 1.41 to 51.08 (m=9.76; SD=8.78).

Vulnerability-Stress Analyses: Stress Reactive Rumination

The use of a multi-wave longitudinal design allowed us to examine the extended RST using an idiographic approach to analysis (e.g., Abela and Hankin 2008, 2011). More specifically, we examined whether the slope of the relationship between negative events and increases in depressive symptoms *within* participants varied *across* participants as a function of a ruminative response style, age and sex. One advantage of utilizing such an approach to analysis is that it allows for the reliable estimation of each participant's degree of stress reactivity (i.e., his or her slope of the relationship between stressors and depressive symptoms). Given that vulnerability-stress models are fundamentally theories of differential stress reactivity, the conceptualization of stress from an idiographic perspective provides an ideal framework for testing such theories. A second advantage of utilizing such a data analytic approach is that for each participant, a high level of stress is operationalized in relation to his/her own average level of stress rather than in relation to the sample's average level of stress. Such an approach towards operationalizing high and low stress levels minimizes the impact of individual differences in the reporting of negative events.

Analytically to test the hypothesis that higher levels of rumination would be associated with greater increases in depressive symptoms following increases in hassles, we employed hierarchical linear modeling. Analyses were conducted using SAS (version 9.1) MIXED procedure and robust maximum likelihood estimation. Our dependent variable was within-subject fluctuations in CDI scores during the follow-up interval (FU_CDI). Primary predictors of FU_CDI were rumination (RUMINATION), fluctuations in HASC scores during the follow-up interval (HASSLES), and the RUMINATION×HASSLES interaction. As RUMINATION is a between-subject predictor, RUMINATION scores were standardized prior to analyses. As HASSLES is a within-subject predictor, HASSLES scores were centered at each participant's mean prior to analyses such that HASSLES reflects upwards or downwards fluctuations in hassles compared to his or her mean level of hassles.

To control for individual differences in baseline level of depressive symptoms, Time 1 CDI scores were included in the model. In short, this analytic approach examines associations between predictors (e.g., RUMINATION x HASSLES) and CDI after adjusting for baseline and lagged links between adjacent CDI scores.

Model specification was achieved using a sequential strategy which involved first examining random-effect components and then examining fixed-effect components. Models initially included random intercept and slope. Additionally, each model included a first-order autoregressive covariance parameter to account for inter-correlation among within-subject residuals over time. Non-significant random effects were deleted from the model prior to examining fixed effects. With respect to random effects, the intercept (p'0.001) and autoregressive AR(1) parameter (r=0.27, p'0.05) were significant and thus were retained in the model. The random effect of slope, however, was not significant and consequently was deleted from the model prior to examining the fixed effects.

Results with respect to the fixed-effects component of the model are presented in Table 3. Of primary importance, the RUMINATION×HASSLES interaction was a significant predictor of within-subject fluctuations in depressive symptoms during the follow-up interval. In order to examine the form of the RUMINATION×HASSLES interaction, the model summarized in Table 3 was used to calculate predicted CDI scores for children possessing either high or low levels of rumination (plus or minus 1.5 SD) who are experiencing either high or low levels of hassles in comparison to their own average level of hassles (plus or minus 1.5 SD×mean within-subject SD). The results of these calculations are presented in Fig. 1. As both FU_CDI and HASSLES are within-subject variables, slopes are interpreted as the increase in a participant's CDI score that would be expected given that he or she scored one point higher on the HASC. Analyses were conducted for each RUMINATION condition examining whether the slope of the relationship between hassles and depressive symptoms significantly differed from 0. Analyses indicated that children possessing high levels of rumination reported higher levels of depressive symptoms when experiencing high levels of hassles than when reporting low levels of hassles (slope=0.18, t(204)=4.71, p'0.0001). At the same time, level of depressive symptoms did not vary as a function of HASC scores for children possessing low levels of rumination (slope=-0.12, t(204)=-1.95, *ns*). Planned comparisons of the slopes of the relationship between HASC scores and depressive symptoms revealed that the slope was significantly greater in children possessing high levels of rumination than in children possessing low levels of rumination (t(204)=3.34, p'0.01).

Age as a Moderator of the Association between Rumination and Depressive Symptoms

Similar analyses as described above were carried out in order to examine whether age moderated the relationship between rumination and fluctuations in depressive symptoms. Once again, our dependent variable was FU_CDI. Primary predictors of FU_CDI were children's age, RUMINATION, HASSLES, and all two- and three-way interactions. With respect to random effects, the intercept (p'0.001), and AR(1) parameter (r=0.24, p' 0.05) were significant and thus were retained in the model. The random effect for slope, however, was not significant and was deleted from the model prior to examining the fixed effects. Results with respect to the fixed-effects component of the model are presented in Table 4. Of primary importance, age was not a significant predictor of FU_CDI either as a main effect or in interaction with any variables.

Sex Differences: Moderation Model

Similar analyses were conducted in order to examine whether sex moderates the relationship between rumination and fluctuations in depressive symptoms. Once again, our dependent

variable was FU_CDI. Primary predictors of FU_CDI were children's sex, RUMINATION, HASSLES, and all two- and three-way interactions. With respect to random effects, the intercept (p'0.0001) and AR(1) parameters (r=0.24, p'0.05) were significant and thus were retained in the model. The slope random effect, however, was not significant and was deleted from the model prior to examining the fixed effects.

Results with respect to the fixed-effects component of the model are presented in Table 5. Of primary importance, a significant 3-way cross-level interaction emerged between sex, RUMINATION and HASSLES. In order to examine the form of the sex×RUMINATION×HASSLES interaction, the model summarized in Table 5 was used to calculate predicted CDI scores for boys and girls possessing either high or low levels of rumination (plus or minus 1.5 SD) who are experiencing either high or low levels of hassles in comparison to their own average level of hassles (plus or minus 1.5 SD×mean within-subject SD). The results of these calculations are presented in Fig. 2. Analyses indicated that among boys, neither high (slope=0.01, t(202)= 0.11, *ns*) nor low (slope=0.02, t(202)=0.19, *ns*) levels of rumination were significantly associated with within-subject fluctuations in depressive symptoms. Among girls, however, high levels of rumination were significantly associated with within-subject fluctuations in depressive symptoms (slope= 0.32, t(202)=6.72, *p'0*.001). At the same time, this relationship was not significant for girls with low levels of rumination (slope=-0.06, t(202)=-0.62, *ns*). Furthermore, comparisons of the slopes of the relationship between HASC scores and depressive symptoms revealed that the slope was significantly greater in girls possessing high levels of rumination than in girls possessing low levels of rumination (t(202)=3.32, p'0.01).

Sex Differences: Mediation Model

Contrary to a mediation model of sex differences in depression, girls and boys did not significantly differ from one another with respect to levels of rumination (t(51)= 0.22, *ns*), nor did they significantly differ in terms of levels of hassles at any follow-up (highest t =1.25, *ns*). Given that there was no significant sex difference in the key explanatory variables of rumination or hassles, lack of support for the mediation model can be inferred (Baron and Kenny 1986).

Discussion

Results of the current study support the applicability of the stress-reactivity hypothesis of the extended RST to children and early adolescents. More specifically, higher levels of rumination were associated with greater increases in depressive symptoms following the occurrence of negative events. Contrary to the developmental hypothesis (Nolen-Hoeksema et al. 1992; Turner and Cole 1994), the strength of the association between rumination and increases in depressive symptoms following negative events did not vary as a function of age. Consistent with moderation models of sex differences in depression, rumination was more strongly associated with increases in depressive symptoms following the occurrence of negative events in girls than in boys. Contrary to mediation models of sex differences in depression, however, no sex differences were observed in either levels of rumination or frequency of negative events.

Several findings warrant additional attention. First, consistent with the results from previous research examining RST in youth, the results of the current study provide strong support for the hypothesis that a ruminative response style confers vulnerability to the development of depressive symptoms (Abela and Hankin 2008) in children and adolescents and onset of depressive episodes in adolescents (Abela and Hankin 2011). Moreover, expanding upon such past research examining the main effects component of RST in youth, the results of the current study indicate that higher levels of stress reactive rumination are associated with

elevations in depressive symptoms specifically following the occurrence of negative events, providing strong support for the conceptualization of the extended RST from a vulnerability-stress perspective (see also Abela and Hankin 2011; Hankin 2009). The results of the current study further expand upon previous research in that they replicate previous findings using multi-wave assessments over a relatively short time frame and responding to items measuring symptoms and stressors in the moment. As this approach, which is similar to experience sampling methodology, possesses strong ecological validity (youth respond to measures in the moment) and likely minimizes reporting biases relative to other methodologies (e.g., field research with symptoms and stressors retrospectively reported over many weeks or months), the results of the current study can be argued to provide particularly powerful support for the stress reactivity hypothesis of the extended RST.

Second, contrary to the developmental hypothesis (Nolen-Hoeksema et al. 1992; Turner and Cole 1994), the results of the current study failed to provide support for the hypothesis that rumination only emerges as a vulnerability factor to depression during the transition from childhood to early adolescence. More specifically, the strength of the association between rumination and increases in depressive symptoms following negative events was not moderated by children's age. It is possible that our failure to find age moderation effects resulted from the combination of the relatively small size and wide age range of our sample. At the same time, however, integrating the current findings with those obtained in previous research with youth samples suggests that this is likely not the case given that previous research utilizing larger samples (e.g., Abela et al. 2007; Hankin 2008a) and purer age groups (Abela et al. 2002) has similarly failed to provide evidence for age as a moderator of the association between rumination and increases in depressive symptoms over time. Moreover, research explicitly aimed at investigating when cognitive vulnerabilities, such as rumination, emerge and exhibit trait-like stability shows that rumination has already stabilized by early adolescence (Hankin 2008b).Thus, future research is likely to benefit from examining the applicability of RST to even younger samples. In addition, such research should continue to examine the impact of development on the vulnerability hypothesis of the response styles theory. More specifically, although the strength of the association between rumination and changes in depressive symptoms does not appear to vary as a function of children's age, other differences may emerge over the course of development. For example, although rumination predicts depressive symptoms across age groups, it is possible that the latent structure of rumination as a vulnerability factor to depression varies as a function of age such that a ruminative response style is impacted by a mixture of trait- and state-like influences in children but by predominantly trait-like influences in adolescents (Abela and Hankin 2008). In addition, it is possible that the pathway through which rumination predicts depressive symptoms varies across development. For example, although cognitive pathways (Abela et al. 2002) may be equally common in children and adolescents, stress generation (Lyubomirsky, and Tkach 2003) and interpersonal rumination (i.e., co-rumination, Hankin et al. 2010; Rose 2002; Stone et al. 2011) pathways may be more pronounced in adolescent samples.

Last, the results of the current study failed to provide support for a mediation model of sex differences indepression. More specifically, findings indicated that girls and boys did not significantly differ in levels of rumination or frequency of negative events. While this finding with this sample of children and early adolescents contradicts RST and most prior research with adolescents (e.g., Abela et al. 2009; Hankin 2009; Shwartz and Koenig 1996) and adults (see review by Nolen-Hoeksema and Hilt 2009), the lack of a significance sex difference in rumination is consistent with other previous research examining the theory in children and early adolescents (Abela et al. 2002, 2004, 2007; Abela and Hankin 2011; Broderick and Korteland 2004). Taken together across age groups, one possibility is that the sex difference in rumination emerges after early adolescence and perhaps after the sex

difference in clinical depression has diverged (Hankin and Abramson 2001; Nolen-Hoeksema and Girgus 1994). Rumination may not precede the emergence of the sex difference in adolescent depression and may not causally explain why more girls become depressed than boys starting in early adolescence. Still, of interest, results supported a moderation model, such that higher levels of rumination were more strongly associated with increases in depressive symptoms following the occurrence of negative events in girls than in boys. It is possible that rumination interacts with girls' increasing level of stressors during the transition from early to middle adolescence (Ge et al. 1994; Hankin et al. 2007) to predict the emergence of sex differences in depressive symptoms. The effect of this interaction on the emergence of sex differences in depressive symptoms may be further compounded by the stronger association between rumination and depressive symptoms following the occurrence of negative events found in girls as compared to boys. Thus, both the increase in stressors that girls experience in the transition from childhood into adolescence and their increased vulnerability due to rumination may combine, rendering girls more vulnerable to depression than boys during this developmental period (Hankin and Abramson 2001; Nolen-Hoeksema and Girgus 1994).

Several limitations of the current study should be noted. First, self-report measures were used to assess depressive symptoms. While the CDI possesses a high degree of reliability and validity, one cannot draw conclusions regarding clinically diagnosed depression based on self-report questionnaires. Future research would benefit by utilizing clinical interview procedures in order to investigate whether the current findings extend to the development of clinical depression. For example, rumination predicts the onset of clinical depression in the transition from early to middle adolescence (Abela and Hankin 2011). Second, self-report measures were used to assess negative events. While measures of life events that require participants to indicate whether and how often an event has occurred are probably less likely to be influenced by informant biases than those that ask subjects to rate the subjective impact of each event, more sophisticated methods of assessing stressors such as interviewing procedures that assess contextual threat may provide better assessments of stress (Brown and Harris 1978). Third, the current study exclusively examined the relationship between rumination and depressive symptoms. Future research would benefit by assessing a broader range of symptom outcomes (e.g., anxiety and/or externalizing symptoms) in order to examine the specificity of rumination to depressive symptoms in youth. Prior research has shown that rumination predicts broad internalizing distress, including bulimic symptoms (Holm-Denoma and Hankin 2010; Nolen-Hoeksema et al. 2007) and general anxiety (Hankin 2008a) but not externalizing, conduct problems (Hankin 2008a; Nolen-Hoeksema et al. 2007). Last, this study utilized a relatively small sample of high-risk youth as all children in the study had at least one parent who had suffered from major depression. While such a high-risk design leads to a powerful test of hypotheses, the use of such a sample minimizes the generalizability of the findings to other populations (e.g., samples not recruited specifically on the basis of parental depression). Future research would benefit by replicating the current findings in larger samples recruited from the general community of younger-aged youth with repeated measures of depressive symptoms and stress to test the stress reactivity RST hypothesis.

In sum, the results of the current study support RSTas higher levels of rumination were associated with elevations in depressive symptoms following increases in negative events in children and early adolescents. This association was stronger among girls than boys. As future research examining the role of cognitive factors such as rumination in the etiology of depression accumulates, a greater understanding of the mechanisms that underlie the onset of depression in children will likely emerge. Such an enhanced understanding is likely to improve identification of children at risk for depression, prevent such children from experiencing future depressive episodes, and provide successful treatment to already

depressed children. Indeed, recent research has begun to test interventions aimed at addressing rumination, and one trial with rumination-focused cognitive-behaviour therapy (CBT) showed effects at treating persistent depression via change in rumination (Watkins et al. 2011). As this study and prior research has shown that rumination predicts depression in children and adolescents, additional intervention research targeting rumination via CBT or mindfulness approaches in depressed youth is merited.

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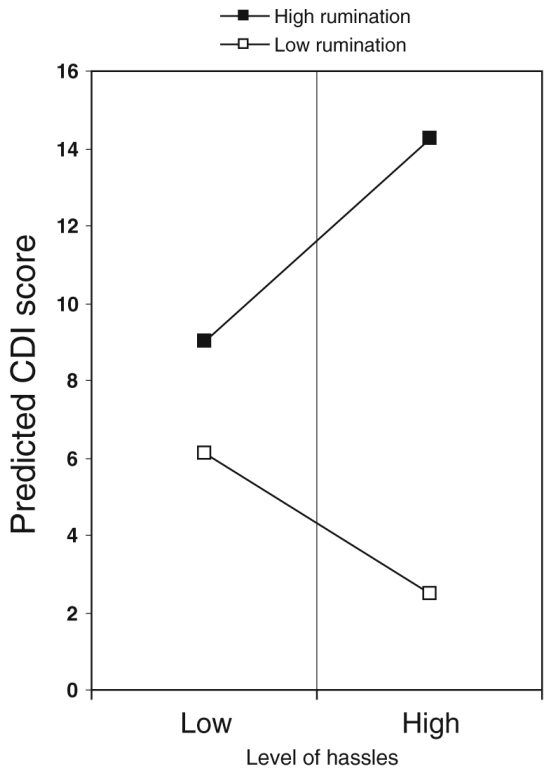

Fig. 1.
Predicted slope of the relationship between hassles and depressive symptoms as a function of level of rumination

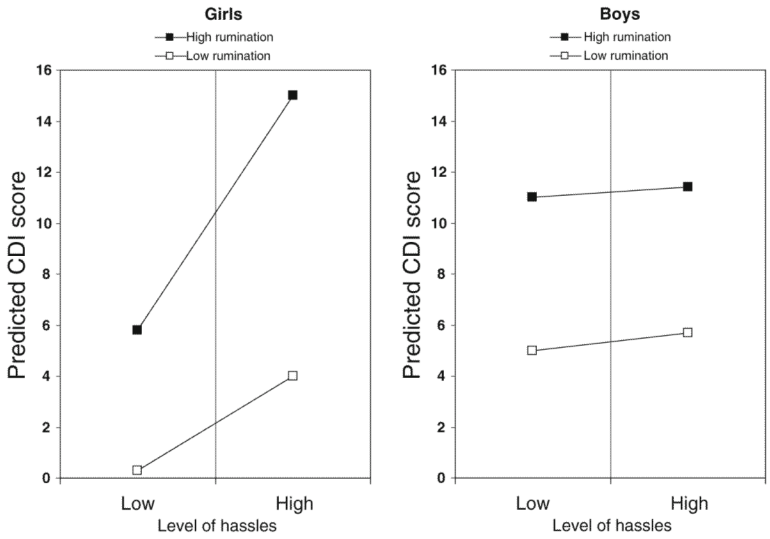

Fig. 2.

Predicted slope of the relationship between hassles and depressive symptoms as a function of level of rumination in girls (*left panel*) and boys (*right panel*)

Table 1

Means, standard deviations and inter-correlations between time 1 measures

	1	2	3	4
1. CDI	–			
2. CRSQ-R	0.21	–		
3. AGE	0.05	−0.15	–	
4. SEX	0.07	0.00	−0.09	–
Mean	5.74	15.98	10.62	0.45
SD	4.27	8.26	2.01	0.50

CDI Children's Depression Inventory; *CRSQ-R* Children's Response Styles Questionnaire – Rumination Subscale; *AGE* Children's age; *SEX* Children's sex (0=Boy; 1=Girl)

Table 2

Means and standard deviations of child depressive symptoms and hassles at six follow-up assessments

	1	2	3	4	5	6
CDI						
Mean	7.16	6.33	7.65	6.70	8.84	8.92
SD	5.96	4.69	6.26	5.58	9.08	9.41
HASC						
Mean	33.89	33.04	34.39	31.36	34.71	31.00
SD	16.57	18.83	23.81	23.89	28.76	24.46
N's at each wave	50	45	47	43	40	41

CDI Children's Depression Inventory; *HASC* Hassles Scale for Children

Table 3

Rumination and hassles predicting within-subject fluctuations in CDI scores during the follow-up interval

Predictor	*b*	*SE*	*F*	*df*
T1_CDI	4.37	0.94	21.85***	1, 47
RUMINATION	0.64	0.58	1.23	1, 47
HASSLES	0.03	0.03	1.16	1, 204
RUMINATION × HASSLES	0.10	0.03	11.15**	1, 204

CDI Children's Depression Inventory; *HASSLES* Children's Hassles Scale (HASC)

* $p<0.05$

** $p<0.01$

*** $p<0.001$

Table 4

Age as a moderator of the association between rumination and change in depressive symptoms following hassles

Predictor	*b*	*SE*	*F*	*df*
T1_CDI	4.34	0.90	23.37***	1, 45
AGE	−0.54	0.77	0.49	1, 45
RUMINATION	0.65	0.57	1.3	1, 45
HASSLES	0.01	0.03	0.04	1, 202
RUMINATION × HASSLES	0.09	0.03	8.56**	1, 202
AGE × RUMINATION	−1.08	0.66	2.69	1, 45
AGE × HASSLES	−0.04	0.04	0.73	1, 202
AGE × RUMINATION × HASSLES	−0.04	0.04	1.2	1, 202

CDI Children's Depression Inventory; HASSLES Children's Hassles Scale (HASC)

** $p<0.01$

*** $p<0.001$

Table 5

Sex as a moderator of the association between rumination and change in depressive symptoms following hassles

Predictor	*b*	*SE*	*F*	*df*
T1 CDI	4.56	0.95	23.14***	1, 45
SEX	−0.65	1.23	0.28	1, 45
RUMINATION	1.24	0.97	1.66	1, 45
HASSLES	0.01	0.03	0.15	1, 202
RUMINATION × HASSLES	0.00	0.05	0.01	1, 202
SEX × RUMINATION	−0.97	1.21	0.64	1, 45
SEX × HASSLES	0.11	0.05	4.92*	1, 202
SEX × RUMINATION × HASSLES	0.13	0.06	4.70*	1, 202

CDI Children's Depression Inventory; HASSLES Children's Hassles Scale (HASC)

* $p<0.05$

** $p<0.01$

*** $p<0.001$