Published in final edited form as:
J Abnorm Psychol. 2013 February ; 122(1): 64–73. doi:10.1037/a0029303.

Effects of Rumination on Child and Adolescent Depressive Reactions to a Natural Disaster: the 2010 Nashville Flood

Julia W. Felton, **David A. Cole**, and **Nina C. Martin**
Vanderbilt University

Abstract

The current longitudinal study tested hypotheses about Nolen-Hoeksema's (1987, 1991) response styles theory (RST) of depression in a sample of child and adolescent public school students. Wave 1 measures of rumination, distraction, and depression were obtained 6 months prior to the 2010 Nashville flood. Similar measures plus a measure of flood-related stressors were administered at Wave 2, approximately ten days after students returned to school after the flood. Results revealed an indirect effect of preflood rumination on postflood depressive symptoms via the intervening variable of postflood rumination, and partial mediation of the effect of preflood depression on postflood depression. Further, the interaction of rumination with flood-related stressors was moderated by age, suggesting that rumination may not become a strong cognitive diathesis for depression until adolescence. Developmental implications emerged for the treatment of child and adolescent victims of natural disasters and for the application of RST to children and adolescents.

Keywords

rumination; child; adolescent; depression; disaster

In May 2010, more than 14 in. of rain fell over a 2-day period, resulting in disastrous flooding of a large section of middle Tennessee. The heaviest rainfall occurred across seven counties in middle and western Tennessee, where rainfall totals were estimated as equivalent to 420 billion gallons of water falling over a period of 48 hours, breaking all previous rainfall records across the state (National Weather Service, 2010). The flood killed more than 20 people in middle Tennessee and caused over $2 billion in damage to personal property in Nashville alone (Nashville Mayor's Office of Recovery, 2010). Hundreds of schools and businesses were closed, displacing large numbers of students and employees, and costing individuals and companies significant lost revenue. Approximately 26,000 people were displaced from their homes (Edwards, 2010), and personal and professional lives were disrupted across the state for months.

Correspondence concerning this article should be addressed to David A. Cole, Department of Psychology and Human Development, GPC 0552, 230 Appleton Place, Vanderbilt University, Nashville, TN 37203-5721. david.cole@vanderbilt.edu.
Julia W. Felton, David A. Cole, and Nina C. Martin, Department of Psychology and Human Development, Vanderbilt University.

Six months before the flood, as part of another study on the cognitive precursors to depression, we collected data on responses to stressful events and current levels of depression from 239 children and adolescents in this region. Approximately ten days after children returned to school after the flood, we collected a second wave of data on children's experience of the flood and their emotional reactions to it. This unique timeline allowed us to measure both pretrauma stress-response styles and posttrauma psychopathology in response to a devastating natural disaster.

Response Styles Theory

Over 20 years ago, Susan Nolen-Hoeksema (1987, 1991) proposed her response styles theory (RST) of depression, suggesting that the tendency to engage in repetitive, negative thinking, or *rumination*, constitutes a relatively stable cognitive response style that predisposes one to experiencing depression. More specifically, Nolen-Hoeksema described depressive rumination as passive perseveration on one's symptoms, the possible causes of those symptoms, and their likely consequences. She posited that ruminating in response to stressful life events predicts both the onset and the maintenance of depressive symptoms. Conversely, the tendency to respond to depressive symptoms and their correlates with distraction was conceived of as a protective factor. A variety of studies have provided empirical support for RST, the most rigorous of which have involved longitudinal research designs, controlled statistically for prior levels of depression, and revealed either a main effect of response style on later depression or a rumination by stress interaction in which stress was more predictive of depression among people with a ruminative response style compared to people without such a style (see Lyubomirsky & Tkach, 2004, for a review). The current study expands on this literature by examining the effects of rumination and distraction on depression in children and adolescents in the context of a natural disaster, namely, the 2010 Nashville, Tennessee flood.

The opportunity to test RST in the context of a natural disaster is as rare as it is important. In tests of diathesis–stress models, the stressors under investigation vary enormously with respect to their cause and their timing. Some events (e.g., poor grades, social rejection) can be as much a consequence of a person's depression as they are causes of it (Hammen, 1991). Event timing also plays a role, in that consequences of more recent events may be more evident than the consequences of events that occurred longer ago. Such event heterogeneity can compromise or complicate tests of diathesis–stress models of depression. By testing RST in the context of a natural disaster, we solve both of these problems, insofar as (a) the natural disaster was in no way caused by the participants' depression, and (b) the timing of the natural disaster was virtually the same for everyone. The current study represents a unique opportunity to control for cause and timing of a major negative life event, to use longitudinal research methods to control statistically for pretrauma levels of depression, and to examine the effects of (previously assessed) ruminative cognitive style on children's depressive symptoms after a natural disaster.

To our knowledge, only one other study has looked at predisaster rumination and postdisaster functioning. In their classic paper on the 1989 Loma Prieta earthquake, Nolen-Hoeksema and Morrow (1991) assessed rumination, distraction, and symptoms of

depression and posttraumatic stress (PTS) in college students shortly before and after the disaster. Results indicated that students who had more severe symptoms of depression, a stronger ruminative style, and a weaker distraction style before the earthquake (and who had more severe quake-related experiences during the earthquake) exhibited significant increases in their levels of depression and stress-related symptoms 10 days after the disaster. Students who reported ruminating about the event immediately after the earthquake were also significantly more likely to be depressed seven weeks later. The moderating effects of rumination and distraction on the relation between quake-related stressors and subsequent symptoms were not examined. To date, such a study has never been conducted with children or adolescents.

The current study is also important because it examines the effect of development on the relation between rumination, distraction, and depression. A recent meta-analysis by Rood, Roelofs, Bögels, Nolen-Hoeksema, and Schouten (2009) reported that support for a longitudinal relation between rumination and depression was stronger and more consistent among adolescents than children. To explain this age difference, the authors cited Driscoll (2004) to suggest that response styles may be relatively unstable in younger children and Abela, Brozina, and Haigh (2002) and Abela, Vanderbilt, and Rochon (2004) to speculate that response styles may not be well developed in childhood (see also Cole et al., 2008). Others have suggested that rumination may require a degree of metacognitive skill (e.g., Papageorgiou & Wells, 2003) and that distraction may require a degree of focus and concentration on the distracting task (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008), skills that may not be well developed prior to adolescence. Furthermore, the use of rumination as a response style seems to increase with age (Hampel & Petermann, 2005). Rood et al. (2009) noted mixed evidence regarding the impact of distraction. Several cross-sectional studies have suggested that distraction is negatively associated with depression (e.g., Abela et al., 2004; Muris, Roelofs, Meesters, & Boomsma, 2004); however, distraction was not significantly related to depression in any of the four longitudinal studies reviewed. Rood et al. (2009) suggested that distraction may be effective in the short term for preventing depression, but it may not be a useful long-term strategy for coping with stressful events. Taken together, these studies led us to hypothesize that the main effects of rumination (and perhaps distraction) on depressive symptoms should increase with age.

Development is also important in understanding sex differences in rates of rumination and distraction. Rood et al.'s (2009) review indicates that most studies of children and young adolescents do not find gender differences in levels of rumination or distraction. By mid to late adolescence, however, girls become more likely to ruminate than boys (Rood et al., 2009). Reinforcing this conclusion, Jose and Brown's (2008) large community study of children and adolescents revealed that gender differences in rumination do not begin to emerge until age 12 and grow steadily until becoming stable in early adulthood. Only one study reported sex differences in rates of distraction. Abela et al.'s (2004) examination of third and seventh graders found that boys were significantly more likely than girls to use distraction when feeling sad.

Implicit in a study testing the effect of predisaster rumination on postdisaster depression is the idea that predisaster rumination is at least partially responsible for one's later tendency

to ruminate after a disaster. This assumption has not been tested. In the search for predictors of rumination, however, several studies have found that previous depression predicts ruminative tendencies, suggesting that depression is as much a cause as it is a consequence of rumination (Abela & Hankin, 2011; Huffziger, Reinhard, & Kuehner, 2009; McLaughlin & Nolen-Hoeksema, 2011; Nolen-Hoeksema, Stice, Wade, & Bohon, 2007). Consequently, the current study examines postdisaster rumination not only as a proximal predictor of depressive symptoms, but also as a consequence of both prior depression and prior ruminative response style.

Children's Reactions to Trauma

Understanding children's reactions to a natural disaster is important in its own right and not just as a vehicle for testing RST. Relatively few studies have examined the relation between natural disasters and psychopathological outcomes in children, and fewer still have had the luxury of being able to control for predisaster measures of psychological functioning. A recent nationally representative survey of 2,030 youths (ages 2–17 years) reported that 13.9% of children and adolescents have experienced a disaster (i.e., flood, fire, tornado, hurricane, ice storm, terrorist attack, or earthquake) at some point in their lives (Becker-Blease, Turner, & Finkelhor, 2010). Of these, 4.1% experienced such a disaster within the last year. Becker-Blease et al. (2010) found that children who experienced a disaster during their lifetimes are at heightened risk for a variety of negative psychological problems, including depression, anxiety, and anger or aggression.

Only a handful of prospective studies have tested for *change* in depressive and traumatic stress symptoms in children due to an unforeseen natural disaster (see Furr, Comer, Edmunds, & Kendall, 2010, for a review). In many of these studies, a year or more elapsed between the disaster and the assessment of postdisaster emotional functioning (e.g., Asarnow et al., 1999; La Greca, Silverman, & Wasserstein, 1998; Weems et al., 2007). Given the natural remission of symptoms over time, such delays could attenuate estimates of the true psychological impact of such events. In the current study, posttest data were collected approximately ten days after the flood.

In a systematic series of studies, La Greca, Silverman, Vernberg, and Prinstein (1996), La Greca et al. (1998), and La Greca, Silverman, Lai, and Jaccard (2010) have implicated a variety of factors, including biological, psychological, and social variables, that can exacerbate or ameliorate the effects of natural disasters on children's mental health. Although the current study was not able to test any of these models in their entirety, we were able to examine three key factors that La Greca et al.'s work has implicated in the prediction of postdisaster pathology: predisaster child characteristics, disaster-related stress exposure, and preexisting psychopathology.

With regard to predisaster characteristics, La Greca et al. (2010) reported that children's emotional responses to hurricane-related trauma differed by age and gender, with PTS symptoms being more severe for younger children and for girls. Furr et al.'s (2010) review supported La Greca et al.'s findings about gender, revealing small to moderate overall effect sizes. The effect of age was less clear, as Furr et al. (2010) reported a nonsignificant effect

of age on PTS reactions in children; however, they noted significant variability in the effect of age across studies.

Also key to La Greca et al.'s (2010) model is the concept of disaster-related stress exposure. Not everyone who lives through a natural disaster experiences the same events, the same losses, the same threat, or the same degree of disruption. Research on PTS in children and adolescents has consistently found that symptoms are related to perceptions of life threat, bodily injury, destruction, and other significant loss (Brown & Goodman, 2005; La Greca et al., 2010; Nader, Pynoos, Fairbanks, & Frederick, 1990; Pynoos, Na-der, Frederick, Gonda, & Stuber, 1987). Furr et al.'s (2010) review confirmed that PTS symptoms systematically covary with disaster proximity, trauma-related loss, and perceived threat.

Finally, La Greca et al.'s (1996, 1998, 2010) models have implicated the importance of preexisting psychopathology in predicting postdisaster mental health problems. Studies that examine these variables are rare; nevertheless, among the few that have been conducted, the results are relatively consistent, concluding that preexisting anxiety and depression predict postdisaster symptoms of PTS and depression (Asarnow et al., 1999; La Greca et al., 1998; Lonigan, Shannon, Taylor, Finch, & Sallee, 1994; Weems et al., 2007). In the current study, we were able to examine the effects of prior levels of depressive symptoms on children's level of depression after the flood.

In the current study, we tested the following hypotheses in the context of the 2010 Nashville, Tennessee flood. Hypothesis 1 was that both preexisting characteristics (i.e., prior psychopathology, rumination, age, and gender) and flood-related variables (i.e., the number of flood-related events to which the child was exposed and the tendency to ruminate after the flood) would predict post-flood symptoms of depression. Hypothesis 2 was that (a) preflood rumination and depressive symptoms would predict postflood rumination and (b) both would lead to postflood symptoms of depression indirectly through postflood rumination. Hypothesis 3 pertained to Nolen-Hoeksema's (1987, 1991) assertion that individuals with self-identified ruminative tendencies would, in the face of stressful events, more likely become depressed. We therefore hypothesized that the relation of flood-related experiences to postflood symptoms of depression would vary as a function of age and level of ruminative tendency (i.e., a three-way interaction), such that older students who scored higher on preflood rumination would, in the presence of a greater number of flood-related experiences, experience more depressive symptoms. The above hypotheses pertain to rumination and depression; given the conflicting literature on the role of distraction in predicting depression, we conducted similar (exploratory) analyses for distraction.

Method

Participants

We recruited Wave 1 participants from four public elementary and middle schools (Grades 5–8) in middle Tennessee. From a larger pool of 483 fifth through eighth graders, 239 students (133 girls [56%]) obtained parental consent and met inclusion criteria (i.e., no English-language difficulty that would interfere with their ability to participate in a questionnaire-based study). As a group, participants did not differ from nonparticipants on

age, race, gender, or grade level (*p*s > .20). Wave 2 participants constituted a 227-person subset of the Wave 1 participants, including only students whose parents granted consent for their children to participate in the study after the flood. Wave 2 participants did not differ from those Wave 1 participants who did not participate in Wave 2 on any Wave 1 study variable (*p*s > .10). Participants ranged in age from 10–15 years (*M* = 11.27, *SD* = 1.24). Self-reports of race indicated that the sample was 86.8% White, 3.3% African American, 4.7% Hispanic, 0.5% Asian, 4.7% biracial or multiracial, and 1.1% other. Comparisons of participants with complete versus incomplete data revealed a few statistically significant differences: namely, participants with some missing data were older, more likely to be male, and less ruminative (*p*s < .05).

Measures

At Wave 1, we obtained demographic information and measures of rumination and depressive symptoms. At Wave 2, children completed the same measures of depressive symptoms and rumination (note that the rumination measure was modified to ask about feelings and behaviors since the flood), as well as a questionnaire asking about their personal flood-related experiences.

Rumination—The Response Style Questionnaire (RSQ; Nolen-Hoeksema & Morrow, 1991) is one of the most commonly used measures of rumination and distraction coping styles, and it has been used with adolescent and child populations (Kercher & Rapee, 2009; Schwartz & Koenig, 1996; Weir & Jose, 2008). The RSQ contains two scales: the Rumination Response Scale (RRS) and the Distraction Response Scale. Respondents rate the frequency with which they engage in various ruminative behaviors (e.g., “Think about how alone you feel”) on 4-point Likert scales (1 = *almost never* to 4 = *almost always*). Although some research has found that rumination is composed of multiple factors, including symptom- and self-focused rumination, brooding, and reflection (e.g., Bagby & Parker, 2001; Treynor, Gonzalez, & Nolen-Hoeksema, 2003), we elected to use the RRS in its entirety, consistent with Nolen-Hoeksema and Morrow’s (1991) study and the majority of other studies cited above. Previous research suggests that the RRS has good internal reliability with adult (Nolen-Hoeksema & Morrow, 1991) and adolescent populations (Schwartz & Koenig, 1996). In the current study, Cronbach’s alphas were high: α = .89 at Wave 1 for rumination and .81 for distraction; α = .92 at Wave 2 for rumination and .83 for distraction.

After the flood, we modified the directions to the RSQ slightly, to read “How often since the flood do you….” Items were edited to ask specifically about the time period immediately after the flood, but were not changed in any other way. Because the flood had many far-reaching consequences, we did not limit children by asking them to rate their rumination only about the flood event itself. True to Nolen-Hoeksema’s (1987, 1991) original conceptualization, we directed children to rate their use of rumination and distraction in response to depressive affect during the time interval immediately after the disaster.

Depression symptoms—Our measure of depressive symptoms was the Children’s Depression Inventory (CDI; Kovacs, 1992), a widely used and well-validated self-report,

assessing number and severity of depressive symptoms (see Reynolds, 1994, for a review). The CDI consists of 27 items tapping cognitive, affective, and behavioral aspects of depression. Each item consists of three statements describing varying degrees of symptom severity; for example: (0) I am sad once in awhile, (1) I am sad many times, and (2) I am sad all the time. The scale has strong internal consistency, and research supports its validity, especially in nonclinical populations (Saylor, Finch, Spirito, & Bennett, 1984). In our own study, the measure demonstrated strong internal consistency, with alphas of 0.90 in both Waves 1 and 2.

Flood experience—We created a Flood Events Questionnaire (FEQ) that asked participants to state whether 19 different flood-related experiences occurred to them. These events ranged from having to miss school to having a family member hurt or killed by the flood. Specific events were drawn from newspaper and television reports of the Nashville flood to ensure that they were pertinent to this disaster. Items are included in the Appendix, as are subjects' responses. Internal consistency of the measure was acceptable (Kuder-Richardson-20 = 0.78).

Procedure

We escorted consented students from their classrooms to a meeting room within the school to administer the questionnaires. At the beginning of each data collection period, a trained research assistant administered and reviewed the assent forms. During data collection, additional research assistants circulated among students and answered questions as needed. Participants received a $10 gift card to a local store. Approximately six months later, and 10 days after children returned to school after the flood, researchers returned to each school. The same procedures were used at the second wave of data collection.

Results

Descriptive Statistics

Means and standard deviations for all of the study variables appear in Table 1. These descriptive statistics are similar to those reported in other school-based studies of children and adolescents (Cole et al., 2008, 2009; Saylor et al., 1984). Some researchers have recommended that CDI scores greater than 18 be used as a rough guideline for clinically significant levels of depression (Kazdin, 1989). Approximately 9% exceeded this cutoff at Wave 1, 14% exceeded this cutoff at Wave 2, and 16% exceeded this cutoff at either Wave 1 or 2.

Hypothesis Tests

Hypothesis 1 was that preexisting characteristics and flood-related variables would predict postflood symptoms of depression. We first addressed this hypothesis by correlating each preexisting characteristic (i.e., preflood CDI scores, rumination, distraction, age, and gender) and each flood-related variable (i.e., the severity of one's flood experience and rumination about the flood) with postflood CDI scores. As shown in column 4 of Table 1, postflood CDI scores correlated positively with preflood CDI, preflood rumination, postflood rumination, and the FEQ and correlated negatively with preflood distraction. We then

conducted partial correlations of each variable to postflood CDI, controlling for preflood CDI. As shown in column 5 of Table 1, only the correlation with FEQ and postflood rumination remained significant after controlling for prior CDI scores. Although not part of this hypothesis, Table 1 also contains correlations of all variables with preflood CDI scores (column 3).

Hypothesis 2 stated (a) that individual differences in preflood rumination and depressive symptoms would predict postflood rumination and (b) that postflood rumination would explain the relation of both preflood rumination and preflood depressive symptoms to postflood depressive symptoms. The effect of prior rumination on postflood rumination was supported by a significant correlation ($r = .48$, $p < .001$), reflecting moderate stability in this sample. Further support for the hypothesis derived from the path analysis in the upper panel of Figure 1. This path diagram represents two simultaneous regressions. The first regression of post-flood rumination onto preflood rumination and preflood CDI was significant ($R^2 = 0.30$, $p < .001$), with significant betas for both prior rumination and prior depressive symptoms. The second regression of postflood CDI onto preflood CDI, preflood rumination, and postflood rumination was also significant ($R^2 = 0.62$, $p < .001$), with significant betas for both postflood rumination and preflood CDI; however, the effect of preflood rumination was small and nonsignificant after controlling for postflood rumination, the mediator.[1] Even though the total effect of preflood rumination on postflood CDI was nonsignificant, we tested the indirect effect of preflood rumination on postflood CDI through postflood rumination. For this test, we used a bootstrapping method for the construction of a 95% confidence interval (CI) around the unstandardized indirect effect (Hayes, 2009; Preacher & Hayes, 2008). The indirect effect was the product $0.21 \times 0.37 = 0.08$, and its bootstrapped CI [0.01, .0.15]. Because the interval did not contain zero, the indirect effect was significant ($p < .05$). We also tested the indirect effect of preflood CDI on postflood CDI through postflood rumination. The indirect effect was $0.44 \times 0.37 = 0.16$, 95% CI [0.07, 0.28], revealing significance ($p < .05$).

We next tested a similar model for distraction. The correlation between preflood distraction and postflood distraction was small and nonsignificant ($r = .16$, $p < .10$). The path diagram is shown in the lower panel of Figure 1. The regression of postflood distraction onto preflood distraction and CDI was nonsignificant ($R^2 = 0.03$). The regression of postflood CDI onto preflood CDI, preflood distraction, and postflood distraction was significant ($R^2 = 0.45$, $p < .001$), but preflood CDI was the only significant predictor. All tests of indirect effects were nonsignificant.

Hypothesis 3 stated that the relation of flood-related experiences to postflood symptoms of depression would be exacerbated by rumination, especially for older participants. Because this implies a three-way interaction, we tested this hypothesis by regressing postflood CDI onto age, preflood rumination, the FEQ, all three 2-way interactions, and the three-way interaction of FEQ by Wave 1 rumination by age (controlling for preflood CDI and gender).

[1]The Gender × Preflood Rumination, Gender × Preflood Depression, and main effects for gender were not significant predictors of postflood depression or rumination ($ps > .60$). All path coefficients remained unchanged to three decimal places when gender was included in the model as a control variable. Consequently, the results reported here do not include gender.

[2] As shown in Table 2, results supported this hypothesis, with a significant Age × Preflood Rumination × FEQ interaction, $t = 2.95$, $p < .003$. As depicted in Figure 2, the Preflood Rumination × FEQ interaction is quite apparent for adolescents but not for children (plotted with high age = 14.5 years and low age = 10.5, respectively). One should keep in mind, however, that the two graphs in Figure 2 depict the diathesis–stress interaction at two arbitrarily chosen ages. This interaction actually emerges gradually, as a function of age. Regions of significance testing allowed us to identify the exact age at which the Preflood Rumination × FEQ interaction becomes statistically significant (Aiken & West, 1991; Bauer, & Curran, 2005; Preacher, Curran, & Bauer, 2006). Regions of significance tests revealed that the Preflood Rumination × FEQ interaction was significant in this sample for ages greater than 11.15 years. In other words, statistical support for this diathesis–stress interaction emerged at age 11.15.

We then conducted a similar (but exploratory) analysis for the Age × Preflood Distraction × FEQ interaction. The interaction was not significant. In fact, all two-, three-, and four-way interactions of distraction with age, FEQ, and gender were nonsignificant, as was its main effect.

Discussion

The current study of child and adolescent responses to the 2010 Nashville, Tennessee, flood gave rise to three sets of results, supporting (or partially supporting) our hypotheses. First, post-flood depressive symptoms correlated positively with preflood depression, preflood rumination, postflood rumination, and the severity of one's flood-related experience—and correlated negatively with preflood distraction. After controlling for preflood depression, severity of one's flood-related experience and post-flood rumination remained significant predictors of postflood depressive symptoms. Second, we found evidence of two indirect pathways: (a) preflood rumination predicted the later tendency to ruminate, which in turn predicted postflood depressive symptoms; and (b) preflood depression predicted postflood rumination, which in turn predicted postflood depression. Third, the tendency to ruminate (assessed before the flood) exacerbated the effects of the flood on depressive symptoms for adolescents but not for children. Below, we elaborate on each of these results as well as their developmental implications for RST and discuss their clinical implications for working with children after natural disasters.

Our first hypothesis was that various preexisting characteristics and specific flood-related variables would predict post-flood symptoms of depression. This hypothesis was partially supported insofar as (a) preflood levels of depression and rumination correlated with postflood depression, and (b) the severity of one's flood experience and the tendency to ruminate after the flood related significantly to postflood depressive symptoms, even after controlling for preflood depression. These findings supported our hypothesis and are consistent with theoretical works by Nolen-Hoeksema (1987, 1991) and La Greca et al. (1996, 1998, 2010). Nolen-Hoeksema's RST posits that engaging in a ruminative response style is uniquely related to depressive symptoms. Our results are the first to examine in

[2]All two-way interactions with gender were nonsignificant.

children the phenomenon that Nolen-Hoeksema and Morrow's (1991) observed in college students: that rumination after a disaster is significantly related to depressive symptoms. Our results for distraction, however, were less compelling. Although use of distraction before the flood negatively correlated with postflood depression, use of distraction to cope in response to the flood was not related to depression. These findings replicate those in Rood et al.'s (2009) review of RST in young people; although distraction may negatively correlate with depression, it is not an effective buffer against the effect of stressful events on depression. Our results also partially support La Greca et al.'s anticipation that certain preexisting characteristics (e.g., prior levels of depression) predict children's emotional reaction to natural disasters. Our results also extend La Greca et al.'s thesis, in that they implicate preflood rumination as another predictive preexisting characteristic. Contrary to La Greca et al.'s model, however, age and gender were not significantly related to postflood depressive symptoms.

Our second hypothesis began with the idea that preflood rumination and depressive symptoms would predict postflood rumination, which in turn would exacerbate postflood symptoms of depression. This pattern of relations was supported by a series of results. First, both prior rumination and prior depressive symptoms predicted postflood rumination. Second, the indirect effect of preflood rumination → postflood rumination → postflood depression was significant. To our knowledge, this is the first study to find that rumination after a natural disaster is a significant link in the prospective relation of rumination to depression. This result represents an important step in the understanding and elaboration of RST and its application to specific negative life events. Third, our results revealed that the longitudinal relation of preflood depression → postflood rumination → postflood depression was also significant. RST explicitly posits that rumination after an event drives changes in depressive affect; however, the theory is silent on the role of depression in driving the tendency to ruminate. In a few studies, investigators have speculated that rumination may be part of the depressive process or possibly a consequence of the disorder (Abela & Hankin, 2011; Huffziger et al., 2009; McLaughlin & Nolen-Hoeksema, 2011; Nolen-Hoeksema et al., 2007). This potential bidirectional effect is not antithetical to RST, because rumination could be both a cause and an effect of depression. The current results support this possibility, suggesting that depressive symptoms before a natural disaster predict rumination after the disaster (even after controlling for prior measures of rumination), and that postflood rumination, in turn, is associated with exacerbations in depressive symptoms after the flood (even after controlling for prior measures of depressive symptoms). As such, these findings reflect a highly reciprocal relation between negative cognitive style and negative affect (Huffziger et al., 2009; Nolen-Hoeksema et al., 2007).

Our third hypothesis was that the relation of the severity of flood-related experiences to postflood symptoms of depression would be exacerbated by rumination, especially for older participants. An Age × Flood Severity × Rumination interaction supported this hypothesis. For participants under the age of 11.15, only severity of flood experience significantly predicted depressive symptoms. By age 11.15, however, rumination began to moderate the effect of flood severity experience on depression. Specifically, among older participants, flood severity predicted depressive symptoms for participants with strong preflood tendencies to ruminate but not for participants with low scores on preflood rumination. In

other words, for adolescents who ruminate, flood-related stressors predicted depression; for adolescents who do not ruminate, flood-related stressors did not predict depression. For children, flood-related stressors predicted depression irrespective of their tendencies to ruminate. This result is important in that it supports the idea that this diathesis–stress interaction emerges with age.

We can speculate about the reasons for the effect of age on the emergence of this cognitive diathesis–stress interaction. Some have argued that various kinds of cognitive style are not well developed (let alone stable) until adolescence (Abela et al., 2002, 2004; Cole et al., 2008; Driscoll, 2004). Others have suggested that a ruminative response style may require a degree of metacognitive skill that is not available in childhood (Papageorgiou & Wells, 2003). Abela et al. (2004) reported that correlations of rumination with other variables change substantially from childhood to adolescence, suggesting that when rumination occurs in childhood, it may be something quite different from the rumination one sees in adolescents or adults. Given children's reduced cognitive capacity as compared to adolescents, it is possible that rumination in children may not be as toxic or negative in its effect as it is in adolescents. Whatever the reason, the current study contributes to the speculation that RST has developmental limits, becoming operational around 11.15 years of age.

Clinical Implications

The results of this study have several interesting and important implications for clinical work, especially after a disaster. The first pertains to the prioritization of victims for psychological support in the aftermath of a natural disaster. Our results support previous findings that child and adolescent victims with a prior history of depression and with greater exposure to disaster-related hardships be given higher priority for psychological support and intervention than those without such a history or exposure (La Greca et al., 1996, 1998, 2010); however, the current study did not support age and gender as significant risk factors, at least not in isolation of other variables.

The second implication pertains to the kind of intervention that should be provided after a natural disaster. Interventions must be quickly and flexibly administered, targeting those most at risk for developing depressive symptoms. One such program is Psychological First Aid, developed in partnership between the National Center for PTSD and the National Child Traumatic Stress Network (http://www.nctsn.org; see Watson, Brymer, & Bonanno, 2011). Psychological First Aid provides information about coping and connecting victims of disasters to social support. It also gives priority to individuals with preexisting psychological risk factors. As supported by the current study, those factors may include a history of depression and those who are exposed to a greater number of stressors. The current study also suggests that the treatment rendered to victims should vary with age. In adolescents, part of the clinical intervention should focus on methods for interrupting rumination about the disaster. In younger children, however, interrupting rumination may not be a therapeutic priority.

The third implication pertains to the role of the media. During the flood, television coverage of the disaster continued virtually without interruption, repeating news reports and video

footage hundreds of times, during the flood and over the ensuing days. Anecdotally (as all three authors lived through this flood), people frequently reported feeling almost “addicted” to the flood-related news casts, watching the same material over and over, almost craving the bit of new material that would occasionally trickle in. Indeed, evidence from the 9/11 terrorist attacks suggests that watching greater amounts of television after traumatic events significantly predicted onset of and increase in PTS symptomatology (Otto et al., 2007). In a clinical sense, news channels became nonstop workshops on how to ruminate about the flood. To suggest that the media reduce or periodically interrupt their redundant coverage of natural disasters is probably unrealistic, because stations would simply lose viewers to other broadcasters. Instead, we suggest that parents who are fortunate enough to have electricity after a natural disaster be encouraged to limit how much time they and their children watch such reports.

Study Limitations and Future Directions

Although this study is unique in its examination of pre- and postdisaster rumination on postdisaster functioning, several limitations suggest avenues for future research. First, the timing of our data collection efforts was good but not perfect. Fortunately, we were able to collect postflood data very shortly after the participants returned to school. Unfortunately, summer vacation began shortly after the flood, preventing us from examining longer term consequences, as did Nolen-Hoeksema and Morrow (1991). When future opportunities for such research arise, investigators should attempt to collect follow-up data if circumstances allow.

Second, when it was originally conceived, we did not anticipate that this study would end up examining children’s reactions to a natural disaster; consequently, the measures we chose were not ideally suited to the myriad of research questions that emerged after the flood. For example, between the flood and the end of the school year, we created our own flood experience measure quickly and were unable to validate it given the timeframe. Further, measures of other types of preexisting psychopathology (e.g., anxiety) would have allowed us to examine the impact of disaster on mental health outcomes other than depression.

Third, flooding is a very specific type of natural disaster and has several characteristics not shared by other types of disasters, raising the questions about generalizing from these results to other catastrophes. For instance, flooding happens (relatively) slowly and is often predicted by weather forecasts, giving people some chance to move or seek shelter (although that was not the case in this instance due to the unusual circumstances of this particular flood). Other types of disasters, such as earthquakes, tend to happen quickly and without as much warning. Also, flooding differs from other kinds of disasters in that it is paired with a relatively neutral and common stimulus (rain). After a flood, even the forecast of a rainy day can trigger psychological reactions, causing exacerbation or maintenance of postflood symptoms in some people. Finally, more than earthquakes and tornadoes, floods are more common in low-lying, lower socioeconomic areas, where preexisting hardships may be common and governmental support infrastructure may be weak.

That said, the Nashville flood differed from many floods in at least two ways. One, weather forecasters did not anticipate that the storm would stall over the middle Tennessee area and

deliver as much rain (or cause as much damage) as it did. People did not have as much warning as they typically do in flood-related disasters. Two, in the Nashville flood, low-lying, low socioeconomic areas were indeed seriously affected; however, flood waters rose so high that they inundated commercial and residential areas with no history of serious flooding, areas that were highly affluent. Consequently, the Nashville flood devastated high and low socioeconomic areas alike. For these reasons, we suggest that efforts to summarize disaster-related research focus less on the type or physical cause of the disaster (e.g., wind, water, tectonic activity) and more on the dynamics of the event (e.g., predictability, severity, duration, associated stimuli), which may vary from person to person.

Finally, the current study focused specifically on rumination and depression. Rumination is also related to worry and anxiety (Broeren, Muris, Bouwmeester, van der Heijden, & Abee, 2011; Fresco, Heim-berg, Mennin, & Turk, 2002; Hong, 2007), and both worry and anxiety are related to the experience of stressful events (Compas, Connor-Smith, Saltzman, Harding Thomsen, & Wadsworth, 2001; DuBois, Felner, Brand, Adan, & Evans, 1992; Johnson & McCutch-eon, 1980; Roemer, Litz, Pepper, & Borkovec, 1995; Rowlison & Felner, 1988). Future research should consider a wider array of emotional outcomes (especially PTS symptoms) that could be affected or moderated by variables such as rumination.

Conclusion

The current study represents the first of its kind to examine RST prospectively in a sample of children and adolescents exposed to a natural disaster. Our findings suggest that rumination represents a significant risk factor for the development of depressive symptoms after a natural disaster for adolescents but not for children. These results highlight the need to examine carefully how models of cognitive style, stress, and pathology might vary over the course of development.

Acknowledgments

Supported by a gift from Patricia and Rodes Hart and by the Warren Family Foundation.

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Appendix. Flood Experiences Questions (Answered Yes or No)

	Responses	
How did the flood affect you? Did these things happen …	**Yes (1)**	**No (0)**
1. Did you miss school because of the flood?	81.7%	8.3%
2. Did the flood get into your house or apartment?	5.5%	94.5%
3. Did you have to leave home because of the flood?	2.4%	97.6%
4. Are you still living somewhere new because of the flood?	2.4%	97.6%
5. Did the flood ruin things in your home?	4.9%	95.1%
6. Did the flood mess up your yard or your neighborhood?	29.9%	70.1%
7. Were your own things ruined by the flood?	5.5%	94.5%
8. Did the flood mess up your family's car?	1.2%	98.8%

	Responses	
How did the flood affect you? Did these things happen …	**Yes (1)**	**No (0)**
9. Did you lose electricity during the flood? Did your power go out?	22.7%	77.3%
10. Did your TV stop working for a while?	27.0%	73.0%
11. Did you have to use less water at home because of the flood?	41.5%	58.5%
12. Were your clothes messed up by the flood?	3.0%	97.0%
13. Was anyone in your family hurt during the flood?	4.9%	95.1%
14. Were your friends or neighbors hurt by the flood?	8.5%	91.5%
15. Did any of your friends lose things because of the flood?	16.6%	83.4%
16. Did you lose a pet because of the flood?	1.8%	98.2%
17. Did your parent miss work because of the flood?	50.9%	49.1%
18. Were roads near your home blocked or messed up by the flood?	67.1%	32.9%
19. Was your friend’s home or property destroyed by the flood?	17.7%	82.3%

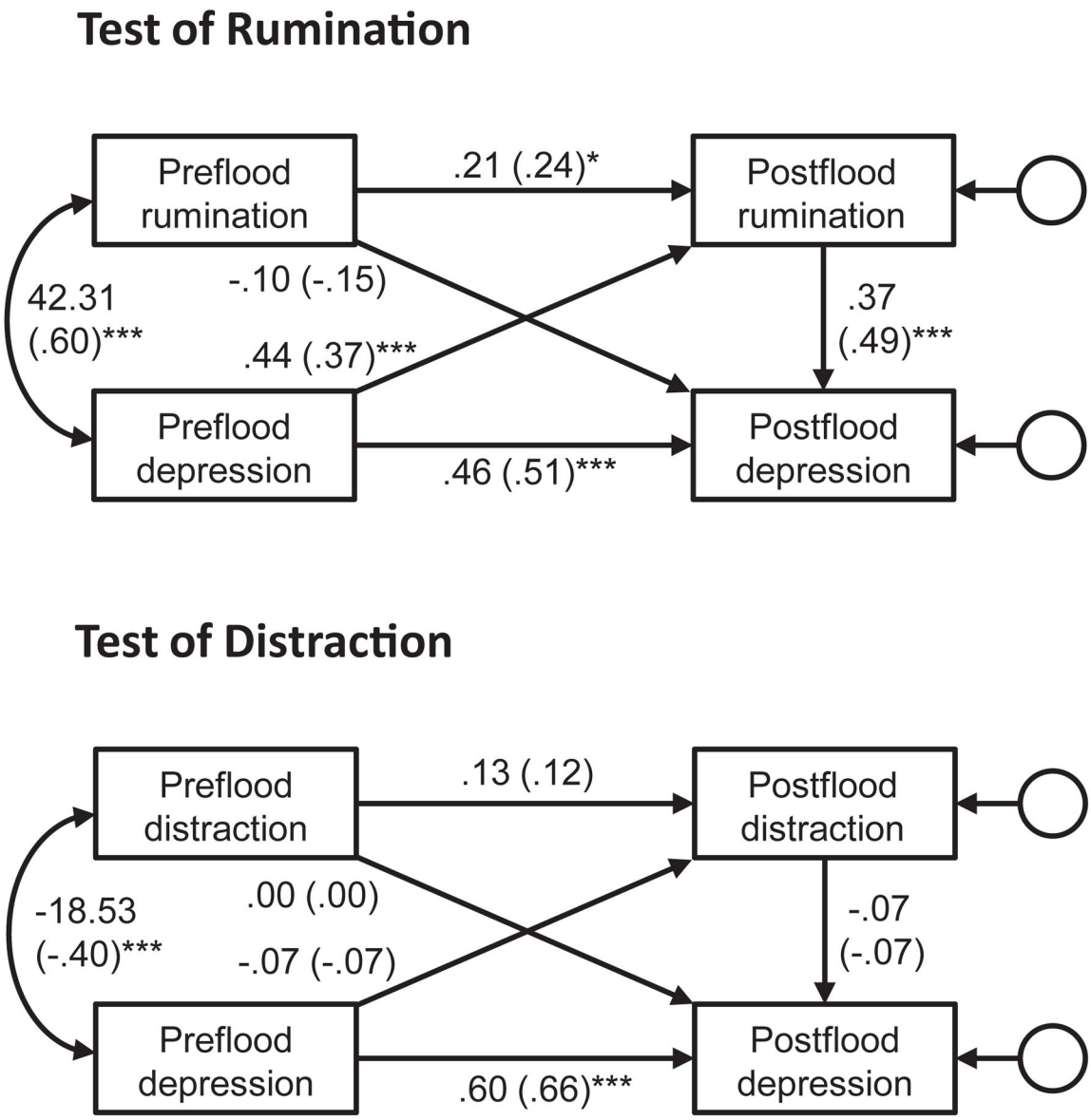

Figure 1.
Standardized and (unstandardized estimates) for path diagrams of rumination, distraction, and depressive symptoms. * $p < 0.05$, *** $p < 0.001$.

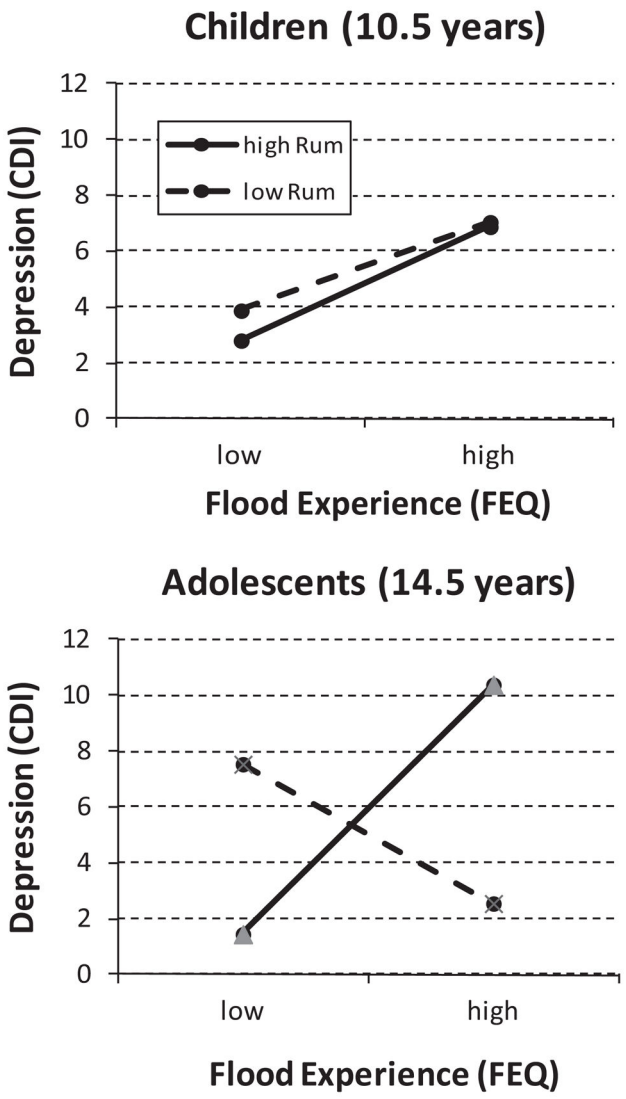

Figure 2.
Plot of three-way Age × Preflood Rumination × FEQ interaction. CDI = Children's Depression Inventory; FEQ = Flood Events Questionnaire.

Table 1

Means, Standard Deviations, Correlations (R), and Partial Correlations (Partial r) of Predictors With Wave 1 and Wave 2 Depression Symptoms

Predictor	*M*	*SD*	*r* with CDI_1	*r* with CDI_2	Partial *r* with CDI_2 controlling for CDI_1
Preflood variables (Wave 1)					
CDI	7.05	7.19	–	0.72***	–
RSQ-RRS	30.69	9.87	0.61***	0.40***	0.04
RSQ-DRS	26.58	6.51	−0.40***	−0.36***	0.01
Age	11.27	1.24	0.02	0.11	0.03
Gender (0 = male, 1 = female)	0.56	0.50	−0.01	0.00	0.03
Postflood variables (Wave 2)					
CDI	7.66	6.88			
FEQ (flood experience)	3.88	2.43	0.11	0.30***	0.31***
RSQ-RRS (rumination)	32.20	10.26	0.54***	0.70***	0.53***
RSQ-DRS (distraction)	26.15	6.38	−0.14	−0.16	−0.10

Note. CDI = Children's Depression Inventory; RSQ = Response Style Questionnaire; RRS = Rumination Response Scale; DRS = Distraction Response Scale; FEQ = Flood Events Questionnaire.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 2

Multiple Regression Predicting Wave 2 CDI

Predictor	Unst. *B*	*SE* (*B*)	Std. β	*t*	*p*
Intercept	−2.91	1.13	—	−2.57	.010
CDI (Wave 1)	0.62	0.07	0.68	8.66	.001
Gender	−0.01	0.03	−0.03	−0.46	.645
Age	0.28	0.11	1.46	2.70	.007
Rumination (Wave 1)	1.45	0.58	3.50	2.52	.012
FEQ (Wave 2)	14.09	5.15	7.42	2.74	.006
Age × Rumination	−0.15	0.05	−3.92	−2.69	.007
Age × FEQ	−1.32	0.48	−7.61	−2.78	.005
Rumination × FEQ	−6.98	2.46	−9.65	−2.84	.004
Age × Rumination × FEQ	0.68	0.23	9.93	2.95	.003

Note. Unst. = unstandardized; Std. = standardized; CDI = Children's Depression Inventory; FEQ = Flood Events Questionnaire.