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Co-Rumination Exacerbates Stress Generation among Adolescents with Depressive Symptoms

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Abstract

Through stress generation, individuals' own thoughts and behaviors can actually lead to increases in their experience of stress. Unfortunately, stress generation is especially common among individuals who are already suffering from elevated depressive symptoms. However, despite the acknowledgement that some individuals with depressive symptoms generate greater stress than others, few studies have identified specific factors that could exacerbate stress generation among individuals with depressive symptoms. The present study examines co-rumination as a factor that might exacerbate stress generation among adolescents with depressive symptoms using a short-term longitudinal design. Considering these processes among adolescents was critical given that many youth experience increases in depressive symptoms at this developmental stage and that co-rumination also becomes more common at adolescence. Participants were 628 adolescents (326 girls; 302 boys) who reported on their depressive symptoms, experiences of stress, and co-rumination with a best friend. Interpersonal stressors (peer and family stress) and non-interpersonal stressors (school and sports stress) were assessed. Consistent with past research, adolescents with depressive symptoms experienced greater interpersonal and non-interpersonal stress over time. Importantly, co-rumination interacted with both depressive symptoms and gender in predicting increases in peer stress. Depressive symptoms predicted the generation of peer stress only for girls who reported high levels of co-rumination with friends. Implications for protecting youth with depressive symptoms against stress generation are discussed.

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Keywords

co-rumination; peer relations; stress generation; depression; adolescence

The experience of stress is a critical risk factor for the development of other psychological symptoms during adolescence (Kim, Conger, Elder, & Lorenz, 2003). As such, understanding factors that contribute to the experience of stress is vital. Previous work indicates that some individuals with internalizing symptoms think and behave in ways that actually contribute to their experience of stress, which is referred to as stress generation (Hammen, 2005). Considering stress generation during adolescence is important given the increase in internalizing symptoms at this time (Twenge & Nolen-Hoeksema, 2002). Notably, though, there is heterogeneity among individuals with depressive symptoms in terms of the degree to which they generate stress. The present short-term longitudinal study tests the idea that stress generation among adolescents with depressive symptoms is exacerbated if they co-ruminate with friends.

Depression and Stress Generation: Considering Co-Rumination as a Moderator

Research on the relation between depression and stress indicates transactional processes. That is, although stress contributes to the development of depressive symptoms, depressive symptoms also can contribute to increased experiences of stress (Hammen, 1991; Rudolph, 2008; for a review, see Liu & Alloy, 2010). Cognitive vulnerabilities (e.g., ruminative tendencies, negative attributional styles; Kercher & Rapee, 2009) and behavioral styles (e.g., engaging in excessive reassurance seeking; Joiner, 2000; Potthoff, Holahan, & Joiner, 1995) common among individuals with depressive symptoms may lead them to experience their lives as increasingly stressful and to generate new stressors (see Shih, Abela, & Starrs, 2009). Not surprisingly, depressive symptoms predict the generation of dependent stressors (i.e., stressors that are at least partially under their own control, e.g., an argument with a friend) but generally are unrelated to independent stressors (i.e., stressors not under their control, e.g., a relative becoming ill).

Despite the acknowledgement that there may be heterogeneity in the degree to which individuals with depressive symptoms generate stress, relatively few studies have examined factors that may exacerbate the impact of depressive symptoms on stress generation. Nonetheless, evidence suggests that the combination of depressed affect and other vulnerabilities (e.g., rumination, Stroud, Sosoo, & Wilson, 2015; relationship problems, Trombello, Schoebi, & Bradbury, 2011; genetic susceptibility for depression; Starr, Hammen, Brennan, & Najman, 2013) may increase stress generation. Although behavioral styles also may moderate the impact of depressive symptoms on stress generation, this possibility is understudied.

The current study tests the hypothesis that co-rumination between friends exacerbates stress generation among adolescents with depressive symptoms. Co-rumination refers to extensive discussion of problems and is characterized by talking about problems frequently, rehashing

problems, speculating about problems including causes and consequences, and dwelling on negative affect associated with problems (Rose, 2002). Considering co-rumination between friends during adolescence is important given that friends are central sources of support at this age (Furman & Rose, 2015). Like rumination, co-rumination is hypothesized to be related to depressive symptoms due to its perseverative, negative focus. In fact, co-rumination between friends is associated with depressive symptoms concurrently (Calmes & Roberts, 2008; Starr & Davila, 2009; Tompkins, Hockett, Abraibesh, & Witt, 2011) and over time (Hankin, Stone, & Wright, 2010; Schwartz-Mette & Rose, 2012; Stone, Hankin, Gibb, & Abela, 2011).

Adolescents with elevated depressive symptoms also may be especially likely to generate stress if they co-ruminate with friends. Recent evidence indicates that co-ruminating increases the salience of problems; that is, co-rumination leads youth to perceive problems as even more serious and more difficult to resolve (Borowski & Rose, 2016). These findings fit with studies indicating that individual rumination also is associated with problems seeming worse and unsolvable (Lyubomirsky & Nolen-Hoeksema, 1995; Lyubomirsky, Tucker, Caldwell, & Berg, 1999). By increasing the salience of problems, co-rumination may activate the tendency of adolescents with depressive symptoms to engage in depression-linked cognitions and behaviors that increase their perceptions of stress and their actual stress experiences. For example, adolescents who co-ruminate engage in greater individual rumination over time (e.g., Jose, Wilkins, & Spindel, 2012). Co-rumination also may activate other depression-linked cognitions, such as self-criticism and making maladaptive attributions. These depression-linked cognitions (rumination, self-criticism, maladaptive attributions) not only could increase perceptions of stress but also could interfere with effective problem solving, leading to additional stressful experiences. In contrast, depressive symptoms may not be linked to stress generation as strongly for youth who refrain from co-rumination.

The moderating effect of co-rumination on stress generation also may be stronger for interpersonal than non-interpersonal stress. The idea that co-rumination may exacerbate the impact of depressive symptoms on stress generation by activating maladaptive cognitions applies to both interpersonal and non-interpersonal stress. However, there are additional reasons why co-rumination may exacerbate the impact of depressive symptoms on interpersonal stress generation in particular. Interpersonal theories of depression suggest that individuals with depressive symptoms engage in aversive behaviors that lead to interpersonal problems, including rejection (Coyne, 1976; Hammen, 2006; Joiner, Coyne, & Blalock, 1999), and empirical studies indicate that youth with depressive symptoms do engage in aversive behaviors (e.g., excessive reassurance seeking, negative feedback seeking, conversational self-focus) that increase risk for rejection and other interpersonal stressors (Borelli & Prinstein, 2006; Prinstein, Borelli, Cheah, Simon, & Aikins, 2005; Schwartz-Mette & Rose, 2016). If co-rumination activates aversive behaviors by increasing problem salience, and these behaviors are uniquely related to interpersonal stress generation, then the moderating effect of co-rumination on stress generation may be especially strong for interpersonal stressors.

Moreover, the moderating effect of co-rumination between friends may be stronger for peer stress than other interpersonal stressors. Co-ruminating friends often belong to the same peer group, and so friends may know more about each other's peer problems than other interpersonal problems, such as family problems. Friends also may be personally invested in each other's peer problems. As a result, friends may spend more time co-ruminating about peer problems than other problems, and conversations about peer problems may be especially emotionally charged. Co-rumination between friends may, therefore, elicit maladaptive cognitions and behaviors most strongly in the peer domain, which could lead to the generation of peer stress.

Although no research has tested whether co-rumination moderates the relation between depressive symptoms and stress generation, some studies examining the effect of stress on depression do suggest interrelations among depressive symptoms, co-rumination, and stress. In one study (Starr, 2015), daily diary data collected each evening indicated that reports of stressors during the day predicted depressed mood during the day only for undergraduates who reported high co-rumination. In another study, daily stressors predicted increasing depressive symptoms from morning to evening only for undergraduates who reported co-ruminating (White & Shih, 2012). These studies, however, did not address whether co-rumination moderates the effect of depressive symptoms on stress generation.

Gender and Developmental Differences

The impact of co-rumination on the relation between depressive symptoms and stress generation also may differ for girls versus boys and for younger versus older adolescents. In terms of gender, the relations may be particularly strong for girls. Girls co-ruminate with friends more than boys (e.g., Jose et al., 2012; Stone et al., 2011) and the prospective relation between co-rumination and depressive symptoms may be stronger for girls than boys (Rose, Carlson, & Waller, 2007). These findings suggest that co-rumination may be a particularly central process in girls' friendships. Moreover, stress generation processes are sometimes found to be stronger among girls than boys (Hankin, Mermelstein, & Roesch, 2007; Rudolph et al., 2000).

In fact, one previous study did indicate positive interrelations among co-rumination, interpersonal stress, and depressive symptoms for girls only. This study did not consider stress generation but rather examined the impact of stress on later depressive symptoms (Bastin, Mezulis, Ahles, Raes, & Bijttebier, 2015). Interpersonal stress predicted increases in depressive symptoms only for girls who reported co-ruminating with friends. For girls who reported lower co-rumination, interpersonal stress did not predict increased depression. The pattern of effects for boys was not easily interpretable. The effect of stress on depressive symptoms was stronger for boys who reported low co-rumination than for boys who reported high co-rumination. Notably, in this study, co-rumination did not interact with the effect of non-interpersonal stress on depressive symptoms for girls or boys.

Hypotheses are more difficult to generate regarding age differences. Because co-rumination in friendships increases during adolescence (Hankin et al., 2010; Stone et al., 2011), the salience of co-rumination and its impact on the relation between depressive symptoms and

stress generation may be stronger for middle than younger adolescents. Alternatively, because coping skills develop with age (Compas, Connor-Smith, Saltzman, Thomsen, & Wadsworth, 2001; Griffith, Dubow, & Ippolito, 2000), older adolescents may be able to manage their emotional and behavioral reactions to co-rumination more effectively than younger adolescents. In this case, co-rumination would be a stronger moderator for younger adolescents. Given these contrasting possibilities, no firm hypotheses are put forth.

The Current Study

In the current study, the impact of co-rumination between friends on the relation between depressive symptoms and stress generation is examined among girls and boys in early and middle adolescence using a short-term longitudinal design. Within the domain of interpersonal stress, peer stress and family stress are considered. School and sports/physical activity stress are considered within the domain of non-interpersonal stress. Hypotheses include: (a) depressive symptoms will predict increases in stress (interpersonal and non-interpersonal), (b) co-rumination will exacerbate the impact of depressive symptoms on interpersonal stress generation; the moderating effect of co-rumination will be weaker for non-interpersonal stress generation and perhaps non-significant, (c) the moderating effect of co-rumination will be stronger for peer stress than family stress, and (d) the moderating effect of co-rumination will be stronger for girls than boys.

Finally, these hypotheses will be considered with and without controlling for individual rumination. A moderate to strong positive relation is typically found between youths' tendencies to ruminate on their own and the degree to which they co-ruminate with friends (e.g., Rose, 2002). Reconsidering the hypotheses while controlling for individual rumination is important to ensure that the effects of co-rumination are not driven by individual rumination.

Method

Participants

Adolescents were recruited from a Midwestern university town using rosters provided by the local public school. Letters were sent to the families of 1,771 adolescents, and 937 of these families were successfully contacted by telephone. The remaining 834 families had disconnected telephone numbers ($n = 248$) or never answered the telephone calls ($n = 586$). Of the 937 families who were successfully contacted via telephone, 321 adolescents participated in the study. Each adolescent who participated was asked to choose a same-sex, same-age, non-relative best or close friend to participate with them. Seven participants were excluded from the final sample because the friend they brought to the lab did not meet one of the above criteria.

The final sample included 628 adolescents (314 friend dyads). Participants were seventh graders ($n = 314$; 51.0% girls; $M_{\text{age}} = 13.01$ years) or tenth graders ($n = 314$; 52.9% girls; $M_{\text{age}} = 16.03$ years). The sample was 62.76% European American, 29.21% African American, and less than 2% each American Indian, Pacific Islander, or Asian American (5.78% reported more than one race). Regarding ethnicity, 3.73% of the sample was

Latino/a. Of 628 adolescents who participated at the initial assessment, 429 (68.3%) also completed the measures used in this report at the 9-month follow-up assessment.

Procedures

At Time 1, participants visited the laboratory and parental consent and youth assent were obtained. Participants completed a series of questionnaires, including those considered in the current study. They completed the same questionnaires 9 months later.

Measures

Depressive symptoms—Adolescents responded to the 20-item Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977). The CES-D assesses symptoms including depressed mood and somatic complaints. Participants responded to each item on a 4-point scale in regards to how they had been feeling over the past week. Internal and test-retest reliability has been established for this measure in adolescent samples (Radloff, 1977, 1991; Garrison, Schluchter, Schoenbach, & Kaplan, 1989). Reliability in the current sample was good ($\alpha = .72$). Scores were the sum of the rating across items.

For descriptive purposes only, recommended cut-off scores were considered in order to describe the current sample. A cut-off score of 16 has been used to identify respondents with high levels of internalizing distress (Barnes & Prosen, 1984; Radloff, 1977; Sawyer, Pfeiffer, & Spence, 2009). In the current sample, 22.9% of participants met this clinical cut-off. Others have recommended a higher cut-off for adolescents (e.g., Prinstein, Boergers, & Spirito, 2001; Roberts, Andrews, Lewinsohn, & Hops, 1990; Roberts, Lewinsohn, & Seeley, 1991). Of the current sample, 16.6% met a more stringent cut-off of 19. These percentages are similar to those in other studies with community samples of adolescents (e.g., Calvete, Orue, & Hankin, 2013). For analyses, the continuous mean scores were used (rather than groups based on the cut-off scores) to allow for greater variability of scores and sensitivity in analyses.

Co-rumination—Participants responded to 27 items assessing co-rumination with the best friend (Rose, 2002). Measures were customized so that the name of each participant's friend was inserted into the measure. Items assessed frequent engagement in problem talk, rehashing problems, mutual encouragement of problem discussions, speculating about causes and consequences, and dwelling on negative feelings associated with problems. Example items are "When we talk about a problem that one of us has, we'll talk about every part of the problem over and over" and "When I have a problem, my friend always tries to get me to tell every detail about what happened." Each item was rated on a 5-point scale. Scores were the mean rating across items for each adolescent. Internal reliability was excellent ($\alpha = .98$).

Stress—Participants reported on their experience of stress over the past month using items from the Daily Hassles Questionnaire (DHQ; Dubois, Burk-Braxton, Swenson, Tevendale, & Hardesty, 2002; adapted from the adult Daily Hassles Scale; Kanner, Coyne, Schaefer, & Lazarus, 1981). The measure assesses daily hassles across several domains; peer, family, school, and sports/physical activity domains were considered in the current study. However,

items were dropped if: (a) the item was related to more than one domain (e.g., “Pressure from parents/guardians to do well in school”), (b) there was considerable ambiguity regarding whether the event was a stressor (e.g., “Being at parties, dances, social events, etc.”), or (c) the item assessed an independent stressor (e.g., “Sick brother or sister.”). Items retained included 11 peer stress items (e.g., “Having trouble making new friends”), 5 family stress items (e.g., “Arguments with parents/guardians”), 5 school stress items (e.g., “Possibility of failing a course”), and 4 sports/physical activity stress items (e.g., “Making mistakes when you participate in sports/physical activities”). Each item was rated on a 5-point scale.

Scores were computed for: (a) interpersonal stressors across the individual domains of peer and family and (b) non-interpersonal stressors across the domains of school and sports/physical activity. In addition, individual scores were computed for each of the four domains (peers, family, school, sports/physical activities). The interpersonal stress score was the mean rating across the 11 peer stress and 5 family stress items (T1 $\alpha = .87$, T2 $\alpha = .88$). The peer stress score was the mean across the 11 peer stress items (T1 $\alpha = .85$, T2 $\alpha = .83$), and the family stress score was the mean across the 5 family stress items (T1 $\alpha = .78$, T2 $\alpha = .82$). The non-interpersonal stress score was the mean rating across the 5 school stress and 4 sports/physical activity stress items (T1 $\alpha = .84$, T2 $\alpha = .77$). The school stress score was the mean across the 5 school stress items (T1 $\alpha = .89$, T2 $\alpha = .79$), and the sports/physical activity stress score was the mean across the 4 sports/physical activity items (T1 $\alpha = .74$, T2 $\alpha = .68$).

Rumination—Participants responded to a version of the Responses to Depression Questionnaire (Nolen-Hoeksema & Morrow, 1991) revised for use with youth (see Rose, 2002). Participants responded to 21 items assessing the extent to which they ruminate (i.e., dwell on their negative affect). Each item was rated on a 4-point Likert scale. Scores were the mean rating across items ($\alpha = .92$).

Missing Data, Interdependence in the Dataset, and Analytic Plan

As noted, 429 of the 628 adolescents completed the measures at Time 2. In addition, there was minimal missing data at Time 1 due to adolescents skipping items (missing data across the Time 1 variables ranged from 0% to 0.6%). Little’s test indicated that the missing data (across both time points) were Missing Completely at Random (MCAR), $\chi^2(81) = 99.48$, $p = .08$. Multiple imputation was used to impute the missing data, and the full sample was used for analyses. Specifically, the missing data were imputed using SPSS (version 23); the iterative Markov chain Monte Carlo method was used to generate five imputed data sets. Pooled estimates across the datasets are presented in the Results. Although conducting analyses with only participants who had complete data might have been justifiable because the data were MCAR (suggesting that the sample of participants with complete data is not biased compared to the full sample), imputing the data was preferable because the approach did not compromise the statistical power of the sample (Little, Jorgensen, Lang, Moore, & Whitney, 2014; Schlomer, Bauman, & Card, 2010; Widaman, 2006).

Because adolescents were nested in friend dyads, each adolescent could not be considered an independent observation. Interclass correlations between the scores of adolescents nested in dyads were: depressive symptoms (ICC = .13), co-rumination (ICC = .32), peer stress (T1 ICC = -.003; T2 ICC = .03), family stress (T1 ICC = .06; T2 ICC = .14), school stress (T1 ICC = .17; T2 ICC = .04), sports stress (T1 ICC = .10; T2 ICC = .07), and rumination (ICC = .15). Multi-level models (adolescents nested in dyads) were used to account for the interdependence in the data.

A separate multi-level model was used for each stress variable (interpersonal stress, peer stress, family stress; non-interpersonal stress, school stress, sports/physical activity stress). Because the same-sex, same-age friend dyads were indistinguishable (i.e., there was not a meaningful variable that differentiated the members of the dyads), compound symmetry was specified as the covariance structure (Kenny, Kashy, & Cook, 2006). Each model was tested in two steps. On the first step, the main effects of the Time 1 stressor, gender, grade, Time 1 depressive symptoms, and Time 1 co-rumination were tested. The Time 2 stressor was the dependent variable. For the second step, all 2-, 3-, and 4-way interaction terms among gender, grade, depressive symptoms, and co-rumination were added to the model. Of particular interest was the interaction between Time 1 depression and Time 1 co-rumination and whether the interaction was further qualified by gender and/or grade. The models were then recomputed with individual rumination included on the first step as an additional control variable.

Results

Means, standard deviations, and correlations among all variables are presented in Table 1. Results from the multi-level models are summarized in Tables 2 and 3.

Interpersonal Stress

For the first model, the Time 2 interpersonal stress score served as the dependent variable (see Table 2). On the first step, Time 1 interpersonal stress was a significant positive predictor of Time 2 interpersonal stress. Depressive symptoms also predicted greater Time 2 interpersonal stress, consistent with the hypothesis that adolescents with depressive symptoms generate greater interpersonal stress over time. The effects of gender, grade, and Time 1 co-rumination were not significant.

On the second step, the three-way interaction among gender, Time 1 depressive symptoms, and Time 1 co-rumination approached significance. Although the interaction did not reach the traditional significance criteria, the interaction was probed due to the the priori hypothesis and the statistical difficulty of detecting interactions in non-experimental designs (e.g., McClelland & Judd, 1993).

The three-way interaction was graphed and is presented in Figure 1, Panel 1. Simple slope analyses were performed to probe the interaction. Consistent with the prediction that co-rumination would exacerbate the effect of depressive symptoms on stress generation, among girls who reported high levels of Time 1 co-rumination (+1 SD), Time 1 depressive symptoms predicted greater Time 2 interpersonal stress, SPE (standardized parameter

estimate) = 0.23, $t = 2.80$, $p = .005$. This effect was not significant for girls who reported low levels of Time 1 co-rumination (-1 SD), $SPE = -0.00$, $t = 0.00$, $p = .998$. The effect of Time 1 depressive symptoms on Time 2 interpersonal stress was non-significant for boys who reported low co-rumination (-1 SD), $SPE = 0.17$, $t = 1.44$, $p = .155$, or high co-rumination ($+1$ SD), $SPE = -0.04$, $t = 0.21$, $p = .840$.

Peer stress—The next model examined the effects of depressive symptoms and co-rumination on peer stress (see Table 2). On the first step, Time 1 peer stress was a significant positive predictor of Time 2 peer stress. Consistent with the stress generation hypothesis, Time 1 depressive symptoms also predicted greater Time 2 peer stress. The effects of gender, grade, and Time 1 co-rumination were not significant. However, on the second step, the interaction between Time 1 depressive symptoms and Time 1 co-rumination was significant. This two-way interaction was qualified by a significant three-way interaction among gender, Time 1 depressive symptoms and Time 1 co-rumination.

The three-way interaction is presented in Figure 1, Panel 2. Consistent with hypotheses, simple slope analyses indicated that, among girls who reported high levels of Time 1 co-rumination ($+1$ SD), Time 1 depressive symptoms predicted greater Time 2 peer stress, $SPE = 0.27$, $t = 3.12$, $p = .002$. This effect was not significant for girls who reported low co-rumination (-1 SD), $SPE = -0.09$, $t = 0.62$, $p = .534$. Unexpectedly, among boys who reported low co-rumination (-1 SD), depressive symptoms predicted greater Time 2 peer stress, $SPE = 0.36$, $t = 2.86$, $p = .007$. However, among boys who reported high co-rumination ($+1$ SD), Time 1 depressive symptoms did not predict Time 2 peer stress, $SPE = 0.07$, $t = 0.39$, $p = .698$.

Family stress—In terms of family stress (see Table 2), the results of the first step indicated that Time 1 family stress was a significant positive predictor of Time 2 family stress. Gender was significant, with girls reporting greater Time 2 family stress than boys. The effect of Time 1 depressive symptoms was positive and approached significance. Grade and Time 1 co-rumination were not significant predictors. The interactions were tested on the second step. Contrary to hypotheses, none of the interactions were significant.

Non-Interpersonal Stressors

Analyses next considered non-interpersonal stress (see Table 3). On the first step, the effect of Time 1 non-interpersonal stress was a positive and significant predictor of Time 2 non-interpersonal stress. Consistent with predictions, Time 1 depressive symptoms also predicted greater Time 2 non-interpersonal stress. However, none of the other effects on the first step were significant, and none of the interactions tested on the second step were significant.

School stress—In the next model (see Table 3), Time 1 school stress was a significant positive predictor of Time 2 school stress. The effect of gender was marginally significant, with girls reporting somewhat greater Time 2 school stress than boys. Consistent with hypotheses, Time 1 depressive symptoms significantly predicted greater Time 2 school stress. The effects of grade and co-rumination were not significant. The interactions were not significant.

Sports/physical activity stress—In the final model (see Table 3), Time 1 sports/physical activity stress was a significant positive predictor of Time 2 stress. Again consistent with hypotheses, Time 1 depressive symptoms significantly predicted greater Time 2 sports/physical activity stress. The effects of gender, grade, Time 1 co-rumination and the interactions were not significant.

Controlling for Rumination

Each of the models was re-computed with rumination included on the first step as a control variable. The details of these analyses are not presented to conserve space but are summarized here. Of interest was whether controlling for rumination changed the effects of depressive symptoms and co-rumination on stress generation.

In the original analyses, the main effect of depressive symptoms on Time 2 stress was significant for five of the six stress variables (interpersonal and non-interpersonal stress; peer stress, school stress, sports/physical activity stress); the effect for the sixth variable (family stress) was marginal. Controlling for rumination attenuated these main effects. Of the five significant effects, two remained significant (non-interpersonal stress and school stress), one remained significant for one gender (sports/physical activity stress for boys), one became marginally significant (peer stress), and one became non-significant (interpersonal stress). The effect that was marginal in the original analyses (family stress) became non-significant. None of the main effects of co-rumination were significant in the original analyses or the analyses in which rumination was controlled.

Importantly, given the primary hypotheses, the pattern of significance for the interactive effects did not change when rumination was controlled. For interpersonal stress, the three-way interaction among gender, depressive symptoms, and co-rumination was marginally significant in the original analysis and remained marginally significant when controlling for rumination. For peer stress, the interaction among gender, depressive symptoms, and co-rumination that was significant in the original analysis remained significant when rumination was controlled.

Discussion

The current study extends the literature on depression and stress by demonstrating that co-rumination exacerbates interpersonal and peer stress generation among adolescent girls with depressive symptoms. Importantly, these moderating effects of co-rumination held while controlling for individual rumination. The results highlight the importance of considering heterogeneity among youth with depressive symptoms, in that some adolescents were more likely than others to generate stress. Understanding factors that contribute to stress generation among youth with depressive symptoms is important, especially because increased stress may contribute to even greater depressive symptoms (Hammen, 2005).

The main effects of depressive symptoms on changes in stress over time that emerged in the current study were generally consistent with previous findings (see Hammen, 2005, 2006). Adolescents' depressive symptoms predicted increases in interpersonal and non-interpersonal stress. Depressive symptoms also predicted increased peer, school, and sports/

physical activity stress and were marginally related to increased family stress. Notably, when individual rumination was controlled, these effects were attenuated. This is not surprising given the strong positive relation between depressive symptoms and rumination and the idea that rumination may be a mechanism through which depressive symptoms lead to stress generation (e.g., Kercher & Rapee, 2009).

Of central interest, the results extended past work by identifying a moderating effect of co-rumination on stress generation. In terms of the composite variables, the interaction between depressive symptoms and co-rumination was marginally significant for interpersonal stress and was not significant for non-interpersonal stress. Specifically, depressive symptoms predicted interpersonal stress generation for adolescent girls who co-ruminated with friends. This pattern of results is interesting in light of past studies indicating stronger effects of depressive symptoms on stress generation for interpersonal than non-interpersonal stressors (Conway, Hammen, & Brennan, 2012; Rudolph, 2008).

The results for the specific stress domains also were generally consistent with hypotheses. The moderating effect of co-rumination was not significant for either school or sports/physical activity stress. These results fit with the hypothesis that the moderating effect of co-rumination would be weaker for non-interpersonal than interpersonal stress.

The results of peer and family stress were consistent with the prediction that the moderating effect of co-rumination would be strongest for peer stress. The moderating effect of co-rumination between friends may be especially strong for peer stress because friends often are embedded in the same peer context, which may lead them to co-ruminate more frequently and intensely about peer stressors than other stressors. Future work could consider whether the impact of depressive symptoms on the generation of family stress is exacerbated when youth co-ruminate with family members (e.g., mothers, see Waller & Rose, 2010, 2013).

Another important next step will be to identify the processes through which girls with depressive symptoms who co-ruminate generate peer stress. As suggested, co-rumination may activate depression-linked cognitive vulnerabilities (e.g., rumination, negative attribution styles, self-perceptions; Jose et al., 2012; Jacobs, Reineke, Gollan, & Kane, 2008; Kercher & Rapee, 2009) and aversive behavioral tendencies (e.g., excessive reassurance seeking, negative feedback seeking, conversational self-focus; Borelli & Prinstein, 2006; Prinstein et al., 2005; Schwartz-Mette & Rose, 2009, 2016). The cognitions could lead girls to perceive peer interactions as especially negative, and the behavioral tendencies could create additional stressors. Moreover, these pathways may be activated especially strongly for girls (as compared to boys) because the mean levels of co-rumination (e.g., Rose, 2002) and some risky cognitions and behaviors (e.g., Jose et al., 2012; Nesi & Prinstein, 2015) are higher among girls than boys. That is, it may take a relatively high level of co-rumination in order to trigger risky cognitions and behaviors and a relatively high level of these cognitions and behaviors to lead to increased perceptions and experiences of stress.

In contrast to the findings for girls, the results for boys did not fit with hypotheses. Depressive symptoms predicted greater peer stress for boys who did not co-ruminate and

were not related to peer stress for boys who did co-ruminate. Because boys' friendships are characterized by lower social support and disclosure overall than girls' friendships (Rose & Rudolph, 2006), boys who report low co-rumination may have very little social support from friends. If these boys lack friends with whom to evaluate problems and generate solutions, they may be at risk for adopting maladaptive strategies (e.g., blaming others) that could lead to more peer stress. Although the findings for boys were inconsistent with hypotheses, they fit with the unexpected pattern of effects that emerged in the previously described study in which the effect of interpersonal stress on depressive symptoms was strongest for boys who reported low co-rumination (Bastin et al., 2015). Together, the studies suggest the co-occurrence of depressive symptoms, stress, and *low* co-rumination among boys.

Despite contributions, the study also has limitations. The most major limitation was the use of a survey measure to assess stress. Life stress interviews are considered the gold standard for assessing stress because they allow for an objective evaluation of the degree to which events are stressful and dependent versus independent (see Hammen, 2005; e.g., Rudolph & Flynn, 2007). Concerns with the current approach include that youth with depressive symptoms may be biased in their reports of stress and that results may be driven by shared-method variance. Notably, though, the latter concern is more serious for bivariate relations than for interactive effects, which are unlikely to be driven by shared-method variance and were of primary interest. Nonetheless, corroborating the results with other methods will be useful. In addition to life stress interviews, future studies could assess depressive symptoms with diagnostic interviews (e.g., Kaufman et al., 1997) and co-rumination with observation (Rose, Schwartz-Mette, Glick, Smith, & Luebbe, 2014).

The generalizability of the results should be considered as well. The results must be interpreted within the context of a community sample. Research is needed to determine if co-rumination exacerbates stress generation among adolescents with clinically significant symptoms. Perhaps the symptoms of clinically depressed youth are severe enough to trigger stress generation regardless of whether they co-ruminate. Also, because youth in the current study participated with a friend, the findings may not extend to isolated youth. Similar to youth in clinical samples, isolated youth may be characterized by heightened depressive symptoms that lead to stress generation regardless of whether they co-ruminate.

In closing, the findings highlight the importance of recognizing that some adolescents with depressive symptoms generate more stress than others. The results indicated that co-rumination can exacerbate the effect of depressive symptoms on the generation of peer stress among girls. Although more research is needed to better understand the findings for boys, the implications for girls are more straightforward. Teaching girls with depressive symptoms how to recognize when their conversations become repetitive, speculative, and negatively focused and how to redirect conversations to be more adaptive may be critical for helping these girls avoid generating even greater experiences of peer stress.

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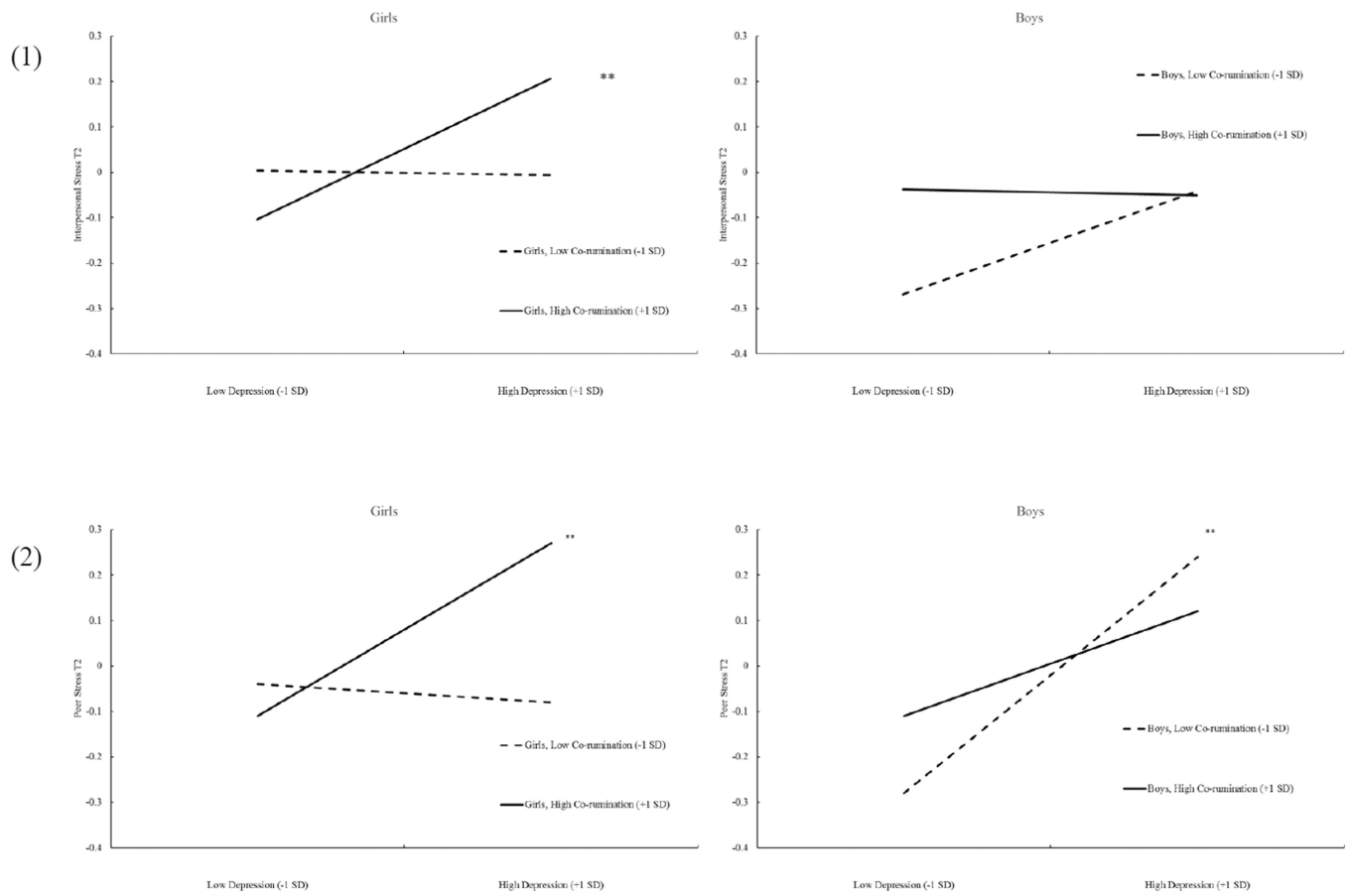


Figure 1. Simple slopes for the 3-way Gender x Depression x Co-rumination interaction on Time 2 Interpersonal Stress (Panel 1) and the 3-way Gender x Depression x Co-rumination interaction on Time 2 Peer Stress (Panel 2). ** $p < .01$

Table 1

Correlations and Descriptive Statistics for Study Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Gender	--												
2. Grade	-.02	--											
3. Rumination	-.18***	.18***	--										
4. Depression	-.21***	.06	.60***	--									
5. Co-rumination	-.39***	.08*	.34***	.19***	--								
6. T1 Peer Stress	-.07	.05	.34***	.42***	.09*	--							
7. T1 Family Stress	-.16***	.10*	.32***	.43***	.10*	.53***	--						
8. T1 School Stress	-.08*	.04	.25***	.35***	.10*	.47***	.38***	--					
9. T1 Sports Stress	-.03	-.09*	.25***	.27***	.05	.56***	.43***	.35***	--				
10. T2 Peer Stress	-.10*	.05	.33***	.34***	.12*	.46***	.38***	.24***	.33***	--			
11. T2 Family Stress	-.23***	.03	.25***	.31***	.14**	.28***	.53***	.18***	.20***	.50***	--		
12. T2 School Stress	-.13**	.06	.19***	.23***	.06	.18***	.25***	.37***	.14**	.34***	.37***	--	
13. T2 Sports Stress	.01	-.07	.18***	.18**	.06	.27***	.16*	.24***	.30***	.50***	.30**	.27***	--
<i>M</i>	--	--	1.98	11.45	2.89	1.71	2.20	2.06	1.65	1.69	2.06	2.30	1.61
<i>SD</i>	--	--	0.55	8.16	0.95	0.59	0.73	1.04	0.66	0.60	0.78	0.93	0.62

Note. T1 = Time 1; T2 = Time 2.

* $p < .05$,

** $p < .01$,

*** $p < .001$.

Table 2
 Summary of Results of Multi-Level Models Predicting Time 2 Interpersonal Stressors

	Time 2 Stress					
	Interpersonal Stress		Peer Stress		Family Stress	
	SPE	t	SPE	t	SPE	t
<u>Step 1: Main Effects</u>						
T1 Stress	0.49	10.38***	0.39	7.75***	0.48	12.43***
Gender	-0.13	1.61	-0.05	0.56	-0.25	2.69*
Grade	-0.02	0.23	0.03	0.40	-0.06	0.86
Depression	0.10	2.25*	0.16	2.89*	0.07	1.75 ⁺
Co-rumination	0.05	1.14	0.05	1.07	0.03	0.70
<u>Step 2: Interactive Effects</u>						
Gender x Grade	0.05	0.24	-0.01	0.05	0.15	0.75
Gender x Depression	-0.02	0.19	0.13	0.92	-0.16	1.36
Gender x Co-rumination	0.02	0.14	-0.10	0.60	0.17	1.27
Grade x Depression	-0.03	0.25	-0.00	0.03	-0.13	1.05
Grade x Co-rumination	0.06	0.51	0.01	0.10	0.15	1.18
Depression x Co-rumination	0.11	1.41	0.18	2.08*	-0.00	0.04
Gender x Grade x Depression	-0.00	0.02	-0.05	0.28	0.15	0.77
Gender x Grade x Co-rumination	0.02	0.09	0.08	0.37	-0.21	1.17
Gender x Depression x Co-rum	-0.22	1.71 ⁺	-0.33	2.63**	-0.01	0.10
Grade x Depression x Co-rum	-0.08	0.70	-0.15	1.14	0.02	0.17
Gender x Grade x Dep x Co-rum	0.16	0.94	0.31	1.49	-0.01	0.06

Note. SPE = standardized parameter estimates. T1 = Time 1.

⁺ $p < .10$,
 * $p < .05$,
 ** $p < .01$,
 *** $p < .001$.

Table 3
 Summary of Results of Multi-Level Models Predicting Time 2 Non-Interpersonal Stressors

	Time 2 Stress					
	Non-Interpersonal Stress		School Stress		Sports Stress	
	SPE	t	SPE	t	SPE	t
<u>Step 1: Main Effects</u>						
T1 Stress	0.35	7.55***	0.32	7.09***	0.26	4.95***
Gender	-0.09	0.86	-0.20	1.92 ⁺	0.12	1.28
Grade	0.09	1.06	0.08	0.86	-0.12	1.27
Depression	0.13	2.99**	0.11	2.18*	0.12	2.21*
Co-rumination	-0.03	0.65	-0.04	0.54	0.06	1.10
<u>Step 2: Interactive Effects</u>						
Gender x Grade	0.04	0.17	-0.04	0.17	0.17	0.85
Gender x Depression	0.13	1.01	0.05	0.37	0.23	1.41
Gender x Co-rumination	-0.08	0.64	-0.05	0.35	-0.03	0.20
Grade x Depression	-0.02	0.18	-0.01	0.12	0.02	0.11
Grade x Co-rumination	0.03	0.20	0.08	0.47	0.02	0.13
Depression x Co-rumination	0.07	0.71	0.07	0.62	-0.06	0.61
Gender x Grade x Depression	-0.05	0.29	0.04	0.21	-0.10	0.49
Gender x Grade x Co-rumination	0.03	0.17	-0.04	0.17	-0.04	0.20
Gender x Depression x Co-rum	-0.05	0.38	-0.10	0.66	0.16	1.05
Grade x Depression x Co-rum	0.04	0.32	-0.02	0.20	0.19	1.17
Gender x Grade x Dep x Co-rum	0.04	0.20	0.19	0.96	-0.29	1.29

Note. SPE = standardized parameter estimates. T1 = Time 1.

⁺ $p < .10$,

* $p < .05$,

** $p < .01$,

*** $p < .001$.