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# Talking Together, Thinking Alone: Relations among Co-Rumination, Peer Relationships, and Rumination

**Julia W. Felton**[1], **David A. Cole**[2], **Mazneen Havewala**[3], **Gretchen Kurdziel**[4], and **Victoria Brown**[3]

[1]Division of Public Health, Michigan State University, Flint, MI

[2]Department of Psychology and Human Development, Vanderbilt University, Nashville, TN

[3]Department of Psychology, University of Maryland, College Park, MD

[4]Department of Psychology, University of Tennessee, Knoxville, TN

## Abstract

Girls are more likely to engage in rumination, associated with the development of mental health problems, as well as report higher levels of friendship quality, hypothesized to protect against these disorders. The current study examined whether co-rumination may drive simultaneous increases in rumination and changes in friendship quality among adolescents. The project included 360 participants (43% boys), ages 9.8 to 15.8 years, and analyses revealed that co-rumination mediated the link between female sex and both rumination and negative friendship quality. There was also a bidirectional relation between co-rumination and positive friendship quality. These findings highlight several pathways by which co-rumination mediates the relation between sex and both maladaptive (i.e. rumination, negative friendship quality) and adaptive (i.e. positive friendship quality) outcomes.

### Keywords

Co-rumination; Rumination; Friendship quality; Peers

Please send correspondence to the first author, julia.felton@hc.msu.edu.

Authors' Contributions

JF conceived of the study with DC, oversaw the data collection, analyzed the data and contributed to writing the manuscript; DC co-conceived the study, participated in the design of the study, created the data analytic plan, and provided feedback on all drafts of the manuscript; MH, GK and VB contributed to drafting the manuscript. All authors have read and accepted the final manuscript.

Conflicts of Interest

The study authors do not have conflict of interests.

Dating Sharing Declaration

The study's data will not be deposited.

Compliance with Ethical Standards

The study was conducted in compliance with all procedures approved by the Vanderbilt University Institutional Review Board. All protocols were consistent with national and international ethical standards.

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent

Informed consent was obtained from all study participants.

## Introduction

Friendships play a central role in the social and emotional development of youth and have long been thought to be protective against the development of psychopathology (Rose & Rudolph, 2006). This may be especially pronounced for girls, who report having more and higher quality friendships (Bastin, Vanhalst, Raes, & Bijttebier, 2018). Peer relationships are associated with important and adaptive functions, such as providing social support (Parker, Rubin, Erath, Wojslawowicz, & Buskirk, 2006) and buffering against the negative effects of stressful events (Evans, Steel, & DiLillo, 2013). Recent research suggests that friendships do not, however, uniformly lead to positive outcomes. Indeed, some friendships are characterized by dysfunctional relational styles that promote maladaptive behaviors, such as disordered eating, drug use, or bullying (Dishion & Tipsord, 2011).

One factor driving these negative outcomes may be co-rumination, defined as the tendency to discuss and rehash problems excessively (Hankin, Stone, & Wright, 2010), encourage fixation on problem-focused conversation (Rose, 2002; Rose, Carlson, & Waller, 2007), and dwell on negative affect among friendship dyads (Tompkins, Hockett, Abraibesh, & Witt, 2011). Research suggests that co-rumination may act as a "double-edged sword" among youth. On the one hand, co-ruminative relationships may model passive and maladaptive approaches to problem solving, which, in turn, may lead to increases in youths' tendencies to engage in negative thinking in the absence of their peers. On the other hand, co-ruminative relationships are experienced as promoting increases in emotional closeness and self-disclosure (Rose et al., 2007). Thus, co-rumination may act as a mechanism for socializing maladaptive stress response styles, while simultaneously increasing perceived social support. The current study will examine both the adaptive and maladaptive outcomes associated with co-rumination,including negative cognitive style (i.e., rumination) and both positive and negative friendship quality, in a longitudinal study of early and middle adolescents.

### Co-Rumination and Rumination: Links to Developmental Stage

Co-rumination was originally conceptualized as representing the overlap between self-disclosure within friendship dyads and rumination, a maladaptive cognitive style characterized by engaging in passive negative thinking in an attempt to understand the causes and consequences of one's depressed mood (Nolen-Hoeksema, 1991; Rose, 2002). Although people who ruminate may believe that dwelling on distress will result in greater self-awareness and, ultimately, an increased ability to cope with sad affect (Papageorgiou & Wells, 2001, 2003), research suggests that rumination is actually associated with the maintenance and exacerbation of a variety of mental health disorders. Moreover, the *relation* between ruminative thinking and psychopathology appears to emerge across early and middle adolescence (Schäfer, Naumann, Holmes, Tuschen-Caffier, & Samson, 2017), immediately preceding the large uptick in rates of mental health disorders found during middle and late adolescence. Thus, understanding predictors of rumination is critical for developing targeted and effective interventions across mental health disorders.

Importantly, and counterintuitively, research suggests even young children who evidence lower rates of psychopathology engage in rumination (e.g. Abela, Brozina & Haigh, 2002).

Indeed, rumination is not associated with negative mental health outcomes until later in development. Recent findings suggest that rumination begins to interact with stressful life events to predict psychopathology around the age of 12 (Felton, Cole, & Martin, 2013), indicating that the transition from early to middle adolescence is a critical period for understanding changes in ruminative responses to stress.

Rose (2002) hypothesized that co-rumination may be an important predictor of increases in rumination across this developmental span. Consistent with social learning theory, which suggests that individuals learn to engage in specific behaviors by observing others, coruminating in dyads may prompt and reinforce a youth to utilize a ruminative response style outside of the relationship. Indeed, co-rumination (but not normative self-disclosure) has been found to serve as a mediator of contagion for internalizing symptoms among youth (Schwartz-Mette & Rose, 2012), suggesting that co-ruminative peer interactions specifically may drive intraindividual maladaptive thinking styles and subsequent psychopathology. In support of this model, several studies have found significant relations between co-rumination and rumination during early adolescence (e.g. Bastin, Mezulis, Ahles, Raes & Bijttebier, 2015; Rose, 2002); however, much of this research has been unable to test prospective bidirectional relations between rumination and co-rumination given the cross-sectional nature of these studies. Stone and Gibb (2015) extended these findings by examining relations between rumination and corumination in a longitudinal study over a six-month period using a sample of 201 high school students. In this study, the authors found that co-rumination predicted increases in rumination, which in turn predicted increases in depressive symptoms, providing further support to suggest co-rumination drives increases in rumination.

Important questions remain, however, regarding whether co-rumination predicts changes in rumination across this developmental period. First, it is not clear that co-rumination leads to rumination, rather than the other direction (rumination leading to increases in co-rumination). It may be that youth who ruminate more seek out and enact co-rumination within their peer relationships. Consistent with this, Jose, Wilkins, and Spendelow (2012) examined the relation between rumination, co-rumination, and social anxiety in children ages 13 to 16 across three assessment periods (3 months apart over a 6-month period). They found that rumination at one wave predicted subsequent co-rumination at the following wave, but that co-rumination did not predict changes in rumination at any point. Second, no study examining the longitudinal relation between these constructs specifically examined youth before the age of 13, during the critical transition period from early to middle adolescence. It may be that co-rumination only leads to rumination among middle adolescents (coinciding with the uptick in related adjustment difficulties) but not earlier. Indeed, studies with younger participants have not consistently supported a relation between co-rumination and mental health problems (e.g. Dirghangi et al., 2015; Starr & Davila, 2009).

## Co-Rumination and Friendship Quality

Alongside the negative outcomes associated with co-rumination, research also suggests that co-rumination drives increases in friendship quality (Rose, 2002; Rose, Schwartz-Mette,

Glick, Smith, & Luebbe, 2014). Indeed, the self-disclosure aspect of co-rumination specifically seems to be associated with perceived closeness within friendships (Rose et al., 2014). A recent examination of the micro-social processes between peers suggests that co-ruminative relationships are characterized by having greater levels of supportive and agreeable responses within conversations. Specifically, youth who engage in rehashing their own problems are more likely to elicit their peers' acknowledgement of the problem, which not only facilitates further discussion, but also reinforces co-rumination within the dyad (Rose et al., 2014).

However, related research suggests that co-rumination may also be linked to negative interpersonal factors. For instance, co-rumination has been found to be a mechanism of stress generation (Rose, Glick, Smith, Schwartz-Mette, & Borowski, 2017), which, in turn, is linked to decreased friendship quality (McLaughlin & Nolen-Hoeksema, 2012). Further, youth who co-ruminate report having more problems with peers generally (Hankin et al., 2010; Shapero, Hankin & Barrocas, 2013). Only one study, however, has looked at co-rumination and its relation to both positive and negative qualities within the friendship dyad and their subsequent effect on psychopathology. Guassi Moreira, Miernicki and Telzer (2016) found that the association between co-rumination and depressive symptoms was moderated by relationship quality, such that co-rumination in a high quality relationship was not associated with depressive symptoms whereas it was in low quality relationships. While this research points to a complex pattern of relations among co-rumination, positive and negative friendship quality, it does not examine whether co-rumination is driving changes in both positive and negative friendship quality.

## The Role of Sex

Central to models of the development of co-rumination, friendship quality, and subsequent rumination and is the role of biological sex. For instance, early sex differences in rates of rumination have been hypothesized to explain the higher rates of related mental health disorders that onset during early and middle adolescence that are more likely to occur in girls during adolescence, such as depression (Twenge & Nolen-Hoeksema, 2002) and eating pathology (Bodell, Wildes, Cheng, Goldschmidt, Keenan, Hipwell, & Stepp, 2018). There also appears to be a strong link between sex and both co-rumination and positive friendship quality, such that girls report higher rates of both co-rumination and friendship quality compared to boys (e.g. Rose et al., 2007; Spendelow, Simonds, & Avery, 2017). Importantly, elevations in rumination and co-rumination are linked to maladaptive outcomes regardless of sex (e.g. Nolen-Hoeksema, 2012; Schwartz-Mette & Rose, 2012), suggesting that, rather than exacerbating the effects between these constructs, sex is a specific predictor of the development of co-rumination, rumination and subsequent mental health problems.

Driving these elevations in co-rumination and rumination among girls may be socialization processes that reinforce specific inter- and intrapersonal styles. For instance, research suggests that adolescents and adults view self-disclosure and ruminative response styles as more consistent with female gender roles (e.g. Broderick & Korteland, 2002; Snell, 1989). Moreover, socialization processes also suggest that co-rumination may be a specific pathway by which girls engender higher rates of friendship quality relative to boys (e.g. Rose,

Carlson & Waller, 2007). Research supports that a feminine gender role orientation is associated with greater self-disclosure, which, in turn, was associated with increases in perceived closeness (Bowman, 2008). As gender-role identification begins to intensify across early to middle adolescence (Hill & Lynch, 1983), girls may become more likely to evidence greater friendship quality and engage in more co-rumination and rumination compared to their male counterparts.

## Current Study

The above disparate lines of research suggest a number of pathways by which girls become more likely to engage in both rumination and co-rumination. The current study sought to identify these specific pathways and address several important gaps in the literature regarding the relations between co-rumination, friendship quality, and rumination. The first goal was to examine the directional relation between co-rumination and rumination across a four-month period in two age groups: early and middle adolescence. Given research suggesting important changes in the nature of co-rumination and rumination across these developmental periods, it was hypothesized that co-rumination would drive increases in rumination for the middle adolescent group only, whereas rumination would not predict changes in co-rumination in either age group. The second goal of the study was to examine co-rumination as a mechanism linking sex and subsequent rumination and friendship quality. It was hypothesized that girls would evidence greater co-rumination, which, in turn, would lead to increases in rumination and both positive and negative friendship quality.

## Method

### Participants

One hundred forty-seven boys and 197 girls in grades 5 through 9 were recruited from four public elementary, middle, and high schools near the Nashville metropolitan area. Participants ages ranged from 9.8 to 15.8 years ($M$ = 12.4, $SD$ = 1.5); youth ages 12 and under (64.4% of the sample) represented early adolescents while youth ages 13 and older (35.6% of the sample) were considered middle adolescents. The racial makeup of the sample was representative of the surrounding area: 86.8% White, 3.3% Black, 4.7% Hispanic/Latino, and 5.2% multi-ethnic or “other.” Youth who had limited command of English and those who were intellectually delayed were not included in the current data collection. Participants were assessed at two time points, four months apart. Of the original participants in Wave 1, 87% of the sample was retained in Wave 2 and an additional 20 students were added who participated in Wave 2 only (resulting in a sample of 132 boys and 184 girls at Wave 2). Full information maximum likelihood estimation methods were used to handle missing data, which provide less biased parameter estimates than procedures such as listwise deletion, pairwise deletion, or single imputation methods under the missing at random assumption (Little & Rubin, 1987). Thus, all analyses were conducted on the full sample of 364 youth. Students who completed both waves did not significantly differ from students who completed only one wave on any demographic or study variables ($p$s > .10).

## Measures

**Rumination.—**The Response Style Questionnaire (RSQ, Nolen-Hoeksema & Morrow, 1991) is a widely used measure of rumination and distraction coping styles (Kercher & Rapee, 2009; Schwartz & Koenig, 1996, Weir & Jose, 2008). For the purposes of the current study, the 17 items identified by Bagby and Parker (2001) as loading onto a symptom-focused factor and a self-focused rumination factor were used. These factors together constitute the Rumination Response Scale (RRS). Respondents rated the frequency with which they engaged in various ruminative behaviors (e.g., “Think about how alone you feel “) on 4-point Likert scales (1 = almost never to 4 = almost always). Scores on the RSQ-RRS can range from 17 to 68. The RRS has strong internal reliability within both adult (Nolen-Hoeksema & Morrow, 1991) and adolescent populations (Schwartz & Koenig, 1996). In the current study, coefficient alphas were .89 at Wave 1 and .92 at Wave 2.

Rumination was also measured using the Children’s Response Styles Questionnaire (CRSQ; Abela, Rochon, & Vanderbilt, 2000), which is composed of two subscales (Ruminitive Response and Distracting Response) and has a total of 24 items. Participants were asked to rate each item on 4-point Likert-type scales (0 = almost never to 3 = almost always). The Ruminative Response subscale has 13 items describing self-focused responses to depressed mood, for example, “When I am sad, I think about how alone I feel.” The subscale has a positive correlation with depressive symptoms and has a coefficient alpha of 0.76 in 3$^{rd}$ graders and 0.84 in 7$^{th}$ graders (Abela et al., 2000). In the current study, the Ruminative Response subscale had alphas of 0.88 and 0.89 at Waves 1 and 2, respectively.

**Co-Rumination.—**Co-rumination was assessed using the Co-Rumination Questionnaire (CRQ, Rose, 2002), which evaluates the extent to which youth typically co-ruminated with their same-sex friend. Participants were asked to rate each of the 27 items on a 5-point Likert scale, ranging from 1 (not at all true) to 5 (really true). Sample questions include: “When we talk about a problem that one of us has, we usually talk about that problem every day even if nothing new has happened” and “When we talk about a problem that one of us has, we try to figure out everything about the problem, even if there are parts that we may never understand.” Corumination total scores had alphas ranging from .90 to .97 in child, adolescent and college samples (Calmes & Roberts, 2008, Rose, 2002: Rose et al. 2007; Starr & Davila, 2009). Cronbach’s alpha for the current sample was .90 and .92 at Waves 1 and 2, respectively.

**Friendship Quality.—**The Network of Relationships Inventory-Behavioral Systems Version (NRI-BSV; Furman & Buhrmester, 2009) is a 24-item measure that assesses positive and negative aspects of close relationships. Eight lower-order factors load onto two higher-order factors. One higher order factor taps positive friendship quality and includes a summary of two attachment factors (‘respondent seeks safe haven’ and ‘respondent seeks secure base’), two caretaking factors (‘respondent provides safe haven’ and ‘respondent provides secure base’), and one affiliation factor. The second higher-order factor taps negative friendship quality and is comprised of conflict, antagonism, and criticism factors. Students were asked to think about their closest same-sex friend and rate how often they engage in various supportive or negative behaviors with this person on a 5-point Likert

scales (from 1 = *little or none*, to 5 = *the most*). For the current study, both the positive and negative friendship quality scales were used. Both scales have high test-retest reliability and have demonstrated convergent and discriminant validity (Furman & Buhrmester, 1985, 2009). In the current study, total scores on the positive friendship quality scale had an alpha of .92 and .93, and total scores on the negative friendship quality had an alpha of .87 and .89, for Waves 1 and 2, respectively.

**Demographics.—**Demographic information, including participant sex[1] and age were self-reported.

### Procedures

Data were collected between 2009 and 2010. Consent forms were sent home to all parents of 5th through 9th graders at five elementary, middle, and high schools in the beginning of the school year. Children were re-consented four months later at Wave 2. Both waves of data collection took place at school during school hours. At the beginning of each data collection session, a trained research assistant administered and reviewed assent forms. Children in the 7th, 8th, and 9th grades proceeded through the questionnaire packets on their own. Due to concerns about reading ability at younger grades, questionnaires were read aloud to participants in the 5th and 6th grades, while participants followed along on their own copies of the questionnaires. At the end of each data collection, participants received a $10 gift card to a local store. The Institutional Review Board at Vanderbilt University approved this research, titled, *Growing Up Thinking Well*.

## Results

### Missing Data Patterns and Descriptive Statistics

First, patterns of missing data were examined using Little's missing completely at random (MCAR) test. These analyses supported the assumption that data was MCAR: $\chi^2$ (160) = 184.52, $p$ = .090. Descriptive statistics for friendship quality, co-rumination, and rumination measures for boys and girls are reported in Table 1. Next, a series of $t$−tests were computed to compare mean levels of boys' and girls' responses on key study variables (see Table 1). Boys and girls differed on all variables, with the exception of negative friendship quality. As expected, girls reported greater positive friendship quality, tendency to co-ruminate, and levels of rumination. Correlations between these variables are reported in Table 2. Of note, there was a significant, negative relation between positive and negative friendship quality at Wave 1 (but not Wave 2). Questionnaires measuring the same construct were also highly correlated in the expected direction.

### Model 1: Relations Between Co-Rumination and Rumination

All hypotheses were tested using M*plus* 6 (Muthén & Muthén, 2010). The first model sought to examine whether co-rumination drove changes in rumination in two groups: early and middle adolescents. To test this, a two-wave, multigroup structural equation cross-lag panel

[1]As students were asked to report their sex, the term "sex" (which refers to a biological construct) is used throughout the manuscript rather than "gender" (which refers to the social roles associated with sex).

model was examined in which Wave 2 co-rumination and rumination were regressed onto Wave 1 co-rumination and rumination, in early and middle adolescent age groups (see Figure 1). Latent factors were then created to represent each of these constructs. A latent rumination factor was created by using the RSQ and CRSQ as indicators. Because only a single manifest measure of co-rumination was given, a latent co-rumination factor was created utilizing a parceling approach. Specifically, individual parcels were created using a heterogeneous approach, by randomly dividing items on the CRQ into three parcels, each serving as a separate indicator of co-rumination. Identical parcels were used at Wave 1 and Wave 2. Utilizing parcels of unidimensional constructs to create multiply indicated latent variables has been shown to improve the stability of estimates and reduce error variances (Kishton & Widaman, 1994; Little, Cunningham, Shahar, & Widaman, 2002). Cross-wave correlations were allowed between the disturbance terms of repeated indicators, in line with recommendations by Marsh (1993). Four fit indices were used to estimate how well the model fit the data: the $\chi^2$ statistic, the Comparative Fit Index (CFI; Bentler, 1990), Tucker-Lewis Index (TLI; Tucker & Lewis, 1973), and the Root Mean Square Error of Approximation (RMSEA; Steiger, 1990).

First, measurement invariance was examined across both age and gender groups. In order to do this, the factor loadings for each of the indicator variables onto each latent variable were constrained to be the same across four groups: early and middle adolescent boys and girls. Adding these constraints did not significantly perturb the fit of the model and provided a good absolute fit to the data: $\chi^2$ (152) = 210.38, $p$ = .001; CFI = 0.98; TLI = 0.98; and RMSEA = .07 [90% CI = .04 to .09], indicating that the measurement model performs similarly across age and sex groups.

The first hypothesis suggested that co-rumination would be associated with increases in rumination among the middle adolescents but not early adolescents. In order to test this hypothesis, path estimates linking these constructs were examined for significant differences between age groups utilizing a multigroup approach. First, an unconstrained multigroup model was tested. This model fit the data well: $\chi^2$ (60) = 74.05, $p$ = .105; CFI = .99; TLI = .99; and RMSEA = .04 [90% CI = .00 to .06]. Next, each parameter estimate between latent factors were sequentially constrained to be equal to one another. A perturbation in model fit, as indexed by changes in the $\chi^2$ and corresponding degrees of freedom, would suggest that the pathways are significantly different from one another. None of these constraints resulted in a significant change in model fit, suggesting no significant differences in the relation of these variables between age groups. Thus, all of the following analyses were conducted on the full sample.

Next, specific pathways in the transactional model were examined. The model continued to fit the data well, $\chi^2$ (24) = 26.04, $p$ = .251; CFI = 1.00; TLI = 1.00; and RMSEA = .02 [90% CI = .00 to .05]. Wave 1 correlations among endogenous variables indicate that baseline co-rumination and rumination were positively correlated with one another. In partial support of the first hypothesis, results suggest that initial elevations in co-rumination predicted increases in rumination for all youth; however, the path between Wave 1 rumination and Wave 2 corumination was not significant, suggesting a unidirectional relation between these constructs.

### Model 2: Sex Effects on Co-Rumination, Friendship Quality, and Rumination

The next set of hypotheses required tests of co-rumination as a mediator of both the relation between sex and rumination and sex and friendship quality in the full sample. Sex was added as an exogenous predictor to the transactional model and the indirect effect of sex onto both positive and negative friendship quality and rumination via co-rumination was examined. Given age-related differences in mean levels of key constructs of interest, age was also added as a baseline covariate (see Figure 2). After fitting the model, the indirect effects (i.e., sex → corumination → positive/negative friendship quality, and sex → co-rumination → rumination) were tested by estimating their confidence intervals, using the bootstrapping procedure recommended by Preacher and Hayes (2008). Unlike hypothesis testing based on parametric statistics, bootstrapping procedures do not assume normality (Preacher & Hayes, 2008). An indirect effect with a confidence interval that does not contain 0 would indicate a statistically significant indirect effect of sex on positive and/or negative friendship quality and rumination through co-rumination. The indirect effects of sex on co-rumination via both positive and negative friendship quality and rumination were also examined as alternative models.

The mediation model fit the data, $\chi^2$ (70) = 215.65, $p < .001$; CFI = .97; TLI = .94; and RMSEA = .07 [90% CI = .06 to .09]. There was a significant effect of sex on rumination, positive friendship quality, and co-rumination at Wave 1, suggesting that, consistent with previous findings, being female was associated with higher levels of each of these constructs (see path estimates in Table 3). Age was significantly associated with rumination, co-rumination, and negative friendship quality, indicating that older age is linked to lower levels of rumination, higher levels of co-rumination, and greater negative friendship quality. Further, the results supported both hypothesized mediation models. Specifically, Wave 1 co-rumination mediated the link between sex and Wave 2 positive friendship quality (indirect effect = .10, *SE* = .03; [95% CI = .047 to .15]), between sex and Wave 2 negative friendship quality (indirect effect = .08, *SE* = .03; [95% CI = .02 to .15]), and between sex and Wave 2 rumination (indirect effect = .06, *SE* = .03; [95% CI = .003 to .12]). Positive friendship quality at Wave 1 was also found to mediate the relation between sex and Wave 2 co-rumination (indirect effect = .05, *SE* = .02; [95% CI = .008 to .10]). Neither the indirect effect of sex to Wave 2 co-rumination via Wave 1 rumination nor Wave 1 negative friendship quality were significant.

In order to examine specific age effects among these relations, post-hoc analyses were conducted using a multigroup model of early and middle adolescents. Utilizing the same approach outlined above, an unconstrained multigroup mediation model (composed of early and middle adolescents) was examined first. In order to make this model as parsimonious as possible, age was removed as a baseline covariate. This model fit the data: $\chi^2$ (132) = 281.29, $p < .001$; CFI = .96; TLI = .94; and RMSEA = .08 [90% CI = .06 to .09]. Next, the specific indirect and direct pathways were constrained to examine whether age statistically moderated the proposed mediation models. None of these constraints resulted in a statistical decrement in fit, suggesting the pattern of relations was similar between early and middle adolescents[2].

## Discussion

Girls experience increases in both the tendency to ruminate (associated with the development of mental health problems) and positive friendship quality (thought to protect against maladaptive psychological outcomes) across adolescence. Research suggests that corumination may be driving these simultaneous increases in both risk and protective factors; however, the longitudinal relations between these constructs, and how these relations may change across development, are not well understood. The current study examined the role of sex and co-rumination in the development of rumination and positive and negative friendship quality. Given notable increases in rates of psychological disorders across adolescence, especially for girls, the models also examined these relations across two critical developmental periods: early and middle adolescence. These results yielded three important findings. First, corumination at Wave 1 predicted increases in residualized rumination at Wave 2, whereas rumination at Wave 1 was not associated with increases in co-rumination over time. However, this relation did not appear to differ by age group. Second, co-rumination and positive friendship quality were related bidirectionally. Specifically, co-rumination led to increases in positive friendship quality while positive friendship quality also predicted increases in co-rumination over time. Third, as hypothesized, the results suggest that co-rumination mediated the link between sex and both rumination and positive and negative friendship quality. These results are expanded upon below.

These findings replicate and extend existing research on the relation between corumination and rumination, suggesting that the content of dyadic interactions (i.e. co-rumination) may drive individual differences in rumination, whereas cognitive style (i.e. rumination) was less likely to influence patterns of interactions within friendships, across age groups. This finding is important in that it suggests that co-rumination is critical to the early development of ruminative tendencies (prior to notable escalations in rumination-linked psychopathology). Moreover, the directionality of this relation may reflect that as youth engage in more rumination as they grow older, they may withdraw or isolate from peers (providing less opportunity for co-rumination) which may serve to exacerbate increases in pathology across later adolescence (e.g. Miers, Blöte, Heyne, & Westenberg, 2014). These results may differ from other studies that found the reverse relation (e.g. Jose et al., 2012) because of differences in methodology. For instance, Jose and colleagues (2012) used single, abbreviated measures of rumination and co-rumination, which may introduce greater measurement error. Moreover, the authors examined relations among an older sample with a narrower age range, suggesting the nature of the relation between rumination and co-rumination may change during late adolescence.

Importantly, the model of early and middle adolescents did not support any of the hypothesized differential age effects. These findings may reflect the relatively truncated age range of the sample. In other words, in may be that the direction and strength of these effects change later in development (as observed in Jose et al., 2012). Alternatively, a recent meta-

[2]In order to further examine the role of age in these relations, a sex by age (measured continuously) interaction was also examined as a predictor of Wave 1 rumination, co-rumination, positive and negative friendship quality. The interaction was not a significant predictor of any construct, nor was the indirect effect of the interaction significant in any of proposed mediation pathways.

analyses including studies of children, adolescents and young adults suggests that age does not moderate the relation between co-rumination and internalizing symptoms (Spendelow et al., 2017). If rumination is one pathway by which co-rumination leads to internalizing symptoms, it may be that the relation between co-rumination and rumination also stays consistent across age groups. Future studies utilizing larger age ranges and linking these constructs to mental health outcomes are needed to illuminate these relations further; however, considered together, the results indicate that co-rumination may be a powerful early target for intervention efforts aimed at decreasing rumination during both early and middle adolescence.

The second finding suggested a bidirectional relation between co-rumination and positive friendship quality, indicating that the improvement in peer relationships secondary to corumination may be a powerful reinforcer of engaging in further co-rumination. The effects on positive friendship quality associated with increased co-rumination (considered alongside the finding that co-rumination is also associated with increases in rumination) also suggests a potential mechanism for increasing long-term rumination. These findings are consistent with the established literature on peer contagion, which suggests that peers may use positive reinforcement to influence one another to engage in specific behaviors associated with negative behavioral and psychological outcomes (see Dishion & Tipsord, 2011 for a literature review). For instance, research on aggressive children suggests that microsocial processes, such as laughing when a peer discusses antisocial behavior, may reinforce these actions and, in turn, promote more deviant behavior (Dishion, Spracklen, Andrews, & Patterson, 1996; Patterson, Dishion, & Yoerger, 2000). Co-rumination may work in a similar way, such that youth reinforce one another when discussing and rehashing specific problems they are experiencing, simultaneously increasing positive regard within the friendship and increasing a ruminative cognitive style.

These findings are also consistent with recent research examining psychopathology and homophilic selection (i.e., the notion that adolescents with mental health problems choose to be friends with peers who are similarly impaired) vs. socialization effects (i.e., the idea that having impaired peers increase one's own psychological symptoms). In a study comparing these two processes, Giletta and colleagues (2011) found that socialization (rather than homophily) processes were driving increases in depressive symptoms; in other words, youths were not necessarily selecting peers with similar levels of depression; rather their peers' levels of depression, over time, influenced their own depressive symptoms. In a similar fashion, the participants may not have been selecting friends who ruminate, but rather were socialized to become more ruminative by their friends.

Interestingly, Giletta et al. (2011) found this relation held for girls only, hypothesizing that female adolescents' higher rates of emotional support within friendship dyads may serve to increase similarities between friends. Indeed, other research suggests that female and male friendships may evidence important qualitative differences. For instance, girls are more likely to perceive their own friendships as socially supportive compared to boys (e.g., Colarossi & Eccles, 2003; Slavin & Rainer, 1990). This relation may be especially characteristic of girls who identify with cultural norms related to femininity; indeed, research suggests that when compared to boys, young girls have more pronounced positive

and internalizing emotional expression (Chaplin, T. M., & Aldao, 2013). Thus, socialization may play multiple roles in these relations: first, girls are socialized to disclose more within friendships, and these friendships, in turn, promote more maladaptive patterns of responding to stressful experiences. Considered alongside the current findings, these results suggest that co-rumination may act as a specific mechanism for socializing maladaptive patterns of responding to stressful experiences.

This research also examined the relation between co-rumination, sex, and negative friendship quality. There was a significant direct effect of sex on negative friendship quality, suggesting that boys report greater negative friendship quality at Wave 2, and also a significant mediation effect, whereby girls report higher rates of co-rumination which, in turn, are associated with higher rates of negative friendship quality. This may be an example of *inconsistent mediation* (MacKinnon, Fairchild, and Fritz, 2007) in which the pathway from male sex to negative friendship quality is in the opposite direction of the pathway from female sex to corumination and co-rumination to negative friendship quality. While the finding that being male is associated with greater negative interactions with peers is supported by considerable extant literature (Jenkins, Goodness, & Buhrmester, 2002; Updegraff et al., 2004), this study is the first to demonstrate that co-rumination may act as a pathway by which girls experience increases in negative interactions within friendship dyads. These findings are supported by other, related, research that suggests youth high in co-rumination report more baseline levels of peer-specific stress (Rose et al., 2017) and greater increases in interpersonal and dependent stressful life events over time (Hankin et al., 2010). Given research that indicates elevations in interpersonal problems are associated with subsequent psychopathology (Martin, Felton & Cole, 2016), increasing negative friendship quality may represent another pathway linking co-rumination to worse emotional adjustments among girls.

Several limitations in the current study point to important avenues for further study. First, mental health outcomes (such as anxiety, depression, substance use, and eating pathology) were not examined in the current model. Although rumination has been consistently linked to a variety of disorders (Aldao et al., 2010), future studies should expand the current analyses by examining pathways to specific psychological outcomes. Second, the four-month time lag between waves of data collection, although long enough to capture significant effects, may have missed other important changes in relationships. Specifically, it may be that it was also too short to identify the effects of individuals' cognitive style on patterns of dyadic interactions, or too long to capture micro-social processes. Adding more waves would further allow us to examine the developmental course of friendships, and determine the effects of inter- and intra-personal styles on the stability of these relationships. Additional waves would also permit examination of the influence of friendship quality on the dual trajectories of co-rumination and rumination.

Third, the study did not include any measures to determine whether youth were reporting on the same friendship at both time points. While a recent review of the developmental trajectory of friendships across youth suggests moderate stability during this developmental period (Poulin & Chan, 2010) and the current data indicated strong stability in friendship constructs over time, future studies should account for changes in best friendships over time.

Fourth, the sample represented a relatively truncated age range. It is possible that utilizing a larger sample spanning a larger time frame would have allowed us to capture differential changes in the relation between these constructs, similar to those that have been found in other studies (e.g. Jose et al., 2012). Moreover, and consistent with previous research (e.g. Rose, 2002), relatively coarse age groups were utilized to reflect distinct developmental periods. Future research should consider examining these relations across more narrowly defined age groups to better understand their developmental trajectories. Finally, all measures were self-report, which may have introduced mono-method bias (e.g., Cook & Campbell, 1979). Future studies should consider utilizing interactional coding systems to capture important nuances in the way that friendship dyads discuss problems (see Rose, Smith, Glick & Schwartz-Mette, 2016). Moreover, the addition of peer-reports of friendship quality would decrease concerns regarding same-informant bias and yield a more nuanced picture of youths' relationships.

## Conclusion

Adolescence is a period of significant change in both social and emotion well-being, specifically for girls; thus, understanding mechanisms linking biological sex to positive and negative outcomes is critical for understanding these developmental processes and refining intervention and prevention approaches. The current study sought to address a number of gaps in the literature regarding the role of co-rumination as a specific pathway by which girls become more likely to develop both risk (rumination and negative friendship quality) and protective (positive friendship quality) factors associated with the onset of psychopathology. Specifically, the study examined the direction of the relation between these constructs, changes in these relations across critical developmental periods, and mechanistic pathways linking sex to adaptive and maladaptive outcomes. These results suggest that co-rumination may be reinforced by its bidirectional relation with friendship quality, which, in turn, drives the development of both rumination and negative friendship quality. Given the precipitous increases in mental health problems across adolescence especially among girls, these findings point to co-rumination as a possible target for improving longer-term adjustment during this vulnerable developmental period.

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## Biographies

Julia Felton is an Assistant Professor in the Division of Public Health, Michigan State University. She received her PhD in Clinical Psychology from Vanderbilt Univeristy. Her

major research interests include identifying and treating early predictors of the development of depression, substance use, and related risk behaviors.

David Cole is a Professor in the Department of Psychology and Human Development, Vanderbilt University. He received his PhD in Clinical Psychology from University of Houstan. His major research interests include development of psychopathology, specifically, childhood depression. Mazneen Havewala is a faculty research assistant in the Department of Psychology, University of Maryland, College Park. Her major research interests include development of psychopathology, specifically, parent-child relations, influence of parenting styles, parental psychopathology and parental conflict on the psycho-social development of the child.

Gretchen Kurdziel-Adams is a Doctor of Philosophy student in the Department of Psychology, University of Tennessee. Her major research interests include attachment and substance use in individuals with borderline personality disorder.

Victoria Brown is a research assistant in the Department of Psychology, University of Maryland. Her major research interests include adaptation and resilience in individuals with disabilities in order to develop therapies and preventative treatments for those with special needs, and early life trauma/stress and emotion perception in individualistic vs. collectivistic cultures.

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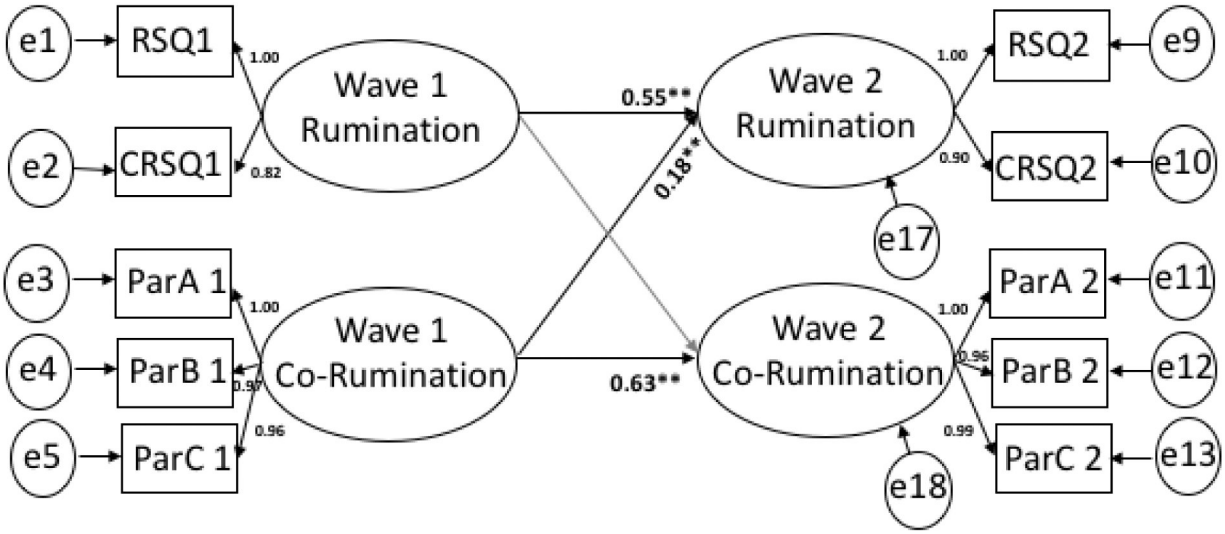


**Figure 1.**

Unstandardized estimates for Model 1.

*Note*. Significant paths are in bold. CRSQ = Children's Response Styles Questionnaire; RSQ = Response Styles Questionnaire; Par = Parcel.

*$p < .05$, **$p < .01$

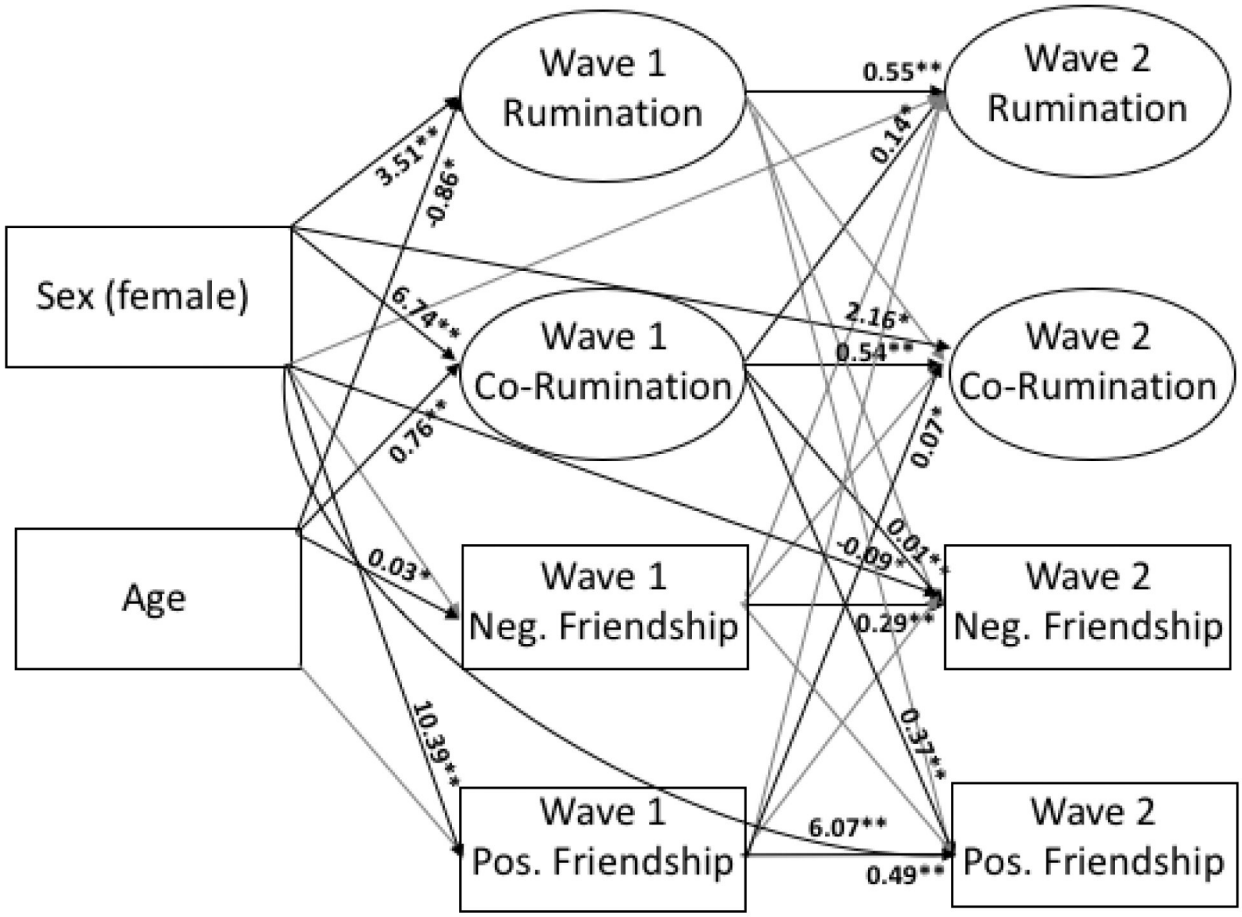


**Figure 2.**
Unstandardized estimates for Model 2.
*Note*. Significant paths are in bold. *$p < .05$, **$p < .01$

## Table 1

Psychometric Properties of the Major Study Variables

| Measure | M (SD) | | *t*(df) | *p* | Cohen's d |
|---|---|---|---|---|---|
| | Boys | Girls | | | |
| Wave 1 NRI – positive | 45.41 (14.25) | 55.88(11.49) | −7.06 (245) | <.001 | 0.81 |
| Wave 2 NRI – positive | 39.84 (12.02) | 53.60 (12.22) | −9.42 (286) | <.001 | 1.13 |
| Wave 1 NRI – negative | 13.78 (5.60) | 13.39 (5.19) | .61 (326) | .542 | 1.13 |
| Wave 2 NRI – negative | 13.27 (5.89) | 12.18 (4.26) | 1.55 (228) | .122 | 0.21 |
| Wave 1 CRQ | 55.48 (20.69) | 75.92 (20.63) | −8.90 (331) | <.001 | 0.99 |
| Wave 2 CRQ | 45.21 (17.03) | 64.83 (23.89) | −8.13 (285) | <.001 | 0.95 |
| Wave 1 RSQ | 28.27 (8.74) | 31.81 (9.70) | −3.41 (330) | <.001 | 0.38 |
| Wave 2 RSQ | 23.66 (7.39) | 28.38 (10.16) | −4.56 (284) | <.001 | 0.53 |
| Wave 1 CRSQ | 21.65 (7.06) | 25.78 (9.05) | −4.24 (267) | <.001 | 0.51 |
| Wave 2 CRSQ | 19.95 (7.54) | 24.15 (8.74) | −4.23 (287) | <.001 | 0.52 |

*Note*. NRI = Network of Relationship Inventory; CRQ = Co-Rumination Questionnaire; RSQ = Response Styles Questionnaire; CRSQ = Children's Response Styles Questionnaire.

**Table 2**

Summary of Intercorrelations of Key Study Variables

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Sex (female) | 1.00 | | | | | | | | | | | |
| 2. | Wave 1 NRI Positive | .38** | 1.00 | | | | | | | | | | |
| 3. | Wave 2 NRI Positive | .49** | .65** | 1.00 | | | | | | | | | |
| 4. | Wave 1 NRI Negative | −.04 | −.12* | −.07 | 1.00 | | | | | | | | |
| 5. | Wave 2 NRI Negative | −.11 | −.06 | −.01 | .33** | 1.00 | | | | | | | |
| 6. | Wave 1 CRQ | .44** | .47** | .48** | .10 | .09 | 1.00 | | | | | | |
| 7. | Wave 2 CRQ | .41** | .42** | .58** | .01 | 0.8 | .62** | 1.00 | | | | | |
| 8. | Wave 1 RSQ | .18** | .18** | .14** | .16* | .08 | .38** | .17** | 1.00 | | | | |
| 9. | Wave 2 RSQ | .25** | .22** | .30** | .15** | .12* | .36** | .43** | .54** | 1.00 | | | |
| 10. | Wave 1 CRSQ | .24** | .25** | .17** | .12* | .13* | .40** | .30** | .81** | .56** | 1.00 | | |
| 11. | Wave 2 CRSQ | .24** | .25** | .23** | .10 | .14** | .39** | .41** | .59** | .78** | .64** | 1.00 | |
| 12. | Wave 1 Age | .02 | −.01 | .18** | .11 | .09 | .15** | .25** | −.14** | .07 | .00 | .01 | 1.00 |

*Note*. NRI = Network of Relationship Inventory; CRQ = Co-Rumination Questionnaire; RSQ = Response Styles Questionnaire; CRSQ = Children's Response Styles Questionnaire.

* $p < .05$,

** $p < .01$.

## Table 3

Path Estimates for Structural Equation Models

| Effect | Unstandardized *(B)* | *95% CI* | *SE(B)* | *p* |
|---|---|---|---|---|
| Model 1. Cross-lag Model | | | | |
| Rumination 1 → Rumination 2 | 0.55 | 0.43 to 0.67 | 0.06 | <001 |
| Co-Rumination 1 → Rumination 2 | 0.18 | 0.06 to 0.30 | 0.06 | .003 |
| Rumination 1 → Co-Rumination 1 | -0.03 | −0.11 to 0.06 | 0.04 | .548 |
| Co-Rumination 1 → Co-Rumination 1 | 0.63 | 0.53 to 0.73 | 0.05 | <001 |
| Model 2. Mediation Model | | | | |
| Rumination 1 → Rumination 2 | 0.55 | 0.43 to 0.66 | 0.06 | <001 |
| Co-Rumination 1 → Rumination 2 | 0.14 | 0.01 to 0.28 | 0.07 | .032 |
| NRI-Negative 1 → Rumination 2 | 0.13 | −2.53 to 2.78 | 1.36 | .926 |
| NRI-Positive 1 → Rumination 2 | 0.03 | −0.04 to 0.10 | 0.04 | .460 |
| Sex → Rumination 2 | 0.83 | −1.11 to 2.77 | 0.99 | .402 |
| Rumination 1 → Co-Rumination 2 | -0.04 | −0.13 to 0.05 | 0.04 | .362 |
| Co-Rumination 1 → Co-Rumination 2 | 0.54 | 0.42 to 0.65 | 0.06 | <001 |
| NRI-Negative 1 → Co-Rumination 2 | -0.70 | −3.03 to 1.63 | 1.19 | .554 |
| NRI-Positive 1 → Co-Rumination 2 | 0.07 | 0.01 to 0.14 | 0.03 | .020 |
| Sex → Co-Rumination 2 | 2.16 | 0.48 to 3.83 | 0.86 | .012 |
| Rumination 1 → NRI-Negative 2 | -0.00 | −0.01 to 0.003 | 0.00 | .655 |
| Co-Rumination 1 → NRI-Negative 2 | 0.01 | 0.001 to 0.01 | 0.00 | .020 |
| NRI-Negative l → NRI-Negative 2 | 0.29 | 0.18 to 0.39 | 0.05 | <001 |
| NRI-Positive 1 → NRI-Negative 2 | -0.00 | −0.004 to 0.002 | 0.00 | .435 |
| Sex → NRI-Negative 2 | -0.09 | −0.16 to-0.01 | 0.04 | .025 |
| Rumination 1 → NRI-Positive 2 | -0.10 | −0.28 to 0.08 | 0.09 | .267 |
| Co-Rumination 1 → NRI-Positive 2 | 0.37 | 0.18 to 0.56 | 0.10 | <001 |
| NRI-Negative l → NRI – Positive 2 | -1.32 | −5.10 to 2.46 | 1.93 | .494 |
| NRI-Positive 1 → NRI-Positive 2 | 0.49 | 0.39 to 0.59 | 0.05 | <001 |
| Sex → NRI-Positive 2 | 6.07 | 3.36 to 8.78 | 1.38 | <001 |
| Age → Rumination 1 | -0.86 | −1.54 to-0.18 | 0.35 | .013 |
| Sex → Rumination 1 | 3.51 | 1.49 to 5.54 | 1.03 | .001 |
| Age → Co-Rumination 1 | 0.76 | 0.25 to 1.28 | 0.26 | .004 |
| Sex → Co-Rumination 1 | 6.74 | 5.21 to 8.26 | 0.78 | <001 |
| Age → NRI-Negative 1 | 0.03 | 0.002 to 0.05 | 0.01 | .034 |
| Sex → NRI-Negative 1 | -0.02 | −0.09 to 0.05 | 0.04 | .536 |
| Age → NRI-Positive 1 | -0.13 | −1.07 to 0.82 | 0.48 | .794 |
| Sex → NRI-Positive 1 | 10.39 | 7.61 to 13.17 | 1.42 | <001 |

*Note*. NRI = Network of Relationship Inventory.