

How is Anxiety Involved in the Longitudinal Relationship between Brooding Rumination and Depressive Symptoms in Adolescents?

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Received: 26 November 2012 / Accepted: 10 December 2012 / Published online: 25 December 2012
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Abstract A growing body of research supports the application of Response Styles Theory to adolescent populations. Although the essential dynamic, namely that rumination increases the incidence of depressive symptoms, has been demonstrated among adolescents, a number of important empirical questions remain, such as: what are the gender differences and developmental trends for brooding and reflective rumination?; does a reciprocal relationship exist between brooding or reflective rumination, on the one hand, and depressive symptoms and anxiety, on the other hand, over time? and how do additional variables (i.e., anxiety) impact upon the rumination-depressive symptoms relationship? In this study, self-reported levels of rumination (both brooding and reflective), and anxious and depressive symptoms were measured longitudinally across 4 months in a sample of 976 community adolescents (46 % females), aged 11–16 years old. Mean group differences showed that female adolescents reported engaging in more brooding rumination than male adolescents beginning at 13 years of age. A reciprocal brooding rumination to depressive symptoms relationship and a reciprocal brooding rumination to anxiety relationship were found over time, and they did not differ for boys and girls. We tested the possibility that anxious symptoms would function as a third variable, but the obtained model showed that brooding rumination and anxiety both contributed unique variance in predicting changes in depressive symptoms over time.

Keywords Rumination · Depressive symptoms · Anxiety · Adolescence · Longitudinal

Introduction: Adolescent Rumination and Depression

Individuals who experience depression during childhood or adolescence are at an increased risk of experiencing depression during adulthood (Harrington et al. 1991). Adult models of depression, such as Response Styles Theory (RST; Nolen-Hoeksema 1987, 1991), have been extended downwards in an attempt to map the development of depression among childhood and adolescence (Nolen-Hoeksema and Girgus 1994; Ziegert and Kistner 2002). RST asserts that depressed mood can be prolonged and exacerbated through the use of cognitive and emotional dynamics such as ruminative coping. Rumination is characterized as a passive coping style wherein individuals focus on the causes, consequences, or symptoms of distress without taking active steps to change their feelings (Nolen-Hoeksema 1991). Depression is defined in the literature as a set of dysphoric cognitions and emotions that a person holds about him/herself (e.g., “I am worthless” and “I am sad”). The central tenet of RST—specifically that an individual who ruminates while depressed maintains and intensifies their depressive symptoms—is supported by a large and growing body of research (for reviews see Nolen-Hoeksema et al. 2008; Thomsen 2006). This theory provides a provocative and promising direction for investigating the roots of depressive thought in adolescence.

Rumination and depressive symptoms have been studied predominantly with adult samples, but interest in the effect of rumination on maladjustment during childhood and adolescence has recently increased. For example, various

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studies have found that rumination is associated with increased maladjustment during childhood and adolescence (e.g., Abela et al. 2002; Muris et al. 2004; Ziegert and Kistner 2002). Longitudinal studies have found that rumination predicts increases in depressive and anxious symptoms across time (Abela and Hankin 2011; Hilt et al. 2010; Schwartz and Koenig 1996). Nolen-Hoeksema et al. (2007), in particular, found that rumination exhibited reciprocal relationships with depressive, bulimic, and substance abuse symptoms across 4 years in a sample of female adolescents. Taken together, these results suggest that adolescents who ruminate are more likely to exhibit a range of psychopathologies.

Despite this burgeoning literature on adolescent rumination and depression, five aspects of the rumination-maladjustment relationship require further investigation. First, it is unclear whether previously identified results for adolescents apply equally well to two main subtypes of rumination: reflective and brooding. Although Treynor et al. (2003) made this useful distinction between different types of rumination almost 10 years ago, only a few studies with adolescents have carried forward this difference in empirical research. Reflective rumination describes thoughtful and non-emotional reassessment of past and present events, feelings, and behaviours (e.g., “write down what you are thinking, and analyze it”), whereas brooding rumination refers to “moody pondering” (e.g., “I think ‘why can’t I handle things better?’”). Second, we know little about how levels of rumination fluctuate across the adolescent period; in particular, do we find the onset of a gender difference in rumination occurring in early adolescence, preceding the gender difference in depression? Third, does the reciprocal relationship between rumination and depression identified among female adolescents (Nolen-Hoeksema et al. 2007) generalize to male adolescents? Fourth, does a reciprocal relationship between rumination and *anxiety* exist that is similar in function and form to the proposed rumination-depression relationship? And fifth, it is unclear whether and how additional so-called “third variables”, such as anxiety, might affect the proposed reciprocal rumination-depression relationship. Anxiety is a promising third variable because the core dynamic of anxiety as identified in the literature, namely unease about the potential occurrence of a negative event or state (e.g., Roseman et al. 1996), seems to overlap with the core dynamic of rumination, namely trying to cope with negative events. The majority of research examining RST has tested the rumination-depression relationship in isolation from additional variables. Because depressed mood is often comorbid with anxious mood (Saylor et al. 1984), we wanted to test the rumination-depression relationship while incorporating concurrent anxious mood.

Brooding and Reflective Rumination in Adolescence

A few studies have used Treynor et al.’s (2003) guidance on the nature of subtypes of ruminative thought within the age range of adolescence. Burwell and Shirk (2007) determined that brooding rumination, but not reflective rumination, was predictive of subsequent depressive symptoms in a longitudinal study of adolescents. Verstraeten et al. (2010), in a study of early adolescents, did not find that brooding rumination predicted depressive symptoms longitudinally, but they did find that reflective rumination exerted a protective influence by negatively predicting depressive symptoms at 1 year for older participants and boys. Similarly, Mezulis et al. (2011) and Willem et al. (2011) also found that brooding rumination, but not reflective rumination, was associated with maladjustment in prospective studies with adolescents. It may be, then, that brooding rumination may be the “active ingredient” in the previously measured construct of general rumination that precipitates maladjustment in general and depressive symptoms in particular. In contrast, this recent evidence suggests that reflective rumination may exert either no or a salubrious effect on adjustment. We adopted this distinction in the following five proposed research goals.

Developmental Trends of Rumination

Researchers have found that females ruminate more than males in both adult and adolescent samples (Broderick and Korteland 2002; Butler and Nolen-Hoeksema 1994; Garnefski et al. 2004; Jose and Brown 2008). Unfortunately, the majority of adolescent studies have collapsed analyses across age, obscuring any developmental trajectories that may exist. Changes in the prevalence of rumination during adolescence, such as the specific age at which the sex difference in rumination first occurs, remain unclear. Further, research is entirely lacking on the developmental trends of brooding versus reflective rumination. Examining the timing at which the gender difference in brooding rumination occurs is important because, for RST to account for the gender difference in depression, females should report higher brooding rumination than males either prior to or at the same time as females report higher depression than males. In contrast, the developmental pattern of depression is better understood. Males and females report similar levels of depressive symptoms before reaching 13 years of age; however, adolescent females report more depressive symptoms than male adolescents from 13 years on (Twenge and Nolen-Hoeksema 2002).

Jose and Brown (2008) conducted one of the few studies that specifically has examined the developmental patterns of rumination (however they did not distinguish between

brooding and reflective rumination). In a cross-sectional study, Jose and Brown found no sex differences in general rumination for 11 year olds, but from 12 years on females reported ruminating more than males. These results suggest that the developmental trajectory of rumination is similar to and perhaps contributes to the developmental trajectory of depression. Extrapolating from these results, we would expect male and female preadolescents to report similar levels of brooding rumination, followed by a divergence during the early adolescent period (about age 12–13 years.) wherein females would report higher levels of brooding rumination than males.

Reciprocal Relationships among Rumination, Depression, and Anxiety

Research to date has emphasised rumination's effect on maladjustment while comparatively little attention has been given to maladjustment's effect on rumination. In one of the few studies that has examined the effect of maladjustment on rumination, Nolen-Hoeksema et al. (2007) found a reciprocal rumination-depression relationship across a 4 year period in a sample of adolescent females. Specifically, initial rumination predicted increases in later depression, and initial depression also predicted increases in later rumination. These findings suggest that a “downward spiral” may exist whereby rumination intensifies depression and depression intensifies rumination. Given that only females were included in the sample, it is unknown whether this reciprocal rumination-depression relationship would be found among male adolescents. There is no theoretical reason to expect that the rumination-depression relationship differs between males and females (Nolen-Hoeksema 1994), despite the frequently confirmed gender difference in mean levels of rumination; therefore, we would expect this relationship to be reciprocal for males as well.

In the present study, we also considered the involvement of anxiety with rumination. Given that rumination longitudinally predicts an increase in anxious symptoms among adolescents (Schwartz and Koenig 1996), it is possible that an unidentified reciprocal relationship between rumination and anxiety also may exist. We wanted to examine whether, similar to the rumination-depression relationship, there is also a downward spiral that occurs between rumination and anxiety whereby rumination intensifies anxious mood while at the same time anxious mood also intensifies rumination. Given that Nolen-Hoeksema et al. (2007) have found that reciprocal relationships exist between rumination and other psychopathologies (e.g., bulimic symptoms), it is quite possible that the rumination-depression relationship functions similarly to the relationship between rumination and

other forms of psychopathology. Consequently we predicted that we also would find a reciprocal rumination-anxiety relationship.

Does Anxious Mood Account for the Rumination-Depression Relationship?

Although rumination has been found to predict various psychopathologies, it is unclear whether the rumination-depression relationship is affected by additional variables (so-called “third variables”). Given the high comorbidity among depressed and anxious mood, it is important to examine how the rumination-depression relationship is influenced by concurrent anxious symptoms. Research with adult samples has shown that the rumination-depression relationship is substantially weakened when levels of anxiety are controlled (Hong 2007; Harrington and Blankenship 2002; Segerstrom et al. 2000). Similarly, in a sample of adolescents, Muris et al. (2004) found that rumination predicted depressive symptoms when measured in isolation; however, when anxious symptoms (worry) were controlled, rumination was no longer related to depressive symptoms. These results suggest that the rumination-depression relationship may be accounted for, at least in part, by anxiety. Unfortunately, because researchers primarily have used concurrent rather than longitudinal designs, it is difficult to reliably distinguish between the unique predictive effects of rumination (particularly brooding rumination) and anxiety on depression. Here we address this gap in the literature by examining the effects of anxiety on the rumination-depression relationship longitudinally. Based on previous findings, we predicted that the strength of the brooding rumination-depression relationship would be reduced when one accounts for concurrent anxious symptoms.

In addition, we believed it possible that rumination, anxiety, and depression might evidence a sequential mediation pattern over time. As Nolen-Hoeksema et al. (2008) have noted, worry (anxiety) and rumination are conceptually and empirically related constructs and they may reinforce each other over time. To this end, we sought to test whether the adolescents in the present study would evidence a longitudinal mediation pattern in which anxiety would lead to rumination, which in turn would lead to depression. In other words, adolescents who worry about the possibility of negative events happening (anxious symptoms) may resultantly engage in more brooding rumination about their inability to cope with negative affect (brooding rumination), and this in turn might lead to an increase in depressive cognitions and affect (depressive symptoms). This mediational pathway has not previously been examined in adolescents.

Research Goals

In short, five goals were proposed for this study. Our first goal was to examine whether brooding rumination, as opposed to reflective rumination, accounts for the negative effects noted by other researchers. Second, we sought to identify age and gender differences in rumination and dysphoric mood across adolescence. Our third goal was to examine whether the reciprocal rumination-maladjustment relationship exists for males as well as females. Our fourth goal was to examine whether the proposed rumination-anxiety relationship exists and is reciprocal. Last, our fifth goal, was to examine whether and how anxious symptoms are involved in the reciprocal rumination-depressive symptoms relationship.

Methods

Participants and Procedures

Eleven demographically diverse schools from New Zealand participated in this study. Schools distributed information sheets describing the study, as well as parental consent forms for adolescents to take home. Participants aged 16 years or older gave their own consent to participate—by New Zealand law parental consent is not required for individuals 16 years and older. Participants younger than 16 years were allowed to participate only if they provided parental consent. In total, 2,366 consent forms were provided to these 11 schools and initially 1,174 adolescents were recruited to participate in this study, equating to a 49 % response rate, similar to other studies using similar populations (e.g., Nolen-Hoeksema et al. 2007). Data were collected during school time in groups of students ranging in size between 10 and 100 adolescents. Written adolescent assent was also obtained after the study was described, but before data collection commenced.

After a few withdrawals, 1,138 adolescents (623 males, 515 females) participated at Time 1. Four months later, 926 participants completed the same survey at Time 2. Attrition was due chiefly to absence at follow-up. Thus, 926 (496 males, 430 females) participants constituted the final sample, with about equal numbers of males and females across the age-span from 11 to 16 years (see Table 1). The majority of participants were European New Zealanders (72 %), 12 % were Maori, 2 % were Asian, 2 % were Pacific Islanders, and 12 % classified their ethnicity as “Other”; these percentages are generally representative of the ethnic distribution of New Zealand.

Table 1 Descriptive statistics: frequencies of males and females by age

Age (in years)	Gender		Total
	Male	Female	
11	85	117	202
12	118	104	222
13	69	40	109
14	91	66	157
15	61	44	105
16	72	59	131
Total	496	430	926

Measures

Rumination

Participants completed the 16-item ruminative response subscale from the Response Styles Questionnaire (RSQ; Nolen-Hoeksema et al. 1993). The RSQ measures the tendency to think about the reasons why the person experiences negative affect. Responses are given on a 5-point Likert scale (1 = never to 5 = always) with higher scores indicating higher levels of ruminative coping. The RSQ, as a summed scale, has demonstrated good internal reliability (Butler and Nolen-Hoeksema 1994), test–retest reliability (Nolen-Hoeksema et al. 1994), and predictive validity of depressive symptoms (Just and Alloy 1997; Nolen-Hoeksema 2000). However, in the present study, we intended to use the two subscales of rumination: reflective and brooding rumination. An example of a reflective rumination item is “I go to my room alone to think about how I feel” and an example of a brooding rumination item is “I think, why can’t I handle things better?” Delineation of the scale into brooding and reflective types of rumination (Treyner et al. 2003) yielded two reliable subfactors (α s = .89 and .79 at T1 and .91 and .79 at T2 respectively). A measurement model CFA on the two subfactors yielded good model fit at T1, $\chi^2/df = 1.88$, $GFI = 1.00$, $AGFI = .99$, $sRMR = .017$, $RMSEA = .031$; 95 % CI $RMSEA = .01-.06$, and also at T2, $\chi^2/df = 2.26$, $GFI = .98$, $AGFI = .95$, $sRMR = .034$, $RMSEA = .07$; 95 % CI $RMSEA = .02-.09$.

Anxious Symptoms

The Beck Anxiety Inventory (BAI; Beck et al. 1988) is a 21-item measure designed to assess the severity of anxious symptoms among adolescents and adults while minimizing the overlap with depressive symptoms. The BAI emphasizes psychosomatic symptoms of nervousness and anxiety, and examples of items are “dizzy or light-headed” and

“difficulty in breathing”. Items are scored from 0 = no symptoms to 3 = severe symptoms; overall scores range between 0 and 63. In this study, the BAI was internally reliable for all age groups at both time points ($\alpha = .83-.94$).

Depressive Symptoms

The Children’s Depression Inventory (CDI; Kovacs 1985, 1992) is a 27-item measure of depressive symptoms in children and adolescents aged 7–17 years. The CDI, modelled on the Beck Depression Inventory (Beck et al. 1996), is structured so that each of the 27 items is composed of 3 sentences (“I like myself”, “I do not like myself”, “I hate myself”), and within each cluster, participants choose the one sentence that best represents how they have felt over the past 2 weeks. Items are scored on a three-point scale: 0 = no symptoms, 1 = mild symptoms and 2 = severe symptoms, with overall scores ranging between 0 and 54. The CDI has good internal reliability (Saylor et al. 1984), and is considered to be a valid measure of depressive symptoms (Kovacs 1985). In this study, the CDI was internally reliable across all age groups at both time points ($\alpha = .84-.93$).

Attrition Over Time

Chi squared analyses determined that males ($p < .05$) were slightly less likely to be retained over time than females. In addition, individuals who were not retained reported higher depressive symptoms at T1 ($p < .05$).

Results

Age and Gender Differences in Rumination, Anxious Symptoms, and Depressive Symptoms

To test for mean group differences in brooding rumination, reflective rumination, anxiety, and depressive symptoms, we conducted a two (gender) by six (age: 11, 12, 13, 14, 15, & 16 years) repeated measures MANOVA and found that, as predicted, females reported significantly higher levels of brooding and reflective rumination, anxious symptoms, and depressive symptoms than males (see Table 2). A main effect for age was not found for either anxious or depressive symptoms; however, a main effect of age was evident for both types of rumination; they both evidenced a linear increase across this age-span. As predicted, the age by sex interaction for depressive symptoms was significant (see Fig. 1). Males reported marginally higher levels of depressive symptoms at 11 years old than females, similar levels of depressive symptoms were noted in 12 and 13 year-olds, and then from 14 years, females

reported more depressive symptoms than males. Probing the significant gender by age interaction for brooding rumination (see Fig. 2) indicated no gender difference until age 13, and thereafter females reported higher levels than males. In summary, and as expected, we found that females engaged in more brooding rumination than males slightly prior to the development of the sex difference in depressive symptoms, providing support for RST.

Relationships among Rumination, Anxious Symptoms, and Depressive Symptoms

Table 3 shows that all variables were intercorrelated moderately to strongly, both concurrently and longitudinally. To further explore the longitudinal relationships among the variables, latent variable path modeling was employed. We first aimed to replicate Nolen-Hoeksema et al.’s (2007) finding that the rumination-depressive symptoms relationship is reciprocal across time. Next, we aimed to extend Nolen-Hoeksema et al.’s findings in two ways: first, by testing whether the rumination-anxious symptoms relationship is also reciprocal; and second, by testing whether anxious symptoms can account for the reciprocal rumination-depressive symptoms relationship.

Model Specification

Three parcels were created for each construct, and parcels were identical at Time 1 and Time 2. Latent variables were correlated concurrently at both time 1 and Time 2 (i.e., all possible covariances were estimated), and autocorrelations between each manifest indicator over time were specified as well. Note that neither autocorrelations nor parcels are represented in Figs. 3, 4, 5 and 6 for ease of interpretation.

Was the Rumination-Depressive Symptoms Relationship Reciprocal?

A latent variable cross-lag path model was specified with two stability pathways (one each for the latent constructs of rumination and depressive symptoms across time), and two cross-lag pathways (initial rumination predicting follow-up depressive symptoms and initial depressive symptoms predicting follow-up rumination). This model was tested separately for brooding and reflective rumination with depressive symptoms because it was predicted that a bi-directional relationship would be obtained only for brooding rumination. As expected, reflective rumination did not evidence a reciprocal relationship with depressive symptoms: the cross-lag between reflective rumination T1 and depressive symptoms T2 was non-significant, $\beta = .01$, $p = .75$; as was the cross-lag between depressive symptoms T1 and reflective rumination, $\beta = .04$, $p = .23$.

Table 2 MANOVA effects of age and gender on rumination, and anxious and depressive symptoms

	Males		Females		$F_{(1, 914)}$ gender	Partial η^2 gender	$F_{(5, 914)}$ age	Partial η^2 age	$F_{(5, 914)}$ age \times gender	Partial η^2 age \times gender
	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>						
Brooding rum	2.15	.03	2.37	.03	23.36***	.03	2.05*	.01	1.97*	.01
Reflective rum	1.95	.03	2.44	.04	104.31***	.10	2.22*	.01	1.59	.01
Anxiety	9.22	.40	10.77	.46	6.51*	.01	1.02	.01	1.81	.01
Depression	7.91	.33	9.07	.37	5.65*	.01	1.04	.01	3.51**	.02

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

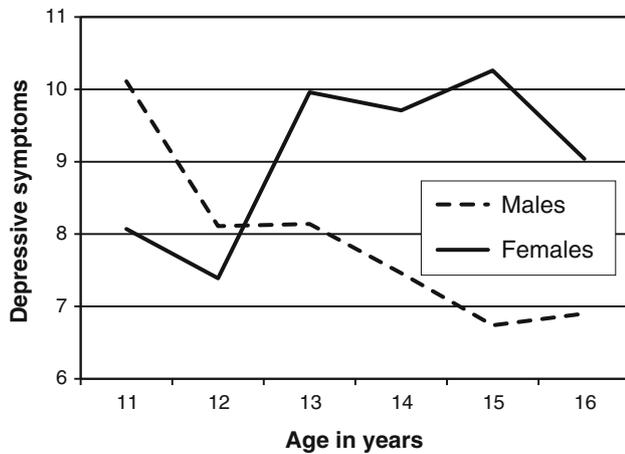


Fig. 1 Mean depressive symptoms scores for males and females across the age span from 11 to 16 years

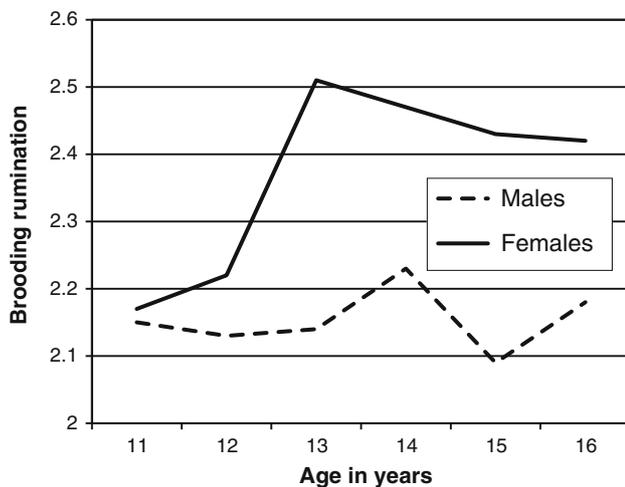


Fig. 2 Mean brooding rumination scores for males and females across the age span from 11 to 16 years

However, a test of the brooding rumination model indicated that, as predicted, a reciprocal rumination-depressive symptoms relationship was obtained (see Fig. 3). As predicted, depressive symptoms at T1

significantly predicted increases in later rumination, $\beta = .11, p = .005$, and brooding rumination at T2 significantly predicted increases in later depressive symptoms, $\beta = .10, p = .004$. This model exhibited good model fit: χ^2/df ratio = 2.85, $GFI = .98, AGFI = .96, sRMR = .026, RMSEA = .045, 95\% CI RMSEA = .04$ to $.05$, and provided support for the Response Styles Theory. An equality constraint was performed on the two cross-lags to determine whether this bi-directional relationship was symmetrical. The Chi square change value proved to be non-significant, $\chi^2_{ch}(1) = .82, p > .50$, suggesting that the two paths were of about equal strength.

Was the Rumination-Anxious Symptoms Relationship Also Reciprocal?

A second latent variable cross-lag model tested the potential reciprocal rumination-anxiety relationship. Again, two models examined whether reflective or brooding rumination would evidence a reciprocal relationship with anxious symptoms. The model for reflective rumination indicated that although anxious symptoms at T1 predicted changes in reflective rumination at T2, $\beta = .09, p = .02$, the reverse path from reflective rumination at T1 to anxious symptoms at T2 did not reach significance, $\beta = .01, p = .82$. This result suggests that anxious adolescents at T1 became more reflective over time, but reflective rumination, in and of itself, did not lead to increases in anxiety.

Examination of the second model revealed, as expected, that brooding rumination evidenced a reciprocal relationship with anxious symptoms over time (see Fig. 4). Brooding rumination significantly predicted increases in later anxious symptoms, $\beta = .09, p = .016$, and anxious symptoms at T1 significantly predicted increases in subsequent brooding rumination, $\beta = .16, p < .001$. Again, model fit indices were good: $\chi^2/df = 1.52, GFI = .99, AGFI = .98, sRMR = .019, RMSEA = .024, 95\% CI RMSEA = .01$ to $.04$. This resulting path model suggests a significant reciprocal brooding rumination-anxious symptoms relationship exists among adolescents, providing additional support for

Table 3 Concurrent and longitudinal correlations among rumination, anxious symptoms, and depressive symptoms

	Brooding rum T1	Reflective rum T1	Anx T1	Dep T1	Brooding rum T2	Reflective rum T2	Anx T2	Dep T2
Brooding rum T1		.57	.55	.57	.61	.38	.43	.51
Reflective rum T1			.41	.41	.39	.63	.29	.34
Anx T1				.64	.45	.34	.65	.56
Dep T1					.43	.32	.47	.75
Brooding rum T2						.51	.55	.57
Reflective rum T2							.38	.41
Anx T2								.65
Mean	2.26	2.19	9.74	8.38	2.21	2.12	10.01	8.25
SD	0.72	0.82	9.29	7.60	0.74	0.80	10.07	7.76

All correlations are significant, $p < .001$

Fig. 3 Reciprocal relationship between brooding rumination and depressive symptoms over 4 months

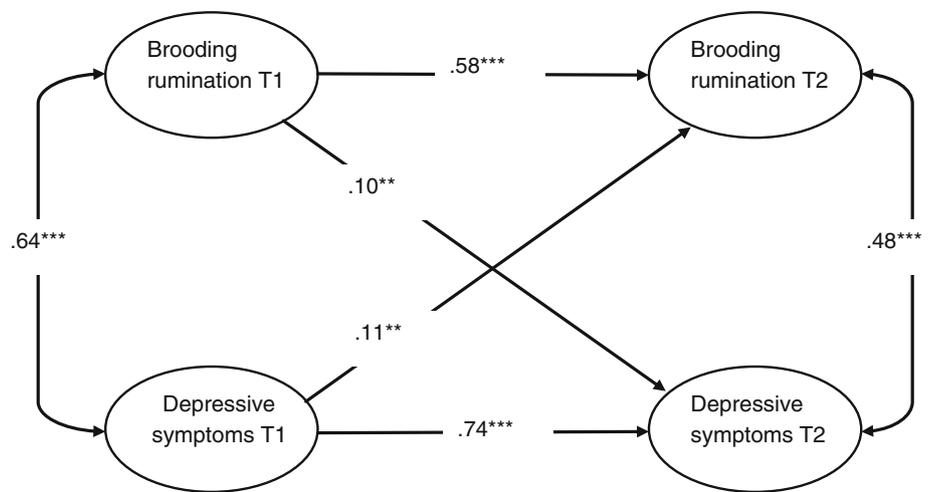
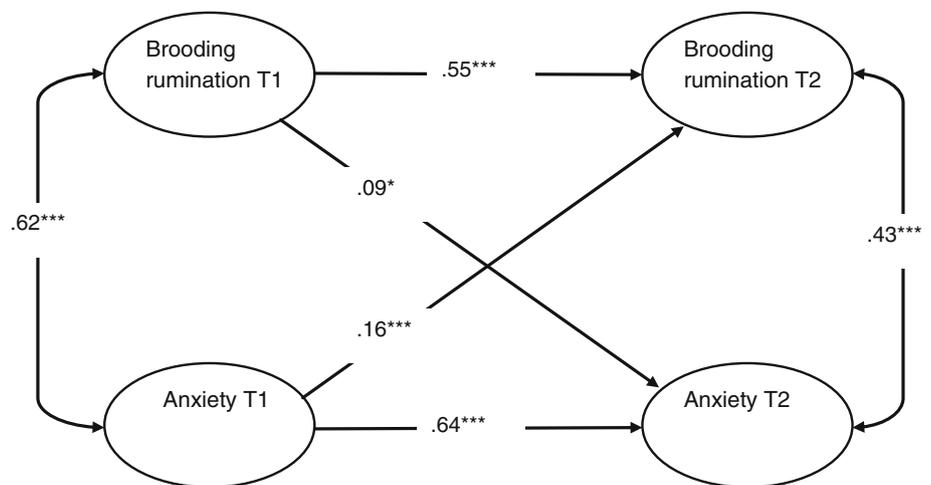


Fig. 4 Reciprocal relationship between brooding rumination and anxiety over 4 months



RST. An equality constraint was performed on the two cross-lags to determine whether this bi-directional relationship was symmetrical. The Chi square change value proved to be

significant, $\chi^2_{ch}(1) = 4.30, p < .05$, suggesting that anxious symptoms more strongly led to brooding rumination than the reverse.

Fig. 5 Reciprocal relationship between anxiety and depressive symptoms over 4 months

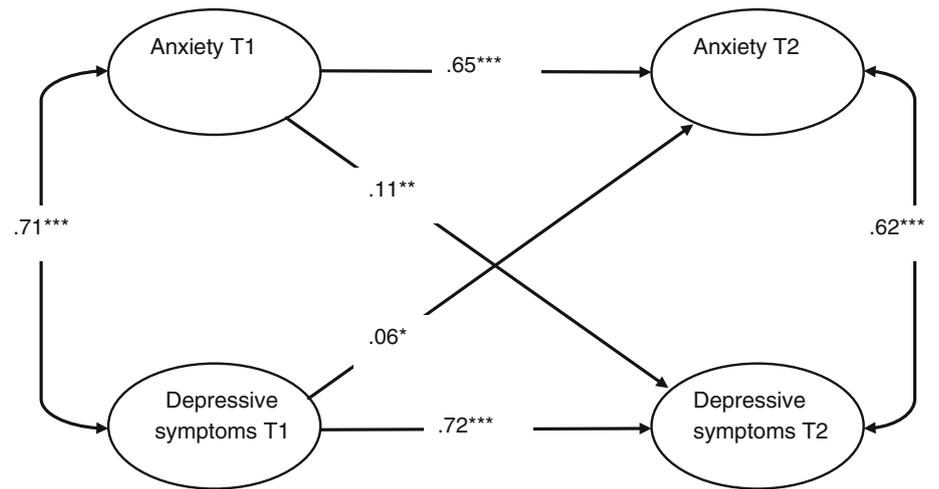
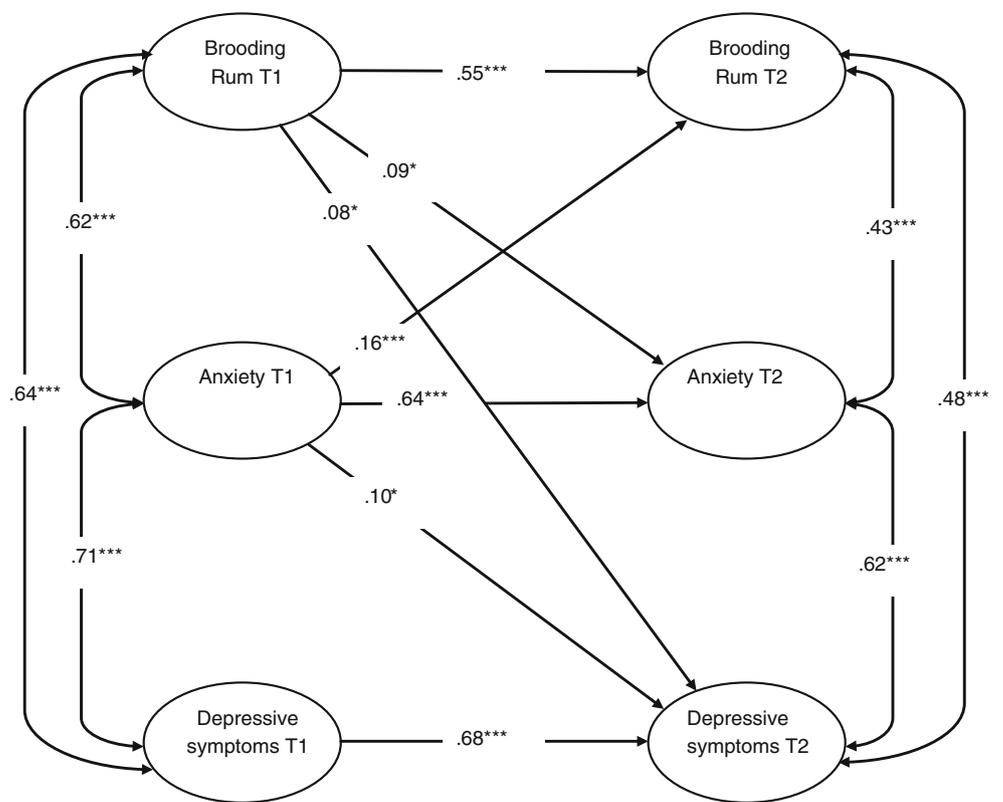


Fig. 6 Relationships among rumination, anxiety, and depressive symptoms over 4 months



Did Anxious and Depressive Symptoms Affect Each Other in a Reciprocal Relationship as Well?

Although not explicitly hypothesized, another two-variable model involving the latent constructs of anxious and depressive symptoms was examined, and Fig. 5 shows that depressive and anxious symptoms were reciprocally related over time. An equality constraint analysis verified that the strength of the two cross-lag coefficients (β s = .11 and .06) were not significantly different from each other, suggesting that depressive symptoms at T1 led to increases in anxious symptoms at T2 to about

the same extent as anxious symptoms at T1 led to increases in depressive symptoms at T2. Model fit was good: $\chi^2/df = 2.48$, $GFI = .98$, $AGFI = .97$, $sRMR = .023$, $RMSEA = .04$; 95 % CI $RMSEA = .03$ to $.05$.

Did Anxious Symptoms Account for the Reciprocal Brooding Rumination to Depressive Symptoms Relationship?

To examine whether the reciprocal brooding rumination to depressive symptoms relationship was affected by

incorporating the third variable of anxious symptoms, a third model was stipulated involving all three constructs across time. The resulting model (see Fig. 6) revealed that both brooding rumination, $\beta = .08$, $p = .021$, and anxious symptoms, $\beta = .10$, $p = .014$, at T1 predicted increases in depressive symptoms at T2. With regard to the two previously identified bi-directional relationships, in this model depressive symptoms at T1 did *not* significantly predict changes in either brooding rumination or anxious symptoms at T2. However, the model did replicate the bi-directional relationship between anxious symptoms and brooding rumination noted earlier in Fig. 3. This model fit the data well: $\chi^2/df = 2.26$, $GFI = .97$, $AGFI = .96$, $sRMR = .026$, $RMSEA = .037$; 95 % CI $RMSEA = .03$ to $.04$. The three-variable path model suggests, contrary to hypothesis, that the inclusion of anxiety did *not* much affect the previously identified brooding rumination to depressive symptoms relationship, in particular, the β only changed from $.10$ to $.08$ between Figs. 3 and 6.

It is important to note that the previously identified brooding rumination to depressive symptoms bi-directional relationship vanished when anxious symptoms was included in the model. Figure 6 shows that depressive symptoms at T1 did not significantly predict changes in brooding rumination at T2, $\beta = .03$, $p = .49$. We believe that this change (from $.11$ to $.03$) was caused by the inclusion of the comorbid third variable of anxious symptoms (covariance of anxious symptoms with depressive symptoms at T1 was $.71$, $p < .001$). Anxious symptoms at T1 was a stronger predictor of brooding rumination at T2 by itself ($\beta = .16$ in Fig. 4) than was depressive symptoms by itself ($\beta = .11$ in Fig. 3), and it seems, judging from the results in Fig. 6, that depressive symptoms at T1 could not explain much unique variance in brooding rumination at T2 above and beyond that explained by anxious symptoms at T1.

A useful way to explain the significant and non-significant cross-lag relationships identified in Fig. 6 is to subject these data to longitudinal mediation analyses. MacKinnon (2008) has laid out several powerful ways to explore potential mediation relationships in two wave longitudinal datasets, as we have here, and we used the autoregressive mediation model that he described. After running two path models, one takes the unstandardized regression coefficients and standard errors of the a and b paths, and uses these values to compute the Sobel's z -score. [For further guidance in how to set up these analyses and to compute the statistical outputs, one can refer to Jose (2013)].

Which potential mediation patterns should be tested here? With three variables in question, one can logically consider six patterns, but since depressive symptoms did not predict either brooding rumination or anxiety, it must be considered to be the dependent variable. This restriction led us to consider two possible mediation patterns:

brooding rumination as the IV and anxious symptoms as the MedV, and anxious symptoms as the IV and brooding rumination as the MedV. The latter possibility was enunciated as a hypothesis in the Introduction, but both possibilities were examined, and the obtained results supported both longitudinal mediation results: in the first case, Sobel's $z = 2.62$, $p = .009$, ratio of indirect to total effects = 9 %; and in the second case, Sobel's $z = 3.12$, $p = .002$, ratio of indirect to total effects = 10 %. These results suggest that brooding led to anxious symptoms which led to depressive symptoms, as well that anxious symptoms led to brooding which led to depressive symptoms. Since brooding rumination and anxious symptoms were found to affect each other in a bi-directional relationship, it seems that one, the other, or both led to increases in depressive symptoms over time. In sum, this obtained pattern does not provide support for the view that anxious symptoms 'explains' the rumination to depressive symptoms relationship (i.e., that it is spurious), but it does strongly suggest that the construct of anxious symptoms is significantly involved with this relationship.

Were Gender and Age Differences Found in These Three Models?

Equality constraints between males and females were tested for all stability and cross-lag coefficients in the above described models, and not a single estimate yielded a significant gender difference. We can conclude, therefore, that these models functioned similarly for both genders. After dividing the age-span into younger (11–12 years) and older (13–16 years) groups, which resulted in approximately equal size groups ($N_s = 424$ and 502 respectively), a series of equality constraints were performed on all stability and cross-lag coefficients in the same models. The only difference obtained was that younger participants evidenced a lower test–retest reliability coefficient for depressive symptoms ($\beta = .75$) than older participants ($\beta = .81$). Otherwise no differences were noted. In general, then, it seems that the obtained patterns were fairly similar between boys and girls and between younger and older adolescents.

Discussion

This study was designed to investigate cognitive and emotional roots of depressive thought in adolescents. The Response Style Theory (Nolen-Hoeksema 1994) served as the starting point in our investigation in that we sought to determine if brooding rumination predicted increases in depressive symptoms over time. Researchers (e.g., Broderick 1998; Broderick and Korteland 2002) have noted that

females report higher levels of rumination than males, but when does this gender difference emerge developmentally and how robust is this difference? In addition, we considered whether a potential “third variable”, namely anxious symptoms (Schwartz and Koenig 1996), might be significantly involved in the proposed downward spiral that seems to occur between rumination and depressive symptoms. Overall, the findings obtained in the present study provided general support for RST but also pointed toward several useful elaborations of the model, at least as they apply to adolescents.

Brooding Rumination is Predictive of Increases in Depressive and Anxious Symptoms over Time

First, the present set of findings strongly support the contention that brooding rumination may be the “active ingredient” in the broad, heterogeneous construct of rumination that has been used in empirical research for several decades. Reflective rumination, in contrast, was not as strongly related to anxiety and depressive symptoms in the current research. Second, as expected, brooding rumination was found to be more prevalent among females prior to the development of the sex difference in depressive symptoms. In this sample, females were more depressed than males from 14 years old but were more ruminative from 13 years old. We take this finding as evidence that rumination may be a vulnerability factor for depressive symptoms. Since the gender difference in brooding rumination debuted 1 year prior to the development of the sex difference in depressive symptoms, this pattern of results would seem to support RST. However, while the sex differences were statistically significant, the sizes of these effects were small, and their statistical significance may be accounted for partly by the large sample size. The statistical test of the third hypothesis showed that the reciprocal rumination to depressive symptoms relationship was equally strong for both boys and girls, supporting RST. And for the fourth prediction, latent variable modeling provided support for the presence of a significant reciprocal relationship between brooding rumination and maladjustment (Fig. 3 depicts depressive symptoms and Fig. 4 depicts anxiety). And last, when anxiety was included with brooding rumination and depressive symptoms, evidence was obtained for two longitudinal mediation pathways, showing that the influence of brooding rumination on depressive symptoms may be more complicated than a simple “X causes Y” relationship. Let us now consider each of these findings in turn.

Cross-Sectional Difference in Brooding Rumination

We found that females ruminated more (i.e., brooding) than males from age 13 years old. This result suggests that

rumination may be a vulnerability factor for psychopathology as it was generally more prevalent in females prior to the development of the sex difference in depressive symptoms, supporting RST. In our study, however, the gender effect size for brooding rumination was relatively small (partial $\eta^2 = .10$). Typically, studies that examine sex differences in rumination have used large sample sizes, benefitting from increased statistical power. These studies do not typically report effect sizes in conjunction with significance tests (e.g., Broderick and Korteland 2002; Garnefski et al. 2004; Muris et al. 2004; Ziegert and Kistner 2002). These reports state that females ruminate more than males based upon a dichotomous “*p* less than .05” statistical decision rather than from effect sizes that tell us *how much more* females ruminate than males. This reliance on statistical significance testing in the absence of effect size reporting may have inflated the perceived size of the sex difference on rumination.

Some studies, however, have reported effect sizes, allowing for an estimation of how much more females ruminate than males. For example, Jose and Brown (2008) found that females reported ruminating significantly more than males from age 12, but the effect sizes were small; partial η^2 s ranged between .02 and .15 depending on age (reported in Brown 2003). Similarly, Weir and Jose (2008) found that the significant effect of gender on rumination was small: partial $\eta^2 < .01$. These results suggest that, although females report ruminating more than males during adolescence, the actual size of the sex difference may be small. In the current study, although the tendency for females to ruminate was found to be significantly higher for older ages, neither male nor female adolescents ruminated very much (on average they scored between “rarely” and “sometimes”).

Longitudinal Relationships between Rumination and Maladjustment

In our next major finding, we extended the results of Nolen-Hoeksema et al. (2007) by showing that the reciprocal rumination-maladjustment relationship is present in an adolescent sample comprised of both males and females. This result supports RST by showing that rumination does not have a qualitatively different effect on depressive symptoms for males and females (Nolen-Hoeksema 1994). In our fourth major finding, we found support for reciprocal rumination-depressive symptoms and rumination-anxiety relationships. These findings suggest that rumination and psychopathology influence each other in a mutual fashion across time: ruminating about one’s negative feelings affects an individual’s emotional state, and in turn, negative affect increases the likelihood an individual will ruminate. The RST originally focused on the rumination to

depression relationship and did not consider the depression to rumination relationship, but recently more attention is being paid to the ways in which rumination may operate within more complicated feedback systems over time (e.g., Nolen-Hoeksema et al. 2007; Weir and Jose 2008).

Anxiety Seems to be Involved in the Rumination-Depressive Symptoms Relationship

The final model obtained here (Fig. 5) yielded several interesting results that we feel point to ways in which the RST model may need to be refined. In particular, inclusion of anxiety caused the previously identified depressive symptoms to brooding rumination relationship to disappear, and anxious symptoms predicted increases in both rumination and depressive symptoms over time. We believe that the clearest way to understand this web of relationships is to appreciate that two longitudinal mediation patterns were obtained: it seems that brooding rumination fostered higher levels of anxiety at the same time that anxiety fostered higher levels of brooding rumination, and both of these variables separately explained unique variance in increases in depressive symptoms over time. Although, as noted above, RST recently has been extended to incorporate additional negative states such as anxiety (Nolen-Hoeksema 2000; Nolen-Hoeksema et al. 2008), the focus chiefly has been on the ability of rumination to predict anxiety. Research evidence exists to support the contention that brooding rumination predicts increases in anxious symptoms in adults (for a review see Nolen-Hoeksema et al. 2008), but we believe that the present findings are the first to show for an adolescent community sample that both brooding rumination and anxiety independently predicted changes in depressive symptoms over time.

We believe that these findings are consistent with Nolen-Hoeksema et al.'s (2008) distinction between “worrying” and brooding rumination. They acknowledged that worry and rumination are correlated significantly and share certain characteristics (e.g., they are both perseverative thought processes), but they also emphasized that the two constructs differed in significant ways too. As they defined these constructs, brooding rumination is past- and present-oriented and “more focused on issues of self-worth, meaning, themes of loss” (p. 407), whereas worry is “more future-oriented” and “focused on anticipated threats” (p. 407). Thus, worry would seem to be more or less synonymous to anxious symptoms, and rumination, in contrast, since it is centered on the theme of loss, is more likely aligned with depressive thoughts (Roseman et al. 1996). The implication is that brooding rumination is more likely to lead to a sense of hopelessness and inaction, whereas anxiety is likelier to lead to a state of agitation and behavioral activation.

The present results show that both anxiety and brooding rumination explained unique variance in increases in depressive symptoms, suggesting, in line with Nolen-Hoeksema et al.'s (2008) distinction between worry and rumination, that they are statistically and conceptually distinct constructs. At the same time, the two longitudinal mediation results showed that anxiety and rumination are temporally related to each other; i.e., they exist in a bi-directional relationship. Thus, we would argue that RST should be adapted to integrate the role of anxiety in the rumination to depression relationship in two ways; first, anxiety seems to stimulate more brooding rumination, which in turn leads to increased depression, and second, brooding rumination seems to lead to increases in anxiety, which in turn leads to increased depression as well. Our results support Nolen-Hoeksema's view that brooding rumination and anxiety/worry are separable constructs, but our findings also show that they are dynamically bound to each other over time in adolescents' lives.

Limitations and Future Directions

The results of this study are strictly limited to depressive symptoms among adolescents residing in the community and no inferences should be made regarding how these results may generalise to clinically depressed adolescents. Future work should explore whether relationships identified here in a community sample generalize to clinical samples.

Various alternative third variables other than anxiety may exist. One such candidate is stress. Stress has been shown to also predict both rumination and depressive symptoms longitudinally in similar samples (Weir and Jose 2008). Stress may in fact be the primary reason why an individual comes to feel anxious and goes on to ruminate about their problems. This possibility suggests that a causal chain may be in play whereby an individual experiences a stressful event (S) about which they feel anxious (A), this anxiety may then prompt the individual to ruminate (R), and then the person consequently feels depressed (D). Testing this proposed SARD model would extend and clarify certain elements described in RST.

Conclusions

The present study showed that adolescent females were more ruminative, anxious, and depressed than adolescent males; however, the effect sizes were small. A central prediction of RST was supported, namely that brooding rumination would be predictive of increased maladjustment, in this case depressive and anxious symptoms. However, when the construct of anxious symptoms was

considered in conjunction with rumination and depressive symptoms, we found that anxious symptoms and rumination manifested a bi-directional relationship and that both anxious symptoms and rumination separately predicted increases in depressive symptoms over time. Our results suggest that adolescents may ruminate and feel depressed because of heightened feelings of anxiety and, further, that they may feel anxious and depressed because they ruminate. Thus, we obtained evidence that several pathways may exist that lead to increased depressive symptoms.

Acknowledgments We would like to thank both the schools and children who participated in this research. We would also like to thank the School of Psychology and the Science Faculty from Victoria University for financial support.

Author Contributions P.J. and K.W. conceived and designed the study; K.W. collected, coded, and cleaned the data; both P.J. and K.W. analyzed the data; K.W. drafted the manuscript, both K.W. and P.J. contributed to writing the manuscript, and P.J. wrote the final versions. Both authors read and approved the final manuscript.

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