



# Exploring the longitudinal relationship between anger rumination and peer victimization when controlling for sadness rumination

Elli Spyropoulou<sup>1</sup> · Theodoros Giovazolias<sup>1</sup>

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## Abstract

Anger rumination is an unconstructive cognitive-emotion regulation strategy that bears negative adjustment outcomes in youth. Anger rumination is mostly examined as an outcome of prior peer victimization. Unidirectional links between maladaptive anger regulation and later peer difficulties have also been reported. Surprisingly, whether anger rumination and peer victimization are mutually related and reinforcing is poorly explored. The present study tested reciprocal associations between anger rumination and peer victimization in 367 5th graders ( $M_{age} = 10.53$ ,  $SE = 0.16$ ; 54.2% girls). To increase precision of findings sadness rumination was treated as a confounder. Self-reported data were obtained at two times, spaced 1 year. Cross-lagged analyses showed that peer victimization predicted increases in anger rumination but not vice versa, after controlling for sadness rumination. Victimized boys were found to be more at risk for endorsing anger rumination over time as compared to victimized girls. Directions for future research and implications for practice are discussed.

**Keywords** Anger rumination · Peer victimization · Sadness rumination · Early adolescence · Longitudinal

## Introduction

Anger rumination represents a maladaptive cognitive-emotion regulation process associated with negative adjustment outcomes in youth (e.g., Yang et al., 2021). Anger rumination is mostly examined as an outcome of previous exposure to peer victimization (Li et al., 2021; Malamut & Salmivalli, 2021). Unidirectional links between maladaptive anger regulation and later peer difficulties have been also supported (Rohlf et al., 2017). Surprisingly, the bidirectional relationship between anger rumination and peer victimization is poorly explored (Camacho et al., 2021). Moreover, whether sadness rumination confounds this relation has not, yet, been clarified. The current study used a two-wave longitudinal design to examine reciprocal associations between anger rumination and peer victimization in early adolescence. Sadness rumination as a potential confounder of these relations was also explored.

Anger rumination involves repetitively and passively focusing on personally meaningful anger-eliciting

experiences (Denson, 2013). It represents a maladaptive cognitive-emotional regulation process, closely associated with sustained anger, emotional arousal, and revenge fantasies (Sukhodokly et al., 2001). Early adolescents usually engage in a more state-like rumination thinking as compared to older ones (Hankin, 2008). However, frequent endorsement of rumination towards negative affect may turn gradually this emotion-focused response style into a mental habit with trait-like features (Hjartarson et al., 2021), and aversive consequences (Yang et al., 2021). Rumination tendencies mark a rise in early adolescence, a life period that also coincides with an increase in interpersonal difficulties, including peer victimization (McLaughlin & Nolen-Hoeksema, 2012). Peer victimization refers to a specific type of peer abuse in which a child is repeatedly and purposefully mistreated by one or more individuals (Hunter et al., 2007). It is a pervasive public health issue, with 1 in 3 adolescents reporting occasional victimization, and 1 in 10 reporting chronic involvement in bullying as a victim (Molcho et al., 2009). Peer victimization entails overt (e.g., pushing) and/or relational (e.g., social exclusion) acts of aggression that both exert severe and long-lasting repercussions on individuals mental health (Armitage et al., 2021). Empirical findings show an increase in stability of peer victimization as children grow older (Pouwels et al., 2016). Understanding peer

✉ Theodoros Giovazolias  
giovazot@uoc.gr

<sup>1</sup> Department of Psychology, University of Crete, Gallos Campus, Rethymno, Crete 74100, Greece

victimization-related processes early in life is, therefore, important for effective interventions. Difficulties in managing effectively negative affect have long been associated with frequent experiences of peer victimization (Herts et al., 2012; Li et al., 2021).

### Peer victimization as a risk factor for anger rumination

Anger rumination is an established outcome of prior peer victimization. Particularly, peer victimization experiences were found to predict increases in anger rumination among 553 3rd to 4th graders (Malamut & Salmivalli, 2021). Similarly, perceived peer victimization was reported to exert a positive influence on anger rumination, in a longitudinal study conducted with 2,152 junior middle school students (Li et al., 2021). These findings seem to advance the “victim schema model” which proposes that frequent exposure to peer victimization may hinder adaptive emotion regulation and stress responses (Rosen et al., 2007). There are several reasons *why* peer victimization can increase risk for later engagement in anger rumination. For instance, peer victimization may damage self-esteem by creating a discrepancy between individuals’ high implicit self-esteem (ideal self) and explicit self-esteem (actual self) (Leeuwis et al., 2015). Perceived self-discrepancies are particularly distressing in adolescence as young individuals still lack the cognitive ability to incorporate effectively conflicting self-attributes into a coherent self-theory (Harter, 2006 as cited in Ferguson et al., 2010). Anger rumination may, therefore, be activated to resolve the actual/ideal conflict and reduce discrepancy-related distress (see Denson, 2013). Executive functions (EFs) is another mechanism that might explain why peer victimization may predispose adolescents to later anger rumination. EFs refer to a set of high-order cognitive skills that enable goal-directed thoughts and behavior (Nyongesa et al., 2019). These cognitive abilities are mostly related to prefrontal cortex, a brain area that undergoes maturation in adolescence and, thus, is susceptible to environmental influences (Herd & Kim-Spoon, 2021). Indeed, aversive interpersonal experiences, including negative peer interactions, seem to interfere with the normal development of EFs (e.g., Lecce et al., 2020). EFs deficits, including difficulties in inhibitory control, task-switching, and attentional disengagement are implied in the initiation of anger rumination after an anger-eliciting event (see Denson, 2013). Finally, peer victimization may be associated with frequent endorsement of anger rumination through cognitive distortions. Research shows that victimized youth are more likely to display hostile attribution bias, a processing style that involves negative interpretations of ambiguous social situations (Perren et al., 2013). Misinterpretations of ambiguity seem to prolong

individuals’ attention on anger-provoking events, and thus, instigate anger rumination (Wang et al., 2019).

### Peer victimization as an outcome of anger rumination

The interpersonal stress model of rumination states that habitual rumination thinking confers risk for interpersonal stressful life experiences, including peer victimization (McLaughlin & Nolen-Hoeksema, 2012). Although maladaptive anger regulation has been related with later increases in peer difficulties (Riley et al., 2019; Rohlf et al., 2017), anger rumination has only recently been established as a potential precursor of peer victimization in adolescence (Camacho et al., 2021). Dwelling on the causes and consequences of anger eliciting events may drive and reinforce experiences of peer victimization for several reasons (Camacho et al., 2021). For instance, anger rumination was found to be uniquely related with increased proneness to anger, a tendency known as irritability (Leigh et al., 2020). Youth irritability, usually manifested through temper outbursts, is reported to predict involvement in peer victimization (Chen et al., 2021). Impairments in EFs is another plausible mechanism that can explain the anger rumination-peer victimization link. Resource Allocation Theory states that habitual rumination depletes cognitive abilities that would otherwise be directed toward executive-related tasks (Levens et al., 2009). In line with this theory, adolescents with higher baseline ruminative thinking were found to display declines in EFs at a 15-month follow-up assessment (Connolly et al., 2014). EFs deficits may, in turn, increase likelihood for future exposure to peer victimization (Holmes et al., 2016) as they usually interfere with individuals’ ability to attune their behavior to social demands, and behave instrumentally (Romero-López et al., 2018). Finally, anger rumination can increase the risk for peer victimization by rendering youth susceptible to hostile attribution bias. Particularly, in a longitudinal study conducted with 941 youth, frequent endorsement of anger rumination was found to be related with a hostile attribution style (Wang et al., 2019). Interpreting ambiguous social cues as threatening may provoke maladjusted behaviors, which, in turn, can increase likelihood for peer victimization (Hébert et al., 2021). For instance, reactive aggression (i.e., impulsive aggressive reaction to perceived threat) has been strongly related with hostile attribution bias (Martinelli et al., 2018). Reactively aggressive children are reported to be at increased risk for being victimized by the peer group (Cooley et al., 2018).

### Sadness rumination as a confounding variable

Whereas anger rumination and peer victimization relate over time, there is a variable that may confound this relationship,

sadness rumination. Particularly, sadness rumination refers to “repetitive thoughts concerning one’s present distress and the circumstances surrounding the sadness” (Conway et al., 2000, p. 404). Anger and sadness rumination are established as distinct, yet highly related constructs (Peled & Moretti, 2010). Indeed, youth who tend to engage in anger rumination are also more likely to engage in sadness rumination (Harmon et al., 2019; Leigh et al., 2020). Longitudinal studies conducted with adolescent samples have shown that victims of peer bullying usually endorse both anger and sadness rumination (Li et al., 2021; Malamut & Salmivalli, 2021). Accordingly, sadness rumination has been reported to increase later involvement in peer victimization (McLaughlin & Nolen-Hoeksema, 2012).

### The current study

The current study used a longitudinal design to explore reciprocal associations between anger rumination and peer victimization in early adolescence. To increase precision of findings, sadness rumination was examined as a confounding variable. It was expected that the bidirectional relationship between anger rumination and peer victimization would be reduced, after controlling for sadness rumination. Based on previous findings (Camacho et al., 2021; Li et al., 2021), reciprocal relationships between anger rumination and peer victimization were expected to be similar for boys and girls.

## Methods

### Procedure and participants

Participants were recruited from 13 public primary schools, all located in Heraklion of Crete. Students with parental consent ( $N = 367$ ;  $M_{\text{age}} = 10.53$ ,  $SE = 0.16$ ; 54.2% girls) were given a personal code, and then were gathered in a classroom to complete two paper-and-pencil brief self-report instruments (~45 min) at two times (T1 = Time 1; T2 = Time 2), spaced 1 year. No compensation was given. Absenteeism reduced sample to 304 participants at T2 ( $M_{\text{age}} = 10.53$ ,  $SE = 0.16$ ; 55.3% girls). Students who participated at both temporal occasions did not significantly differ from those who participated only at first occasion neither in sex [ $\chi^2_{(1)} = 0.77$ ,  $p = 0.38$ ] nor in the study variables [anger rumination,  $t_{(358)} = 0.66$ ,  $p = 0.51$ ; peer victimization,  $t_{(362)} = 1.95$ ,  $p = 0.06$ , sadness rumination,  $t_{(355)} = 1.43$ ,  $p = 0.16$ ]. For the current study, all available pieces of information of the 367 students were used (see analytical strategy). All procedures were approved by the Institute of Educational Policy and the Greek Ministry of Education. Due to the anonymity of data collection no official information was received regarding any participants’ involvement in counseling or other mental

health support during the lag period of the study or before. However, all students were made aware of support available if needed.

## Measures

### Anger rumination

Anger Rumination (AR) was measured with the 19-item Children’s Anger Rumination Scale (CARS; Smith et al., 2016; Spyropoulou & Giovazolias, 2021). CARS is a 4-point Likert-type scale (1 = almost never to 4 = almost always) that assesses children’s AR tendencies. CARS’s internal consistency was (T1,  $\alpha = 0.90$ ; T2,  $\alpha = 0.92$ ).

### Peer victimization

Peer Victimization (PV) was measured with the 9-item Victimization of Self (VS) subscale of the Peer Experience Questionnaire – Standard Version (PEQ; Vernberg et al., 1999; Giovazolias et al., 2010). The VS is a 5-point Likert-type scale (1 = never to 5 = a few times a week) that examines participants’ perceived peer victimization in the last 3 months. VS’s internal consistency was (T1,  $\alpha = 0.81$ , T2,  $\alpha = 0.78$ ).

### Sadness rumination

Sadness Rumination (SR) was measured with the 10-item Rumination subscale of the Children’s Response Styles Scale (CRSS; Ziegert & Kistner, 2002; Spyropoulou & Giovazolias, 2022). Participants were asked to rate on an 11-point Likert scale (0 = never to 10 = always) the frequency of their ruminatory behaviors. SR’s internal consistency was (T1,  $\alpha = 0.84$ ; T2,  $\alpha = 0.89$ ).

### Sex

Sex assigned to birth was self-reported by participants. It was coded as “0 = boys” and “1 = girls”.

### Analytical strategy

Descriptive statistics, correlations analysis, and the Little’s MCAR test were performed with the IBM Statistical Package for the Social Science (SPSS) version 25.0. Structural equation modeling (SEM) and tests for multivariate normality were conducted with Mplus version 8.1. Associations between variables were assessed with Pearson correlations ( $r = 0.10$  to  $0.29$ , small;  $r = 0.30$  to  $0.50$ , medium;  $r > 0.50$ , large; Cohen, 1988). Sex mean differences on all study variables across T1/T2 were tested with independent  $t$  tests.

Cohen's  $d$  effect sizes ( $d=0.20$ , small;  $d=0.50$ , medium;  $d=0.80$ , large) were also reported (Cohen, 1988). Latent structural equation modeling (SEM) was performed to partial out the biasing effect of measurement error, leading to more valid estimates (Ledgerwood & Shrout, 2011). Little's MCAR test was significant,  $\chi^2_{(2075)} = 2,390.24$ ,  $p < 0.001$ , but the normed chi-square ( $\chi^2/df$ ) was low ( $2,390.24/2075 = 1.15$ ), implying missing at random (MAR) data. Full information maximum likelihood estimation (FIML) with robust standard errors (MLR) was applied. MLR takes into account all available pieces of information (missing values are not replaced or imputed), and corrects for significant departure from multivariate normality [T1 (skewness = 30.76; kurtosis = 56.71,  $p < 0.001$ ); T2 (skewness = 15.53; kurtosis = 65.14,  $p < 0.001$ )] (Mardia, 1970). Instead of using individual items, parcels were created, following the random parceling procedure, so as to establish the observed indicators for the latent variables (Matsugana, 2008). As compared to individual times, parcels are proposed to be more reliable, and are less likely to be influenced by method effects. Parceled results are also more likely to meet the assumptions of normality and to produce more stable estimates (Little et al., 2013; Marsh et al., 1998). Following the recommended minimum of three or four parcels per factor (Marsh et al., 1998), the nineteen items of the CARS, the six items of the PEQ, and the ten items of the CRSS were aggregated to form three parcels each (T1/T2). Using Confirmatory Factor Analysis (CFA) a series of models were initially conducted at T1/T2 to test whether the three constructs should be modeled separately or as indicators of a common factor: (1) the one-factor model (all indicators loaded on a single factor) vs. the two-factor model of AR and SR; (2) the one-factor model vs. the three-factor model of AR, PV, and SR. Constructs' convergent validity would be accomplished with Composite Reliability (CR) values upper the recommended cut off |0.70| (Nunnally, 1978). Accordingly, constructs' discriminant validity would be established with factor correlations lower |0.80| (Brown, 2015). Multi-group CFA was employed to test measurement invariance of the three-factor model across both time and sex; a constrained model in which factor loadings were set to be equal across both time and sex (metric/weak invariance) was compared with the baseline model in which factor loadings were freely estimated across both time and sex (Newsom, 2015). Metric invariance is considered to be a minimal prerequisite for assessing autoregressive models (see Benbenishty et al., 2016). Reciprocal associations between AR and PV were tested using a two-wave cross-lagged panel model (CLPM) design, which estimates the amount and strength of the longitudinal effect of one investigate construct on another (cross-lagged effects) by taking into account within time associations (cross-sectional correlations) as well as across-time stability (autoregressive effects) (Selig & Little, 2012).

First, a CLPM (M1) was employed to test how AR and PV relate over time. In M1, sex was included as control variable; both latent variables were regressed on sex at T1/T2. Next, a second CLPM (M2) was tested, that was identical to M1, except that SR was controlled for at each time point; AR and PV at T1 were regressed on  $SR_{T1}$ , and AR and PV at T2 were regressed on  $SR_{T2}$ . Possible sex differences in M2 were examined using multi-group CFA. Significant moderation would be supported with a significant chi-square difference test ( $\Delta\chi^2 < 0.05$ ) between the baseline model (only factor loadings of the measurement part were constrained to be equal for boys and girls), and the constrained model (cross-lagged paths were also set to be equal for boys and girls). In that case follow-up models would be performed to further probe which path(s) differed by sex. Particularly, a model in which each path would be separately freed would be compared with the constrained model to assess for significant moderation of the individual path.

Considering the sensitivity of the chi-square statistic ( $\chi^2$ ) to sample size (in larger sample sizes the p-value decreases even in a trivial model misfit), the  $\chi^2$  to the respective degrees of freedom ( $\chi^2/df$ ), the comparative fit index (CFI), the Tucker-Lewis index (TLI), and the root mean square error of approximation were used to evaluate model fit. A good fit was indicated by values  $\leq 2$  for  $\chi^2/df$ ,  $\geq 0.90$  for CFI and TLI, and  $\leq 0.08$  for RMSEA (Kline, 2016; Wheaton et al., 1977). Measurement invariance across both time and sex would be established with a nonsignificant chi-square difference test ( $\Delta\chi^2 > 0.05$ ); the model constraints do not worsen the model fit (Satorra & Bentler, 2001) and the criterion of  $\Delta CFI$ ,  $\Delta TLI$ , and  $\Delta RMSEA \leq 0.01$  (Chen et al., 2021). Determination of appropriate sample size in SEM is often considered in light of the number of observed variables. In the present study, the general rule of thumb of 100 participants in each group for multi-group analysis (Kline, 2016) was accomplished (boys = 168; girls = 199).

Nestedness of the data within 13 schools was addressed with the type = COMPLEX procedure in Mplus.

## Results

### Descriptive statistics and correlations

Correlations, means, and standard deviations for the study variables are displayed in Table 1. Constructs' relationships were small to large, and in the expected direction at both T1/T2 ( $r_s = 0.17$  to  $0.69$ ,  $p < 0.01$ ). Significantly higher levels of AR and SR were found among girls than boys in T2: AR (T1,  $t_{(358)} = -1.36$ ,  $p = 0.17$ ,  $d = 0.14$ ; T2,  $t_{(298)} = -3.49$ ,  $p < 0.001$ ,  $d = 0.40$ ); SR (T1,  $t_{(355)} = -1.92$ ,  $p = 0.06$ ,  $d = 0.20$ ; T2,  $t_{(295)} = -3.06$ ,  $p < 0.01$ ,  $d = 0.36$ ). The observed mean level of PV did not significantly differ for boys and girls

**Table 1** Intercorrelations and descriptive statistics for study variables

Variable	AR (T1)	AR (T2)	PV (T1)	PV (T2)	SR (T1)	SR (T2)
AR (T1)	-					
AR (T2)	0.46**	-				
PV (T1)	0.28**	0.30**	-			
PV (T2)	0.24**	0.42**	0.37**	-		
SR (T1)	0.53**	0.36**	0.23**	0.17**	-	
SR (T2)	0.35**	0.69**	0.19**	0.34**	0.36**	-
<i>M</i>	37.28	35.40	14.71	13.63	49.06	48.74
<i>SD</i>	10.68	11.07	6.07	5.64	20.47	21.95

AR anger rumination, PV peer victimization, SR sadness rumination, T1 time 1, T2, time 2

\*\* $p < 0.01$

across T1/T2: PV (T1,  $t_{(362)} = -0.19, p = 0.362, d = 0.02$ ; T2,  $t_{(295)} = 0.14, p = 0.89, d = 0.02$ ).

**Measurement properties**

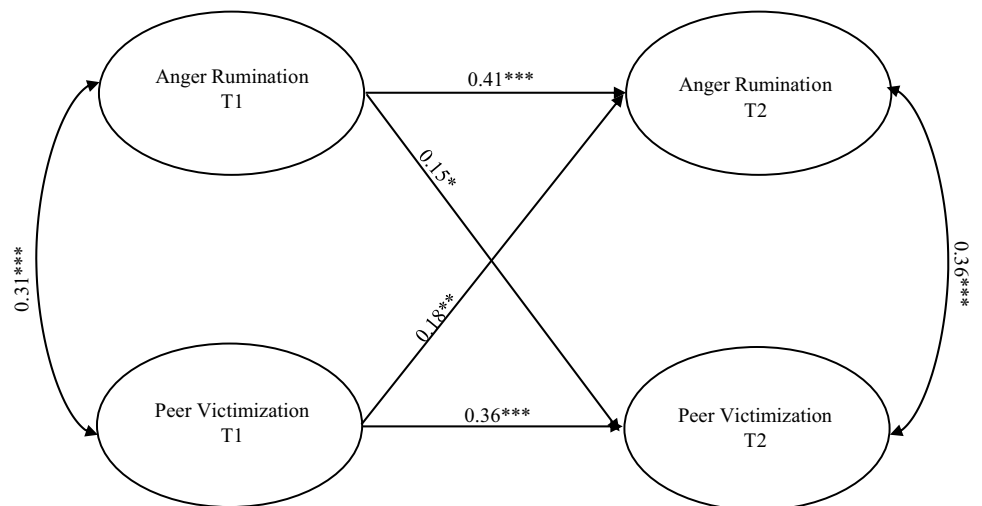
In support of previous findings (du Pont et al., 2018), the two-factor model of AR and SR outperformed (T1,  $\chi^2_{(8)} = 12.68, p = 0.12, \chi^2/df = 1.58, CFI = 1.00, TLI = 0.99, RMSEA = 0.04$ ; T2,  $\chi^2_{(8)} = 15.69, p = 0.05, \chi^2/df = 1.96, CFI = 0.99, TLI = 0.98, RMSEA = 0.06$ ) the one-factor model (T1,  $\chi^2_{(9)} = 468.69, p < 0.001, \chi^2/df = 50.07, CFI = 0.52, TLI = 0.20, RMSEA = 0.37$ ; T2,  $\chi^2_{(9)} = 228.01, p < 0.001, \chi^2/df = 25.33, CFI = 0.77, TLI = 0.61, RMSEA = 0.28$ ), indicating that SR and AR could be modelled separately. Similarly, AR, PV, and SR were measured as intended, as the three-factor model showed better fit (T1,  $\chi^2_{(33)} = 57.82, p = 0.05, \chi^2/df = 1.75, CFI = 0.98, TLI = 0.97, RMSEA = 0.05$ ; T2,  $\chi^2_{(33)} = 44.89, p = 0.08, \chi^2/df = 1.36, CFI = 0.99, TLI = 0.98, RMSEA = 0.03$ ) than the one-factor model, (T1,  $\chi^2_{(36)} = 472.27, p < 0.001, \chi^2/df = 13.11, CFI = 0.60, TLI = 0.50, RMSEA = 0.18$ ; T2,  $\chi^2_{(36)} = 460.63, p < 0.001, \chi^2/df = 12.79, CFI = 0.66,$

$TLI = 0.57, RMSEA = 0.18$ ). Constructs’ convergent validity was supported as all CR values [T1, ( $AR_{CR} = 0.88; PV_{CR} = 0.82; SR_{CR} = 0.86$ ); T2 ( $AR_{CR} = 0.92; PV_{CR} = 0.85; SR_{CR} = 0.89$ )] exceeded the recommended cut off |0.70| (Nunnally, 1978). Accordingly, constructs’ discriminant validity was established [T1, ( $AR \leftrightarrow PV = 0.30; AR \leftrightarrow SR = 0.61; SR \leftrightarrow PV = 0.23$ ); T2, ( $AR \leftrightarrow PV = 0.46; AR \leftrightarrow SR = 0.77; SR \leftrightarrow PV = 0.39$ )] based on the recommended cut-off |0.80| (Brown, 2015). Measurement invariance of the three-factor model across time and sex was also established; baseline model ( $\chi^2_{(234)} = 277.86, p < 0.05, \chi^2/df = 1.19, CFI = 0.99, TLI = 0.98, RMSEA = 0.03$ ), constrained model ( $\chi^2_{(255)} = 303.55, p < 0.05, \chi^2/df = 1.19, CFI = 0.98, TLI = 0.98, RMSEA = 0.03$ ), ( $\Delta\chi^2_{(22)} = 25.79, p = 0.26; \Delta CFI, \Delta TLI, \Delta RMSEA \leq 0.01$ ).

**Cross-lagged models**

A two-wave cross-lagged panel model (CLPM) was initially performed to test how AR and PV relate over time (M1; see Fig. 1). In M1, both  $AR_{T1/T2}$  and  $PV_{T1/T2}$  were regressed on sex. M1 showed good fit to

**Fig. 1** CLPM (M1) testing reciprocal relations between anger rumination and peer victimization. Note. Standardized coefficients for cross-sectional relations and longitudinal relations. Sex assigned to birth as covariate (0 = boy 1 = girl) is not depicted for graphic simplicity. T1 Time 1, T2 Time 2. \* $p < 0.05$ ; \*\* $p < 0.01$ , \*\*\* $p < 0.001$





the data,  $\chi^2_{(54)} = 71.23, p = 0.06, \chi^2/df = 1.31, CFI = 0.99, TLI = 0.98, RMSEA = 0.03$ . Both cross-lagged effects were significant, [AR<sub>T1</sub> → PV<sub>T2</sub> ( $\beta = 0.15, SE = 0.06, p < 0.05$ ); PV<sub>T1</sub> → AR<sub>T2</sub> ( $\beta = 0.18, SE = 0.06, p < 0.05$ )] after controlling for autoregressive effects, [AR<sub>T1</sub> → AR<sub>T2</sub> ( $\beta = 0.41, SE = 0.06, p < 0.001$ ); PV<sub>T1</sub> → PV<sub>T2</sub> ( $\beta = 0.36, SE = 0.08, p < 0.001$ )], within time associations, [AR<sub>T1</sub> ↔ PV<sub>T1</sub> ( $r = 0.31, SE = 0.07, p < 0.001$ ); AR<sub>T2</sub> ↔ PV<sub>T2</sub> ( $r = 0.36, SE = 0.08, p < 0.001$ )], and sex [sex → AR<sub>T2</sub> ( $\beta = 0.16, SE = 0.05, p < 0.01$ ); sex → AR<sub>T1</sub>, PV<sub>T1</sub>, PV<sub>T2</sub> ( $ps > 0.05$ )].

Next, a second CLPM (M2; see Fig. 2) was tested, that was identical to M1, except that SR was controlled for at each time point. The M2 fitted the data well,  $\chi^2_{(135)} = 168.80, p < 0.05, \chi^2/df = 1.25, CFI = 0.99, TLI = 0.98, RMSEA = 0.03$ . Only the cross-lagged path from PV<sub>T1</sub> to AR<sub>T2</sub> remained significant, albeit smaller in effect size (compared to M1) [PV<sub>T1</sub> → AR<sub>T2</sub> ( $\beta = 0.13, SE = 0.05, p < 0.01$ ); AR<sub>T1</sub> → PV<sub>T2</sub> ( $\beta = 0.05, SE = 0.64, p = 0.46$ )], after controlling for SR at each time point [SR<sub>T1</sub> → AR<sub>T1</sub> ( $\beta = 0.62, SE = 0.04, p < 0.001$ ); SR<sub>T1</sub> → PV<sub>T1</sub> ( $\beta = 0.27, SE = 0.04, p < 0.001$ ); SR<sub>T2</sub> → AR<sub>T2</sub> ( $\beta = 0.68, SE = 0.05, p < 0.001$ ); SR<sub>T2</sub> → PV<sub>T2</sub> ( $\beta = 0.33, SE = 0.09, p < 0.001$ )], autoregressive effects [SR<sub>T1</sub> → SR<sub>T2</sub> ( $\beta = 0.39, SE = 0.07, p < 0.001$ ); ART1 → ART2 ( $\beta = 0.21, SE = 0.06, p < 0.001$ ); PVT1 → PVT2 ( $\beta = 0.34, SE = 0.08, p < 0.001$ )], within time associations [AR<sub>T1</sub> ↔ PV<sub>T1</sub> ( $\beta = 0.19, SE = 0.06, p < 0.01$ ); AR<sub>T2</sub> ↔ PV<sub>T2</sub> ( $\beta = 0.20, SE = 0.05, p < 0.001$ )] and sex (all  $ps > 0.05$ ).

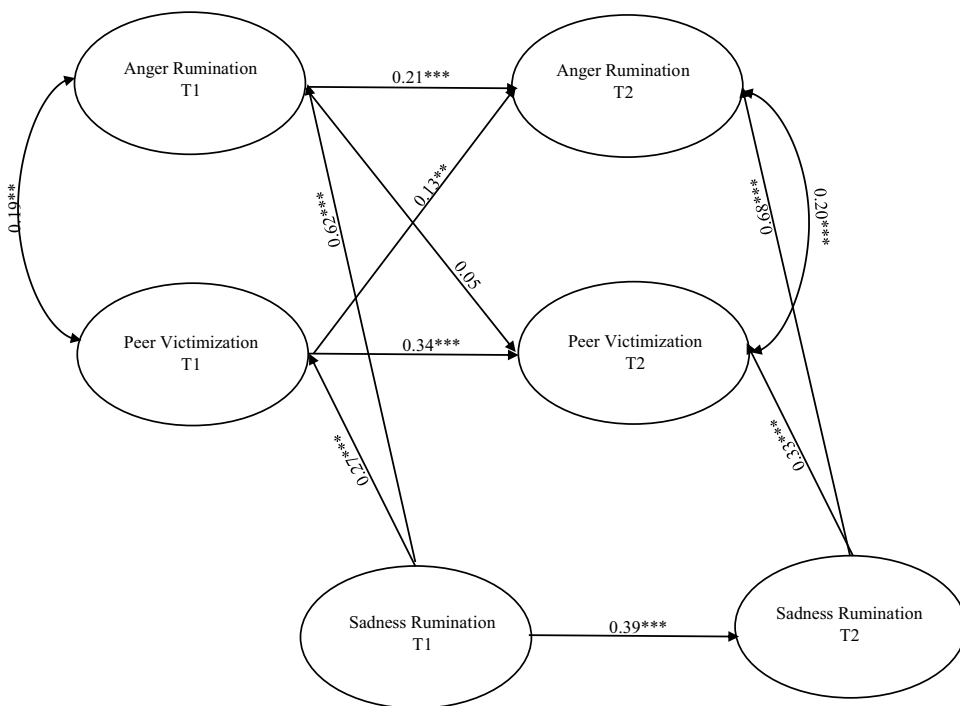
### Sex moderation effects

Possible sex differences in the two cross-lagged paths of M2 were examined using multi-group CFA. The baseline model, in which only factor loadings of the measurement part were set to be equal for boys and girls, fitted the data adequately,  $\chi^2_{(263)} = 313.01, p < 0.05, \chi^2/df = 1.19, CFI = 0.98, TLI = 0.98, RMSEA = 0.03$ . The constrained model, in which the two cross-lagged paths (AR<sub>T1</sub> → PV<sub>T2</sub>; PV<sub>T1</sub> → AR<sub>T2</sub>) were also set to be equal for boys and girls, showed also acceptable fit,  $\chi^2_{(265)} = 315.43, p < 0.05, \chi^2/df = 1.19, CFI = 0.98, TLI = 0.98, RMSEA = 0.03$ . Particularly, in the unconstrained model, the cross-lagged path from AR<sub>T1</sub> to PV<sub>T2</sub> was nonsignificant for both boys ( $\beta = 0.08, SE = 0.08, p = 0.28$ ) and girls ( $\beta = 0.01, SE = 0.09, p = 0.89$ ). Instead, the cross-lagged path from PV<sub>T1</sub> to AR<sub>T2</sub> was significant only for boys ( $\beta = 0.24, SE = 0.06, p < 0.001$ ) and not for girls ( $\beta = 0.05, SE = 0.09, p = 0.56$ ). However, based on the non-significant chi-square test,  $\Delta\chi^2_{(2)} = 2.41, p = 0.30$ , the chi-square difference between the baseline and the constrained model was too small to claim statistical sex moderation.

### Additional analyses

A CLPM (M3; see Supplemental Material) was performed to test whether SR is a distinct predictive marker/and or an outcome of PV, after controlling for AR. Both SR<sub>T1/T2</sub> and PV<sub>T1/T2</sub> were regressed on sex. M3 showed good fit to the data,  $\chi^2_{(135)} = 167.13, p < 0.05, \chi^2/df = 1.24, CFI = 0.99, TLI = 0.99, RMSEA = 0.03$ . Both cross-lagged effects

**Fig. 2** CLPM (M2) testing reciprocal relations between anger rumination and peer victimization controlling for sadness rumination. Note. Standardized coefficients for cross-sectional relations and longitudinal relations. Sex assigned to birth as covariate (0 = boy 1 = girl) is not depicted for graphic simplicity. T1 Time 1, T2 Time 2. \*\* $p < 0.01$ , \*\*\* $p < 0.001$



were nonsignificant, [ $SR_{T1} \rightarrow PV_{T2}$  ( $\beta = 0.02$ ,  $SE = 0.06$ ,  $p = 0.69$ );  $PV_{T1} \rightarrow SR_{T2}$  ( $\beta = -0.05$ ,  $SE = 0.04$ ,  $p = 0.18$ )] after controlling for autoregressive effects, [ $SR_{T1} \rightarrow SR_{T2}$  ( $\beta = 0.11$ ,  $SE = 0.05$ ,  $p < 0.05$ );  $PV_{T1} \rightarrow PV_{T2}$  ( $\beta = 0.30$ ,  $SE = 0.08$ ,  $p < 0.001$ )], within time associations, [ $SR_{T1} \leftrightarrow PV_{T1}$  ( $r = 0.09$ ,  $SE = 0.05$ ,  $p = 0.05$ );  $SR_{T2} \leftrightarrow PV_{T2}$  ( $r = 0.10$ ,  $SE = 0.09$ ,  $p = 0.26$ )], and sex [ $sex \rightarrow SR_{T1}$  ( $\beta = 0.08$ ,  $SE = 0.02$ ,  $p < 0.001$ );  $sex \rightarrow SR_{T2}$ ,  $PV_{T1/T2}$  ( $ps > 0.05$ )].

## Discussion

Anger rumination is mostly studied as an outcome of previous exposure to peer victimization. Unidirectional links between maladaptive anger regulation and later interpersonal difficulties have also been established. Surprisingly, the bidirectional relationship between anger rumination and peer victimization in adolescence is poorly studied. Moreover, whether sadness rumination confounds this relation, has not been yet clarified. Literature has long underscored the importance of pursuing research that incorporates both anger and sadness rumination. To address this gap, the present study explored reciprocal relations between anger rumination and peer victimization after controlling for sadness rumination at each time point. Sex-based differences were also examined.

As it was expected the relationship from peer victimization to anger rumination reduced, but remained significant, after controlling for sadness rumination. Additional analyses, however, showed that sadness rumination was not predicted by peer victimization when controlling for anger rumination. These findings seem to be partially in line with recent studies supporting increases in both anger and sadness rumination after exposure to peer victimization (Li et al., 2021; Malamut & Salmivalli, 2021). The peer victimization-anger rumination link may be accounted for by several mechanisms. For instance, peer victimization can damage individuals' self-esteem by creating a discrepancy between one's high implicit self-esteem (ideal self) and one's explicit self-esteem (actual self) (Leeuwis et al., 2015). Ideal vs. actual self-esteem discrepancies may evoke feelings of anger and frustration (Makros & McCabe, 2001), and, thus, initiate the anger rumination process in order to be resolved and distress is relieved (see Denson, 2013). Indeed, fantasies of revenge, inherently embedded in the anger rumination process seem to temporarily help victims of bullying down-regulate emotional discomfort and restore the damaged self by envisioning punishing the perpetrator (Goldner et al., 2019). This notion is also supported by findings suggesting activation of the neurological reward systems (e.g., dorsal striatum) in revengeful thinking (de Quervain et al., 2004). Frequent endorsement of vengeful thoughts may, however, become a mental habit with aversive outcomes. For instance,

incidents of serious school violence have been linked with experiences of peer victimization and fantasies of revenge afterward (see Yeager et al., 2011). Peer victimization may also increase anger rumination by interfering with the normal development of EF, which are considered necessary for constructive, goal directed thinking (e.g., Lecce et al., 2020). Research shows that adolescents with better EF engage more frequently in cognitive reappraisal (i.e., reinterpretation of a situation's meaning) (Lantrip et al., 2016). Cognitive reappraisal is an emotion regulation strategy that facilitates adaptive processing of anger-provoking events (Denson et al., 2012). Peer victimization may also foster anger rumination by increasing hostile attribution bias, a cognitive processing style that prolongs allocation of attention on current anger-inducing experiences as well as negative schemas stored in the long term memory (Perren et al., 2013; Wang et al., 2019). Finally, peer victimized youth are less likely than their nonvictimized counterparts to maintain stable friendships over time (Ehrhardt et al., 2022). Higher involvement in friendships has been prospectively related with more reappraising of the anger-eliciting experience (von Salisch & Zeman, 2018), and therefore, less anger rumination.

In the present study, the relationship from anger rumination to peer victimization became nonsignificant when controlling for sadness rumination. In other words, baseline anger rumination did not seem to uniquely predict peer victimization over time, when the effect of sadness rumination was partial out. Similarly, sadness rumination did not emerge as a unique predictor of later peer victimization, when anger rumination was controlled for (see additional analyses). These findings seem to contradict previous studies reporting both anger (Camacho et al., 2021) and sadness rumination (McLaughlin & Nolen-Hoeksema, 2012) to be associated with later increases in peer victimization. It should be noted, however, that none of prior researches, incorporated both types of rumination to examine the development of peer victimization. In the present study, neither anger rumination nor sadness rumination seemed to uniquely predict peer victimization one year later. At this point someone could reasonably wonder: “*Why then anger rumination in M1 emerged as potential risk factor for later peer victimization?*” A possible explanation could be that peer victimization in M1 is predicted by the shared variance between anger rumination and sadness rumination. In other words, there may be a general rumination style that associates with aversive interpersonal experiences over time rather than each type of rumination *per se*. In line with this notion, considerable evidence suggests that emotion regulation strategies are less distinct in small ages (e.g., Abela et al., 2004). Age, gender, personality traits, as well as specific contextual characteristics may interact to differentiate the repertoire of strategies that children employ as they grow up (e.g., Sanchis-Sanchis et al., 2020). One finding of note was that even after

controlling for sadness rumination, within time associations between anger rumination and peer victimization remained significant ( $r_s = 0.19$  and  $0.20$ , respectively). Perhaps anger rumination and peer victimization share something in common that fades away in the one year time lag employed here. Further research is needed to provide accurate evidence for this speculation.

Sex-related moderation effects were not supported. However, victimized boys showed to be more at-risk for being engaged in anger rumination as compared to victimized girls, when controlling for sadness rumination. The finding does not seem to align with recent work showing no gender-based difference in the prospective relationship from peer victimization to anger rumination (e.g., Li et al., 2021) as well as other suggesting that girls are more likely than boys to endorse rumination following an adverse peer experience (Vanhalst et al., 2018). The greater likelihood of victimized boys for future anger rumination seems to advance previous findings supporting higher levels of revenge fantasies among male than female victims (Goldner et al., 2019). Male-female differences in the trajectory of brain maturational processes could partially explain the higher propensity of male victims towards anger rumination. Empirical findings have shown that male adolescents may have more difficulties in self-regulation as compared to females of the same age (van Tetering et al., 2020). Self-regulation is a neuropsychological ability closely related to brain maturation that appears to be negatively linked with anger rumination (White & Turner, 2014). In addition, social support seeking is one mechanism that could also protect victimized girls of greater anger rumination over time. Research shows that female victims are usually more willing to seek social support from parents, teachers and friends (Cava et al., 2021). Problem-oriented coping strategies, including help-seeking are negatively related with anger rumination (Givi et al., 2014). Indeed, social sharing of an emotional experience has shown to reduce related distress (Rimé et al., 2020), which, may, in turn, inhibit the anger rumination process. Inversely, higher levels of anger rumination did not seem to exert any significant influence on later peer victimization when controlling for sadness rumination, either for boys or girls, in contrast with previous findings (Camacho et al., 2021).

### Strengths, limitations, and future directions

The present study was the first to explore the bidirectional relationship between anger rumination and peer victimization when controlling for sadness rumination in early adolescence. All analyses were performed with latent SEM to partial out the measurement error in the measured variables, and thus disentangle meaningful change (Ledgerwood & Shrout, 2011). Developmentally appropriate and

psychometrical sound instruments were also employed to increase validity of results.

Along with strengths, there are also some limitations that provide interesting directions for future research. Studies with two-waves of data provide in general little information about stability effects (Fraleley & Roberts, 2005) as well as intra-individual and inter-individual changes in the level of variable over time (Ployhart & MacKenzie, 2015). Future studies would be strengthened by employing more complex data-analytical approaches with 3 or more data waves (e.g., latent growth curve models) to overcome methodological shortcomings related to two measurement waves (Selig & Preacher, 2009).

The present study was exploratory in nature. Therefore, conclusions are not definite and interpretations should be made with caution. For instance, the prospective relationship from peer victimization to anger rumination, reported herein, is not sufficient for claiming causality. Future studies with a greater sample size, and more data waves are needed to clarify the temporal precedence between anger rumination and peer victimization as well as to identify potential underlying mechanisms in the anger rumination-depressive symptoms link (e.g., hostile attribution bias) that could inform effective treatments. The fact that anger rumination did not emerge as a vulnerability factor for later peer victimization either for boys or girls, does not preclude the possibility that this relation might occur when other third variables are considered. For example, social support is proposed to mitigate the effect of rumination on negative affect (Puterman et al., 2010) as well as to reduce the likelihood of being peer victimized (Sulkowski & Simmons, 2018). That means that anger rumination can increase risk for peer victimization when low social support is received. Present findings also imply that there may be a general rumination style, and not anger or sadness rumination *per se* that renders early adolescents vulnerable to peer victimization over time. Despite of evidence showing that emotion regulation strategies are less distinct in small ages (e.g., Abela et al., 2004) it is also possible that present results may be due to a methodological artefact. Therefore, further research is needed to replicate these findings in early adolescence as well as to assess the unique aversive outcomes of each type of rumination in later life stages, when emotion regulation strategies become more differentiated. Finally, in future studies it would be interesting to examine whether, and if so why male victims are more likely to endorse anger rumination as compared to female victims. Male-female differences in the trajectory of brain maturational processes, or in other interpersonal factors (i.e. social support seeking) represent two potential research areas.

Another caveat involves the use of only self-reports. Self-reports provide a valuable insight in the way individuals perceive themselves and their environment. However,



self-reports are also susceptible to potential social desirability bias (e.g., underreport social undesirable attitudes or behaviors), which may have artificially masked true variable correlations. Another issue of employing the same methodology (i.e., self-report) is common method bias which may have inflated relations of constructs under study (Podsakoff et al., 2003). Future studies would be strengthened by performing multi-informant (e.g., peer nominations) and multi-method modalities (e.g., semi-structure interviews).

The present study explored the bidirectional relationship between anger rumination and peer victimization after partialling out the concurrent effect of sadness rumination at each time point of measurement. Accordingly, the longitudinal relationship between sadness rumination and peer victimization was tested after controlling for the concurrent effect of anger rumination at each time point of measurement. Future studies might benefit by exploring the longitudinal bidirectional relationship between anger rumination, sadness rumination, and peer victimization using more data waves and a greater variability in age groups across adolescence.

Finally, the present study focused on a non-stratified sample, which precludes representativeness of findings. For instance, sexual minority students (those who are attracted to the same or both sexes or are questioning) tend to report more frequent experiences of peer bullying (Luk et al., 2018) which may render them more vulnerable to anger rumination. Therefore, sample representativeness should be addressed in the future.

### Implication for treatments

The positive effects of peer victimization on anger rumination imply that prevention and treatment programs could focus on youths' peer victimization experiences to reduce risk for later anger rumination. Social Skills Training (SST) programs are reported to be beneficial in decreasing peer victimization in adolescence. SST's main target is to help youth acquire the behavioral and cognitive social skills that enable healthy interpersonal functioning (e.g., Fox & Boulton 2003). Social support seeking is an active coping strategy that may buffer the negative effects of peer victimization (see Kaiser et al., 2020). Research shows that family, teachers, peers and close friends may attenuate the negative effects of peer victimization by providing emotional and verbal support as well as by encouraging adaptive emotion regulation strategies (Cooley et al., 2015). Particularly, cognitive reframing is proposed to be effective in helping youth downregulate the emotional impact of an aversive experience and, thus, reduce the likelihood of being engaged in anger rumination (Rimé et al., 2020). Indeed, in a functional neuroimaging study performed by McRae et al., (2010) cognitive reframing was found to decrease amygdala (brain structure involved in processing of aversive information)

response, and increase activation in prefrontal cortex (brain structure involved in goal directed thinking). Future studies might benefit by testing the longitudinal effectiveness of cognitive restructuring techniques (i.e., better adjustment outcomes) across teen-years, when prefrontal cortex development has not yet fully completed, and socio-emotional challenges are still heightened. Although anger rumination was not found to determine *per se* later peer victimization across early adolescence, present findings also imply that there may be a general, less differentiated rumination style that predicts aversive interpersonal experiences over time. At this point it should be mentioned that high levels of ruminative thinking don't necessarily render individuals vulnerable to later external interpersonal stressors (i.e., high ruminators are being exposed to more frequent and intense experiences of peer victimization). It is also possible that frequent endorsement of rumination may affect how individuals perceive and manage these external stressors (i.e., high ruminators may experience personally meaningful negative events as more aversive and intense than they actually were or experience negative related affect for longer periods than is useful). In line with this notion evidence has shown that rumination about negative events may contribute to a reduced temporal psychological distance from these events (Siedlecka et al., 2015). That means that ruminators may feel that a past negative event occurred "just recently", which may increase the perceived intensity of that event. In any case, frequent endorsement of rumination may become a mental habit with trait-like features (Hjartarson et al., 2021), and maladjustment outcomes (e.g., Yang et al., 2021). Therefore, timely targeting this emotion-focused strategy – regardless of its type – is considered important in order to help youth become resilient adults. Distraction (i.e., purposely driving attention to pleasant or neutral activities and thoughts rather than one's distress) and mindfulness techniques (i.e., focusing on mental events in a nonjudgmental way) are considered helpful in getting young individuals out of a ruminative state (Hilt & Pollak, 2012). Particularly, Mindfulness-Based Programs (MBPs) teach individuals how to accept negative emotions without pushing them away or becoming overwhelmed (see McKeering & Hwang, 2019). Indeed, individuals induced in a mindful state following a negative mood induction reported less negative affect compared to those induced in a rumination state (Broderick, 2005). In a similar vein, MPBs are also promising in helping youth empower executive functioning, necessary for adaptive emotion regulation (Sanger & Dorjee, 2015).

### Conclusion

The bidirectional relationship between anger rumination and peer victimization has been poorly studied. Moreover, sadness rumination as a potential confounder of this relationship had never been examined. Using a two-wave

longitudinal design, the present study explored the reciprocal relationship between anger rumination and peer victimization in early adolescence, when controlling for sadness rumination. Sex-moderation effects were also assessed. Results showed that peer victimization was associated with subsequent increases in anger rumination but not vice versa, after controlling for sadness rumination. Additional analyses also indicated that there may be a general rumination style that predicts young individuals' peer victimization experiences over time. Statistical sex-moderation effects were not supported. However, victimized boys were found to be more at risk for being engaged in anger rumination over time as compared to victimized girls. Prevention and treatment efforts should focus on early adolescents' both peer victimization experiences and anger rumination tendencies. However, before developing such interventions, further research is needed to clarify the longitudinal relationship between anger rumination and peer victimization across youth as well as to explain whether, and if so why victimized boys are more likely to endorse anger rumination over time as compared to victimized girls.

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**Data availability** The codes underlying this study are available through Open Science Framework in <https://osf.io/bn3gh/>. The datasets are available from the corresponding author on reasonable request.

## Declarations

**Ethical approval** We have adhered to APA ethical standards in conducting this study. This study was approved by the Greek Ministry of Education (No: Φ15/30515/40339/Δ1).

**Informed consent** Oral assent was obtained from all participating students and written consent was obtained from their parents via enveloped letter.

**Conflict of interest** The authors declare no competing interests.

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