Running Title: Causes and Consequences of Stress Generation

**Causes and consequences of stress generation: Longitudinal associations of negative events,
aggressive behaviors, rumination, and depressive symptoms**

Akira Hasegawa^{1*}, Shin-ichi Oura¹, Tetsuya Yamamoto²,
Yoshihiko Kunisato³, Yuko Matsuda⁴, and Masaki Adachi⁴

¹ Faculty of Human Relations, Tokai Gakuin University

² Graduate School of Technology, Industrial and Social Sciences, Tokushima University

³ Department of Psychology, School of Human Sciences, Senshu University

⁴ Graduate Schools of Health Sciences, Hirosaki University

*Correspondence: Akira Hasegawa

Tokai Gakuin University

5-68 Naka-kirino, Kakamigahara City, Gifu, 504-8511, Japan

e-mail: mail-ad.of.hasse@tokaigakuin-u.ac.jp

Telephone number: +81-58-389-2200

Abstract

The present study examined the causes and consequences of stress generation in university students in Japan. A two-wave longitudinal study with an 8- or 9-week interval was conducted in the fall of 2020. Undergraduate and graduate students at four universities in Japan ($N = 201$) completed self-report measures assessing experiences of negative interpersonal dependent events, negative non-interpersonal events, and negative independent events at two times. At the same time, they also responded to measures of aggressive behaviors, trait rumination, and depressive symptoms. Path analyses revealed that baseline aggressive behaviors were positively associated with an increase in subsequent negative interpersonal dependent events, even after controlling for the influences of negative interpersonal dependent events, rumination, and depressive symptoms at baseline. However, aggressive behaviors were not significantly associated with subsequent negative non-interpersonal dependent events or negative independent events. These findings suggest that aggressive behaviors may have been a factor leading to interpersonal stress generation. Furthermore, all categories of negative event experiences predicted an increase in subsequent depressive symptoms, but not subsequent rumination, and rumination was not significantly associated with subsequent depressive symptoms. The present research extends previous examinations of the causes and consequences of stress generation conducted in Western countries by using specific measures of aggressive behaviors and by including a non-restricted sample of university students in Japan.

Keywords: stress generation, negative event, aggression, rumination, depression

The stress generation hypothesis (Hammen, 1991) assumes that depression-prone individuals are active agents in the creation of negative events. Previous studies have shown that individuals with depressive disorders or subclinical depressive symptoms, in contrast to their non-depressed counterparts, experience frequent negative dependent events, which are stressors resulting from their own behaviors or characteristics (see Liu & Alloy, 2010, for a review). Previous studies have also suggested that negative life events generated by the self can predict a future increase in depressive symptoms (Belmans *et al.*, 2019; Flynn *et al.*, 2010; Flynn & Rudolph, 2011; Hankin *et al.*, 2010; Snyder & Hankin, 2016) as well as the recurrence of major depression (Bos *et al.*, 2007). Therefore, the stress generation hypothesis holds that person-environment interactions exacerbate depression.

Previous studies have also examined cognitive and behavioral factors leading to stress generation. Aggressive behaviors are considered to be one such factor. Because aggressive behaviors are acts by which others are physically or psychologically harmed, it is reasonable to assume that these behaviors may be a cause of interpersonal stress generation. A few longitudinal studies have supported this assumption. For example, a study with adolescent girls by Stroud *et al.* (2015) found that scores on the aggression subscale of the Multidimensional Personality Questionnaire-Brief Form (Patrick *et al.*, 2002) were associated with an increase in acute interpersonal dependent stressors during the subsequent one year, even after controlling for baseline depressive symptoms and rumination. Similarly, a study of university students with bipolar spectrum disorders and others with no Axis I psychiatric disorder suggested that scores on the physical aggression subscale, as well as scores on the hostility and anger subscales of the Aggression Questionnaire (Buss & Perry, 1992), were positively associated with subsequent anger-evoking events (Molz *et al.*, 2013).

Although these previous results suggest that aggressive behaviors may be a factor in stress generation, very few studies have examined this possibility. In addition, previous studies had been conducted in Western countries only. Therefore, it remains unclear whether these results apply to non-Western populations. The study by Stroud *et al.* (2015) also had specific limitations in that the study included only female adolescent participants and did not use a specific measure of aggressive behaviors. Furthermore, Molz *et al.* (2013) included only university students with specific characteristics (i.e., students with bipolar disorders and those without any Axis I disorders) in the study sample. Therefore, it is uncertain whether their findings are applicable to university students in general. Considering these limitations, the present study attempted to obtain further evidence of the longitudinal relationship between aggressive behaviors and interpersonal stress generation in university students in Japan. This study also addressed the following issues.

This study examined whether aggressive behaviors predict subsequent negative interpersonal dependent events even after controlling for the influence of depressive symptoms and rumination. As described above, depressive symptoms have been a consistent predictor of increased negative dependent events (Liu & Alloy, 2010). Moreover, rumination, which is a robust predictor of depression (see Nolen-Hoeksema *et al.*, 2008, for a review), may be a factor in stress generation, particularly in the interpersonal domain (Flynn *et al.*, 2010; McLaughlin & Nolen-Hoeksema, 2012; Shapero, Hamilton, *et al.*, 2013; Stroud *et al.*, 2015), although negative results have also been obtained (Hamilton *et al.*, 2013, 2017; Shapero, Hankin, *et al.*, 2013). A longitudinal study has reported positive associations between aggressive behaviors, depressive symptoms, and rumination (McLaughlin *et al.*, 2014). Therefore, it is essential to examine whether the association between aggressive behaviors and subsequent negative interpersonal dependent events can be found without confounding depressive symptoms and rumination. Stroud *et al.*

(2015) found an association between baseline aggression and subsequent acute interpersonal dependent stressors after controlling for the influences of baseline acute interpersonal dependent stressors as well as depressive symptoms and rumination. In the present study, we examined whether similar partial associations can be obtained.

In addition, this study examined associations of negative interpersonal dependent events, negative non-interpersonal dependent events, and negative independent events with subsequent depressive symptoms and rumination. Although previous research has suggested that concurrent correlations with depressive symptoms are significantly stronger for negative dependent events than for negative independent events (Hasegawa, Oura *et al.*, 2021), the reason for this remains unclear. This result might indicate that depressive symptoms predict negative dependent events but not negative independent events (Liu & Alloy, 2010). It is also plausible that negative dependent events have a greater effect on depressive symptoms than do negative independent events, because attributing negative events to internal causes is associated with depressive symptoms (Huang, 2015). A longitudinal study should reveal which of these explanations is more adequate.

Furthermore, the goal progress theory of rumination assumes that negative events can prevent a person from attaining goals, which leads to rumination about goals that are yet to be attained (Martin *et al.*, 2004). In fact, previous studies have demonstrated that frequent exposure to negative events is prospectively associated with increased rumination (Michl *et al.*, 2013). Moreover, among negative interpersonal dependent events, negative non-interpersonal dependent events, and negative independent events, only negative interpersonal dependent events have been longitudinally associated with an increase in rumination after controlling for the influences of other categories of events (Hamilton *et al.*, 2015). An explanation may lie in the psychobiological theory

of depression (Slavich *et al.*, 2010), which proposes that because humans have a fundamental drive to maintain positive social status, social values, and social regard, social rejections that threaten these needs may elicit negative self-referential cognitions concerning social worth and self-esteem (i.e., rumination). Although these findings are important in explaining the causes of rumination, few studies have examined the association between negative events and rumination assessed at a later time point.

The present study also examined the relationship between rumination and subsequent depressive symptoms after controlling for the influences of aggressive behaviors and each category of negative events assessed in stress generation research. Although many longitudinal studies have shown that trait rumination is associated with an increase in depressive symptoms (Nolen-Hoeksema *et al.*, 2008), to our knowledge, no previous study has examined this partial association. This investigation should provide additional evidence about the causes and consequences of stress generation and rumination.

In summary, a short-term longitudinal study was conducted to examine the longitudinal relationships between aggressive behaviors, three categories of negative events in the stress generation research context, rumination, and depressive symptoms in university students in Japan. This study examined four hypotheses. At first, we hypothesized that aggressive behaviors at baseline would be positively associated with subsequent experiences of negative interpersonal dependent events, even after controlling for the influence of baseline negative interpersonal dependent events as well as depressive symptoms and rumination. We also predicted that aggressive behaviors would not be significantly associated with subsequent experiences of negative non-interpersonal dependent events and negative independent events (Hypothesis 1). In addition, we predicted that all categories of negative events would be associated with an increase

in depressive symptoms (Hypothesis 2) and rumination (Hypothesis 3). We also explored whether the associations with depressive symptoms and rumination would differ for each category of negative events. Finally, we hypothesized that rumination would be associated with increased depressive symptoms (Hypothesis 4).

Method

Participants

Participants were recruited in classes at Hirosaki University, Senshu University, Tokai Gakuin University, and Tokushima University in Japan. Undergraduate and graduate students ($n = 437$) in these universities responded to a packet of questionnaires during September and October 2020 (Time 1). Most participants answered the questionnaires again 8 weeks later (Time 2) in the same classroom in which they had been recruited at Time 1. However, 25 participants answered the questionnaires 9 weeks after Time 1 because their class could not be held 8 weeks later due to the spread of COVID-19. In addition, 36 participants at Tokushima University and 119 undergraduate students at Tokai Gakuin University who participated at Time 1 could not respond to the questionnaires at Time 2 because their classes could not be conducted face-to-face on the day originally scheduled as Time 2, for the same reason. Although these classes were held online at Time 2, online surveys could not be conducted because the Japanese version of the Beck Depression Inventory-Second Edition, one of the scales used in this study, was prohibited from being used online by Nihon Bunka Kagakusha Co., Ltd. In total, 259 students answered the questionnaire 8 or 9 weeks after Time 1.¹

The data of participants who did not participate at both time points and those with missing data on any questionnaire at either time were excluded from the analyses. The final sample comprised 201 students (84 men, 117 women). The mean age of the final sample was 20.20 ($SD =$

2.83, age range 18–51 years) at Time 1. All participants were Japanese, except for 3 participants (one Chinese, one Korean, and one Thai).

Measures

Aggression Scale (Isobe & Hishinuma, 2007). This scale is a measure of aggressive behaviors. This study used only the items of the overt aggression subscale for assessing aggressive behaviors. This subscale is composed of 12 items assessing physical and verbal aggressive behaviors, including “sometimes I was violent unintentionally” and “sometimes I was sarcastic and said bad things to others’ faces.” Each item was rated on a five-point rating scale using the anchors 1 (*not at all true of me*) and 5 (*extremely true of me*). The overt aggression subscale demonstrated sufficient internal consistencies at Time 1 and 2 (α s = .83 and .84, respectively).

Negative Independent/Dependent Events Scale (Hasegawa, Oura et al., 2021). This scale is a self-report measure assessing experiences of negative events in university students that was designed to test the stress generation hypothesis. The Negative Independent/Dependent Events Scale contains 25 items on the negative interpersonal dependent events subscale (e.g., “I had a terrible relationship with my friend”), 14 items on the negative non-interpersonal dependent events subscale (e.g., “My report was badly graded”), and 20 items on the negative independent events subscale (e.g., “I faced a disaster such as heavy rain or snow”). This scale showed acceptable construct validity (Hasegawa, Oura et al., 2021). Participants were asked to respond to the extent to which they had experienced each event in the last 8 weeks using a rating scale ranging from 1 (*never*) to 4 (*often*). Alpha coefficients at Time 1 and 2 were .91 and .92 for the negative interpersonal dependent events subscale, .82 and .83 for the negative non-interpersonal dependent events subscale, and .80 and .83 for the negative independent events subscale.

Ruminative Responses Scale (RRS; Nolen-Hoeksema & Morrow, 1991). The RRS is a scale of trait rumination. This scale includes 22 items, each rated on a 4-point rating scale anchored at 1 (*almost never*) and 4 (*almost always*). Five items in the RRS assess brooding (e.g., “Think ‘Why do I have problems other people don’t have?’”), five items assess reflection (e.g., “Analyze recent events to try to understand why you are depressed”), and 12 depression-related items (e.g., “Think about how sad you feel”; Treynor *et al.*, 2003). We calculated brooding and reflection subscale scores and the total RRS score. Adequate psychometric properties of the RRS, including good internal consistency and construct validity and moderate test-retest reliability of the total and subscale scores, have been reported (Schoofs *et al.*, 2010; Treynor *et al.*, 2003). The Japanese translation of the RRS by Hasegawa (2013) was used. Alpha coefficients at Time 1 and 2 were .95 and .95 for the overall RRS, .86 and .85 for the brooding subscale, and .76 and .79 for the reflection subscale in our sample.

Beck Depression Inventory-Second Edition (BDI-II; Beck et al., 1996). The BDI-II is a well-validated questionnaire assessing the severity of depressive symptoms experienced in the past two weeks. Participants respond to 21 items using a 0–3 scale, with higher scores indicating more severe depression. The Japanese translation of the BDI-II by Kojima and Furukawa (2003) was used. The BDI-II showed excellent internal consistency at Time 1 and 2 (both α s = .92) in our sample.

Procedure

Students were given a description of the study prior to participation. Only the students who agreed to take part in the study responded to the questionnaires. Participants answered all scales described above at Time 1 and 2. Participants wrote their birthdays and the last four digits of their mobile phone numbers on spaces provided in the questionnaire packet, which were used to match

the data from the surveys at the two times. The Ethics Committee of Tokai Gakuin University approved the study.

Statistical Analysis

Data were analyzed by allowing for missing data. Descriptive statistics and *t*-tests were conducted using SPSS ver. 23 (IBM Corporation), and all other analyses were conducted using Mplus 8.3 (Muthén & Muthén, 1998–2017). Simple correlations among all variables were calculated. Path analysis with maximum likelihood estimation method was conducted to examine whether aggressive behaviors, each category of negative events, rumination, and depressive symptoms at Time 1 were predictive of each variable at Time 2. We examined separate models using one of the subscales for negative interpersonal dependent events, negative non-interpersonal dependent events, and negative independent events. Although we used total RRS scores as the main variable of rumination, we conducted supplementary path analyses using either brooding or reflection subscales. In each model, correlations between all variables at Time 1 and those between error variables of all study variables at Time 2 were assumed.

Little's MCAR test (1988) yielded a non-significant chi-square value ($\chi^2(201) = 233.58, p = .057$), indicating that values were missing at random. Missing data were handled with multiple imputations using Bayesian analysis when conducting correlation analyses and path analyses. Imputation was conducted using age, gender, and all items of study variables, and 20 data sets were generated and used for analyses. In other analyses, missing data were handled with the pairwise method.

Because some studies have suggested that influences of psychological predictors on stress generation are stronger among females than males (Liu & Alloy, 2010), we initially planned to collect data from at least 150 male and 150 female participants in order to conduct a multiple group

path analysis with gender of each participant as a grouping variable. However, because of the spread of COVID-19 in Japan, a sample of sufficient size could not be collected, and we were unable to compare longitudinal associations of each variable between male and female groups.

Results

Descriptive statistics are shown in Table 1. Paired *t*-tests were performed using the data from participants who completed each subscale at both Time 1 and 2 without missing values. No variables had significantly different scores between Time 1 and Time 2 ($ts < 1.38$, $ps > .169$, $ds < 0.04$). Table 2 shows the correlations between each of the study variables.

Table 3 shows the results of the path analyses using total RRS score as an index of rumination. There was no test of overall model fit because all models were saturated (i.e., zero degrees of freedom). The model using negative interpersonal dependent events as a measure of negative events indicates that aggressive behaviors at Time 1 were significantly related to increased negative event experiences at Time 2. On the other hand, baseline aggressive behaviors had nonsignificant associations with subsequent negative non-interpersonal dependent events and negative independent events. All categories of negative events at Time 1 were associated with an increase in depressive symptoms at Time 2. Baseline rumination was not significantly associated with subsequent depressive symptoms. In all models, depressive symptoms at Time 1 were predictive of an increase in rumination at Time 2, but all categories of negative events were not predictive of later rumination. Aggressive behaviors at Time 2 were predicted by aggressive behaviors at Time 1 but by no other variables.

Supplementary analyses were conducted with brooding or reflection subscales as a rumination measure instead of total RRS scores. The results were largely the same as those in the

models using total RRS scores, except for a nonsignificant association between depressive symptoms at Time 1 and reflection at Time 2 (see Tables S1 and S2).

Discussion

Consistent with Hypothesis 1, aggressive behaviors at baseline were related to an increase in negative interpersonal dependent events, but not negative non-interpersonal dependent events or negative independent events, assessed 8 or 9 weeks later. In addition, the longitudinal association of aggressive behaviors with subsequent negative interpersonal dependent events was significant even after controlling for baseline depressive symptoms and rumination. These results are in line with a few previous findings (Molz *et al.*, 2013; Stroud *et al.*, 2015), but extend these by including university students in Japan who were not selected based on diagnostic criteria. Because aggressive behaviors are acts of physically or psychologically harming others, students who frequently engage in such behaviors are likely to be rejected by their counterparts, leading to interpersonal stress generation.

Furthermore, all categories of negative events were associated with an increase in subsequent depressive symptoms. These results support Hypothesis 2 and concur with those of many previous studies in which the experience of negative events was found to increase the risk of developing depressive symptoms and depressive disorders (for reviews, see Hammen, 2005; Monroe *et al.*, 2014). The influences of negative interpersonal dependent events, negative non-interpersonal dependent events, and negative independent events on depressive symptoms were very similar (see Table 3). A previous study (Hasegawa, Oura *et al.*, 2021) reported concurrent correlations with depressive symptoms that were significantly stronger for negative dependent events than for negative independent events, and in the present study, concurrent associations between each category of negative events and depressive symptoms were in the same direction

(see Table 2). The present findings indicate that the differences in the magnitude of the concurrent correlations with depressive symptoms cannot be explained by different influences of the categories of negative events on depressive symptoms.

The present study also found that depressive symptoms were not significantly associated with any category of negative events.² Therefore, concurrent associations with depressive symptoms that were stronger for negative dependent events than for negative independent events could not be explained by effects of depressive symptoms on stress generation. The nonsignificant associations between depressive symptoms and subsequent negative dependent events found here are inconsistent with the vast majority of previous results on stress generation effects of depression (Liu & Alloy, 2010). This inconsistency may be related to the fact that this study was conducted under the unusual situation of the global COVID-19 pandemic.

In this study, none of the categories of negative event at baseline were significantly associated with subsequent rumination, and baseline rumination was not significantly associated with subsequent depressive symptoms.³ These results do not support Hypotheses 3 and 4. Consistent with the goal progress theory of rumination (Martin *et al.*, 2004) and the psychobiological theory of depression (Slavich *et al.*, 2010), previous studies have shown that frequent exposure to negative events is associated with an increase in rumination (Michl *et al.*, 2013; Hamilton *et al.*, 2015). In these studies, negative event experiences assessed with self-report measures had a smaller effect on rumination (Michl *et al.*, 2013) than those assessed with a structured interview (Hamilton *et al.*, 2015). It is possible that assessment with a self-report measure of negative events may have weakened the influence of negative event experiences on rumination in the present study, because self-reports of negative event experiences can be affected by participant characteristics, such as interpretation bias (Liu, 2013).

The nonsignificant association between rumination and subsequent depressive symptoms was not consistent with many previous longitudinal studies (Nolen-Hoeksema *et al.*, 2008). The predictive power of scores on the Japanese RRS on future depressive symptoms may be relatively weaker than that of the original RRS. For example, the total score on the Japanese RRS predicted increased depressive symptoms assessed 4 and 8 weeks later (Hasegawa *et al.*, 2013, 2018), but not 6 months later (Hasegawa *et al.*, 2015). The Japanese RRS has been used less often than the original RRS to examine the longitudinal relationship between rumination and subsequent depressive symptoms. More effort is necessary to examine the relationship of Japanese RRS scores with future depressive symptoms.

In a broader context, the present study supplemented previous findings of an association between executive function and rumination. For example, Hasegawa, Matsumoto, *et al.* (2021) conducted a concurrent study with university students and found that response inhibition deficits had an indirect positive association with rumination via increases in aggressive behaviors and negative interpersonal events. This suggests a pathway to rumination for a subcomponent of executive function. However, Hasegawa, Matsumoto, *et al.* (2021) were unable to identify causality between variables, and they did not use a scale dedicated to assessing negative independent events and negative dependent events separately. The present study suggests that aggressive behaviors can lead to an increase in negative interpersonal dependent events in a longitudinal design. Therefore, the present study supports part of the pathway of response inhibition deficits to rumination suggested by Hasegawa, Matsumoto, *et al.* (2021), although the assumed association between negative interpersonal dependent events and subsequent rumination was not significant. Further studies are necessary to investigate the causes and consequences of stress generation and rumination using multiple methods.

In summary, the present study suggests that aggressive behaviors are a factor leading to interpersonal stress generation. In addition, negative interpersonal dependent events, negative non-interpersonal dependent events, and negative independent events were associated with an increase in depressive symptoms 8 or 9 weeks later, and all negative events had similar predictive powers for depressive symptoms. This study adopted a longitudinal design to examine causality between variables by using a specific measure of aggressive behaviors and including university student participants in Japan that were not selected based on diagnostic criteria, and thus extended previous examinations of the causes and consequences of stress generation conducted in Western countries.

Several limitations of the present study should be noted. The sample consisted only of university students, making it unclear whether the results are generalizable to other age groups or to clinical samples. In addition, the sample size was inadequate for a multiple group path analysis to compare the associations between each variable for male and female groups. Future studies are needed to replicate these findings with different and larger samples. Furthermore, all variables were assessed with self-report measures. More sophisticated assessment tools, such as structured clinical interviews, should be used in future work. Finally, the study was conducted under the unusual situation of the COVID-19 pandemic in Japan. These circumstances may have affected the present findings, although the results obtained in such a situation may have important implications. A future investigation after the pandemic should replicate the present research.

Footnotes

¹ At Hirosaki University, all classes were conducted online for three weeks in the follow-up period due to the spread of the COVID-19, whereas all classes were held face-to-face during the rest of the follow-up period. At Senshu University, only seminars and practical training were conducted face-to-face, and the other classes were held online throughout the study period. At

Tokai Gakuin University, all classes were held face-to-face during the period when the final sample answered the questionnaires. At Tokushima University, all classes were held face-to-face for approximately the first two weeks of the follow-up period, and after that, all classes other than seminars and practical training were conducted online.

² In order to examine whether the nonsignificant association between depressive symptoms and stress generation was due to the influence of other study variables, we conducted supplementary path analyses using only depressive symptoms and each category of negative events at both time points. Baseline depressive symptoms were not significantly associated with subsequent negative interpersonal dependent events ($\beta = .01, p = .846$), negative non-interpersonal dependent events ($\beta = .09, p = .147$), or negative independent events ($\beta = .08, p = .190$). These results suggest that the nonsignificant associations between depressive symptoms and stress generation could not be explained by effects of baseline aggressive behaviors and rumination.

³ Path analyses using only each category of negative events and rumination at both time points showed that negative interpersonal dependent events, negative non-interpersonal dependent events, and negative independent events at baseline were not significantly associated with subsequent rumination (β s ranged from .05 to .08, $ps \geq .147$). In addition, path analyses using only rumination and depressive symptoms at both time points showed that baseline rumination was not significantly associated with subsequent depressive symptoms ($\beta = -.03, ps = .541$). These results suggest that the nonsignificant associations between these variables are not explained by covariates.

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Availability of data and material: This study's dataset can be found at the Open Science Framework [<https://osf.io/83prm/>].

Declarations

Conflicts of Interest: The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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

Consent to participate: Informed consent was obtained from all individual participants included in the study. **Conflicts of Interest:** The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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Table 1*Descriptive statistics for each measure*

	<i>n</i>	<i>M</i>	<i>SD</i>	Range	Skewness	Kurtosis
<i>Time 1</i>						
Aggressive behaviors	200	23.80	7.75	12 – 46	0.89	0.15
Negative interpersonal dependent events	197	37.20	10.44	25 – 71	0.98	0.32
Negative non-interpersonal dependent events	198	23.89	6.57	14 – 48	0.79	0.31
Negative independent events	199	29.40	6.76	20 – 59	1.07	1.40
Brooding	200	10.69	4.15	5 – 20	0.39	–0.74
Reflection	201	8.70	3.29	5 – 18	0.73	–0.27
Rumination total	199	43.85	14.76	22 – 84	0.49	–0.35
Depressive symptoms	196	13.36	10.16	0 – 56	1.18	1.57
<i>Time 2</i>						
Aggressive behaviors	200	23.32	7.87	12 – 47	1.13	0.79
Negative interpersonal dependent events	199	37.09	10.69	25 – 90	1.36	2.74
Negative non-interpersonal dependent events	200	23.43	6.46	14 – 49	0.91	0.84
Negative independent events	201	28.85	7.16	20 – 59	1.56	2.94
Brooding	199	10.75	4.09	5 – 20	0.36	–0.71
Reflection	201	8.72	3.47	5 – 20	0.95	0.29
Rumination total	199	43.89	14.99	22 – 82	0.49	–0.54
Depressive symptoms	198	12.92	9.98	0 – 49	0.99	0.83

Table 2*Correlations between variables*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>Time 1</i>															
1. Aggressive behaviors															
2. Negative interpersonal dependent events	.32														
3. Negative non-interpersonal dependent events	.27	.66													
4. Negative independent events	.32	.69	.69												
5. Brooding	.15	.47	.52	.43											
6. Reflection	.22	.44	.43	.39	.56										
7. Rumination total	.19	.50	.54	.46	.90	.77									
8. Depressive symptoms	.15	.47	.50	.37	.62	.39	.66								
<i>Time 2</i>															
9. Aggressive behaviors	.75	.27	.25	.29	.09	.15	.14	.15							
10. Negative interpersonal dependent events	.33	.70	.52	.48	.31	.36	.35	.34	.38						
11. Negative non-interpersonal dependent events	.18	.52	.68	.50	.35	.32	.37	.40	.26	.61					
12. Negative independent events	.23	.49	.48	.63	.26	.24	.27	.30	.32	.66	.67				
13. Brooding	.10	.40	.38	.32	.63	.52	.65	.56	.16	.46	.39	.32			
14. Reflection	.12	.33	.30	.29	.33	.68	.50	.34	.15	.41	.35	.31	.60		
15. Rumination total	.11	.41	.42	.36	.58	.63	.70	.60	.17	.49	.44	.37	.92	.79	
16. Depressive symptoms	.13	.49	.51	.40	.51	.34	.54	.84	.17	.46	.51	.39	.61	.39	.66

Note. Absolute correlations of .14 or higher are significant at $p < .05$.

Table 3*Standardized estimates for each path analysis model*

Independent variables	Negative interpersonal dependent events as a stressor measure			
	Aggressive behaviors T2	Negative interpersonal dependent events T2	Rumination total T2	Depressive symptoms T2
Aggressive behaviors T1	.74 *** [.67, .81]	.12 * [.01, .22]	-.04 [-.14, .06]	-.03 [-.10, .05]
Negative interpersonal dependent events T1	.04 [-.07, .15]	.66 *** [.56, .76]	.05 [-.06, .17]	.15 ** [.06, .24]
Rumination total T1	-.06 [-.19, .06]	-.01 [-.15, .13]	.53 *** [.41, .65]	-.08 [-.18, .03]
Depressive symptoms T1	.07 [-.06, .19]	.02 [-.12, .15]	.23 ** [.10, .36]	.83 *** [.74, .91]
Independent variables	Negative non-interpersonal dependent events as a stressor measure			
	Aggressive behaviors T2	Negative non-interpersonal dependent events T2	Rumination total T2	Depressive symptoms T2
Aggressive behaviors T1	.74 *** [.67, .80]	.00 [-.10, .11]	-.03 [-.13, .07]	-.02 [-.09, .06]
Negative non-interpersonal dependent events T1	.05 [-.07, .16]	.65 *** [.54, .76]	.01 [-.11, .13]	.15 ** [.05, .24]
Rumination total T1	-.07 [-.20, .06]	-.07 [-.21, .08]	.54 *** [.42, .67]	-.08 [-.19, .02]
Depressive symptoms T1	.07 [-.06, .19]	.12 [-.02, .26]	.24 *** [.11, .37]	.83 *** [.74, .91]

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Independent variables	Negative independent events as a stressor measure			
	Aggressive behaviors T2	Negative independent events T2	Rumination total T2	Depressive symptoms T2
Aggressive behaviors T1	.73 *** [.66, .80]	.03 [−.08, .15]	−.04 [−.14, .06]	−.02 [−.10, .06]
Negative independent events T1	.06 [−.04, .17]	.62 *** [.52, .73]	.04 [−.07, .15]	.13 ** [.04, .21]
Rumination total T1	−.07 [−.20, .05]	−.11 [−.26, .04]	.53 *** [.41, .66]	−.08 [−.18, .03]
Depressive symptoms T1	.07 [−.05, .19]	.14 [−.00, .28]	.24 *** [.11, .36]	.85 *** [.77, .93]

Note. T1 means variable measured at Time 1, and T2 means variable measured at Time 2. Numbers in brackets indicate 95% confidence intervals. * $p < .05$. ** $p < .01$. *** $p < .001$.

Table S1*Standardized estimates in each model of path analysis using brooding subscale as a rumination measure*

Independent variables	Negative interpersonal dependent events as a stressor measure			
	Aggressive behaviors T2	Negative interpersonal dependent events T2	Brooding T2	Depressive symptoms T2
Aggressive behaviors T1	.73 *** [.66, .80]	.12 * [.01, .22]	-.02 [-.13, .08]	-.03 [-.11, .05]
Negative interpersonal dependent events T1	.05 [-.07, .16]	.67 *** [.57, .77]	.08 [-.05, .21]	.14 ** [.05, .23]
Brooding T1	-.09 [-.21, .03]	-.05 [-.18, .08]	.43 *** [.31, .56]	-.06 [-.16, .03]
Depressive symptoms T1	.08 [-.04, .20]	.04 [-.09, .16]	.26 *** [.12, .39]	.82 *** [.74, .89]
	Negative non-interpersonal dependent events as a stressor measure			
	Aggressive behaviors T2	Negative non-interpersonal dependent events T2	Brooding T2	Depressive symptoms T2
Aggressive behaviors T1	.73 *** [.67, .80]	-.00 [-.11, .10]	-.01 [-.12, .10]	-.02 [-.10, .06]
Negative non-interpersonal dependent events T1	.06 [-.06, .17]	.65 *** [.54, .76]	.01 [-.12, .14]	.14 ** [.05, .23]
Brooding T1	-.10 [-.22, .02]	-.06 [-.20, .07]	.45 *** [.32, .58]	-.07 [-.17, .03]
Depressive symptoms T1	.08 [-.04, .20]	.12 [-.02, .25]	.27 *** [.14, .41]	.82 *** [.74, .90]

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	Negative independent events as a stressor measure			
	Aggressive behaviors T2	Negative independent events T2	Brooding T2	Depressive symptoms T2
Aggressive behaviors T1	.73 *** [.66, .80]	.03 [−.08, .14]	−.01 [−.12, .10]	−.02 [−.10, .05]
Negative independent events T1	.07 [−.04, .18]	.61 *** [.51, .72]	.03 [−.09, .15]	.12 ** [.04, .21]
Brooding T1	−.10 [−.22, .02]	−.08 [−.22, .06]	.45 *** [.32, .58]	−.06 [−.16, .04]
Depressive symptoms T1	.08 [−.03, .20]	.12 [−.02, .26]	.27 *** [.14, .40]	.84 *** [.76, .91]

Note. T1 means variable measured at Time 1, and T2 means variable measured at Time 2. Numbers in brackets indicate 95% confidence intervals. * $p < .05$. ** $p < .01$. *** $p < .001$.

Table S2*Standardized estimates in each model of path analysis using reflection subscale as a rumination measure*

Independent variables	Negative interpersonal dependent events as a stressor measure			
	Aggressive behaviors T2	Negative interpersonal dependent events T2	Reflection T2	Depressive symptoms T2
Aggressive behaviors T1	.74 *** [.67, .81]	.11 * [.01, .21]	-.04 [-.15, .07]	-.03 [-.11, .05]
Negative interpersonal dependent events T1	.04 [-.08, .15]	.65 *** [.54, .75]	.02 [-.11, .14]	.13 ** [.04, .22]
Reflection T1	-.04 [-.15, .06]	.05 [-.06, .16]	.65 *** [.55, .75]	-.01 [-.10, .07]
Depressive symptoms T1	.05 [-.06, .15]	.00 [-.11, .11]	.09 [-.03, .20]	.79 *** [.72, .85]
	Negative non-interpersonal dependent events as a stressor measure			
	Aggressive behaviors T2	Negative non-interpersonal dependent events T2	Reflection T2	Depressive symptoms T2
Aggressive behaviors T1	.74 *** [.67, .81]	-.01 [-.11, .10]	-.03 [-.14, .07]	-.02 [-.10, .06]
Negative non-interpersonal dependent events T1	.04 [-.07, .15]	.63 *** [.52, .73]	-.02 [-.14, .10]	.12 ** [.03, .22]
Reflection T1	-.04 [-.15, .06]	.03 [-.09, .14]	.66 *** [.57, .75]	-.01 [-.09, .08]
Depressive symptoms T1	.04 [-.07, .15]	.08 [-.04, .20]	.10 [-.02, .22]	.79 *** [.72, .85]

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	Negative independent events as a stressor measure			
	Aggressive behaviors T2	Negative independent events T2	Reflection T2	Depressive symptoms T2
Aggressive behaviors T1	.73 *** [.66, .80]	.03 [−.08, .15]	−.04 [−.15, .07]	−.02 [−.10, .05]
Negative independent events T1	.06 [−.05, .17]	.61 *** [.50, .71]	.01 [−.10, .13]	.11 * [.02, .20]
Reflection T1	−.05 [−.15, .06]	−.04 [−.16, .08]	.65 *** [.56, .75]	−.00 [−.09, .08]
Depressive symptoms T1	.04 [−.06, .15]	.09 [−.03, .21]	.09 [−.03, .20]	.81 *** [.75, .87]

Note: T1 means variable measured at Time 1, and T2 means variable measured at Time 2. Numbers in parentheses indicate 95% confidence intervals. * $p < .05$, ** $p < .01$, *** $p < .001$.