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Depressive rumination and urgency have mutually enhancing relationships but both predict unique variance in future depression: A longitudinal study

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Abstract: This study examined possible associations between rumination and impulsivity and if these variables make unique contributions to increasing depression. A three-wave longitudinal study was conducted with an interval of four weeks between waves. University students in five Japanese universities completed the Japanese version of the Beck Depression Inventory-Second Edition, Ruminative Responses Scale, and UPPS-P Impulsive Behavior Scale on the three occasions (Time 1, $n = 284$, Mean age = 20.07 years, $SD = 2.50$, Age range 18–43 years; Time 2, $n = 198$; Time 3, $n = 165$). We conducted linear mixed model analyses to examine longitudinal relationships between variables with depression, rumination, and either UPPS-P subscale as fixed factors and the same variables assessed four weeks later as dependent variables. Results indicated that both negative and positive urgency predicted subsequent rumination, and rumination predicted subsequent negative but not positive urgency. Furthermore, rumination explained the unique variance in subsequent depression, even after controlling for the initial depression and negative or positive urgency score, and as did negative and positive urgency after controlling for initial depression and rumination. These findings suggest that rumination and urgency have a mutually enhancing relationship, although they make unique contributions to intensifying depression.

ABOUT THE AUTHORS

Akira Hasegawa is Associate Professor of the Department of Psychology, Faculty of Human Relations at Tokai Gakuin University in Japan. His primary research interests lie in the field of depression, and its vulnerability and maintenance factors. Especially, his current research is focused on processes that perpetuate depressive rumination. He has conducted collaborative studies on depression and rumination with his graduate students, and with colleagues in different institutes in Japan. This article is one report of a project investigating psychological factors that intensify depression, which is conducted in collaboration with Yoshihiko Kunisato, Hiroshi Morimoto, Haruki Nishimura, and Yuko Matsuda.

PUBLIC INTEREST STATEMENT

Results of this study indicated that two cognitive-behavioral patterns intensify depression in university students. One is rumination, which is a repetitive negative thought primarily focused on the past. The other is urgency which is a subset of impulsivity and represents the tendency to act rashly while experiencing negative or positive affect. Also, this study suggested that urgency increases ruminative thoughts, and rumination increases urgency when experiencing negative affect, which is not the case when experiencing positive affect. Therefore, it is plausible that interventions designed to decrease ruminative tendencies and urgency would be effective for preventing and alleviating depression in adults. Cognitive behavioral therapy is an established treatment to decrease rumination. However, few studies have examined procedures to decrease urgency. Therefore, more research is needed to develop treatments for urgency.

Subjects: Social Sciences; Behavioral Sciences; Health and Social Care

Keywords: depression; rumination; impulsivity; urgency; UPPS-P

1. Introduction

Many researchers have studied depressive rumination and impulsivity as psychological correlates and vulnerability factors for depression (Berg, Latzman, Bliwise, & Lilienfeld, 2015; Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008; Saddichha & Schuetz, 2014; Wright, Lipszyc, Dupuis, Thayapararajah, & Schachar, 2014). The findings of a relationship between these two constructs would have important implications for both theory and clinical practice. However, only a few studies have investigated the possible relationship. The present study investigated concurrent and longitudinal associations between rumination and impulsivity, and compared the predictive powers of these two constructs for depressive symptomatology.

The widely used definition of rumination is that proposed by Nolen-Hoeksema (1991), that emphasizes “behaviors and thoughts that focus one’s attention on one’s depressive symptoms and on the implications of these symptoms” (p. 569). Frequency of rumination in daily life as assessed through the total scores on the Ruminative Responses Scale (RRS; Nolen-Hoeksema & Morrow, 1991) predicts more severe depression (Hasegawa, Koda, Hattori, Kondo, & Kawaguchi, 2013; Nolen-Hoeksema & Morrow, 1991) as well as the onset of major depressive episodes (Nolen-Hoeksema, 2000; Spasojević & Alloy, 2001). In addition, experimental induction of rumination increases negative mood in dysphoric participants (Lyubomirsky & Nolen-Hoeksema, 1995; Lyubomirsky, Tucker, Caldwell, & Berg, 1999; Nolen-Hoeksema & Morrow, 1993). A subsequent study extracted two factors from the RRS: *Brooding*, which is “a passive comparison of one’s current situation with some unachieved standard,” and *reflection*, which is “a purposeful turning inward to engage in cognitive problem solving to alleviate one’s depressive symptoms” (Treynor, Gonzalez, & Nolen-Hoeksema, 2003, p. 256). Several longitudinal studies showed that brooding was associated with more depression at six months to 1 year later, whereas reflection was associated with less depression or showed no association, indicating that brooding may represent a more maladaptive aspect of rumination than reflection (Schoofs, Hermans, & Raes, 2010; Treynor et al., 2003).

Impulsivity is assumed to consist of heterogeneous clusters such as rash actions, actions without much consideration, and boredom susceptibility. Researchers often use self-report measures to assess trait impulsivity. The most popular dimensions of self-reported impulsivity are those proposed by Whiteside and Lynam (2001) and Lynam and his colleagues (2006), which include the following five traits: *Negative urgency* (i.e. the tendency to act rashly when experiencing negative affect), *lack of premeditation* (i.e. not thinking about the consequences of one’s actions), *lack of perseverance* (i.e. not following through with a task), *sensation seeking* (i.e. the tendency to seek excitement), and *positive urgency* (i.e. the tendency to act rashly when experiencing positive affect). On the other hand, impulsivity is also assessed via behavioral responses during laboratory tasks, often referred to as “behavioral impulsivity.” Although there are many tasks that assess behavioral impulsivity, the frequently used measures to assess the response disinhibition aspects of impulsivity are the go/no-go and stop signal tasks (MacKillop et al., 2016).

Previous studies have shown mixed findings on the relationships between rumination and impulsivity. Valderrama, Miranda, and Jeglic (2016) examined the relationships between the RRS brooding and reflection subscales and self-reported impulsivity as described above (except for positive urgency, which was not included). Of the four subscales, negative urgency had the strongest correlation with brooding ($r = .29, p < .01$). In addition, lack of premeditation and lack of perseverance were weakly but significantly correlated with brooding ($r_s = .11$ and $.13$, respectively, both $p_s < .01$). In terms of behavioral impulsivity, Hilt, Leitzke, and Pollak (2014) showed that in a youth sample, rumination scores assessed with the Children’s Response Styles Questionnaire (Abela, Brozina, & Haigh, 2002) were associated with difficulty inhibiting negative word stimuli when switching from negative to positive blocks on an affective go/no-go task. On the other hand, performance on the stop signal task with neutral stimuli does not appear to be associated with rumination (Aker, Harmer, & Landrø, 2014).

More work is needed to clarify the relationships between rumination and impulsivity. The present study attempted to extend the study of Valderrama et al. (2016) described above, in the following ways. First, this study included an examination of the relationships between rumination and positive urgency. Such an assessment is potentially important in understanding the mechanism related to depression, given that this trait is an important variable that predicts unique variance in externalizing dysfunction such as risk taking behaviors and problem gambling, even after controlling for the other four UPPS-P traits (Cyders et al., 2007), and is also itself a correlate of depression (Karyadi & King, 2011). Second, we examined the relationships between rumination and impulsivity after controlling for level of depressive symptoms. Because rumination and self-reported impulsivity are both related to depression (Berg et al., 2015; Nolen-Hoeksema et al., 2008), it is important to ascertain whether the relationship between rumination and impulsivity might stem from a confounding effect of depression. Third, we investigated possible longitudinal associations between rumination and self-reported impulsivity. If rumination shows concurrent but not longitudinal relationships with the dimensions of impulsivity, it could be concluded that such relationships may stem from same background factor. However, if rumination or impulsivity predicts subsequent scores for the opposite variable after controlling for initial scores, such a pattern would indicate more dynamic and potentially causal associations between rumination and impulsivity. Finally, the present study assessed possible unique contributions of rumination and impulsivity in predicting future depression. Such an emphasis could improve our understanding of how and why depression might persist, and could inform treatment efforts.

The present article reports a three-wave longitudinal study that examined the concurrent and prospective associations among rumination, impulsivity, and depression. We examined whether rumination and each dimension of impulsivity served to predict one another, as assessed four weeks later, and whether these variables make unique contributions to intensifying depression. Because the UPPS-P Impulsive Behavior Scale (Lynam et al., 2006) that assesses the five dimensions of self-reported impulsivity described above had not been translated into Japanese, we translated the scale into Japanese and used this translation in the present investigation. We also provide some preliminary data that support the reliability and validity of the Japanese version of the UPPS-P.

2. Method

2.1. Participants

The sample of this study was the same as the one investigated by Hasegawa, Kunisato, Morimoto, Nishimura, and Matsuda (in press). However, we also asked the participants to complete the UPPS-P (Lynam et al., 2006) and Barratt Impulsiveness Scale, Version 11 (BIS-11; Patton, Stanford, & Barratt, 1995). The present article reports data concerning impulsivity assessed with the UPPS-P and BIS-11, and its relationships with rumination and depression that Hasegawa et al. (in press) did not report.

Two-hundred and eighty-five undergraduate and graduate students took part in the first questionnaire administration (Time 1) in March 2015. Participants were recruited from the Hiroso University, Hiroshima International University, Senshu University, Tokai Gakuin University, and University of Tsukuba in Japan, and completed a packet of questionnaires. Students that were under treatment by a psychiatrist, clinical psychologist, or a counselor were excluded from the study for ethical reasons, because of the possibility that their mood could deteriorate as a result of participation in the study. All participants except one were Japanese.

About four weeks (Time 2) and eight weeks (Time 3) later, participants completed the same questionnaires as at Time 1. A researcher sent the questionnaire packet to the participants and they were asked to complete and return the questionnaires within one week. Two-hundred and two participants at Time 2 and 173 participants at Time 3 returned the questionnaires.

Of the data provided by 285 participants at Time 1, the responses of one individual were excluded because we suspected that the participant provided false responses to the questionnaires (e.g.

step-like answers to successive items such as “1, 2, 3, 4, 3, 2, 1”). This participant’s scores at Time 2 were also excluded. Of the data from 202 participants at Time 2, one individual was excluded for the reason described above, and three were excluded because they completed the questionnaires more than 35 days after Time 1 (i.e. four weeks plus one additional week). Of the data from 173 participants at Time 3, eight were excluded because they completed the questionnaires more than 63 days after Time 1 (i.e. eight weeks plus one additional week). Final samples comprised 284 individuals at Time 1, 198 at Time 2, and 165 at Time 3. The sample at Time 1 was composed of 118 men and 166 women, and mean age of the sample was 20.07 ($SD = 2.50$; range 18–43) and the median age was 19 years.

2.2. Measures

Beck Depression Inventory-Second Edition (BDI-II; Beck, Steer, & Brown, 1996). The BDI-II is a well-validated 21-item self-report questionnaire that measures the severity of depressive symptoms experienced over the past two weeks. Participants rate their responses using a 0–3 scale, with higher scores indicating greater severity of depression. We used the Japanese version of the BDI-II which has demonstrated good reliability and validity (Kojima & Furukawa, 2003).

Ruminative Responses Scale (RRS; Nolen-Hoeksema & Morrow, 1991). The RRS includes 22 items, each of which is rated on a 4-point rating scale anchored between 1 (*Almost never*) and 4 (*Almost always*). The RRS consists of five items assessing brooding (e.g. “Think ‘Why do I have problems other people don’t have?’”), five items assessing reflection (e.g. “Analyze recent events to try to understand why you are depressed”), and 12 depression-related items. We calculated brooding and reflection subscale scores as well as total RRS scores that involve summing the scores on all 22 items. Adequate psychometric properties of the RRS, including good internal consistency and construct validity, as well as moderate test-retest reliability for the total and subscale scores, have been reported (Schoofs et al., 2010; Treynor et al., 2003). We used the Japanese version of the RRS which has demonstrated acceptable reliability and validity (Hasegawa, 2013).

UPPS-P Impulsive Behavior Scale (UPPS-P; Lynam et al., 2006). This is a 59-item self-report measure that assesses five impulsivity-related traits: Negative urgency, lack of premeditation, lack of perseverance, sensation seeking, and positive urgency. Before undertaking the translation, the author obtained permission to translate the original version of the scale into Japanese from its developer, Dr Lynam. Two individuals with a Ph.D., an associate professor (AH) and one full-time lecturer (YK) who specializes in clinical psychology translated the UPPS-P into Japanese. Another full-time lecturer, one assistant professor, two graduate students taking a doctoral course, two taking a Master’s level course, and two undergraduate students, all specializing in psychology, checked the translation for correctness and intelligibility. Based on their comments, AH revised the translation. Next, two bilingual Japanese who have doctoral or Master’s degrees in psychology and who had not read the original English version of the scale translated the items back into English. Review by AH confirmed that the original English version and the back-translated version of the scale did not qualitatively differ in meaning. Each item is rated on a 4-point rating scale anchored by 1 (*Disagree strongly*) and 4 (*Agree strongly*). Although the original ratings were anchored from “*Agree strongly* (1)” to “*Disagree strongly* (4)”, we reversed the rating scales because all other scales used here involved anchor points where higher values mean more endorsement. Higher scores on each UPPS-P subscale mean higher impulsivity.

Barratt Impulsiveness Scale, Version 11 (BIS-11; Patton et al., 1995). This is a well validated self-report measure of impulsivity and includes 30 items, each of which is rated on a 4-point rating scale anchored between 1 (*Rarely/never*) and 4 (*Almost always/always*). We used the Japanese version of the BIS-11 which has demonstrated sufficient reliability and validity (Someya et al., 2001). We used the BIS-11 only to examine concurrent validity of the UPPS-P. Total BIS-11 scores were calculated and used.

2.3. Procedure

The researchers explained about this study and its exclusion criterion to undergraduate and graduate students in the five universities described above. Then, the students that were interested in the study were asked to come to a specified room in each university and one of the authors or a graduate-students assistant explained the outline of this study to the students before conducting the survey. After that, the students that agreed to participate in the study completed the packet of questionnaires in a small group setting (Time 1). The procedure took participants about 20 min to complete. Researchers sent out the same questionnaire packet so that the packet could reach each participants' home about 25 days (Time 2) and 53 days (Time 3) from completion at Time 1. Participants were asked to complete and return the questionnaires to the researchers within one week. The average duration between administration of the questionnaire package at Time 1 and Time 2 for the final sample was 27.71 days ($SD = 2.41$; from 24 to 35 days), that between Time 2 and Time 3 was 28.33 days ($SD = 2.98$; from 20 to 38 days), and that between Time 1 and Time 3 was 55.78 days ($SD = 2.57$; from 53 to 63 days). All participants received a book voucher worth 500 yen (approximately \$4 US) at Time 1 and 1000 yen (approximately \$8 US) at Time 3 for their participation. The Ethics Committee of Tokai Gakuin University approved this study.

2.4. Statistical analysis

All analyses were performed using SPSS ver. 23. Raw scores for each variable were analyzed, and missing data were handled using the pairwise method. Zero-order Pearson's correlations were computed between each of the measures. Partial correlations were calculated (with BDI-II scores partialled out) to examine direct associations between rumination and each impulsivity dimension after controlling for depression. To examine whether rumination and each impulsivity dimension predict one another, linear mixed models (LMMs) with maximum likelihood estimation were conducted. Total scores on the BDI-II and RRS and either UPPS-P subscale score were put into fixed factors, and each score on the RRS and either UPPS-P subscale assessed at the next time point was put into separate dependent variables. In all models, the repeated covariance type was set for unstructured covariance. Because the UPPS-P subscale scores were correlated with each other, we conducted separate LMMs with either UPPS-P subscale score in addition to BDI-II and RRS scores as fixed factors, so as to prevent multicollinearity. Furthermore, LMMs were conducted to examine whether rumination and each UPPS-P subscale (i.e. fixed factors) predict subsequent BDI-II scores. We evaluated a total of 15 LMMs. For example, the first model tested whether negative urgency assessed at Times 1 and 2 predicted rumination at Times 2 and 3, respectively, even after controlling for the effects of rumination and depressive symptoms at the prior assessment. Because the findings were quite similar when we conducted the same analyses with the durations between each testing occasion put into fixed factors, durations were not included in the analyses described below.

These models tested the average predictive effect of the independent variable on the dependent variable over each of the four-week intervals in the three-wave data-set. This analytic method produces relatively stable longitudinal associations between each variable than regression analysis for the data collected in only two time points. This method has been adopted in other longitudinal studies (e.g. Nolen-Hoeksema, Stice, Wade, & Bohon, 2007) and experience-sampling studies (e.g. Moberly & Watkins, 2008).

We also examined concurrent associations using the brooding and reflection subscale scores instead of RRS total scores. However, we did not examine the corresponding longitudinal associations with impulsivity and depression because the predictive powers of the separate brooding and reflection subscales of the Japanese RRS are weak and often nonsignificant for depression (Hasegawa, Hattori, Nishimura, & Tanno, 2015; Hasegawa et al., 2013).¹

3. Results

3.1. Descriptive statics

Descriptive statics are displayed in Table 1. Although the BDI-II scores were skewed, the results were quite similar after converting the BDI-II scores using square root transformation. Therefore, subsequent analyses were conducted using the raw scores of each scale.

Participants that responded to each measure twice or more ($n = 215$) scored lower than those that responded to the scales only at Time 1 (i.e. the participants that dropped out; $n = 69$) on the lack of perseverance, sensation seeking, and positive urgency at Time 1 ($p < .05$). These results suggest the possibility that the findings of the study might have been influenced by participants who dropped out.

Table 1. Descriptive statistics for each scale at each time point

	<i>n</i>	<i>M</i>	<i>SD</i>	<i>Skewness</i>	<i>Kurtosis</i>	<i>α</i>
BDI-II Time 1	281	12.87	8.94	0.95	0.60	.89
BDI-II Time 2	195	11.30	8.93	1.30	1.78	.91
BDI-II Time 3	163	10.60	9.36	1.40	2.11	.92
Brooding Time 1	284	13.07	3.95	-0.18	-0.88	.78
Brooding Time 2	197	12.78	3.92	-0.01	-0.83	.81
Brooding Time 3	165	12.67	3.96	-0.15	-0.76	.82
Reflection Time 1	284	10.43	3.52	0.35	-0.56	.70
Reflection Time 2	197	9.89	3.47	0.38	-0.76	.74
Reflection Time 3	165	9.64	3.57	0.51	-0.62	.80
RRS total Time 1	283	51.48	13.38	-0.10	-0.69	.91
RRS total Time 2	195	49.71	13.04	0.03	-0.71	.91
RRS total Time 3	163	49.21	13.84	0.05	-0.53	.93
Negative urgency Time 1	283	28.59	6.69	0.10	-0.13	.84
Negative urgency Time 2	196	28.02	6.66	-0.02	-0.41	.85
Negative urgency Time 3	161	27.87	7.42	0.06	-0.44	.89
Lack of premeditation Time 1	283	25.51	5.69	-0.01	0.08	.84
Lack of premeditation Time 2	195	25.08	6.14	0.02	-0.02	.89
Lack of premeditation Time 3	162	25.22	5.67	-0.06	-0.18	.87
Lack of perseverance Time 1	282	22.52	4.56	0.13	-0.02	.73
Lack of perseverance Time 2	195	22.34	4.91	0.42	0.35	.79
Lack of perseverance Time 3	160	22.50	4.77	0.18	-0.12	.78
Sensation seeking Time 1	284	30.19	6.90	-0.07	-0.58	.80
Sensation seeking Time 2	195	29.43	7.46	-0.05	-0.50	.85
Sensation seeking Time 3	161	29.16	7.86	-0.02	-0.69	.86
Positive urgency Time 1	282	30.89	8.14	0.21	-0.09	.90
Positive urgency Time 2	196	29.43	8.38	0.17	-0.53	.92
Positive urgency Time 3	161	28.84	8.84	0.07	-0.60	.93
BIS-11 Time 1	276	66.07	11.58	0.42	-0.13	.85
BIS-11 Time 2	192	65.71	11.21	0.31	0.02	.85
BIS-11 Time 3	158	65.23	11.27	0.29	0.18	.86

Notes: BDI-II = Beck Depression Inventory-Second Edition; RRS = Ruminative Responses Scale; BIS-11 = Barratt Impulsiveness Scale, Version 11.

3.2. Reliability and validity of the UPPS-P

As shown in Table 1, Cronbach’s alphas were high for each UPPS-P subscale.² Table 2 shows correlations between UPPS-P subscale and total BIS-11 scores at each time point. UPPS-P subscales, excluding sensation seeking, were strongly correlated with total BIS scores, indicating good concurrent validity for the four subscales. Sensation seeking was weakly but positively correlated with total BIS-11 scores. This weak correlation is consistent with an exploratory factor analysis conducted by Whiteside and Lynam (2001), which showed that traits assessed with the BIS-11 were only weakly associated with a dimension of sensation seeking (see also MacKillop et al., 2016).

Table 3 shows test-retest correlations for each UPPS-P subscale score. Test-retest correlations of the UPPS-P subscales at the interval of four weeks (i.e. test-retest correlations at Times 1 and 2, and those at Times 2 and 3) were all at least .80, and those at the interval of eight weeks (i.e. test-retest correlations between Times 1 and 3) were all greater than .78. These correlation coefficients and the internal consistencies of each subscale were indicative of the adequate reliability of the scales, although ideally, test-retest correlations should be examined at an interval of 1 to 2 weeks. The test-retest correlation also implied that scores on each subscale of the UPPS-P might fluctuate somewhat between 4 to 8 weeks. Therefore, the subsequent analyses examined whether the fluctuations of each impulsivity dimension were predicted by rumination.

3.3. Concurrent associations between rumination, impulsivity, and depression

Table 4 shows the correlations between each measure at Time 1, and partial correlations between them after controlling for BDI-II scores. Total RRS and brooding subscale scores were positively correlated with negative urgency and positive urgency, and negatively correlated with lack of premeditation. These associations were significant even after controlling for depression. The relationships between reflection and both negative and positive urgency were significant but slightly weaker than those for the brooding subscale. A z-test for the comparison of two overlapping correlations based on dependent groups, as described by Hittner, May, and Silver (2003), demonstrated that the correlation between reflection and negative urgency was weaker than that for brooding ($Z = -4.92$, $p < .001$), but that the correlation between reflection and positive urgency was not significantly different in magnitude than that for brooding ($Z = -1.90$, $p = .06$). Reflection was also positively

Table 2. Correlations between each UPPS-P subscale score and total BIS-11 scores

	BIS-11					
	Time 1		Time 2		Time 3	
Negative urgency	.57	***	.61	***	.67	***
Lack of premeditation	.63	***	.67	***	.65	***
Lack of perseverance	.58	***	.63	***	.61	***
Sensation seeking	.19	**	.21	**	.17	*
Positive urgency	.54	***	.50	***	.57	***

Note: BBIS-11 = Barratt Impulsiveness Scale, Version 11.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 3. Test-retest correlations for each subscale of the UPPS-P

	Time 1–Time 2		Time 2–Time 3		Time 1–Time 3	
Negative urgency	.81	***	.87	***	.78	***
Lack of premeditation	.83	***	.83	***	.83	***
Lack of perseverance	.81	***	.85	***	.82	***
Sensation seeking	.87	***	.87	***	.86	***
Positive urgency	.80	***	.87	***	.79	***

*** $p < .001$.

Table 4. Correlations between each measure at Time 1 (lower side) and partial correlations between measures after controlling for BDI-II scores (Upper side)

	1	2	3	4	5	6	7	8	9
1. BDI-II	-								
2. Brooding	.48 ***	-	.38 ***	.83 ***	.37 ***	-.20 ***	-.01 ***	-.04 ***	.25 ***
3. Reflection	.23 ***	.44 ***	-	.70 ***	.14 *	-.22 ***	-.14 *	.20 ***	.20 ***
4. RRS total	.54 ***	.87 ***	.70 ***	-	.38 ***	-.22 ***	-.03 ***	.09 ***	.33 ***
5. Negative urgency	.44 ***	.50 ***	.22 ***	.52 ***	-	.25 ***	.30 ***	.12 *	.70 ***
6. Lack of premeditation	.02 ***	-.17 **	-.21 ***	-.18 **	.24 ***	-	.45 ***	.22 ***	.22 ***
7. Lack of perseverance	.25 ***	.11 ***	-.07 ***	.11 ***	.37 ***	.44 ***	-	-.07 ***	.16 **
8. Sensation seeking	-.05 ***	-.06 ***	.18 **	.04 ***	.09 ***	.22 ***	-.08 ***	-	.29 ***
9. Positive urgency	.36 ***	.38 ***	.27 ***	.46 ***	.75 ***	.21 ***	.24 ***	.25 ***	-

Notes: BDI-II = Beck Depression Inventory-Second Edition; RRS = Ruminative Responses Scale.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 5. Linear mixed models with each subsequent score for measures of rumination, impulsivity, and depression as dependent variables

Independent variables	Negative urgency as a impulsivity measure											
	RRS total					BDI-II						
	B	SE	t	B	SE	t	B	SE	t			
Intercept	5.01	[0.87, 9.15]	2.10	2.39*	0.97	2.85]	0.95	1.02	-4.34	[-6.85, -1.82]	1.27	-3.41***
BDI-II	0.08	[-0.04, 0.20]	0.06	1.38	0.01	[0.00, 0.06]	0.03	0.38	0.79	[0.72, 0.86]	0.04	21.52***
RRS total	0.74	[0.66, 0.82]	0.04	17.73***	0.04	[0.00, 0.08]	0.02	2.17*	0.06	[0.01, 0.11]	0.03	2.25*
Negative urgency	0.22	[0.07, 0.37]	0.08	2.86**	0.87	[0.80, 0.94]	0.03	25.12***	0.11	[0.02, 0.20]	0.05	2.34*
<i>Lack of premeditation as a impulsivity measure</i>												
Intercept	8.70	[3.14, 14.25]	2.82	3.09**	1.09	[0.76, 2.93]	0.94	1.16	-4.88	[-8.24, -1.52]	1.70	-2.87**
BDI-II	0.12	[0.00, 0.24]	0.06	2.05*	0.01	[-0.03, 0.05]	0.02	0.62	0.79	[0.72, 0.87]	0.04	21.69***
RRS total	0.79	[0.71, 0.87]	0.04	19.46***	0.01	[-0.01, 0.04]	0.01	1.04	0.09	[0.04, 0.13]	0.02	3.45***
Lack of premeditation	-0.02	[-0.16, 0.13]	0.08	-0.20	0.92	[0.87, 0.97]	0.02	36.92***	0.09	[-0.00, 0.18]	0.05	1.90
<i>Lack of perseverance as a impulsivity measure</i>												
Intercept	7.13	[2.17, 12.09]	2.52	2.84**	2.28	[0.92, 3.65]	0.69	3.30**	-4.34	[-7.38, -1.29]	1.54	-2.81**
BDI-II	0.11	[-0.00, 0.23]	0.06	1.91	0.03	[-0.00, 0.07]	0.02	1.96	0.80	[0.73, 0.87]	0.04	21.73***
RRS total	0.79	[0.71, 0.87]	0.04	20.20***	-0.01	[-0.03, 0.01]	0.01	-0.77	0.08	[0.03, 0.13]	0.24	3.35***
Lack of perseverance	0.06	[-0.12, 0.23]	0.09	0.63	0.90	[0.86, 0.95]	0.02	36.91***	0.08	[-0.03, 0.19]	0.06	1.51
<i>Sensation seeking as a impulsivity measure</i>												
Intercept	9.73	[5.05, 14.42]	2.37	4.10***	0.53	[-1.32, 2.39]	0.94	0.57	-3.42	[-6.31, -0.54]	1.46	-2.34*
BDI-II	0.12	[0.01, 0.24]	0.06	2.07*	-0.02	[-0.06, 0.03]	0.02	-0.71	0.81	[0.73, 0.88]	0.04	22.20***
RRS total	0.79	[0.72, 0.87]	0.04	20.24***	0.01	[-0.02, 0.04]	0.02	0.50	0.08	[0.04, 0.13]	0.02	3.46***
Sensation seeking	-0.06	[-0.17, 0.06]	0.06	-1.00	0.97	[0.93, 1.02]	0.02	42.85***	0.03	[-0.04, 0.09]	0.04	0.71
<i>Positive urgency as a impulsivity measure</i>												
Intercept	5.98	[2.05, 9.92]	1.99	3.00**	0.71	[-1.37, 2.78]	1.05	0.67	-4.32	[-6.67, -1.97]	1.19	-3.63***
BDI-II	0.09	[-0.02, 0.21]	0.06	1.59	-0.00	[-0.06, 0.06]	0.03	-0.03	0.79	[0.72, 0.87]	0.04	22.05***
RRS total	0.76	[0.68, 0.84]	0.04	18.51***	-0.00	[-0.04, 0.04]	0.02	-0.02	0.06	[0.02, 0.11]	0.02	2.63**
Positive urgency	0.14	[0.02, 0.25]	0.06	2.31*	0.96	[0.90, 1.02]	0.03	30.70***	0.09	[0.02, 0.16]	0.04	2.57*

Notes: BDI-II = Beck Depression Inventory-Second Edition; RRS = Ruminative Responses Scale. Numbers in parentheses shows 95% confidence intervals.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

associated with sensation seeking and negatively associated with lack of premeditation even after controlling for depression. Reflection was not significantly correlated with lack of perseverance, but did show a significant relationship after controlling for BDI-II scores.

3.4. Longitudinal associations

LMMs were conducted to test whether rumination and each UPPS-P trait were longitudinally associated with each other after controlling for initial depression. Negative and positive urgency scores predicted subsequent RRS total scores after controlling for initial RRS total scores and BDI-II scores (see left line of Table 5). Total RRS scores also predicted subsequent negative urgency scores (see middle line of Table 5).

We also conducted LMMs to examine whether rumination and each UPPS-P trait explain unique variance in subsequent depression level after controlling for the influences of the other variable (see right line of Table 5). Total RRS scores predicted subsequent BDI-II scores even after controlling for BDI-II and UPPS-P subscale scores at initial time points. Furthermore, negative and positive urgency both predicted subsequent BDI-II scores after controlling for initial BDI-II and RRS scores.

4. Discussion

Consistent with a previous study (Valderrama et al., 2016), of all UPPS-P subscales, negative urgency correlated most strongly with brooding as well as RRS total scores in a concurrent examination. This study also showed that positive urgency is positively correlated with brooding and RRS total scores, indicating that rumination is related to response disinhibition not only during negative affect but positive as well. Importantly, because rumination was associated with both negative and positive urgency even after controlling for depression scores, these relationships do not appear to stem from the confounding influences of depression.

Furthermore, to our knowledge, this study is the first to show longitudinal associations between rumination and impulsivity. Negative and positive urgency both predicted RRS total scores assessed 4 weeks later, after controlling for initial rumination and depression scores. Conversely, rumination predicted subsequent negative but not positive urgency. Concurrent associations between rumination and negative as well as positive urgency could indicate that common background factors drive both rumination and urgency (e.g. effortful control; Carver, Johnson, & Joormann, 2008; Eisenberg, Hofer, Sulik, & Spinrad, 2014). However, although this notion is possible, the prospective associations identified here suggest mutually enhancing relationships between rumination and urgency.

It is possible that if individuals with high negative or positive urgency react impulsively, they could ruminate about the consequences of their reactions and their impulsive actions. On the other hand, it is possible that the prospective association between rumination and negative urgency is mediated by negative attention and interpretation bias. Trait rumination is positively correlated with attention bias for sad faces (Joormann, Dkane, & Gotlib, 2006) and a tendency to interpret ambiguous information in a rumination-consistent manner (Mor, Hertel, Ngo, Shachar, & Redak, 2014). Furthermore, induced rumination increases negative interpretations about the self and about one's situation (Lyubomirsky & Nolen-Hoeksema, 1995; Lyubomirsky et al., 1999), and works to bias interpretation of emotionally ambiguous homographs (Hertel & El-Messidi, 2006). Negative attention and interpretation bias that stems from rumination and that can lead to sudden increases in negative affect may give rise to impulsive reactions (i.e. negative urgency). RRS total scores might not predict positive urgency because rumination leads to a negative *but not* a positive attention and interpretation bias. Interestingly, a positive association between rumination and negative urgency is consistent with the findings of Hilt et al. (2014) showing that rumination was associated with difficulty inhibiting negative but not positive information during an affective go/no-go task.

After controlling for initial depression and impulsivity scores, RRS total scores predicted BDI-II scores assessed four weeks later. These results were consistent with the growing body of evidence suggesting that rumination represents a vulnerability to depression (Nolen-Hoeksema et al., 2008).

Interestingly, negative and positive urgency also predicted subsequent depression, even after controlling for rumination. To our knowledge, this study is the first to show that rumination and negative as well as positive urgency can predict future depression after controlling for each other, highlighting the importance of rumination and impulsivity in the fields of research and clinical practice for depression.

Other findings regarding the relationships between rumination and impulsivity were somewhat inconsistent with the findings of Valderrama et al. (2016). This study found that RRS total and subscale scores were *negatively* correlated with lack of premeditation. Because lack of premeditation assesses a tendency not to think before one's actions, it is understandable that this subscale was negatively related to rumination, a tendency toward thinking too much. In addition, sensation seeking was positively associated with reflection but not brooding or RRS total scale scores. Because a meta-analysis by Berg et al. (2015) showed that sensation seeking was negatively associated with depression and anxiety, this finding does not suggest that reflection has maladaptive aspects. Verhaeghen, Joormann, and Khan (2005) indicated that highly reflective individuals have much creative interest because reflection leads to heightened sensitivity toward their feelings. Therefore, it is possible that such individuals may seek novel experiences to satisfy their creative pursuits.

The correlation between reflection and negative urgency was weaker than that for brooding. The definition and item content of the reflection subscale indicates that reflection represents thought processes whose valence is less negative. It is plausible that impulsive reactions lead to frequent thoughts with more negative valence, that is, brooding but not reflection. Furthermore, the weak relationship between reflection and negative urgency may result from a lack of relationship between reflection and negative attention bias (Joormann et al., 2006).

The present study has some limitations. Although the present study showed good concurrent validity, internal consistencies and test-retest reliability for the Japanese version of the UPPS-P, this study did not examine the convergent and discriminant validity of the scale. Furthermore, we did not conduct a confirmatory factor analysis to examine the factor structure of the UPPS-P, due to a relatively small sample size. The present reliability and validity data for the UPPS-P should be considered preliminary, and future studies should further examine the scale's psychometric properties. Next, all assessments in this study relied on self-report measures. Because there are many behavioral measures of impulsivity, future studies should examine the longitudinal associations between rumination and behavioral impulsivity. In addition, it is important to examine unique contributions of rumination and self-reported or behavioral impulsivity to predict onset of depressive disorders identified with structured clinical interviews. Furthermore, because the participants completed the questionnaires in their homes at Time 2 and 3, it was unclear whether the participants accurately reported the days on which the questionnaires were completed (we could not conduct an online survey because the Japanese version of the BDI-II is prohibited for use online by Nihon Bunka Kagakusha Co., Ltd.). Moreover, the intervals between each occasion when participants completed the questionnaires varied somewhat, although the results did not change after controlling for this variable. Methods to fix the date when participants complete the questionnaires could help increase the confidence in our findings.

To our knowledge, this study is the first to show that the relationships between rumination and negative as well as positive urgency are not due to confounding with depression, and rumination and negative as well as positive urgency are longitudinally associated with each other, although positive urgency did not predict subsequent rumination. These findings indicate the possibility that rumination and urgency have mutually enhancing relationships, although it is possible that both traits also have common background factors. In addition, this study showed that rumination and both forms of urgency can predict future depression after controlling for one another, indicating that both rumination and urgency make unique contributions to intensify depression. Because this study was preliminary in nature and has some limitations, future work should address these limitations and seek to demonstrate clearer associations among depression, rumination, and impulsivity.

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Competing interests

The authors declare no competing interest.

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Notes

1. Predictive powers of brooding and reflection subscales for depression were reported by Hasegawa et al. (*in press*).
2. We did not conduct a confirmatory factor analysis to further examine the UPPS-P because this study had a relatively small sample size. We discuss this limitation later.

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