Why do People Overthink? A Longitudinal Investigation of a Meta-Cognitive Model and Uncontrollability of Rumination

Abstract

*Background*: The meta-cognitive model of rumination is a theoretical model regarding the relationship between rumination and depression. Although meta-cognitive therapy for rumination was established based on this model, insufficient longitudinal studies addressing this model have been conducted. Moreover, the uncontrollability of rumination, suggested to be driven by negative meta-beliefs about rumination, has not been examined using this meta-cognitive model.

*Aims*: We longitudinally examined the meta-cognitive model and its relationship with uncontrollability of rumination and depressive symptoms.

*Method*: Undergraduate students (*N* = 117) were asked to complete two measurements (with a 6-month gap between them) of positive and negative meta-beliefs about rumination, causal analysis, understanding, uncontrollability of rumination, and depression.

*Results*: Cross-lagged effect modelling revealed that positive meta-beliefs predicted high causal analytic rumination. However, the results did not support the causal analytic and understanding aspects of how rumination predicted negative meta-beliefs. Negative meta-beliefs predicted high depressive symptoms, and depressive symptoms predicted high negative meta-beliefs. Negative meta-beliefs predicted high uncontrollability of rumination, whereas uncontrollability of rumination did not predict depressive symptoms.

*Conclusions*: The results partially supported the meta-cognitive model. The prediction of depressive symptoms on negative meta-beliefs suggests that depression-related cognition might be involved in increasing negative meta-beliefs, rather than the repetitive causal analytic and understanding aspects of rumination. In line with meta-cognitive therapy, negative meta-beliefs could be a target for treating depression.

*Keywords:* rumination, meta-cognition, depression, cross-lagged effect modelling, uncontrollability.

Why do People Overthink? A Longitudinal Investigation of a Meta-Cognitive Model and the Uncontrollability of Rumination

**Introduction**

Why do people repeatedly think about their problems even if they cannot find the answers for them? Over the past 25 years, several studies on rumination have been developed (Nolen-Hoeksema, 1991; Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008; Papageorgiou & Wells, 2003; Watkins, 2008). Researchers have focused on rumination because it plays a prominent role in predicting and maintaining depressive symptoms (Just & Alloy, 1997; Nolen-Hoeksema, 1991). Moreover, rumination is also related to avoidance (Cribb, Moulds, & Carter, 2006; Moulds, Kandris, Starr, & Wong, 2007), social problem-solving skills (Lyubomirsky & Nolen-Hoeksema, 1995; Watkins & Baracaia, 2002), overgeneral memory (Ramponi, Barnard, & Nimmo-Smith, 2004; Sumner, 2012), and intrusive memory (Birrer, Michael, & Munsch, 2007; Ehring, Fuchs, & Kläsener, 2009), which are all depression-related symptoms or vulnerabilities of depression (Marx, Williams, & Claridge, 1992; Ottenbreit & Dobson, 2004; Williams et al., 2007; Williams & Moulds, 2007). Therefore, identifying the causes of rumination and developing interventions for rumination can help in the treatment of depression.

Among some of the theories of mechanisms of rumination proposed to date (e.g. Martin & Tesser, 1996; Watkins & Nolen-Hoeksema, 2014), the meta-cognitive model of rumination (Papageorgiou & Wells, 2003) is one of the representative models. However, due to insufficient empirical studies on meta-cognitive model, its applicability and validity are still unclear. Therefore, we examined the meta-cognitive model of rumination.

**Meta-cognitive Model and Theory of Rumination**

The meta-cognitive model of rumination (Papageorgiou & Wells, 2004) was derived from the S-REF (self-regulatory executive function) model (Wells & Matthews, 1994), and meta-cognitive model of worry (Wells, 1995, 1997). The meta-cognitive model describes a process wherein rumination is triggered by intrusions and/or stimuli within the environment, leading to a worsening of depression. According to the meta-cognitive model of rumination, at first, a positive meta-belief such as ‘ruminating about my problems helps me’ occurs in response to a trigger. Further, in response to positive meta-beliefs, rumination, which is supposed to help in problem solving or understanding the problem, occurs. Such rumination based on positive meta-beliefs is often used by people to solve their problems and understand themselves better, and in some cases, it produces effective strategies and outcomes. However, in many cases, rumination is prolonged and repetitive without resulting in any effective solution. Consequently, negative meta-beliefs about rumination such as ‘ruminating about my problems is uncontrollable’ are likely to grow. Moreover, negative meta-beliefs induce further rumination, which exacerbates depressive symptoms (Papageorgiou & Wells, 2009). Papageorgiou & Wells (2004) also considered depression-related cognition and/or behaviour could also be a factor of negative meta-beliefs. Depressive symptoms may have a role in establishing negative meta-beliefs, because it is related to negative meta-cognition, inactive behaviour, and loss of motivation (Wells, 2009). These symptoms trigger negative meta-beliefs, such as nonattainment of tasks and failure in relationships.

The meta-cognitive therapy for rumination (Wells, 2009; Wells & Papageorgiou, 2004) focuses on and treats positive and negative meta-beliefs to reduce rumination and depressive symptoms. When problem-solving rumination fails, people experience feelings of self-inconsistency, which, in turn, escalates their depressive symptoms (Wells, 2009). Therefore, to reduce depressive symptoms, the first goal of meta-cognitive therapy for rumination is to achieve modification of positive meta-beliefs. In addition, it has also been observed that feelings of threat, such as uncontrollability, caused by negative meta-beliefs could increase depressive symptoms (Papageorgiou & Wells, 2009). Accordingly, meta-cognitive therapy for rumination also modifies negative meta-beliefs in anticipation of reducing depressive symptoms (Wells, 2009).

**A Design to Examine the Meta-cognitive Model of Rumination**

To quantitatively measure the meta-cognitive model of rumination, some measuring scales have been developed. Papageorgiou and Wells (2003) developed the positive beliefs about rumination scale (PBRS) and the negative beliefs about rumination scale (NBRS), which measure meta-beliefs about rumination. They demonstrated a series of flow showing that positive meta-beliefs predicted rumination measured by the Ruminative Responses Scale (RRS; Treynor, Gonzalez, & Nolen-Hoeksema, 2003), that rumination predicted negative meta-beliefs, and that negative meta-beliefs predicted depressive symptoms using a cross-sectional design. These results were in line with the meta-cognitive model of rumination.

Although some prior studies have supported the meta-cognitive model of rumination (Kubiak, Zahn, Siewert, Jonas, & Weber, 2014; Papageorgiou & Wells, 2001, 2003, 2004, 2009; Roelofs, Huibers, Peeters, Arntz, & van Os, 2010; Roelofs, Papageorgiou, Gerber, Huibers, Peeters, & Arntz, 2007; Solem, Hagen, Hoksnes, & Hjemdal, 2016), the evidence is insufficient. Since almost all previous studies have employed a cross-sectional design, there remains insufficient longitudinal evidence supporting the meta-cognitive model of rumination (except Papageorgiou & Wells, 2009). Longitudinal studies are essential for examining the relationship between rumination, meta-beliefs, and depression, since these variables indicate high correlations and the general factor of repetitive thinking style can be assumed to be based on these variables. Under such conditions, significant pathways will likely be obtained, even if they lack causal relationships. Therefore, the relationship between rumination-related variables may be confusing in cross-sectional studies.

In addition, longitudinal studies may not only reinforce previous findings, but also provide novel findings. For example, as mentioned above, depressive symptoms could also exacerbate negative meta-beliefs. As such, it can be assumed that there is a reciprocal association between depression and negative meta-beliefs; however, the influence of depression on negative meta-beliefs has not been examined in empirical studies. Longitudinal studies allow us the advantage of testing such a hypothesis.

**The Leuven Adaptation of Rumination on Sadness Scale** (**LARSS) and Meta-Cognitive Model of Rumination**

Raes, Hermans, Williams, Bijttebier, and Eelen (2008) developed the LARSS, which consists of three subscales: causal analytic rumination (e.g. I keep asking myself what could have contributed to my feeling so sad), understanding form of rumination (e.g. I keep thinking about how I feel, to understand myself and my sad feelings better), and uncontrollability of rumination (e.g. I think about it so much, it almost drives me crazy).

Within the meta-cognitive model of rumination, causal analytic rumination and understanding form of rumination measure rumination in response to triggers and positive meta-beliefs. Although these two factors are very similar, causal analytic rumination is more akin to the type of problem solving thoughts. On the other hand, understanding form of rumination merely reflects trying to understand the meaning of sadness (Raes et al., 2008).

Uncontrollability of rumination reflects the perception or experience of having uncontrollable thoughts and might be driven by negative meta-beliefs. Although the negative meta-beliefs include the meta-cognition of uncontrollability such as the belief that ‘rumination is uncontrollable’, Wells (2009) distinguishes the perception or experience of having uncontrollable thoughts from the meta-belief or knowledge of uncontrollability of rumination. He suggests that one’s meta-cognition consists ofknowledge, experience, and strategy. The meta-cognitive knowledge or belief involves beliefs and theories regarding the thinking style about the self, which include positive and negative meta-beliefs.

On the other hand, meta-cognitive experience refers to situational evaluation and emotions on the mental state of the self. Uncontrollability of rumination measured by the LARSS reflected such situational experience or perception of being uncontrollable. The meta-cognitive strategy reflected coping strategy for perceived experiences such as thought suppression or giving up. Negative meta-beliefs about rumination are related to self-focus, repetitive negative thinking style, and attentional bias for uncontrollability and the harmful outcomes of rumination (Wells & Matthews, 1994). As a result, it can lead to focused attention on uncontrollability of rumination and thereby, the rumination is prolonged.

Further, negative meta-beliefs induce giving up controlling ruminative thoughts as a strategy, which can thereby contribute to uncontrollable rumination (Papageorgiou & Wells, 2009). As such, negative meta-beliefs could elevate uncontrollability of rumination. Uncontrollability of rumination has also been getting much attention recently because it is closely related to depressive symptoms (Raes et al., 2008). However, no previous studies have longitudinally examined the relationship between negative meta-beliefs, uncontrollability of rumination, and depressive symptoms. Therefore, these issues need to be addressed.

**This Study**

We longitudinally examine the meta-cognitive model and uncontrollability of rumination and depression. Our hypothetical model is shown in Figure 1. We tested 8 pathways in this model and specified what pathways were particularly relevant. We used cross-lagged effect modelling (Finkel, 1995) to infer reciprocal causal relationships. Although both causal analytic and understanding rumination (Raes et al., 2008) are involved in rumination in response to positive meta-beliefs, we used both factors to examine whether type of rumination could predict negative meta-beliefs and whether positive meta-beliefs predicted causal analytic and understanding rumination.

INSERT FIGURE 1 ABOUT HERE

**Method**

**Participants and Procedure**

Data were collected at two points: April (Time 1) and October (Time 2). Participants took part in exchange for course credit. Participants were Japanese undergraduate students who majored in psychology (Time 1: *N* = 242, 156 women, 20.15 ± 3.44 years; Time 2 (6 months later): *N* = 117, 71 women, 20.43 ± 0.82 years). Compared to the first investigation, 125 students dropped out because approximately half of the participants who had participated in the first investigation did not attend classes in the October semester. Before responding to the questionnaire, all participants provided informed consent for each investigation. This research was approved by the ethics committee of XXX (no. 27-11).

**Measures**

We measured positive meta-beliefs using the PBRS, rumination in response to positive meta-beliefs using the LARSS-causal analytic factor and understanding factor, negative meta-beliefs using the NBRS, uncontrollability of rumination using the LARSS uncontrollability factor, and depression using the second-edition of the Beck Depression Inventory (BDI-II; Beck, Steer, & Brown, 1996).

**BDI-II.** The BDI-II (Beck et al., 1996) is a representative self-report questionnaire that measures 21 depressive symptoms on a 4-point scale. Participants selected the items that were most applicable to them in the previous two weeks. Kojima and Furukawa (2003) developed the Japanese version of this scale, which has good reliability and validity. Cronbach’s alpha in the present study was .91 at Time 1 and Time 2.

**PBRS.** The PBRS (Papageorgiou & Wells, 2001, 2003) measures positive meta-beliefs about rumination (e.g. I need to ruminate about my problems to find the causes of my depression). This scale has 9 items, and the responses are rated on a 4-point scale (1 = *do not agree* to 4 = *agree a lot*). Participants responded based on how they generally agreed with these items. Takano and Tanno (2010) developed the Japanese version of this scale, which has good test-retest reliability and convergent and discriminant validities. Cronbach's alphas in the present study were .88 at Time 1 and .93 at Time 2.

**NBRS.** The 13-item NBRS (Papageorgiou, personal communication; see also Luminet, 2004; Papageorgiou & Wells, 2003, 2009) measures negative meta-beliefs about rumination using a 4-point self-report scale. Participants responded based on how they generally agreed with these items. This scale has two factors: uncontrollability (e.g. Ruminating means I am out of control) and harmful effects (e.g. Ruminating makes me physically ill). The Japanese version of this scale was developed by authors (Unpublished). Both factors in the Japanese version have good internal consistency (αs = .84 and 87, respectively), test-retest reliability over a month (*rs* = .73, 71, respectively), and validity, like the original version. The present study used the total score as an index of negative meta-beliefs. Cronbach’s alphas in the present study were .93 at Time 1 and .91 at Time 2.

**LARSS.** The 17-item LARSS (Raes et al., 2008) is an inclusive rumination scale measured with a 5-point scale. The LARSS consists of three factors: causal analysis, understanding, and uncontrollability. All items have the stem ‘When I am sad, down, or feel blue…’ and participants were instructed to answer each item in that condition. Matsumoto and Mochizuki (2015) developed the Japanese version of this scale. Each factor of the Japanese version has good test-retest reliability and convergent and discriminant validities. Cronbach’s alphas for each factor in the present study at Time 1 and Time 2 ranges from .80 to .88.

**Statistical Analyses**

All analyses were conducted using IBM SPSS 22.0 and Amos 22.0. To address missing-at-random data, the full information maximum likelihood method was used. To comprehensively examine the meta-cognitive model of rumination and depression, cross-lagged effect modelling was conducted. Cross-lagged effect modelling is an analytic method to estimate the reciprocal causal relationship between two or more prospective measuring points. This includes autoregressions and cross-lagged paths between two or more time-points. For example, when two variables (e.g. ‘X’ and ‘Y’) are measured between two elapsed time-points, the influence of X Time 1 on X Time 2 and Y Time 1 on Y Time 2 are autoregressions. The influence of X Time 1 on Y Time 2 and Y Time 1 on X Time 2 are cross-lagged effects. The cross-lagged effect modelling has an advantage of controlling for synchronous effects and autoregressions (Kenny, 2005). We used PBRS, NBRS, LARSS causal analysis, understanding, and uncontrollability, and the BDI-II in the cross-lagged effect model from Time 1 to Time 2. Namely, the model in the present study assumed six autoregressions for each variable between Time 1 and Time 2 and the hypothetical cross-lagged paths.

For model selection, we used chi-square, comparative fit index (CFI), root mean square error of approximation (RMSEA), 90% confidence interval (CI), and Akaike's Information Criterion (AIC). We set the criterion of good-fit model proposed by Schermelleh-Engel, Moosbrugger, and Muller (2003), chi-square less than 2 df, CFI more than .97, RMSEA less than .05 and lower bound of 90% CI was .00, and much less AIC. Since a 90% CI of the RMSEA is influenced by the sample size (Chen et al., 2008) and considering the current small sample size, the criterion of the upper bound of 90% CI was much less than .10. We also conducted a chi-square difference test for model comparison (Kline, 1998). In this test, the difference in the chi-square between the two models was distributed according to the difference in degree of freedom between the two models. There were significant differences in model fitness if the obtained chi-square value was significantly based on chi-square table. We tested the following two models:

**Model 1:** A baseline model with autoregressions of the 6 variables that did not constrain the factor loadings.

**Model 2:** A hypothetical model that freely estimated the baseline autoregressions; regression pathways of PBRS at Time 1 can predict LARSS causal analysis and understanding at Time 2, LARSS causal analysis and understanding at Time 1 can predict NBRS at Time 2, NBRS at Time 1 can predict LARSS uncontrollability and depressive symptoms at Time 2, LARSS uncontrollability at Time 1 can predict depressive symptoms at Time 2, and depressive symptoms at Time 1 can predict negative meta-beliefs at Time 2 (Figure 2).

INSERT FIGURE 2 ABOUT HERE

**Results**

**Descriptive Statistics and Correlations**

In the preliminary analysis, as shown in Table 1, descriptive statistics and correlations between each variable were calculated. As predicted, almost all variables were related to each other. However, there were non-significant relations between BDI-II Time 1 and PBRS Time 2, PBRS Time 1 and BDI-II Time 2, NBRS Time 1 and PBRS Time 2, PBRS Time 1 and uncontrollability Time 2, Uncontrollability Time 1 and PBRS Time 2, BDI-II Time 2 and PBRS Time 2, and PBRS Time 2 and NBRS Time 2. There was a non-significant difference between the participants at Time 1 and Time 2 in the BDI-II (*t* = 0.20, *p* = .84), PBRS (*t* = 0.28, *p* = .78), NBRS (*t* = 0.21, *p* = .84), LARSS causal analysis (*t* = 0.24, *p* = .81), understanding (*t* = 0.52, *p* = .60), and uncontrollability (*t* = 0.95, *p* = .34) scores. There was also a non-significant difference between the drop-out group and completed group at Time 1 for BDI-II (*t* = 0.01, *p* = .99), PBRS (*t* = 0.54, *p* = .59), NBRS (*t* = 0.65, *p* = .51), LARSS causal analysis (*t* = 0.17, *p* = .86), understanding (*t* = 1.71, *p* = .09), and uncontrollability (*t* = 0.72, *p* = .47) scores. For these reasons, the following analysis was conducted assuming the missing-at-random data.

INSERT TABLE 1 ABOUT HERE

**Cross-lagged Effects Modelling**

For the selection of the model, we first tested the baseline model (Model 1). This baseline model was an inadequate fit based on chi-square, CFI, and RMSEA and its confidence interval (*chi-square* = 83.00, *df* = 30, *p* < .001, *CFI* = .960, *RMSEA* = .086, *90% CI* = [.064, .108], *AIC* = 203.00). Then, we tested our hypothetical model (Model 2). This model was a good-fit based on chi-square, CFI, RMSEA (*chi-square* = 32.92, *df* = 22, *p* = .063, *CFI* = .993, *RMSEA* = .045, *90% CI* = [.000, .076], *AIC* = 168.92). Chi-square difference test also showed Model 2 was a better fit than Model 1 (*chi-square* = 51.08, *df* = 8, *p* < .05). Therefore, we selected Model 2 as the final model (Figure 2). To eliminate the possibility of severe multicollinearity in the final model, we individually performed a multiple regression analysis for each Time 2 variable. The VIFs were less than 2.05; therefore, it was permissible.

The results of cross-lagged effect modelling showed that there was a significant positive effect of positive meta-beliefs at Time 1 on causal analytic rumination at Time 2 (*β* = .24, *B* = .20, *SE* = .07, *p* = .003). Negative meta-beliefs moderately predicted elevated levels of depressive symptoms at Time 2 (*β* = .39, *B* =.43, *SE* =.09, *p* < .001), and, in turn, depressive symptoms at Time 1 positively predicted high negative meta-beliefs at Time 2 (*β* = .22, *B* = .18, *SE* = .06, *p* = .002). Moreover, there was a positively significant effect of negative meta-beliefs at Time 1 on uncontrollability of rumination at Time 2 (*β* = .27, *B* = .18, *SE* = .05, *p* < .001). These results support our hypothetical model.

On the other hand, positive meta-beliefs at Time 1 did not predict the understanding form of rumination at Time 2 (*β* = .14, *B* = .12, *SE* = .06, *p* = .065). Moreover, negative meta-beliefs at Time 2 were not predicted by causal analytic rumination at Time 1 (*β* = .01, *B* = .02, *SE* = .14, *p* = .88) and understanding form of rumination at Time 1 (*β* = .05, *B* = .08, *SE* = .11, *p* = .49). Uncontrollability of rumination at Time 1 did not predict depressive symptoms at Time 2 (*β* = -.05, *B* = .09, *SE* = .13, *p* = .48).

**Discussion**

We longitudinally investigate the meta-cognitive model and the uncontrollability of rumination and its involvement in depressive symptoms. We performed longitudinal investigations for six months and analysed the results by using cross-lagged effect modelling. The baseline model was an inadequate fit and we decided to adopt the hypothetical model that indicated goodness of fit. In line with the hypothetical model, the results showed that positive meta-beliefs somewhat predicted prominent levels of causal analytic rumination. Negative meta-beliefs moderately predicted prominent levels of depressive symptoms, and, in turn, depressive symptoms also somewhat predicted prominent levels of negative meta-beliefs. Inconsistent with the hypothetical model, understanding form of rumination was not predicted by positive meta-beliefs. Moreover, causal analytic rumination and understanding form of rumination did not predict negative meta-beliefs. While negative meta-beliefs somewhat predicted uncontrollability of rumination, it did not predict depressive symptoms. As mentioned below, we have discussed each component of the meta-cognitive model of rumination.

In line with the meta-cognitive model of rumination and our hypothetical model, the results showed that positive meta-beliefs somewhat predicted prominent levels of causal analytic rumination. Previous studies had used a cross-sectional design to understand this (e.g. Papageorgiou & Wells, 2003), while this study extended on those findings by verifying the relationship longitudinally. On the other hand, inconsistent with the meta-cognitive model of rumination and our hypothetical model, positive meta-beliefs did not predict the understanding form of rumination. The results suggested that causal analytic rumination was more driven than the understanding form of rumination by positive meta-beliefs. Positive meta-beliefs could be regarded as active problem-solving thoughts. Causal analytic rumination has a characteristic, which focuses more on problem solving than rumination as merely having a purpose to understand. Accordingly, causal analytic rumination had higher association with positive meta-beliefs than understanding form of rumination.

We did not find such causal analytic or an understanding form of rumination that contributed to the strengthening of negative meta-beliefs. This finding is inconsistent with the meta-cognitive model of rumination and our hypothetical model. Previous studies have presumed that repeated causal analytic and understanding form of rumination derived from positive meta-beliefs induced the onset of negative meta-beliefs, eventually depressive symptoms, in the meta-cognitive model of rumination (Papageorgiou & Wells, 2004). In fact, some cross-sectional studies support this view (Kubiak et al., 2014; Papageorgiou & Wells, 2001, 2003, 2004, 2009; Roelofs et al., 2007, 2010; Solem et al., 2016). However, our results suggest that simply the repetition and a habit of causal analytic and the understanding form of rumination were not a causal factor responsible for negative meta-beliefs, at least in nonclinical students. A potential reason for this dissimilar result could be the way rumination was measured. Previous studies used RRS to measure rumination; however, we used LARSS causal analysis and understanding factors. The RRS includes brooding types of rumination and depression-related rumination (Treynor et al., 2003), and this scale is highly correlated with depressive symptoms. On the other hand, the LARSS causal analysis and understanding factors are moderately correlated with depressive symptoms. This implies that the prediction of RRS on negative meta-beliefs, which was supported by previous studies, might be confounded by depression-related elements that were included in the RRS.As will be described later, a finding about the prediction of depressive symptoms on negative meta-beliefs also supports this view. This study had an advantage of controlling for synchronous effects and autocorrelations, which differed from the previous studies. Therefore, this study could provide more refined findings than previous cross-sectional studies on negative meta-beliefs and rumination in response to positive meta-beliefs. Further longitudinal examination with rigorous statistical methods in any sample is needed to clarify the relationship between causal analytic/understanding rumination and negative meta-beliefs.

Consistent with the meta-cognitive model of rumination and our hypothetical model, negative meta-beliefs moderately predicted prominent levels of depressive symptoms. This result was a replication of the findings of Papageorgiou and Wells (2009). On the other hand, Papageorgiou and Wells (2003) indicated that negative meta-beliefs about uncontrollability and harm did not predict depression. The biggest difference between these studies was regarding whether they restricted requirement of participants. Both Papageorgiou and Wells (2009) and this study used a college student sample with no restrictions on participation based on the depression score; however, Papageorgiou and Wells (2003) used only non-depressed participants extracted by a pre-analysis screening using their depression scores. This dissociation suggests the possibility that depressive symptoms moderate the influence of negative meta-beliefs on subsequent depressive symptoms. In other words, this association might only be observed in people with some degree of mild or greater depressive symptoms.

Moreover, results suggest that depressive symptoms also somewhat predicted prominent levels of negative meta-beliefs. This longitudinal relationship is a novel finding. Therefore, negative meta-beliefs and depressive symptoms were reciprocally associated with each other. The prediction of depressive symptoms on negative meta-beliefs suggests that depression-related cognition or behaviour might be involved in increasing negative meta-beliefs. Previous studies have also suggested this relationship, for example, Papageorgiou and Wells (2003) and Roelofs et al. (2010) hypothesized that metacognitive efficiency (lack of confidence of one’s cognition) was decreased by depressive symptoms and thereby, negative meta-beliefs were strengthened. There is a possibility that such depression-related cognition or behaviour mediated the relationship between depressive symptoms and negative meta-beliefs. Although we did not assess the vulnerable factors for depression from cognitive and behavioural aspects, such as meta-cognitive efficiency or cognitive reactivity (Van der Does, 2002), negative self-schema (Yilmaz, Gençöz, & Wells, 2015), or behavioural activation (Martell, Dimidjian, & Herman-Dunn, 2010), we recommend that future studies assess the influence of vulnerability factors on the occurrence of negative meta-beliefs.

Finally, consistent with our hypothetical model, the results suggest that negative meta-beliefs drive uncontrollability of rumination. However, uncontrollability of rumination did not contribute to depressive symptoms. Although it was speculative, cognitive processing, such as threat feelings caused by established negative meta-beliefs, influenced depressive symptoms rather than the duration or severity of uncontrollability of rumination itself. The results that showed that it was the negative meta-beliefs and not uncontrollability of rumination that predicted elevated levels of depressive symptoms explained the working mechanism of meta-cognitive therapy for rumination. Wells (2009) argued that rumination, as a response to meta-beliefs, persisted if meta-beliefs were modified. This is because rumination itself was habituated to and associated with some stimuli within the environment. According to these theories, meta-cognitive therapy for rumination treats meta-beliefs about rumination; however, it cannot treat rumination itself. Nevertheless, the fact that meta-cognitive therapy was effective in reducing depressive symptoms (Normann, van Emmerik, & Morina, 2014) could be because negative meta-beliefs are the root of depressive symptoms.

Regarding clinical implications, in line with meta-cognitive therapy (Wells, 2009), negative meta-beliefs about rumination could be one of the targets to deal with severe depressive symptoms, because negative meta-beliefs and depressive symptoms have a reciprocal relationship. While strong negative meta-beliefs have already been established, the approach for negative meta-beliefs will be more effective at addressing depressive symptoms. This, conversely, means that it is not essential to treat the uncontrollability of rumination itself.

**Limitations and Future Directions**

The limitations of the present study were that we examined only nonclinical students, and with a relatively small sample. The characteristics of our sample might influence the results. For example, there is a possibility that causal analytic rumination predicted elevated levels of negative meta-beliefs in clinical depression. Regarding sample size, although there are no clear criteria to determine if we met the requirements, a larger sample size is better for more stable parameter estimates (Usami et al., 2015). Overall, the generalizability of the results remains unclear. Although we conducted modelling using observed variables, latent variable modelling should be examined in the future.

We did not assess vulnerability for depression, such as cognitive reactivity. As mentioned above, the development of negative meta-beliefs might be involved in depression-related cognition. Therefore, there is a need to examine the meta-cognitive model in people with clinical/former depression and with genetic/family vulnerability for depression, or with measured negative cognitive reactivity. In addition, since this study was conducted over 6 months, it remains unclear how the meta-cognitive model of rumination would function in shorter and longer intervals. The original meta-cognitive model of rumination, as proposed by Papageorgiou and Wells (2003), did not define an applicable period. It is possible that the state-dependent uncontrollability of rumination occurred due to causal analytic rumination and positive meta-beliefs. Examination of distinct time frames would shed light on how variables in the meta-cognitive model behave over time.

**Acknowledgements**

The authors are grateful to Dr. Costas Papageorgiou for providing materials.

**Ethical Statements**

All procedures performed in this study 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.

**Conflicts of Interest**

The authors declare that they have no conflicts of interest.

**Financial Support**

The Japan Society for the Promotion of Science funded this study (grant number: 14J00543).

**References**

Beck, A. T., Steer, R., & Brown, G. (1996). *Beck Depression Inventory―Second edition*. Harcourt Assessment, Inc.

Birrer, E., Michael, T., & Munsch, S. (2007). Intrusive images in PTSD and in traumatised and non-traumatised depressed patients: A cross-sectional clinical study. *Behaviour Research and Therapy*, *45*, 2053–2065. doi:10.1016/j.brat.2007.03.005

Chen, F., Curran, P. J., Bollen, K. A., Kirby, J., & Paxton, P. (2008). An empirical evaluation of the use of fixed cutoff points in RMSEA test statistic in structural equation models. *Sociological Methods and Research*, *36*, 462–496. doi:10.1177/0049124108314720

Cribb, G., Moulds, M. L., & Carter, S. (2006). Rumination and experiential avoidance in depression. *Behaviour Change*, *23*, 165–176. doi:10.1375/bech.23.3.165

Ehring, T., Fuchs, N., & Kläsener, I. (2009). The effects of experimentally induced rumination versus distraction on analogue posttraumatic stress symptoms. *Behavior Therapy*, *40*, 403–413. doi:10.1016/j.beth.2008.10.001

Finkel, S. (1995). *Causal analysis with panel data*. Thousand Oaks, CA: Sage Publications.

Just, N., & Alloy, L. B. (1997). The response styles theory of depression: Tests and an extension of the theory. *Journal of Abnormal Psychology*, *106*, 221–229. doi:10.1037/0021-843x.106.2.221

Kenny, D. A. (1975). Cross-lagged panel correlation: A test for spuriousness. *Psychological Bulletin*, *82*, 887–903. doi:10.1037/0033-2909.82.6.887

Kline, R. B. (1998). *Principles and practice of structural equation modeling*. New York: Guilford.

Kojima, M., & Furukawa, T. (2003). *BDI-II－Beck Depression Inventory－* Tokyo: Nihon Bunka Kagakusha.

Kubiak, T., Zahn, D., Siewert, K., Jonas, C., & Weber, H. (2014). Positive beliefs about rumination are associated with ruminative thinking and affect in daily life: Evidence for a metacognitive view on depression. *Behavioural and Cognitive Psychotherapy*, *42*, 568–576. doi:10.1017/S1352465813000325

Luminet, O. (2004). Measurement of depressive rumination and associated constructs. In C. Papageorgiou & A. Wells (Eds.), *Depressive rumination: Nature, theory, and treatment* (pp. 187–215). New York: Wiley.

Lyubomirsky, S., & Nolen-Hoeksema, S. (1995). Effects of self-focused rumination on negative thinking and interpersonal problem solving. *Journal of Personality and Social Psychology*, *69*, 176–190. doi:10.1037/0022-3514.69.1.176

Martell, C. R., Dimidjian, S., & Herman-Dunn, R. (2010). *Behavioral Activation for Depression: A Clinician's Guide*. New York: Guilford Press.

Martin, L. L., & Tesser, A. (1996). Some ruminative thoughts. In R. S. Wyer (Ed.), *Ruminative thoughts: Advances in social cognition* (Vol. 9, pp. 1–47). Hillsdale, NJ: Erlbaum.

Marx, E. M., Williams, J. M. G., & Claridge, G. C. (1992). Depression and social problem solving. *Journal of Abnormal Psychology*, *101*, 78–86. doi:10.1037/0021-843X.101.1.78

Matsumoto, N. & Mochizuki, S. (2015). Development of the Japanese version of Leuven Adaptation of the Rumination on Sadness Scale and examining reliability and validity. *Japanese Journal of Personality*, *24*, 77–87. (In Japanese) doi: 10.2132/personality.24.77

Moulds, M. L., Kandris, E., Starr, S., & Wong, A. C. M. (2007). The relationship between rumination, avoidance and depression in a non-clinical sample. *Behaviour Research and Therapy*, *45*, 251–261. doi:10.1016/j.brat.2006.03.003

Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of depressive episodes. *Journal of Abnormal Psychology*, *100*, 569–582. doi:10.1037/0021-843x.100.4.569

Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking rumination. *Perspectives on Psychological Science*, *3*, 400–424. doi:10.1111/j.1745-6924.2008.00088.x

Normann, N., van Emmerik, A. A., & Morina, N. (2014). The efficacy of metacognitive therapy for anxiety and depression: A meta analytic review. *Depression and Anxiety*, *31*, 402–411. doi:10.1002/da.22273

Ottenbreit, N. D., & Dobson, K. S. (2004). Avoidance and depression: The construction of the Cognitive–Behavioral Avoidance Scale. *Behaviour Research and Therapy*, *42*, 293–313. doi:10.1016/s0005-7967(03)00140-2

Papageorgiou, C., & Wells, A. (2001). Positive beliefs about depressive rumination: Development and preliminary validation of a self-report scale. *Behavior Therapy*, *32*, 13–26. doi:10.1016/s0005-7894(01)80041-1

Papageorgiou, C., & Wells, A. (2003). An empirical test of a clinical metacognitive model of rumination and depression. *Cognitive Therapy and Research*, *27*, 261–273. doi:10.1023/a:1023962332399

Papageorgiou, C., & Wells, A. (2004). Nature, functions, and beliefs about depressive rumination. In C. Papageorgiou & A. Wells (Eds.), *Depressive rumination: Nature, theory and treatment* (pp. 3–20). Chichester: Wiley.

Papageorgiou, C., & Wells, A. (2009). A prospective test of the clinical metacognitive model of rumination and depression. *International Journal of Cognitive Therapy*, *2*, 123–131. doi:10.1521/ijct.2009.2.2.123

Papageorgiou, C., & Wells, A. (2015). Group metacognitive therapy for severe antidepressant and CBT resistant depression: A baseline-controlled trial. *Cognitive Therapy and Research*, *39*, 14–22. doi:10.1007/s10608-014-9632-x

Ramponi, C., Barnard, P. J., & Nimmo-Smith, I. (2004). Recollection deficits in dysphoric mood: An effect of schematic models and executive mode? *Memory*, *12*, 655–670. doi:10.1080/09658210344000189

Raes, F., Hermans, D., Williams, J. M. G., Bijttebier, P., & Eelen, P. (2008). A “triple W”-model of rumination on sadness: Why am I feeling sad, what’s the meaning of my sadness, and wish I could stop thinking about my sadness (but I can’t!). *Cognitive Therapy and Research*, *32*, 526–541. doi:10.1007/s10608-007-9137-y

Roelofs, J., Huibers, M., Peeters, F., Arntz, A., & van Os, J. (2010). Positive and negative beliefs about depressive rumination: A psychometric evaluation of two self-report scales and a test of a clinical metacognitive model of rumination and depression. *Cognitive Therapy and Research*, *34*, 196–205. doi:10.1007/s10608-009-9244-z

Roelofs, J., Papageorgiou, C., Gerber, R. D., Huibers, M., Peeters, F., & Arntz, A. (2007). On the links between self-discrepancies, rumination, metacognitions, and symptoms of depression in undergraduates. *Behaviour Research and Therapy*, *45*, 1295–1305. doi:10.1016/j.brat.2006.10.005.

Schermelleh-Engel, K., Moosbrugger, H., & Muller, H. (2003). Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods of Psychological Research Online*, *8*, 23–74.

Schoofs, H., Hermans, D., & Raes, F. (2010). Brooding and reflection as subtypes of rumination: Evidence from confirmatory factor analysis in nonclinical samples using the Dutch Ruminative Responses Scale. *Journal of Psychopathology and Behavioral Assessment*, *32*, 609–617.

Solem, S., Hagen, R., Hoksnes, J. J., & Hjemdal, O. (2016). The metacognitive model of depression: An empirical test in a large Norwegian sample. *Psychiatry Research*, *242*, 171–173. doi:10.1016/j.psychres.2016.05.056

Sumner, J. A. (2012). The mechanisms underlying over general autobiographical memory: An evaluate review of evidence for the CaR–FA–X model. *Clinical Psychology Review*, *32*, 34–48. doi:10.1016/j.cpr.2011.10.003

Takano, K., & Tanno, Y. (2010). Positive beliefs about rumination, self-rumination, and self-reflection. *Japanese Journal of Personality*, *19*, 15–24. doi:10.2132/personality.19.15

Treynor, W., Gonzalez, R., & Nolen-Hoeksema, S. (2003). Rumination reconsidered: A psychometric analysis. *Cognitive Therapy and Research*, *27*, 247–259. doi:10.1023/a:1023910315561

Usami, S., Hayes, T., & McArdle, J. J. (2015). Inferring longitudinal relationships between variables: Model selection between the latent change score and autoregressive cross-lagged factor models. *Structural Equation Modeling: A Multidisciplinary Journal*, *23*, 331–342. doi: 10.1080/10705511.2015.1066680

Van der Does, W. (2002). Cognitive reactivity to sad mood: structure and validity of a new measure. *Behaviour Research and Therapy*, *40*, 105–120. doi:10.1016/s0005-7967(00)00111-x

Watkins, E. R. (2008). Constructive and unconstructive repetitive thought. *Psychological Bulletin*, *134*, 163–206. doi:10.1037/0033-2909.134.2.163

Watkins, E. R., & Baracaia, S. (2002). Rumination and social problem solving in depression. *Behaviour Research and Therapy*, *40*, 1179–1189. doi:10.1016/s0005-7967(01)00098-5

Watkins, E. R., & Nolen-Hoeksema, S. (2014). A habit-goal framework of depressive rumination. *Journal of Abnormal Psychology*, *123*, 24–34. doi:10.1037/a0035540

Wells, A. (1995). Meta-cognition and worry: A cognitive model of generalized anxiety disorder. *Behavioural and Cognitive Psychotherapy*, *23*, 301–320. doi:10.1017/s1352465800015897

Wells, A. (1997). *Cognitive Therapy of Anxiety Disorders: A practice manual and conceptual guide*. Chichester, UK: Wiley.

Wells, A. (2009). *Metacognitive therapy for anxiety and depression*. New York, NY: The Guilford Press.

Wells, A., & Matthews, G. (1994). *Attention and Emotion: A clinical perspective*. New York: Lawrence Erlbaum.

Wells, A., & Papageorgiou, C. (2004). Metacognitive therapy for depressive rumination. In C. Papageorgiou & A. Wells (Eds.), *Depressive rumination: Nature, theory and treatment* (pp. 259–273). Chichester: Wiley.

Williams, A. D., & Moulds, M. L. (2007). Cognitive avoidance of intrusive memories: Recall vantage perspective and associations with depression. *Behaviour Research and Therapy*, *45*, 1141–1153. doi: 10.1016/j.brat.2006.09.005

Williams, J. M. G., Barnhofer, T., Crane, C., Hermans, D., Raes, F., Watkins, E., & Dalgleish, T. (2007). Autobiographical memory specificity and emotional disorder. *Psychological Bulletin*, *133*, 122–148. doi:10.1037/0033-2909.133.1.122

Yilmaz, A. E., Gençöz, T., & Wells, A. (2015). Unique contributions of metacognition and cognition to depressive symptoms. *Journal of Genetic Psychology*, *142*, 23–33. doi: 10.1080/00221309.2014.964658





*Figure 1*. The hypothetical model of this study

*Note*. LARSS: Leuven Adaptation of Rumination on Sadness Scale.



*Figure 2.* Cross-lagged effect modelling of the meta-cognitive model of rumination and depression (\*\**p* < .01, \*\*\**p* < .001)

*Note*. LARSS: Leuven Adaptation of Rumination on Sadness Scale. Non-significant paths are illustrated as dotted lines.