

# Differential Effects of Reflection and Brooding on the Relationship Between Anxiety Sensitivity and Self-harm: A Serial Mediation Study

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Anxiety sensitivity is known to increase the risk of self-harm; however, the underlying mechanisms remain unclear. Studies have considered rumination as a potential factor that increases the risk of suicide, and anxiety sensitivity has been proposed as a probable factor that affects self-harm through rumination. We investigated the mediating effect of rumination on anxiety sensitivity and self-harm and extended the study by examining the involvement of two subtypes of rumination, reflection and brooding. Responses on anxiety sensitivity, rumination, and history of self-harm were collected from psychiatric patients ( $N = 148$ ) at a university hospital. Mediation analyses were conducted to examine the simple mediating effect of global rumination and serial mediating effect of reflection and brooding between anxiety sensitivity and self-harm. Rumination mediated the relationship between anxiety sensitivity and self-harm, while reflection and brooding sequentially mediated the path from anxiety sensitivity to self-harm. Additionally, brooding alone mediated this path, whereas reflection alone did not. Our findings indicate that rumination increases the risk of self-harm in psychiatric patients with high anxiety sensitivity. Furthermore, they indicate that reflection may turn into brooding and heighten the risk of self-harm, suggesting that interventions for individuals with high anxiety sensitivity to prevent self-harm should target both reflection and brooding.

**Keywords:** rumination, reflection, brooding, anxiety sensitivity, self-harm

## Introduction

As the prevalence of self-harm has increased over the past few decades (Cheon et al., 2020; Griffin et al., 2018), it has gained attention in the mental health field. However, the definition of self-harm, unaffected by its growth in frequency and intensity, has remained

ambiguous over the years (Mangnall & Yurkovich, 2008). In an effort to distinguish underlying intentions of self-harm, scholars have introduced the concept of nonsuicidal self-injury (NSSI) characterized as any damage done to one's body without intent to die (Nock, 2009). Despite these differences, NSSI and suicide attempts are not entirely dissimilar and share some commonalities. The gateway theory views them as fundamentally compatible behaviors with distinguished depictions that lie in a spectrum (Brausch & Gutierrez, 2010; Whitlock et al., 2013). Moreover, the intention underlying self-harming behavior is not always clear, not only for clinicians but also for individuals who engage in self-harming behaviors (Kapur et al., 2013). Therefore, despite attempts to distinguish between types of self-harming behavior, the terms self-harm and self-injury are often used comprehensively to encompass any

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behavior intended to damage one's body that may result in destruction, illness, or ultimate death (Brereton & McGlinchey, 2020; Linehan et al., 2006).

Self-harm is frequently reported in the clinical population, and patients who suffer from mental illnesses such as depression, anxiety, addiction, lack of impulse control, and personality disorders are, above all, at higher risk of it (Chai et al., 2020; Hawton et al., 2013). Depression is one of the leading risk factors of self-harm; anxiety, a distressing emotion that occurs in anticipation of future threats (American Psychiatric Association, 2013), also escalates the risk considerably (Chartrand et al., 2012; Foley et al., 2006). One stable factor related to both depression and anxiety, called anxiety sensitivity, may expound mechanisms of self-harm (Naragon-Gainey, 2010). Anxiety sensitivity is defined as the fear of experiencing anxiety, and individuals who are extremely sensitive to anxiety catastrophize upcoming consequences in three areas (i.e., cognitive, physical, and social concerns) due to the misinterpretation of fearful situations (Stanley et al., 2018). It is an internal factor that increases anxiety levels in individuals and is highly associated with anxiety disorders (Reiss et al., 1986). Some studies have found that anxiety sensitivity is an integral variable that increases the rate of self-harm. Capron et al. (2012) conducted research targeting smokers and found that cognitive concerns were critical for predicting high suicidality. Another study that investigated the relationship between anxiety sensitivity and NSSI found that for people with substance use disorders, social concerns had a positive association with NSSI frequency and versatility (Dixon et al., 2018). In a meta-analysis study that explored anxiety sensitivity and its relationship with suicide, all three subfactors of anxiety sensitivity were proven to exert a greater risk of suicide, with cognitive concerns having the strongest effect (Stanley et al., 2018). However, the study results lack consistency, as other studies have revealed no significant differences in the level of anxiety sensitivity in self-injury history (McCoy et al., 2010), suggesting the need to investigate the mechanisms underlying the association between anxiety sensitivity and self-harm.

In exploring the factors causing and maintaining self-harm, emotion regulation has been repeatedly discussed (Favazza, 1998; Gratz, 2003). One representative emotion regulation strategy associated with self-harm is rumination, defined as a repetitive think-

ing style in which a person focuses on causes, consequences, and symptoms of negative affect (Nolen-Hoeksema, 1991). Along with avoidance and suppression, it is a maladaptive strategy empirically established as cognitive susceptibility for psychiatric patients, especially those with mood disorders (Cooney et al., 2010; Nolen-Hoeksema, 1991). The emotion cascade model provides a possible explanation for the relationship between rumination and self-harm (Selby et al., 2008). Rumination worsens and perpetuates negative emotions, which in turn escalates negative thoughts. Intensified unpleasant mood and cognition can then trigger compensatory responses to reduce distress. (Nolen-Hoeksema, 1991; Watkins & Roberts, 2020). At this stage, deficits in effective problem-solving skills may lead individuals to adopt maladaptive coping strategies such as self-harming behaviors to escape from an aversive state. Consequently, endogenous opioids are secreted to reduce pain, including emotional distress, thereby negatively reinforcing self-harming behaviors (Chapman et al., 2006; Selby et al., 2013). Gratz et al. (2016) also found that people who deliberately harm themselves implicitly associate self-harm with emotional relief, adding support to the extant literature on the emotional motives of self-harm (e.g., Buckholdt et al., 2015; Clapham & Brausch, 2022; Nock & Prinstein, 2004). Studies have shown that rumination is also interconnected with other mental illnesses including anxiety-related disorders, such as posttraumatic stress disorder, social anxiety, and obsessive-compulsive disorder (Dell'Osso et al., 2019; Mellings & Alden, 2000; Raines et al., 2017), but research on how rumination is associated with anxiety sensitivity and self-harm is still limited.

As rumination has been widely studied as a maladaptive cognitive style, several researchers have attempted to differentiate subtypes of rumination (Trapnell & Campbell, 1999; Treynor et al., 2003). Research has shown that rumination is broadly classified into two subtypes: reflection and brooding (Martin & Tesser, 1996; Treynor et al., 2003). Brooding is a coping behavior that involves making passive comparisons to ideals and a tendency to dwell on negative outcomes, while reflection is frequently defined as a cognitive process that focuses on problem solving in an attempt to understand the reasons behind the problems (Treynor et al., 2003). Despite the strong positive association between the two subtypes, brooding and reflection have been found to be predictive of distinct outcomes. Brooding is a widely used emotion regulation

strategy for individuals with depression, and it has been consistently associated with adverse outcomes, resulting in various negative psychological factors including substance abuse, suicidal ideation, and depression (Adrian et al., 2014; Cole et al., 2015; Crane et al., 2007). On the other hand, reflection is often recognized as a positive or adaptive emotion regulation strategy (Moberly & Watkins, 2008; Treynor et al., 2003). Because it is practiced when seeking solutions to problems, it is compatible with an adaptive cognitive coping style such as cognitive reappraisal, which involves reframing thoughts and attempting to change emotions to more positive ones (Gross & John, 2003; Lazarus, 1993; Troy & Mauss, 2011). Nonetheless, studies on reflection have shown mixed results and have even reported associations with unhealthy outcomes (Lengelle et al., 2016; Walbridge, 2021). For example, in studies exploring the relationship between reflection and suicidality, reflection was shown to have positive (Miranda & Nolen-Hoeksema, 2007), neutral (O'Connor & Noyce, 2008), and negative associations (Crane et al., 2007). The possibility of a moderating effect of participants' characteristics could be considered to investigate the factors that provoke the differential effects of reflection. Advocating this assumption, Treynor et al. (2003) revealed that brooding was the only subtype relevant to depression in targeted random community samples. In contrast, another study by Whitmer and Gotlib (2011) found that in currently depressed individuals, both reflection and brooding failed to successfully regulate negative emotions. It is possible that the level of psychological vulnerability or aspects of the symptoms may induce differences.

Despite consistent reports on their unique attributes, only a limited number of researchers have started to investigate the reciprocity of reflection and brooding, and have observed that reflection has the inclination to precede brooding (Kim & Kang, 2022; Takano & Tanno, 2009; Yang et al., 2021). In recent studies investigating the differential roles of brooding and reflection in a stressful environment, such as the COVID-19 pandemic, a serial relationship between reflection and brooding emphasized how initially positive intent of reflection does not always persist (Kim & Kang, 2022; Yang et al., 2021). In Kim and Kang's (2022) domestic study that investigated the path from perceived stress to life satisfaction and mediating effects of reflection and brooding, reflection showed a positive association not only with life satisfaction

but also with brooding. This study suggests that stressors like COVID-19 can trigger reflection in an attempt to cope, but because a portion of people engage in reflection and brooding simultaneously, the positive effects of reflection can easily diminish, initiating a vicious cycle of negative emotions and cognitions and hindering problem-seeking thoughts (Kim & Kang, 2022). Yang et al. (2021) focused on cognitive concerns of anxiety sensitivity in predicting anxiety severity through reflection and brooding and suggested that individuals who have high cognitive anxiety concerns as a trait tend to solve problems when faced with adversity, but when this cognitive coping style is not coupled with constructive action, it could only aggravate anxiety. Eventually, reflection can cause negative emotions in the short term, and negative emotions can also cause reflection (Treynor et al., 2003). In sum, even though reflection is generally adaptive and used to solve problems and achieve goals (Martin & Tesser, 1996), a failure to settle problems successfully causes reflection to persist and consequently deteriorate into brooding, which provokes immersion in negative thinking, such as passively comparing the current situation to the unachieved ideals and asking oneself "why" things have happened (Miranda & Nolen-Hoeksema, 2007). As previously mentioned, research has found that this transition could lead to negative outcomes, such as reduced life satisfaction (Kim & Kang, 2022), heightened risk of depression (Takano & Tanno, 2009) and elevated levels of anxiety (Yang et al., 2021). However, the above-mentioned studies have targeted healthy individuals, and studies exploring the sequential relationship between the two subtypes of rumination in clinical samples are lacking. Mental disorders (i.e., depression) can debilitate adaptive coping mechanisms, and rumination in people with psychiatric illnesses are expected to exacerbate negative outcomes, including self-harm (Siegle et al., 2004; Surrence et al., 2009). People with high anxiety sensitivity favor cognitive coping strategies in stressful situations to an excessive degree; however, due to low efficiency in emotion regulation, they tend to devote attention to negative stimuli and be preoccupied with pessimistic thought content, which in turn can increase the risk of self-harm by intensifying negative emotions (Klein et al., 2018). Therefore, although reflection is frequently discussed as an accommodative strategy, it may induce more maladaptive effects in psychiatric patients, especially those with high anxiety sensitivity.

In this study, we examined the possible tendency of psychiatric patients with high anxiety sensitivity to have a higher risk of self-harm, and the mediating role of rumination in the relationship between anxiety sensitivity and self-harm was also explored. In addition, we considered the respective roles and the sequential roles of reflection and brooding in predicting self-harm among psychiatric patients. Specifically, we hypothesized the following: rumination would mediate the relationship between anxiety sensitivity and self-harm; brooding and reflection would sequentially mediate the relationship between anxiety sensitivity and self-harm; and brooding and reflection would also sequentially mediate the relationship between each of the subfactors of anxiety sensitivity and self-harm. This study aimed to investigate the emotional (anxiety sensitivity) and cognitive (rumination: reflection and brooding) risk factors for self-harm in psychiatric patients and propose clinical implications and psychotherapeutic interventions based on these findings.

## Methods

### Participants

This study used data from psychological assessments administered to inpatients and outpatients at a university hospital in Seoul, South Korea. Out of 166 participants, we excluded data of those that reported active psychotic symptoms, had intellectual disabilities, and were diagnosed with neurocognitive disorders based on the criteria of DSM-5; 148 participants remained to be used in the final analyses. The participants included 97 men (65.5%) and 51 women (34.5%) between the ages of 18 and 79 years ( $M=29.7$ ,  $SD=13.5$ ). The level of education in the final sample comprised 2.7% middle school degree or less, 63.5% high school degree, 8.1% community college degree, 21.6% college degree, and 3.4% graduate or professional education, with one missing datum (0.7%). The primary diagnoses of the patients were major depressive disorder (61, 41.2%), persistent depressive disorder (23, 15.5%), attention-deficit/hyperactivity disorder (11, 7.4%), bipolar II disorder (11, 7.4%), posttraumatic stress disorder (8, 5.4%), and others. The disorders in the “other” category included alcohol use disorder (4, 2.7%), panic disorder (4, 2.7%), adjustment disorder (3, 2.0%), bipolar I disorder (3, 2.0%), unspecified anxiety disorder (3, 2.0%),

borderline personality disorder/trait (2, 1.4%), gambling disorder (2, 1.4%), unspecified depressive disorder (2, 1.4%), agoraphobia (1, 0.7%), autism spectrum disorder (1, 0.7%), borderline intellectual functioning (1, 0.7%), generalized anxiety disorder (1, 0.7%), insomnia (1, 0.7%), obsessive compulsive disorder (1, 0.7%), social anxiety disorder (1, 0.7%), social communication disorder (1, 0.7%), somatic symptom disorder (1, 0.7%), specific phobia (1, 0.7%), and Tourette’s disorder (1, 0.7%).

### Measures

#### Anxiety Sensitivity

To assess anxiety sensitivity, the Korean version of the Anxiety Sensitivity Index-3, validated by Lim and Kim (2012) and based on the original scale developed by Taylor et al. (2007), was used. The three subscales include social, cognitive, and physical concerns about anxiety, with higher scores indicating greater fear of anxiety symptoms. It has 18 items rated on a 5-point Likert scale, with scores ranging from 0 (very little) to 4 (very much). In the current study, the internal consistency for the social (Cronbach’s  $\alpha=0.765$ ), cognitive (Cronbach’s  $\alpha=0.748$ ), and physical (Cronbach’s  $\alpha=0.807$ ) subscales were all found to be adequate.

#### Rumination

The Ruminative Response Scale developed by Nolen-Hoeksema and Morrow (1991) and validated in Korean by Kim et al. (2010) was used to measure rumination. Higher scores represent more frequent use of a repetitive thinking style, in which a person focuses on causes, consequences, and symptoms of negative affect. This scale has 22 items and is rated on a 4-point Likert scale, with scores ranging from 1 (almost never) to 4 (almost always). The total rumination score, along with the scores of two of the three subscales, reflection and brooding, were used in the analyses. A high score in reflection represents a cognitive process intentionally focusing on the internal self to solve problems and is neutral in emotional valence, whereas a high score in brooding represents comparing unachieved standards and the current situation and is negative in emotional valence. The internal consistency was 0.937 for total rumination, and 0.800 and 0.863 for reflection and brooding, respectively.

## Self-Harm

Trained clinical psychologists with master's degrees conducted clinical interviews with the Korean version of the Structured Clinical Interview for DSM-5 Disorders Clinician Version (SCID-5-CV) (First et al., 2016/2017), and the history of deliberate self-harm was explored. The self-harm variable was rated dichotomously to indicate whether self-harm had occurred. Patients were asked two questions: "Have you ever attempted suicide?" and "Have you ever harmed yourself?", to be answered, and the ones who answered "yes" to either one of the questions were coded to indicate the presence of past history of self-harm. Patients who answered "no" to both questions were considered to have no history of self-harm.

## Statistical analysis

We analyzed descriptive statistics of participant characteristics and correlations between anxiety sensitivity, rumination, and self-harm using IBM SPSS version 20.0 (IBM: Armonk, NY, USA) and conducted mediational analyses using Hayes' Macro Process version 3.5 in SPSS 20.0 (Hayes, 2012). Using simple mediation, we investigated the mediating effect of global rumination on the path from anxiety sensitivity to self-harm. Serial mediation analysis was used to examine the sequential relationship between reflection and brooding and their mediating role in relation to anxiety sensitivity and self-harm. Additionally, we explored the simple and sequential mediating effects of rumination on each subscale of anxiety sensitivity. Age and sex were entered as covariates in the mediation analysis. Statistical significance was set to less than 0.05.

## Procedures

We retrospectively collected data on psychological assessments administered to inpatients and outpatients at a university hospital located in Seoul, South Korea, from December 2020 to September 2021. Of the 166 data collected, 148 were used in the final analysis. All research procedures were approved by the Institutional Review Board (IRB, file number 2021-09-024-001) of Hanyang University Medical Center. As this research was a retrospective chart review study, the requirement for consent was waived by the IRB committee.

## Results

### Descriptive statistics

Seventy-two patients reported engaging in self-harm at least once in their lifetime (48.6%), whereas 76 patients reported no history of self-harm (51.4%). Of the 72 patients who reported a history of self-harm, 22 patients (30.6%) had only reported a history of suicide attempts without NSSI, 25 patients (34.7%) had only reported a history of NSSI without suicide attempt, and the remaining 25 patients (34.7%) had a history of both suicide attempts and NSSI.

### Correlational analysis

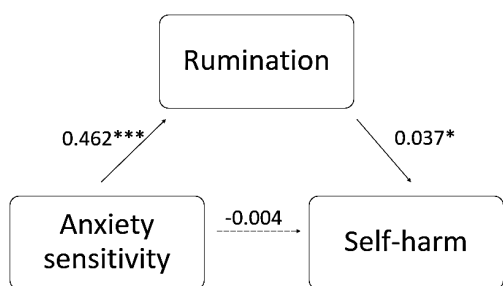
The correlations among the variables used in this study are listed in Table 1. Anxiety sensitivity, rumination, and their subscales showed strong correlations with each other (all  $p < 0.01$ ). Self-harm was positively correlated with cognitive ( $p < 0.05$ ) and social ( $p < 0.05$ ) subscales of anxiety sensitivity, global rumination ( $p < 0.01$ ),

**Table 1.** Descriptive and Correlational Analysis ( $N = 148$ )

	Self-harm	ASI-3	Cognitive	Social	Physical	RRS	Reflection	Brooding
Self-harm	-							
ASI-3	0.148	-						
Cognitive	0.177*	0.888**	-					
Social	0.163*	0.850**	0.668**	-				
Physical	0.036	0.823**	0.587**	0.524**	-			
RRS	0.292**	0.636**	0.649**	0.562**	0.411**	-		
Reflection	0.161	0.427**	0.476**	0.361**	0.249**	0.804**	-	
Brooding	0.341**	0.567**	0.564**	0.509**	0.376**	0.872**	0.548**	-
<i>M</i>	0.487	35.007	12.446	13.000	9.561	61.601	14.730	17.885
<i>SD</i>	0.502	19.349	8.017	7.173	7.453	14.690	4.432	4.739

Note. ASI-3 = Anxiety Sensitivity Index-3; RRS = Ruminative Response Scale.  
\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .





**Figure 1.** A simple mediation analysis of anxiety sensitivity on self-harm via rumination (N = 148).

Note. The path coefficients are unstandardized. Sex and Age were also included as covariates. \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

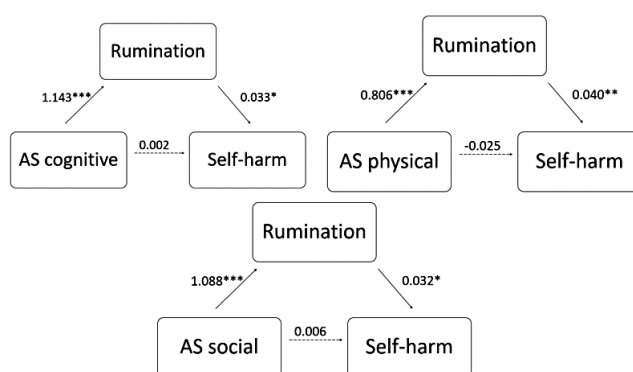
and brooding ( $p < 0.01$ ), and showed a trend of correlation with reflection ( $p = 0.051$ ). However, it was not significantly correlated with the physical subscale ( $p = 0.667$ ) of anxiety sensitivity.

### Mediational analyses

Mediation effect of rumination in the relationship between anxiety sensitivity and self-harm

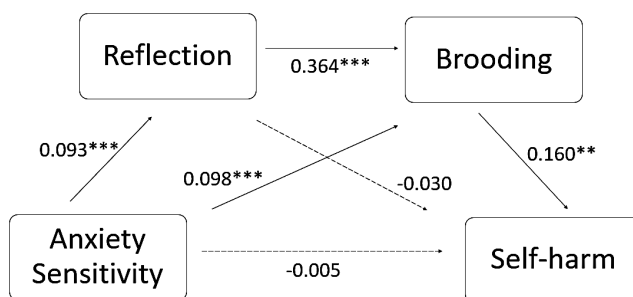
Simple mediation examining the indirect effect of anxiety sensitivity on self-harm via rumination, controlling for age and sex, was conducted, as depicted in Figure 1. The overall model was statistically significant ( $p < 0.01$ ). Global anxiety sensitivity predicted rumination ( $b = 0.462$ ,  $SE = 0.047$ ,  $p < 0.01$ ) and rumination significantly predicted self-harm ( $b = 0.037$ ,  $SE = 0.017$ ,  $p < 0.05$ ). In this model, the direct effect of anxiety sensitivity on self-harm is not statistically significant ( $p = 0.756$ ). However, the indirect effect of anxiety sensitivity on self-harm via rumination was significant (indirect effect = 0.0174, Boot  $SE = 0.008$ , 95% CI [0.0018, 0.0352]). The results showed that global anxiety sensitivity and self-harm were fully mediated by rumination.

We extended the analyses by investigating how the subfactors of anxiety sensitivity predicted self-harm through rumination (see Figure 2). Similar to the prior analysis conducted with global anxiety sensitivity, two of the three subfactors, cognitive (indirect effect = 0.038, Boot  $SE = 0.025$ , 95% CI [0.0022, 0.1009]) and physical concerns (indirect effect = 0.032, Boot  $SE = 0.017$ , 95% CI [0.0087, 0.0755]), indirectly predicted self-harm via rumination. However, rumination did not have a mediating effect on the relationship between social concerns and self-harm (indirect effect = 0.035, Boot  $SE = 0.019$ , 95% CI [-0.0001, 0.0767]).



**Figure 2.** Simple mediation analyses of three subfactors of anxiety sensitivity on self-harm via rumination (N = 148).

Note. AS = anxiety sensitivity; The path coefficients are unstandardized. Sex and Age were also included as covariates. \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .



**Figure 3.** A serial mediation analysis of anxiety sensitivity on self-harm via reflection and brooding (N = 148).

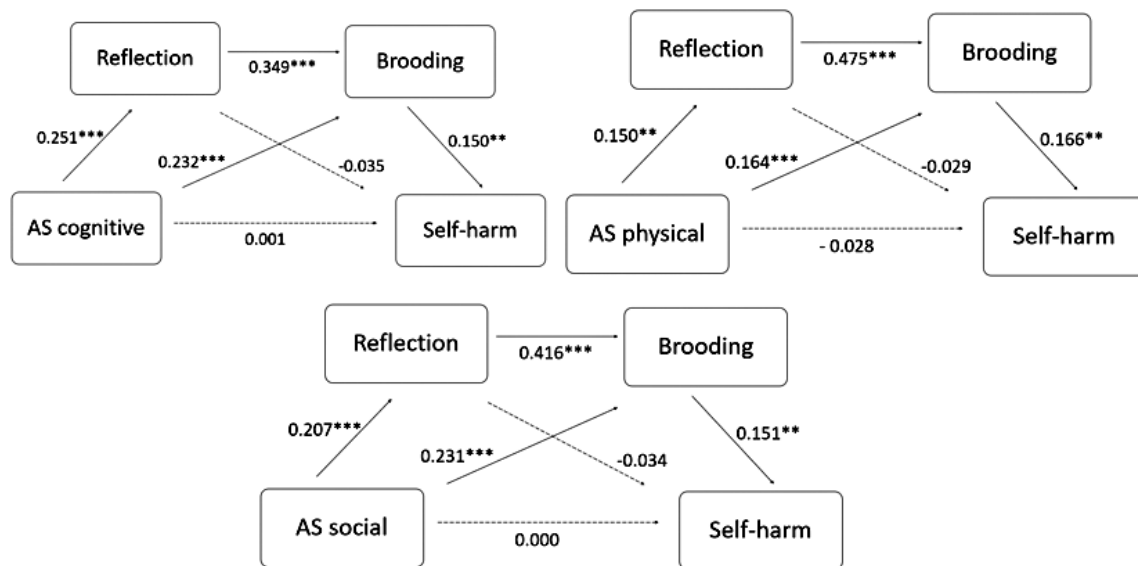
Note. The path coefficients are unstandardized. Sex and Age were also included as covariates. \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

Serial mediation effect of reflection and brooding in the relationship between anxiety sensitivity and self-harm  
 Serial mediation analysis was performed with reflection preceding brooding as a mediator after controlling for age and sex. As Figure 3 shows, no direct effect of anxiety sensitivity on self-harm was found ( $b = -0.005$ ,  $SE = 0.012$ ,  $p > 0.05$ ). Anxiety sensitivity predicted reflection ( $b = 0.093$ ,  $SE = 0.017$ ,  $p < 0.01$ ), yet reflection did not predict self-harm ( $b = -0.030$ ,  $SE = 0.050$ ,  $p > 0.05$ ). No indirect effect of anxiety sensitivity on self-harm via reflection was found (indirect effect = -0.003, Boot  $SE = 0.005$ , 95% CI [-0.0134, 0.0072]). Meanwhile, anxiety sensitivity predicted brooding ( $b = 0.098$ ,  $SE = 0.017$ ,  $p < 0.01$ ) and brooding predicted self-harm ( $b = 0.160$ ,  $SE = 0.054$ ,  $p < 0.01$ ). The indirect effect of anxiety sensitivity on self-harm via brooding was significant (indirect effect = 0.016, Boot  $SE = 0.007$ , 95% CI [0.0055, 0.0314]). Finally, the path from

**Table 2.** Indirect Effect of the Subfactors of Anxiety Sensitivity on Self-harm Via Reflection and Brooding ( $N = 148$ )

Path	Indirect effect	Boot SE	95% CI	
			LLCI	ULCI
AS Cognitive → Reflection → Self-harm	-0.008	0.015	-0.0409	0.0194
AS Cognitive → Brooding → Self-harm	0.035	0.019	0.0107	0.0826
AS Cognitive → Reflection → Brooding → Self-harm	0.013	0.007	0.0033	0.0285
AS Social → Reflection → Self-harm	-0.007	0.011	-0.0314	0.0154
AS Social → Brooding → Self-harm	0.035	0.018	0.0090	0.0781
AS Social → Reflection → Brooding → Self-harm	0.013	0.006	0.0032	0.0278
AS Physical → Reflection → Self-harm	-0.004	0.010	-0.0260	0.0140
AS Physical → Brooding → Self-harm	0.027	0.015	0.0080	0.0655
AS Physical → Reflection → Brooding → Self-harm	0.012	0.007	0.0023	0.0285

Note. AS = anxiety sensitivity; CI = confidence interval; LLCI = lower limit confidence interval; ULCI = upper limit confidence interval.

**Figure 4.** Serial mediation analyses of the subfactors of anxiety sensitivity on self-harm via reflection and brooding ( $N = 148$ ).

Note. AS = anxiety sensitivity; The path coefficients are unstandardized. Sex and Age were also included as covariates. \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

reflection to brooding ( $b = 0.364$ ,  $SE = 0.074$ ,  $p < 0.01$ ) and the sequential mediating effect of reflection and brooding were also significant. The path where high anxiety sensitivity led to increased reflection, which in turn was related to increased brooding and ultimately self-harm, was significant (indirect effect = 0.005, Boot  $SE = 0.003$ , 95% CI [0.0016, 0.0112]). Thus, our hypothesis that reflection and brooding would serially mediate the relationship between anxiety sensitivity and self-harm was supported.

In addition, we examined the same path with the subfactors of anxiety sensitivity established as predictors (see Table 2 and Figure 4). The results showed that all three subfactors showed similar trends in that reflection and brooding sequentially mediated the

relationship between cognitive concerns and self-harm (indirect effect = 0.013, Boot  $SE = 0.007$ , 95% CI [0.0033, 0.0285]), social concerns and self-harm (indirect effect = 0.013, Boot  $SE = 0.006$ , 95% CI [0.0032, 0.0278]), and physical concerns and self-harm (indirect effect = 0.012, Boot  $SE = 0.007$ , 95% CI [0.0023, 0.0285]), respectively. These results indicate that reflection and brooding serially mediate the relationship between all the subfactors of anxiety sensitivity and self-harm.

## Discussion

In the current study, we examined how anxiety sensitivity and

self-harm are related by exploring the mediating effect of rumination and further investigating the sequential mediating effects of reflection and brooding. These results suggest that psychiatric patients with high anxiety sensitivity are more vulnerable to self-harming behaviors when using rumination as an emotion regulation strategy. A meta-analysis by Rogers and Joiner (2017) showed that suicide attempts were associated with global rumination and brooding, but not reflection; the current study found that global rumination and brooding, but not reflection, mediated the relationship between anxiety sensitivity and self-harm. However, the path from anxiety sensitivity and self-harm was also sequentially mediated by reflection and brooding, suggesting that for psychiatric patients with high anxiety sensitivity, the positive aspects of reflection do not persist and deteriorate into pessimistic and passive forms of negative thoughts.

Studies on suicide have focused on brooding as a maladaptive coping strategy, whereas reflection has been frequently reported as a problem-solving method (Burwell & Shirk, 2007; Surrence et al., 2009). However, numerous studies have presented evidence that reflection does not always lead to positive outcomes and is often related to maladaptation (Fresco et al., 2002; Joormann et al., 2006). Miranda and Nolen-Hoeksema (2007) argued that both brooding and reflection were associated with suicidal ideation over time. Additionally, Yang et al. (2021) and Kim and Kang (2022) suggested that using reflection to solve problems does not guarantee positive outcomes, especially in crises. The results of the current study align with previous findings because they suggest that reflection consequently degenerates into brooding and lead to a failure in preventing self-harm. It can be inferred that even when anxiety-sensitive individuals with psychiatric disorders use reflection in distressing situations, their cognitive processes do not yield productive outcomes. To elucidate how reflection degenerates into brooding, certain mechanisms were considered.

People with high anxiety sensitivity have elevated negative urgency and thus tend to try to eliminate distress as quickly as possible (Whiteside & Lynam, 2001). In other words, they have a low threshold for tolerating negative emotions in stressful situations and tend to engage in coping behaviors actively. In particular, tolerating distressing emotions can be even more challenging for individuals with a clinical level of psychological symptoms. With

the desire to alleviate distress but a lack of mature coping skills, people are likely to engage in easy ways to regulate emotions. Moreover, owing to their attentional bias to negative and threatening stimuli (Hunt et al., 2006; Schoth et al., 2016), individuals with high anxiety sensitivity may effortlessly initiate rumination. Attentional bias can also be further reinforced by the poor executive functioning of ruminators, as monitoring, shifting, and updating information become difficult and negative thoughts remain in working memory for a longer time (Joormann, 2010; Koster et al., 2011). Moreover, endeavors to use reflection to solve problems can develop into impotent means in vulnerable populations, and shifting attention to positive stimuli would become demanding. Consequently, this inflexibility in cognition could generate fixation on negative information, which could cause an initially goal-oriented approach to be converted into maladaptive rumination, such as brooding.

As the current study shows, people with high anxiety sensitivity tend to form devastating thoughts in stressful situations and often use cognitive coping skills to reduce their distress. According to Righi et al. (2009), anxious, less self-confident individuals tend to self-evaluate at the cognitive level, which can exacerbate their stress levels. Teasdale (1999) suggested that self-focus has differential modes, and the conceptual-evaluative self-focus mode of thought processing impedes recovery from distressing events, while non-evaluative and experiential self-focus helps people narrow down their concerns (Teasdale, 1999; Watkins & Teasdale, 2004). With susceptibility, psychiatric patients with high anxiety sensitivity may attempt to evaluate why problems occur while reflecting, which in turn can be an ineffective strategy for alleviating negative emotions. Consequently, this can result in brooding about the problem, and with insufficient coping skills, the risk of self-harm could increase.

Despite the conceptual complexity of the two subtypes of rumination, both subtypes proceed as cognitive processes to regulate emotions in situations with negative emotions. According to Martin and Tesser's (1996) control theory, rumination occurs when there is an unsatisfied goal that needs to be pursued. When there is a discrepancy between the status quo and what one desires, information on what one wants to achieve becomes easily accessible (Zeigarnik, 1938). State rumination is easily activated to pursue



one's goals (Martin & Tesser, 1996). Based on this goal progress concept of control theory, rumination can be seen as self-regulation, as one accesses goal-related information and initiates problem-solving (Wells & Matthews, 1994). This conceptualization is somewhat relevant to reflection, which involves pondering problem-solving to overcome distressing emotions concomitant with unfulfilled desires (Treyner et al., 2003). Although it appears plausible, with some factors that impede successful problem solving, the positive functions of reflection may not prevail. For reflection to function adaptively, individuals should be equipped with effective coping skills. However, considering that the participants were patients at a university hospital experiencing clinical distress, it is likely that they were not capable of using coping strategies effectively. Considering that anxiety sensitivity is strongly associated with perfectionism (Flett et al., 2004), patients with high anxiety sensitivity are likely to have extremely high standards. As perfectionists have goals that are difficult to achieve, the discrepancy between reality and the ideal cannot easily diminish. Rumination and perfectionism have shown a strong positive correlation (Randles et al., 2010; Xie et al., 2019). Because unrealistic goals are hard to process concretely by focusing on 'how' to do the action, one tends to ruminate with an abstract processing style, focusing on 'why' things have happened (Watkins, 2008) with no constructive means to resolve problems. Furthermore, abstract processing in rumination sustains problem-solving deficits, which depletes resources needed to cope with stress or to work through problems, prolonging the state of distress, as thoughts about unresolved goals linger longer than solved goals (Zeigarnik, 1938). The enduring discrepancy between reality and expectation may amplify negative affect as people passively compare the situation they are currently facing to the ideal standards, initiating brooding (Watkins, 2008).

The results of the current study suggest that all three aspects of anxiety sensitivity (i.e., cognitive, social, and physical concerns) explain the heightened risk of self-harm via reflection and brooding. Patients with high cognitive concerns fear losing control and find death the ultimate solution (Capron et al., 2012). Moreover, patients with social concerns may fear being secluded from their social environment (Joiner et al., 2009), and ruminating about isolation can lead to increased self-harm. These results are compara-

ble to the interpersonal theory of suicide by Joiner (2005), in which the false beliefs in one's situation, such as perceived burdensomeness and thwarted belongingness, are crucial factors in predicting suicide. In the current study, physical concerns also led to a high risk of self-harm through reflection and brooding. Interestingly, the results on physical concerns were not in agreement with previous studies that asserted that a high pain threshold, especially when combined with fear of losing mind capacity, often precedes suicide attempts and NSSI (Brown et al., 2002; Kirtley et al. 2016; Orbach et al., 1996). A positive association between physical pain and suicide risk has been repeatedly reported, and insensitivity to pain has even led to reduced participation in reward-driven activities (Rizvi et al., 2017). The results of this study, where high physical concerns also predicted self-harm via rumination, suggest that experiencing more concerns about physical sensation does not always mean having a low pain threshold. Physical concerns involve cognitive processes such as the fear of catastrophic events in the presence of physical sensations. Thus, high physical concerns may lead to high cognitive concerns and ultimately, a heightened risk of self-harm.

From a therapeutic perspective, cognitive interventions should be introduced with caution in psychiatric patients with high anxiety sensitivity. As patients with high anxiety sensitivity are not equipped with flexible mental capacity, vaguely asking clients to seek solutions may not be effective. Therefore, more sophisticated interventions targeting diverse aspects of rumination should be used to prevent self-harm in patients with high anxiety sensitivity. Cognitive behavioral therapies specifically targeting rumination, or rumination-focused CBT have been developed for individuals with habitual rumination (Watkins et al., 2007). In this approach, functional analysis is used to help clients systemically understand when and how rumination occurs by examining context, along with the antecedents and consequences of rumination (Watkins & Roberts, 2020). In addition, functional analysis helps individuals learn how to differentiate between helpful and non-helpful thinking styles; alongside imagery techniques, behavioral experiments, and experiential approaches, it provokes a concrete thinking style, thereby further reducing discrepancies between reality and expectations. Cognitive bias modification also helps develop a concrete thinking style by asking clients "how" questions in different re-

recorded scenarios (Hertel et al., 2014). Such therapeutic interventions, designed to reduce abstract thinking styles and improve concrete processing, have shown effectiveness in reducing rumination (Jacobs et al., 2016). Moreover, because rumination is worsened by the belief that it is useful in reducing distress, metacognitive training could be considered to challenge this belief (Wells, 2011). In this process, clients are trained to shift their attention from the internal self to external stimuli (Papageorgiou & Wells, 2009). Similarly, mindfulness skills are highly recommended for developing alternatives to negative thoughts and emotions, implying that accepting unpleasant feelings and maintaining awareness can be helpful in reducing rumination (Segal et al., 2002). Both techniques operate as attention shift from self-focused negative stimuli to other stimuli. Additionally, adapting mindfulness-based programs can increase cognitive flexibility, which, in turn, may reduce avoidant behaviors and even lower anxiety sensitivity (Alimehdi et al., 2016; Hamill et al., 2015; Marshall et al., 2010). When positive reappraisal is combined with mindfulness, it can be more beneficial than reappraisal alone (Pogrebtsova et al., 2018). Perhaps an inference can be made that practicing mindfulness may amplify the practical aspects of reflection and help with successful emotion regulation.

This study had some limitations. First, we used a dichotomous variable to measure self-harm; other dimensions of self-harm, such as frequency, intensity, or forms of self-harm, were not assessed or analyzed in this study. Thus, more research is needed to clarify how anxiety sensitivity and rumination are interrelated with the various features of self-harm. Second, this study was cross-sectional. Future studies can longitudinally track changes in rumination and how they affect self-harming behaviors. Additionally, most of the sample comprised patients with depressive disorders; thus, the generalizability of the results to other types of psychiatric patients should be considered with caution.

Nonetheless, this study contributes to the literature as it is the first to demonstrate how anxiety sensitivity predicts self-harm sequentially via reflection and brooding among psychiatric patients. Although few studies have targeted the clinical population, this study adds empirical support for the risk factors of self-harm, such as anxiety sensitivity, brooding, and reflection in the clinical literature. Additionally, it has the strength of measuring self-harm

with reported histories of self-harming behavior in the clinical interview, which improved the validity of the outcome variable. Finally, based on the findings of this study, future research should further investigate the factors that increase the risk of self-harm in people with high levels of anxiety sensitivity and develop suitable interventions targeting the clinical population.

### Author contributions statement

Jiyoung Hong, M.A., a former clinical psychology resident at Hanyang University Seoul Hospital, conceived and designed the study, collected data, analyzed data, and drafted the original manuscript. Seok Hyeon Kim, M.D. and Sungwon Roh, M.D., professors at Hanyang University Seoul Hospital, contributed to the data collection and reviewed and edited drafts. Sojung Kim, Ph.D., a licensed clinical psychologist at Hanyang University Seoul Hospital, conceived and designed the study, collected and analyzed data, provided resources, and reviewed and edited drafts as the principal supervisor of research. All the authors provided critical feedback, participated in the revision of the manuscript, and approved the final submission.

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