# Examining rumination and sleep: A transdiagnostic approach to depression and social anxiety

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## ABSTRACT

*Background:* Research suggests that rumination is related to sleep difficulties. Both rumination and sleep have been shown to play important roles in various psychopathologies, with rumination often described as a transdiagnostic process. The relationship between rumination, sleep, and psychopathology has been researched in depression, but less so in other disorders. The aim of this study is to replicate previous findings between sleep and depression, but to examine these relationships in another disorder, social anxiety.
*Methods:* Participants included 143 individuals from Amazon Mechanical Turk. There were 61 participants with symptoms of social anxiety, and 21 participants with symptoms of depression. Participants took a series of surveys. In addition to correlation coefficients and *t*-tests, multiple linear regression analyses were completed in order to examine the relations between sleep, rumination and psychopathology (i.e., depression and anxiety, respectively).
*Results:* Sleep and rumination independently predict variance in depression scores, even when accounting for social anxiety symptoms. In contrast, in individuals with symptoms of social anxiety, the relationship between sleep and social anxiety is mediated by rumination after accounting for depressive symptoms.
*Limitations:* A limitation of this design was that psychopathology symptoms and sleep quality were examined through self-report evaluations. Additionally, the overall sample size was small; however, the relative number of participants in each group was substantial despite this limitation.
*Conclusions:* Our results strengthen the importance of examining rumination as a transdiagnostic process, but identify differences between these relationships that may be relevant in the treatment of these disorders. Further clinical implications discussed.

## 1. Introduction

Sleep disturbances impact many forms of psychopathology (Morin, 1996). It is estimated that 50%–80% of psychiatric patients experience sleep disturbances during the period of their mental illness. Additionally, a third of individuals seeking treatment for insomnia have a psychological disorder and another third have sub-clinical symptoms of a psychological disorder. Most commonly, these diagnoses include depression and anxiety (Morin, 1996). Research suggests that sleep difficulties may be related to rumination. Rumination, or repetitive, relatively uncontrollable thinking about negative content, often disrupts sleep (Pillai & Drake, 2015). This relationship may be cyclical as researchers also found that individuals with sleep difficulties ruminate more often than those without them. Further, in individuals with insomnia disorder and healthy controls, rumination is related to increased sleep onset latency, beyond subjective self-report measures (Galbiati,

Giora, Sarasso, Zucconi, & Ferini-Strambi, 2018; Zoccola, Dickerson, & Lam, 2009). Thus, there is a relationship between sleep and rumination in both self-report and objective sleep measures.

The Research Domain Criteria (RDoC) classifies pathological processes, like rumination, using a dimensional model rather than a categorical model (Cuthbert & Insel, 2013). Research taking this approach has found that various psychopathological processes, such as rumination, appear across multiple disorders rather than being specific to single diagnostic categories, demonstrating their transdiagnostic nature (Ehring & Watkins, 2008). However, there may be disorder-specific differences in various aspects of rumination. For example, rumination in depression often occurs as repetitive thoughts about an individual's symptoms and their consequences. In contrast, individuals with social anxiety may have ruminative thoughts about recent social interactions. Studying rumination across disorders may give us better insight into the process and how we may intervene to improve outcomes for people

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**Table 1**
Demographics.

| Demographic | | Overall (n = 143) | "Non-Depressed" (n = 108) | "Depressed" (n = 28) | "Socially anxious" (n = 61) | "Non-socially anxious" (n = 82) |
|---|---|---|---|---|---|---|
| Mean Age (SD) | | 38.44 (11.64) | 39.14 (11.97) | 36.42 (10.95) | 37.49 (11.08) | 39.16 (12.06) |
| Mean BDI (SD) | | 10.40 (11.23) | 5.59 (5.80) | 28.93 (6.94) | 18.03 (11.73) | 4.72 (6.51) |
| Mean Mini-SPIN (SD) | | 5.10 (3.97) | 4.16 (3.54) | 5.15 (3.94) | 9.20 (1.95) | 2.06 (1.67) |
| Mean Total PSQI Score | | 6.83 (4.10) | 6.24 (3.69) | 10.14 (3.92) | 8.54 (3.55) | 5.55 (4.03) |
| Gender | Male | 60 | 49 | 8 | 21 | 39 |
| | Female | 82 | 58 | 20 | 39 | 43 |
| | Gender not given | 1 | 1 | 0 | 1 | 0 |
| Race | American Indian/Alaskan Native | 11 | 1 | 0 | 0 | 1 |
| | Asian | 10 | 7 | 3 | 9 | 1 |
| | Black/African American | 17 | 13 | 2 | 4 | 13 |
| | Native Hawaiian/Pacific Islander | 0 | 0 | 0 | 0 | 0 |
| | White | 111 | 85 | 21 | 45 | 66 |
| | Multiracial | 3 | 1 | 2 | 2 | 1 |
| | Race not given | 1 | 1 | 0 | 1 | 0 |
| Education | Some High School | 4 | 3 | 1 | 2 | 2 |
| | Graduated High School | 18 | 15 | 2 | 10 | 8 |
| | Some College | 61 | 39 | 18 | 25 | 36 |
| | Bachelor's Degree | 44 | 35 | 7 | 20 | 24 |
| | Graduate Degree | 16 | 16 | 0 | 4 | 12 |

with these illnesses.

Most research on the relationship between sleep and rumination has been done in individuals with depression. For example, one study found significant associations between rumination, negative mood, and subjective sleep quality (Thomsen, Mehlsen, Christensen, & Zachariae, 2003). The study showed that rumination is independently associated with depressive mood and subjective sleep quality, suggesting that rumination contributes independently to these variables. Another study found that in individuals with depressive symptoms, pre-sleep rumination predicts significantly longer sleep onset latency, suggesting that rumination impacts sleep beyond subjective sleep quality (Pillai, Steenburg, Ciesla, Roth, & Drake, 2014). Taken together, the research supports that sleep, rumination, and depression all contribute to and influence each other.

The relationship between rumination, sleep, and other forms of psychopathology is not as well studied. A second disorder that rumination may play a key role in is social anxiety. According to Kocovski, Endler, Rector, and Flett (2005)), socially anxious individuals are more likely to ruminate than individuals who are not. Additionally, research suggests that social anxiety and sleep are closely related. One study found that social anxiety is related to poorer sleep quality, longer sleep latency, more frequent sleep disturbance, and more severe daytime dysfunction (Stein, Kroft, & Walker, 1993). These results suggest that there may be relationships or interactions between sleep, social anxiety, and rumination. By examining the differences in these relationships between disorders, we may be able to extend therapies that address rumination and sleep difficulties in depression to these difficulties in individuals with social anxiety.

It is important to acknowledge the comorbidity between depression and social anxiety. Studies report this comorbidity at anywhere from 20% to 70% (Gorman, 1996/1997Gorman, /, 1997Gorman, 1996/1997). There is also large overlap in pharmacotherapy, and both disorders share symptoms (Gorman, 1996/1997Gorman, /, 1997Gorman, 1996/1997). This strong comorbidity is important to consider when comparing these relationships.

The current study aims to confirm the relationship between rumination, sleep, and depression, and to investigate the role of sleep and rumination in individuals with symptoms of social anxiety using a non-clinical sample, utilizing clinical measures. We use linear regression analyses to determine the contribution of rumination to sleep difficulties in individuals with social anxiety. We hypothesize that rumination

and sleep will both independently contribute to depressive symptoms, consistent with the current literature. Further, we hypothesize that these relationships will be similar in social anxiety (i.e., rumination and sleep will both independently contribute to social anxiety symptoms), as rumination is a transdiagnostic process.

## 2. Method

### 2.1. Participants

143 participants were recruited from Amazon Mechanical Turk (MTurk). Participants included 60 males, 82 females, and 1 subject who did not identify their sex. The mean age of the sample was 38.45 years. Participants were evaluated for both social anxiety and depression symptoms. Participants were assigned to the social anxiety group (> = 6; n = 61) or non-social anxiety group (< 6; n = 82) based on their scores on the Mini-Social Phobia Inventory. These same participants were also assigned to the depressed group (> = 20; n = 28) or the non-depressed group (< 20; n = 108) based on their score on the Beck Depression Inventory. Because 7 participants did not respond to a question on the Beck Depression Inventory, they were excluded from all depression analyses, leaving 136 participants for these analyses. Additionally, there was a large overlap between the number of participants with depression and social anxiety. Out of the 28 participants with depressive symptoms, 24 of these participants have a comorbidity with social anxiety. Out of the 61 participants with social anxiety, 28 also met criteria for depression. See Table 1 for demographic information.

### 2.2. Measures

#### 2.2.1. Ruminative response scale (RRS)

The 22-item RRS is a self-report measure that assesses three aspects of rumination: depression, brooding, and reflection. The questionnaire uses a 4-point Likert scale (1 = almost never to 4 = almost always). The internal reliabilities were $\alpha = .90$ for total rumination, $\alpha = .77$ for the brooding subscale, and $\alpha = .72$ for the reflection subscale (Treynor, Gonzalez, & Nolen-Hoeksema, 2003). Internal reliabilities in our sample were $\alpha = 0.95$ for total rumination, $\alpha = 0.94$ for the depression subscale, $\alpha = 0.89$ for the brooding subscale, and $\alpha = 0.76$ for the reflection subscale.

### 2.2.2. Beck depression inventory (BDI)

The BDI assesses cognitive, affective, and physical symptoms of depression. Although typically a 21-item questionnaire, we used the 20-item BDI that does not include the suicide question. It uses a 4-point Likert scale (0 = absence of depressive symptom, 3 = severe depressive symptom) and the scores from each question are added together to obtain a final score. Previous research shows that a score of 20 or greater is a reliable cut-off for moderate depression and the reliability and validity of this measure are well established (α = 0.92; Zgaljardic, 2011). The internal reliability in our sample was α = 0.95.

### 2.2.3. Pittsburg sleep quality index (PSQI)

The PSQI is a self-report questionnaire which accesses sleep quality in the previous month. It has 19 questions which form seven components of sleep quality: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Components are added to obtain a global sleep score. Research shows that a score of 5 or higher is a reliable cutoff for poor sleep (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The PSQI has high internal reliability (α = 0.83; Buysse et al., 1989). The internal reliability in our sample was α = 0.84.

### 2.2.4. Mini-Social phobia inventory (Mini-SPIN)

This 3-item questionnaire is based on the 17-item Social Phobia Inventory (SPIN) and is a tool for screening for social anxiety disorder. The 3 items use a 5-point Likert scale (0 = not at all, 4 = extremely), and a sum of 6 or higher suggests difficulties with social anxiety. Researchers have shown that the sensitivity of the Mini-SPIN is 88.7% and the specificity is 90.0% (Connor, Kobak, Churchill, Katzelnick, & Davidson, 2001). The internal reliability in our sample is α = 0.92.

### 2.3. Procedure

Participants were recruited on Amazon Mechanical Turk (MTurk) and were provided a link to the Qualtrics Survey. Research has shown that MTurk is a reliable and valid way of collecting a diverse and re-presentative sample (Buhrmester, Kwang, & Gosling, 2011). Upon completing the surveys, they received compensation of \$3.50 for their time. The study was declared IRB exempt by the University of Michigan IRB.

### 2.4. Data analysis

Pearson correlation coefficients were computed to view the relationships between sleep, rumination, depression, and social anxiety. Then, *t*-tests were calculated to compare the differences between sleep and rumination in depression and social anxiety groups. Finally, multiple linear regression analyses were completed to use sleep, rumination, and social anxiety scores to predict depression, and additionally to use sleep, rumination, and BDI scores to predict social anxiety.

## 3. Results

### 3.1. Correlations

Pearson correlation coefficients were calculated to assess the relationships between sleep, rumination, depression, and social anxiety. All variables were strongly correlated ($p < .001$) except for the reflection subscale of rumination. Results in Table 2.

Pearson correlation coefficients were computed between various aspects of sleep with the two disorders. As expected, social anxiety scores are significantly correlated with difficulty falling asleep ($r$ (141) = .34, $p < .001$) and waking up in the middle of the night or early morning ($r$(141) = .27, $p < .001$). BDI scores are also significantly correlated with difficulty falling asleep ($r$(134) = .39, $p < .001$) and waking up in the middle of the night or early morning ($r$

(134) = .35, $p < .001$).

### 3.2. T-tests for equality of means

*t*-tests were computed to examine differences between depressed and non-depressed groups, as well as between socially anxious and non-socially anxious groups, for total sleep score, total rumination, and three rumination subscales. The results conclude that the depressed group has significantly worse subjective sleep quality and significantly increased rumination compared to the non-depressed group. A similar pattern was observed between the socially anxious group and the non-socially anxious group. See Table 3 for statistical values.

### 3.3. Linear regression analyses

Linear regression analyses were conducted to predict depression using social anxiety scores in the first step, followed by sleep in the second step and adding total rumination in the third step. These same analyses were repeated for rumination subscales. To summarize, social anxiety symptoms and total PSQI score were significant in each model ($p < .001$). Further, total rumination, depressive rumination, and brooding rumination were also statistically significant in their respective models ($F$ (1, 135) = 68.35, $F$ (1, 135) = 79.26, and $F$ (1, 135) = 59.33, respectively, $p < .001$). However, reflection rumination score did not contribute to depressive symptoms ($F$ (1, 135) = 46.37, $p = .177$). The results are shown in Table 4.

Additionally, linear regression analyses were conducted to predict social anxiety using BDI scores in the first step, then added in the second step and total rumination in the third step. These same analyses were performed for rumination subscales. The results are shown in Table 5.

## 4. Discussion

The present study focused on the transdiagnostic relationships between rumination, subjective sleep quality, and psychopathological symptoms in depression and social anxiety. Our results show that there are significant relationships between rumination, sleep, and psycho-pathology for both depression and social anxiety. However, the nature of these relationships varies between depression and social anxiety. In individuals with depressive symptoms, our results are consistent with previous findings in the literature suggesting that sleep and rumination contribute independently to depression. This pattern held for all rumination subscales except for the reflection subscale. Most importantly, our findings suggest that the relationship between sleep and social anxiety is mediated by rumination, even after controlling for depressive symptoms (see Fig. 1). Due to high overlap between depression and social anxiety, the results were controlled by using social anxiety or depression scores in first step. Rumination and sleep were placed in subsequent steps of the regression analyses in order to show that these variables still predicted additional variance in depression and social anxiety.

Our findings suggest that the ruminative process' effect on sleep differs in depression and social anxiety. In depression, sleep, rumination, and social anxiety all independently contribute to the disorder. For social anxiety, however, depression and rumination are significant contributors but sleep is not, suggesting that the relationship between sleep and social anxiety is mediated by rumination. This distinction does not support our hypotheses and instead shows that the ruminative process impacts depression and social anxiety in different ways. These findings suggest that sleep does not directly impact social anxiety, rather other symptoms, like rumination or depressive symptoms, contribute more significantly to overall level of social anxiety symptoms. This may be due to the fact that sleep difficulties in social anxiety are better explained by the high rates of comorbidity between depression and social anxiety. Alternatively, sleep may not directly contribute to

**Table 2**

Correlations for Sleep, Rumination, Depression, and Social Anxiety.

| Variable | 1. Total Sleep Score | 2. RRS Total | 3. RRS Depressed | 4. RRS Brooding | 5. RRS Reflection | 6. BDI Score | 7. Social Phobia |
|---|---|---|---|---|---|---|---|
| 1. Total Sleep Score | – | | | | | | |
| 2. RRS Total | 0.47*** | – | | | | | |
| 3. RRS Depressed | 0.50*** | 0.96*** | – | | | | |
| 4. RRS Brooding | 0.40*** | 0.89*** | 0.79*** | – | | | |
| 5. RRS Reflection | 0.20* | 0.70*** | 0.53*** | 0.52*** | – | | |
| 6. BDI Score | 0.55*** | 0.69*** | 0.74*** | 0.63*** | 0.25** | – | |
| 7. Social Phobia | 0.37*** | 0.54*** | 0.54*** | 0.58*** | 0.20* | 0.62*** | – |

\* $p < .05$.
\*\* $p < .005$.
\*\*\* $p < .001$.

**Table 3**

Differences in Sleep & Rumination by Symptom Group.

*t*-tests in Depression

| | *t*-value | *p*-value | 95% CI | Non-depressed Mean (SD) | Depressed Mean (SD) |
|---|---|---|---|---|---|
| PSQI Score | −4.91 | < 0.001 | −5.47, -2.33 | 6.24 (3.69) | 10.14 (3.92) |
| RRS Total | −7.05 | < 0.001 | −23.83, -13.39 | 40.64 (12.48) | 59.25 (12.35) |
| RRS Depressed | −7.49 | < 0.001 | −14.84, -8.64 | 21.80 (7.38) | 33.54 (7.44) |
| RRS Brooding | −6.57 | < 0.001 | −6.82, -3.66 | 9.26 (3.77) | 14.50 (3.73) |
| RRS Reflection | −2.37 | 0.019 | −2.99, -0.27 | 9.58 (3.20) | 11.21 (3.42) |

*t*-tests in Social Anxiety

| | *t*-value | *p*-value | 95% CI | Non-socially anxious Mean (SD) | Socially anxious Mean (SD) |
|---|---|---|---|---|---|
| PSQI Score | −4.62 | < 0.001 | −4.27, -1.71 | 5.55 (4.03) | 8.84 (3.55) |
| RRS Total | −7.64 | < 0.001 | −19.94, -11.74 | 37.16 (12.20) | 53.00 (12.36) |
| RRS Depressed | −7.55 | < 0.001 | −11.95, -6.99 | 19.89 (7.32) | 29.36 (7.55) |
| RRS Brooding | −7.59 | < 0.001 | −6.08, -3.56 | 8.10 (3.04) | 12.92 (4.21) |
| RRS Reflection | −2.83 | 0.005 | −2.62, -0.48 | 9.17 (3.36) | 10.72 (3.09) |

Values for *t*-tests examining differences between the depressed and non-depressed groups ($n = 28$; $n = 108$), as well as between the socially anxious and non-socially anxious groups ($n = 61$; $n = 82$).

social anxiety symptoms because their relationships with other variables, such as rumination, explain the relationship instead.

This may have important implications in the diagnosis and treatment of depression and social anxiety because sleep actively contributes to depression, while it does not directly contribute to social anxiety. For example, it may be critical to focus on sleep when treating a depressed individual, but an individual with social anxiety may benefit more from an approach that address comorbid depressive symptoms or rumination more specifically. However, the importance of rumination in both disorders suggests that this process needs to be considered in their treatment.

A limitation of this design was that depressive and social anxiety symptoms, and sleep quality were examined through self-report evaluations. Other research suggests that rumination is also related to objective sleep variables (Galbiati et al., 2018; Zoccola et al., 2009). Thus, it may be useful to also examine these relationships with objective sleep data. Additionally, future research should examine these

relationships in clinical populations and using other measurement methods in order to confirm these results. A second limitation of the design was the overall sample size, which may have impacted our findings. Despite this, the relative number of participants in the depression group and in the social anxiety group was substantial enough to examine. Further studies should examine these relationships in bigger independent sample sizes. In addition to addressing these limitations, future studies should explore the relationship between sleep, rumination, and psychopathology in other disorders. It may also supplement this research to also consider other types of repetitive thought, such as worry. Exploring these relationships may help to distinguish the intricacies in rumination between other disorders. Finally, other studies may benefit from examining specific differences in these relationships with specific components of sleep (e.g., sleep latency, sleep time). These future examinations of these variables will significantly add to the literature on psychopathology and sleep.

**Table 4**

Linear Regression Predicting Depression.

| Variable | Model 1 | | Model 2 | | Model 3 | | Model 4 | | Model 5 | | Model 6 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | β | t (135) | β | t (135) | β | t (135) | β | t (135) | β | t (135) | β | t (135) |
| Social Anxiety | .62 | 9.10*** | .48 | 7.37*** | .30 | 4.49*** | .27 | 4.36*** | .31 | 4.36*** | .47 | 7.08*** |
| PSQI Score | | | .38 | 5.79*** | .27 | 4.35*** | .22 | 3.75*** | .32 | 5.09*** | .37 | 5.63*** |
| Total Rumination | | | | | .40 | 5.86*** | | | | | | |
| Depressive Rumination | | | | | | | .48 | 7.11*** | | | | |
| Brooding Rumination | | | | | | | | | .33 | 4.59*** | | |
| Reflection Rumination | | | | | | | | | | | .09 | 1.36 |
| $R^2$ | .382 | | .506 | | .608 | | .643 | | .574 | | .513 | |
| F (135) | 82.84*** | | 68.21*** | | 68.35*** | | 79.26*** | | 59.33*** | | 46.37*** | |

**Table 5**
Linear Regression Predicting Social Anxiety.

| Variable | Model 1 | | Model 2 | | Model 3 | | Model 4 | | Model 5 | | Model 6 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | β | t (135) | β | t (135) | β | t (135) | β | t (135) | β | t (135) | β | t (135) |
| BDI | .62 | 9.10*** | .60 | 7.37*** | .45 | 4.49*** | .46 | 4.36*** | .40 | 4.35*** | .59 | 7.08*** |
| PSQI Score | | | .03 | 0.35 | .01 | 0.09 | .01 | 0.08 | .02 | 0.22 | .03 | 0.32 |
| Total Rumination | | | | | .25 | 2.67* | | | | | | |
| Depressive Rumination | | | | | | | .21 | 2.12* | | | | |
| Brooding Rumination | | | | | | | | | .33 | 3.91*** | | |
| Reflection Rumination | | | | | | | | | | | .06 | 0.84 |
| $R^2$ | .382 | | .383 | | .414 | | .403 | | .447 | | .386 | |
| F (135) | 82.84*** | | 41.21*** | | 31.12*** | | 29.63*** | | 82.84*** | | 27.65*** | |
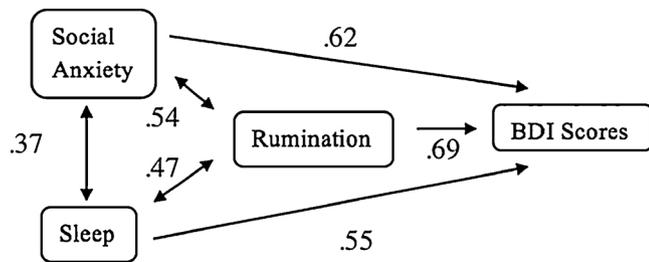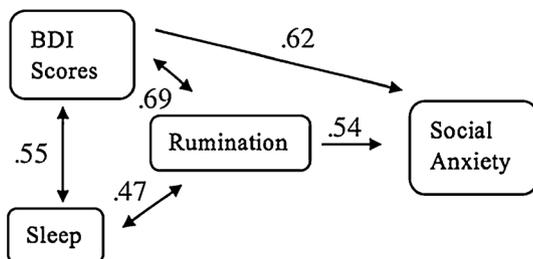


**Fig. 1.** Relationships with Sleep and Rumination in Depression and Social Anxiety.

In conclusion, this study contributes to the literature on depression and social anxiety through the discovery that their individual relationships with subjective sleep quality and rumination are not the same. Our data reiterate the fact that sleep and rumination independently contribute to depression. Additionally, our research suggests that the relationship between sleep, rumination, and social anxiety is different from the relationship between sleep, rumination, and depression. Rumination acts as a mediator in the relationship between sleep and social anxiety, after accounting for depressive symptoms. This distinction is important because it expands on rumination's function as a transdiagnostic process. These findings emphasize the importance of rumination in psychopathology and may have significant implications in the future research, prevention, and intervention of depression and social anxiety.

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