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Analyzing the Unique Role of Repetitive Negative Thinking on Insomnia in College Students

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ANALYZING THE UNIQUE ROLE OF REPETITIVE NEGATIVE THINKING ON INSOMNIA IN COLLEGE STUDENTS

by

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Abstract

Repetitive negative thinking is a transdiagnostic construct that conceptually covers worry and rumination, which are strongly associated with anxiety and depression. Worry is typically future oriented, whereas rumination is past oriented. RNT has been posited as a causal and maintaining factor for multiple disorders, including generalized anxiety disorder, depression, and insomnia. The current study aimed to further understand the contribution of RNT in insomnia symptoms, after controlling for anxiety and depression. A self-report battery measuring anxiety, depression, RNT and insomnia was administered to 101 college students. In this sample, 52% of participants endorsed clinical levels of insomnia. Bivariate correlations found anxiety, depression, and RNT to be significantly associated with insomnia. A hierarchical multiple regression indicated anxiety and depression predicted insomnia symptoms and accounted for 24.1% of the variance in insomnia symptoms. In the second step, the addition of RNT predicted insomnia symptoms and accounted for an additional 3.1% of the variance in insomnia symptoms. Results suggest that insomnia is significantly correlated with anxiety, depression, and RNT. More specifically, results highlight that RNT plays a unique role in insomnia symptoms, even after controlling for anxiety and depression. Findings suggest that additional research into RNT as a causal factor in insomnia is needed. One potential implication is that reducing RNT in treatment may improve symptoms of insomnia.

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Introduction

Repetitive negative thinking (RNT) is an umbrella term for the experience of getting stuck in one's own negative thoughts (Wahl et al., 2019). RNT has been shown to be maladaptive, and although it is particularly salient to depression and anxiety, RNT has been linked to many forms of psychopathology (Ehring & Watkins, 2008; Taylor & Snyder, 2021). RNT is also associated with intrusive thoughts and low levels of mindfulness (Gustavson et al., 2018). Furthermore, RNT has been associated with numerous negative outcomes, such as accelerated brain aging (Karim et al., 2021), increased risk for Alzheimer's disease (Marchant & Howard, 2015), increased degeneration in global cognition, and delayed memory (Marchant et al., 2020). Research has examined several factors which may predict RNT. For instance, gender has been shown to be impactful, with women being more likely than men to exhibit RNT (Graham et al., 2020), and more specifically rumination (Johnson & Whisman, 2013). Moreover, research has suggested that older adults ruminate less than their younger counterparts (Ricarte et al., 2016).

Conceptually, RNT covers depressive rumination, defined as, "repetitively and passively focusing on symptoms of distress and on the possible causes and consequences of these symptoms" (Nolen-Hoeksema et al., 2008, p. 400), and worry, defined as "a chain of thoughts and images, negatively affect-laden, and relatively uncontrollable" (Borkovec et al., 1983, p. 10). In the past, worry and rumination have been studied in isolation from a disorder-focused perspective, with rumination commonly being associated with depression while worry is associated with generalized anxiety disorder (Spinhoven et al., 2015). To this end, many studies have indicated that rumination and worry are distinct RNT processes, which have been conceptualized as disorder-specific risk factors for depression and anxiety, respectively (Taylor

& Snyder, 2021). Studies directly comparing characteristics of worry versus rumination have revealed some differences in temporal orientation; however, this is the only difference found across studies and this distinction has been minimized to explain the connection between these RNT processes (McEvoy & Brans, 2013; Topper, 2016). More specifically, worry about the future typically stems from previous experiences; therefore, albeit focused on the potential of future events, future-oriented worry may be rooted in past experiences. The same can be said of rumination, for excessive thoughts about the past are relevant because they are typically impactful on the present or future. Consequently, this relationship between the past, present, and future could help explain the overlap between worry and rumination (McLaughlin et al., 2007).

Despite the potential distinctions in worry and rumination, research has found considerable overlap in the thought processes core to worry and rumination and has also indicated that these RNT processes may be the underlying commonality between anxiety and depression (Gustavson et al., 2018). For instance, measures of rumination and worry have been found to be highly correlated and similarly related to symptom levels of anxiety and depression (Topper, 2010). In addition, components of RNT, including unpleasantness, repetitiveness, and feelings of situational lack of control, were found to be core features observed across both worry and rumination (Kircanski et al., 2015). Moreover, RNT was found to be a factor in the maintenance of anxiety and depression, and correlations between the factors may be attributed to phenomena such as goal interruption, failures of emotional processing, and information processing, which may lead to RNT and thereby increase negative mood states, including both anxiety and depression (Segerstrom et al., 2000). Kircanski et al. (2015) found equivalent high levels of worry and rumination across individuals diagnosed with depression, generalized anxiety disorder, and co-occurring depression and generalized anxiety disorder. Moreover, RNT, worry,

and brooding uniquely predict anxiety and depression (McEvoy & Brans, 2013). This provides further evidence of the connections of rumination and worry within these disorders. Gustavson et al. (2018) aimed to directly quantify the proportion of the overlap between depression and anxiety symptoms that can be directly attributed to RNT. Findings suggested that the experience of depression and anxiety symptoms are at the core of the overlap between rumination and worry, and it was found that RNT captures important transdiagnostic and overlapping variance across depression and anxiety symptoms. Moreover, there was little variance unique to anxiety that predicted depression (and vice-versa) above and beyond RNT.

While the definitions differ regarding the focus on individuals' thinking, Ehring and Watkins suggest the possibility of defining RNT by the three process characteristics that are common across disorders (2008). Specifically, the maladaptive thinking processes central to RNT are described as repetitive, passive and/or relatively uncontrollable, and focused on negative content. In addition, RNT has been described as predominantly verbal, relatively abstract, and possibly related to positive and negative meta–cognitions (Ehring & Watkins, 2008). The overall foundation of RNT is believed to lie on the presence of important, unresolved goals, which are often perfectionistic and unattainable (Topper, 2010). Interestingly, RNT is regarded as both an adaptive and normative process as it is present in those who are psychologically healthy as well as those with psychological disorders. The literature suggests that RNT is elevated across various mental disorders, including generalized anxiety disorder (Ehring & Watkins, 2008), panic disorder, social anxiety disorder, and depression (McEvoy et al., 2013), as well as posttraumatic stress disorder, insomnia, and psychosis (Ehring & Watkins, 2008). Further, the key processes of RNT have been found to be identical between individuals diagnosed with major depressive disorder, generalized anxiety disorder, or obsessive-compulsive

disorder (Wahl et al., 2019). In general, it is thought that the difference in RNT between those who are psychologically healthy and those with disorders is that those with disorders are more prone to more extreme or unattainable goals, which are inflexible and disrupts one's life, whereas RNT among those who are psychologically healthy may function to assist with goal setting and may motivate one to take action (Ehring & Watkins, 2008). Consequently, this characterization not only further highlights RNT's transdiagnostic attributes, but also provides insight into the function of RNT.

A small body of research has highlighted RNT as a potential mechanism underlying emotional disorders, particularly generalized anxiety disorder and major depressive disorder. Notably the core processes of RNT: repetitiveness, intrusiveness, uncontrollability, lack of productivity, and avoidance have been found to be higher in those with major depressive disorder and generalized anxiety disorder (Wahl et al., 2019). The repetitive and intrusive nature of RNT can be seen in work by Ruscio et al. (2011), which found that those exhibiting frequent negative thought intrusions, regardless of thought content, exhibit the strongest and most sustained negative response to a subsequent stressor. These negative, intrusive thoughts are associated with increased severity of anxiety and depression (Ruscio et al., 2011). Relatedly, Krahé et al. (2019) found that RNT and generalized anxiety disorder are associated with increased negative interpretation bias, which is defined by consistent resolution of ambiguous information in a negative way (Hirsch & Mathews, 2012). These findings connect to Stade et al. (2022) which aimed to measure RNT in real-time and found that as trait RNT increased, participants' cognitive responses to stimuli changed, with responses to negative and ambiguous stimuli becoming more negative, and responses to positive stimuli becoming more positive. This implies that high trait RNT is associated with amplified responding to emotional stimuli generally, rather than to

negative or ambiguous stimuli specifically. Moreover, these results highlight how RNT directly impacts thought content and how the intrusive, repetitive, and uncontrollable nature of RNT subsequently influences and contributes to anxiety and depressive symptoms. Importantly, in addition to studies examining RNT as a factor contributing to worsening symptoms, research has also examined RNT in the context of treatment. This research may be especially important, for RNT appears to remain consistent and stable over time (Hijne et al., 2020), with previous studies finding that rumination often remains constant, even in those who experience significant changes in their depressive symptoms (Bagby et al., 2004). This suggests that RNT may need to be directly targeted in treatment in order to improve symptoms. More specifically, metacognitive therapy interventions, a frequent treatment method for generalized anxiety disorder, has been found to be effective at decreasing repetitive thoughts and increasing perceived controllability of RNT (McEvoy et al., 2015).

In sum, RNT is a transdiagnostic factor which is present and prevalent across multiple disorders (Ehring & Watkins, 2008). At its core, RNT describes the process of getting stuck in one's thoughts (Wahl et al., 2019) and is defined by central characteristics (e.g. repetitiveness, uncontrollability, and intrusiveness), which is thought to contribute to causality and maintenance of multiple mental health disorders, including generalized anxiety disorder and major depressive disorder (Ehring & Watkins, 2008). Given RNT's transdiagnostic features, research examining RNT may be helpful in understanding syndromes that co-occur with anxiety and depression. One particular outcome that is common to anxiety and depression (Koffel & Watson, 2009) and associated with worse outcomes is insomnia (Mason & Harvey, 2014).

Insomnia

Insomnia is a condition characterized by difficulties falling or staying asleep (DSM-5; Lancee et al., 2017). Population census studies have found that about 30% of adult samples report one or more symptom of insomnia (Roth, 2007), and prevalence rates of clinical insomnia are approximately 6% (Roth, 2007), making it the most common sleep disorder in the general population (La et al., 2020). Females have a higher prevalence of insomnia (Zeng et al., 2020), and, more specifically, may be at a 40% greater risk of developing insomnia (Zhang & Wing, 2006). Overall, the risk for insomnia increases with age, reaching close to 50% in elderly individuals (Ohayon, 2002). Insomnia is higher in those with lower income and education levels (Ohayon, 2002). Half of individuals with insomnia symptoms have recurrent, persistent, or multiple health issues (Ohayon, 2002). Therefore, insomnia is costly and associated with increased healthcare consumption, sick leave, poorer quality of life, and is commonly comorbid with a range of illnesses such as diabetes and asthma (Bin et al., 2014) and is positively correlated with alcohol use (Perney & Lehert, 2018), ADHD, and suicidality (Hsieh et al., 2019). Moreover, insomnia is highly associated with physical pain, life stress, and health dissatisfaction (Hsieh et al., 2019).

Insomnia has high comorbidity with anxiety and depression (Ohayon et al., 1998). Mason and Harvey (2014) found that 40% of the individuals with depression or anxiety also had comorbid insomnia, and that insomnia symptoms were associated with more severe symptoms of anxiety and depression. Additional evidence for the connection between insomnia and depression comes from Cheng et al. (2020), who treated 358 patients using Digital Cognitive Behavioral Therapy for Insomnia and found that the treatment significantly reduced rumination, which significantly mediated improvements in insomnia, depression, as well as prevention of incident

depression. Previous research found severity of generalized anxiety disorder to be the strongest independent factor related to the presence of moderate and severe insomnia (Navarrete et al., 2017); however, depression is also a significant factor, with some research estimating that about 90% of patients with depression have problems with sleep quality (Tsuno et al., 2005). Altogether, insomnia's high comorbidity with anxiety and depression points to significant overlap across disorders, which may be important to consider when thinking about disorder symptomatology, outcomes, maintenance, and treatment.

In addition to connections with anxiety and depression, insomnia symptoms have been associated with RNT (Cox et al., 2016). Prior research suggests deficits in executive function may be a potential mechanism by which sleep disturbance may influence maladaptive negative thoughts, indicating that executive function may be the linking factor between sleep disturbance, worry, and rumination (Cox et al., 2016). In addition, nighttime sleep related worry has been identified as an important factor in the maintenance of insomnia (Lancee et al., 2017). Relatedly, recent work has highlighted evening chronotypes, or individual differences in circadian rhythm, as having associations with anxiety, depression, and maladaptive behaviors. More generally, chronotypes refer to one's circadian preferences, such as preference for early mornings or evenings (Taylor & Hasler, 2018). Evening chronotypes are thought to be related to increased RNT compared to intermediate and morning chronotypes (Cox & Olatunji, 2022), suggesting an underlying biological component that may connect sleep issues and RNT. Wicklow and Espie (2000) sought to foster better understanding of how intrusive thoughts before bed delay sleep and contribute to insomnia symptoms. Correlational and regression analyses found that thinking about sleep, anticipating poor sleep, and thoughts centered around rehearsal, planning, and problem solving all heavily contributed to negative sleep outcomes. Worrying in bed may also

lead to heightened sympathetic and lessened parasympathetic activation (Weise et al., 2013). Moreover, later bedtimes have been found to significantly predict levels of RNT, with later bedtimes and longer sleep onset latency being highlighted as significant, strong predictors of RNT levels (Stewart et al., 2020). As discussed above, the core features of RNT, including experiencing thoughts which are repetitive, intrusive, unproductive, and retrospective have been highlighted as contributors and maintaining factors in insomnia, anxiety, and depression.

Current Study

RNT has been found to have significant influence across disorders, including anxiety, depression, and insomnia. The transdiagnostic features of RNT means that it may play a causal and maintaining role in the disorders in which it impacts. As generalized anxiety disorder and depression share high comorbidity (Kessler et al., 2005), and insomnia is commonly associated with both anxiety and depression (Koffel & Watson, 2009), RNT could be a potential common underlying factor. The current study aims to further investigate the connections between all of these in order to foster a better understanding of the role RNT plays and how it could help uniquely explain insomnia symptoms, after accounting for depression and anxiety. While previous work has highlighted RNT as an important factor across disorders (Ehring & Watkins, 2008), few studies have looked at RNT as a factor which might influence insomnia symptoms among college students. Indeed, college students have been found to have higher rates of clinical insomnia than the general population, with about a quarter of college students experiencing insomnia symptoms (Gress-Smith et al., 2015; Taylor et al., 2013). As noted in previous research, sleep disturbance is particularly common in college students and has been highlighted as problematic. Increased research is needed to better understand the factors which contribute to increased levels of insomnia in college students. Moreover, as there is a close relationship

between sleep quality and physical and mental health (Lund et al., 2010), treatment interventions targeting insomnia in college students are needed to better ensure students' physical and mental well-being. Thus, the central aim of this study is to assess correlations among anxiety, depression, and insomnia, and to evaluate the unique role that RNT plays in insomnia symptoms.

Hypotheses

1. Repetitive negative thinking, generalized anxiety disorder, and depression will be positively correlated with insomnia.
2. Repetitive negative thinking will be positively associated with insomnia symptoms after controlling for anxiety and depression symptoms.

Method

Participants

To participate in the current study, participants had to be at least 18-years-old and pass all attention checks. A total of 101 participants (M = 19.75, SD = 4.19) completed the study. Participants were all college undergraduates, who were primarily freshman (60%), female (79%), and white (82%). See Table 1 for a summary of demographic characteristics.

Measures

Insomnia Severity Index (ISI)

The ISI (Morin et al., 2011) is a brief instrument designed to assess the severity of nighttime and daytime components of insomnia. Moreover, it assists in the clinical evaluation of patients with insomnia complaints in treatment research (Bastien et al., 2001). This measure consists of seven items that participants are asked to rate on a five-point Likert-type scale, with each item being rated from 0 (*none*) to 4 (*very severe*). The measure includes questions about falling asleep, staying asleep, early morning waking, interference with daily life, and satisfaction or distress in current sleep experiences. Total scores range from 0-28. Scores below seven indicate the absence of insomnia, whereas scores between eight to fourteen indicate subthreshold insomnia, scores between 15 to 21 indicate moderate insomnia, and scores of above 22 indicate severe insomnia (Morin et al., 2011). The ISI has been shown to have high reliability and validity, as well as high internal consistency in both community ($\alpha = 0.90$) and clinical ($\alpha = 0.91$) samples (Morin et al., 2011).

Perseverative Thinking Questionnaire (PTQ)

The PTQ (Ehring et al., 2011) is a 15-item self-report measure that focuses on the core characteristic processes of RNT (Ehring et al., 2011). For instance, items assess

unproductiveness associated with RNT, mental capacity captured by RNT, as well as the repetitiveness, intrusiveness, and inability to disengage that is centrally associated with RNT. Scores are measured on a five-point Likert scale and range from 0 (*never)* to 4 (a*lmost always*), with higher scores indicating greater levels of RNT (Devynck et al., 2017). Internal consistency for the PTQ is high, with all subscales of RNT, including core characteristics of RNT (α=.92-.94), unproductiveness of RNT (α= .77-.87), and RNT capturing mental capacity (α= .82-.90) being found to have high internal consistency. The PTQ has been deemed a useful, reliable and valid measure of RNT (Ehring et al., 2011).

Depression Anxiety Stress Scale-21 (DASS-21)

The DASS-21 (Lovibond & Lovibond, 1995) is a 21-item self-report measure which measures emotional states of depression, anxiety, and stress. There are seven questions for each construct. The depression scale focuses on hopelessness, lack of interest in life or activities, and dysphoria. The stress scale is centered around non-specific arousal, difficulty relaxing, or emotional reactions such as irritation. The anxiety scale focuses on autonomic arousal and experience in anxious affect. Participants score the items on a 4-point Likert-type scale ranging from 0 (*did not apply to me at all*) to 3 (*applied to me very much or most of the time*). Scores for the DASS are determined by scoring responses in each category; however, the scoring is dimensional rather than categorical. Higher scores indicate higher severity for each subscale. Lovibond and Lovibond (1995) found that the DASS successfully discriminates between depression, anxiety, and stress, though the three are highly correlated with one another. The DASS-21 has high reliability, with the DASS-21 Depression (α= .85), DASS-21 Anxiety (α= .81), and DASS-21 Stress (α= .88) all showing high scale reliability (Osman et al., 2012).

Procedure

Participants enrolled in the study at the University of Mississippi through a psychology research pool known as Sona systems, and data were collected online through Qualtrics between October 8th 2020 and November 2nd 2021. Interested individuals signed up as part of a larger study which aimed to better understand the relationship and effects between positive health behaviors and generalized anxiety symptomatology. Individuals were provided with information about the study and following consent to participate, completed a questionnaire battery. Participants received course credits for completing the study.

Results

Descriptive Statistics

The current study aimed to further understand the role RNT plays in insomnia. The majority of participants reported finding it difficult to control their worry (57.4%) and having difficulty falling and staying asleep (51.5%) during the last six months. Moreover, in the current sample, on the ISI, 52.5% (n = 53) participants endorsed clinical levels of insomnia (M = 15.43, SD = 6.41). The average score for the DASS anxiety was 7.51 (SD = 7.47), with 34.7% (n = 35) reporting moderate to very severe (score of 10+) levels of anxiety. On the DASS-Depression, the average score was 9.66 (SD = 10.33), with 32.7% (n=33) endorsing moderate to very severe (score of 14+) levels of depression. On the PTQ, the mean score was 37.41 (SD= 15.74).

Examination of Hypotheses

Bivariate correlational analyses were conducted to examine anxiety, depression, and RNT in relation to insomnia. Consistent with the current study's hypothesis, correlations indicated a significant positive relationship between insomnia and anxiety (r = .484, p < .001), depression (r = .399, p < .001), and RNT (r = .456, p < .001). These results indicate that high depression, anxiety, and RNT symptoms are each associated with higher levels of insomnia. See Table 2.

Next, a hierarchical multiple regression analysis was conducted to evaluate Hypothesis 2. See Table 3 for the full results. In the first step, anxiety and depression predicted insomnia symptoms, (F (2, 97) = 15.37, p < .002, R^2= .23) and accounted for 24.1% of the variance in insomnia symptoms. In the second step, the addition of RNT uniquely predicted insomnia, (F (3, 96) = 11.92, p= .047 R^2= .27) and accounted for an additional 3.1% of the variance in insomnia

symptoms. The results of this regression are consistent with the study's hypothesis and show that RNT has a unique role above and beyond anxiety and depression.

Discussion

The present study tested the unique role that RNT plays in insomnia in college students. By working to further understand these connections, this study aimed to help foster a stronger understanding of RNT's transdiagnostic function. In this sample, 52.5% of college students reported clinical levels of insomnia. These results are nearly identical to Amaral et al. (2018), which found 52.3% of college students in their sample reported sleep difficulties. This finding is also comparable to other studies which use the Insomnia Severity Index (ISI) as a measurement tool. For example, one study found that 47% of a college sample reported mild levels of insomnia, 20% reported moderate levels, and 3% reported severe levels of insomnia. This means that two-thirds of the sample reported experiencing symptoms of insomnia and a quarter of the sample experienced mild to severe levels of insomnia (Gress-Smith et al., 2015). Nevertheless, the current results are not consistent with another study, which found 9.5% of a student sample met DSM-5 criteria for clinical rates of insomnia. Moreover, 26.9% of the sample met severity, frequency, and duration criteria but did not report an insomnia complaint (Taylor et al., 2013). The differing results of these studies may be attributed to variable insomnia criteria across studies. However, the current study is consistent with variable previous research in finding that college students have a high rate of insomnia, particularly in the context of the general population, wherein 6% of individuals are estimated to experience clinical insomnia (Roth, 2007).

First, the relationships between RNT, generalized anxiety disorder, depression, and insomnia were tested. These results point to insomnia as being significantly associated with symptoms of anxiety, depression, and RNT. Second, a hierarchical multiple regression indicated that RNT plays a unique role in insomnia symptoms, even when controlling for anxiety and

depression. These findings are consistent with previous research, which has found that insomnia frequently co-occurs with anxiety symptoms (Mason & Harvey, 2014) and depression (Van der Zweerde et al., 2019) and that RNT is a significant factor within anxiety, depression, and insomnia (Ehring & Watkins, 2008). Moreover, these findings are consistent with prior work examining these constructs in college student samples. For instance, one study found that engaging in RNT at bedtime leads to higher levels of self-reported stress and insomnia symptoms in college students with insomnia (Benham, 2021). Relatedly, delayed timing of sleep and shorter sleep duration are associated with transdiagnostic RNT in college students and those who prefer later sleep and activity times have higher levels of RNT (Nota & Coles, 2015). These results provide potential insight into why college students have higher rates of insomnia and RNT, for college students often experience sudden shifts in sleep duration and timing, which provides an opportunity for increased RNT, anxiety, and depression. These findings lend further support to past research showing that sleep difficulties were positively associated with perceived stress, negative affect, RNT, and cognitive emotional strategies (e.g., rumination). More specifically, a previous study found stress directly affected sleep difficulties, while rumination and negative affect are essential mediators in the relationship between stress and sleep disturbance (Amaral et al., 2018). While RNT was not found to mediate this relationship, it was significantly associated with rumination and negative affect, which suggests that RNT has a negative impact on sleep outcomes when it is associated with negative affect or rumination (Amaral et al., 2018).

These findings provide important insight into the function and role of RNT in insomnia, as results support RNT as a transdiagnostic construct. Transdiagnostic factors are important to consider in psychopathology. In particular, transdiagnostic factors move beyond the categorical view of disorders by focusing on disorder dimensionality and comorbidity to test how mental

disorders are often manifestations of a few underlying core dimensions (Krueger & Eaton, 2015). Consequently, transdiagnostic mechanisms are important to consider in relation to causality, maintenance, and comorbidity across disorders, or in the case of the current study – anxiety, depression, and insomnia. Approaching disorders and treatment through a transdiagnostic lens is important for it addresses more than one disorder by targeting only one construct, which gives way to a more parsimonious way to understand psychopathology and outcomes across disorders. The current study highlights the potential importance of RNT as a unique factor in insomnia symptoms. This information may be important for future treatment, as focusing on RNT may also serve to improve outcomes for those with psychiatric disorders, including anxiety, affective, and sleep disorders. More specifically, RNT may be a useful construct to target to improve insomnia, anxiety, and depression outcomes.

In terms of the potential clinical implications, many studies have examined the impact of targeting RNT as the focus of treatment. In particular, existing literature has focused on cognitive behavioral therapy (CBT) specifically targeting RNT. Meta-analyses have found that CBT targeting RNT specifically and general CBT have the same outcomes in anxiety, depression, and RNT symptoms. For instance, Bell et al. (2023) focused on those with anxiety and/or depression between ages 14-24 across 24 studies to test the effect of psychological treatment (e.g., CBT, attention bias modification) on RNT. Reductions in RNT were significantly associated with lower symptoms of depression and anxiety for RNT focused interventions. However, subgroup analyses found that RNT specific treatments led to similar outcomes as the interventions that did not explicitly target RNT (Bell et al., 2023). This finding suggests that treatments do not have to systematically target RNT to see reductions. These results align with the meta-analysis by Monteregge et al. (2020), which included 46 studies examining treatment for adults with anxiety.

They found that anxiety and RNT symptom outcomes were nearly identical in treatment that specifically targeted RNT and that which did not. Similarly, Spinhoven et al. (2018) conducted a meta-analysis which included adults with anxiety across 46 studies on RNT-focused psychological treatments including cognitive behavioral techniques and process-focused techniques, as well as non-RNT-focused treatment, typically through the use of CBT. Results found that any active intervention decreased RNT, and treatments specifically targeting RNT had comparable outcomes to general psychological interventions (e.g., CBT). Moreover, the effectiveness of CBT treatment for RNT did not appear to be affected by the type of RNT (i.e., worry versus rumination; Spinhoven et al., 2018). Altogether, these studies highlight that it may not be necessary to specifically target RNT in treatment to see positive outcomes. However, symptoms of RNT did decrease through the natural process of treatment through CBT, which provides useful insight into the effectiveness of using CBT to treat RNT symptoms. Since RNT is decreased by CBT, there is not a specific need to develop and implement specialized or new treatment to improve RNT symptoms. Altogether, the results of these studies show that RNT is an important factor that responds to treatment and is associated with positive outcomes, and yet, no new or specialized treatment is needed to specifically target RNT.

Another treatment option is that cognitive behavioral therapy for insomnia (CBT-I) may also be helpful in improving outcomes in not only insomnia, but also anxiety, depression, and RNT. For instance, Ballesio et al. (2021) found CBT-I reduces general worry, sleep-related worry, and depression. CBT-I has been consistently found to reduce worry and depressive symptoms, including symptoms which are prevalent at night. This information is important to consider in relation to RNT, for higher levels of RNT are common in the evening time (Cox et al., 2016). Therefore, CBT-I may also improve outcomes in RNT, as sleep-related worry and

rumination significantly predict sleep-related impairment (Tutek et al., 2021). A separate study found that RNT symptoms decreased following standard CBT-I sessions, and that improvements in insomnia symptoms corresponded with decreased levels of RNT (Cox & Olatunji, 2022). Another study employed a meta-analysis to test RNT outcomes in individuals with insomnia following CBT-I treatment. However, analyses were unable to be completed due to a lack of available studies, which highlights the high demand for future studies to further test CBT-I as a method of improving outcomes in RNT (Ballesio et al., 2021). While preliminary research appears to support CBT-I as improving RNT, worry, and depression, further work is needed to better understand and support findings by Cox and Olatunji (2022), who to date are the only study to test outcomes in RNT following CBT-I.

The current findings and literature point to several directions for future research. Firstly, there is a need for additional studies focused on better understanding the factors, such as RNT, that may underlie insomnia and comorbid disorders, such as anxiety and depression. Secondly, the timing of sleep has been highlighted as an important causal factor in RNT and insomnia; however, more research is needed to further understand the relationship. There is little understanding of whether sleep-related worry directly influences sleep at night or whether people who are unable to sleep have time to begin worrying about why they cannot sleep, thereby triggering sleep-related worry (Lancee et al., 2017). Although previous work has placed emphasis on duration of sleep, timing of sleep appears to be a stronger predictor of levels of RNT (Stewart et al., 2020). Shorter sleep duration and delayed timing of sleep has been found to be associated with heightened levels of RNT. Importantly, these results suggest that sleep disruption may be connected to the process of RNT, regardless of thought content. (Nota & Coles, 2015). Therefore, future studies could explore RNT and insomnia in relation to timing of

sleep, including inability to fall asleep, problems staying asleep, and early waking. More specifically, future work could benefit from analyzing RNT levels across bedtimes, as well as whether early morning waking or problems staying asleep are contributing factors. Results from such studies could be beneficial for understanding the maintenance of RNT in insomnia and by extension may help inform treatment which may improve sleep outcomes. Finally, future research could focus on improving RNT outcomes through treatment. Though sparse, previous literature has noted that interventions which target RNT through third-wave approaches (focus on processes, e.g., mindfulness and increased focus on fostering awareness of thoughts and emotions) have greater influences on reducing RNT than those that target content (Bell et al., 2023). This direction may aid future interventions by not only contributing to knowledge regarding RNT causality, but also by informing specific methodologies or treatments which may better serve to improve RNT outcomes. Altogether, future research may benefit from focusing on causal factors in RNT and applying such factors to treatment which may serve to improve RNT symptoms.

Although the current study provides an important contribution to the literature, several limitations must be considered. First, the current study employed self-report measures, which may increase bias in measures and may influence validity (Donaldson & Grant-Vallone, 2002). The current study also included a small, fairly homogenous sample. Participants in the current study were mostly white (82%), and female (79%). Gender may be an important factor in the results of the current study, as increased prevalence of insomnia (Zeng et al., 2020), anxiety (Bandelow & Michaelis, 2015), depression (Faravelli et al., 2013), and RNT (Graham et al., 2020) are seen in women. In addition, this sample focused on college students. Insomnia has increased prevalence in older adults (Roth, 2007), with advanced age as a consistent risk factor

for insomnia (Mai & Buysse, 2008); therefore, replication in an older sample is needed. Interestingly, despite the young age of participants, 52% of the current sample endorsed clinical levels of insomnia, which is higher than the national average. Few studies have tested age in relation to RNT, but young adults have been found to have increased levels of rumination (Ricarte et al., 2016). Therefore, the current sample may not be an accurate representation of the general population. Future research can benefit from ensuring a larger, more diverse sample, particularly in terms of age.

In sum, this study found significant positive correlations between anxiety, depression, RNT, and insomnia symptoms. This relationship can be further understood by the additional finding that RNT plays a significant, unique role in insomnia above and beyond anxiety and depression symptoms. In this study, the transdiagnostic role of RNT was found to be important in understanding the unique role in insomnia symptoms, and with existing research, these findings highlight the potential benefits of using CBT to reduce RNT in treatments for insomnia.

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Table 1.
Sample Characteristics (N= 101)

	% (n)
Gender	
Female	79.2 (80)
Male	19.8 (20)
Transgender	1.0 (1)
Year in College	
Freshman (1st year)	60.4 (61)
Sophomore (2nd year)	7.8 (18)
Junior (3rd year)	10.9 (11)
Senior (4th year)	7.9 (8)
Other	3.0 (3)
Age (mean ± SD)	9.75 ± 4.19
Sexual Orientation	
Heterosexual/Straight	90.1 (91)
Bisexual	4.0 (4)
Gay	3.0 (3)
Questioning	2.0 (2)
Pansexual	1.0 (1)
Race/Ethnicity	
White/Caucasian	82.2 (83)
Black/African American	8.9 (9)
Multiracial	5.0 (5)
Asian/Pacific Islander	4.0 (4)
Ethnicity	
Non-Hispanic/Latinx	95.0 (96)
Hispanic/Latinx	5.0 (5)
Employment Status	
No	77.2 (78)
Yes	22.8 (23)

Table 2.

Correlations Between Study Variables

	1	2	3	4
1. PTQ	—-	.603**	.630**	.456**
2. DASS- Depression		—-	.718**	.399**
3. DASS-Anxiety			—-	.484**
4. ISI				—-
Mean	37.41	9.66	7.51	15.43
Standard Deviation	15.74	10.33	7.47	6.41
n	101	100	101	101

Note. PTQ = Perseverative Thinking Questionnaire Total Score; DASS-DEPRESSION = Depression Anxiety Stress Scale-21-depression score; DASS-ANXIETY = Depression Anxiety Stress Scale-21-anxiety score; ISI = Insomnia Severity Index Total Score

** Correlation is significant at the 0.01 level

Table 3:

Results of a Hierarchical Multiple Regression Examining the Unique Role of Repetitive Negative Thinking on Insomnia Symptoms

Variable	*B*	*SE*	*T*	*p*	R^2	ΔR^2
Step 1					.225	.241
Constant	12.23	.82	14.9	>.001		
Anxiety	.35	.11	3.22	.002		
Depression	.07	.08	.83	.410		
Step 2					.271	.031
Constant	9.69	1.50	6.48	>.001		
Anxiety	.27	.11	6.49	.021		
Depression	.02	.08	.25	.804		
RNT	.096	.048	2.01	.047		

Note. Anxiety = Depression Anxiety Stress Scale-21- anxiety score; Depression = Depression Anxiety Stress Scale-21- depression score; RNT= Perseverative Negative Thinking Questionnaire Total Score

APPENDIX A

Insomnia Severity Index

For each question, please CIRCLE the number that best describes your answer. Please rate the CURRENT (i.e. LAST 2 WEEKS) SEVERITY of your insomnia problem(s)

1. Difficulty falling asleep

None	Mild	Moderate	Severe	Very Severe
0	1	2	3	4

2. Difficulty staying asleep

None	Mild	Moderate	Severe	Very Severe
0	1	2	3	4

3. Problems waking up too early

None	Mild	Moderate	Severe	Very Severe
0	1	2	3	4

4. How SATISFIED/DISSATISFIED are you with your CURRENT sleep pattern?

Very Satisfied	Satisfied	Moderately Satisfied	Dissatisfied	Very Dissatisfied
0	1	2	3	4

5. How NOTICEABLE to others do you think your sleep problem is in terms of impairing the quality of your life?

Not at all Noticeable	A Little	Somewhat	Much	Very Much Noticeable
0	1	2	3	4

6. How WORRIED/DISTRESSED are you about your current sleep problem?

Not at all Worried	A Little	Somewhat	Much	Very Much Worried

0	1	2	3	4

7. To what extent do you consider your sleep problem to INTERFERE with your daily functioning (e.g. daytime fatigue, mood, ability to function at work/daily chores, concentration, memory, mood, etc.) CURRENTLY?

Not at all Interfering	A Little	Somewhat	Much	Very Much Interfering
0	1	2	3	4

Guidelines for Scoring/Interpretation:

Add the scores for all seven items (questions 1 + 2 + 3 + 4 + 5 +6 + 7) = _____ your total score

Total score categories:

0–7 = No clinically significant insomnia

8–14 = Subthreshold insomnia

15–21 = Clinical insomnia (moderate severity)

22–28 = Clinical insomnia (severe)

APPENDIX B

Perseverative Thinking Questionnaire						
Instruction: In this questionnaire, you will be asked to describe how you *typically* think about negative experiences or problems. Please read the following statements and rate the extent to which they apply to you when you think about negative experiences or problems.						
		never	rarely	sometimes	often	Almost always
1	The same thoughts keep going through my mind again and again.	0	1	2	3	4
2	Thoughts intrude into my mind.	0	1	2	3	4
3	I can’t stop dwelling on them.	0	1	2	3	4
4	I think about many problems without solving any of them.	0	1	2	3	4

5	I can't do anything else while thinking about my problems.	0	1	2	3	4
6	My thoughts repeat themselves.	0	1	2	3	4
7	Thoughts come to my mind without me wanting them to.	0	1	2	3	4
8	I get stuck on certain issues and can't move on.	0	1	2	3	4
9	I keeping asking myself questions without finding an answer.	0	1	2	3	4
10	My thoughts prevent me from focusing on other things.	0	1	2	3	4

11	I keep thinking about the same issue all the time.	0	1	2	3	4
12	Thoughts just pop into my mind.	0	1	2	3	4
13	I feel driven to continue dwelling on the same issue.	0	1	2	3	4
14	My thoughts are not much help to me.	0	1	2	3	4
15	My thoughts take up all my attention.	0	1	2	3	4

APPENDIX C

Depression Anxiety Stress Scale- 21

Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:

0 Did not apply to me at all

1 Applied to me to some degree, or some of the time

2 Applied to me to a considerable degree or a good part of time

3 Applied to me very much or most of the time

---

1 (s) I found it hard to wind down	0	1	2	3
2 (a) I was aware of dryness of my mouth	0	1	2	3
3 (d) I couldn't seem to experience any positive feeling at all	0	1	2	3
4 (a) I experienced breathing difficulty (e.g. excessively rapid	0	1	2	3
breathing, breathlessness in the absence of physical exertion)	0	1	2	3
5 (d) I found it difficult to work up the initiative to do things	0	1	2	3
6 (s) I tended to over-react to situations	0	1	2	3
7 (a) I experienced trembling (e.g. in the hands)	0	1	2	3
8 (s) I felt that I was using a lot of nervous energy	0	1	2	3
9 (a) I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
10 (d) I felt that I had nothing to look forward to	0	1	2	3

11 (s) I found myself getting agitated	0	1	2	3
12 (s) I found it difficult to relax	0	1	2	3
13 (d) I felt down-hearted and blue	0	1	2	3
14 (s) I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3
15 (a) I felt I was close to panic	0	1	2	3
16 (d) I was unable to become enthusiastic about anything	0	1	2	3
17 (d) I felt I wasn't worth much as a person	0	1	2	3
18 (s) I felt that I was rather touchy	0	1	2	3
19 (a) I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat)	0	1	2	3
20 (a) I felt scared without any good reason	0	1	2	3
21 (d) I felt that life was meaningless	0	1	2	3

Recommended cut-off scores for conventional severity labels (normal, moderate, severe) are as follows:

NB Scores on the DASS-21 will need to be multiplied by 2 to calculate the final score.

	Depression	Anxiety	Stress
Normal	0-9	0-7	0-14
Mild	10-13	8-9	15-18
Moderate	14-20	10-14	19-25

Severe	21-27	15-19	26-33
Extremely Severe	28+	20+	34+