



Distinguishing rumination from worry in clinical insomnia[☆]

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ABSTRACT

Research has found that repetitive thought processes, such as worry and rumination, play an important role in several disorders; however, these cognitive processes have not yet been examined in insomnia. This study explores rumination and worry in insomnia by examining: 1) whether those high and low on rumination and worry differ on subjective sleep measures, and 2) whether rumination and worry are distinct processes in insomnia. Participants ($N = 242$) were diagnosed with an insomnia disorder by sleep experts. Participants completed measures of worry and rumination and maintained a 2-week daily sleep log. Results of a multivariate analysis of variance found no main effect of worry; although high and low ruminators differed on several sleep log indices, including sleep efficiency, wakefulness after sleep onset and sleep quality. Factor analysis supported the idea that rumination and worry are separate constructs. Whereas previous research has focused on worry in insomnia, these findings suggest that rumination is important for understanding sleep disturbance. Further, although rumination and worry are both repetitive thought processes, these results indicate that they are distinct processes within insomnia and should be treated as such. The results are discussed with respect to treatment implications for Cognitive Behavioural Therapy for Insomnia.

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“Worrying” about rumination in clinical insomnia

Repetitive thought is an important perpetuating risk factor in psychological models (Segerstrom, Tsao, Alden, & Craske, 2000; Watkins & Teasdale, 2004) that pervades across many disorders (Harvey, Watkins, Mansell, & Shafran, 2004). Much of the repetitive thought literature has focused on depression, anxiety, anger, and general health conditions (Watkins, 2008), but repetitive thought in insomnia is an area that requires further examination. Research suggests that cognitive processes, particularly the phenomena of not being able shut-off or control thoughts (Lichstein & Rosenthal, 1980) as an important maintaining factor in insomnia (Espie, Inglis, Tessier, & Harvey, 2001; Harvey, 2002; Lundh & Broman, 2000). Most models of insomnia acknowledge the role of repetitive thinking throughout the 24-h period in sleep difficulties, although the importance of such thinking in the perpetuation of insomnia varies from model to model (Harvey, 2002). In Harvey's model (2002) negatively-valenced mental activity usually focuses on concerns about not getting enough sleep and whether it will be

possible to function adequately during the day while suffering from daytime symptoms of insomnia, such as fatigue, disturbed mood, or concentration difficulties (Harvey, 2002). Such repetitive thought purportedly fuels further emotional arousal and this cycle perpetuates chronic insomnia. Both rumination (Carney, Edinger, Meyer, Lindman, & Istre, 2006; Thomsen, Mehlsen, Christensen, & Zachariae, 2003) and worry have purported roles in this cycle (Harvey, 2002) but there have been few empirical attempts to clarify how these roles are similar or different.

It has been suggested that even though both rumination and worry may involve a repetitive thought process (Segerstrom et al., 2000; Watkins & Teasdale, 2004), the cognitive content of rumination is on making attributions for disturbed mood and symptoms such as fatigue or concentration difficulties (Nolen-Hoeksema, 1991), whereas worry may be more focused on future, negative consequences of the current mood state (Borkovec, Ray, & Stöber, 1998). In insomnia, we might expect ruminative content to focus on “why” they are feeling fatigued during the day, and look to the past to explain the fatigue (i.e., they would attribute their low mood during the day to the previous night's sleep). However, an individual who is experiencing worry might focus on how their current mood state (e.g., anxiety) might prohibit (future) good sleep later that night, which could lead to (future) fatigue that would interfere with (future) functioning. In both instances, these thoughts could

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perpetuate the associated negative mood states of dysphoria and anxiety respectively and fuel further repetitive thinking; thus increasing arousal and either extending wakefulness (e.g., [Perlis et al., 1997](#)) or interfering with sleep (e.g., [Lundh & Broman, 2000](#)). [Watkins and Teasdale \(2004\)](#) and [Watkins, Moulds, & Mackintosh \(2005\)](#) have highlighted the role of these repetitive thought processes across various disorders; however, insomnia has not been included in this discussion. Although the role of worry has been explored in some depth in the insomnia literature ([Borkovec, Ray, & Stöber, 1998](#); [Hall, Buysse, Reynolds, Kupfer, & Baum, 1996](#); [Gross & Borkovec, 1982](#); [Kales, Caldwell, Soldatos, Bixler, & Kales, 1983](#); [Kales et al., 1984](#); [Watts, Coyle, & East, 1994](#)), rumination has not received the same degree of attention with respect to its role in sleep disturbance. Further compounding this discussion is the tendency for the insomnia literature to group the two processes together, even labelling them “ruminative worry” ([Espie & Lindsay, 1987](#)). Although worry-specific measures (e.g., [Harvey and Greenall, 2003](#)) have been used there are no validated rumination-specific measures used in insomnia. If they are indeed similar processes but with different content, it is possible that differing treatment strategies might be needed for each. Despite the paucity of research, some studies have demonstrated the importance of rumination in sleep quality. In one such study, [Thomsen et al. \(2003\)](#) investigated the relationship between rumination, negative mood and sleep quality in a healthy, analog sample. The authors found a significant association between rumination and subjective sleep quality, suggesting that rumination, like worry, influences sleep quality in poor sleepers.

In another analog investigation, [Carney, Edinger, Meyer, Lindman, and Istre \(2006\)](#) used the Symptom-Focused Rumination Subscale ([Bagby, Rector, Bacchioni, & McBride, 2004](#)) from a validated rumination measure, the Response Styles Questionnaire ([Nolen-Hoeksema & Morrow, 1991](#)) to examine whether good and poor sleepers differ in their tendencies to ruminate on symptoms such as fatigue, disrupted mood, and concentration difficulties. The items on this scale not only describe rumination about depression symptoms, they also describe rumination about common symptoms found in insomnia. Poor sleepers appear to respond to disruptions in their mood by thinking repetitively about the cause of their fatigue, achiness, and concentration difficulties ([Carney et al., 2006](#)). Other studies have supported that there is substantial overlap between depression and the symptoms of insomnia, most notably, nocturnal sleep disturbances, irritability, decreased concentration, and fatigue ([Carney, Ulmer, Edinger, Krystal, & Knauss, 2008](#)). [Carney and colleagues \(2006\)](#) found that after controlling for depression symptoms, rumination was not characteristic of good sleepers but the type of rumination mentioned was prevalent in poor sleepers. In addition to these important findings, this study demonstrates the utility of the Symptom-Focused Rumination Scale in sleep research.

The aforementioned study findings and rumination's purported role in cognitive theory ([Harvey, 2002](#)) suggest that rumination deserves further research exploration. Given that the two main studies have been conducted in non-clinical samples, these findings need to be extended to clinical samples of insomnia. The present study does so by investigating whether rumination, in addition to worry, relates to subjective sleep indices among individuals with clinical insomnia. In addition it is important to consider whether rumination plays a significant and independent role in the maintenance of insomnia. Given the differences between the two constructs with respect to their cognitive content, rumination and worry may be distinct and have independent or dynamic effects on individuals with insomnia.

The present study used a well-characterized clinical insomnia population to examine the relation between rumination and worry

in insomnia. This study extends previous analog investigations ([Carney et al., 2006](#); [Carney & Waters, 2006](#); [Thomsen et al., 2003](#)) by examining a clinical sample of those with insomnia, and comparing the relation of worry and rumination to sleep variables. Specifically, our first goal was to examine whether those high and low on rumination, in addition to worry, differ on sleep indices. To this end, we controlled for anxiety and depression by entering them as factors, which are associated with the mood states of worry and rumination respectively. By controlling for levels of these mood states, we could maintain good generalizability by including those with comorbid psychiatric conditions. Our first hypothesis was that individuals with insomnia who are high on rumination, compared to those low on rumination, will have significantly lower sleep efficiency and sleep quality, and significantly greater sleep onset latency and wakefulness after sleep onset. The second aim of our study was to determine whether rumination and worry are distinct constructs. We factor analyzed the Symptom-Focused Rumination Scale (SYM) and the Penn State Worry Questionnaire (PSWQ), which are validated measures of rumination and worry respectively. Our second hypothesis was that the items on the SYM and PSWQ will comprise separate independent factors.

Method

Participants

Participants included a combination of clinical-referred outpatients interested in insomnia treatment and volunteers for an insomnia study being conducted at two collaborating medical centers with sleep medicine specialty programs (Duke University Medical Center, Durham, NC & Rush Medical Center, Chicago, IL). The study was conducted in the insomnia specialty clinics at both sites. These clinics include physicians and psychologists, who specialize in sleep medicine. Participants included self-referred individuals seeking treatment, and research volunteers recruited via advertisements. Those participants who were eligible were recruited into a larger insomnia National Institute of Mental Health funded diagnostic insomnia parent study ($N = 242$). To meet eligibility, participants were: 1) over the age of 18 years, 2) fluent in the English language, 3) mentally competent to provide informed consent, 4) no self-reported acute psychiatric or medical conditions, 5) not a current inpatient, 6) no sign of significant cognitive impairment (i.e., have a Mini Mental Status Exam score > 24), and 7) not previously evaluated by any of the 6 diagnostic study clinicians at the recruitment site. Those with clinically significant sleep apnea were excluded using the following criteria: 1) Apnea/Hypopnea Index (AHI) > 15 on overnight polysomnography (PSG), or AHI > 5 with an Epworth Sleepiness Scale score > 10 . As a result, 29 participants were excluded. Similarly, to exclude those with Periodic Limb Movement (PLM) Disorder, those individuals with a PLM arousal index > 5 on PSG were also excluded, which resulted in 3 exclusions. Participants with a primary diagnosis of Restless Leg Syndrome or a Circadian Disorder were excluded; no participants fit these criteria. The final sample included 210 participants with insomnia ranging in age from 18 to 83 ($M = 48$, $SD = 15$), and, as is common in insomnia samples, about two thirds (67%) were female. The largest racial/ethnic group was Caucasian (58%), followed by African American (35%). [Table 1](#) provides demographic information for the sample.

Measures

Once enrolled, participants completed several questionnaires including the measures listed below. In addition, study participants completed a 10-page self-report sleep history questionnaire. This

Table 1
Participant characteristics.

	Proportion (%)
Sex	
Male	33%
Female	67%
Ethnicity	
Caucasian	58%
African American	35%
Asian American	3%
American Indian	1%
Other	3%
DSM-IV-TR Insomnia Diagnosis	
Primary Insomnia	60%
Insomnia Related to Another Mental Disorder	33%
Insomnia Due to a General Medical Condition	7%
DSM-IV-TR Axis I Comorbidities	
Major Depressive Disorder	17%
Anxiety Disorders	9%
Substance Use	4%
Other	7%
None	62%
	Mean (SD)
Self Report Measures	
Beck Anxiety Inventory	11.14 (8.67)
Beck Depression Inventory 2nd Edition	15.38 (10.36)
Symptom Focused Rumination Scale	17.19 (5.60)
Penn State Worry Questionnaire	44.66 (18.84)
Sleep Log Indices	
Sleep Efficiency	73.90 (12.18)
Sleep Quality	5.09 (1.41)
Sleep Onset Latency	50.56 (36.84)
Wakefulness after Sleep Onset	32.40 (24.40)

questionnaire queries: demographics, current and past sleep complaints, medical and psychiatric history, and previous treatment history. After the intake interview appointment data were collected (i.e., the questionnaire battery and the Sleep History Questionnaire), all participants completed two weeks of prospective sleep diaries at home.

Beck Anxiety Inventory (BAI: Beck & Steer, 1993)

The BAI is comprised of 21 questions regarding how the individual has been feeling in terms of common symptoms of anxiety in the past week. The BAI is designed to distinguish anxiety symptoms from depressive symptoms based on symptoms recently experienced, including numbness, hot and cold sweats, or feelings of dread. The BAI demonstrates high internal reliability and good factorial and discriminant validity (Kabacoff, Segal, Hersen, Van Hasselt, 1997) although the psychometric properties in clinical insomnia populations have not been adequately examined as yet.

Beck Depression Inventory, Second Edition (BDI-II: Beck, Steer, & Brown, 1996)

The BDI-II is a 21-item self-report measure that assesses common depressive symptoms, such as depressed mood, hopelessness, suicidal ideation, sleep disturbance, and appetite change. The recommended scoring guidelines are as follows: scores of 0–13 indicate no minimal depression, scores of 14–19 indicate mild depression, scores of 20–28 indicate moderate depression, and scores of 29 or above indicate severe depression (Beck et al., 1996). The BDI-II has very good internal consistency (split half Pearson = .93). It also has well-established content validity and is good at differentiating between depressed and non-depressed individuals (Beck et al., 1996; Richter et al., 1998). The BDI-II has been used and validated in insomnia patients (Carney et al. 2008).

Penn State Worry Questionnaire-Past Week (PSWQ-PW: Stöber & Bittencourt, 1998)

The PSWQ-PW is an adaptation of the original PSWQ (Meyer, Miller, Metzger, & Borkovec, 1990), which is one of the most common tools used to assess pathological worry. The PSWQ-PW contains 15 items that assess state-dependent worry. The instructions ask participants to refer to “the past week” and the items are phrased in past-tense. The PSWQ-PW has very good internal consistency (Cronbach’s alpha = .91) as well as substantial covariance with the past-week Worry Domain Questionnaire (Stöber & Bittencourt, 1998). The PSWQ-PW has not yet been examined specifically in insomnia research.

Symptom-focused Rumination Scale (SYM)

Rumination is measured by the symptom-focused rumination subscale of the Rumination Style Questionnaire (Nolen-Hoeksema & Morrow, 1991). The SYM is made up of eight items that assess the tendency to think about symptoms such as, “Think about how hard it is to concentrate”, or “Think about your feelings of fatigue and achiness”. We changed the period to the PAST WEEK to match the period of the PSWQ-PW. As previously mentioned, the SYM is the only measure of rumination that has been able to effectively distinguish good and poor sleepers, and this finding provides the rationale for using this scale in the present study (Carney et al., 2006). Internal consistency estimates of the SYM are highly acceptable (Bagby, Rector, Bacchiochi, & McBride, 2004), and these estimates are similarly high in poor sleepers (Carney et al., 2006).

Sleep logs

Subjective sleep estimates were acquired using hand-held computers, programmed to record this information. The electronic log consisted of a Palm Pilot®-style personal data assistant (PDA) with a program that routinely collects subjective sleep data. The program uses Satellite Forms software (©Thacker Network Technologies, Inc, Lacombe, Alberta), and requires participants to divulge information regarding each night’s bedtime, sleep onset latency, number and length of nocturnal awakenings, time of final awaking, and rising time. The program also requested participant ratings (on a 10-point scale) of the quality of each night’s sleep and how rested they felt upon waking. This information was recorded daily upon waking, over a two-week pre-interview assessment period of the study. Derived from these sleep logs were estimates of total sleep time (TST), sleep onset latency (SOL), time spent awake after initially falling asleep but excluding time between the final awakening and rise time or “wakefulness after sleep onset” (WASO), the percentage of time in bed spent sleeping or “sleep efficiency” (SE), a 10-point Likert-scale rating of sleep quality and a 10-point Likert-scale rating of how rested the respondent felt upon awakening ratings. Such indices are common subjective sleep indices recommended in a recent published position paper on insomnia research measures (Buysse, Ancoli-Israel, Edinger, Lichstein, & Morin, 2006).

Diagnostic interviews

The objective of the parent study was to evaluate the reliability of insomnia diagnoses, so there were pairs of assessors that provided diagnoses for each participant. Six sleep clinicians at each study site were paired to form three clinician dyads that were randomly assigned to one of three different assessment methods. Each dyad had differing amount of information available to them. The first dyad used a semi-structured interview; the Duke Structured Interview for Sleep Disorders (DSISD) (Edinger et al., 2004, 2009) to query diagnostic DSM-IV-TR criteria for sleep disorders. The second dyad employed an unstructured clinical interview along with the patients’ sleep history questionnaire and summary

statistics from the 2-week sleep diaries. The third dyad had the most amount of information, which included summary statistics from the two nights of PSG, an unstructured clinical interview, sleep history questionnaire and summary statistics from the 2-week sleep diaries. Immediately after the interview with each participant, the clinicians used electronic diagnostic rating forms to assign insomnia diagnoses on a programmed PDA computer. Clinicians rated each DSM-IV-TR diagnosis on a 100-point visual analogue scale (VAS) labelled “doesn’t fit at all” at its left extreme and “fits extremely well” at its right extreme. Clinicians were instructed to consider each sleep disorder diagnosis separately and rate how well that diagnosis “fit” the study participant in question.

Procedure

All study procedures were reviewed and approved by the institutional review boards of the two collaborating study sites. Participants provided informed consent including signing consent forms prior to enrolling in the study. Participants contacted the Project Coordinator by telephone and were asked whether they had difficulty sleeping over the phone. If they complained of poor sleep they were scheduled for an in-lab interview with the Project Coordinator which included the Structured Clinical Interview for DSM-IV Axis I Disordered (SCID) (Spitzer, Williams, Gibbons, & First, 1996). The SCID was used to evaluate the presence/absence of Axis I disorders. Participants then completed a self-report survey test battery and the Sleep History Questionnaire. They were scheduled for two consecutive nights of PSG and asked to complete two weeks of sleep diaries. Once the sleep history questionnaire, two weeks of sleep diary monitoring and the PSGs were completed, each participant was randomly assigned and scheduled to see one of the three possible clinician dyads. Thus, each participant was assessed by the three different methods (structured interview, unstructured interview plus sleep logs, and unstructured interview, sleep logs plus PSG) and by each one of the three clinician dyads. All participants were assigned DSM-IV-TR diagnoses by the three dyads of clinicians at each site and the highest mean rated DSM-IV-TR sleep disorder diagnosis was retained as the primary diagnosis. Only those with an insomnia diagnosis were selected for analysis in this study.

Analyses

Two-by-two multivariate analyses of variance (MANOVA) and follow up analyses of variance (ANOVA) were used to determine whether those high and low on rumination and worry differed on subjective sleep measures. We controlled for the specific effects due to depression and anxiety by entering them as a factor and examining whether they had significant interactions with rumination and worry respectively, in each MANOVA. Given there are no published clinical cut-offs for the SYM, a median split of 17 was used to establish a factor of high and low ruminators. Established clinical cut-off scores of 17 (Beck, Steer, & Brown, 1996), 45 (Behar, Alcaine, Zuellig, & Borkovec, 2003) and 16 (Beck, Epstein, Brown, & Steer, 1988) were used to determine whether individuals were high and low on the BDI, PSWQ and BAI respectively. Importantly, this is the first study which examines these group differences in a clinical sample of insomnia. To determine whether rumination and worry are distinct constructs in a clinical insomnia sample, an exploratory factor analyses was conducted using the items of the SYM and the PSWQ.

Results

Mean scores on sleep variables and self-report measures are displayed in Table 2. An inspection of the values of the mean scores

Table 2
Means and standard deviations for scores on sleep log indices.

Sleep Log Indices	Rumination		Worry	
	High (n = 114)	Low (n = 96)	High (n = 111)	Low (n = 100)
SE	72.38 (12.81)	75.82 (11.14)	73.54 (12.49)	74.23 (11.92)
SQ	4.80 (1.42)	5.42 (1.33)	4.94 (1.39)	5.24 (1.43)
SOL	53.12 (36.45)	46.81 (36.00)	53.63 (37.72)	47.46 (35.80)
WASO	82.60 (51.19)	69.54 (39.03)	74.30 (44.90)	79.01 (48.00)

Note: SE = Sleep Efficiency, SQ = Sleep Quality, SOL = Sleep Onset Latency, WASO = Wakefulness after Sleep Onset.

suggests that the distributions were approximately normal and the skewness and kurtosis values were within the normal range (West, Finch, & Curran, 1995). The Cronbach’s alpha values for each psychological measure were: SYM (.86); PSWQ (.84); BAI (.89); and BDI (.90).

The results of the first MANOVA revealed a main effect of rumination, $F(4, 203) = 2.54, p = .041$. Follow up ANOVAs examined group differences on Sleep Efficiency (SE), Sleep Quality (SQ), Sleep Onset Latency (SOL) and Wakefulness after Sleep Onset (WASO). The results revealed that those high on rumination – HIGH RUM had significantly lower SE than those low on rumination – LOW RUM, $F(1, 206) = 4.29, p = .040, \eta^2 = .020$. In addition, HIGH RUM had significantly worse SQ than LOW RUM, $F(1, 206) = 7.53, p = .007, \eta^2 = .035$. HIGH RUM ($M = 82.60, SD = 51.19$) were also found to have significantly higher rates of WASO than LOW RUM, $F(1, 206) = 4.62, p = .033, \eta^2 = .022$. No significant differences were found for ruminator status on SOL, $F(1, 206) = .963, p = .335$. There was no main effect of depression, $F(4, 203) = .244, p = .913$, nor was there an interaction between rumination and depression, $F(4, 203) = .552, p = .698$.

The second MANOVA indicated that there was no main effect of worry, $F(4, 204) = .761, p = .552$, anxiety, $F(4, 204) = .270, p = .897$, nor was there a significant interaction between them, $F(4, 204) = .170, p = .152$.

The aim of the final set of analyses was to determine whether the two constructs, worry and rumination, are related or distinct. Thus we conducted: 1) a simple Pearson’s Product Moment Correlation between the PSWQ and the SYM ($r = .56, p < .001$), and then 2) an exploratory factor analysis of the SYM and PSWQ items. The factor analysis revealed a three-factor solution, as can be seen in Table 3. The three factors together explain 57% of the total variance and all of the Eigenvalues were > 1 . The varimax rotated factor matrix was obtained using the maximum likelihood extraction method. The first factor explained 30.53% of the variance and contains the PSWQ high worry items, which load exclusively on this factor. The second factor, which accounted for 17.06% of the variance, contains the rumination items from the SYM. The third factor, accounting for 9.45% of the variance, consists exclusively of the reversed-scored items on the PSWQ (i.e. the absence of worry items).

Discussion

This is the first study in a clinical sample with a validated rumination questionnaire to show that rumination is significantly related to insomnia. Such a finding is in accordance with the previous analog studies of Thomsen et al. (2003) and Carney et al. (2006). Rumination appears to relate to prospective appraisals of sleep quality as well as sleep continuity indices of sleep (i.e., the efficiency of sleep and the time spent awake after sleep onset). It could be that the presence of rumination is arousing and thus causes sleep disruption, or alternatively the daytime symptoms

Table 3
Factor loadings of the SYM and PSWQ items for a rotated (varimax) factor solution.

	“Rumination”	“Worry”	“Absence of worry”
<i>SYM Items</i>			
Think “I won’t be able to do my work/job because I feel so bad” (SYM1)	.61	.28	–.04
Think about your feelings of fatigue and achiness (SYM2)	.63	.18	.00
Think about how hard it is to concentrate (SYM3)	.65	.26	–.03
Think about how unmotivated and passive you feel (SYM4)	.70	.35	.02
Think about how you don’t seem to feel anything anymore (SYM5)	.55	.29	.08
Think “why can’t I get going?” (SYM6)	.65	.28	.13
Think about how sad you feel (SYM7)	.52	.44	–.00
Think about how you don’t feel up to doing anything (SYM8)	.71	.10	.09
<i>PSWQ Items</i>			
My worries overwhelmed me (PSWQ2)	.24	.77	–.06
Many situations made me worry (PSWQ4)	.20	.83	.00
I knew I shouldn’t have worried about things but I just couldn’t help it (PSWQ5)	.28	.83	.03
When I was under pressure I worried a lot (PSWQ6)	.19	.82	.10
I was always worrying about something (PSWQ7)	.31	.85	–.04
As soon as I finished one task, I started to worry about everything else I had to do (PSWQ9)	.24	.76	.01
I noticed that I had been worrying about things (PSWQ12)	.32	.79	–.01
Once I started worrying I couldn’t stop (PSWQ13)	.36	.77	–.04
I worried all the time (PSWQ14)	.30	.83	.02
I worried about projects until they were done (PSWQ15)	.23	.71	.09
If I didn’t have enough time to do everything, I didn’t worry about it (PSWQ1)	.05	.10	.55
I didn’t tend to worry about things (PSWQ3)	.00	–.01	.51
I found it easy to dismiss worrisome thoughts (PSWQ8)	–.02	–.08	.73
I did not worry about anything (PSWQ10)	.10	.07	.64
When there was nothing to be done about a concern, I didn’t worry about it anymore (PSWQ11)	.01	–.05	.79

Note: Factor loadings > .50 are in bold.

caused by sleep disruption may be the impetus for increased rumination about the cause of the symptoms. Of course, it is possible that a predisposition towards arousal might cause all of these phenomena which bear no impact on each other. Any of these scenarios could occur in those with insomnia.

This study also replicates Carney et al.’s (2006) finding that rumination is not simply accounted for by elevations in potentially related mood states, and is thus, not mere depressive rumination. Rumination is conceptualized as a cognitive response to a mood state (e.g., dysphoria), and is a process that commonly occurs in the context of depression. In the current study we statistically controlled for levels of depression so we could determine the role of rumination on sleep disturbance independent of its role in depressed mood states. Our findings showed no rumination by depression interaction suggesting that rumination plays a role in insomnia that is not dependent on the presence of depression. The absence of a main effect for dysphoria means that those with insomnia and increased depression symptoms did not differ on sleep diary estimates from those with insomnia and low depression symptoms; a finding reported elsewhere (Kohn & Espie, 2005). Lastly, the internal consistency of the rumination measure was high, thus supporting the notion that this instrument may be a reliable measure for use in clinical insomnia groups. Internal consistency was high in the other measures too (e.g., the PSWQ, BAI and BDI-II) suggesting that these measures have acceptable reliability when used with clinical insomnia groups.

This is the first study in a clinical insomnia population that examined rumination in relation to worry. The factor analysis results support the idea that although rumination and worry are significantly correlated (perhaps because of their shared repetitive thought process), they are distinct in content. One surprising finding was that although those high and low on rumination differed on several sleep log indices, there was no main effect of worry on sleep. We say this is surprising because previous research has focused almost exclusively on the role of worry in insomnia, when it appears that rumination is as, if not more, important for eliciting sleep difficulties. One provocative possibility is that previous measures have been capturing rumination rather than

worry and we have misattributing sleep difficulties to worry rather than rumination. However, perhaps a more likely explanation is that a general worry measure like the Penn State Worry Questionnaire may be too broad to capture worries that are pertinent to sleep. Future studies could test this hypothesis by employing sleep-specific worry questionnaires and their relation to sleep indices.

Although these results may best be regarded as preliminary, this study enrolled a large and well-characterized clinical sample, so it may be appropriate to consider potential implications of the results. The current standard treatment for insomnia, Cognitive Behavioral Therapy (CBT) for Insomnia (Morin, Culbert, & Schwartz, 1994; Murtagh & Greenwood, 1995), arguably contains worry-targeted adjuncts (Carney & Waters, 2006; Harvey, Tang, & Browning, 2005); however, there are no rumination-specific strategies incorporated into this intervention. We might assume that those treated with cognitive therapy may learn to become less ruminative through cognitive training to observe, record, and challenge thoughts; however, it is unknown as to what extent this actually occurs (Beck, Rush, Shaw, & Emery, 1979; Ingram & Hollon, 1986), and this has never been evaluated in CBT for insomnia.

Perhaps the addition of rumination strategies into CBT for insomnia could improve our outcomes. Although CBT is an effective strategy, there is room for improvement with respect to the extent to which those who undergo such therapy actually become good sleepers. Mindfulness-based cognitive therapy (MBCT) was developed to address rumination (Carney & Segal, 2005); perhaps MBCT or some other rumination-targeting strategy, could be helpful in insomnia. There are current studies of the application of mindfulness to insomnia (Ong, Shapiro, & Manber, 2008, 2009) and these and other studies could test whether incorporating rumination management into CBT for insomnia can improve outcomes. In addition, because both insomnia and rumination are critical risk factors for the development of depression, addressing rumination in an insomnia treatment could potentially help prevent depression as well.

Despite the potentially exciting implications of this study for future research, this study should also be considered within the context of its limitations. One limitation is the low effect size observed for the statistically significant findings. Additionally, data

were unavailable for the medication status or the presence of comorbid medical conditions, so it is unknown as to whether this could have been an important factor. Those with acute medical conditions were excluded but those with less significant medical conditions were permitted in the study; the diagnosis of insomnia related to a general medical condition was the least common diagnosis in the sample (only 14 participants). As inspection of the Sleep Log means suggests that sleep onset may have been a more prominent feature than wakefulness after sleep onset. Future studies could evaluate whether worry might be a more important factor in those with sleep onset insomnia and less of an issue of maintenance insomnias. On a related issue, we only assessed one sleep-related index—the sleep log. While the sleep log may be considered a gold standard of insomnia assessment (Buysse et al., 2006), it may be interesting to assess whether there are differences on objective sleep measures such as those measured by polysomnography or actigraphy. Another limitation relates to the cross-sectional design, in that we can only say that rumination is associated with sleep disturbance but we are unable to establishing any causal links between rumination and insomnia. Future longitudinal studies could test for possible cause and effect relationships between sleep and symptom-focused rumination.

These limitations notwithstanding, we now have confirmation that rumination is associated with sleep disturbance in those with clinical insomnia and such difficulties are not accounted for by worry or dysphoria. This observation is consistent with cognitive models that posit a role for both rumination and worry (Harvey, 2002), but until now we did not have empirical confirmation. In findings that parallel other disorders (e.g., Harvey et al., 2004), rumination and worry have distinct content, albeit they likely share cognitive processes (i.e., repetitive thinking). Hopefully, future studies will test rumination's role in risk models and in treatment studies, in an attempt to improve insomnia outcomes.

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