

# Presleep Cognitive Activity and Thought Control Strategies in Insomnia

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The aim of this study was to examine presleep cognitive activity and thought control strategies used by individuals with insomnia, with and without comorbid generalized anxiety disorder (GAD), and by good sleepers. Fifty participants were divided into the following comparison groups: (a) individuals with insomnia alone ( $n = 14$ ), (b) individuals with insomnia and comorbid GAD ( $n = 16$ ), and (c) good sleepers ( $n = 20$ ). Participants completed a standardized evaluation including interviews and questionnaires on insomnia, anxiety, presleep cognitive activity, and thought control strategies. Results showed that individuals with insomnia and comorbid GAD reported greater presleep cognitive arousal than individuals with insomnia alone, who in turn reported greater cognitive arousal than good sleepers. Results also showed that individuals with insomnia and comorbid GAD used avoidance as a mean of controlling disturbing presleep cognitions more frequently than the other two-groups. Both groups of individuals with insomnia evaluated their presleep thought control strategies as being less effective than good sleepers did. These results support the assertion that higher presleep cognitive arousal plays a role in insomnia and, by distinguishing individuals with insomnia alone (i. e., without comorbid anxiety disorders) from individuals with comorbid GAD, this study further suggests that higher cognitive arousal in individuals with insomnia is not necessarily accounted for by high rates of comorbidity between insomnia and GAD. The main clinical implication of these findings is that the evaluation and treatment of insomnia should consider these cognitive features in order to optimize outcome.

**Keywords:** Insomnia; cognitive arousal; thought control strategies; avoidance

Cognitive activity has been hypothesized to play an important role in the development and maintenance of insomnia (Borkovec, 1982; Harvey, 2002; Morin, 1993). Experimental manipulations of presleep cognitive activity have shown that higher levels of cognitive activity increase sleep-onset latency in otherwise good sleepers (Ansfield, Wegner, & Bowser, 1996; Gross & Borkovec, 1982; Haynes, Adams, & Franzen, 1981; Tang & Harvey, 2004).

Furthermore, individuals with insomnia are more likely to attribute their sleep difficulties to presleep activities involving greater cognitive arousal, such as planning and reappraisal, than to somatic factors such as sweating and palpitations (Lichstein & Rosenthal, 1980). Individuals with insomnia also tend to evaluate their cognitions as more intrusive, unpleasant, negative, worrisome and hard to dismiss, than good sleepers do (Borkovec, Lane, & VanOot, 1981; Harvey, 2000; 2001; Kuisk, Bertelson, & Walsh, 1989).

Studies on thought control strategies conducted with nonclinical samples have suggested that avoidance was one of the most frequently used coping strategies to eliminate intrusive thoughts (Freeston, Ladouceur, Provencher, & Blais, 1995; Freeston, Ladouceur, Thibodeau, & Gagnon, 1991). Although it produces an immediate relief, avoidance remains an ineffective and maladaptive long-term strategy compared to problem-solving strategies (Suls & Fletcher, 1985). A number of studies have shown that trying to eliminate thoughts from consciousness may paradoxically increase the frequency of these thoughts during the suppression period (enhancement effect; Trinder & Salkovskis, 1994), or after the attempts to suppress (rebound effect; Clark, Ball, & Pape, 1991; Wegner, 1989), and tend to make them even more intrusive. In many instances, worry and anxiety have been shown to increase intrusive thoughts (Freeston, Dugas, & Ladouceur, 1996; York, Borkovec, Vasey, & Stern, 1987).

Individuals with anxiety disorders are known to have more intrusive thoughts (not necessarily at bedtime) and more difficulty coping with them than nonanxious individuals (Borkovec, Shadic, & Hopkins, 1991; York et al., 1987). Studies on thought control strategies conducted among individuals with anxiety disorders have shown that avoidance, as a means of controlling disturbing thoughts, is typically used by individuals with higher anxiety levels, whereas less anxious individuals use problem-oriented strategies more often (Borkovec & Lyonfields, 1993; Genest, Dudley, & Keegan, 1990). According to the latter authors, avoidance is especially used by individuals with GAD.

Evidence suggests that individuals with insomnia use suppression (avoidance), worry, reappraisal, and punishment strategies to control intrusive thoughts more often than good sleepers do (Hall et al., 1997; Harvey, 2001, 2003) and that these strategies are associated with poor quality sleep, dysfunction, anxiety, depression, and cognitive interference (Hall et al., 1997; Harvey, 2003). It has been reported that individuals with insomnia feel less in control of their thinking and are more inclined to purposefully try to control their intrusive thoughts compared to good sleepers (Harvey, 2000). Moreover, a higher frequency of intrusive thoughts and avoidance behaviors was also shown to be related to longer sleep-onset latency and to lighter sleep as assessed by polysomnography (Hall et al., 1997). This relationship was also observed in an experimental manipulation of bedtime thoughts suppression, where both normal sleepers and individuals with insomnia reported longer sleep latency and poorer sleep quality when given explicit suppression instructions (Harvey, 2003).

A methodological shortcoming of the research reviewed on the effects of cognitive activity and avoidance on sleep is that insomnia has not been distinguished from GAD in the samples employed. As insomnia is known to be frequently comorbid with GAD (Bélanger, Morin, Langlois, & Ladouceur, 2004; Hoehn-Saric, 1981; Mellinger, Balter & Uhlenhuth, 1985), a question this study sought to answer was whether worry and managing worry with avoidance is characteristic of insomnia in the absence of GAD or are the results reviewed accounted for by high rates of comorbidity between insomnia and GAD. Furthermore, despite some similarities among individuals with insomnia and those with anxiety, there is little comparative information on presleep cognitive activity and thought control strategies, and on the perceived efficacy of the thought control strategies, among individuals with insomnia alone and among those with coexisting anxiety disorders.

Accordingly, the aim of the present study was to assess presleep cognitive arousal and the use of thought control strategies and perceived strategy efficacy in individuals with chronic insom-

nia alone, individuals with comorbid insomnia and GAD, and good sleepers. A first hypothesis was that individuals with comorbid insomnia and GAD (insomnia + GAD group) would present higher cognitive arousal at bedtime than individuals with chronic insomnia alone (insomnia alone group) who, in turn, would present higher cognitive arousal than good sleepers. A second hypothesis was that the insomnia + GAD group would use avoidance strategies to manage bedtime intrusive thoughts more frequently than individuals with insomnia alone, who would use these strategies more frequently than good sleepers.

## METHOD

### Participants

Participants were 50 adults (33 women and 17 men), their mean age was 43.7 years ( $SD = 12.56$ ), many were married (52%) and employed full-time (44%). Their average education level was 14.51 years ( $SD = 3.22$ ). All participants were recruited through newspaper adverts in the Quebec metropolitan area. Inclusion criteria were (a) aged between 18 and 65 years old, (b) not using any psychotropic medication, (c) not meeting criteria for any DSM-IV disorder (other than GAD) that was the primary cause of sleep disturbances, and (d) not receiving psychological treatment. Individuals with insomnia had to meet the criteria of the *Diagnostic and Statistical Manual of Mental Disorders*, 4th ed. (DSM-IV; American Psychiatric Association, 1994) but also present difficulties initiating or maintaining sleep greater than 30 minutes long and a sleep efficiency below 85% as reported on a 2-week baseline sleep diary assessment, both for 3 or more nights per week.

In addition, insomnia severity had to be of at least 4 on a 9-point Likert-type scale ranging from 0 (not at all/never) to 8 (very severe/all the time); severity was determined by the clinician conducting the Insomnia Interview Schedule (IIS; Morin, 1993). Individuals with insomnia and GAD had to meet both criteria for insomnia and DSM-IV criteria for GAD. A clinical interview was used to assess the presence of GAD and other psychopathologies. A score of at least 4 on the ADIS-IV severity scale, ranging from 0 (not at all/never) to 8 (very severe/all the time), was required to include the person in the study. Thirty individuals meeting criteria for insomnia were selected and were divided into two groups based on the presence (insomnia + GAD group;  $n = 16$ ) or absence of coexisting GAD (insomnia alone group;  $n = 14$ ). To be included in the good sleepers group, potential participants had to report no sleep difficulties and were required to have an average sleep efficiency greater than 85% on a 2-week baseline sleep diary assessment.

### Measures

The Insomnia Interview Schedule (IIS; Morin, 1993) is a semistructured interview designed to obtain a sleep history, screen for other sleep disorders, and gauge the relative contribution of psychological, behavioral, environmental, and medical factors to the sleep difficulties. It also provides guidelines for conducting a functional analysis investigating antecedents, consequences, secondary gains, as well as precipitating and perpetuating factors of insomnia.

The Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV; Brown, Di Nardo, Lehman & Campbell, 2001) is a structured interview designed to screen for anxiety disorders. It also assesses mood, somatoform and psychotic disorders, as well as substance/alcohol abuse and/or dependence according to the DSM-IV's diagnostic criteria.

A Sleep Diary (Morin, 1993) was used to obtain information on daytime napping, medication intake, bedtime, sleep-onset latency, frequency of nocturnal awakenings, duration of awakenings, wake-up time, rising time, feeling upon rising (5-point scale), and sleep quality (5-point scale). Participants were instructed to complete their diary on a daily basis upon rising in the

morning. The sleep diary is a practical and economical tool and is a widely used measure in insomnia research. In this study, a sleep diary was completed for a 2-week baseline period in order to decrease reactivity effects and provide a more valid index of insomnia. Variables retained from the diaries were total wake time (TWT), total sleep time (TST), and sleep efficiency (SE). TWT was defined as the summation of the time spent awake (sleep-onset latency and duration of all awakenings including early-morning awakenings). TST was computed by subtracting TWT from time spent in bed. SE was obtained by dividing TST by time spent in bed, then multiplying by 100.

The Insomnia Severity Index (ISI; Morin, 1993) is a seven-item questionnaire that yields a quantitative index of sleep impairment. Participants rated the following items on a 5-point Likert-type scale ranging from 0 (not at all) to 4 (extremely): (a) severity of insomnia (initial, middle, late); (b) satisfaction with current sleep patterns; (c) interference with daytime functioning; (d) noticeability of impairment to significant others; and (e) level of distress caused by the sleep problem. These subjective ratings provide valuable information on the patient's perception of sleep difficulties. Total scores range from 0 to 28, where higher scores indicate higher perceived insomnia severity. The French version shows good internal consistency ( $\alpha = .88$ ) and adequate test-retest reliability for a 2-week interval ( $r = .65$ ; Blais, Gendron, Mimeault, & Morin, 1997).

The Pre-Sleep Arousal Scale (PSAS; Nicassio, Mendlowitz, Fussell, & Petras, 1985) is a 16-item questionnaire which assesses the intensity of presleep cognitive and somatic arousal. Participants rated on a 4-point scale how intensely they generally experienced each symptom at bedtime. Scores of the two subscales (cognitive & somatic), ranging from 8 to 40, are computed separately by summing across cognitive and somatic arousal items. The PSAS is a helpful screening measure to discriminate poor from good sleepers. Cronbach coefficients vary between .67 and .88 while test-retest correlations for the two subscales are of .72 and .76 respectively. Only the scores on the cognitive subscale were used in the present study.

The Cognitive Avoidance Questionnaire (CAQ; Langlois et al., 1996) is a 41-item questionnaire which assesses frequency of use of different types of avoidance strategies. Participants evaluated their reactions to different thoughts on a 6-point scale ranging from 1 (not at all typical of me) to 5 (very typical of me). It was shown to have good internal consistency ( $\alpha = .96$ ) and satisfactory validity.

The Intrusive Thoughts Questionnaire (ITQ; Freeston et al., 1991) was used to identify a target intrusive thought at bedtime. Participants were asked to describe a specific thought that came frequently to mind at bedtime, possibly disturbing their sleep at night. Although the ITQ contains many items aimed at assessing different features of intrusive thoughts, its main purpose is to identify a specific thought to be targeted for the structured neutralizing interview.

The Structured Neutralizing Interview (SNI; Freeston et al., 1995) examined the repertoire of strategies used by each participant to cope with the thought identified on the ITQ. Using this technique, rigorous questioning is undertaken to identify all the strategies used. Each strategy is then analyzed and rated with regard to the perceived efficacy of the strategy using a 5-point scale ranging from 0 (not at all effective) to 4 (extremely effective). The strategies were further divided into six main categories: (a) avoidance, (b) continuous attention, (c) talk about, (d) minimal attention, (e) nonoriented action on the thought, and (f) various. Interrater reliability was calculated on 15% of the strategies identified during the interview and during classification. The interview was performed by a skilled experimenter and the interrater task by a graduate psychology student trained with the SNI.

## Procedures

Following a telephone screening interview, potential participants were scheduled for the ADIS-IV interview. Upon arriving, they signed a consent form, filled a demographic questionnaire, and completed the ADIS-IV interview. They were then provided with a copy of the ISI and a sleep

diary to fill out daily at home. They were scheduled for a second interview one week later. During this second visit, they underwent the IIS and returned the completed questionnaires and sleep diary. Participants who still met the inclusion criteria were asked to fill out the PSAS, the CAQ and another sleep diary during the upcoming week. On the third assessment visit, participants returned their completed questionnaires, filled out the ITQ, and underwent the Structured Neutralizing Interview. Participants completed daily sleep diaries for an additional 2 weeks after this last interview.

## RESULTS

Mean severity of sleep difficulties on the IIS was 5.6 ( $SD = 0.75$ ) for the insomnia alone group, 5.6 ( $SD = 0.93$ ) for the insomnia + GAD group, and 0 for the good sleepers group. GAD's mean severity (for the insomnia + GAD group) was 5.9 ( $SD = 0.81$ ) as assessed by the ADIS-IV severity scale.

No baseline between-group difference was observed for age, level of education, or gender.

### Sleep variables

Group means and standard deviations for sleep variables are presented in Table 1. A MANOVA was performed on the sleep parameters, which yielded significant group effects on the sleep diary variables (SE, TWT, TST), and on the ISI ( $F(8, 86) = 21.03, p < .0001$ ). Subsequent ANOVAs yielded significant between group differences for SE ( $F(2, 46) = 42.91, p < .0001$ ), TWT ( $F(2, 46) = 42.17, p < .0001$ ), TST ( $F(2, 46) = 25.17, p < .0001$ ), and ISI scores ( $F(2, 46) = 140.92, p < .0001$ ). Post hoc Scheffé tests (correcting for unequal number of participants in each group) showed that both groups of individuals with insomnia, as expected, reported more severe sleep difficulties than good sleepers ( $p < .05$ ). No significant difference was observed between the insomnia alone and the insomnia + GAD groups on any of the sleep parameters.

### Cognitive Arousal

Group means and standard deviations for the PSAS cognitive subscale are presented in Table 2. A significant between-group difference was observed ( $F(2,46) = 48.78, p < .0001$ ). Scheffé post hoc tests indicated that the insomnia + GAD group reported higher presleep cognitive arousal than the insomnia alone group ( $p < .05$ ) and this latter group reported higher presleep cognitive arousal than the good sleepers group ( $p < .05$ ).

**TABLE 1. GROUP MEANS AND STANDARD DEVIATIONS FOR THE SLEEP VARIABLES.**

Sleep Variable	Groups		
	INS Alone ( $n = 14$ )	INS + GAD ( $n = 16$ )	GS ( $n = 20$ )
Insomnia severity			
ISI scores	19.3 <sub>a</sub> (4.0)	19.3 <sub>a</sub> (3.4)	2.6 <sub>b</sub> (3.0)
Sleep diary data			
SE (%)	63.6 <sub>a</sub> (11.4)	67.2 <sub>a</sub> (16.7)	93.8 <sub>b</sub> (3.3)
TWT (minutes)	182.5 <sub>a</sub> (57.7)	159.6 <sub>a</sub> (79.9)	34.5 <sub>b</sub> (19.2)
TST (minutes)	361.3 <sub>a</sub> (176.0)	326.1 <sub>a</sub> (88.0)	457.9 <sub>b</sub> (58.9)

*Note.* Presence of different letters in the same row indicates a significant difference between the groups,  $p < .05$ . GS = good sleepers; INS alone = individuals with insomnia; INS + GAD = individuals with comorbid insomnia and generalized anxiety disorder; ISI = Insomnia Severity Index; SE = sleep efficiency; TWT = total wake time; TST = total sleep time.

**TABLE 2. GROUP MEANS AND STANDARD DEVIATIONS FOR COGNITIVE AROUSAL AND AVOIDANCE SCALES.**

Variable	Groups		
	INS Alone ( $n = 14$ )	INS + GAD ( $n = 16$ )	GS ( $n = 20$ )
Cognitive arousal			
PSAS (cognitive subscale)	19.4 <sub>a</sub> (6.9)	24.9 <sub>b</sub> (5.3)	9.2 <sub>c</sub> (1.5)
Avoidance			
CAQ score	71.7 (22.7)	93.2 <sub>a</sub> (28.8)	66.4 (23.2)
Number of strategies (reported on the SNI)	4.2 (2.5)	4.6 (2.6)	2.95 (1.8)

*Note.* Presence of different letters in the same row indicates a significant difference between groups,  $p < .05$ . GS = good sleepers; INS alone = individuals with insomnia only; INS + GAD = individuals with comorbid insomnia and generalized anxiety disorder; PSAS = Pre-sleep Arousal Scale; CAQ = Cognitive Avoidance Questionnaire; SNI = Structured Neutralizing Interview.

### Thought Control Strategies

**Avoidance.** Number of avoidance strategies used was assessed using the SNI data and the CAQ scores. Group means and standard deviations are presented in Table 2. No significant between-group difference was observed regarding the number of avoidance strategies reported on the SNI. A significant between-group difference was observed for the CAQ scores ( $F(2, 46) = 5.29$ ,  $p < .01$ ). Scheffé post hoc tests showed that the insomnia + GAD group used avoidance as a coping strategy more frequently than the good sleepers group ( $p < .05$ ). No other significant difference was observed on this variable.

**Structured Neutralizing Interview.** Table 3 presents a list of the strategies used to neutralize intrusive thoughts most frequently reported by this sample. Interrater reliability was 86% for the strategies reported during the interview and 85% for categorization of these strategies. Some strategies were more frequently reported across the whole sample. The strategies most frequently reported, defined as those that were used by at least half of the sample and which represented at least 80% of all strategies reported by participants were: (a) physical action, (b) talking about, (c) trying to convince oneself that the thought is unimportant, (d) thought replacement, (e) thought-stopping, and (f) doing nothing. Participants reported using between 2 and 14 strategies ( $M = 8.7$ ,  $SD = 3.06$ ). The good sleepers group reported using a mean of 7.6 strategies ( $SD = 3.15$ ), the insomnia alone group reported 9.0 ( $SD = 3.06$ ), and the insomnia + GAD group reported 9.81 ( $SD = 2.61$ ). No significant between-group difference was observed on number of strategies used.

**Strategy Efficacy.** Participants reported that their strategies were moderately effective (see Table 3). Mean strategy efficacy was 1.57 ( $SD = 1.02$ ), 1.63 ( $SD = 1.26$ ) and 2.65 ( $SD = 0.81$ ), for the insomnia alone, insomnia + GAD and the good sleepers groups respectively. A significant between-group difference was observed for strategy efficacy ( $F(2, 47) = 6.26$ ,  $p < .01$ ). Scheffé post hoc tests showed that both insomnia groups evaluated their strategies as less effective than the good sleepers group ( $p < .05$ ). No significant difference was observed between the two insomnia groups.

## DISCUSSION

The aim of this study was to examine presleep cognitive arousal and thought control strategies in individuals with insomnia, with and without comorbid GAD, and in good sleepers in order to better understand how these features compare between these groups. Another objective was to exam-

**TABLE 3. STRATEGIES REPORTED ON THE SNI, % OF INDIVIDUALS USING THEM, AND STRATEGY EFFICACY**

Strategy	% of Individuals Using the Strategy <sup>a</sup>			Strategy Efficacy
	INS Alone	INS + GAD	GS	<i>M (SD)</i>
<b>Avoidance</b>				
Physical action	20	28	30	2.4 (0.97)
Thought replacement	20	24	20	2.0 (1.0)
Thought-stopping	14	16	26	1.7 (1.2)
<b>Continuous attention</b>				
Find solutions	12	10	10	2.1 (1.0)
Analyze	8	14	22	2.2 (1.3)
Visualize the thought	6	8	4	1.9 (1.2)
Exposure	6	2	8	2.9 (1.3)
Try to convince that it is unimportant	12	26	30	1.9 (1.0)
Talk about (to others)	22	20	34	2.6 (0.9)
Check by asking others	0	2	2	2.5 (0.7)
<b>Minimal attention</b>				
Do nothing	18	16	20	1.8 (1.2)
Evaluate the thought as unimportant	8	6	4	1.8 (1.3)
<b>Nonoriented action on the thought</b>				
Positivism	0	0	2	4.0 (0.0)
Decrease physiological activation	6	4	2	2.2 (1.1)
Relax, meditate	2	6	4	2.5 (0.6)
<b>Others</b>				
Internal dialogue	0	0	0	0.0 (0.0)
Act out the thought	6	12	2	2.2 (1.1)
Act out the thought mentally	0	0	0	0.0 (0.0)
Emotional reaction	2	4	2	2.3 (1.0)
Religious strategy	0	2	2	3.0 (0.0)
Unclassifiable	2	4	6	2.2 (1.8)

<sup>a</sup>Based on  $N = 50$ .

ine how the thought control strategies employed by these individuals were subjectively rated. Results indicated that individuals with comorbid insomnia and GAD reported higher cognitive arousal at bedtime than individuals with insomnia alone, who in turn reported higher cognitive arousal than good sleepers. Individuals with comorbid GAD reported using avoidance strategies more frequently than good sleepers as assessed by a self-report questionnaire but not with the interview. Both insomnia groups evaluated their thought control strategies as being less effective in decreasing the incidence of, and the discomfort associated with, their intrusive thoughts compared to good sleepers. Finally, no significant difference was observed between individuals with insomnia alone and those with insomnia and GAD on any of the sleep parameters.

Some researchers (Borkovec, 1982; Edinger, Stout, & Hoelscher, 1988; Harvey, 2002) have suggested that higher cognitive activity or arousal at bedtime represents an essential feature of insomnia. Results from this study support this assertion by showing that individuals with insomnia without coexisting GAD (or other axis I anxiety disorders), reported higher bedtime cognitive arousal than good sleepers, and further suggest that higher cognitive arousal in individuals

with insomnia is not necessarily accounted for by the presence of GAD, since comorbidity between insomnia and this disorder (and other axis I disorders) was ruled out with scrutiny in the insomnia alone group. Our results also showed that, although cognitive arousal was further exacerbated by the presence of GAD, no significant difference was observed with regard to self-reported sleep parameters or perceived insomnia severity, between those with insomnia alone or insomnia with coexisting GAD. It could have been expected that higher cognitive arousal be associated with more severe sleep disturbances. A possible explanation for this is that arousal may no longer interfere with sleep above a certain level. On the other hand, this finding also suggests that presleep cognitive arousal does not suffice in explaining sleep difficulties. For instance, according to some authors (Edinger, Wohlgemuth, Radke, Marsch, & Quillian, 2001a; Espie, 2002; Harvey, 2002; Morin, 1993; Morin & Espie, 2003) diurnal cognitive arousal and worry about the consequences of the sleep problem during the day would also contribute in maintaining insomnia.

Results of this study are in line with previous findings showing that individuals tend to use an extended repertoire of strategies in attempting to control disturbing thoughts at bedtime (Freeston et al., 1995; Harvey, 2001, 2003), among which avoidance seems the most frequently used strategy, in both nonclinical and clinical samples. Results on the CAQ also showed that individuals with GAD reported using avoidance significantly more often than the two other groups. However, no significant between-group difference was observed on the SNI. The divergent results might be explained by the instruments' respective characteristics. Both measures assess avoidance in different ways. The SNI considers only one specific thought considered unpleasant and intrusive and data are collected in the context of a face-to-face evaluation, whereas the CAQ is a cued-questionnaire where participants rate how often they use the different described thought control strategies in general. Although the information collected using the SNI is more exhaustive personalized, it is possible that the interview context might have increased the social desirability bias often associated with self-reporting.

Individuals with insomnia, with and without coexisting GAD, rated their thought control strategies as being less effective than good sleepers did. Visual inspection of the SNI data suggests that compared to the former groups, good sleepers tended to use a greater proportion of adaptive strategies (e.g., talking about the thought, analyzing the thought). It is possible that the strategies' perceived efficacy was more negative because the strategies actually were less efficient (Tallis, Davey, & Cappuzo, 1994). An alternative explanation is that good sleepers might not perceive their thoughts at bedtime as unpleasant and disturbing as individuals with insomnia or GAD do. Greater efforts to dismiss negative thoughts may be required by both insomnia groups, which may lead to lower evaluations of their strategies' efficacy and a feeling of having uncontrollable thoughts. These observations need to be validated in controlled experiments.

These results must be interpreted with caution. First, the evaluation of cognitive arousal and thought control strategies were based on recall, which could have involved a memory bias. Social desirability, especially for the SNI data, might also explain some of the divergent results observed. A small sample size also represented an important limitation of this study. This hindered statistical power, and might explain some of the nonsignificant findings. Replication of this study with a larger sample is warranted. Adding a group of individuals with GAD without insomnia would also improve the design of the present study in allowing the assessment of the unique contributions of insomnia and GAD on presleep cognitive activities. Another factor limiting the generalizability of the present findings is that cognitive activity after the presleep period, for example during nightly or early-morning awakenings, was not assessed in this study. Examining this might have furthered our understanding of cognitive activity in insomnia according to different clinical presentations. Finally, it should be mentioned that the correlational nature of this study precludes any conclusion regarding the causal nature of the present findings. Studies manipulating cognitive arousal and thought control strategies are needed to further our understanding of their role in insomnia and GAD.

Nevertheless, results from this study support the assertion that higher presleep cognitive arousal plays a role in insomnia and, by distinguishing individuals with insomnia alone from individuals with comorbid GAD, this study further suggests that higher cognitive arousal in individuals with insomnia is not necessarily accounted for by high rates of comorbidity between insomnia and GAD. This study also brings forward new data on perceived strategy efficacy. This information can lead to more easily identifiable treatment targets and provide an empirical rationale for the need to change maladaptive thought control strategies.

Future research should investigate the impact of developing adaptive thought control strategies based on the presence of—and discomfort associated with—intrusive thoughts. Repetitive questionnaire administration or use of daily self-monitoring reports could help assess if individuals are consistent in the choice of the thought control strategies they use. It would also be interesting to assess if anxiety, cognitive arousal, and avoidance can be predictors of insomnia severity. Finally, treatment studies could compare standard cognitive-behavior therapy for insomnia with treatments targeting intrusive thoughts and avoidance strategies. The challenge of intrusive thoughts at bedtime and the replacement of avoidance strategies by more adaptive ones might prove helpful with refractory individuals who do not respond to standard cognitive-behavior therapy for insomnia. These studies could determine if this additional component may have clinical usefulness or improve actual insomnia treatment and/or prevent relapse.

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