



# Emotion Regulation Strategies as a Moderator Between Insomnia Severity and Bedtime Procrastination

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**Background and Objective** Bedtime procrastination, defined as the behavior of going to bed later than intended in the absence of external factors, has been associated with insomnia and emotion regulation. The present study aimed to explore the moderating effect of emotion regulation strategies in the relationship between insomnia severity and bedtime procrastination.

**Methods** This sample consisted of 374 adults (mean age  $23.08 \pm 2.17$  years, 84.5% females). Participants completed the Bedtime Procrastination Scale, an Emotional Regulation Strategy checklist, and the Insomnia Severity Index.

**Results** Bedtime procrastination was positively correlated with insomnia severity ( $r = 0.280$ ,  $p < 0.001$ ) and negatively correlated with active coping ( $r = -0.148$ ,  $p < 0.01$ ). Insomnia severity was positively correlated with avoidance coping ( $r = 0.099$ ,  $p < 0.05$ ) and negatively correlated with active coping ( $r = -0.170$ ,  $p < 0.01$ ) and support-seeking coping ( $r = -0.110$ ,  $p < 0.05$ ). There was a significant moderating effect of support-seeking coping in the relationship between insomnia and bedtime procrastination ( $B = 0.0165$ , 95% confidence interval =  $0.0014-0.0316$ ).

**Conclusions** As a result of the present study, individuals using more support-seeking coping were more likely to delay bedtime as their insomnia symptoms became more severe. These findings suggest that support-seeking coping may be an important factor to consider in the clinical context of providing intervention for individuals with insomnia.

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**Keywords** Sleep; Emotional regulation; Procrastination.

## INTRODUCTION

Insomnia is a sleep disorder characterized by difficulty initiating or maintaining sleep accompanied with daytime function impairment [1]. Insomnia poses as a risk factor for various psychiatric symptoms [2,3], which have been partially explained by its link to sleep and emotion regulation difficulties [4,5].

Many theoretical models of emotion regulation have highlighted specific adaptive or maladaptive strategies that effectively reduce negative emotions [6-8]. The process model of emotion regulation developed by Gross [8] proposes that emotion regulation is conceptualized as a process that takes place throughout the unfolding of emotional responses. Based on this model, emotion regulation strategies can be categorized two strategies: antecedent-focused strategies and response-focused strategies [8,9]. In previous studies, suppression, one of the response-focused strategies, has been associated with decreasing positive emotions, weakened social support, and increased sympathetic activation of the cardiovascular system [9-11]. This result may suggest that using maladaptive emotion regulation strategies is a potential threat to sleep and health, considering many sleep disorders have exaggerated and maladaptive neurobiological and cognitive-emotional responses to stress [12]. Further-

more, individuals with insomnia may perceive bedtime as aversive due to staying awake for long periods of time at night [13], and their bedtime habits may be influenced by the strategies they take to regulate these negative emotions. For instance, individuals with insomnia symptoms may strategically delay their bedtime to avoid negative feelings to increase their readiness for sleep [14,15].

Bedtime procrastination is a sleep health behavior that is defined as “going to bed later than intended, without having any external factors for doing so” [16]. Bedtime procrastination has been shown to be associated with insufficient sleep and insomnia, as well as other psychological variables such as depression and anxiety [16-18].

Recent studies of procrastination have suggested that procrastination is associated with maladaptive emotion regulation strategies such as avoidance [19,20]. Similarly, previous studies have shown that individuals engage in bedtime procrastination by primarily engaging in smartphone use before bedtime [17,21,22] in an effort to regulate negative emotions [23-25]. Studies have found that individuals report using their phones before going to bed relieves stress [23] and distracts themselves from negative thoughts [14]. Furthermore, a previous study of bedtime procrastination by our research group conducted functional analysis of bedtime procrastination and found the main reported function of bedtime procrastination to be emotional regulation [15]. However, based on Gross’ model, not all emotion regulation strategies are effective [11]. Thus, it is necessary to explore what specific types of emotion regulation strategies are associated with the relationship between insomnia symptoms and bedtime procrastination, because the emotional experience of bedtime for individuals with sleep problem such as insomnia may differ from that of non-clinical populations.

For this reason, this study aims to explore the moderating effect of three emotion regulation strategies (active coping, avoidance coping, and support-seeking coping) in the relationship between insomnia severity and bedtime procrastination.

## METHODS

### Participants

The data for this study was collected as a part of a larger intervention study targeting individuals with high levels of bedtime procrastination [15]. Participants were recruited between March 2019 and March 2020 in Seoul, South Korea, using advertisements through online community postings and offline fliers. This study was approved by Sungshin Women’s University Institutional Review Board (SSWUIRB 2019-003). In this study, young adults were recruited based on the previous study that noted that general procrastination behavior was most common in early adulthood [26].

A total of 402 volunteers completed the online survey that

recruited participants for this study. Among the respondents, 28 individuals who did not complete the online survey or had errors in responses to the survey were excluded from the study. A total of 374 participants were included for final analysis.

### Measurements

#### Bedtime Procrastination Scale

The Bedtime Procrastination Scale (BPS) was developed by Kroese et al. [16] and measures the degree of bedtime procrastination. The BPS consists of 9 items that describe sleep-related behaviors and habits that reflect high or low level of bedtime procrastination. Items were rated on a 5-point Likert scale from 1 (almost never) to 5 (almost always). The BPS total score range is 9 to 45 points, with higher scores reflecting higher levels of bedtime procrastination. The Cronbach’s  $\alpha$  was 0.72 in this study.

#### Insomnia Severity Index

The Insomnia Severity Index (ISI) was developed by Bastien et al. [27] and is composed of 7 items that measure the severity of insomnia during the past 2 weeks. The ISI is rated on a 5-point Likert scale from 0 to 4. The total score range is 0–28, and higher scores reflect greater insomnia severity. In the present study, participants who scored above 15 were excluded [28]. The Cronbach’s  $\alpha$  was 0.64 in this study.

#### Emotional Regulation Strategy checklist

The Emotional Regulation Strategy (ERS) checklist developed by Yoon [29] is composed of 25 items that measure emotion regulation strategy of individuals. The emotional regulation strategy checklist is rated on a 5-point Likert scale from 1 to 5. The total score range is 25–75. This checklist contains three subscales as follows: 1) active coping (ERS\_A): planning and taking specific strategies to solve problems; 2) avoidance coping (ERS\_D): avoiding and distracting from problem situations; and 3) support-seeking coping (ERS\_S): seeking emotional and instrumental social support from social relationships. The Cronbach’s  $\alpha$  was 0.73 in this study.

### Statistical Analyses

All statistical analyses were conducted by using SPSS Statistics version 21 (IBM Corp., Armonk, NY, USA). Correlational analyses were conducted using Pearson’s correlation coefficient between main variables.

The moderation effect was analyzed using Model 1 in PROCESS [30]. Analyses were bootstrapped with 5000 replications to calculate standard errors and 95% confidence intervals. A total of three models were constructed with the moderator based on three types of emotion regulation strategies (M). In all models, ISI was entered as the predictor (X) and BPS was entered as outcome (Y). The three modeled differed based on the types of moderating variable entered: ERS\_A, ERS\_D, and ERS\_S. Simple

slopes analysis was conducted on the moderating effects to detect relationships between the predictor and outcome variable at three levels of the moderator (low means one standard deviation [SD] below the mean; medium means mean, and high means 1 SD above the mean). Furthermore, the Johnson-Neyman technique [31] was conducted to determine which value ranges of the moderating variable the interaction (moderating) effect was statistically significant or not. Johnson-Neyman technique can analyze the significance regions where the simple slope of the dependent variable to the independent variable is significantly different from zero [32]. Thus, this technique allows us to obtain cutoff points of the moderator at which the effect of the independent variable on the dependent variable is statistically significant [33].

Post-hoc exploratory analyses were conducted on variables with significant effects. An independent samples t-test was conducted by dividing the sample into two groups based on total mean score.

## RESULTS

### Demographic Information

Demographic information is presented in Table 1. The sample consisted of 374 participants (mean age  $23.08 \pm 2.17$  years, 84.5% female). Most participants were university students (81.3%) and almost all participants were single (99.7%).

### Association Between Variables

Table 2 shows the correlations, means, and SDs of the three measures in the current sample. BPS was positively correlated with ISI ( $r = 0.280, p < 0.001$ ) and negatively correlated with ERS\_A ( $r = -0.148, p < 0.01$ ). In addition, ISI was negatively correlated with ERS\_A ( $r = -0.170, p < 0.01$ ) and ERS\_S ( $r = -0.110, p < 0.05$ ).

### ERS\_S as a Moderator between ISI and BPS

Results of the moderation analysis are presented in Table 3. ERS\_S was found to moderate the relationship between ISI and BPS, indicating that the association between ISI and BPS varied as a function of ERS\_S (Fig. 1). However, the moderation effect of ERS\_A and ERS\_D were not significant.

Exploratory post-hoc analysis of the interaction was conducted by testing the conditional effects of an ISI at three levels of ERS\_S, 1 SD below the mean, at the mean, and 1 SD above the mean (Fig. 2). ISI was significantly related to BPS at all three levels of ERS\_S (coefficient<sup>1SD below</sup> = 0.179, 95% CI = 0.009–0.348; coefficient<sup>mean</sup> = 0.343, 95% CI = 0.228–0.459; coefficient<sup>1SD above</sup> = 0.442, 95% CI = 0.279–0.606).

Specifically, the significance region of the conditional effect of ERS\_S was identified through Johnson-Neyman analysis (Table 4). The moderator value defining Johnson-Neyman sig-

**Table 1.** Demographic characteristics of participants

Characteristic	Value (n = 374)
Gender	
Female	316 (84.5)
Male	58 (15.5)
Age (yr)	23.08 ± 2.17
Education	
High school graduation	10 (2.7)
University student	304 (81.3)
Bachelor' degree	60 (60.0)
Marital status	
Married	1 (0.3)
Single	373 (99.7)
Employment status	
Student	337 (90.1)
Not employed	19 (5.1)
Employed	18 (4.8)

Values are presented as n (%) or mean ± standard deviation.

nificance region was  $-7.450$ , indicating that the conditional effect of ERS\_S was significant when the score of ERS\_S was higher than  $-7.450$ .

### Independent Samples t-Test

Results of an independent samples t-test are presented in Table 5. The total sample ( $n = 374$ ) was assigned to either the high-level ERS\_S group ( $n = 213$ ) or the low-level ERS\_S group ( $n = 161$ ) based on a total mean score of ERS\_S (mean = 26.65). As a result, there were no significant difference between the high-level ERS\_S group (mean = 37.82, SD = 4.79) and the low-level ERS\_S group (mean = 38.73, SD = 4.08) on BPS [ $t(372) = 1.925, p = 0.055$ ].

## DISCUSSION

This study aimed to investigate the moderating effect of emotion regulation strategies on the relationship between insomnia severity and bedtime procrastination. The specific main results and implications are as follows.

### Bedtime Procrastination as a Possible Emotion Regulation Strategy

Our results indicate insomnia severity was more strongly associated with bedtime procrastination in participants who endorsed support-seeking coping only, but not active or avoidant coping. To the best of our knowledge, this is the first study investigating the moderating effects of various types of emotion regulation strategies on the association between insomnia severity and bedtime procrastination.

**Table 2.** Correlations, means, standard deviations of the insomnia severity, bedtime procrastination and emotion regulation strategies (n = 374)

	Scores		Correlation matrix				
	Mean	SD	1	2	3	4	5
1. BPS	38.21	4.52	-				
2. ISI	15.77	3.92	0.280***	-			
3. ERS_A	26.07	6.11	-0.148**	-0.170**	-		
4. ERS_D	29.59	6.51	0.080	0.099*	-0.258**	-	
5. ERS_S	26.65	7.64	-0.094	-0.110*	0.307**	-0.192**	-

\*p < 0.05; \*\*p < 0.01; \*\*\*p < 0.001.

BPS, Bedtime Procrastination Scale; ISI, Insomnia Severity Index; ERS, Emotional Regulation Strategy; ERS\_A, active coping; ERS\_D, avoidance coping; ERS\_S, support-seeking coping.

**Table 3.** Moderating effect of emotional regulation strategies on the relationship between insomnia severity and bedtime procrastination (n = 374)

Dependent variable	Model	B	se	t	p-value	LLCI	ULCI
BPS	Constant	38.258	0.227	168.881	< 0.001	37.813	38.704
	ISI	0.303	0.058	005.230	< 0.001	0.189	0.417
	ERS_A	-0.080	0.037	-2.147	0.033	-0.153	-0.007
ERS_D	ISI*ERS_A	0.012	0.009	1.251	0.212	-0.007	0.030
	Constant	38.205	0.226	169.160	< 0.001	37.761	38.649
	ISI	0.317	0.058	5.484	< 0.001	0.203	0.430
ERS_S	ERS_D	0.036	0.035	1.032	0.303	-0.033	0.104
	ISI*ERS_D	0.003	0.009	0.290	0.772	-0.015	0.020
	Constant	38.265	0.225	170.276	< 0.001	37.823	38.707
ERS_S	ISI	0.321	0.058	5.587	< 0.001	0.208	0.434
	ERS_S	-0.043	0.030	-1.469	0.143	-0.102	0.015
	ISI*ERS_S	0.017	0.008	2.119	0.035	0.001	0.032

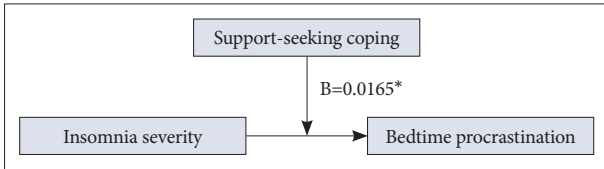
BPS, Bedtime Procrastination Scale; ISI, Insomnia Severity Index; ERS, Emotional Regulation Strategy; ERS\_A, active coping; ERS\_D, avoidance coping; ERS\_S, support-seeking coping; LLCI, lower bound within the 95% confidence interval; ULCI, upper bound within the 95% confidence interval.

Our findings are consistent with previous studies that insomnia and emotion regulation are associated with bedtime procrastination. According to a previous study, insomnia patients experience aversion to bedtime because the act of going to bed is repeatedly paired with restless, frustration for waiting to fall sleep [13]. These characteristics of insomnia symptoms may increase individual's tendency for increasing time spent procrastinating before bedtime. Indeed, a recent study suggested that people who have difficulty falling asleep reported that they procrastinate their bedtime strategically [34]. In addition, some of these individuals report ruminating or feeling anxious if they do not fall asleep immediately, and postpone their bedtime to avoid having to deal with these negative emotions [34]. Therefore, people with insomnia may procrastinate their bedtime to reduce their negative emotions associated with not being able to sleep.

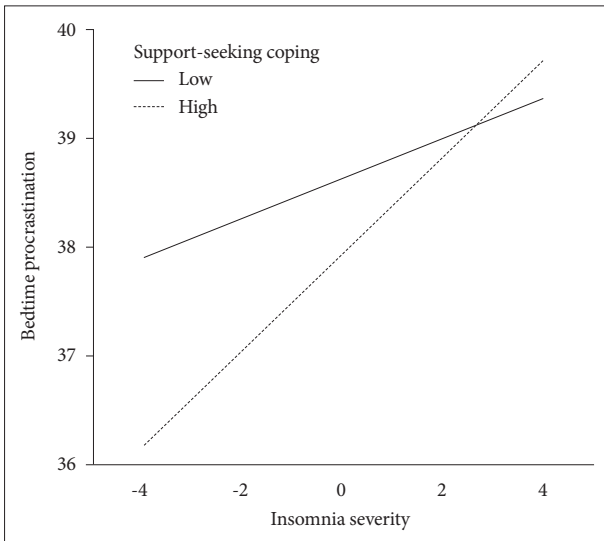
In our study, only support-seeking showed a moderating effect on the relationship between insomnia and bedtime procrastination. While these results are not consistent with previous

studies that suggest procrastination is associated with emotion regulation strategies such as avoidance or active coping [19,20,35], our findings suggest that social interaction may be most associated with insomnia symptoms. Our results indicated the moderating effect of support-seeking coping was significant at all levels. However, participants with higher levels of support-seeking coping experienced greater increases in bedtime procrastination when insomnia symptom severity increased compared to participants with lower levels of support-seeking coping. These results suggest that individuals who utilize social resources more actively to escape negative feelings or thoughts may have stronger tendency to delay their bedtime when experiencing sleep problems such as insomnia.

However, it is unclear how support-seeking coping affects the relationship between insomnia severity and bedtime procrastination. One possible explanation may be that individuals who tend to engage in bedtime procrastination primarily use digital media devices before bedtime [17]. Mobile devices can facilitate engagement of social interaction even during the night and en-



**Fig. 1.** Model about moderating effect of support-seeking coping on the relationship between insomnia severity and bedtime procrastination. \* $p < 0.05$ .



**Fig. 2.** Moderating effect of support-seeking coping on the relationship between insomnia severity and bedtime procrastination.

hance perceived social support in those who prefer to engage in support-seeking coping. A previous study suggested that people who procrastinate at bedtime spend significantly more time on mobile applications for communication and leisure before bedtime [17]. Similarly, another previous study showed that participants use their digital devices to “post about feelings” and “seek someone out for help” [36]. Another possible explanation for our finding is that loneliness during nighttime may affect bedtime procrastination in individuals with insomnia. According to previous studies, the common experience of being awake for many hours alone in insomnia patients can lead to feelings of social isolation [37]. Although the relationship has yet to be fully understood, some studies reported that an increase in loneliness among younger adults is potentially related to their screen time and social media use [38]. Furthermore, it is possible that the emotion regulation coping strategies were partially influenced by the COVID-19 pandemic that occurred during the study period. During the pandemic, social interactions and support were limited and emotional distress increased [36]. Thus, participants may try to reduce their emotional distress or negative affect by engaging in indirect social interactions such as using social network services. In addition, the environmental changes that occurred because of COVID-19 may have also limited the emotion regulation strategies available to participants. A previ-

**Table 4.** Support-seeking coping value defining Johnson-Neyman significance region

ERS_S	Effect	se	t	p-value	LLCI	ULCI
-18.650	0.014	0.154	0.088	0.930	-0.288	0.315
-17.050	0.040	0.142	0.281	0.779	-0.239	0.319
-15.450	0.066	0.131	0.507	0.612	-0.191	0.323
-13.850	0.093	0.120	0.775	0.439	-0.143	0.328
-12.250	0.119	0.109	1.093	0.275	-0.095	0.333
-10.650	0.146	0.099	1.476	0.141	-0.048	0.339
-9.050	0.172	0.089	1.937	0.054	-0.003	0.346
-8.957	0.173	0.088	1.966	0.050	0.000	0.347
-7.450	0.198	0.080	2.489	0.013*	0.042	0.355
-5.850	0.225	0.072	3.138	0.002**	0.084	0.365
-4.250	0.251	0.065	3.867	< 0.001***	0.123	0.379
-2.650	0.277	0.060	4.614	< 0.001***	0.159	0.396
-1.050	0.304	0.058	5.269	< 0.001***	0.190	0.417
0.550	0.330	0.058	5.709	< 0.001***	0.217	0.444
2.150	0.357	0.061	5.881	< 0.001***	0.237	0.476
3.750	0.383	0.066	5.829	< 0.001***	0.254	0.512
5.350	0.409	0.073	5.640	< 0.001***	0.267	0.552
6.950	0.436	0.081	5.393	< 0.001***	0.277	0.595
8.550	0.462	0.090	5.135	< 0.001***	0.285	0.639
10.150	0.489	0.100	4.890	< 0.001***	0.292	0.685
11.750	0.515	0.110	4.667	< 0.001***	0.298	0.732
13.350	0.541	0.121	4.468	< 0.001***	0.303	0.780

\*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ .

ERS, Emotional Regulation Strategy; ERS\_S, support-seeking coping; LLCI, lower bound within the 95% confidence interval; ULCI, upper bound within the 95% confidence interval.

**Table 5.** Association between support-seeking coping and bedtime procrastination (n = 374)

	Low-ERS_S (n = 161)		High-ERS_S (n = 213)		t	p-value
	Mean	SD	Mean	SD		
BPS	38.73	4.08	37.82	4.79	1.925	0.055

BPS, Bedtime Procrastination Scale; ERS, Emotional Regulation Strategy; ERS\_S, support-seeking coping.

ous study found that emotion regulation strategies became more homogeneous after COVID-19 when the diversity of social and physical contexts experienced by participants was reduced [36]. Although only 76 of the 374 participants were recruited after the COVID-19 pandemic, restricted social support and limited diversity of emotion regulation strategies during this particular period may have influenced individuals to delay bedtime using support-seeking coping. However, it is also unclear whether delaying bedtime to gain social support is ultimately adaptive or maladaptive for individuals with insomnia symptoms. Although



support-seeking coping is generally thought to be adaptive [39], recent studies suggest that social media-based support-seeking coping may lead to negative effects, termed “social media service (SNS) fatigue” [40]. Therefore, in future research, it is worth exploring the specific pathways and results that support-seeking coping influence the relationship between insomnia severity and bedtime procrastination.

### Limitations and Recommendations for Research

This study has some limitations. First, our sample consisted of mainly females, and additional studies with higher proportion of male participants should be conducted to generalize our results. Second, the COVID-19 pandemic occurred during the period of our study. In our study, 76 of the 374 participants were recruited after the COVID-19 pandemic started. The COVID-19 pandemic dramatically changed social behaviors of individuals worldwide. In particular, lockdowns due to COVID-19 have led to an increase in social media use, and psychological problems such as loneliness and isolation have emerged as important mental health issues. These changes may have influenced our participants to seek more social support and use digital devices in bed for longer periods, overstating our findings. Therefore, future studies should be conducted to exclude special situational factors such as COVID-19. Third, the current study did not exclude psychopathological disorders such as depression, schizophrenia, and bipolar disorder because it was an exploratory study investigating the interaction of insomnia and emotion regulation strategies on bedtime procrastination. These disorders may affect participants’ sleep and mood. Therefore, it needs to exclude psychopathological disorders in future studies. Finally, this was an exploratory study that investigated the moderating effects of three different emotion regulation coping on the relationship between insomnia severity and bedtime procrastination. Thus, it did not investigate how the support-seeking coping that was shown to moderate the relationship between insomnia severity and bedtime procrastination affected the psychosocial adaptation. Therefore, future research should explore the specific processes by which support-seeking coping influences the relationship between insomnia severity and bedtime procrastination. In addition, it would be meaningful to determine what the consequences of bedtime procrastination associated with the use of support-seeking coping are for an individual’s sleep and psychology.

### Conclusion

Despite these limitations, this study has the following contributions. First, this is the first study to investigate the interaction of insomnia and emotion regulation strategies on bedtime procrastination. To date, research on bedtime procrastination has been focused on how it affects sleep problems such as insomnia. However, bedtime procrastination likely occurs not only among healthy individuals but also among those who already experi-

ence insomnia. Considering that people with already experienced sleep problems are more vulnerable in terms of emotional and physical health compared to healthy individuals, it is important to understand what factors reinforce problematic behaviors such as bedtime procrastination in this population. Therefore, the present study is notable in that it is the first to investigate the impact of insomnia on bedtime procrastination and the role of specific emotion regulation strategies that are relevant in this relationship. Second, the present study found that the use of support-seeking coping was a significant factor influencing bedtime procrastination in individuals with insomnia. These findings suggest that social connections may be a key determinant of delayed bedtime for individuals experiencing sleep problems. Examining social relationships or lack of intimacy may provide a clinical context for delivering sleep interventions, especially for individuals who are likely to delay their bedtime.

### Availability of Data and Material

The datasets generated or analyzed during the study are available from the corresponding author on reasonable request.

### Author Contributions

Conceptualization: all authors. Data curation: Huisu Jeon. Formal analysis: Huisu Jeon, Wooyoun Lee. Funding acquisition: Sooyeon Suh. Investigation: Huisu Jeon. Methodology: Huisu Jeon. Project administration: Sooyeon Suh. Resources: Huisu Jeon. Software: Huisu Jeon. Supervision: Sooyeon Suh. Validation: Sooyeon Suh. Visualization: Huisu Jeon, Wooyoun Lee. Writing—original draft: Huisu Jeon, Wooyoun Lee. Writing—review & editing: Sooyeon Suh.

### Conflicts of Interest

Sooyeon Suh, a contributing editor of *Sleep Medicine Research*, was not involved in the evaluation process or decision to publish this article. The remaining author has declared no conflicts of interest.

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