Original Research

The Roles of Procrastinatory Cognitions and Bedtime Procrastination in Insomnia among Students

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Abstract

Background and Objective: Insomnia is one of the most prevalent sleep-related problems among university students. To date, several explanatory models for insomnia have been presented; however, the perspective of procrastination has been less considered. The present study's aim was to determine the association between procrastinatory cognitions and bedtime procrastination, and insomnia among students.

Materials and Methods: The present study was a cross-sectional study. The study population consisted of students of Zanjan University of Medical Sciences, Zanjan, Iran. A total of 433 students were selected using stratified random sampling method. Data were collected using the Insomnia Severity Index (ISI), Bedtime Procrastination Scale (BTPS), and Procrastinatory Cognitions Inventory (PCI).

Results: The severity of insomnia in medical students varied from non-clinical to clinical insomnia. In addition, the results of regression analysis indicated that the full model was significant regarding the predictors of insomnia. Only 3% of variance in insomnia severity was due to demographic variables, while bedtime procrastination and procrastinatory cognitions explained 33% of the variance in the severity of insomnia among students.

Conclusion: The procrastination-related structures such as procrastinatory cognitions and bedtime procrastination play an important role in explaining insomnia in students. Addressing these variables as perpetuating factors can be considered in the treatment of insomnia in students.

Keywords: Insomnia, Cognition, Procrastination

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Introduction

In order to survive, the human body has adapted to day and night changes through the circadian rhythms (1). Impairment of the circadian rhythm, in addition to functional consequences, has crucial impact on life. Sleep disorders are one of the consequences of disturbed circadian rhythms that refer to any problems in the quantity and quality of sleep. The Diagnostic and Statistical Manual of Mental Disorders (DSM-5) has identified 10 disorders as sleep-wake disorders (2) among which insomnia is the most common complaint about sleep in the general population (1, 2). Symptoms of insomnia are non-restorative sleep, and trouble falling asleep and continuing sleep, which may be accompanied by frequent waking or difficulty in returning to sleep (3). Although insomnia is a common phenomenon in the general population, the prevalence of this problem appears to be higher among students than the general population (4). A recent study of 7626 students from 6 United States (US) universities showed that 62% of students had poor sleep indices (5). In another study, 68.6% of students in Hong Kong reported insomnia symptoms (6). Furthermore, a systematic review reported a prevalence of 11.2-28.8 percent for insomnia (4). Taylor at al. studied 1039 students and found that 57.1% of the students had no insomnia and 9.5% had chronic insomnia (7). In addition, 6.6% of them com-

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plained of insomnia, but did not meet the criteria, and 26.9% did not complain about it, although they had the criteria for insomnia (7).

Although, the prevalence of insomnia is different in studies, almost all studies have highlighted the rather high prevalence of this problem and its importance in the student population. Moreover, medical students are constantly faced with a change in sleep schedule due to their participation in numerous educational and practical programs and internship courses in day-night shifts, and enduring multiple stressors. Studies have shown that the prevalence of sleep problems is often higher among medical students than students in other fields (8), and the prevalence of insomnia varies between different fields of study (9-12). The high prevalence of insomnia in students has serious consequences, as several studies have shown that poor sleep quality and insomnia lead to issues in students' clinical and educational performance (13-15), and may even lead them to the brink of failure in their education (16).

The necessity of studying the etiology of insomnia and its interventions in students has led to many studies in this area in which the disturbance of the circadian rhythm, medical conditions, hormonal changes, and psychological problems have been addressed as the main causes of insomnia. The attempt to explain the psychological aspects of insomnia has evolved from Bootzin's stimulus control model (17) to Harvey's cognitive model (18) and the meta-cognitive model of Ong et al. (19). With the recognition of the importance of psychological issues in sleep problems, the attention of recent studies has been drawn to the association between sleep problems and procrastination.

Procrastination refers to the deficiency or lack of self-regulatory function and the behavioral tendency to delay doing what is necessary for achieving the goal (20) and is recognized as a personality trait (21). Studies have shown that the prevalence of health problems among procrastinators is higher and they are less likely to have healthy behaviors (including healthy nutrition, physical activity, and treatment seeking) (22-24). The concept of bedtime procrastination has not been taken into consideration in studies in the field of procrastination; thus, there was almost no study on the correlation between procrastination and sleep problems. With sleep insomnia conceptualization, in the study of Kroese et al., a link was found between procrastination and sleep problems (25). The results of their study indicated that bedtime procrastination refers to the desire of individuals to delay their bedtime, and this kind of procrastination is one of the causes of inadequate sleep in the general population (25). While insomnia in students is partly due to their difficulty in falling asleep, bedtime procrastination is also very common among them. However, there has been limited evidence of a relationship between student bedtime procrastination and insomnia.

The characterization of personality traits in the information processing system, or in other words, the cognitive aspects of personality traits have always interest researchers. Given that procrastination is also recognized as a personality trait, understanding its cognitive aspects has had valuable implications. Stainton et al. conducted a study to investigate the automatic thoughts related to procrastination (26). They assumed that individuals, who are prone to procrastination traits, are vulnerable to trait-specific rumination, especially in relation to their postponed behaviors. They believed that this type of rumination occurs not only during and after the procrastination, but also before postponing the behavior (26).

Later, Flett et al. re-examined procrastinatory cognitions in a sample of students (27). They realized that negative self-assessments were a central element in understanding the cognitions associated with procrastination; in addition, the experience of procrastination-related cognition specifically increases the level of psychological distress and stress (27).

Based on the role of stress in the occurrence of insomnia (28), Sirois et al. asserted that the correlation between procrastination and quality of sleep is mediated by stress (29). Accordingly, it seems that procrastinatory cognition is the second link between procreation and insomnia due to increased psychological arousal. However, the relationship between procrastinatory cognitions and insomnia is not clear yet.

Given the high prevalence of sleeping problems and procrastination in students, it seems that insomnia in students is partly due to postponing sleep time. Although bedtime procrastination is well-known in the context of procrastination, its relationship with the severity of insomnia in students has not been studied. Moreover, procrastinatory cognitions, which often manifest in automatic thoughts, have a role in delayed sleep and insomnia due to increased stress and anxiety. This study

was undertaken to investigate the role of bedtime procrastination and procrastinatory cognitions in the severity of insomnia in medical students and to explain the predictors of the prevalence of insomnia among students.

Materials and Methods

Participants

The study population consisted of students of Zanjan University of Medical Sciences, Zanjan, Iran. The sample volume was based on the average of samples of previous prevalence studies in this area (6, 30). A total of 500 participants were selected of which 67 (13%) students did not complete the questionnaires. Thus, the final sample included 433 students, selected based on stratified random sampling. The participants were selected from each school (medicine, dentistry, pharmacy, paramedical, public health, nursing, and midwifery) of the university based on the ratio of the school to the total population of students at the university.

Procedure

In the second step, assessment questionnaires were given to the students in different environments such as college campus, study hall, restaurant, and dormitories. Students were free to participate in the study if they wished. In order to maintain the confidentiality of information, a code was assigned to each questionnaire, and students did not have to provide personal information such as name or place of residence. After completing the data collection, a profile of the results was sent to each subject by email.

To measure demographic variables including gender, affiliated faculty, age, place of residence, procrastination history, and employment, a researcher-made questionnaire was used. Furthermore, the Procrastinatory Cognitions Inventory (PCI), Bedtime Procrastination Scale (BTPS), and Insomnia Severity Index (ISI) were used to measure the sleep-related variables. The study interviewers were students of the Master of Clinical Psychology who had been trained. The collected data were analyzed in SPSS software (version 23, IBM Corporation, Armonk, NY, USA).

Chi-square test was used to compare the ratio of nominal demographic variables. T-test was used to compare the scores of women and men in variables such as ISI, BTPS, and PCI scores. Univariate analysis of variance (ANOVA) and stepwise linear regression analysis were utilized to compare men and women in all items of ISI, and to predict the role of demographic, BTPS, and PCI scores, respectively. Furthermore, ISI was compared among different schools using post hoc test (LSD).

Measures

Insomnia Severity Index

This questionnaire was first introduced in 1993 by Morin (31). The ISI is a short tool for assessing clinical insomnia and is widely used in clinical studies and research in the field of insomnia. The questionnaire has 7 items that measure the severity of sleep onset, sleep maintenance, and early morning awakening problems, sleep dissatisfaction, interference of sleep difficulties with daytime functioning, noticeability of sleep problems by others, and distress caused by sleep difficulties. The items are scored based on a 5-point Likert scale ranging from never (0) to always (4) within 2 weeks. The internal consistency of this questionnaire was reported as good, and its internal reliability was estimated to be 0.76 at baseline and 0.78 in the follow-up (32). The internal consistency of the Iranian version of the ISI (Cronbach's alpha: 0.80) was reported as good (33).

Bedtime Procrastination Scale

The BTPS was first introduced by Kroese et al. (25). The questionnaire consists of 9 items that assess the susceptibility of people to unnecessary delayed sleep time. Four items directly address bedtime procrastination, and their grading is direct. The remaining questions are scored based on a 5-point Likert scale ranging from never (0) to always (4). Higher scores in this questionnaire represent greater bedtime procrastination. In the study by Kroese et al., the internal and external validity of the questionnaire was reported to be good, and its test-retest reliability (0.79) was reported to be acceptable (25). In the study by Sirois et al., the Cronbach's alpha of this questionnaire was estimated to be 0.89 (34). Using Cronbach's alpha, the reliability of BTPS in this study was found to be 0.82.

Procrastinatory Cognitions Inventory

The PCI consists of 18 items that assess the frequency of thoughts associated with procrastination. The items are scored based on a 5-point Likert scale ranging from never (0) to always (4). The total score ranges from 0 to 72. Higher scores reflect more procrastinatory cognitions. The first study on the psychometric properties of this tool was performed by Stainton et al. (26). Their study

showed that PCI has a single-factor structure and its internal stability is high (0.94). The PCI also has a moderate to high correlation with procrastination trait (0.69), which indicates the validity of its concurrent criterion. In the study by Flett et al., the reliability of this questionnaire was reported through calculating Cronbach's alpha coefficient ($\alpha = 0.88$) (27). Cronbach's alpha of PCI in this study was 0.88.

Results

In the present study, 433 students participated, 55.66% of them were women, 89% of them were single, and 87.3% lived in the dormitory (Table 1). In this study, 30.9% of the participants were paramedical students, and 54.3% were students in a master's degree. There was no significant difference between women and men in terms of the demographic variables.

The average ISI score among the students was 11.55. The results of the t-test (Table 1) showed that the prevalence of insomnia in men was significantly higher than that in women (t = 0.22; P = 0.023).

In addition, the mean of bedtime procrastination in the students was 24.09. The comparison of the two groups showed that the difference in bedtime procrastination was significant between women and men. Men had a significantly higher bedtime procrastination score than women (t = 2.97; P = 0.003). Finally, the average PCI score in students was 50.32. Although the mean score of this index in men was higher than that in women, the difference between the two groups was not statistically significant (t = 0.981; P = 0.327).

The review of the assumptions for using regression analysis showed that, in the case of multivariate collinearity, the tolerance and variance inflation factor (VIF) were 0.897 and 1.115, respectively (Cut-off point of less than 0.1 for tolerance and above 10 for VIF) which indicates the lack of multivariate collinearity in the data. Outlier data showed that the value of Mahalanubis is 10.86% less than its critical value for the two dependent variables (13.83); therefore, the outlier did not affect the distribution of data. Nevertheless, the Durbin Watson test for checking the independence of errors (0.597) showed that we violated the assumption of non-correlation between errors (range: 1.5-2.5). Independence of the predictive variables and their moderate correlation is also indicative of non-violation of the assumptions of regression analysis (Table 2).

Table 1. Demographic characteristics and descriptive statistics of the study participants (n = 433)

Variable		Gender				Total		Chi-square test	
		Men		Women					
		N	%	N	%	N	%	x^2	P-value
		192	44.34	241	55.66	433	100	-	-
Marital	Single	174	90.6	212	88	386	89.1	0.780	0.377
	Married	18	9.4	29	12	47	10.9		
Place of residence	Dormitory	126	83.44	212	88	378	87.3	0.771	0.434
	Home	25	16.56	29	12	54	12.5		
Faculty	Medicine	47	10.9	76	17.6	123	28.4	2.943	0.567
	Dentistry	15	3.5	15	3.5	30	6.9		
	Nursing	53	12.2	64	14.8	117	27		
	Paramedicine	64	14.8	70	16.2	134	30.9		
	Pharmacy	13	3	16	3.7	29	6.7		
Degree	BA	108	56.3	127	52.7	235	54.3	2.011	0.570
	MA	25	13	28	11.6	53	12.2		
	PhD	4	2.1	3	1.2	7	1.6		
	MD	55	28.6	83	34.4	138	31.9		
								T-test	
		Mean	SD	Mean	SD	Mean	SD	T	P-value
ISI		12.81	5.97	10.97	5.86	11.55	5.94	2.28	0.023*
BTPS		25.06	5.90	23.32	6.14	24.09	6.09	2.97	0.003**
PCI		50.95	11.02	49.82	12.96	50.32	12.14	0.981	0.327

SD = Standard deviation; BA: Bachelor of Arts; MA: Master of Arts; PhD: Doctor of Philosophy; MD: Doctor of Medicine; ISI: Insomnia Severity Index; BTPS: Bedtime Procrastination Scale; PCI: Procrastinatory Cognitions Inventory

**P < 0.01, *P < 0.05

Table 2. Correlation matrix for demographic variables and study measures

Variable	1	2	3	4	5	6	7
Gender	-						
Residence	-0.040	-					
Faculty	-0.064	-0.050	-				
Degree	0.053	0.070	-0.494**	-			
ISI	-0.109*	0.049	0.091*	0.010	-		
BTPS	-0.142**	-0.019	0.060	-0.036	0.548**	-	
PCI	-0.046	-0.041	0.047	-0.038	0.339**	0.321**	-

ISI: Insomnia Severity Index; PTPS: Bedtime Procrastination Scale, PCI: Procrastinatory Cognitions Inventory
Note. N= 433. ** P < 0.01, * P < 0.05

Using stepwise linear regression analysis, the variables of gender, residency, faculty, and educational level (degree) were first entered into the model (due to the fact that most participants were single, the marital status variable was excluded). The results showed that demographic variables could significantly predict nearly 3% of the variance in insomnia.

In the second step, ISI, BTPS, and PCI were also entered into the model. The results showed that the second model was also significant (F = 37.013; *P* < 0.05; Adjusted R = 0.333) and it might explain 33.3% of the variance in the severity of insomnia among students. Among the demographic variables, only the faculty significantly predicted insomnia. The regression coefficients for gender and place of residence were not significant; however, the regression coefficients for the second stage variables were significant. In other words, bedtime procrastination and procrastinatory cognitions could significantly predict insomnia among students (Table 3).

Among the demographic variables, only faculty predicted the severity of insomnia in students; however, it was not known that the difference between which faculties was the cause of this predictive power. For this purpose, inter-groups ANOVA and LSD (post hoc test) were used. The results of ANOVA showed that the variance in insomnia between the pairs of faculties was not significant (F = 1.465; P > 0.05).

The results of LSD showed that there was a significant difference between the mean scores of students in the Faculty of Medicine and the Faculty of Nursing (P < 0.05). In other words, a higher prevalence of insomnia was reported by the students of the Faculty of Nursing than those of the Faculty of Medicine.

Discussion

This study showed the frequency of insomnia in medical students on non-clinical, mild, moderate and clinical ranges was 25%, 41%, 28% and 5%, respectively. Moreover, addressing procrastination was important in predicting insomnia among students. Although most studies of insomnia have used the Pittsburgh Sleep Quality Index (PSQI) for the diagnosis of insomnia and the tool used in this study was the ISI, the correlation between these two questionnaires (35) made it possible to compare the studies to some extent.

In line with the result of studies that reported a 62% prevalence for insomnia in student in the US (5) and 66.8% in students in Hong Kong (6), in this study, 74.4% of students in some way experienced a range of insomnia (mild to clinical) and only 25.6% of students had no symptoms of insomnia. Nevertheless, most students (40.9%) reported the severity of their insomnia to be below the threshold.

Table 3. Stepwise Linear Regression Analysis of predictors of insomnia severity

	R	R square	Adjusted R square	Std. Error of the Estimates	R square change
Model 1	160.	0.026	0.016	5.89	0.026
Model 2	0.585	0.343	0.333	4.85	0.317
Model 2	**B**	**SE B**	**β**	**t**	**P-value**
Gender	-0.332	0.475	-0.028	-0.698	0.486
Home	0.998	0.618	0.064	1.616	0.107
Faculty	0.418	0.203	0.093	2.054	0.041*
Degree	0.342	0.199	0.078	1.717	0.087
BTPS	0.471	0.041	0.483	11.536	0.000**
PCI	0.90	0.020	0.184	4.429	0.000**

**P < 0.01, *P < 0.05, BTPS: Bedtime Procrastination Scale; PCI: Procrastinatory Cognitions Inventory

Given the results of a systematic review, the prevalence of insomnia in students in various studies has been reported between 11.2% and 28.8% (4). The results of the present study may seem confusing, so for a closer look at the prevalence, it is better to consider the percentage of people with moderate to high insomnia rates. Furthermore, 33.4% of students in this study encountered serious insomnia problems, which was consistent with systematic review results (4).

Although demographic variables can significantly predict about 3% of the variance in insomnia, only the variable of faculty could significantly predict insomnia. Obviously, this effect was due to a significant difference in the prevalence of insomnia between the students of the Faculty of Medicine and Faculty of Nursing. It seems that the stressful period of nursing education and the bedtime procrastination of the students are the causes of the higher prevalence of insomnia in students of the Faculty of Nursing compared to the students at the Faculty of Medicine.

While only 3% of insomnia in students was due to their demographic characteristics, 33.3% was due to bedtime procrastination and procrastinatory cognitions. As expected, students who, despite their awareness of the undesirable consequences of insomnia, unnecessarily delay their sleep in a self-imposed way, have higher ISI scores. Unlike people who suffer from sleep disorders, bedtime procrastinators can sleep well enough; however, they are deprived of sleep only because they go to bed late (36).

On the one hand, the delay in going to bed can be a result of irritating sleep preparation (for example, tooth brushing, locking doors, etc.) (37), which itself is a kind of passive procrastination. On the other hand, delayed sleep may be a cause of active procrastination and doing work under time pressure. However, Sirois and Pychyl suggested that bedtime procrastination, like all other types of procrastination, is a self-regulating problem that significantly affects the health and well-being of individuals (36).

Harvey's Cognitive Model was the first that introduced the role of cognitive processes in the etiology and continuation of insomnia. Harvey found that people with insomnia tended to increasingly worry about their sleep and the effects of insomnia throughout the day. This cognitive hyperarousal puts the individual in an anxious state in which the individual has to choose selectively to monitor the internal and external symptoms that jeopardize sleep and when he/she observes a sign or a certain flaw in his/her sleep, his/her cognitive excitation further increases (18). Ong et al. also emphasized the role of dysfunctional cognitions in the formation of worry about insomnia, rumination about its outcomes, and unrealistic expectations that lead to more cognitive, emotional, and physiological excitations in people with insomnia, and provide their metacognitive model for insomnia (19). Accordingly, the present study also examined procrastinatory cognitions, often experienced in the form of negative automatic thoughts (for example, "Why cannot I complete what I have begun?"), looking for the role of specific cognitions in explaining insomnia. The results showed that although the PCI evaluates procrastinatory cognitions in general (not procrastinatory cognitions that are related to sleep), it significantly predicted insomnia among students. Regarding the role of negative automatic thoughts in cognitive arousal and its relationship with insomnia, procrastinatory cognitions, consistent with Harvey's Cognitive Model, seem to delay sleep time due to cognitive hyperarousal and anxiety. Nevertheless, to find out more precisely the role of procrastinatory cognitions in the prediction of insomnia, we need more specialized tools that measure sleep-related procrastinatory cognitions. Finally, this study showed that the structures that are related to procrastination in students play a decisive role in explaining the severity of their insomnia. In other words, students who had more procrastinatory cognitions and less willingness to go to bed were more likely to have severe insomnia. Clearly, various explanations have been provided for insomnia thus far, but given the fact that most studies have been conducted on clinical samples, it seems that emphasizing psychological constructs in the development and maintenance of insomnia is crucial in non-clinical populations, and especially students. Regarding the high prevalence of procrastination and insomnia in student populations, it is suggested that future studies focus on the association of insomnia with other aspects of procrastination. In addition to identifying major factors in the development and maintenance of insomnia, appropriate strategies can be developed for reducing insomnia among students.

Conclusion

This study showed that although demographic

variables are useful in identifying factors associated with vulnerability to insomnia, procrastination-related structures, such as bedtime procrastination and procrastinatory cognitions, can also explain a significant proportion of insomnia among students.

Conflict of Interests

Authors have no conflict of interests.

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