

**The impact of Bedtime Procrastination on Job Performance mediated by Quality of
Sleep and moderated by Chronotype.**

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Abstract

This research studied possible antecedents and consequences of bedtime procrastination. A relatively new form of (trait) procrastination. I set out to answer how chronotype influences bedtime procrastination, and how bedtime procrastination impacts job performance when mediated by quality of sleep. Through the use of linear regression, I aimed to answer these questions. The key findings found are inconsistent with literature. They indicate that there is no evidence to support a possible influence of chronotype on bedtime procrastination, nor that bedtime procrastination impacts job performance negatively with quality of sleep as the mediator. The results found within this study are surprising when held in contrast to the available literature. This study adds to the research available on bedtime procrastination, a relatively new phenomenon that has increasingly been studied the last decade.

Keywords: Chronotype, Bedtime Procrastination, Job Performance, Morning-Eveningness, Quality of Sleep, Well-being,

The impact of Bedtime Procrastination on Job Performance mediated by Quality of Sleep and moderated by Chronotype.

In a Dutch study (Kroese et al., 2016) it is shown that 53.2% of the people of a representative sample ($N = 2431$) regularly, between 2 and 7 days a week, go to bed later than they intended to go to bed without having an external reason to delay their bedtime. It is curious how this action appears unintended and without a clear external reason or explanation, yet it is still a prevalent phenomenon. Nauts et al. (2019) researched how bedtime procrastinators explain their procrastination. They (Nauts et al. 2019) found evidence for categorizing the reasons given by procrastinators in three main categories: deliberate procrastination, mindless procrastination, and strategic delay.

This thesis centers around bedtime procrastination. The body of literature on bedtime procrastination as a form of procrastination and its implications on sleep has steadily been growing since Kroese et al. (2014) first proposed this phenomenon as a possible factor in sleep quality. In their article, Kroese et al. (2014), suggest that bedtime procrastination is a form of procrastination, and they define bedtime procrastination as “going to bed later than intended while no external circumstances are accountable for doing so”, even when the procrastinator expects to be worse off if they indeed procrastinate on their bedtime (Hill et al., 2022).

The term ‘procrastination’ is generally defined as an individual’s trait or behavioral disposition to postpone or delay performing tasks and/or making decisions (Milgram, Mey-Tal & Levison, 1998). In the available literature procrastination has also been called trait procrastination (Lay & Silverman, 1996) or general procrastination (Milgram, Mey-Tal & Levison, 1998). For the sake of ease, I will continue to use the term procrastination in my thesis. Procrastination is largely studied in relation to academic behavior of students and how

they delay performing tasks and making decisions related to academic behavior (van Eerde, 2003).

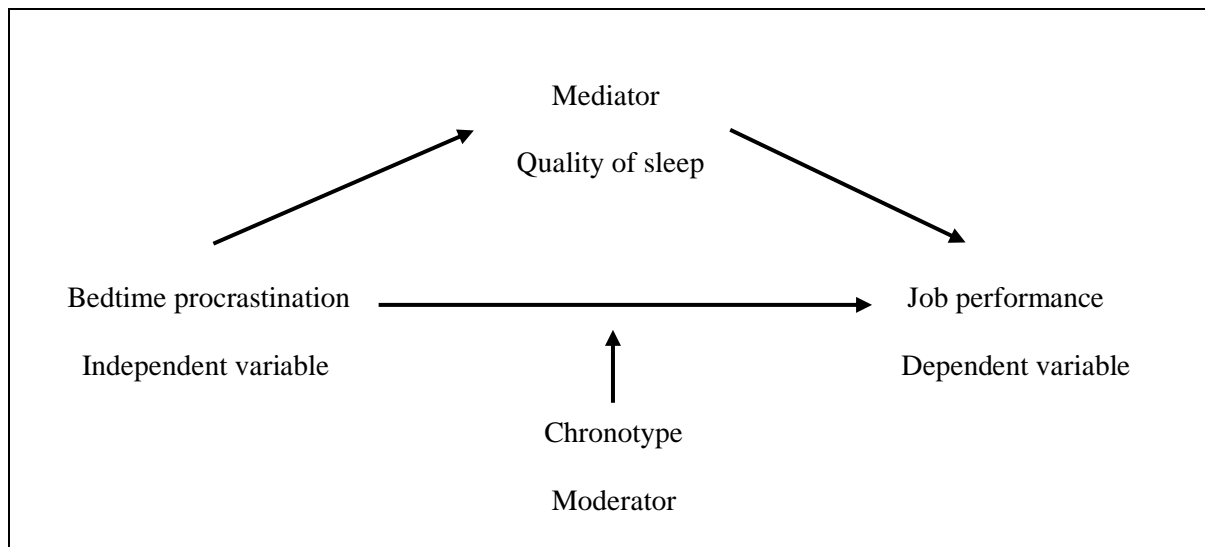
This means that in the course of the last decade, bedtime procrastination has been progressively studied as a subset of general procrastination, and as a possible cause of a decrease in sleep quality (Kroese et al., 2014). A sufficient amount of sleep is required to improve and maintain the overall health and well-being of the general public (Hirshkowitz et al., 2015). This implies that if bedtime procrastination is an important factor in the duration and quality of sleep, it may also indirectly influence health and well-being. If one's sleep duration and sleep quality are negatively influenced by their bedtime procrastination, in turn this can negatively influence task performance at work (Binnewies et al., 2009). A study by Kühnel et al. (2018) found an association between bedtime procrastination and a possible antecedent influencing bedtime procrastination occurring called chronotype which I will discuss more in depth within the literature review.

Current literature available on the antecedents and consequences of bedtime procrastination has not yet explored how bedtime procrastination can influence job performance through its influence on quality of sleep. The purpose of the current study is to begin exploring this gap in research on bedtime procrastination.

This paper aims to answer how chronotype influences the relationship between bedtime procrastination and quality of sleep as a moderator, and how bedtime procrastination influences job performance when quality of sleep mediates between the two variables. Figure 01 visually displays the research model on which this study is based.

Figure 01.

The Research Model



Note. This figure shows the research model consisting of four variables: Bedtime procrastinator, Job performance, (quality of) sleep, and chronotype.

Literature Review

Bedtime Procrastination

As mentioned before, bedtime procrastination refers to postponing one's bedtime when there are no external reasons for doing so (Kroese et al., 2014) even though the procrastinator anticipates being worse off if they do procrastinate on their bedtime (Hill et al., 2022). Previously, I also mentioned that the researchers of one study propose three subcategories of bedtime procrastination: deliberate bedtime procrastination, mindless procrastination, and strategic delay (Nauts et al., 2019).

Nauts et al. (2019) classified the first category of bedtime procrastination as deliberate procrastination. According to Nauts et al. (2019) procrastinators in this specific category delayed their bedtime knowingly and intentionally. These people procrastinated on purpose even if they believed they would be worse off as a result of procrastinating on their bedtime (Nauts et al. 2019). During the time the procrastinators gained by delaying their bedtime, they often will engage in hobbies or carry out chores.

A second category called mindless bedtime procrastination was created by Nauts et al. (2019) to categorize procrastinators who reported their reason for delaying their bedtime to be unintentional because for a while they simply were not aware of the time or their bedtime approaching. These procrastinators miss their bedtime primarily due to distraction and/or inattention (Nauts et al., 2019). They engage in immersive activities and their sense of time will generally become distorted.

The third and final category labelled as strategic delay was created by Nauts et al. (2019) to categorize procrastinators who are aware that they are delaying their bedtime but who also convince themselves that they have reasons arguing why it is in fact not better for them to adhere to their bedtime. Thus, instead of following their scheduled bedtime these procrastinators delay their bedtime because they believe they have ample of reason to do so.

Bedtime Procrastination and Job Performance

As noted by Motowidlo et al. (1997) job performance is multidimensional and pertains to the behavior of employees that directly or indirectly aid organizational goals. Research on a potential association between bedtime procrastination and job performance appears to be non-existing. Nevertheless, one study suggests that feeling physically and mentally rested is positively associated with task performance at work (Binnewies et al., 2009).

Thus, if bedtime procrastination is negatively associated with multiple facets of sleep (Kroese et al., 2014; Kroese et al., 2016; Ma et al., 2022) it is plausible that this in turn negatively affects health and well-being (Hirshkowitz et al., 2015), and consequently negatively influences task performance at work (Binnewies et al., 2009).

Hypothesis 1. The variable job performance takes the role of dependent variable whereas bedtime procrastination takes the role of independent variable. Based on the available literature I predict a negative association between bedtime procrastination and

quality of sleep. If bedtime procrastination increases, an individual's quality of sleep decreases. If bedtime procrastination decreases, an individual's quality of sleep increases. I also predict a positive association between quality of sleep and job performance. Thus, as quality of sleep increases so will job performance. This also indicates that if quality of sleep decreases so will job performance.

Chronotype as a Moderator

Previous research has established chronotype, also discussed as morningness-eveningness in relevant literature (Hasan, Jankowski & Khan, 2022), as a person's preference for when to sleep and when to wake as a result of their circadian rhythm (Horne & Östberg, 1977). People who prefer to go to bed early and wake up early have been established as morning people, or larks (Zhu et al., 2022). On the contrary, people who prefer to go to bed late and wake up late have been established as night people, or owls (Zhu et al., 2022).

According to Hasan, Jankowski & Khan (2022) morningness-eveningness types can aid in explaining behavioral and psychological outcomes in individuals. In another study, Kühnel et al. (2018) found an association between chronotype and bedtime procrastination, more specifically later chronotypes reported more bedtime procrastination than earlier types. Thus, if chronotype influences the likelihood of bedtime procrastination occurring then we should find an association between chronotype and bedtime procrastination. Following Kühnel et al. (2018) we should specifically find a negative association. This means that someone classified as a morningness person should wake up earlier in the day and should go to sleep earlier in the day too. Whereas eveningness type people should wake up later in the day and go to bed later in the day too.

Hypothesis 2. Chronotype plays the role of moderator in the current research model, and I believe that an individual's chronotype will moderate a correlational relationship between the independent variable bedtime procrastination and the dependent variable job

performance following that people with a later chronotype will engage more in procrastinating their bedtime than people with an earlier chronotype will. Thus, I predict that we will find more bedtime procrastination and a lower job performance in individuals with a later chronotype. This means I also predict that individuals with an earlier chronotype will engage in less bedtime procrastination and thus have a higher job performance than people who do have a later chronotype.

Quality of Sleep as a mediator

As stated before, sleep is important for our general well-being (Hirshkowitz et al., 2015). When we do not get enough sleep our risk of developing symptoms of mental illness or aggravating the symptoms of already present mental illness increases (Van der Kloet, Merckelbach, Griesbrecht, & Lynn, 2012). Sleep deprivation also increases experienced stress, anger, and anxiety in response to stressors (Minkel et al., 2012). Finally, a lack of sleep can negatively impact our memory (Yoo et al., 2007).

The literature on the presence of a possible association between bedtime procrastination and sleep is contradictory (Hill et al., 2022). A number of studies have found a possible negative association between bedtime procrastination and sleep duration (Kroese et al., 2014; Kroese et al., 2016), bedtime procrastination and quality (Kroese et al., 2014; Ma et al., 2022), and bedtime procrastination and daytime fatigue (Kroese et al., 2016). However, the results of several other studies did not report a negative association between bedtime procrastination and sleep duration (Exelmans & van den Burck, 2018), and bedtime procrastination and sleep quality (Suh et al., 2022).

Hypothesis 3. Sleep plays the role of mediator in the current research model; I propose bedtime procrastination influences job performance through its influence on sleep. Thus, I predict when bedtime procrastination increases in an individual this will influence

quality of sleep to decrease. Following the decrease in quality of sleep, job performance in turn will decrease.

Conservation of Resources Model

Conservation of resource theory is a motivational stress theory proposed by Hobfoll in 1988 and its core argument states that people strive to obtain and protect their personal and social resources (Hobfoll, Freedy, Lane & Geller, 1990). If individuals cannot protect these resources, they will experience stress. According to Hobfoll, Freedy, Lane & Geller (1988) stress arises from any of the following three situations. In the case of resources being threatened, i.e. lost. When resources are actually lost, and when an investment of resources does not yield at least the same or more as the amount of resources that was invested.

Applying the conservation of resource theory (Hobfoll, Freedy, Lane & Geller, 1990) to bedtime procrastination, I propose that in the event people's day to day responsibilities do not match their chronotype it will lead to an increase in observed bedtime procrastination. Once an individual's bedtime procrastination increases, their quality of sleep will also deteriorate. When quality of sleep is decreased a loss of resource occurs. According to the conservation of resource theory this will cause stress within an individual. An adequate amount of sleep is important in maintaining personal well-being and stress puts a strain on well-being (Hirshkowitz et al., 2015). In turn, a loss of resources and an increase in stress will negatively affect job performance (Binnewies et al., 2009).

I hypothesized that an increase in bedtime procrastination negatively influences job performance mediated through quality of sleep. This we can see in the conservation of resources model when one is low on the resource of sleep which might be influenced by one engaging in bedtime procrastination, they will experience an increase in stress to which job performance will suffer. I also hypothesized that a later chronotype is associated with a

higher likelihood of bedtime procrastination, setting into motion the depletion of the resource sleep.

Method

Participants

A total of 192 participants responded. After processing, 146 participants were left (76 females, 62 males, 2 others, and 6 did not answer, $M_{\text{age}} = 38.46$, $SD = 13.439$) partook in this study. By far most participants were Dutch 47.8%, German 16.9%, or Greek 12.5%. As part of the criteria to participate in the study, participants had to work a minimum of 20 hours in the week they participated. Participants worked an average of 36.73 hours per week, with $SD = 10.007$. Participants were also not allowed to work nightshifts. Participants were gathered through convenience sampling. Multiple students collaborated and reached out to people in their own network to ask for their participation.

Measures

Bedtime procrastination

A 9-item scale was used to assess bedtime procrastination in participants and adopted from Kroese et al. (2014). Participants had to indicate their level of agreement, or disagreement, with statements on a Likert scale. For example, “I do not go to bed on time” and “I go to bed later than I had intended”. Each of the nine items are documented in Appendix B. Bedtime Procrastination Questionnaire. Questions were answered on a Likert scale from 1 (*never*) to 5 (*always*). Each item was combined into one scale, “bedtime procrastination”. Before combining the nine items into one scale, three items had to be reverse coded. Cronbach’s alpha for the scale bedtime procrastination was $\alpha = .051$. This indicates a low level of consistency between the nine items.

Chronotype

To measure chronotype we used Horne and Östberg’s morningness-eveningness Questionnaire reduced by Adan and Almirall (1991). Adam and Almirall (1991) were able to reduce the questionnaire down to five items. I used these five items to create the scale

“chronotype”. Example questions are “At what time of the day do you think that you reach your “feeling best” peak?”, and “One hears about morning and evening types of people, which one of these types do you consider yourself to be?”. See appendix C for all five items. Cronbach’s alpha for this scale was $\alpha = -.227$. The chronotype scale also has a low level of consistency between the items.

Job performance

The variable job performance was measured with the help of items adapted and developed by Koopmans et al. (2012) and Williams and Anderson (1991). A total of seven items were combined to create the scale “job performance”. A sample item is “Adequately completes assigned duties”. Out of the seven items, two had to be reversed coded. A reverse coded sample item is “Fails to perform essential duties”. See Appendix D for all seven items. Questions were answered on a Likert scale from 1 (*strongly disagree*) to 5 (*strongly agree*). Cronbach’s alpha for the scale “job performance” is $\alpha = .089$, also indicating a low level of consistency between the seven items.

Sleep

The variable sleep was measured with three items. These three items were decided on for this particular study. An example item is “How would you rate the quality of your previous night’s sleep?”. This question was answered on a Likert scale from 1 (*very poor*) to 5 (*excellent*). See Appendix E for all three items. Cronbach’s alpha for the “sleep” scale $\alpha = .628$. This indicates some consistency between the three-item scale.

Procedure

Before the start of the experiment participants were asked to fill out a baseline questionnaire, see Appendix A. During the experiment participants were asked to fill out a 5-day daily diary survey. They would fill out the survey once in the morning and once in the evening. One of the researchers involved gathered all the people the students gathered for this

study and administered the survey through online contact with the participants by using email. Before filling out the survey each participant was told of their rights and asked to give their informed consent.

Data analysis procedure

We used SPSS version 26.0.0. to conduct the data analysis. First, I deleted variables and their data irrelevant to the current study. This was meant to keep the dataset as unconvoluted as possible. To identify outliers, I created boxplots in SPSS and the participants that were flagged as outliers I deleted. The participants that were flagged as outlier I deleted. This resulted in taking out data from 23 participants. Third, I examined the dataset for participants who did not finish the experiment. I did this by looking at my “progress” variable. This variable showed how much a participant had completed. Anything below a 100% was removed from the dataset. In doing so, the valid sample size is $n = 146$. Fourth, a couple of items were reverse coded and thus I now had to recode back. Fifth, after reverse coding, I created one scale variable out of all the items for each variable of interest in this study. The software used to analyze the data, SPSS, automatically removes missing data during the analysis.

Then I set out to answer the research questions introduced in the introduction. I first performed a simple linear regression to test whether chronotype is negatively associated with bedtime procrastination. To test the second research question, I downloaded an extension for SPSS 26.0.0 called PROCESS Macro (Hayes, 2022) and used that to test the research model. This model consists of job performance as the dependent variable, bedtime procrastination as the independent variable, and sleep and chronotype as the mediators. To test this in PROCESS Macro I used their preset model number 4. PROCESS Macro uses OLS and logistic regression to analyze data and models (Hayes, n.d.).

Results

Descriptive Statistics and Correlations

The current dataset can be summarized as follows: chronotype has $M = 2.699$ with $SD = .349$ ($N = 139$), bedtime procrastination has $M = 2.908$ with $SD = .393$ ($N = 137$), Sleep has $M = 3.419$ with $SD = .625$ ($N = 103$), and job performance has $M = 3.649$ with $SD = .272$ ($N = 135$). Table 1 shows the correlations between the variables.

Table 1

Correlations of the study variables

Variable	1	2	3	4
1. Chronotype	-			
2. Bedtime procrastination	$r = .234^*, p = .006$	-		
3. Quality of sleep	$r = .097, p = .339$	$r = -.061, p = .550$	-	
4. Job performance	$r = .120, p = .473$	$r = .017, p = .168$	$r = -.074, p = .844$	-

Note. Pearson correlations between chronotype, bedtime procrastination, quality of sleep, and job performance.

* Correlation is significant at the 0.01 level (2-tailed).

Research Design

Table 2 contains the moderated mediation model fitting the research design discussed earlier. Job performance is the dependent variable and bedtime procrastination is the independent variable. Sleep is the mediator and chronotype functions as the moderator.

Table 2

Results for Estimated Coefficients of the Moderated Mediation Model

Variables	Mediator: Sleep				DV: Job performance			
	<i>b</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>b</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Bedtime Procrastination	-.0488	.1684	-.2899	.7725	-.1771	.5897	-.3003	.7646
Sleep					-.0243	.0493	-.4929	.6233

Chronotype									
Bedtime procrastination x Chronotype									
Constant	3.5685	.4905	7.2751	.0000	4.0457	1.7632	2.2946	.0241	
R^2	.0009				.0117				
F	.0841*			.7725	.2655**			.8994	

Note. $n = 95$.

* $df1 = 1, df2 = 94$

** $df1 = 4, df2 = 90$

Hypotheses testing

Hypothesis 1

My first hypothesis is that bedtime procrastination and quality of sleep are negatively associated. In other words, the more an individual procrastinates on their bedtime the lower their quality of sleep is. I used the scale variables previously discussed to measure the correlation between variables. I found a nonsignificant negative association of $-.061$ ($p = .550$) which can be found in table 1.

Hypothesis 2

Second, I predicted that the moderator chronotype influences the relationship between bedtime procrastination and job performance. More precisely, a later chronotype increases the likelihood of an individual procrastinating more on their bedtime and thus associated with a decrease in their job performance. I found a nonsignificant correlation of $r = .234$ ($p = .006$) between chronotype and bedtime procrastination. The direct effect of for a lower, average, and higher chronotype is nonsignificant as shown in table 3.

Table 3

Conditional Direct Effect of Bedtime Procrastination on Job Performance

Chronotype	Effect	SE	t	p	95% CI	
					LL	UL
2.4	-.0422	.1140	-.3705	.7119	.2686	.1842

2.8	-.0197	.0846	-.2332	.8161	-.1879	.1484
3.0	-.0085	.0980	-.0867	.9311	-.2032	.1862

Note. The conditional effect of bedtime procrastination on job performance conditional on chronotype.

Hypothesis 3

Finally, I hypothesized that the mediator sleep is influenced by bedtime procrastination and that an increase in bedtime procrastination will be associated with a decrease in quality of sleep. The found correlation between bedtime procrastination and quality of sleep is $r = -.061$ ($p = .550$). Table 2 shows a nonsignificant effect of bedtime procrastination on the mediator sleep ($b = -.4088$, $p = .7725$). The indirect effect of bedtime procrastination on job performance is .0012.

Table 4

Indirect Effect(s) of Bedtime Procrastination on Job Performance

Variable	Effect	BootSE	95% BootCI	
			BootLL	BootUL
Sleep	.0012	.0120	-.0219	.0298

Note. Indirect effect of bedtime procrastination on Job Performance through the mediator sleep.

Discussion

In this study I investigated how chronotype influences the relationship between bedtime procrastination and quality of sleep as a moderator, and how bedtime procrastination influences job performance when quality of sleep mediates between the two variables. In line with the conservation of resource theory (Hobfoll, Freedy, Lane & Geller, 1990) I proposed that a lack of sleep resources due to bedtime procrastination leads to stress and can negatively influence job performance. I hypothesized that an increase in bedtime procrastination negatively influences job performance mediated through quality of sleep. I hypothesized that there would be a negative association between bedtime procrastination and quality of sleep. I also hypothesized that a later chronotype is associated with a higher likelihood of bedtime procrastination, setting into motion the depletion of the resource sleep.

The results obtained in this study do not support a significant negative association between bedtime procrastination and quality of sleep. They also do not support a significant effect of bedtime procrastination on job performance when mediated by sleep. Finally, the results also do not support a significant association between a later chronotype and a higher likelihood of bedtime procrastination. Findings are partially not in line with the discussed literature. Binnewies et al. (2009) found a lack of sleep negatively influences task performance at work.

Limitations and Future Directions

The findings of this study are not in line with the current literature available. A number of reasons might attribute to this. The smallest valid sample size used consists of 95 participants. A notable observation is the occurrence of Cronbach's alpha's that are too low to be accepted. This is the case for each scale variable used in the analysis. Some items might not be suitable for their intended purpose, or the number of items is not high enough. Lastly,

the sample used in this study has been gathered through convenience sampling and its findings can thus not be generalized.

Ensuing the limitations that have been discussed I propose three improvements for any future similar research. First, a larger sample size should be gathered to improve power. Second, alternative questionnaires should be researched to improve Cronbach's alpha. The removal of some or all items might be necessary, or increasing the number of items could benefit research into this field. Finally, sampling should be moved away from convenience sampling and to random sampling so to enable generalizability.

Theoretical and practical implications

The findings oppose theories used as a basis for the research design used in this study. This is in line with some of the available literature that is also contradictory. Even though this study did not find any significant values, there were effects found. Future research might still uncover more about the relationships between the variables used in this study. This study also contributes to the growing of collective knowledge on bedtime procrastination.

Conclusions

All in all, the results do not support hypotheses that I predicted. This is in opposition to the available research. Future research will play an important role in clearing up the present contradictions.

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Appendix A. Baseline Questionnaire

Scale	Item
Screening	
Age	How old are you (in years)?
Work hours	How many hours do you work per week (on average)?
Work hours (daily)	How many hours do you work on a usual workday?
Demographics	
Gender	What is your gender?
Nationality	In which country do you currently live?
Co-living	Do you live by yourself or with someone else?
Education	What is your highest completed level of education?
Work	What kind of work contract do you have?
Job title	What is your current job title?
Leadership	Do you have a leadership position?
Occupation	In which field are you working?
Occupation 2	How would you classify your current job?
Occupation 3	How long have you been working for your current employer?

Occupation 4	How long have you been working in your current job?
Work time	When does your workday usually start? (e.g., 9 am)
Work time 2	When does your workday usually end? (e.g., 1700)
Remote work	To what extent are you currently working remotely?

Appendix B. Bedtime Procrastination Questionnaire

Code	Item
BP1	I go to bed later than I had intended.
BP2	I go to bed early if I have to get up early in the morning.
BP3	If it is time to turn off the lights at night I do it immediately (R).
BP4	Often, I am still doing other things when it is time to go to bed.
BP5	I easily get distracted by things when I would like to go to bed.
BP6	I do not go to bed on time.
BP7	I have a regular bedtime which I keep to (R).
BP8	I want to go to bed on time, but I just don't.
BP9	I can easily stop with my activities when it is time to go to bed (R).

Note. "R" indicates that the item was coded in reverse.

Appendix C. Chronotype Questionnaire

Code	Item
rMEQ1	Considering only your own diurnal rhythm, at what time would you get up if you were entirely free to plan your day?
rMEQ2	After the first half hour after having woken in the morning, how tired do you feel?
rMEQ3	At what time in the evening do you feel tired and as a result in need of sleep?
rMEQ4	At what time of the day do you think that you reach your “feeling best” peak?
rMEQ5	One hears about morning and evening types of people. Which one of these types do you consider yourself to be?

Appendix D. Job Performance Questionnaire

Code	Item
JP1	Adequately completes assigned duties.
JP2	Engages in activities that will directly affect his or her performance evaluation.
JP3	Fails to perform essential duties (R).
JP4	Fulfills responsibilities specified in job description.
JP5	Meets formal performance requirements of the job
JP6	Neglects aspects of the job he or she is obliged to perform (R).
JP7	Performs tasks that are expected of him or her.

Note. “R” indicates that the item was coded in reverse.

Appendix E. Sleep Questionnaire

Code	Item
SQ1	How would you rate the quality of your previous night's sleep? (1 = very poor, 5 = excellent)
SQ2	Went to bed last night at... lights out at...
SQ3	minutes until fell asleep... finally work at...
