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Effects of work arrangements on the sleep regimen of creative R&D employees

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Traditional 'nine-to-five' working schedules do not consider individual characteristics. We identify what types of employees suffer from the adverse effects of work arrangements on their sleep regimen based on a survey of Estonian creative research and development (R&D) employees (N=153). We present ordinary least squares and ordered probit regression estimates and recursive structural equation model estimates of the employees' perceived level of sleep regimen disruption. We find that evening-type employees, women and employees with a lower creative intensity of work perceive with a significantly higher probability that work limits their sleep, while employees having flexibility in both working time and workplace feel less impacted by work-driven constraints on their sleep regimen. Granting working time and working place flexibility and avoiding the allocation of excessive administrative duties to creative R&D employees may have a considerable positive impact on improving their sleep, thus contributing to improving their well-being and work results.

Keywords: sleep; morningness-eveningness; flexible work; gender; R&D jobs; Estonia

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1. Introduction

The timing and location of work as well as other aspects of work arrangements may have a strong impact on the sleep regimen and overall quality of life for employees. While there is ample evidence that shift and night work arrangements compromise sleep and various health outcomes [1–5], it is important to note that traditional 'nine-to-five' work schedules do not accommodate the heterogeneous individual characteristics of 'normal' daytime employees either. The person-job fit literature, such as Caldwell and O'Reilly [6], highlights the importance of the fit between individual characteristics and the work environment in improving work performance. Flexible work time is a key work environment factor, allowing employees to adjust their working time according to their personal preferences, and work at the time when they feel most productive. In a review of earlier studies on working time arrangements, Golembiewski and Proehl [7] point to the positive effect that flexible work time can have on gaining control of work and personal life. Golden et al. [8] show that flexible working time arrangements are associated with increased happiness.

A major advantage of flexible working time is that it enables employees to be in tune with their circadian rhythms – the biological phenomena relating to the sleep-wake timing preferences of individuals, also known as morningness-eveningness. Based on their circadian rhythm, people can be broadly classified into three chronotypes: morning, neither, or evening type. Roughly 40 per cent of the population displays distinct morningness or eveningness patterns, while the rest is neither type [9,10]. Morning-type individuals wish to go to sleep and wake up early, and are more alert in the early part of the day. In contrast, evening-type individuals prefer to go to sleep and wake up late, and are more alert in the evening. Although chronotype appears to have a genetic background [11] (cf. works by 2017 Nobel prize recipients J. Hall, M. Rosbash and M. Young on molecular mechanisms controlling inner circadian rhythms), it can be influenced by individual (e.g. age, gender) and environmental (e.g. place of residence, exposure to light) factors as well [9]. The phase lags in circadian rhythmic functions can be large, ranging from 2 to 12 hours between morning-types and evening-types [9].

Ill-fitting work schedules that clash with the circadian clock can have adverse effects on the employee. If the sleep-wake cycle is out of sync with the individual circadian rhythms, the risk of several health issues increases [12]. Juda et al. [13] investigate how chronotype affects tolerance to shift work in terms of social jet lag (i.e. sleep deficit accumulation during workdays and sleeping longer during days off), sleep duration and sleep disturbance. They establish that during night shifts, morning-type employees had reduced sleep duration, high social jet lag, and increased levels of sleep disturbance. Similar symptoms were noted for evening-type employees during early shifts.

Increased control over working time, however, can have a positive effect on workers' sleep and health outcomes. Takahashi et al. [14] explore the connection between worktime control and fatigue, sleep problems, and depression symptoms in a large sample of both daytime and shift workers. The authors discover that greater

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worktime control, measured as both control over working hours and days off, was linked with decreases in incomplete recovery, insomnia symptoms (for men only), daytime sleepiness, and depression symptoms. Moen et al. [15] conducted a longitudinal survey in a natural experiment setup to see if participation in a corporate initiative giving employees greater worktime flexibility predicted changes in their health-related behaviours. They found that partaking in the initiative predicted positive changes in several respects, including sleeping almost an hour longer at night, exercising more, not going to the workplace when sick and visiting the doctor when ill. Mellner et al. [16] find on a large sample of professional employees that the ability of psychological detachment from work may be a key mechanism in mediating the effects of flexibility in working time and workplace on sleep. Männasoo and Meriküll [17] found that research and development (R&D) engagement in new member states of Central and Eastern Europe is highly volatile, which might affect the work arrangements and related stress factors and occupational health issues of R&D employees in this region.

In this study, we seek to identify which types of employees feel that work limits their sleep regimen. Furthermore, we examine whether the arrangement of work (e.g. working time flexibility, distance work option, creative intensity of work) has an effect on the perceived extent to which the sleep regimen is limited by work. For these purposes, we exploit data collected via our original repeated survey among creative R&D employees in Estonia. We present ordinary least squares regressions, ordered probit regressions as well as recursive structural equation estimates of how much employees perceived their sleep regimen to be disrupted by work.

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2. Materials and Methods

2.1. Participants

This study uses data collected through our original online repeated survey among Estonian creative R&D employees. The sample was compiled based on 2012 (i.e. latest available) statistical data on R&D by Statistics Estonia. We omitted 'technicians' and 'supporting staff' from the population and focused solely on 'researchers' due to the more creative nature of their work. In full-time equivalent, there were roughly 4,400 creative R&D employees in Estonia in the period 2010–2014. Considering the restrictions that teaching schedules at education institutions and work schedules at medical institutions set on time and workplace flexibility and work arrangements in general, we have excluded approximately 2,400 creative R&D employees in education and healthcare from the population of our study. In addition, as working arrangements in micro-entities and larger organisations differ, around 1,000 employees (in full-time equivalent) who work at research institutes and micro-enterprises with less than 15 creative R&D employees were excluded from the population.

Therefore, the total population of creative R&D employees of interest for our study is approximately 1,000, representing 23 different employers. While we suggested all 23 employers from the private and public sector to participate in our study, 11 employers accepted the invitation. Eight employers joined during the first wave of the study carried out in spring-summer 2015 and 3 joined in the identical second wave in winter 2016. We pooled the data from the two waves for this paper. Similar to Hazak et al. [18,19], Virkebau and Hazak [20], Ruubel and Hazak [21] and other papers on the same dataset, regarding recurring participants, we selected randomly which responses to consider. Additionally, contradictory and irrelevant responses were removed. The final

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sample comprises 153 employees – around 15% of the total population of one thousand (see Table 1). Creative R&D employees from public research institutes made up 21% of the final sample, while 28% worked at private companies in banking, 23% in technology, 15% in R&D, and 14% in the IT industry.

As the employees had the opportunity to join the sample only if their employer participated in the study, the individuals were not selected from the population randomly but through a company-based selection. Also, survey completion versus non-completion may be related to a selection bias. These selection biases are addressed by weighting the responses by respondent gender and their employer's field of activity, with the purpose of aligning the sample to the gender and activity field characteristics of the population. In all regression models we have clustered standard errors either by employer or employer-gender etc. interaction term in order to account for any unobserved company level patterns in the responses.

2.2.Instruments

The questionnaire included a total of 90 questions addressing various aspects of the organisation of work, work results, sleepiness, sleep patterns, tiredness, health as well as socio-demographic information. A 5-point Likert type scale is used to gain a response to the question 'To what extent do you feel that your work is limiting or has limited your sleep regimen?' (*sleeplim)* and this is used as the dependent variable in the models presented in this paper. Explanatory variables have been selected based on our research hypotheses and extant literature. One of these is the reduced morningness-eveningness questionnaire (rMEQ, by Adan and Almirall [22]) score. Ordered categories of employee-reported sleeping hours have been incorporated as a further explanatory variable. Other independent variables reflect different aspects of work arrangements and

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job satisfaction. Age, gender, number of family members and education are the main control variables for individual socio-demographic characteristics in the models. The health factor represents the respondent's general health condition based on a set of survey questions. Refer to Table 1 for a detailed overview of the model variables and description of the subjects, and to Figure 2 for histograms of some key model variables.

Table 1. Model variables and description of the subjects (mean and standard deviation (SD, in brackets) shown for continuous and ordered variables; percentage of respondents shown for binary and categorical variables)

Variable	**Description**	**All:** Mean (SD)/ %	**Males:** Mean (SD)/ %	**Females:** Mean (SD)/ %
	N	**153**	**87**	**66**
Dependent				
sleeplim	To what extent do you feel that your work is limiting or has limited your sleep regimen?:			
	1 = *not at all* (base)	29%	37%	20%
	2 = *to a small extent*	40%	38%	42%
	3 = *somewhat*	16%	15%	18%
	4 = *to a large extent*	12%	9%	15%
	5 = *totally*	3%	1%	5%
Explanatory				
flextime	Flexible (=1) vs fixed (=0) working time arrangement of the employee	75%	82%	67%
place	It is possible (=1) vs not possible (=0) to work from a location suitable for the employee (e.g. home) as often as he/she likes	27%	28%	27%
workhours	Employee reported average working hours per working day	10.10 (1.67)	10.10 (1.44)	10.11 (1.95)
atwork	Employee reported share of working hours at the workplace out of total working hours per working day	0.82 (0.13)	0.81 (0.14)	0.84 (0.11)
creatime	Employee reported share of creative work in total working time of the employee (%)	52.71 (21.41)	52.05 (21.05)	53.59 (22.01)
context	1 = *work as part of a R&D team* (base)	78%	76%	80%
	2 = *work as part of a team, which comprises mostly of non-R&D employees*	16%	18%	14%
	3 = *individual employee in the R&D area*	6%	6%	6%
nature	1 = *permanent work* (base)	90%	92%	87%
	2 = *non-permanent work, with a duration of more than 1 year*	7%	5%	11%
	3 = *non-permanent work, with a duration of less than 1 year*	3%	3%	2%
job satisfaction	To what extent are you satisfied with your work? (5-level Likert type scale, 1 = *not at all* to 5 = *totally*)	3.76 (0.73)	3.76 (0.75)	3.76 (0.72)
meq	Reduced morningness-eveningness questionnaire score, 1…25 scale ranging from 'Definitely an evening-type' to 'Definitely a morning-type'	14.73 (3.53)	14.98 (3.57)	14.39 (3.49)
sleephours	Employee reported average sleeping hours per day on the scale:			
	1 = *less than 6 hours* (base)	7%	6%	8%
	2 = *6-7 hours*	50%	49%	50%
	3 = *7-8 hours*	38%	39%	36%
	4 = *8-9 hours*	6%	6%	6%
	5 = *over 9 hours*	0%	0%	0%
gender	Male (=1) vs female (=0)	57%	100%	100%
age	Age in years	38.76 (11.51)	37.72 (12.19)	40.12 (10.48)
family	Employee reported number of people living together with the employee	1.66 (1.46)	1.72 (1.54)	1.58 (1.36)
education	Educational level:			
	1 = *primary education* (base)	0%	0%	0%
	2 = *secondary education*	8%	14%	0%
	3 = *vocational education*	3%	5%	0%
	4 = *undergraduate degree*	30%	33%	26%
	5 = *master's degree*	41%	33%	51%
	6 = *PhD*	18%	15%	23%
educationy	Years of education starting from primary education	16.58	15.96	17.39

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Variable	Description	All: Mean (SD)/ %	Males: Mean (SD)/ %	Females: Mean (SD)/ %
		(2.66)	(2.85)	(2.14)
fhealth	General health condition factor (with overall Kaiser-Meyer-Olkin measure of sampling adequacy of the factor 0.6), comprising:	0.00 (0.81)	0.05 (0.81)	-0.07 (0.81)
	(1) 'Do you have high blood pressure or have you ever used medicine for high blood pressure?' (yes=1)	20%	22%	18%
	(2) 'Do you suffer or have you suffered from diseases that significantly affect your mental fatigue?' (5-point Likert type scale, 1 = *never* to 5 = *often*)	1.71 (0.95)	1.75 (0.97)	1.67 (0.93)
	(3) 'Does your disease or injury interrupt you while doing your daily job?' (5-point Likert type scale, 1 = *no obstacles* to 5 = *not able to work*)	1.58 (0.73)	1.57 (0.77)	1.58 (0.68)
	(4) 'How many workdays have you been absent from work due to disease or medical examination in the past 12 months?'(5-level scale, 1 = *none* to 5 = *100-365 days*)	1.75 (0.72)	1.77 (0.69)	1.71 (0.76)
	(5) body-mass index (continuous)	24.65 (3.90)	25.35 (3.11)	23.72 (4.61)

Note: R&D = Research and development

2.3.Statistical analysis

We present six alternative estimates of the employees' perceived extent to which their sleep regimen was limited by work. The six different model setups enable us to consider various angles of how work arrangements affect sleep, and to test the robustness of the results. The first two regression models (see Models 1 and 2 in Table 2) represent the ordinary least squares (OLS) continuous estimations of the dependent variable. The third and fourth model (Models 3 and 4) show the ordered probit maximum likelihood estimations of the ordered discrete categories of the dependent variable. As the distribution of the dependent variable is skewed and non-normal, as expected, the ordered probit estimations led to a better descriptive power for the dependent variable compared to the OLS model. The ordered probit model therefore functions as the main model for reporting the study results in the following sections. We compiled a fifth and sixth model, however, as structural equation models (SEM) in order to take into account the selection due to it being certain types of employees that opt for flexible working time (represented by the *flextime* variable), as well as for creativity intensive positions (represented by the *creatime* variable). The fully observed recursive SEM models (Models 5 and 6) present the perceived extent to which work limited the employees'

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sleep (*sleeplim*) as the final stage dependent variable, whereas the ordered probit estimates of *sleeplim* in the main equation contains *flextime* and *creatime* as the endogenous selection variables among other explanatory variables. The three-dimensional SEM model includes in parallel a probit estimation of *flextime* and an OLS estimation of *creatime*. Compared to the OLS and ordered probit estimates of the dependent variable, the SEM models thereby help to control for the selection mechanisms for positions with a flexible working time option and for creativity intensive positions. SEM models 5 and 6 differ from each other only in terms of incorporating the flexible working time variable (*flextime*) as a separate explanatory variable (Model 6), as opposed to in interaction with the flexibility in the workplace (*place*) variable (Model 5). For the estimations we use the cmp (Conditional Mixed Process) module of the Stata14 software by StataCorp (Texas, USA).

3. Results

The results of the six alternative models are outlined in Table 2 in the Appendix. The models show overall qualitatively similar results for model fit and coefficient estimates.

From all six models we find the morningness-eveningness type of employee to have a statistically significant connection with his/her perception of sleep regimen limitations due to work. We find that relationship to be non-linear, as illustrated on the Figures 1a and 1b. Compared to morning-type employees and the neither type, evening-type employees feel with a significantly higher probability that work limits their sleep 'to a large extent' (*sleeplim*=4; Figure 1b). The opposite applies to perceiving no work related limitations to sleep (*sleeplim*=1; Figure 1a) – evening-type employees perceive it with a significantly lower probability in comparison to the neither type and morning-type people.

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Figure 1. Probabilities of an employee perceiving that his/her work is limiting or has limited his/her sleep regimen 'not at all' (left panel; Figures 1a, 1c, 1e, 1g) and 'to a large extent' (right panel; Figures 1b, 1d, 1f, 1h) for different morningness-eveningness (*meq*; Figures 1a, 1b, 1c, 1d), creative intensity (*creatime*; Figures 1e, 1f) and sleeping time (*sleephours*; Figures 1g, 1h) levels (adjusted ordered probit estimates at means with error bars denoting 90% confidence intervals based on Model 2)

[Figures are saved separately from text]

In Models 1-4 results we find that employees who have flexibility in both working time and workplace (i.e. *flextime* = 1 and *place* = 1) perceive the limitations that their work sets on their sleep regimen at a significantly lower probability than the employees who do not enjoy both of these liberties. For a graphical illustration of that complex relationship, refer to Figures 1c and 1d, where probabilities of an employee perceiving that his/her work is limiting or has limited his/her sleep regimen 'not at all' (*sleeplim*=1; Figure 1c) and 'to a large extent' (*sleeplim*=4; Figure 1d) have been shown for the different combinations of the flexible working time and distance work (i.e. flexible working place) options and different morningness-eveningness (*meq*) levels (adjusted ordered probit estimates at means based on Model 3). We however note that support to that finding is limited as the marginal effects of *flextime* and *place* individually do not appear statistically significant in Models 1-4, and Models 5 and 6, where selection mechanism into positions with flexible working time has been taken into account, do not reveal any post-selection effect of flexible working time nor distance work option on the perceived extent of limitations that work sets on sleep.

We find from all the six alternative model estimates that creative intensity has a statistically significant negative relationship with the employee's perception of working

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time distracting his/her sleep regimen. Refer to Figures 1e and 1f for the illustration of the significant decrease in the probability of an employee feeling his/her work being a large (Figure 1f) or no (Figure 1e) limiter of sleep along with the increase in the creative intensity of work.

For an expected result, we find a statistically significant negative relationship between sleeping hours and the level of perceived work related limitations on sleep. The linkages between employee reported sleeping hours and perceived limitations of sleep regimen caused by work are illustrated on the Figures 1g and 1h.

In the ordered probit based estimates of *sleeplim* in Models 3-6 we find gender to be a statistically near-significant determinant of the level of perceived limitations of sleep regimen caused by work. Compared to women, men have a 12-13 percentage points higher probability of feeling that work does not set any limits on their sleep rhythms. Women have a 6 percentage points higher probability of perceiving that work has limited their sleep regimen 'to a large extent'. Refer to Table 3 for the marginal effects. Women are however less likely than men to get access to jobs providing flexible working time as becomes evident from Models 5 and 6.

In order to test whether the perceived limitations of sleep regimen caused by work might be driven by overall satisfaction with work by the employee, we have included job satisfaction as an additional explanatory variable into Models 2 and 4. As can be seen from Table 2, both of these models reveal that perceived work related limitations on sleep are not related to the job satisfaction of the employee. This, along with controlling for the effect of sleeping hours in all the models, provides some additional support to the finding that work arrangements, chronotype and gender are related to perceived limitations that work sets on the sleep regimen of an employee.

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4. Discussion and conclusions

The purpose of this study was to identify what type of creative R&D employees suffer from the adverse effects of work arrangements on their sleep regimen. The starting point for the investigation was the notion that traditional daily ('nine-to-five') work schedules might not account for individual characteristics, including their circadian rhythm. Several significant findings arise from our study. First, evening-type employees feel that their sleep regimen is significantly more disturbed by work compared to the other chronotypes. This result reveals that traditional work schedules, where the working day usually starts between 8 or 9 in the morning, rather accommodates the preferences of morning or neither-types but does not comply with the natural choices of evening-types. A sleep-wake cycle that is out of sync with the individual's inner circadian clock is associated with adverse outcomes concerning sleep and health in general [12,13]. Moreover, considering that the sleep regimen is connected to the individual's genetic background, which evidently cannot be chosen or changed by the employee, the evening-type people appear to be unfairly disadvantaged by having to follow a daily schedule not in compliance with their needs. An understanding of these severe problems and discussions on changing working time arrangements are necessary at both employer and regulator level, as well as in society at large.

Second, we find that female employees have a considerably higher probability of perceiving their work as strongly limiting their sleep regimen, while being less likely than men in getting access to jobs with flexible work schedules. We note that although it has been generally found that women sleep more than men [23], in our sample of Estonian R&D employees, the sleeping hours of men are slightly longer. It could be possible that women feel more distracted by paid work because they do more unpaid work at home, thus limiting the overall time available for sleep and leisure. In Estonia,

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women do a disproportionately high share of care-giving and household tasks, even in families where both spouses work full-time [24], and that might explain our study results in addition to the lower likelihood of women getting jobs with flexitime.

Third, our results show some support to the finding that employees who have flexibility in both working time and working place feel significantly less impacted by work-driven constraints on their sleep regimen. This result corroborates the findings by Takahashi et al. [14] and Moen et al. [15], who uncover that added control over working time is associated with reduced work-life conflict, better sleep and improved health. More generally, our findings support the discoveries by Golden et al. [8], who show that greater working time flexibility is linked with increased happiness, and Anderson et al. [25], who discovered that employees experience more positive feelings (e.g., happiness, enthusiasm, alertness) and less negative feelings (e.g., fear, anxiety, guilt) on days when they telework as opposed to when they work at the office.

Finally, we find employees with a higher creative intensity of work less affected by the limitations that work sets on their sleep, in comparison to employees with a higher share of administrative and other non-creative tasks. A possible explanation for this is that creative assignments are the preferred and primary work tasks of a creative R&D employee, and remain the basis on which the employee is evaluated, while administrative and other non-creative tasks are (non-preferred) side-tasks. These tasks must be done, but they are largely 'invisible' and are not highly valued by the employees themselves or by their supervisors. As administrative tasks can distract and slow down the creative work, and be related to additional strain, less time may be available for the principal creative tasks of the employee and possibly also for sleep.

The above findings make novel contributions. However, this study has

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limitations. While the results are statistically significant, they are based on a small sample of 153 employees. Also, individuals in the population were approached on a company basis, and thus could only participate if their employer agreed to the study. Besides, survey completion by the respondent might have incurred a selection bias. To an extent, these selection biases were addressed by weighting of the sample to align it with population characteristics regarding the respondent's gender and the employer's industry. Furthermore, clustering standard errors by employer was used to account for dependencies in such clusters. Nevertheless, all selection biases cannot be offset. Considering future studies, similar analyses on larger samples in different countries and/or different professions could be a motivating research path.

Despite these limitations, our study points to the mismatch between the traditional 'nine-to-five' work schedules of creative R&D employees and the individual characteristics of the employees such as their inner circadian clock. Evening-type and female R&D employees are significantly more likely to be limited by the adverse effects of work on their sleep regimen. Not only is the well-being of employees impaired when they feel that work limits their sleep, but the employers are also disadvantaged, as they are potentially underutilising the creative capabilities of their employees. Granting working time and working place flexibility may have a major positive impact on improving the sleep of creative R&D workers as well as improving productivity. Avoiding the allocation of excessive administrative duties to creative R&D employees may have a further positive effect on their sleep.

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Appendix

Table 2. Ordinary least squares (OLS), ordered probit and structural equation model (SEM) estimates of *sleeplim*

Variable	Model 1: OLS	Model 2: OLS	Model 3: Ordered probit	Model 4: Ordered probit	Model 5: SEM	Model 6: SEM
Main equation						
Estimation					*oprobit*	*oprobit*
flextime=0 # *place*=1[‡]	-0.165	-0.091	-0.244	-0.160	-0.242	
	(0.59)	(0.60)	(0.83)	(0.83)	(0.82)	
flextime=1 # *place*=0	-0.165	-0.164	-0.227	-0.225	0.104	
	(0.19)	(0.19)	(0.21)	(0.21)	(0.87)	
flextime=1 # *place*=1	-0.381***	-0.346***	-0.528***	-0.483***	-0.196	
	(0.12)	(0.10)	(0.17)	(0.16)	(0.77)	
flextime (Yes=1)						0.013
						(0.80)
workhours	-0.004	0.007	-0.007	0.008	-0.006	-0.012
	(0.05)	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)
atwork	0.761	0.752	0.737	0.732	0.715	1.001
	(0.54)	(0.55)	(0.71)	(0.72)	(0.70)	(0.74)
creatime	-0.010**	-0.010**	-0.015**	-0.015***	-0.022***	-0.021***
	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)
context=2	-0.100	-0.937	-0.125	-0.113	-0.018	-0.041
	(0.32)	(0.30)	(0.37)	(0.36)	(0.25)	(0.27)
context=3	0.175	0.213	0.074	0.126	0.150	0.166
	(0.30)	(0.29)	(0.35)	(0.31)	(0.46)	(0.45)
nature=2	0.193	0.194	0.323[§]	0.318§	0.313[§]	0.354*
	(0.16)	(0.16)	(0.22)	(0.22)	(0.21)	(0.19)
nature=3[‡]	-0.374*	-0.413*	-0.413	-0.496	-0.403	-0.399
	(0.19)	(0.21)	(0.31)	(0.38)	(0.31)	(0.32)
job satisfaction		-0.089		-0.114		
		(0.10)		(0.14)		
meq	-0.378**	-0.399**	-0.361**	-0.383**	-0.357**	-0.342**
	(0.14)	(0.13)	(0.15)	(0.15)	(0.15)	(0.16)
meq^2	0.010**	0.011**	0.009*	0.009*	0.008*	0.008*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
sleephours	-0.229*	-0.225*	-0.242*	-0.236*	-0.239*	-0.215[§]
	(0.11)	(0.11)	(0.14)	(0.14)	(0.14)	(0.13)
gender (Male=1)	-0.377	-0.367	-0.492*	-0.481*	-0.531[§]	-0.518[§]
	(0.24)	(0.25)	(0.28)	(0.28)	(0.32)	(0.32)
age	-0.001	-0.002	0.000	-0.001	0.002	0.004
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
family	-0.046	-0.045	-0.085[§]	-0.087*	-0.084[§]	-0.081[§]
	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)
education=3	-1.023*	-0.995*	-1.598*	-1.536*	-1.541*	-1.487*
	(0.52)	(0.54)	(0.84)	(0.87)	(0.81)	(0.78)
education=4	-0.515[§]	-0.522[§]	-0.597*	-0.608*	-0.554*	-0.553*
	(0.30)	(0.30)	(0.32)	(0.32)	(0.33)	(0.30)
education=5	-0.571	-0.534	-0.652	-0.607	-0.586	-0.621
	(0.44)	(0.47)	(0.52)	(0.55)	(0.56)	(0.52)
education=6	-0.696[§]	-0.665	-0.883[§]	-0.844§	-0.773	-0.863*
	(0.48)	(0.49)	(0.54)	(0.55)	(0.61)	(0.48)
Scores for factor *fhealth*	0.105	0.094	0.130	0.117	0.129	0.118
	(0.10)	(0.30)	(0.12)	(0.13)	(0.12)	(0.11)

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Variable	Model 1: OLS	Model 2: OLS	Model 3: Ordered probit	Model 4: Ordered probit	Model 5: SEM	Model 6: SEM
constant	7.062*** (1.21)	7.380*** (1.27)				
creatime, *Estimation*					*OLS*	*OLS*
age					0.087 (0.25)	0.087 (0.25)
gender (Male=1)					1.704 (3.77)	1.703 (3.77)
education					2.379*** (0.64)	2.379*** (0.64)
constant					11.437* (6.52)	11.436* (6.52)
flextime, *Estimation*					*probit*	*probit*
age					-0.017 (0.01)	-0.017 (0.01)
gender (Male=1)					0.532*** (0.20)	0.532*** (0.20)
education					0.073** (0.04)	0.072** (0.04)
meq					0.011 (0.03)	0.010 (0.03)
context=2					-0.837* (0.44)	-0.840* (0.44)
context=3					-0.659 (0.58)	-0.660 (0.57)
constant					-0.241 (0.61)	-0.221 (0.60)
cut_1_1, constant			-6.341*** (1.26)	-6.705 (1.38)	-6.281*** (1.55)	-5.796*** (1.46)
cut_1_2, constant			-4.985*** (1.27)	-5.360 (1.40)	-4.944*** (1.50)	-4.463*** (1.41)
cut_1_3, constant			-4.169*** (1.25)	-4.536 (1.36)	-4.141*** (1.45)	-3.662*** (1.35)
cut_1_4, constant			-3.069*** (1.12)	-3.428 (1.22)	-3.060** (1.30)	-2.584** (1.20)
lnsig_2, constant					2.972*** (0.04)	2.972*** (0.04)
atanhrho_12, constant					0.108§ (0.07)	0.098§ (0.06)
atanhrho_13, constant					-0.160 (0.47)	-0.136 (0.45)
atanhrho_23, constant					0.257* (0.15)	0.255* (0.15)
R^2	0.393***	0.395***				
pseudo-log-likelihood			-172.15***	-171.47***	-919.96***	-920.75***
Number of obs	150	150	150	150	153	153

Notes: Estimated coefficients with employee clustered standard errors below in parentheses, ‡ only 4 observations in this category, no contextual significance; § p<0.15, * p<0.10, ** p<0.05, *** p<0.01; significance of pseudo-log-likelihoods is based on the Wald's χ^2

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Table 3. Average marginal gender effects (Male=1) for different levels of *sleeplim*

sleeplim =	**1**	**2**	**3**	**4**
Model 3	0.125*	0.011	-0.482*	-0.060*
	(0.071)	(0.012)	(0.026)	(0.035)
Model 4	0.123*	0.009	-0.470*	-0.059*
	(0.072)	(0.012)	(0.027)	(0.036)
Model 5	0.133¥	0.013	-0.050*	-0.065¥
	(0.084)	(0.015)	(0.028)	(0.041)
Model 6	0.131¥	0.014	-0.050*	-0.064¥
	(0.083)	(0.016)	(0.028)	(0.042)

Note: ¥ p<0.15, * p<0.10, ** p<0.05, *** p<0.01

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Figure 2. Histograms of creative intensity of work (*creatime*, Figure 2a) and morningness-eveningness (*meq*, Figure 2b)

[Figures are saved separately from text]

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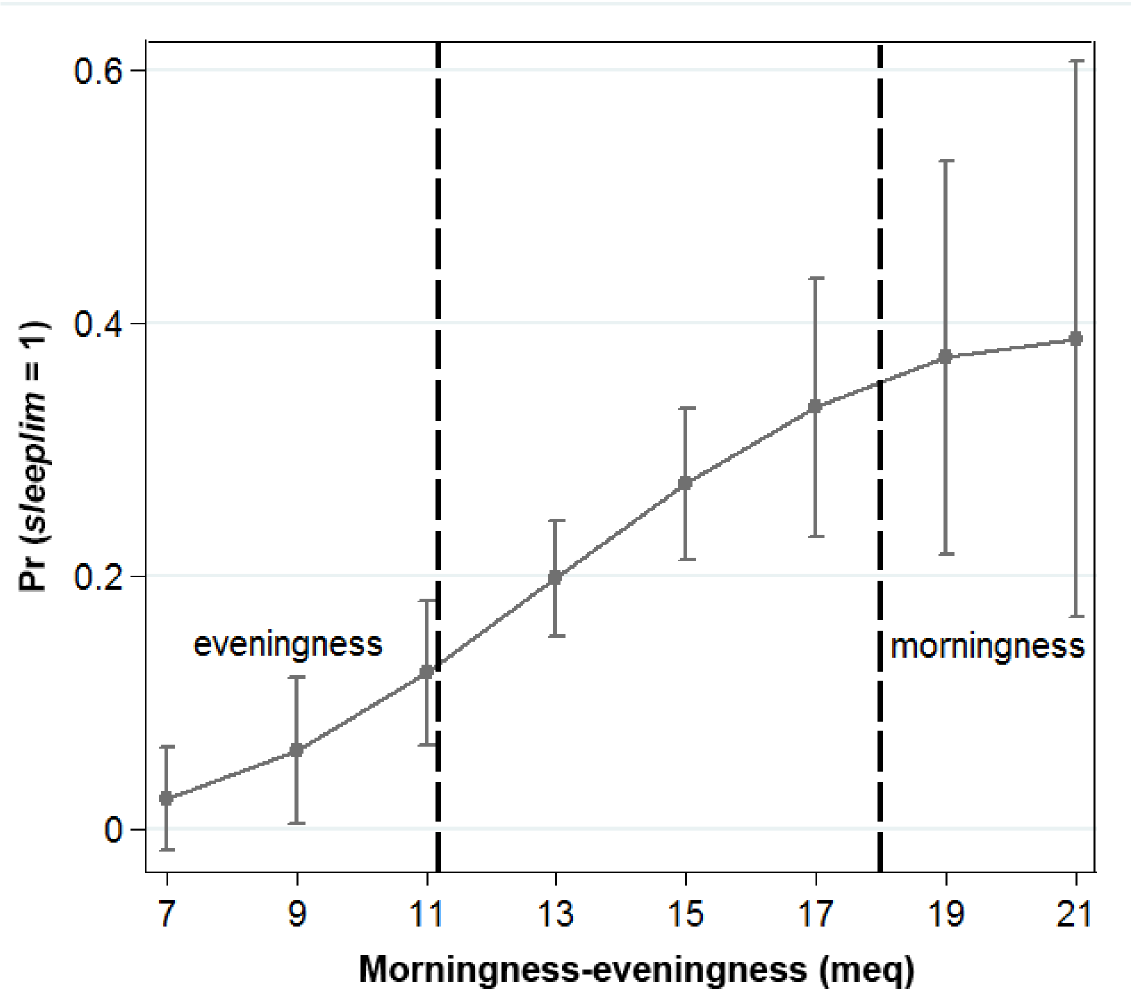

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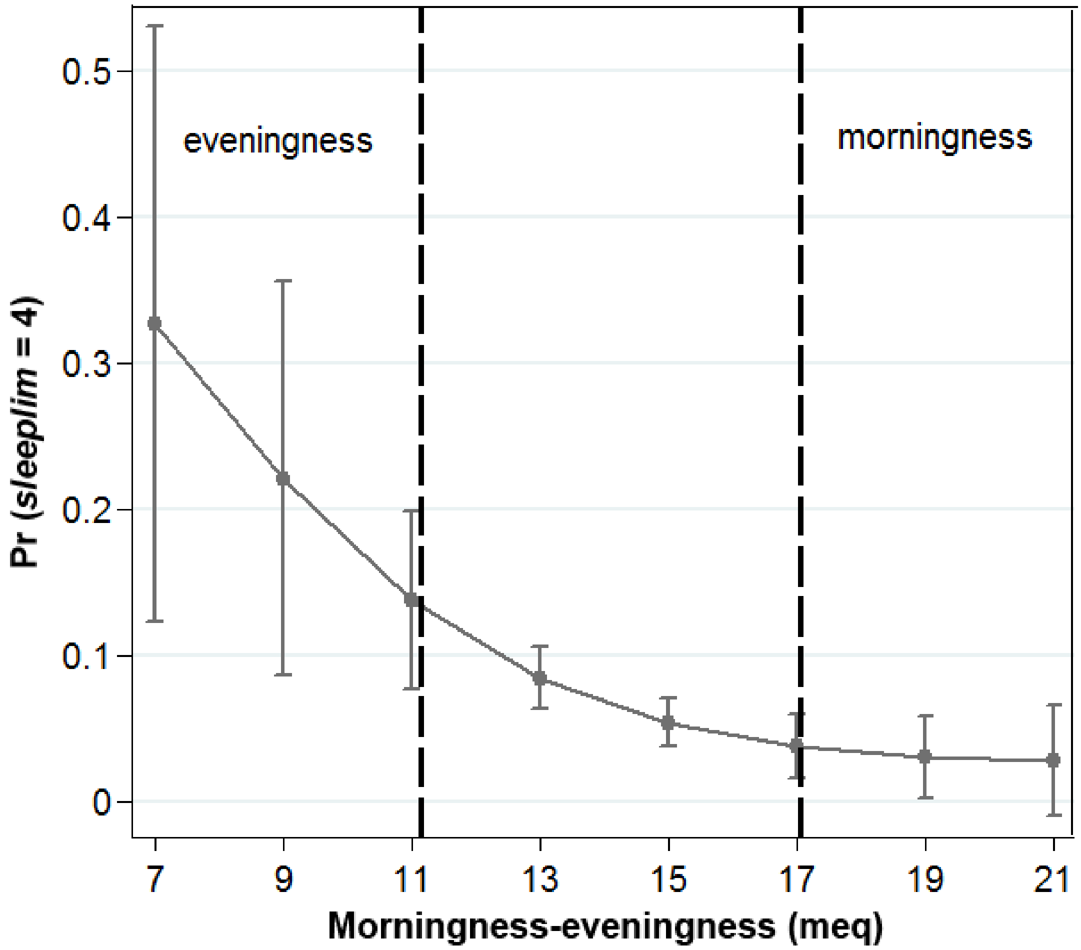

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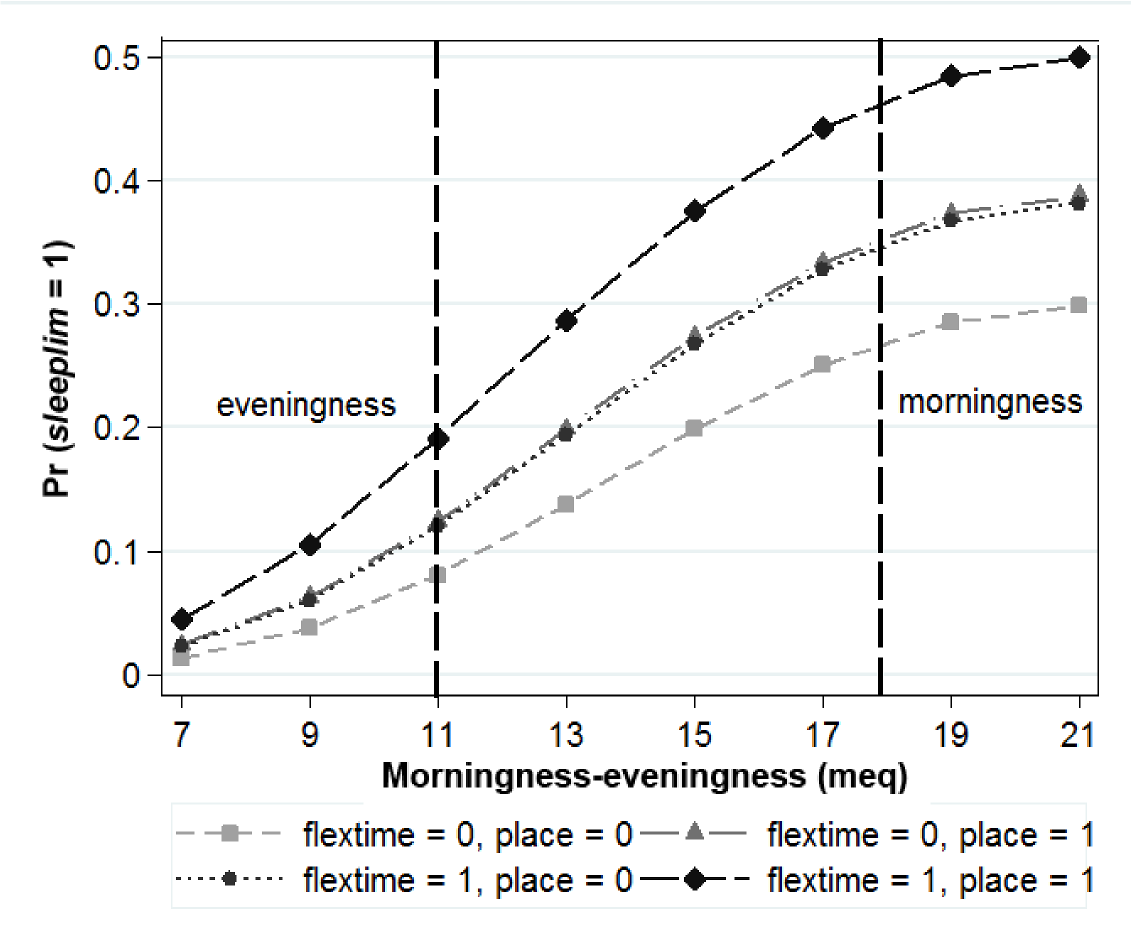

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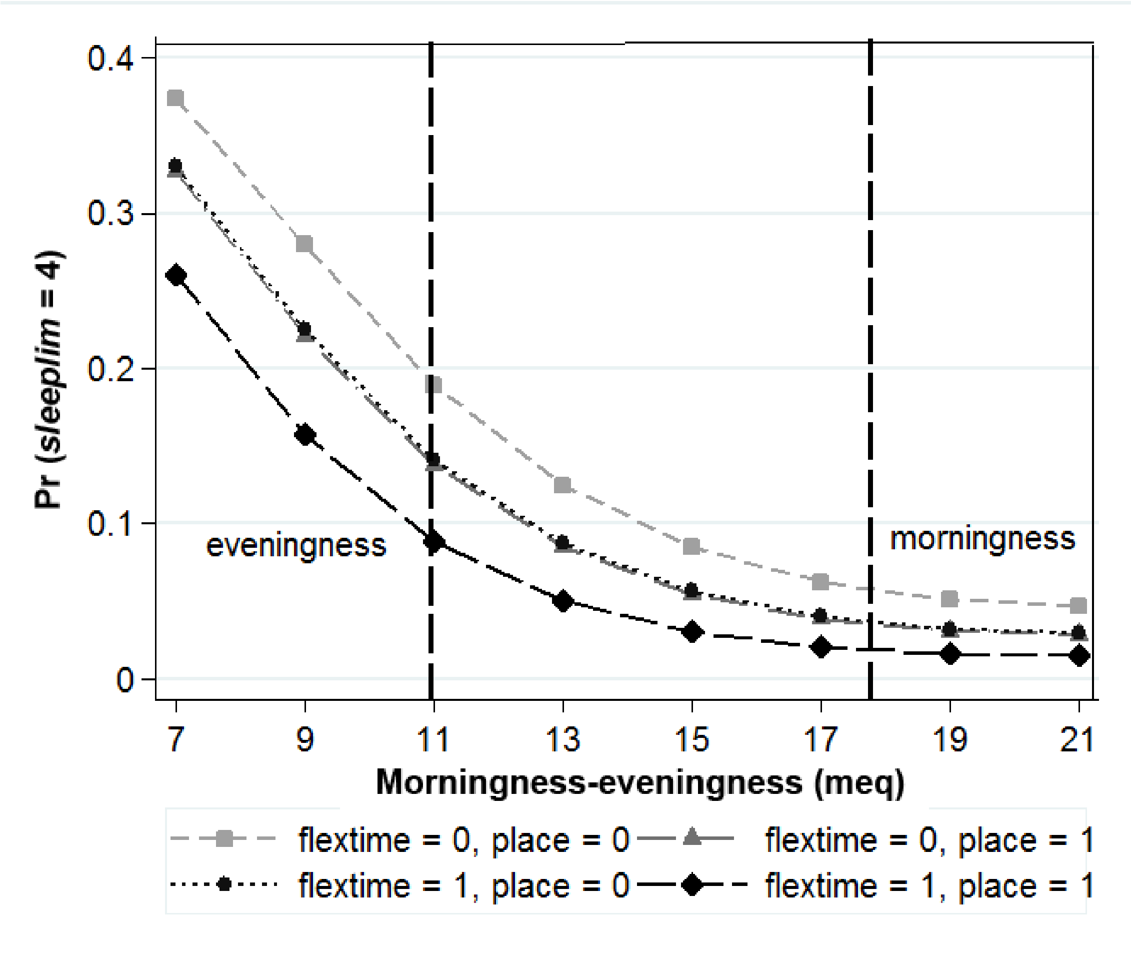

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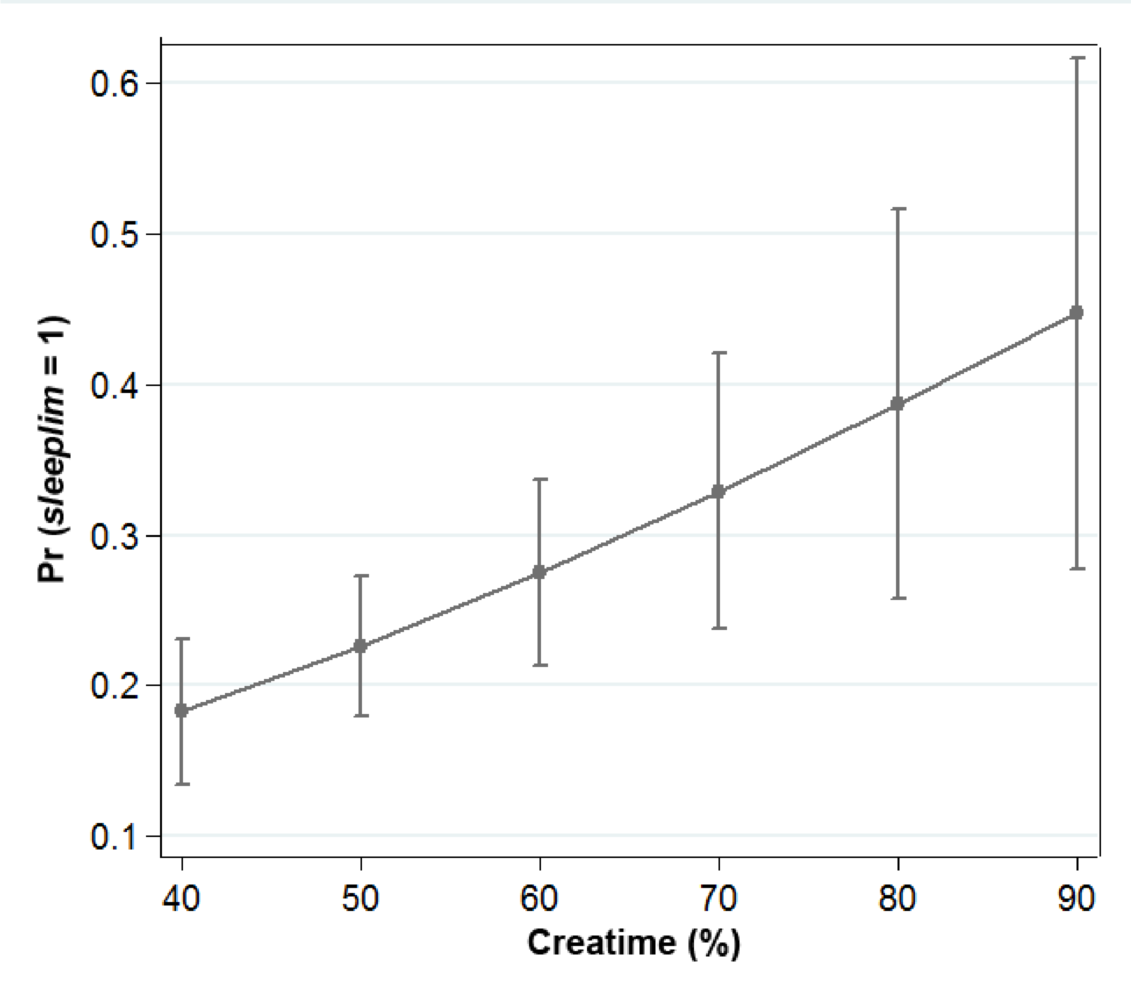

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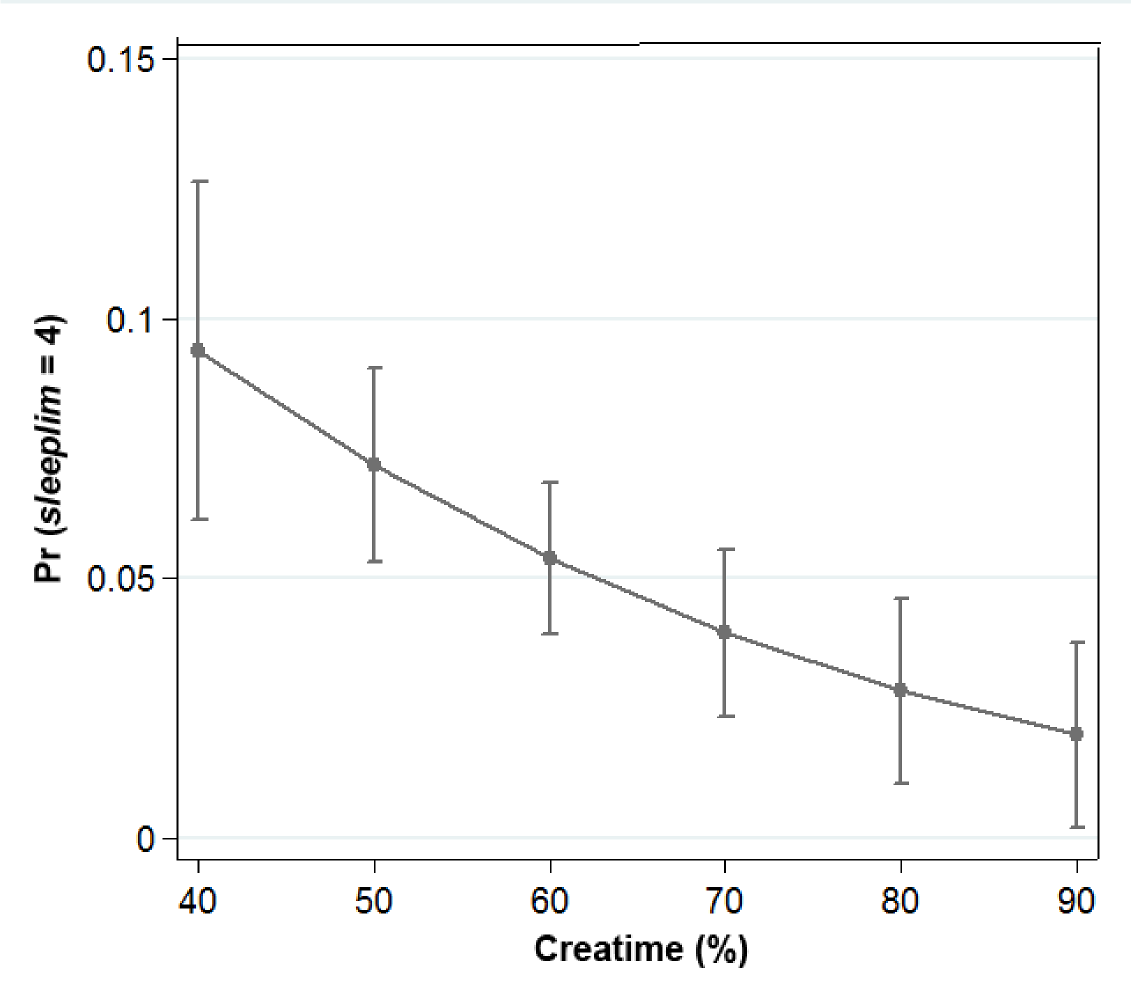

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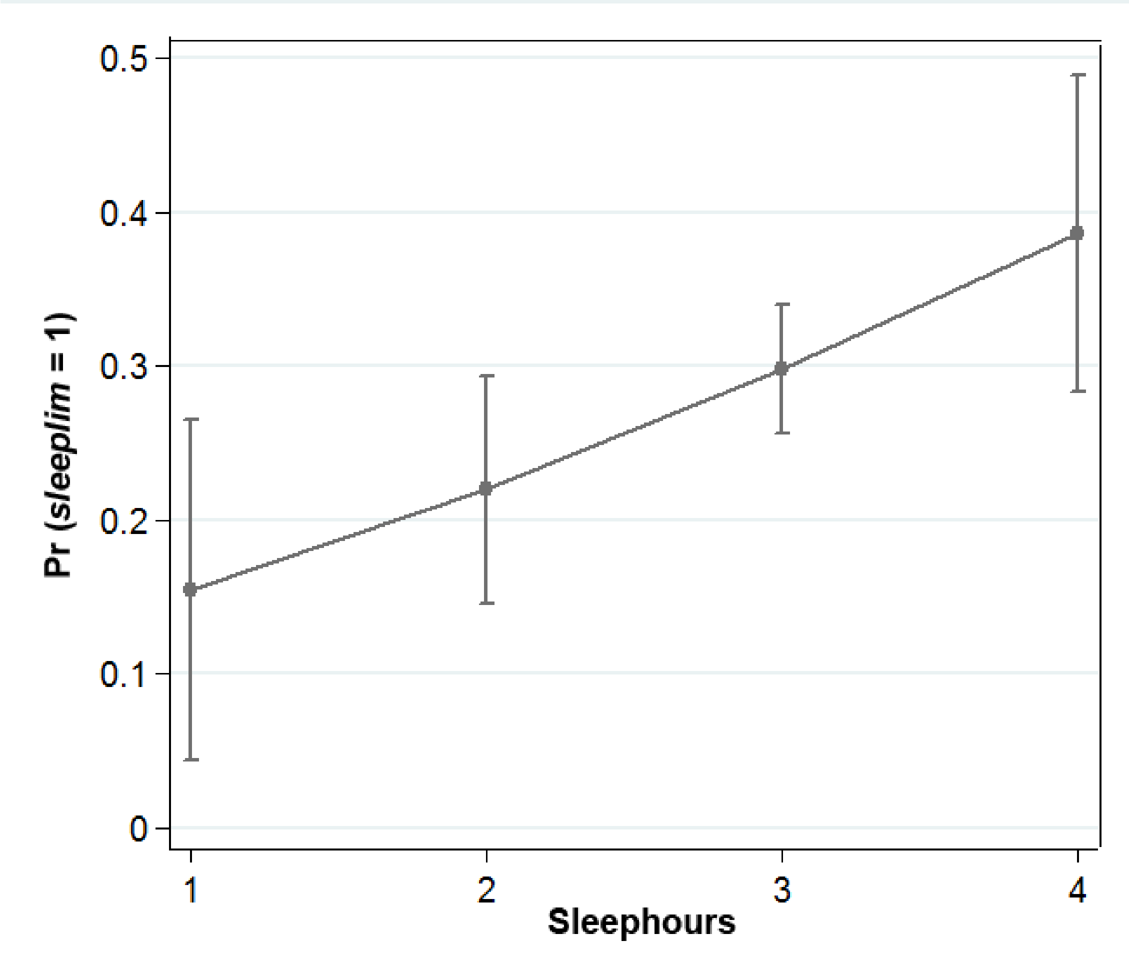

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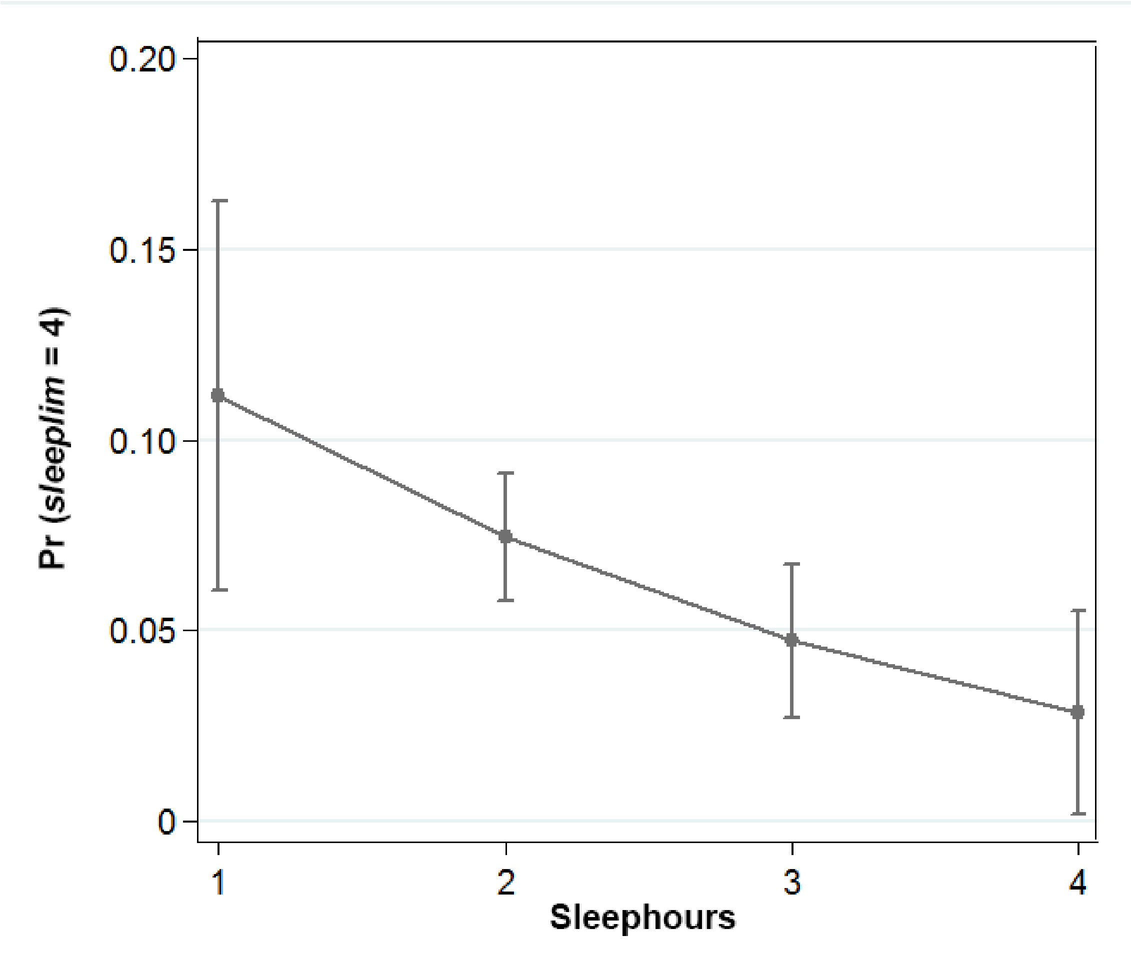

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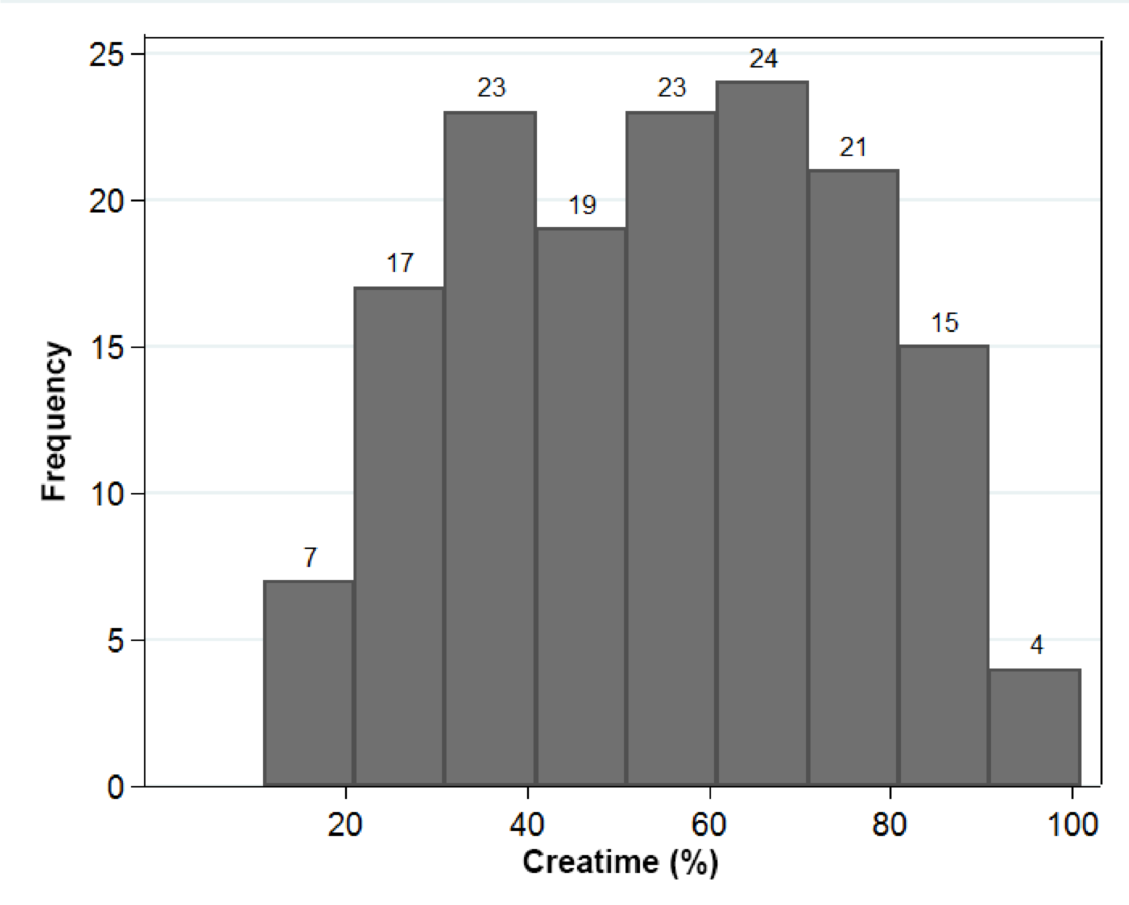

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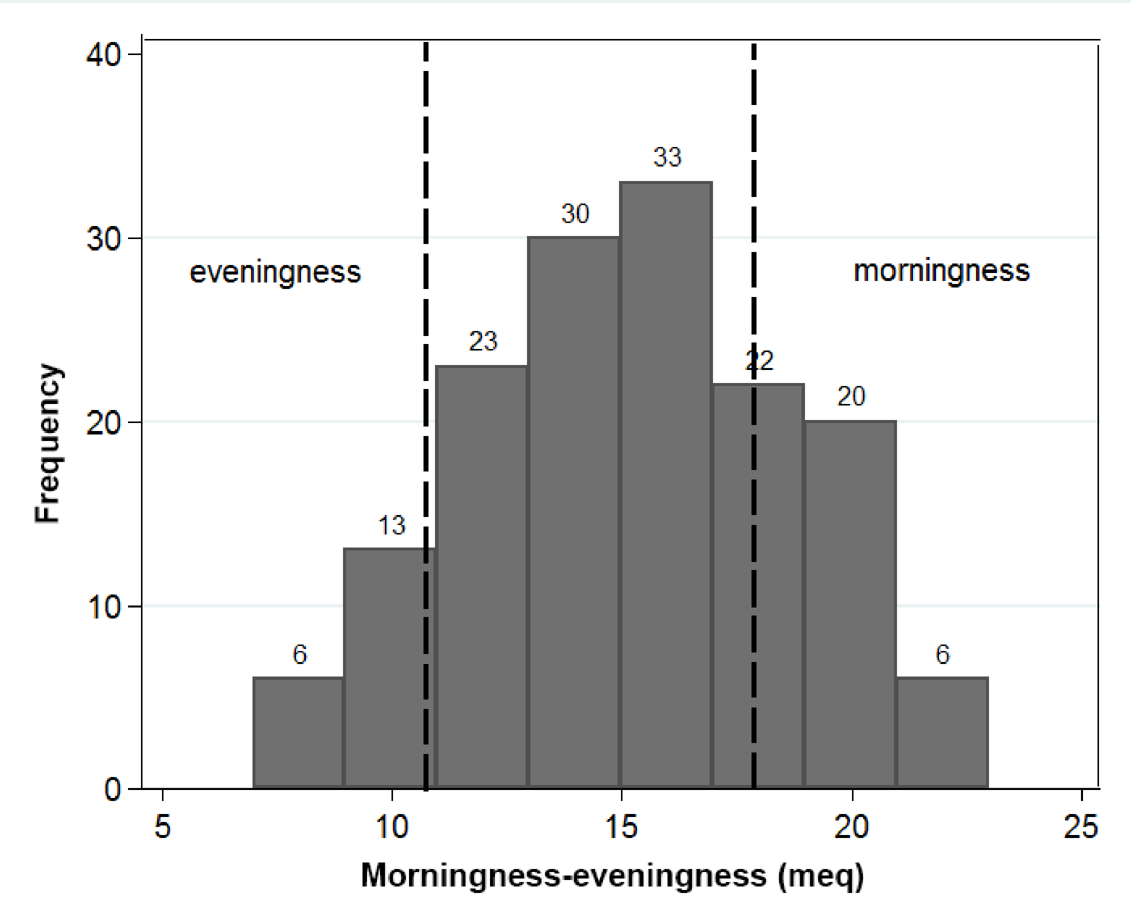

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