Interaction of long working hours and sense of coherence on objective total sleep time: SLeep Epidemiology Project at University of Tsukuba

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Abstract

Background: Long working hours are a risk factor for short sleep duration among workers, suggesting that high stress under long working hours is associated with sleep. Sense of coherence (SOC) is a dispositional orientation that allows individuals to be more resilient to stressors in daily life. High SOC can maintain sleep under long working hours.

Objective: This study aimed to investigate the interaction between SOC and long working hours on total sleep time among Japanese workers. We hypothesized that individuals with higher SOC would be less susceptible to sleep reduction associated with long working hours compared to those with lower SOC.

Methods: A questionnaire and an actigraphy-based cross-sectional survey were conducted among workers in Ibaraki and Tokyo prefectures in Japan. The 13-item SOC scale was used to obtain responses, and weekly working hours were recorded. Total sleep time (TST) per day was measured with an actigraphy device worn for 1 week. Long working hours were defined as more than 50 hours per week; multiple regression analysis with TST as the dependent variable was performed to examine the interaction between long working hours and SOC. A simple slope analysis was performed for further analysis of the interaction.

Results: A total of 785 workers from 540 surveyed workers were included in the analysis. Multiple regression analysis showed a decrease in TST for long working hours alone, whilst an interaction between long working hours and SOC was associated with an increase in TST. Single slope analysis showed that lower SOC was associated with a greater decrease in TST.

Conclusions: Our findings suggest the need for interventions designed to promote SOC in protecting the sleep of workers during long working hours.

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Results: A total of 785 workers from 540 surveyed workers were included in the analysis. Multiple regression analysis showed a decrease in TST for long working hours alone, whilst an interaction between long working hours and SOC was associated with an increase in TST. Single slope analysis showed that lower SOC was associated with a greater decrease in TST.

Conclusions: Our findings suggest the need for interventions designed to promote SOC in protecting the sleep of workers during long working hours.

Keywords: Actigraphy; Long Working Hours; Sleep Duration; Salutogenesis; Worker; Employee

1. Introduction

Sleep duration is an important biomarker in human sleep, and short sleep duration is associated with increased cardiovascular disease, diabetes, mental disorders, and all-cause mortality [1-3]. In addition, short sleep duration is a risk for occupational accidents, incidents, and presenteeism among workers [4, 5]. Japan has the lowest average sleep duration among developed countries [6], especially among the working-age population. Ikeda and colleagues report that permanent daytime workers in Japan sleep about 360 minutes on average [7]. It is important to identify factors that protect sleep duration in this population.

In workers, long working hours are a risk factor for insufficient sleep [8, 9]. International organizations and countries have established standards for maximum working hours. For example, International Labor Organization (ILO) conventions stipulate a maximum of 48 hours of work per week [10]. In Japan, the Labor Standards Law stipulates that an employer shall not make an employee work more than 8 hours per day or 40 hours per week [11]. An agreement should be concluded between an employer and an employee and submitted to the Labor Standards Inspection Office, when the employer wants to extend working hours or have an employee work on holidays. As a general rule, the upper limit of overtime work is 45 hours per month or 360 hours per year. When there are special temporary circumstances, the upper limit can be up to 720 hours per year or less than 100 hours per month or up to an average of 80 hours per month over multiple months [11]. Assuming 45 hours of overtime per month, this translates into an approximate 50-hour workweek, which is roughly in line with the conventions set forth by the ILO. Against this background, long working hours are often defined as around 50 hours per week, and a meta-analysis by Wong and colleagues reported that working hours in excess of around 50 hours per week are associated with risk of cardiovascular and cerebrovascular diseases, depression, anxiety disorder, and sleep disorder in workers [9]. They also suggest that the mechanism of short sleep duration due to long working hours is related to high work stress and the sympathetic nervous system [12, 13], in addition to difficulty in securing sleep. Research on the effect of increased sleep on reduced work hours is limited, although a study by Schiller and colleagues reported that a 25% reduction in weekly work hours resulted in an increase of 23 minutes of sleep [14]. On the other hand, it has been noted that sleep duration may not increase [15]; therefore, methods other than the reduction of working hours are important to maintain workers' sleep duration.

Salutogenesis is an approach to human health that examines the factors that promote and maintain physical and mental health [16]. Antonovsky defined Sense of Coherence (SOC) as the ability to maintain health in the face of stressful events and situations [17, 18]. SOC is defined as comprehensibility, manageability, and meaningfulness [17, 18]. People with high SOC have a higher ability to cope with stress and maintain physical and mental health in the face of stress, and associations between SOC and depression and all-cause mortality have been reported [19, 20]. Furthermore, SOC has been reported to protect against stress in workers and even against serious stresses such as post-traumatic stress disorder [21, 22]. Long working hours are a stressful situation, and workers' SOC may be associated with sleep duration.

To our knowledge, only two studies have previously examined the association between SOC and sleep duration: in a study of software office workers, Morita and colleagues reported that workers with high SOC maintained more than 6 hours of sleep per day as compared with workers with low SOC [23]; in a study of civil servants, Kósa and colleagues also reported a U-shaped association between SOC and sleep duration, with a positive association between SOC and sleep duration of up to 8 hours per day [24]. However, the interviews in these studies focused only on subjective sleep duration, which may be subject to recall bias [25]. Since subjective sleep duration is reported to be longer than actual sleep duration, it is more important to measure objective sleep duration. The gold standard for objective sleep duration is polysomnography (PSG) [26], but it is not suitable for measuring large populations. Recently, actigraphy, with its built-in accelerometer, has been used in epidemiologic studies to measure objective sleep duration, with a reported agreement rate of approximately 90% with PSG [27, 28]. Furthermore, previous studies have not taken into account the factor of working hours in the relationship between sleep duration and SOC, and it would be useful to examine the interaction between long working hours and SOC, as SOC can help maintain health under stress. It is important to examine interactions in epidemiology to consider effective interventions to improve outcomes with limited resources [29]. By examining interactions, we can gain clues about the reasons and mechanisms whereby exposure factors affect outcomes [30]. Whilst the interaction between SOC and long working hours in workers' psychological stress has been studied [21], the interaction between SOC and long working hours with sleep duration has not been reported. Examining the interaction between long working hours and SOC in objective sleep can provide important insights into the protection of workers' sleep.

Hence, we examined the interaction between long working hours and SOC by using actigraphy to measure sleep duration in workers.

2. Methods

2.1. Study design

Data from the SLeep Epidemiology Project at University of Tsukuba (SLEPT) study were used. The SLEPT study is a sleep epidemiology study conducted jointly by the University of Tsukuba and the International Institute for Integrative Sleep Medicine, University of Tsukuba. A cross-sectional survey was conducted from 2016 to 2017, and data were collected by means of a self-administered questionnaire, a participant's sleep diary for one week, and actigraphy. The participants were workers at four workplaces: a national university hospital in Ibaraki Prefecture, a national research institute, a corporate research institute, and a medical corporation in Tokyo. The participants were recruited by use of flyers, posters, workplace group emails, and workplace online bulletin boards. Some participants were referred by research staff or other study participants. There was no monetary reward for participation, but the results of the sleep measurements were fed back to the participants.

2.2. Measurements

2.2.1. Basic attributes

Age, sex, height, weight, drinking habits, exercise habits, and smoking status were surveyed. Survey items related to exercise habits were "Yes" (= "I exercise at least 30 minutes, twice a week, for one year") or "No" (= "other")[31]; those related to drinking habits were "Yes" (= "more than once a week") or "No" (=

“less than once a week”); and those related to smoking habits were “never smoker,” “former smoker,” or “current smoker.” They were also asked about any diseases the participant was currently being treated for and any medications the participant was currently taking were also surveyed.

2.2.2. Occupational factors

The participants were asked about their working hours (hours) for the last week, their daily one-way commuting time (minutes), and their employment status as defined by the Ministry of Health, Labor and Welfare (full-time regular employees/regular staff, full-time employees with short hours, part-time employees, contract employees, managers/staff, and others). They were also asked about whether they were currently engaged in shift work.

The Brief Scales for Job Stress (BSJS) [32] was used for Job Stress; the BSJS is a 20-item questionnaire based on a job demands-control-support model similar to the Job Content Questionnaire[33]. All participants were asked, "Please select the statement about your current work environment that most closely matches your feelings." Responses were rated on a 4-point scale (1 = "disagree" to 4 = "agree") and mean scores (range: 1.00–4.00) were calculated for six subscales: "workload," "mental workload," "interpersonal relationships,” "job control," "reward from work," and "support from colleagues and superiors.” The reliability and validity of this scale have been reported [34-36]. Workload, mental workload, and interpersonal relationship were defined as stress factors, and job control, reward from work, and support from colleagues and superiors, as stress-buffering factors. The Cronbach alpha coefficient for the BSJS in this study was 0.766.

2.2.3. Objective total sleep time

The MTN-220 (ACOS Co Ltd., Nagano, Japan) was used to record total sleep time (TST). Participants wore the MTN-220 on their trunk by clipping it to their trousers/pants, 24 hours a day for one week, except when bathing; the MTN-220 records activity using a built-in 3-axis acceleration sensor [37]. In a laboratory validation study, the agreement with PSG data ranged from 84.7% to 85.4% [37]. Data were extracted from the MTN-220 device by use of SleepSignAct2 software (Kissei Comtec Co. Ltd., Nagano, Japan). Sleep and wake detection from MTN-220 data followed the previously reported algorithm of SleepSignAct2 [37]. A sleep diary was used to measure subjective sleep patterns. Participants were required to estimate their sleep duration each morning and record the results in a sleep diary. After data acquisition, the data from the sleep measurements and the sleep diary were checked for consistency. Objective sleep duration on actigraphy was calculated after determining the wake times and bedtimes in the participants' sleep diaries, and the TST (minutes) was the average of all nights of data collected by actigraphy.

2.2.4. Sense of Coherence

The 13-item version of the Sense of Coherence scale (SOC-13) was used to assess SOC [18]. A shortened version of the original 29-item Sense of Coherence scale, the SOC-13 scale was developed by Antonovsky [18, 38]. The SOC-13 includes items categorized into three subscales: Comprehensibility (consisting of 5 items: 2, 6, 8, 9, and 11), Manageability (consisting of 4 items: 3, 5, 10, and 13), and Meaningfulness (consisting of 4 items: 1, 4, 7, and 12). The final score for each participant is the sum of the scores of the items, including reversed scores for questions 1, 2, 3, 7, and 10 (where a score of 7 is considered as 1, 6 as 2, 5 as 3, 4 as 4, 3 as 5, 2 as 6, and 1 as 7). Scores range from 13.0 to 91.0 points, with higher total scores indicating a stronger sense of coherence. The Japanese version of the SOC-13 questionnaire [39], which has been translated and validated in this language, was used in our study. Members of the Society for Theory and Research on Salutogenesis (STARS) are authorized to use this questionnaire for academic research [40]. The authors, Kei Muroi, Shotaro Doki, and Shin-ichiro Sasahara, are members of STARS. The Cronbach alpha coefficient for the SOC-13 in this study was 0.856.

2.3. Statistical analysis

A total of 785 workers participated in the study. Written informed consent was obtained from all the participants. Four participants subsequently withdrew their consent, and their data were deleted. An additional 36 participants were excluded because they did not meet the eligibility criteria. This was due to inconsistencies between the sleep measurement data and the sleep diaries. Of the remaining 747 participants, 207 participants having sleep disorders such as sleep apnea, having a history of psychiatric disorders, taking sleeping pills or psychotropic drugs, working short hours or part-time, or missing data were excluded, leaving a total of 540 participants for analysis.

Long working hours were defined as more than 50 hours of work per week. BMI was calculated from height and weight and divided into 3 groups (underweight: <18.5, normal weight: 18.5–24.9, overweight: ≥25), age was divided into 5 groups (20–29, 30–39, 40–49, 50–59, and 60 or over), and commuting time was doubled to daily one-way commuting time. Multiple regression analysis was conducted with TST as the dependent variable and with long working hours, SOC-13, and the interaction term between the two variables as the independent variables. The SOC-13 was centralized to avoid multicollinearity due to the correlation between the main effect term and the interaction term. Age, sex, BMI, drinking habits, exercise habits, smoking status, BSJS, presence of shift work, and commuting time were entered as confounders in the multiple regression model. When an interaction was observed, we performed simple slope analysis and plotted the results based on the studies by Aiken and West [41] and Cohen and colleagues [42] and tested the simple slopes of the regression lines corresponding to combinations of low (one standard deviation below the mean: −1SD) and high (one standard deviation above the mean: +1SD) levels of the SOC. Furthermore, we made the plot of the two-way interaction between long working hours and SOC. The statistical software used was R (R Foundation for Statistical Computing, Vienna, Austria) version 4.3.1, the significance level was 0.05 on both sides, and the pequod package [43] was used for single slope analysis.

2.4. Ethical consideration

The research proposal was reviewed and approved by the ethics committee of the University of Tsukuba (approval 1065-10), and all procedures were conducted in accordance with the ethical standards of national research committees and the Declaration of Helsinki.

3. Results

Table 1 shows the descriptive characteristics of the participants. The mean (SD) for overall sleep duration was 322 minutes (58.0), and the mean (SD) for SOC was 58.3 (11.9). The long hours group (≥50 hours/week) showed a shorter mean TST (<50 hours/week 332 min [SD 56.1], ≥50 hours/week 315 min [SD 58.5], p<0.001); no difference was found between the two groups for SOC (<50 hours/week 58.0 [SD 11.8], ≥50 hours/week 58.5 [12.0], p=0.62).

Table 1. Demographic characteristics

		Working Hours		
		<50 hours/week	**≥50 hours/week**	**p-value**
		n=236	**n=304**	
Sex n, (%)	Male	85 (36.2)	180 (59.2)	<0.001*
	Female	150 (63.8)	124 (40.8)	
Age n, (%)	20-29	35 (14.8)	54 (17.8)	0.12*
	30-39	70 (29.7)	82 (27.0)	
	40-49	68 (28.8)	73 (24.0)	
	50-59	46 (19.5)	82 (27.0)	
	60 and over	17 (7.20)	13 (4.30)	
BMI n, (%)	Underweight	23 (9.70)	18 (5.90)	0.042*
	Normal weight	166 (70.3)	242 (79.6)	
	Overweight	47 (19.9)	44 (14.5)	
Drinking habit n, (%)	No	81 (34.3)	69 (22.7)	0.004*
	Yes	155 (65.7)	235 (77.3)	
Exercise habit n, (%)	No	188 (79.7)	244 (80.3)	0.91*
	Yes	48 (20.3)	60 (19.7)	
Smoking status n, (%)	Never smoker	180 (76.3)	229 (75.3)	0.94*
	Current smoker	20 (8.50)	25 (8.20)	
	Former smoker	36 (15.3)	50 (16.4)	
Shift work n, (%)	No	219 (92.8)	262 (86.2)	0.018*
	Yes	17 (7.20)	42 (13.8)	

BSJS			
Workload, *M* (SD)	1.83 (0.630)	2.60 (0.740)	<0.001†
Mental Workload, *M* (SD)	1.95 (0.700)	2.46 (0.710)	<0.001†
Interpersonal Relationship, M (SD)	1.75 (0.670)	2.02 (0.78)	<0.001†
Reward from Work, *M* (SD)	2.81 (0.820)	3.01 (0.77)	0.004†
Support from Colleagues and Superiors, *M*(SD)	3.00 (0.650)	2.90 (0.630)	0.072†
Job control, *M* (SD)	2.83 (0.720)	2.88 (0.770)	0.500†
CommutingTime, M (SD)	73.4 (75.5)	62.9 (50.2)	0.053†
SOC-13, *M*(SD)	58.0 (11.8)	58.5 (12.0)	0.62†
TST, *M*(SD)	332 (56.1)	315 (58.5)	<0.001†

Note. *M*, mean; SD, standard deviation
*, chi-square test; †, unpaired t-test.
Abbreviations: BMI, body mass index; BSJS, Brief Scales for Job Stress; SOC-13, 13-item Sense of Coherence scale; TST, total sleep time.

Table 2 shows the results of the multiple regression analysis with TST as the dependent variable and long hours worked, SOC-13, and the interaction of the two variables as the independent variables. A main effect of long working hours was found (β=−0.115, p=0.023), as well as an interaction between long working hours and SOC (β=0.147, p=0.026), while SOC alone was not associated with TST (β=−0.760, p=0.45).

Table 2. Results of the interaction between working hours and SOC on multiple regression analysis

	B	**SE**	**t-value**	**β**	**p-value**
Working hours (Ref. < 50 hours/week)					
≥ 50 hours/week	-13.5	5.89	-2.29	-0.115	0.023
SOC-13	-0.261	0.344	-0.760	-0.0537	0.45
Working hours ≥50 hours/week x SOC-13	0.943	0.423	2.23	0.147	0.026

Note. β, standard coefficient; B non-standard coefficient; SE, standard error.
Abbreviations: Ref, reference; SOC-13, 13-item Sense of Coherence scale; TST, total sleep time.

Table 3 shows the results for the covariates in the multiple regression analysis. Female sex (β=0.155, p=0.0020), having an overweight BMI (β=−0.0954, p=0.030), and working a shift (β=−0.0914, p=0.044) were associated with TST. The adjustment R-squared value on multiple regression analysis was 0.0560.

Table 3. Result for covariates on multiple regression analysis

	B	SE	t-value	β	p-value
Sex (Ref. Male)					
Female	18.0	5.80	3.11	0.155	0.0020
Age (Ref. 20-29)					
30-39	-2.43	7.81	-0.311	-0.0188	0.76
40-49	-15.3	8.10	-1.89	-0.116	0.059
50-59	-10.6	8.78	-1.21	-0.0777	0.23
60 and over	-19.8	13.0	-1.52	-0.0783	0.13
BMI (Ref. normal weight)					
BMI underweight	-0.157	9.47	-0.0165	-0.000720	0.99
BMI overweight	-14.8	6.81	-2.17	-0.0954	0.030
Drinking habit (Ref. No)					
Yes	2.87	5.74	0.500	0.0221	0.62
Smoking status (Ref. never smoker)					
Current smoker	-0.961	9.24	-0.104	-0.00458	0.92
Former smoker	2.18	7.12	0.306	0.0138	0.76
Exercise habit (Ref. No)					
Yes	-0.998	6.34	-0.158	-0.00688	0.88
Shift work (Ref. No)					
Yes	-17.0	8.41	-2.02	-0.0914	0.044
BSJS Workload	-3.39	4.29	-0.790	-0.0465	0.43
BSJS Mental Workload	0.774	4.52	0.171	0.0100	0.86
BSJS Interpersonal Relationship	5.60	4.16	1.34	0.0716	0.18
BSJS Reward from Work	-1.09	3.83	-0.285	-0.0150	0.78
BSJS Job Control	4.28	3.90	1.10	0.0548	0.27
BSJS Support from Colleagues and Superiors	2.81	4.71	0.596	0.0310	0.55
Commuting Time	-0.0323	0.0400	-0.808	-0.0348	0.42

Note. β, standard coefficient; B non-standard coefficient; SE, standard error. Abbreviation: Ref, reference; BMI, body mass index; BSJS, Brief Scales for Job Stress

Table 4 shows the simple slope analysis for moderating effects at (−1SD) low and (+1SD) high levels of

SOC between TST and long working hours. Only low levels of SOC were significant. At low levels of SOC, long working hours significantly and negatively predicted TST (β=−24.7, t=−3.19, p=0.0015). However, at high levels of SOC, long working hours did not significantly predict TST (β=−2.21, t =−0.29, p=0.78).

Table 4. Result of simple slopes analysis of combinations of low and high levels of the SOC.

	β	**SE**	**t-value**	**p-value**
Low SOC-13 (-1 SD)	-24.7	7.76	-3.19	0.0015
High SOC-13 (+1 SD)	-2.21	7.76	-0.29	0.78

Note. β, simple slope; SE, standard error; SD, standard deviation. Abbreviations: SOC-13, 13-item Sense of Coherence scale

Figure 1 shows the plot of the two-way interaction between long working hours and SOC on TST.

4. Discussion

To our knowledge, this is the first report examining the association of SOC with objective sleep duration. The TST of the participants was 322 minutes, which was less than the national average. Previously, Takahashi and colleagues measured the sleep duration of 55 Japanese workers by use of actigraphy and reported an average total sleep time of 384 minutes [44]. By comparison, the sleep duration of the current study population was shorter; on the other hand, the mean SOC of the current study population was 58.5, which was comparable to the national survey sample [39]. The reliabilities of the BSJS and SOC-13 in this study were confirmed as the Cronbach alpha coefficients exceeded 0.70 [45].

Multiple regression analysis showed that high BMI and shift work were associated with shorter sleep duration, consistent with the results of previous studies [46-48]. Our results showed that women tended to sleep more than men. In a previous study of sex differences in sleep duration, among adult non-shift workers in 47 countries, men tended to have shorter sleep durations measured by wearable devices than those of women throughout their lifetime, consistent with our results [49]. On the other hand, sleep duration measured by actigraphy in Japanese was shorter for women than for men, which was speculated to be because women in Japan have more domestic roles [50]. The reason for the difference between our results and those of this previous study may be the method of recruiting participants in the current study. Since women are more health conscious and have more health behaviors than men [51, 52], it is possible that the study attracted women who were trying to get more sleep as a result of their health behaviors.

A decrease in TST was observed for long working hours (≥50 hours/week) alone, whilst an interaction between long working hours and SOC was associated with an increase in TST. Single slope analysis showed that both long hours worked groups decreased TST, but that lower SOC was associated with a significantly greater decrease in TST. The interaction results in this study suggest that the effect of long working stress varies with SOC. Recent studies suggest that sleep disturbances are not directly caused by stress, but rather by stress coping and reactivity [53, 54] and that those with higher SOC are more likely to develop coping behaviors and use more appropriate stress coping strategies, such as seeking assistance, during stress load and seeking help [18]. Since high SOC plays an important role in coping with stress, it is possible that workers' SOC may be protective in sleep. Furthermore, although studies are limited to health care workers, biological mechanisms have been reported to associate stress with SOC and the dorsolateral prefrontal cortex (DLPFC) [55, 56], suggesting that high SOC is associated with a high functioning DLPFC. With respect to stress-coping mechanisms, the prefrontal cortex plays an important role in translating stress experiences into adaptive behaviors by integrating cognitive and emotional behaviors and promoting neuroendocrine and autonomic nervous system flexibility in response to stress [57, 58]. Those with higher SOC have associated higher functioning of the DLPFC and may be better adapted to work stress in long working hours. Further investigation of the biological mechanisms in stress, SOC, and sleep duration is warranted.

4.1. Implications

An approach that focuses on SOC to protect workers' duration is warranted [14, 15], as it has been suggested that reducing working hours alone may not be sufficient to maintain sleep duration. SOC has been suggested to grow in adulthood, and to improve SOC, it is important to increase Generalized Resistance Resources (GRRs), or resources that can be utilized in coping with stress [59, 60]. Within the framework of

SOC-GRRs, increasing resources in the workplace is important and can be used as an occupational health measure. Useful GRRs in the workplace include good interpersonal relationships, employee decision-making authority, and opportunities to use skills and knowledge [60]. For occupational health professionals and workplace managers, focusing on GRRs in the workplace and increasing GRRs could help increase workers' sleep duration in addition to reducing working hours.

4.2. Limitations

This study was a cross-sectional study, so causal relationships are unknown. In addition, there is a generalizability issue because the study population were white-collar workers. Furthermore, there is a possibility of selection bias, which is a healthy worker effect. The multiple regression analysis resulted in an adjusted R-squared of 0.0560, which is not a good fit for the model. It is possible that unmeasured confounders such as marital status and economic status [61, 62] were not adjusted for in the current study. In addition, it has been reported that 31% to 55% of sleep duration is related to genetic factors [63, 64], and future analyses should take genetic factors into account to construct a model to predict sleep duration. Furthermore, since a study of healthy college students aged 18 to 40 years reported that waist-worn actigraphy devices underestimated TST in comparison with arm-worn devices [65], it is possible that the present waist-worn actigraphy device (ACOS MTN-220) also underestimated total sleep time in the same way. Therefore, electroencephalography-based sleep tracking devices similar to PSG would be suitable for more accurate evaluation of objective sleep measurement. Finally, since the working hours surveyed in this study are a subjective assessment, an objective assessment such as reporting using a timecard or smartphone applications would be more accurate [66].

5. Conclusions

The interaction between long working hours (≥50 hours/week) and SOC for workers indicated that lower

SOC could lead to shorter sleep duration. The results suggest that a SOC-focused approach is important to maintain workers' sleep duration. Future studies should include large-scale follow-up and investigation of the biological mechanisms.

Declaration of competing interest

No potential conflict of interest was reported by the authors.

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Data availability

The data set is not publicly available for privacy reasons.

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Supplementary Files

Figures

The plot of the two-way interaction between long working hours and SOC on TST (minutes). Note. SD, standard deviation
Abbreviation: SOC-13, 13 item sense of coherence scale; TST, total sleep time.