Sleep and chronotype in relation to work-related stress and negative affect: The moderating role of a flexible start of work

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Introduction

Sufficient sleep is an important aspect of people's overall health and well-being [20]. There is considerable evidence that sleep deprivation is associated with a spectrum of negative health consequences, such as poor subjective health, bad mood, and a higher mortality risk [4, 14, 15], even though sleep restriction therapy for treating insomnia and depressive symptoms can also have antidepressant effects [6]. Several studies also found enhanced stress levels after sleep reduction [18, 21]. The relationship between sleep duration and stress, however, is reciprocal and work stress between sleep duration and stress, sleep reduction [18, 21]. The relation of enhanced stress levels after sleep deprivation is associated with an increased risk of negative health consequences, such as poor subjective health, bad mood, and a higher mortality risk [4, 14, 15], even though sleep restriction therapy for treating insomnia and depressive symptoms can also have antidepressant effects [6]. Several studies also found enhanced stress levels after sleep reduction [18, 21]. The relationship between sleep duration and stress, however, is reciprocal and work stress between sleep duration and stress, sleep reduction [18, 21]. The relationship between sleep duration and stress, however, is reciprocal and work stress between sleep duration and stress, sleep reduction [18, 21]. The relationship between sleep duration and stress, however, is reciprocal and work stress between sleep duration and stress, sleep reduction [18, 21]. The relationship between sleep duration and stress, however, is reciprocal and work stress between sleep duration and stress, sleep reduction [18, 21]. The relationship between sleep duration and stress, however, is reciprocal and work stress between sleep duration and stress, sleep reduction [18, 21].
companies, such as better work–life balance, higher job satisfaction, better performance, well-being, and health [3, 11, 22]. Individual-oriented flexible worktime arrangements give workers the ability to adapt daily working hours to their own personal preferences and have positive effects on sleepiness and mood [31]. An interventional study also found increased sleep duration for employees with more control over working hours, compared to those with a traditional worktime schedule [23]. An individual-oriented flexible start of work in particular may be important regarding sleep and chronotype, since the beginning of work marks the end of sleep for many working adults. Late chronotypes could delay their start of work according to their individual biological clock and consequently prolong their sleep duration, reduce sleep deficits, decrease stress levels, and enhance well-being. A similar effect could be expected for people reporting shorter sleep durations and a greater need for additional sleep time in the morning. It has already been shown that delaying school starting times can have positive effects on sleep, performance, and well-being for children, adolescents, and college students [7, 13, 30]. Whether delaying work starting times could have similar effects for daytime workers is still not sufficiently examined yet, although results from a recent study showed that home office, which often offers great work time flexibility, is associated with a longer sleep duration and a decreased social jetlag [29]. Therefore, the aim of our study is to examine the relationships between sleep duration, need for additional sleep, chronotype, and aspects of well-being (work-related stress and negative affect) in daytime workers and to investigate the protective role of a flexible start of work.

Methods

Participants

Since we were interested in employees with a regular daytime work schedule, only people who were of age, worked at least 20 h a week, and did not work in shifts were asked to participate. Participants not meeting these criteria were excluded from data collection at the beginning of the questionnaire. The questionnaire was distributed via social media platforms and mailing lists. Data collection took place from August 1 to October 31, 2019. The total sample consisted of 438 German participants (247 female) with a mean age of 37.68 years (standard deviation [SD] = 12.39). Up to 40.5% of the sample graduated from university, 24.8% successfully passed the Abitur (highest school leaving certificate in Germany), and 34.7% reported a lower school certificate. The questionnaire consists of 19 items. The lower the sum score the greater the tendency towards eveningness. The reliability of the instrument was high (α = 0.87). We used three items of the subscale “work overload” and three items of the subscale “excessive demands from work” from the Trier Inventory for the Assessment of Chronic Stress (TICS) to assess work-related stress experienced during the past 4 weeks [27]. The items are answered on a scale from 1–5, higher scores indicating higher stress levels. Because the six items had high factor loadings on the first principal component (0.69–0.83) and the subscales were highly correlated (r = 0.66), we computed one global mean score (α = 0.88). Negative affect was measured with the Positive and Negative Affect Schedule (PANAS) [32]. The

Original studies

### Table 1  Descriptive statistics and bivariate correlations

|          | M   | SD  | Min | Max | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     |
|----------|-----|-----|-----|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1 Chronotype | 53.81 | 10.36 | 21  | 81  | 1     | –     | –     | –     | –     | –     | –     | –     | –     |
| 2 NAS     | 50.22 | 47.11 | 0   | 240 | –0.41**| 1     | –     | –     | –     | –     | –     | –     | –     |
| 3 Sleep duration | 0.55  | 0.77  | 0   | 3   | –0.20**| 0.15**| 1     | –     | –     | –     | –     | –     | –     |
| 4 Work starting time | 07:57 | 01:08 | 04:45 | 15:00 | –0.26**| –0.10* | 0.03  | 1     | –     | –     | –     | –     | –     |
| 5 Flexible start of work | 4.32  | 1.93  | 1   | 7   | 0.19* | –0.18**| –0.08 | 0.07  | 1     | –     | –     | –     | –     |
| 6 Work-related stress | 2.41  | 0.79  | 1   | 4.82 | –0.21**| 0.21**| 0.14**| 0.00  | –0.03 | 1     | –     | –     | –     |
| 7 Negative affect | 1.91  | 0.64  | 1   | 4.40 | –0.09**| 0.20**| 0.16**| –0.07 | –0.02 | 0.49**| 1     | –     | –     |
| 8 Age     | 37.68 | 12.39 | 18  | 73  | 0.19**| –0.08 | 0.12* | –0.09 | 0.06  | –0.11*| –0.15**| 1     | –     |
| 9 Gender  | –    | –    | –   | –   | –0.03 | –0.03 | 0.06  | –0.02 | 0.02  | –0.10*| –0.05 | 0.07  | 1     |

N = 438, Gender (1 = female, 2 = male), one participant reported diverse and was not included in the correlation with the gender variable; Min minimum, SD standard deviation, M mean, NAS need for additional sleep time in the morning

**p ≤0.01, *p ≤0.05
Sleep and chronotype in relation to work-related stress and negative affect: The moderating role of a flexible start of work

Abstract

Objectives. The present study investigated the relationships between sleep (sleep duration and need for additional sleep time in the morning), chronotype, work-related stress, and negative affect in daytime workers. Furthermore, it was examined whether a flexible start of work moderates these relationships.

Methods. A cross-sectional online study was conducted. Participants were 438 (247 female) daytime workers between 18 and 73 years (mean = 37.68, standard deviation = 12.39). The questionnaire included the “sleep duration” subscale of the Pittsburgh Sleep Quality Index (PSQI), the Morningness–Eveningness Questionnaire (MEQ), two subscales of the Trier Inventory for the Assessment of Chronic Stress (TICS), the negative affect scale of the Positive and Negative Affect Schedule (PANAS), questions regarding how many minutes participants would like to sleep longer in the morning, and how flexible their start of work is.

Results. Short sleep duration and a greater need for additional sleep in the morning were significantly associated with late chronotype. Shorter sleep duration, a greater need for additional sleep, and a late chronotype were associated with higher work-related stress and negative affect. A flexible start of work moderated these relationships: People with longer sleep duration, less need for additional sleep time, and an early chronotype showed lower stress and negative affect levels when having a flexible start of work. A flexible start of work showed no or negative effects on workers with shorter sleep duration, a greater need for additional sleep time, or a late chronotype.

Conclusions. The effect of a flexible start of work for daytime worker’s well-being depends on a person’s individual sleep timing and chronotype.

Keywords
Sleep duration · Morningness–Eveningness Questionnaire · Sleepiness · Life stress · Well-being

Sleep and Chronotyp im Hinblick auf arbeitsbedingten Stress und negative Stimmung: die moderierende Wirkung eines flexiblen Arbeitsbeginns

Zusammenfassung

Ziel der Arbeit. In der vorliegenden Arbeit wurden Zusammenhänge zwischen der Schlafdauer, dem Bedürfnis nach mehr Schlaf am Morgen, dem Chronotyp, Arbeitsstress und negativem Affekt bei Arbeitnehmern untersucht. Außerdem wurde überprüft, inwieweit ein flexibler Arbeitsbeginn diese Zusammenhänge beeinflusst.

Methoden. Es wurde eine Online-Querschnittsstudie durchgeführt. Die Teilnehmer waren 438 (247 Frauen) Arbeitnehmer zwischen 18 und 73 Jahren (Mittelwert: 37.68; Standardabweichung: 12.39). Der Fragebogen enthielt die Subskala „Schlafdauer“ des Pittsburgh Sleep Quality Index (PSQI), den Morningness–Eveningness Questionnaire (MEQ), 2 Subskalen des Trierer Inventars zum chronischen Stress (TICS), die Skala „negativer Affekt“ des Formulars Positive and Negative Affect Schedule (PANAS) und Fragen dazu, wie lange die Teilnehmer gern morgens länger schlafen würden und wie flexibel ihre Arbeitszeiten sind.

Ergebnisse. Eine kurze Schlafdauer und ein stärkeres Bedürfnis nach Schlaf am Morgen waren signifikant mit einem späteren Chronotyp verbunden. Eine kürzere Schlafdauer, ein stärkeres Bedürfnis nach mehr Schlaf und ein später Chronotyp zeigten Zusammenhänge mit mehr Arbeitsstress und negativem Affekt. Ein flexibler Arbeitsbeginn wirkte sich auf diese Zusammenhänge aus: Arbeitnehmer mit längerer Schlafdauer, einem niedrigeren Bedürfnis nach mehr Schlaf oder einem frühen Chronotyp wiesen weniger Stress und negativen Affekt auf, wenn sie flexiblere Arbeitszeiten hatten. Flexible Arbeitszeiten zeigten keinen oder einen negativen Effekt für Arbeitnehmer mit einer kürzeren Schlafdauer, einem stärkeren Bedürfnis nach mehr Schlaf oder einem späten Chronotyp.

Schlussfolgerung. Der Effekt eines flexiblen Arbeitsbeginns auf das Wohlbefinden von Arbeitnehmern hängt von individuellen Schlafzeiten und dem Chronotyp ab.

Schlüsselwörter
Schlafdauer · Morningness–Eveningness Questionnaire · Schlafqualität · Lebensbelastung · Wohlbefinden

negative affect scale consists of 10 items that assess negative affect in the past four weeks. Average ratings differ between 1 (not at all) and 5 (extremely). Reliability was high (α = 0.87). We used three items to measure a flexible start of work. The items were “My working hours are flexible”, “I can choose the start of my working hours due to my preference”, and “The start of my working hours is decided by my profession or my boss”. The items were answered from I strongly disagree = 1 to I strongly agree = 7, item three had to be recoded. A higher mean score stands for more flexibility. The reliability was high (α = 0.86).

Control variables

Because sleep and chronotype are associated with age [24], which in our data is also correlated with work-related stress and negative affect (Table 1), we included age as a control variable. Gender is often associated with insufficient sleep and chronotype as well [24], but showed no or only minor correlations with the relevant variables in our data and was therefore not included as a control variable (Table 1).

Statistical analysis

We first report bivariate correlations with a significance level of p < 0.05. To examine whether the predicted associations
remain stable after controlling for age, work starting time, work duration, the remaining sleep variables respectively, partial correlations were computed. We used multiple regression analyses to test moderating effects of a flexible start of work. All predictors were transformed into z-scores to avoid problems of multicollinearity. Missing data of a person on a maximum of one single item per scale was replaced through mean imputation. The total number of imputations did not exceed 5% of the data per variable and should therefore not lead to a bias in the data. All data analyses were conducted with SPSS Statistics (version 26, IBM, Armonk, NY, USA).

**Ethical considerations and declaration of interest**

This study was approved by the Ethics Committee of the Universität der Bundeswehr München and all participants gave informed consent prior to the online questionnaire in digital form.

**Results**

**Correlations**

All relevant descriptive statistics and bivariate correlations are shown in Table 1. Late chronotypes reported a significantly shorter sleep duration and a greater NAS compared to early chronotypes. A shorter sleep duration was associated with a greater NAS. A short sleep duration and a greater NAS were both significantly associated with greater work-related stress and negative affect, even after controlling for start of work, work duration, age, the remaining sleep variable, and chronotype (Table 2). Greater work-related stress and negative affect were significantly associated with a later chronotype (Table 1). Yet only the association between chronotype and work-related stress remained significant, after controlling for sleep duration, NAS, start of work, work duration, and age (Table 2).

**Moderation analyses**

To test the moderating effect of a flexible start of work six multiple linear regression analyses were conducted (Table 3).

All regression models revealed significant moderating effects (Fig. 1a–f). Post hoc analyses revealed that there were no differences for people with a shorter sleep duration on work-related stress regarding different levels of a flexible start of work, whereas people with a longer sleep duration benefited from a flexible start of work. Similarly, people with a longer sleep duration and greater flexibility showed lower negative affect levels, yet people with a shorter sleep duration even showed elevated negative affect levels. Moderating effects in the same direction were also found for NAS regarding work-related stress and negative affect. Workers with a lower NAS showed lower levels of stress and negative affect when they reported to have a flexible start of work. Workers with a higher NAS reported higher levels of stress and negative affect the more flexible their start of work was. Since the distribution of the variable NAS included five outliers with values above three standard deviations, we tested whether the two moderating effects remained stable after deleting the corresponding participants. Both moderating effects remained significant. Results also revealed that late chronotypes with more flexibility experienced more work-related stress and negative affect than late chronotypes with less flexibil-

### Table 2 Partial (and bivariate) correlations

| Control variables | Work-related stress | Negative affect |
|-------------------|---------------------|-----------------|
| NAS, chronotype, start of work, work hours, age | Sleep duration 0.11* (0.14**) | 0.16** (0.16**) |
| Sleep duration, chronotype, start of work, work hours, age | NAS 0.12* (0.21**) | 0.15 (0.20**) |
| Sleep duration, NAS, start of work, work hours, age | Chronotype −0.10* (−0.21**) | 0.02 (−0.09*) |

* N = 438, NAS need for additional sleep time in the morning.
** p ≤ 0.01, * p ≤ 0.05, bivariate correlations in parentheses.

### Table 3 Moderating effects of a flexible start of work

| Regression | Predictor | Criteria | Work-related stress | Negative affect |
|------------|-----------|----------|---------------------|-----------------|
| 1          | Sleep duration 0.15 | <0.01 | 0.18 | <0.001 |
|            | Flexible start of work −0.01 | 0.77 | 0.00 | 0.98 |
|            | Sleep duration × Flexible start of work 0.12 | 0.01 | 0.15 | <0.01 |
|            | − | F(3, 434) = 5.05, p < 0.01, R² = 0.03 | F(3, 434) = 7.06, p < 0.001, R² = 0.05 |

| 2          | NAS 0.22 | <0.001 | 0.22 | <0.001 |
|            | Flexible start of work 0.01 | 0.81 | 0.02 | 0.62 |
|            | NAS × Flexible start of work 0.13 | <0.01 | 0.13 | <0.01 |
|            | − | F(3, 434) = 9.50, p < 0.001, R² = 0.06 | F(3, 434) = 9.38, p < 0.001, R² = 0.06 |

| 3          | Chronotype −0.21 | <0.001 | −0.10 | 0.04 |
|            | Flexible start of work 0.01 | 0.78 | 0.01 | 0.91 |
|            | Chronotype × Flexible start of work −0.10 | 0.04 | −0.14 | <0.01 |
|            | − | F(3, 434) = 7.94, p < 0.001, R² = 0.05 | F(3, 434) = 4.29, p < 0.01, R² = 0.03 |

* N = 438, NAS need for additional sleep time in the morning.
ity and early chronotypes benefited from flexible working hours.

Discussion

The purpose of the present study was to investigate the relationship between sleep, chronotype, and facets of well-being in daytime workers. Late chronotype was associated with a shorter sleep duration and a greater NAS, and all three of these variables were related to work-related stress and negative affect. As expected, late chronotypes experienced higher stress and negative affect levels compared to early chronotypes, yet only the association between chronotype and stress remained significant after controlling for age, sleep, and work-related variables. These results support former findings that suffering from a short sleep duration and being a late chronotype increases the risk for stress and mood problems [4, 19, 23] and emphasize the interconnection of sleep, chronotype, and work-related well-being. However, the question remains how other work-related characteristics may play a part in these relationships.

A possible influencing factor may be work starting time. We found that a flexible start of work moderated the effect of sleep duration, NAS, and chronotype on work-related stress and negative affect, yet not in the expected direction. A flexible start of work did not have a beneficial effect for people reporting a shorter sleep duration, a greater NAS, or a late chronotype; in fact, they even showed enhanced work-related stress and negative affect levels. In contrast, people with a longer sleep duration, a lower NAS, or an early chronotype benefited from a flexible start of work and showed a decrease in work-related stress and negative affect. Since it is quite comprehensible that early chronotypes or people who get enough sleep in the morning, and sleep longer may benefit from a flexible start of work, as many studies report positive effects of flexible work time arrangements [3, 11, 22], it remains unclear why workers with a shorter sleep duration, a greater NAS, or a late chronotype did not benefit and even reported higher stress and negative affect levels.

Several factors may contribute to the explanation of our findings. For example, it was not investigated whether children or other external factors may influence daytime workers sleep timing and therefore affect our findings. Furthermore, studies found that high variability in working hours is linked to negative effects on sleep, well-being, and health [10, 11]. Stability in daily routines seems to be important for a person’s overall well-being, makes life more predictable and subsequently may reduce stress levels. It is possible that a flexible start of work leads to more variability in work routines and consequently may also result in elevated stress and negative affect levels. Whether external factors, variability in start of work, or other aspects of flexible working hours may play a part regarding our findings needs to be further investigated.

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Limitations

The present study makes important contributions to previous research, yet the results consist of cross-sectional data, which do not allow a causal interpretation. Other explanations for the found relationships and moderations are possible but were not examined. We, for example, did not investigate whether a higher variability in start of work for later chronotypes or people with a shorter sleep duration might explain these relationships. Therefore, further investigations are needed, which include a broader set of control variables, such as variability in work starting time or other work- or sleep-related aspects, to control for confounding variables. Furthermore, research based on longitudinal data or intervention studies are needed to explore causal relationships and changes in sleep and well-being over time.

Conclusions

Sleep duration, need for additional sleep time in the morning, and chronotype are important factors for the well-being of daytime workers and should be considered as a prominent issue for overall health and satisfaction of employees. The results demonstrated that the presence of a flexible start of work is not beneficial for every employee, but rather depends on individual’s sleep habits and chronotype. Late chronotypes and people with a shorter sleep duration or a greater need for additional sleep in the morning do not seem to profit from a flexible start of work. In contrast, early chronotypes and people with a longer sleep duration and a lower need for additional sleep time experience less negative affect and stress when having a flexible start of work. However, many of the underlying factors are at present still unknown and need to be further investigated.

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Conflict of interest. C. Saalwirth and B. Leipold declare that they have no competing interests.

This study was approved by the Ethics Committee of the Universität der Bundeswehr München and all participants gave informed consent prior to the online questionnaire in digital form.

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References
1. Åkerstedt T, Fredlund P, Gillberg M, Janson B (2002) Work load and work hours in relation to disturbed sleep and fatigue in a large representative sample. J Psychosom Res 53:585–588
2. Åkerstedt T, Knutsson A, Westerholm P et al (2002) Sleep disturbances, work stress and work hours: a cross-sectional study. J Psychosom Res 53:741–748
3. Baltes BB, Briggs TE, Huff JW et al (1999) Flexible working hours, health, and well-being. J Appl Psychol 84:496–513
4. Baum KT, Desai A, Field J et al (2014) Sleep restriction worsens mood and emotion regulation in adolescents. J Child Psychol Psychiatry Allied Discip 55:180–190
5. Biss RK, Hasler L (2012) Happy as a lark: morning-type younger and older adults are higher in positive affect. Emotion 12:437–441
6. Boland EM, Rao H, Dinges DF et al (2017) Meta-analysis of the antidepressant effects of acute sleep deprivation. J Clin Psychiatry 78:e1020–e1034
7. Bowers JM, Moyer A (2017) Effects of school start time on students’ sleep duration, daytime sleepiness, and attendance: a meta-analysis. Sleep Health 3:422–431
8. Buschgens C, Graham D, Cottrell D (2010) Well-being under chronic stress: is morningness an advantage? Sleep Health 6:330–340
9. Buysse DJ, Reynolds CF, Monk TH et al (1989) The Pittsburgh sleep quality index: a new instrument for psychiatric practice and research. Psychiatry Res 28:193–213
10. Chandola T, Brunner E, Marmot M (2006) Chronic stress at work and the metabolic syndrome: prospective study. Br Med J 332:521–524
11. Costa G, Åkerstedt T, Nachreiner F et al (2004) Flexible working hours, health, and well-being in Europe: some considerations from a SALITA project. Chronobiol Int 21:831–844
12. Dingés D, Pack F, Williams K et al (1997) Cumulative sleepiness, mood disturbance, and psychomotor vigilance performance decrements during a week of sleep restricted to 4–5 hours per night. Sleep 20:267–277
13. Dunster GP, La Iglesia L, Ben-Hamo M et al (2018) Sleepmore in Seattle: later school start times are associated with more sleep and better performance in high school students. Sci Adv 4:eaaud200
14. Fernandez-Mendoza J, He F, Calhoun SL et al (2020) Objective short sleep duration increases the risk of all-cause mortality associated with possible vascular cognitive impairment. Sleep Health 6:71–78
15. Fox EC, Wang K, Aquino M et al (2018) Sleep debt at the community level: impact of age, sex, race/ethnicity and health. Sleep Health 4:317–324
16. Hinz A, Gaeser M, Braehler E et al (2017) Sleep quality in the general population: psychometric properties of the Pittsburgh Sleep Quality Index, derived from a German community sample of 9284 people. Sleep Med 30:57–63
17. Horne JA, Ostberg O (1976) A self-assessment questionnaire to determine morningness-eveningness in human circadian rhythms. Int J Chronobiol 4:97–110
18. van Leeuwen WMA, Sallinen M, Virkkala J et al (2018) Physiological and autonomic stress responses after prolonged sleep restriction and subsequent recovery sleep in healthy young men. Sleep Biol Rhythms 16:45–54
19. Lu Y, Wheaton AG, Chapman DP et al (2016) Prevalence of healthy sleep duration among adults—United states, 2014. MMWR Morb Mortal Wkly Rep 65:137–141
20. Luyster FS, Strollo PJ, Zee PC, Walsh JK (2012) Sleep: a health imperative. Sleep 35:727–734
21. Minkel J, Moreta M, Muto J et al (2014) Sleep deprivation potentiates HPA axis stress reactivity in healthy adults. Health Psychol 33:1430–1434
22. Nijp HH, Beckers DGI, Geurts SAE et al (2012) Systematic review on the association between employee worktime control and work-non-work balance, health and well-being, and job-related outcomes. Scand J Work Environ Health 38:299–313
23. Olson R, Crain TL, Bodner TE et al (2015) A workplace intervention improves sleep: results from the randomized controlled work, family, and health study. Sleep Health 1:55–65
24. Roenneberg T, Kuehnle T, Juda M et al (2007) Epidemiology of the human circadian clock. Sleep Med Rev 11:429–438
25. Roesser K, Meule A, Schwertle B et al (2012) Subjective sleep quality exclusively mediates the relationship between morningness–eveningness preference and self-perceived stress response. Chronobiol Int 29:955–960
26. Roesser K, Obergfell F, Meule A et al (2012) Of larks and hearts—morningness/eveningness, heart rate variability and cardiovascular stress response at different times of day. Physiol Behav 106:151–157
27. Schulz P, Schlottke W, Becker P (2004) Trierer Inventar zum chronischen Stress (TICS, Version 3) – Manual. Hogrefe, Göttingen
28. Soehner AM, Kennedy KS, Monk TH (2011) Circadian preference and sleep-wake regularity: associations with self-report sleep parameters in daytime-working adults. Chronobiol Int 28:802–809
29. Staller N, Randler C (2020) Changes in sleep schedule and chronotype due to COVID-19 restrictions and home office. Somnologie. https://doi.org/10.1016/j.sleep.2020.00277
30. Stock AA, Lee S, Nahmod NG, Chang AM (2020) Effects of sleep extension on sleep duration, sleepiness, and blood pressure in college students. Sleep Health 6:32–39
31. Takahashi M, Iwasaki K, Sasaki T et al (2011) Worktime control-dependent reductions in fatigue, sleep problems, and depression. Appl Ergon 42:244–250
32. Watson D, Clark LA, Tellegen A (1988) Development and validation of brief measures of positive and negative affect: the PANAS scales. J Pers Soc Psychol 54:1063–1070
33. Wittmann M, Dinh J, Merrow M, Roenneberg T (2006) Social jetlag: Misalignment of biological and social time. Chronobiol Int 23:497–509