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Sleep Latency vs. Shuteye Latency: Prevalence, Predictors, and Relation to Insomnia Symptoms in a Representative Sample of Adults

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Summary

S*huteye latency* (SEL) refers to the time spent performing activities in bed before attempting sleep. This study investigates (1) the prevalence, duration, and predictors of SEL, (2) its association with insomnia symptoms (sleep onset latency (SOL), sleep quality and fatigue), and (3) the activities engaged in during SEL. A representative sample of 584 adults (18-96 years old) participated in an online survey. Respondents reported their SEL on weeknights (Sunday – Thursday) and weekend nights (Friday and Saturday), and activities during SEL. One in five adults tried to sleep immediately at bedtime. Around 16% of respondents were awake >30min on both week- and weekend nights. Younger people and those with an eveningness preference reported longer SEL. Longer SEL corresponded with a progressive decline in sleep quality, increased SOL, and more fatigue. Those with an SEL >30min reported using both passive (e.g., TV) and interactive (e.g., smartphone) media more frequently than respondents with an SEL <30min, but there was no difference between the groups for non-screen related activities.. Implications of SEL on measurements commonly used in sleep research are discussed. Shuteye latency may be symptomatic of how modern lifestyle puts increasing pressure on sleep, but may also reveal a previously undocumented behavior associated with insomnia symptoms.

Keywords: sleep behavior, adults, technology use, quota sample

Introduction

Standardized subjective measures of sleep (e.g., School Sleep Habits Survey, Pittsburgh Sleep Quality Index) define sleep onset latency (SOL) as the time it takes you to fall asleep. We argue that the increased portability of technological devices (e.g., smartphones) coupled with increased accessibility to various activities (e.g., via WiFi) may have introduced measurement error into these assessments. For example, a woman goes to bed at 11.00 PM. She reads a book for half an hour and checks her social media accounts for another ten minutes. She sets her alarm, and falls asleep shortly afterwards. If she was asked to report how long it took her to fall asleep, she may appear to be at risk for having sleep-onset insomnia (Lichstein et al., 2003). After all, she reported that she went to bed at 11.00 PM, but did not fall asleep until 11.40 PM.

The scenario described above is not uncommon in today's society. An increasing number of people are repurposing their bed as a venue for leisure. A growing body of research shows that technology use is prevalent both before bedtime and in bed, and is detrimentally related to various sleep outcomes such as impaired sleep quality, delayed sleep onset, night wakenings and sleep shortage (see Cain & Gradisar, 2010; Hale & Guan, 2015). The present study argues that the modernization of our bedtime ritual places pressure on the conceptualization and operationalization of sleep variables, such as SOL. This mismatch between sleep behavior and commonly used measures of sleep in surveys may lead to inaccurate estimates of SOL.

A recent study introduced a new concept for time spent performing activities in bed before attempting to go to sleep: shuteye latency (SEL) (Exelmans & Van den Bulck, 2017). In their study among 338 young adults (18-25 yrs old), they found that SEL was approximately 40 min on average. For 16% of the sample, SEL was >1h. Results indicated that sleep quality deteriorated among those with longer SEL, and that usage of mobile media (e.g., smartphones) was prominent during SEL.

The present study expands the proposition by Exelmans and Van den Bulck (2017), and will examine four research questions. First, we will describe the prevalence of SEL among adults (>18 years old), as 90% of people aged 13-64 yrs old use technology around bedtime (Gradisar et al., 2013). Six out of ten adults take their phone with them to the bedroom (Exelmans & Van den Bulck, 2016) and the average video gamer appears to be between 30-35 years old (Williams et al., 2008). Second, we will examine the demographic predictors of SEL, and include whether circadian preference (i.e., morningness-eveningness) contributes to longer SEL. Individuals with an evening preference tend to stay up later and be more active during the evening compared to morning types (Giannotti et al., 2002; Taillard et al., 1999). Third, the relationship between SEL and three insomnia symptoms will be examined (i.e., SOL, sleep quality and fatigue). Finally, we will explore the activities adults are performing during SEL and how they are related to these insomnia symptoms.

Method

Data Collection

A quota sample, stratified by gender, age, and educational level, was recruited by undergraduate students enrolled in a research methodology class. Students contacted respondents (≥18 years old) according to the quota derived from recent census data (blinded) and invited them to participate in an online survey. A minority of respondents (N = 50) preferred participation via paper-and-pencil survey (offline participants) and were sent a copy of the questionnaire via mail. As online sampling tends to underrepresent older populations, the option to participate via paper-and-pencil surveys would provide a more representative sample (Gradisar et al., 2013). There was no significant difference between online and offline participants for the variables of interest, but offline participants were significantly older ($t(581) = -6.05$, $p=.000$) and lower educated ($t(582) = 4.74$, $p=.000$). The study was presented as a study on leisure time and well-being to blind the relationships we were studying. This research was conducted in accordance with the ethics requirements of [blinded], and informed consent was obtained from all respondents.

Measures

Shuteye latency. We used the Bed Time Shuteye Time (BTST) measure (Exelmans & Van den Bulck, 2017). We asked respondents to read a definition of *bedtime* (i.e., the time at which you decide to go to bed) and *shuteye time* (i.e., the time at which you decide to go to sleep) and described a situation in which they were equal (i.e., a person goes to bed, switches off the lights and attempts to sleep) and a situation where both differed (i.e., a person goes to bed, reads a book for half an hour and tries to sleep afterwards). Next, we asked respondents to report how long bedtime and shuteye time were separated from each other on weeknights (Sunday—Thursday) and weekend nights (Friday and Saturday). This was referred to as shuteye latency (SEL). We provided five answer categories: 0 min (when I go to bed, I immediately try to go to sleep), <15 min, 15≥ x <30min, 30≥ x <45 min, 45≥ x <1 hour, >1hour.

Shuteye latency activities. We offered respondents a list of 11 activities comprising both media and non-media activities. They indicated how frequently they engaged in those activities (1 = never, 2 = about once a month, 3 = 2-3 times a month, 4 = about once a week, 5 = 2-3 times a week, 6 = (almost) every day). Three blank text boxes were also provided, and 43 out of 1752 text boxes (2.5%) were used by participants. The majority of these suggestions could be re-categorized under the pre-defined categories, and the remaining answers were "*worrying/thinking*", "*reading a magazine/the newspaper*", "*crossword puzzle*", and "*drink something*".

Sleep quality. The Pittsburgh Sleep Quality Index (PSQI) (Buysse et al., 1989) comprises 19 self-rated items that assess respondents' sleep quality over the past month. The items are grouped into seven components (subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication and daytime dysfunction), each scored on a 0–3 scale. The components can be summated into an overall score between 0-21. Lower scores indicate better sleep quality ($\alpha = .64$).

Sleep onset latency (SOL). We used one item from the PSQI as an indicator of SOL, i.e., "*During the past month, how long has it usually taken you to fall asleep each night?*". This was an open-ended question recoded into minutes of SOL.

Fatigue. The Fatigue Assessment Scale (FAS; Michielsen et al., 2004) consists of 10 items indicating symptoms of fatigue. Respondents were asked to report how they usually feel using a five-point scale (1 = never, 5 = always). A total fatigue score (0-50) was calculated, with higher scores indicating more fatigue (α = .87).

Morningness-eveningness. The Diurnal Scale (Torsvall & Akerstedt, 1980) assesses the morningness-eveningness dimension with seven items. Higher scores indicate greater morningness. Initial reliability analysis yielded an internal consistency of .67. However, by deleting one item from the scale ("*If you always had to go to bed at 2400, what do you think it would be like to fall asleep then?*"), reliability increased to .73. Issues with this item have already been reported by Greenwood (1991). We dropped this item and used a six-item measure for all subsequent data analyses.

Demographic and control variables. We recorded gender (0 = male, 1 = female), age, educational level, shiftwork (0 = no, 1 = yes), perceived physical health, history of sleep problems (0 = no, 1 = yes) and bedtime. Educational level was measured by asking respondents about the highest educational degree they obtained: a sixth,ninth or twelfth grade certificate, a college or university degree. To assess their health status, respondents were asked 'in general, would you say your health is:' and response categories were 1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent (Jenkinson et al., 1993). Respondents who indicated they had consulted a health care provider regarding sleep problems in the past were categorized as having a history of sleep problems.

Results

Sample Description

A total of 584 questionnaires were completed. The sample consisted of 51.2% women and 48.8% men, ranging between 18 and 96 years old (M = 48.5, SD = 18.8). For educational level, 31.5% of respondents had obtained a sixth grade or ninth grade certificate (i.e., lower secondary education), 37.0% had obtained a twelfth grade certificate (i.e., upper secondary education) and 31.5% had a college or university degree (i.e., post-secondary or higher education). The sampled population was a proportional representation of adults in [blinded] for gender ($\chi^2(1)$, N = 584) = .000, p = .99), age ($\chi^2(6)$, N = 584) = 1.008, p = .99), and education ($\chi^2(2)$, N = 584) = .302, p = .86). Approximately one in eight (12.2%) respondents reported that they had consulted a doctor regarding sleep difficulties, and were therefore considered as having a history of sleep problems.

RQ1 & 2: Prevalence and Predictors of SEL

Around one in four respondents (26% on weeknights, 24.7% on weekend nights) tried to go to sleep immediately after going to bed, reflected in an SEL of zero min. One in three had an SEL of <15 min (32.0% on weeknights, 33.0% on weekend nights), and one in four had an SEL between 15 and 30 min (26% on weeknights, 25.5% on weekend nights). SEL was >30 min on weeknights and weekend nights for 16% and 16.8% of respondents, respectively. The length of SEL on weeknights vs. weekend nights differed only slightly: SEL on weekend nights was somewhat longer than SEL on weeknights. However, for 70% of respondents, there was no difference at all.

To obtain an estimate of average SEL, we recoded the categories by taking the midway point of each category[1]. This computation indicated an average SEL of 16.11 min (SD = 17.39) on weeknights and 16.46 min (SD = 17.64) on weekend nights, resulting in an average daily SEL of 16.21 min (SD = 16.62). This estimate was used for all additional analyses.

Average SEL was predicted by age (β = -.258, p=.000) and morningness-eveningness (β = -.137, p=.004): younger respondents and those with an eveningness preference reported longer SEL. We ran additional moderation analysis to examine whether they have a combined effect on SEL. We found a positive moderation (β = .095, p=.019), indicating that the effect of age on SEL was stronger among those with an eveningness preference. Gender, educational level, being a shiftworker, having history of sleep problems, perceived physical health and self-reported bedtime did not predict daily SEL.

RQ3: Shuteye Latency and Insomnia Symptoms

Sleep Onset Latency. Sleep onset latency was 19.18 min on average (SD = 19.29). SOL was >30 min for 25.2% of respondents, a cut-off used for sleep-onset insomnia (Lichstein et al., 2003). Average SEL was positively related to SOL (β = .517, p=.000): as SEL increased, SOL also increased (Table 1). Given the significant association between age, morningness-eveningness, and SEL, we checked for moderation effects. This was significant for age (β = .113, p=.004.): the association between SEL and SOL increased with age.

Logistic regression analysis was performed to investigate a dose-response relationship between SEL and SOL (Table 3). We compared four groups: those with an average SEL of

[1] To calculate average SEL, we took the midway point of each answer category: for example, 15-30 minutes was recoded as 22.50. Daily SEL was then computed by multiplying weeknight SEL by 5 and adding it to the SEL on weekendnight multiplied by 2, then divided by seven: ((weekday SEL *5) + (weekendnight SEL*2))/7.

zero min (21.7%, reference category), <15 min (34.9%), 15≥ x <30min (27.6%), ≥30min (15.8%), and used the >30 min as a cut-off for SOL. As shown in Table 2, respondents who had an SEL between 15 and 30 min, were 4.01 times more likely of having a SOL >30 min compared to those with no SEL (p=.000). Those with an SEL >30 min were 17.85 times more likely of having a SOL >30 min (p=.000).

Sleep Quality. The mean score on the PSQI was 4.86 (SD= 2.83, Min = 0 Max = 16). The score was >5 for 34% of respondents, who were considered poor sleepers (Buysse et al., 1989). SEL positively predicted sleep quality (β= .322, p=.000). The longer SEL became, the higher the score on the PSQI, thus the poorer sleep quality adults reported. Additional moderation analyses indicated that the association between SEL and sleep quality was moderated by age: this relationship was stronger for older participants (β = .109, p=.007).

Logistic regression analysis was performed to investigate a dose-response relationship between SEL and sleep quality. We compared the same groups for SEL as we did for the logistic regression analysis above. Respondents who had an SEL between 15 and 30 min, were 2.94 times more likely of having poor sleep quality (PSQI >5) compared to those with no SEL (p=.000). These odds rose to 6.89 for those with an SEL over 30 min (p=.000).

Fatigue. Respondents scored 9.15 (SD = 6.18, Min = 0, Max = 33) on average on the FAS. Shuteye latency positively predicted respondent's fatigue score (β = .113, p=.003): The longer SEL became, the more fatigue adults reported. This association between SEL and fatigue was moderated by morningness-eveningness: the relationship was stronger for those with an eveningness preference (β = -.092, p=.025).

[Table 1 and 2]

RQ4: SEL Activities and their Association with Insomnia Symptoms

We asked respondents how frequently they engaged in various activities during SEL (Table 3). For media activities, phone use and television viewing were the most popular: 24.3% watched television during SEL for at least 2-3 times a week, and 33.2% used their smartphone that often. Video gaming was the least prevalent: 4.4% did this 2-3 times a week during SEL. For non-media activities, talking, having sex, or reading a book were the most prevalent activities during SEL. Respectively, 27.9%, 17.6% and 15.4% of the respondents engaged in these activities for at least 2-3 times per week during SEL.

There were few notable differences according to gender. Men (M = .40, SD = 1.122) played videogames more frequently during SEL than women (M = .19, SD = .84) (t(497.793) = 2.47, p=.014). For non-media activities, men (M= 1.99, SD = 1.616) reported a higher frequency of sex during SEL than women (M = 1.41, SD = 1.578) (t(551)=4.25, p=.000), whereas women (M = 1.46, SD = 1.825) reported more book reading than men (M = .76, SD = 1.45) (t(548) = -5.01, p=.000).

We found that age was inversely related to almost every SEL activity, indicating that younger people were more active during SEL. For morningness-eveningness, we found similar negative correlations, but these were predominantly applicable to media activities: people with an eveningness preference engaged in more technology use during SEL than morning types.

The associations between SEL activities and insomnia symptoms were investigated with hierarchical regression analyses (Table 4). Results indicated that interactive media use (videogames, cellphone, tablet) during SEL was associated with a poorer sleep quality (β=.136, p=.013), while use of passive media (television and laptop) was related to longer SOL (β=.110, p=.033). None of the listed activities had a significant association with fatigue.

[Table 3 and 4]

Discussion

The time people spend awake in bed before attempting to sleep has been labelled as shuteye latency (SEL), and has been related to poorer sleep quality (Exelmans & Van den Bulck, 2017). This study was designed to determine the prevalence and predictors of SEL, document the activities performed during SEL, and examine the relationship between SEL and three insomnia symptoms (i.e., SOL, sleep quality and fatigue) in adults.

We computed a daily SEL of 16.2 minutes. Shuteye latency was non-existent for one in four adults: they tried to go to sleep immediately after they went to bed. At the other extreme, 16% of adults reported an SEL above 30 minutes for both weeknights and weekend nights. The average daily SEL observed in this study is substantially shorter than that reported by the sample of 18-25 year olds by Exelmans and Van den Bulck (2017), which was around 40 minutes. It thus seems that SEL is longer and more prevalent among young adults. This is further supported by the finding that age and diurnal preference predicted SEL in this study: younger respondents and those with an eveningness preference reported longer SEL. Individuals with an eveningness preference generally report more irregular sleep schedules and shorter sleep duration (Giannotti et al., 2002; Roenneberg et al., 2003), which dovetails with our observation that they delay sleep once in bed to a greater extent. Younger people are also more likely to have an eveningness preference (Digdon & Howell, 2008; Paine et al., 2006), and additional moderation analysis indicated both predictors jointly influence SEL, meaning that the association between age and SEL is stronger among respondents with an eveningness preference.

A longer SEL coincided with higher scores for all three indicators of insomnia, i.e., a longer SOL, poorer sleep quality and more symptoms of daytime fatigue. The negative association between SEL and fatigue was stronger for respondents with an eveningness preference. For SOL and sleep quality, we documented a dose-response relationship with SEL: both insomnia symptoms became progressively worse as SEL increased. This is consistent with the findings of Exelmans and Van den Bulck (2017).

The negative association between SEL and respectively SOL and sleep quality increased with age. When older adults postpone sleep in bed, their SOL increases and sleep quality declines more sharply compared to younger adults. Research has shown that our ability to initiate and maintain sleep decreases with age, undermining sleep quality (Markov et al., 2012; Vitiello, 2012). Therefore, one explanation could be that older adults become more vulnerable or sensitive to the behaviors that could harm sleep, including SEL.

Regarding technology use during SEL, adults engaged most frequently in television viewing and smartphone use. In the younger sample researched by Exelmans and Van den Bulck (2017), phone use and computer use were most prevalent, whereas television viewing was not. Future research might examine the outlets respondents use for television watching. It could be that television is an equally popular pastime during SEL for all age groups, but that older adults might turn to more traditional outlets for watching television, whereas younger age group might watch on portable screens. Moreover, while in the present study age was inversely related to all SEL activities, eveningness was exclusively related to media activities. Younger age groups are typically inclined towards eveningness and it has been shown that people with an eveningness preference spend more time in front of screens (Fossum et al., 2014; Kauderer & Randler, 2013). Future studies on the interaction between media use, sleep, and circadian preference are recommended. For instance, we wonder whether an eveningness preference predisposes people to use more media at night, leading them to report poorer sleep, or whether their biological clock keeps them awake later at night and they simply fill this extra time with media use.

Finally, we found that interactive types of media use during SEL were related to poorer sleep quality, while more passive media use was related to longer SOL. Interactive media may be more detrimental to sleep quality because of the engaging content (which leaves the user aroused and may undermine sleep quality) (Dworak et al., 2007; Gradisar et al., 2013). Moreover, notifications or incoming messages may disrupt sleep during the night (Short et al., 2013; Woods & Scott, 2016). The association between passive media and longer SOL is puzzling. While users are expected to be less engaged compared to interactive media, they still may need time to digest the content they viewed, which could explain their higher SOL. Another possibility is that those with a long SOL may resort to passive forms of media use as a way to fill time.Passive media use requires less motivation or effort and may therefore allow sleepiness to be more perceived.. Finally, could it be that they choose to go to bed earlier and attempt to sleep too early after ceasing television watching? Exploring possible particularities of the television audience may assist future researchers in the interpretation of the effects of television on sleep.

Implications

While there have been exceptions (e.g., the Consensus Sleep Diary; Carney et al., 2012; Natale et al., 2015), many survey-based measurements of sleep (e.g. PSQI, School Sleep Habits Survey) will measure bedtime and SOL, but do not take into account SEL. These measures may infer SOL as the time taken from bedtime to the point of sleep onset, and do not delineate when people are actually attempting to sleep. These assessments of SOL may thus be inflated, and possibly over-estimate the extent to which samples experience sleep-onset insomnia (i.e, SOL>30min; Lichstein et al., 2003). Moreover, even if self-report measures of sleep include questions about the time a person attempted sleep (Carney et al., 2012), the type of activities performed during SEL are likely to affect SOL as well (i.e., TV associated with longer SOL). Whilst the extended consensus diary asks extra questions about the person's sleep hygiene (e.g., naps, caffeine consumption), it does not include any questions pertaining to technology use in the bed. As adolescents are a population with a high affinity for technology use around bedtime (Bartel et al., 2016), our findings have implications for examining SEL in this vulnerable group. Thus, in light of the present study's findings, current self-report measures of sleep may require modification both regarding the timing of SEL and the activities engaged in during SEL. These may not only provide a more accurate estimate of potential sleep onset insomnia but also elucidate the behaviors contributing to poor sleep and insomnia symptoms. .

Limitations and Future Research

Several limitations need to be acknowledged. We used an online survey, which is inexpensive and easy to administer, but cannot avoid self-selection bias. Although students were instructed to carefully follow the quota instructions, we could not control who participated in the survey or the circumstances under which participation took place. This may limit generalizability to the population. Moreover, we focused on adults in the general population. Future studies could therefore be performed among younger populations (adolescents) or clinical samples (such as those with insomnia).

We used a cross-sectional design, which precludes any causal inference. Even though we investigated SEL as a predictor of insomnia symptoms, the reverse hypothesis may be equally likely: those who struggle with insomnia, may willfully postpone sleep once in bed and thus report longer SEL. People who have difficulty initiating sleep may decide to watch television in bed in an attempt to promote sleep (Tavernier & Willoughy, 2014).

Future studies may employ actigraphy to further validate the phenomenon of SEL and aid in determining whether it is exclusively in issue in survey research or not. While Exelmans and Van den Bulck (2017) used a metric variable to assess SEL, we have used a categorical variable. The provided answer categories may signal respondents what we think is normal vs. excessive SEL and therefore induce bias in the estimates. A metric operationalization may possibly result in longer SEL, which should be verified in future research. Moreover, respondents completed the measure of SOL before answering the SEL questions. Consequently, our SOL measure may be inflated. If we "correct" the SOL measure – that is, subtract average SEL from SOL – the percentage of respondents with an SOL >30min drops from 25.2% to 8.2%. Results of the regression analyses remain unchanged nonetheless. We recommend future research to incorporate the same background information for both SOL and SEL measures. Finally, even though we explored what respondents were doing during SEL, future studies could try to get a more detailed picture of SEL activities. For instance, aside from the devices people attended to, research could try to untangle whether the type of activities performed on these devices impact sleep differently (Exelmans & Van den Bulck, 2018; Wood et al., 2012). Are they engaged with work or leisure in bed? What content are they watching? Are they multi-tasking? Qualitative research or diary data could help to clarify these issues.

Conclusion

The findings of this study substantiate the existence of SEL among a representative sample of adults. Shuteye latency appears to be more prevalent among younger adults, and is strongly related to diurnal preference. The longer SEL becomes, the more symptoms of insomnia people report (i.e., longer SOL, poorer sleep quality, fatigue). Technology use during SEL seemed to exacerbate these symptoms. These findings have implications for the measurement of the post-bedtime routine in adult sleep research, and highlight an additional factor contributing to the identification and possible treatment of insomnia.

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Table 1 Hierarchical regression analyses predicting sleep onset latency, sleep quality, and fatigue.

	Sleep Onset Latency			Sleep Quality			Fatigue		
	B	SE(B)	β	B	SE(B)	β	B	SE(B)	β
Gender	.639	1.374	.017	.091	.208	.016	.980	.450	.079
Age	.001	.042	.001	.005	.006	.034	-.070	.014	-.214***
Upper secondary education[a]	-1.538	1.712	-.038	.010	.259	.002	.028	.561	.002
Higher education[b]	-5.053	1.798	-.121**	-.503	.273	-.083	-.871	.589	-.065
Shiftwork	-1.167	2.302	-.018	.890	.349	.094*	1.321	.754	.064
History of sleep problems	3.136	2.133	.053	1.884	.320	.219***	1.974	.698	.104**
Perceived health	-.554	.839	-.025	-.752	.127	-.232***	-2.782	.275	-.392***
Morningness-eveningness	-.421	.225	-.078	-.001	.034	-.001	-.215	.074	-.125**
Bedtime	-1.926	.682	-.115**	.028	.103	.011	-.646	.223	-.120**
SEL	.640	.044	.551***	.061	.007	.342***	.032	.014	.087*
ΔR^2			.238***			.092***			.011**
SELxAge	.007	.002	.113**	.001	.000	.109***	.000	.001	-.017
SELxmorningness-eveningness	.015	.011	.052	.000	.002	-.008	-.008	.004	-.092*
ΔR^2			.018**			.010*			.009*

Note. [a] Dummy variable whereby 0 = lower secondary education, 1 = upper secondary education. [b] Dummy variable whereby 0 = lower secondary education, 1 = higher education.

*p<.05, **p<.01, ***p<.001

Table 2 Logistic regression analysis predicting sleep onset latency (SOL) and sleep quality (PSQI)

	SOL >30min		Sleep Quality (PSQI >5)	
	Exp(B)	95% CI	Exp(B)	95% CI
Gender[a]	1.103	[.698; 1.744]	1.486	[.990; 2.231]
Age	.994	[.981;1.008]	1.007	[.994; 1.019]
Upper secondary education[b]	.885	[.519; 1.511]	1.059	[.650; 1.725]
Higher education[c]	.316***	[.166; .601]	.538*	[.310 .933]
Shiftwork[d]	.758	[.358; 1.604]	1.775	[.925; 3.406]
History of sleep problems[e]	1.577	[.826; 3.009]	3.672***	[1.996; 6.753]
Perceived health	.944	[.714; 1.249]	.534***	[.411; .694]
Morningness-eveningness	1.015	[.943; 1.093]	1.013	[.948; 1.083]
Bedtime	.764*	[.603; .967]	1.072	
SEL 0 min	***		***	
SEL <15 min	.564	[.258; 1.231]	1.132	[.634; 2.021]
SEL 15≥ x <30min	4.008***	[2.069; 7.767]	2.940***	[1.638; 5.278]
SEL ≥ 30min	17.851***	[8.439; 38.182]	6.891***	[3.453; 13.754]

Note. CI: Confidence Interval. [a]reference category = male; [b]Dummy variable whereby 0 = lower secondary education, 1 = upper secondary education; [c]Dummy variable whereby 0 = lower secondary education, 1 = higher education.; [d]reference category = no shift work, [e]reference category = no sleep problem. Model SOL R^2: .248 (Cox & Snell), .365 (Nagelkerke), Model PSQI R^2: .216 (Cox & Snell), .299 (Nagelkerke).

*p<.05, **p<.01, ***p<.001

Table 3 Frequency of activities during shuteye latency and correlations with age and morningness-eveningness

		never	Once a month	2-3 times a month	Once a week	2-3 times a week	(almost) every day	R age	R M/E
Media	Television viewing	61.8%	4.6%	4.3%	5.0%	5.4%	18.9%	-.047	-.014
	Laptop or computer	78.1%	2.7%	4.2%	2.9%	4.0%	8.1%	-.339***	-.207***
	Tablet or e-reader	76.9%	4.9%	4.0%	3.6%	5.5%	5.1%	-.196***	-.086*
	Videogaming	89.6%	3.3%	1.5%	1.3%	2.6%	1.8%	-.147**	-.131***
	Cellphone/smartphone	55.0%	2.2%	3.8%	5.8%	11.2%	22.0%	-.622***	-.273***
Non-media	Listening to music	73.7%	7.4%	4.0%	5.3%	3.4%	6.2%	-.186***	-.089*
	Reading a book	62.5%	7.6%	7.6%	6.9%	8.1%	7.3%	-.050	-.055
	Talking, conversation	47.5%	8.2%	6.4%	10.0%	14.2%	13.7%	-.222***	-.073
	Working or school	84.6%	3.4%	2.9%	3.3%	1.8%	4.0%	-.271***	-.065
	Sex	39.2%	10.5%	12.8%	19.9%	14.6%	3.0%	-.356***	-.005
	Planning, scheduling	80.6%	7.0%	2.4%	4.8%	3.0%	2.2%	-.245***	-027

Note. R = pearson correlation coefficient. M/E = morningness-eveningness preference

*p<.05, **p<.01, ***p<.001

Table 4 Hierarchical regression analysis for SEL activities predicting insomnia symptoms

	Sleep Onset Latency			Sleep Quality			Fatigue		
	B	SE(B)	β	B	SE(B)	β	B	SE(B)	β
Gender	2.107	1.752	.053	.112	.231	.020	.992	.476	.080
Age	-.095	.060	-.090	.006	.008	.041	-.067	.016	-.207***
Upper secondary education[a]	-2.697	2.206	-.065	-.201	.292	-.035	-.297	.600	-.023
Higher education[b]	-5.659	2.331	-.132	-.528	.309	-.087	-1.176	.634	-.088
Shiftwork	-1.629	2.946	-.024	.766	.389	.081	.704	.801	.034
History of sleep problem	6.537	2.677	.110	2.275	.348	.271***	2.699	.728	.146***
Perceived health	-1.360	1.073	-.060	-.797	.141	-.249***	-2.621	.292	-.374***
Morningness-eveningness	-.587	.296	-.107*	-.048	.039	-.061	-.279	.080	-.163**
Bedtime	-1.810	.950	-.101	-.119	.124	-.047	-.931	.258	-.167***
SEL Passive Media	.747	.350	.110*	.013	.046	.014	.090	.095	.043
SEL Interactive Media	.256	.347	.043	.115	.046	.136*	.109	.094	.059
SEL Non-media	-.321	.206	-.086	.005	.027	.009	.034	.056	.029

Note. [a]Dummy variable whereby 0 = lower secondary education, 1 = upper secondary education; [b]Dummy variable whereby 0 = lower secondary education, 1 = higher education.

*p<.05, **p<.01, ***p<.001