A relationship between nighttime smartphone use and sleep problems among university students in Japan

--- A preliminary questionnaire survey ---

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Introduction

Recently, electronic screen devices such as personal computers, videogame consoles, and smartphones have become highly accessible. However, despite its functionality and convenience, some authors have already raised an alarm over smartphone use at night. Christensen et al. [1] pointed out that nighttime smartphone use might be related to some sleep difficulties.

It could be speculated that there might be two kinds of mechanisms in which the nighttime smartphone use cause sleep difficulties as follows; 1) physiological stimulation to our eyes by the light emitted from a screen of smartphones [2]; 2) negative or positive emotional activation caused by viewing web contents including pictures, movies, or sentences, which can induce any kinds of emotional arousal [3,4].

As suggested by these previous findings, smartphone use at night could lead to some nighttime sleep problems as also some daytime arousal problems [5]. Therefore, the present study focused on smartphone use in undergraduate students in a university in Japan and aimed to clarify the relationship between nighttime smartphone use and sleep difficulties by a questionnaire study.

References

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Methods

Participants: This study has been approved by the research ethics committee of Nagano University (#2017-015), and the survey was conducted in January 2018. Data were collected from 101 undergraduate students. After excluding 11 respondents who gave an invalid or no response to more than one-third of the overall question items, the final sample consisted of 90 students (43 male, 45 female, and 2 non-respondents), with a valid response rate of 89.11%. The age range of the final sample was 18 to 24 years, with an average age of 20.5 years

Measures: The questionnaire included items pertaining to nighttime sleep (52 items cited from TMIN-LHI; [6]), circadian rhythm (19 items cited from the Japanese version of the Morningness-Eveningness Questionnaire, MEQ; [7]; Original English version [8]), daytime sleepiness (8 items cited from the Epworth Sleepiness Scale, ESS; [9]), daily use of electronic devices including videogames and smartphones (22 items), and others.

Figure 1. Time spent on internet browsing and using a smartphone after 6 pm on a weeknight.

Results

Time spent on internet and smartphone: The average time spent on internet browsing and using a smartphone after 6 pm on a weeknight was calculated. As Figure 1 shows, the average time spent ($\pm$ SD) was 2.1 ($\pm$ 1.36) hours for internet browsing and 2.3 ($\pm$ 1.44) hours for smartphone use. Then, the participants who browse internet sites or use a smartphone for 3 hours or more on a weeknight were classified as the “heavy users” (high-use group) and were compared with their classmates with less than 3 hours of use (low-use group). The high- and low-use group for internet browsing included 36 students and 54 students respectively, while the high- and low-use groups for smartphone included 35 students and 55 students, respectively.

Sleep schedule and difficulties in the high- and low-use groups: In terms of sleep schedule, the average score were compared between the high and low-use groups for smartphone use and internet browsing, and the results indicated that there were no significant differences in bedtime, wake time, and sleep duration between these two groups for internet browsing and smartphone use.

Regarding sleep difficulties, the one-way ANOVA showed a significant difference in average of reported score between the high- and low-use groups for smartphone use in **WASO (Wake after sleep onset; p = 0.039; Table 1)** but not in the other sleep difficulties, indicating that **the heavy smartphone users tend to experience WASO more frequently**. On the other hand, there were no significant differences in any of the sleep difficulties between the groups for internet browsing.

Table 1. Comparison of sleep schedule and difficulties between high-use (N = 35) and low-use groups (N = 55) for smartphone use.

		High-use (≥ 3.0 h)		Low-use (< 3.0 h)		Statistical tests ¹		Response of participants	
		Mean	SD	Mean	SD	F	P		
Sleep schedule	Bedtime	24:45	1.30	24:48	1.84	0.021	0.886	Time of day (hours)	
	Wake time	7:47	1.31	7:44	1.27	0.041	0.840	Time of day (hours)	
	Duration	6.30	1.36	6.53	1.19	0.684	0.411	Duration (hours)	
Sleep difficulties	Sleep latency	4.89	2.18	4.13	1.86	3.114	0.081	†	"1" (≤ 5 m) to "8" (> 60 m)
	Falling asleep	2.74	1.12	2.87	1.09	0.297	0.587		"1" (Very easy) to "5" (Very difficult)
	Wake after sleep onset (WASO)	1.74	0.95	1.38	0.68	4.407	0.039	*	"1" (Never) to "5" (≥ 4 times)
	Morning mood	3.23	1.06	3.25	0.97	0.014	0.905		"1" (Very well) to "5" (Very bad)
	Sufficiency of sleep	2.03	0.75	2.38	1.06	2.938	0.090	†	"1" (Well) to "5" (Bad)
	Dream	3.03	1.22	3.15	1.03	0.239	0.626		"1" (Never) to "5" (Very often)
	Nightmare	2.40	1.00	2.50	0.85	0.23	0.633		"1" (Never) to "5" (Very often)
	Daytime sleepiness	2.17	0.75	2.16	1.05	0.001	0.970		"1" (Never) to "4" (Very often)
	Sleepiness at a tense	1.37	0.49	1.27	0.59	0.677	0.413		"1" (Never) to "4" (Very often)

¹ Differences were compared between the high- and low-use groups using one-way ANOVA, * p < 0.05, † p < 0.10