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LETTER TO THE EDITOR

A Survey of Japanese Young Adults' Postures When Using Smartphones before Sleeping

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Although mobile technologies, devices and software have enriched our lives in many ways, including medical applications, the potential negative effects are often overlooked. A growing amount of evidence suggests that there are potential negative impacts of smartphones on biophysiological processes, especially on sleep.[1–6] Studies have shown that blue lights, especially the short-wavelength light (380~495 nm) emitted from smartphone monitors, disrupts circadian rhythm by retarding nocturnal melatonin production.[7]

Previously, we conducted a survey to examine the use of mobile phones among 398 nursing students.[8] We found that 339 (85.2%) of them utilized mobile phones every night before sleep, and that 267 of them (67.1%) used mobile phones even after they turned off the room lights. In addition, we found that using mobile phones after turning off the room lights was associated with sleepiness during the daytime. While we found that such smartphone usage can disrupt sleep, we did not clarify the usage habits in detail, such as duration of phone usage, posture while using phones, and where phones are kept during sleep. We thought that by understanding such habits in detail we would be able to disentangle the factors that are playing roles in sleep disruption. Therefore we conducted a survey focusing on the factors mentioned above and tried to picture the habits of pre-sleep smartphone usage. The study was approved by the Institutional Review Board of Aino University Junior College.

A total of 141 nursing students were asked to participate in the survey after their classes and informed that the participation was voluntary and would not affect their grades. 138 of them (22 male, 116 female, 21.7 $\pm$ 5.2 years old) gave their consent and provided information about their phone usage habits. The students answered that they use phones before sleeping nearly every day (6.65 $\pm$ 1.13 days/week), for 35.0 $\pm$ 18.5 minutes. Regarding their body position, they used phones while lying in bed for 5.9 days/week, whereas they used phones while sitting in a chair for 3.5 days/week. Moreover, the time spent in the lying position was significantly longer than in the sitting position (12.52 $\pm$ 1.36. vs 18.22 $\pm$ 23.06 minutes, $F(1,274) = 5.71$, $p < .05$). When we asked about their phone use habits after they turned off the room lights, it was also found that they used phones 5.14 $\pm$ 2.85 days/week even after they turned off the room lights. In terms of the lying position before and after they turned off the room lights, the time in the lateral position was significantly longer than the other lying positions (Before bedtime: $F(2,274) = 17.79$, $p < .01$; After lights out: $F(2,274) = 8.66$, $p < .01$).

Regarding the storage of mobile phones, 98.5% of participants kept phones within hand's reach. With regard to the power state of mobile phones while sleeping, more than half of the participants (50.7%) had their phone's ringtone on, 25.4% had their phone set to vibrate, and 21.7% had their phone's ringtone and vibrate off.

In addition to our previous report, there are other studies that showed negative impacts from smartphones on sleep;[9,10] however, they did not provide details on the smartphone usage, including the duration, posture and/or storage, which are factors we consider important: e.g. posture can moderate the distance of the phone which directly affects the intensity of the light, and not only exposure to the

	Frequency (day/week)			Duration (minutes)				
	Mean	SD	One-way ANOVA	Mean		SD	One-way ANOVA	Tukey's test
Before Bed Time								
All Positions	6.65	1.13	–	34.96		18.48	–	–
Sitting Position	3.54	3.36	**	12.52		1.36	*	–
Lying Position	5.85	2.41		18.22		23.06		–
Dorsal Position				9.79	a)	14.79	**	a), b) <c)*
Prone Position				8.43	b)	14.56		
Lateral Position				20.10	c)	26.27		
After Lights Out								
Lying Position	5.14	2.85	–	22.31		20.25	–	–
Dorsal Position				8.71	d)	14.59	**	d), e) <f)*
Prone Position				6.40	e)	13.17		
Lateral Position				13.96	f)	21.14		

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

Table 1: Smartphone Usage Habit among Youth (n = 138)

phone's light before sleep but also the sounds of email receipt, etc. can directly interrupt their sleep. Thus many factors have to be taken into consideration when understanding sleep disruption. To the best of our knowledge, this is the first report which closely gathered such information.

As this is a survey, the results of the study must be interpreted in the context of the following limitations. First, the participants' responses were based on their memory recall, and so bias will naturally exist in their answers. This is an inherent difficulty of surveys of this kind, and we could have eliminated this problem only by monitoring their sleeping habits every night. However this was not practical, and would not necessarily provide accurate results, as such monitoring can alter participants' habits. Second, we targeted only nursing students who were in their early twenties, and therefore we cannot generalize the results of the survey in regards to other age groups. However, we consider that a similar usage pattern can be found to a certain degree, at least among youth. Third, we did not have questions regarding sleep quality, therefore we could not correlate smartphone habits to sleep disruption. Forth, questions regarding when not using smartphone were not included in the survey either; which made it difficult to study how people's lives have been altered by smartphone usage.

In summary, a vast majority of the students who participated in the survey answered that they use their phone almost every night before sleep, even after they turned off the lights, and they favor doing so in a lateral laying position. Moreover, they do not turn off the power during sleep, and, keep their phone easily accessible within hand's reach. Further study is needed to better understand what factors are playing major roles in sleep disruption caused by smartphone usage in order for us to recommend the proper use of smartphones.

Conflicts of Interest

All authors have completed the Unified Competing Interest form at www.icmje.org/coi_disclosure.pdf (available on request from the corresponding author) and declare: no support from any organization for the submitted work; Taishiro Kishimoto has received consultant fees from Dainippon Sumitomo, Novartis, Otsuka, speaker's honoraria from Banyu, Eli Lilly, Dainippon Sumitomo, Janssen, Novartis, Otsuka, Pfizer, grant support from the Pfizer Health Research, Takeda, Tanabe-Mitsubishi, Dainippon-Sumitomo, Otsuka and Mochida; Masaru Mimura has received grants and/or speaker's honoraria from Asahi Kasei Pharma, Astellas Pharmaceutical, Daiichi Sankyo, Dainippon-Sumitomo Pharma, Eisai, Eli Lilly, GlaxoSmithKline, Janssen Pharmaceutical, Meiji-Seika Pharma, Mochida Pharmaceutical, MSD, Novartis Pharma, Otsuka Pharmaceutical, Pfizer, Tsumura, Shionogi, Takeda, Tanabe Mitsubishi Pharma, and Yoshitomi Yakuhin within the past three years. Michitaka Yoshimura, Momoko Kitazawa and Kazuo Tsubota have nothing to disclose; no other relationships or activities that could appear to have influenced the submitted work.

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