EFFECT OF USING SMARTPHONE BEFORE BED ON SLEEP QUALITY AMONG UNDERGRADUATE STUDENTS AT CHULALONGKORN UNIVERSITY, THAILAND

Mookrawee Bunyalug, Naowarat Kanchanakhan*

College of Public Health Sciences, Chulalongkorn University, Bangkok, 10330, Thailand

ABSTRACT:

Background: People perform better when they have a good sleep but the smartphone usage is the one activity that people do before bedtime which can interrupt their sleep. Therefore, this study aimed to describe the effect between using smartphone before bedtime and sleep quality of undergrad student of Chulalongkorn University.

Methodology: A cross-sectional study was conducted in 423 students, both male and female in Chulalongkorn University by convenient sampling. There are 4 sections of the questionnaire; 1) general information and covariate factors, 2) Stress, 3) Smartphone use behavior and mobile phone problematic use scale and 4) sleep quality (PSQI). Data collection was done through self-report. The descriptive statistic and Chi-square were used to analyze the data.

Results: The study shows that 96.9% of the participants use the smartphone before bedtime, besides 90.8% of the use it in bed. The Mobile Phone Problematic Use Scale (MPPUS) with the sleep quality is in poor level with 63.5%. The general information (age and monthly allowance), covariate factor (caffeine drink and stress) and smartphone use in bed are related to sleep quality with sleep $p < 0.05$.

Conclusion: The result showed some gap that the participant lacked of concern about the smartphone use before bedtime with the sleep quality, the raising of smartphone use it not only rise among undergraduate student, but in every age group. Therefore, this problem should be solved by creating a campaign to educate the people, so that they can be aware of.

Keywords: Smartphone; Sleep quality; Thailand

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INTRODUCTION

Every human need a resting period which known as sleep. Sleep is an important tool that help the body to restore, refresh and maintain the body system. It helps the body to slow down the function after exhausted during day time. Sleep is a condition of body and mind that relax for several hours at night time with the eyes close and the whole body is immobile posture. The recommended length of sleep is around 7-9 hours for most of the people, but sometime different age group need different sleep length.

Recent studies show that people perform better when they have a good sleep. They learn thing better and can memorize faster. Having an enough quality of sleep can prevent you from having a mental health, physical health and quality of life problems. Your brain will work better with a good quality of sleep. Sleep can help to improve human being skill in learning thing or even in making a decision. Lack of sleep may cause people to be mood swing, sad, depressed or even lack of motivation. Therefore, sleep quality is an important tool for being healthy [1].

* *Correspondence to: Naowarat Kanchanakhan*
E-mail: Naowarat.K@Chula.ac.th

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Many researches have shown that smartphone have a link with sleep quality whether by the screen light, the electromagnetic field, and even the thing that we received from using smartphone which can cause stress. For example, the brighter the screen we use at night the harder we can fall sleep. In all electronic devices emitting the blue light which it causes the pineal gland to produce less melatonin, a sleep hormones [2]. The light was received through the eyes and then it will send the signal to the hypothalamus that it is still a daytime, so that the melatonin suppression occurs. The pineal gland will be activating after the absence of light. The smartphone can cause a bad effect on health and sleep quality [2].

In Thailand, the prevalence of poor sleep quality among college student is 48%. One study had shown that college student sleep quality was affect by the use of mobile phone. Yet it is also affect the study performance [3]. However, few studies have been investigated effect of smartphone use before bed and sleep quality among Thai college students. Therefore, this study aimed to describe the effect between using smartphone before bedtime and sleep quality of undergrad student of Chulalongkorn University.

METHODOLOGY

A cross-sectional study was applied among undergrad students of Chulalongkorn University, Thailand which is located in Bangkok, Thailand. The period of study was from April to July 2017. Self-administrative questionnaire was used for data collection.

The sample covered only Thai program undergraduate student of Chulalongkorn University. Inclusion criteria was Thai male and female students who had a smartphone, age above 18 years old who were enrolled in the academic year 2016, and willing to be part of the project. Exclusion criteria were the one who has hearing loss, the participant that was on the psychological pill and the one who took sleeping pills**.**

The sampling technique of this study was convenient sampling. The participant was randomly selected upon whom the researcher met and agreed to participate. The sample size of this study is 384 students with adding more 10% of the non-response case, so the final sample size is 423 students for this project.

There are 4 sections of the questionnaire with the total of 81 questions, 1) General information & covariate factors (16 questions), 2) Stress, ST5, from Department of Mental Health, Thailand [4]. There are 5 questions asking about the stress. 3) Smartphone use behavior & Mobile Phone Problematic Use Scale, MPPUS was created by Bianchi and Phillips [5], (11&27 questions) and 5) Sleep quality, Pittsburg Sleep Quality Index (PSQI) by Buysee et al. [6], (21 questions). The descriptive statistic and Chi-square were used to analyze the data. The researcher has done the content validity by three experts on the fields. Reliability also have been tested which resulted the Cronbach's alpha of > 0.7.

The research has been approved by the Ethics Review Committee for Research Involving Human Research Subject, Health Science Group, Chulalongkorn University with reference number 063.1/60.

RESULTS

Relationship between demographic characteristic and sleep quality

The researcher has compared all the variables of demographic with sleep quality and the result shown that there is a relationship between sleep quality with age, education level and monthly allowance. Age by year of the participant is significantly associate with sleep quality by having the p-value of 0.000. Poor sleep quality has high number in participant age of 19 and 20 years old. In group of 19 years old, there are 184 students and 60.8% of them are having poor sleep quality. For the group of 20 years old, there are 126 students and 79.3% of them are having the poor sleep quality.

Education level also showed the relationship with the sleep quality with p-value 0.015. In freshmen year, there were 56.9% students facing with poor sleep quality and it was the highest number among all the education level, which was followed by sophomore with 27.5% students who has poor sleep quality. And the least is senior year only 3% students has poor sleep quality.

On the other hand, monthly allowance also showed the strong significant relationship with the *p*-value of 0.001. The one who has monthly allowance of less than 5,000 baht, about 45.7% of them are having poor sleep quality. Similar outcome also shows in group of 5,001-10,000 baht, 41.3% of this group also facing with poor sleep quality. Meanwhile, the one who got monthly allowance above 15,001 baht seem to have a better score on sleep quality than the lower range of income (Table 1).

Table 1 The socio-demographic characteristics and sleep quality

Characteristics	All (n= 423)		Poor sleep quality (n=269)		Good sleep quality (n=154)		*p*-value
	n	(%)	n	(%)	n	(%)	
Gender							
Male	202	47.8	121	45.0	81	52.6	0.131
Female	221	52.2	148	55.0	73	47.4	
Faculty							
Non-health	327	77.3	206	76.6	121	78.6	0.638
Health	96	22.7	63	23.4	33	21.4	
Education level							
Freshman	225	53.1	153	56.9	72	46.7	0.015*
Sophomore	112	26.5	74	27.5	38	24.7	
Junior	68	16.1	34	12.6	34	22.1	
Senior	18	4.3	8	3.0	10	6.5	
GPA							
Less than 3.0	195	48.5	127	49.6	68	46.6	0.558
More than 3.0	207	51.5	129	50.4	78	53.4	
Monthly allowance (Baht)							
Less than 5,000	181	42.8	123	45.7	58	37.7	0.001*
5,001-10,000	171	40.4	111	41.3	60	38.9	
10,001-15,000	63	14.9	35	13.0	28	18.2	
Above 15,001	8	1.9	0	0	8	5.2	

Table 2 The sleep covariate factors and sleep quality

Covariate factors	All (n= 423)		Poor sleep quality (n=269)		Good sleep quality (n=154)		*p*-value
	n	(%)	n	(%)	n	(%)	
Energy drink							
No	337	79.7	214	79.6	123	79.9	0.938
Yes	86	20.3	55	20.4	31	20.1	
Time							
Morning	14	16.3	6	42.9	8	57.1	
Afternoon	21	24.4	6	26.6	15	71.4	
Evening	2	2.3	2	100	0	0.0	
Night	49	57.0	41	83.7	8	16.3	
Caffeine drink							
No	89	21.0	42	15.6	47	30.5	0.000*
Yes	334	79.0	227	84.4	107	69.5	
Time							
Morning	74	22.2	49	66.2	25	33.8	
Afternoon	157	47.0	113	72.0	44	28.6	
Evening	66	19.7	41	62.1	25	37.9	
Night	37	11.1	26	70.3	11	29.7	
Smoking							
No	399	94.3	253	94.1	146	94.8	0.747
Yes	24	5.7	16	5.9	8	5.2	
How many cigarettes you smoke in one week?							
- None	6	25	4	66.7	2	33.3	
- 1 cigarette	16	66.7	10	62.5	6	37.5	
- 2-5 cigarettes	2	8.3	1	50.0	1	50.0	
Alcohol consumption							
No	199	47	123	45.7	76	49.4	0.472
Yes	224	53	146	54.3	78	50.6	

Table 2 The sleep covariate factors and sleep quality (cont.)

Covariate factors	All (n= 423)		Poor sleep quality (n=269)		Good sleep quality (n=154)		*p*-value
	n	(%)	n	(%)	n	(%)	
When you drink?							
- Occasionally	188	83.9	128	68.1	60	31.9	
- Sometime	28	12.5	16	57.1	12	42.9	
- Often	8	3.6	2	25.0	6	75.0	
Exercise							
No	175	41.4	116	43.1	59	38.3	0.334
Yes	248	58.6	153	56.9	95	61.7	
How long for exercise in one time?							
- Less than 30 minutes per time	88	35.5	57	64.8	31	35.2	
- More than 30 minutes per time	160	64.5	96	60.0	64	40.0	
Shift work							
No	368	87.0	231	85.9	137	89.0	0.364
Yes	55	13.0	38	14.1	17	11.0	
Time							
- Day time	42	76.4	40	95.2	2	4.8	
- Night time	13	23.6	2	15.4	11	84.6	
Stress							
Mild stress	142	36.6	60	22.3	82	53.2	0.000*
Moderate stress	185	43.7	136	50.6	49	31.8	
Severe stress	51	12.1	38	14.1	13	8.4	
Extremely severe stress	45	10.6	35	13.0	10	6.6	

Relationship between covariate factors and sleep quality

In this part, the researcher has tested the relationship between sleep quality with the covariate factors which are energy drink, caffeine drink, smoking, alcohol consumption, exercise, shifted work and stress. The researcher had defined answer into two subtypes which are "Yes" and "No" for six factors except stress that the researcher had defined according to the participant score. Among those seven factors, only 2 factors were related with the sleep qualities which are caffeine drink and stress.

There are 334 participants that saying they consumed the caffeine drink and among those number 84.4% of participants were having poor sleep quality. The *p*-value of caffeine drink and sleep quality is 0.000 which shows a very strong significant. Another factor that also show the positive relationship with sleep quality is stress. The pattern in the table can show that the more stress you have, the more possible chance of having a poor sleep quality. The number of poor sleep quality in Mild was 22.3% of students, Moderate was 50.6 of students, and Severe was 14.1 of students and extremely severe group had 13.0% of students. The *p*-value is 0.000 (Table 2).

Relationship between smartphone use behavior and sleep quality

There are four factors in this section; using smartphone before bedtime, using smartphone use in bed before bedtime, mode of smartphone during sleep and light adjustment. There were three factors in this part which were significant with sleep quality except using smartphone before bedtime. First one was the using smartphone before bedtime in bed, there were 384 students who said that they used their smartphone in bed. As a result, 93.3% of those who used smartphone on bed had the poor sleep quality. Therefore, the researcher had defined "Yes" to the one who used smartphone and "No" referred to the one who did not use. The *p*-value is 0.018. Second was the mode of smartphone during sleep with *p*-value of 0.030. No doubt that the highest number of poor sleep quality was in Normal group with 38.7% of participants, followed by vibration with 36.8% of participants and the least is Silent mode with 24.5% of participants with poor sleep quality. Third was light adjustment, even though 77.1% of participants said that they adjusted their screen light when used in the dark place, but the result showed that 81.4% of participants were having a poor sleep quality. Therefore, light adjustment was associated

Table 3 The smartphone use behavior with sleep quality

Smartphone use behavior	All (n= 423)		Poor sleep quality (n=269)		Good sleep quality (n=154)		*p*-value
	n	(%)	n	(%)	n	(%)	
Using smartphone before bedtime							
No	13	3.1	8	3.0	5	3.2	0.876
Yes	410	96.9	269	97.0	149	96.8	
Time							
Less or equal to 1 hour	297	72.4	178	59.9	119	40.1	
More than 1 hour	113	27.6	83	73.5	30	26.5	
Using smartphone use in bed before bedtime							
No	39	9.2	18	6.7	21	13.6	0.018*
Yes	384	90.8	251	93.3	133	86.4	
Time							
Less or equal to 1 hour	300	78.1	191	63.7	109	36.6	
More than 1 hour	84	21.9	60	71.4	24	28.6	
Mode of smartphone during sleep							
Vibration	168	39.7	99	36.8	69	44.8	0.030*
Normal	144	34.0	104	38.7	40	26.0	
Silent	111	26.3	66	24.5	45	29.2	
Screen light adjustment							
Yes	326	77.1	219	81.4	107	69.5	0.005*
No	97	22.9	50	18.6	47	30.5	

Table 4 MPPUS and sleep quality

MPPUS	All (n= 423)		Poor sleep quality (n=269)		Good sleep quality (n=154)		*p*-value
	n	(%)	n	(%)	n	(%)	
Low impact	17	4	5	1.9	12	7.8	0.003*
High impact	406	96	264	98.1	142	92.2	

with sleep quality with *p*-value of 0.005. In this part, the researcher had defined "Yes" to the one who had adjusted their light screen to darker screen when they stay in the dark environment and "No" referred to the one who did not adjust their light screen at all (Table 3).

Relationship between MPPUS and sleep quality

Mobile Phone Problematic Use Scale was divided into two group Low Impact with score of less than 65 and High Impact of score above 65 points. It displayed the significant relationship with p-value of 0.003. In Low Impact group, there were 1.9% of participants that are poor sleep quality while High Impact group had as much participation as 98.1 who has poor sleep quality. Surprisingly, the Low Impact group had a higher number in Good Sleep Quality with 12 participants (Table 4).

DISCUSSION

There are 3 factors of smartphone use behavior that are interesting in the researcher opinion which are using smartphone before bedtime in bed, mode of smartphone during sleep and screen light adjustment. Firstly, is using smartphone before bedtime in bed; this has confirmed the researcher's objective, the relationship between sleep quality and use the smartphone before bed time, in the study. The result was supported the previous research that the study conducts 166 participants with the age of 20-30 were compare the smartphone user with the non-smartphone user by using Pittsburg Sleep Quality Index (PSQI) and the result show that non smartphone user have a better sleep [7]. The result from Undergrad Student at Chulalongkorn University showed the similar outcome with study from Thomee [8]; the cohort study was conducted in young adult age of 20-24 and there were 4156 participants whom were asking the questions at baseline and at 1 year follow up, the outcome of the study presented that high mobile phone use was related to sleep disturbances.

Secondly, regarding the mode of smartphone during sleep, there were 168 students who said that vibration is the preferable choice of smartphone at night. From the data, it indicates that the one who

put on vibration were likely having a roommate. It can be seen clearly that by putting on both vibration and normal can cause the sleep disturbances by producing the noise. Since all electronic devices contain the electromagnetics wave, it contains non-ionizing radiation which can possibly effect human health [9]. One study mentioned that the most safest mode to put while sleeping is the Airplane mode so that all the wave will shut down and not be able to interrupt the brain activity [10].

Finally, the screen light adjustment of your smartphone, it is positively demonstrated that it is better to adjust the light of the screen according to the environment. Because in every smartphone, it contains the blue light, therefore those blue light will harm to yourself by hurting your eyes and decrease the melatonin level. The blue light is known as the light in the day time, so receiving a lot of blue light from the smartphone will make your brain think that it is day time and the melatonin production will decrease [2]. Using the mobile in bedroom is associate with the delayed timing of sleep. In 2008, the study shown that people who expose with smartphone radiation will took longer time fall asleep and decrease the duration of deep sleep [11]. A Swedish study linked the heavy smartphone with sleep problems, stress and depression [12]. As the result, this study showed similar outcome with the previous study, therefore the one who adjust their screen light have 10% better in having a good sleep quality.

As mentioned earlier that sleep quality and MPPUS has significant relationship. However, the researcher intended to see the relationship between these two variables because in MPPUS, it can predict whether the phone will cause the problem for participant or not, and will it link with participant's sleep quality. Question number 6 from MPPPUS "I lose sleep due to the time I spend on my mobile phone" there is 58.4% of the participant who answer the scale of 5-10 points and the average score for this question is 5. So more than half of them seem to have a lack of sleep due to smartphone use. One study also show the significant relationship in MPPUS and sleep quality, but not the sleep length [13].

CONCLUSION

As a consequence, the outcome showed the relationship between sleep quality and smartphone use before bed. Even though, they are some covariates factors that might affect the sleep quality such as caffeine drink and stress so further study is needed. Moreover, using smartphone before bedtime in bed displays the relationship ($p=0.018$) with sleep quality, the longer you are using your mobile in bed it can cause the higher chance of having poor sleep quality. Besides, mode of mobile is also related with sleep quality. Lastly, Screen light adjustment is another key feature to the sleep quality. The brighter light of the smartphone you have the brighter blue light you will get; therefore, it will decrease the melatonin production and you will fall sleep harder. However, this research cannot be assumed to all the undergraduate students in Thailand since this research only conduct in Chulalongkorn University. In short, further study is needed because this research only covers on Smartphone using which are not include all other type of electronic device.

LIMITATION

There are a few numbers of the limitation in this research. First of all, the questionnaire contains a lot of questions that might cause missing data because the participant allows to leave the research if he/she doesn't want to participant anymore.

Second, since it is self-reported questionnaire, it is possible that the participant might not understand the question. Therefore, the participant might give the wrong answer or skip the question.

Lastly, this study was convenience sampling so it is possible that there will be some bias because the population cannot cover the whole university.

RECCOMENNDATION

Overall, all the result has showed some gaps that the participant is lack of concern about the smartphone use before bedtime with the sleep quality, the raising of smartphone use it not only rise among undergraduate student, but in every age group. Therefore, this problem should be solved by creating a campaign to educate the people, so that they can be aware of it. The campaign can first start at Chulalongkorn University, by promoting about how is the smartphone use before bed cause poor sleep quality. Yet, screen light adjustment also plays a big role in decreasing the melatonin production. One last important thing is that Chulalongkorn University should raise the concern of the stress among the student. The reason of stress condition must be investigated.

REFERENCES

1. Smith A. US Smartphone use in 2015. [updated 2015 April; cited 2016 Nov]. Available from: http://www.pewinternet.org/2015/04/01/us-smartphone-use-in-2015/
2. Mortazavi SMJ, Mortazavi SA, Habibzadeh P, Mortazavi G. Is it blue light or increased electromagnetic fields which affects the circadian rhythm in people who use smartphones at night. Iran J Public Health. 2016 Mar; 45(3): 405-6.
3. Kawasaki N, Tanei S, Ogata F, Burapadaja S, Loetkham C, Nakamura T, et al. Survey on cellular phone usage on students in Thailand. J Physiol Anthropol. 2006 Nov; 25(6): 377-82.
4. Thailand, Department of Mental Health. ST5. [cited 2017 Feb]. Available from: http://www.dmh.go.th/test/qtest5/
5. Bianchi A, Phillips JG. Psychological predictors of problem mobile phone use. Cyberpsychology & Behavior. 2005 Feb; 8(1): 39-51. doi: 10.1089/cpb.2005.8.39
6. Buysse DJ, Reynolds CF, 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Res. 1989 May; 28(2): 193-213.
7. Munezawa T, Kaneita Y, Osaki Y, Kanda H, Minowa M, Suzuki K, et al. The association between use of mobile phones after lights out and sleep disturbances among Japanese adolescents: a nationwide cross-sectional survey. Sleep. 2011 Aug; 34(8): 1013-20. doi: 10.5665/SLEEP.1152
8. Thomée S, Härenstam A, Hagberg M. Mobile phone use and stress, sleep disturbances, and symptoms of depression among young adults--a prospective cohort study. BMC Public Health. 2011 Jan; 11(1): 66. doi: 10.1186/1471-2458-11-66
9. Altpeter ES, Röösli M, Battaglia M, Pfluger D, Minder CE, Abelin T. Effect of short-wave (6-22 MHz) magnetic fields on sleep quality and melatonin cycle in humans: the Schwarzenburg shut-down study. Bioelectromagnetics. 2006 Feb; 27(2): 142-50. doi: 10.1002/bem.20183
10. Champion C. The top-5 ways to protect yourself from cellphone radiation. [cited 2017 Mar]. Available from: http://inhabitat.com/the-top-5-ways-to-protect-yourself-from-cellphone-radiation/.
11. Mobile phone radiation disrupts sleep, causes headaches. [updated 2008 Jan; cited 2017 Mar]. Available from: http://articles.economictimes.indiatimes.com/2008-01-21/news/27697646_1_mobile-phone-radiation-phones-from-exposure-scenarios-bengt-arnetz
12. Hall K. How mobile phones affect sleep (INFOGRAPHIC). [updated 2013 Feb; cited 2016 Nov]. Available from: http://www.huffingtonpost.com/2013/02/15/phones-sleep-mobile-_n_2680805.html
13. White AG, Buboltz W, Igou F. Mobile Phone Use and Sleep Quality and Length in College Students. Int J Humanit Soc Sci. 2011; 1(18): 51-8.