# JRHS
**Journal of Research in Health Sciences**

journal homepage: www.umsha.ac.ir/jrhs

**Original Article**

# Mobile Phone Addiction and Its Relationship to Sleep Quality and Academic Achievement of Medical Students at King Abdulaziz University, Jeddah, Saudi Arabia

**Nahla Khamis Ibrahim (PhD)[1,2]\*, Bashaer Saleh Baharoon (MBChB)[3], Waad Fouad Banjar (MBChB)[3], Anfal Abdulrahman Jar (MBChB)[3], Roba Mahmod Ashor (MBChB)[3], Alanoud Akram Aman (MBChB)[3], Jawaher Rabah Al-Ahmadi (SBFM)[1]**

[1] Family and Community Medicine Department, Faculty of Medicine, King Abdulaziz University, Jeddah, Saudi Arabia

[2] Department of Epidemiology, High Institute of Public Health, Alexandria University, Alexandria, Egypt

[3] Interns, Faculty of Medicine, King Abdulaziz University, Jeddah, Saudi Arabia

## ARTICLE INFORMATION

*\* Correspondence:*

*Nahla Khamis Ragab Ibrahim (PhD)*

*E-mail: nahlakhamis@yahoo.com*

## ABSTRACT

**Background:** Adverse effects of Mobile Phone (MP) usage could lead to dependency problems, and medical students are not excluded from it. We aimed to determine the pattern of MP usage, and its relation to sleep quality and academic performance between medical students at King Abdulaziz University (KAU), Jeddah, Saudi Arabia.

**Study design:** A cross-sectional study.

**Methods:** A multistage stratified random sample was used for selection of 610 participants, during 2016-2017. A validated, anonymous data collection sheet was used. It inquired about the Grade Point Averages (GPA). It included the Problematic Mobile Phone Use Questionnaire (PMPU-Q) for assessing various aspects of cellphone addiction (dependency, financial problems, prohibited and dangerous use). The Pittsburgh Sleep Quality Index (PSQI) was also included. Descriptive and inferential statistics were done.

**Results:** A high frequency of MP usage prevailed among participants (73.4% used it >5 h/day). About two-thirds of participants had poor sleep quality. Females, owners of smartphone for >1 yr, and increasing time spent on MP were associated with MP dependency. Lower academic achievers had significantly worse MP scores on financial problems, dangerous use, and total PUMP. MP dependency was correlated with subjective sleep quality score, and sleep latency. Global PSQI scale was correlated with prohibited MP use.

**Conclusions:** Lower achievers had significantly worse scores on MP financial problems, dangerous usage, and the total PMPU. MP dependency was correlated with poor subjective sleep quality, and sleep latency. Rationale MP usage is needed to decrease the dependency, improve sleep quality, and academic achievement of medical students.

## Introduction

Under the extensive technological revolution, the mobile phone (MP) usage has rapidly increased[1]. Nowadays, smartphone is not just used for phone-calls and text-messaging, but it goes beyond that. It reached out to include internet access to multimedia through social networks, video games and Global Positioning System (GPS) navigation[1,2]. MPs are now utilized globally as one of the chief information and communication technologies (ICTs)[1]. The smartphones have also proved to be useful for medical students as a potential tool to "learn anywhere"[3].

Despite the benefits, there are many adverse effects of the smartphone irrational usage. MP could lead also to dependency problems[4-6] characterized by excessive and continuity of performing an activity despite its negative outcomes. This includes mental stress, feeling of being captivated, role conflicts, and obligatory feelings to respond to all notifications, calls, and messages. Nomo-phobia is a fear of not having the MP around. Saudi Arabia ranked the first of all countries of Gulf Cooperation Council regarding the proportion of MP users[4].

Medical students are not excluded from MP addiction; due to more MP engagement in their daily life[7]. Furthermore, sleep is crucial for preserving the person's physical and mental health. Smartphone usage might lead to sleep disturbance[8], which may affect the concentration level and academic performance[9]. However, few types of research were done to determine the pattern of MP usage, and its relationship of usage with sleep quality and academic achievements[10], especially among medical students in Jeddah.

We aimed to determine the pattern of MP usage, and its relation to sleep quality and the academic performance of medical students at King Abdulaziz University (KAU).

# Methods

This cross-sectional study was conducted during the academic year 2016-2017. All medical students who completed the freshman year (from the 2$^{nd}$-6$^{th}$ year), and accepted to participate in the study were eligible to enroll. A multistage stratified random sample method was used to select medical students. Students' gender and educational level were considered for the stratification purpose. The sample size was calculated by the formula of calculation of sample from the cross-sectional study. Since the rate of problematic MP usage between medical students in Jeddah, other parts of Saudi Arabia by the used tool is unknown, so "*P*" was supposed to equal "q" (0.5) as the most conservative sample in this case[11]. The minimum calculated sample size for achieving a precision of ± 4%, at 95% confidence interval (C.I.) was 600 students.

A validated, confidential, anonymous data collection sheet was used. It inquired about personal and socio-demographic data. It assessed also the Grade Point Averages (GPA) during last semester. The questionnaire included the English version of Pittsburgh Sleep Quality Index (PSQI)[12]. The English version has a good validity and reliability[13,14]. The data sheet contained also the standardized English version of the Problematic Mobile Phone Use-Questionnaire (PMPU-Q)[15,16]. This tool comprises thirty items for assessment of various aspects of cellphone addiction (dependency, financial problems, prohibited & dangerous use). PMPU-Q contains also general questions about MP and Short Message Service (SMS) usage. It has good validity and reliability. Its internal consistency reliability was assessed by Cronbach's alpha and found to range from 0.85 to 0.90[15]. For the dangerous MP domain, a mild modification was done to fit for females in Saudi Arabia and re-validation was done.

### Statistical analysis

SPSS ver. 21 (Chicago, IL, USA) was used. The PMPU-Q score was calculated with its four domains[10,14]. Nineteen self-rated PSQI were combined into seven components[12]. Descriptive statistics using proportions, means and standard deviations (SDs) was done. Inferential statistics were conducted. Student's *t*-test and ANOVA were used for comparing between means. Post-hoc Least Statistical Difference (LSD) was calculated. Pearson's correlation coefficient (r) was used to measure the strength of the association between two continuous variables

### Ethical statement

The research was confirmed to the ethical standards of Helsinki declaration. The Institutional Review Board (IRB) of KAU approved the study with a Reference Number: 92-16. Each student accepted to participate in the study signed a written informed consent.

# Results

The study enrolled 610 participates; with a slight increase than minimal sample for the stratification purpose. The male: female ratio was 1.06:1. The mean (± SD) of the age was 21.60± 2 yr. According to PSQI, 68.4% of the students had poor sleep quality, and the actual sleeping hours per day was 6.0 ± 1.84 h.

All participants had MPs, and 73.4% of them used their MP for >5 h per day (average of 3.0 h). The most frequently used mobile's applications were What's App (45%), followed by Snap Chat (35%), YouTube (25%), Instagram (19%), Twitter (19%), Path (11%) and Facebook (7%). The mean checking What's App was 10 times per day.

Table 1 shows that older students (aged ≥22 yr), and those enrolled in the clinical years had significantly (*P*<0.001) worse scores regarding the financial problems, dangerous MP use and the total PUMP score compared to others. Furthermore, females had more MP dependency. The mean MP dependency score was significantly higher among females compared to males (*P*<0.001). On the other hand, males had worse scales on the financial problems, dangerous mobile use, and the total PUMP compared to females. Students who owned smartphones for more than 5 yr, and those spent>30 min/day on their MP obtained significantly higher scores in the dependency, dangerous mobile use, and total PUMP compared to others. Regarding the relationship between MP use and the academic achievement, the table shows that students with lower GPA had significantly worse scores on MP financial problems, dangerous MP usage, and the total PMPU compared to their counterparts with higher scholastic achievements. Those who reported an increased frequency of calls and SMS had increased MP financial problems, dangerous MP use and total PMPU score than others. However, there is no relationship between MP use and income.

Table 2 shows that there are significant correlations between MP dependency with each of subjective sleep quality (*P*<0.01), and sleep latency (*P*<0.05) domains of the PSQI. Furthermore, prohibited MP scale was significantly correlated with subjective sleep quality, sleep latency, sleep disturbance, use of sleep medication and the total PSQI scale. Furthermore, dangerous MP use was significantly correlated with sleep latency and the usage of sleep medication. Academic achievement was negatively correlated with dangerous mobile use and financial problems.

# Discussion

In the current study, females were significantly more dependent on MP than were males. This result supports the preceding studies from Turkey[2] and Korea[17]. These findings might be because females usually like the talk and to do interpersonal interaction with her relatives and friends more than males [17]. On the other hand, absence of such association was reported from another Turkish study [8]. In the current study, males had worse scales on financial problems, dangerous MP usage, and with the total PUMP scales compared to females. The reason for that might be due to the differences between social engagements among both genders in Saudi culture.

A study done by college students from the USA demonstrated that MP usage was negatively associated with their GPA[18], which is in line with our findingd. These results are also consistent with other previous studies[19, 20]. Such findings may be because modern MPs create accessing to Internet, checking social media, playing video games, contacting friends, exploring new applications, or engaging with many MP leisure activities. These can lead to decrease the concentration levels and sleep quality, and cause wasting of more time on MP. Such time is needed for more studying and obtaining better GPA.

**Table 1:** Relationship between domains of problematic mobile phone usage and the characteristics of medical students at King Abdulaziz University, Jeddah, Saudi Arabia

| Variables | MP Dependence | | Financial problems | | Prohibited use | | Dangerous use | | Total PUMP Score | |
|---|---|---|---|---|---|---|---|---|---|---|
| | mean | SD | mean | SD | mean | SD | mean | SD | mean | SD |
| Age (yr) | | | | | | | | | | |
| <22 | 19.07 | 3.74 | 27.84 | 5.38 | 11.01 | 2.29 | 11.63 | 2.76 | 69.83 | 9.08 |
| ≥22 | 13.75 | 2.75 | 31.12 | 6.39 | 10.84 | 2.46 | 13.57 | 2.75 | 74.40 | 10.55 |
| *P* value | 0.097 | | 0.001 | | 0.388 | | 0.001 | | 0.001 | |
| Gender | | | | | | | | | | |
| Male | 18.28 | 3.14 | 31.41 | 6.43 | 11.00 | 2.37 | 12.69 | 2.91 | 73.20 | 10.32 |
| Female | 19.38 | 4.11 | 27.32 | 5.01 | 10.18 | 1.65 | 10.00 | 2.20 | 67.00 | 9.77 |
| *P* value | 0.001 | | 0.001 | | 0.378 | | 0.001 | | 0.001 | |
| Academic year | | | | | | | | | | |
| Basic | 18.77 | 3.74 | 27.79 | 5.54 | 11.00 | 2.21 | 11.29 | 2.78 | 68.99 | 9.75 |
| Clinical | 18.84 | 3.64 | 30.51 | 6.27 | 10.87 | 2.48 | 13.45 | 2.74 | 74.20 | 10.38 |
| *P* value | 0.846 | | 0.001 | | 0.505 | | 0.001 | | 0.001 | |
| Grade Point | | | | | | | | | | |
| <4.5 | 18.67 | 3.38 | 30.11 | 6.46 | 10.87 | 2.39 | 13.15 | 2.84 | 73.54 | 10.55 |
| ≥4.5 | 19.09 | 3.61 | 28.53 | 5.42 | 10.86 | 2.23 | 11.83 | 2.99 | 70.44 | 9.84 |
| *P* value | 0.192 | | 0.005 | | 0.948 | | 0.001 | | 0.010 | |
| Income (SR/month) | | | | | | | | | | |
| ≥10,000 | 18.85 | 3.69 | 29.37 | 6.10 | 10.89 | 2.36 | 12.62 | 2.95 | 73.34 | 10.35 |
| <10,000 | 17.65 | 3.37 | 30.71 | 6.56 | 11.88 | 2.96 | 12.08 | 2.84 | 72.36 | 12.41 |
| *P* value | 0.185 | | 0.375 | | 0.090 | | 0.679 | | 0.940 | |
| Duration of having a smartphone (yr) | | | | | | | | | | |
| <1 | 11.5 | 6.36 | 25.50 | 13.44 | 11.00 | 4.24 | 9.50 | 2.12 | 57.50 | 26.16 |
| 1-5 | 18.5 | 3.67 | 28.88 | 5.66 | 11.09 | 2.32 | 12.01 | 2.86 | 70.19 | 9.69 |
| >5 | 18.97 | 3.65 | 29.63 | 6.19 | 10.88 | 2.39 | 12.92 | 2.89 | 73.18 | 10.46 |
| *P* value | 0.007 | | 0.277 | | 0.616 | | 0.014 | | 0.008 | |
| Time spent on mobile phone per day (min) | | | | | | | | | | |
| 0-10 | 15.69 | 5.59 | 28.54 | 6.85 | 10.31 | 3.17 | 10.11 | 3.10 | 61.44 | 17.69 |
| >10 | 18.83 | 3.62 | 29.46 | 6.13 | 10.91 | 2.37 | 12.23 | 3.12 | 73.69 | 9.61 |
| *P* value | 0.002 | | 0.590 | | 0.368 | | 0.040 | | 0.001 | |
| Calls made per day | | | | | | | | | | |
| 0-2 | 18.84 | 3.85 | 27.27 | 5.50 | 10.79 | 2.29 | 11.35 | 2.81 | 67.74 | 10.20 |
| 3-5 | 18.60 | 3.55 | 30.53 | 5.89 | 11.10 | 2.47 | 12.61 | 2.92 | 74.08 | 9.72 |
| >5 | 19.31 | 3.57 | 32.69 | 5.34 | 10.87 | 2.37 | 13.44 | 2.82 | 76.85 | 9.66 |
| *P* value | 0.294 | | 0.001 | | 0.308 | | 0.001 | | 0.001 | |
| SMS sent per day | | | | | | | | | | |
| 0-3 | 18.87 | 3.81 | 28.80 | 5.96 | 10.77 | 2.39 | 12.32 | 2.88 | 71.19 | 10.17 |
| 4-10 | 18.19 | 3.64 | 29.18 | 6.41 | 11.22 | 2.49 | 13.22 | 2.69 | 73.64 | 12.01 |
| >10 | 19.17 | 3.19 | 31.26 | 6.04 | 11.18 | 2.26 | 13.27 | 2.93 | 74.62 | 10.07 |
| *P* value | 0.144 | | 0.001 | | 0.120 | | 0.030 | | 0.030 | |

**Table 2:** Correlation coefficients between sleep quality components, academic achievement and the domains of Problematic Mobile Phone among medical students at King Abdulaziz University, Jeddah, Saudi Arabia

| PSQI Components | Prohibited use | Financial problems | Dangerous use | Dependency |
|---|---|---|---|---|
| Subjective sleep quality score | 0.100 | -0.046 | -0.070 | 0.136 |
| Sleep latency | 0.100 | -0.070 | -0.142 | 0.100 |
| Sleep duration | 0.053 | -0.026 | -0.042 | 0.034 |
| Sleep efficiency | -0.022 | -0.030 | 0.006 | 0.049 |
| Sleep disturbance | 0.153 | 0.090 | -0.006 | -0.058 |
| Use of sleep medication | 0.087 | 0.223 | 0.146 | -0.062 |
| Daytime dysfunction | 0.008 | -0.062 | -0.060 | 0.058 |
| Total PSQI score | 0.112 | 0.004 | -0.042 | 0.069 |
| Academic achievement | 0.026 | -0.127 | -0.138 | 0.036 |

More than two-thirds of our participants had poor sleep quality (PSQI), which agrees with the previous studies from Palestine[21] and Jeddah[22]. In San Francisco, California, the longer average spent on the screen-times through the time on bed was associated with poor quality of sleep, diminished sleep efficiency, and increased in the sleep onset latency.[23] Our results were consistent with the results from California as MP dependency score was associated with the subjective sleep quality and sleep latency. Various aspects of mobile phone use such as problem mobile phone use are associated with sleep quality[24]. Presence of significant positive correlations was illustrated between smartphone addiction with each subjective sleep quality, sleep disturbance, daytime dysfunction, and PSQI global scores [2]. Furthermore, Switzerland showed an association between smartphone usage and later bedtimes, but no association with sleep disturbance [25]. However, a study conducted from Taiwan found no association between MP usage and sleep duration[26].

The application of our results can be done through building of educational campaigns on dangerous the dangerous of MP overuse. This can decrease the problems. Such campaigns can be done among medical, non-medical or other students.

The limitations and potential biases of the stud was the bias of the cross-sectional study as temporal ambiguity.

## Conclusion

A high frequency and an extensive duration of daily MP usage noticed among medical students from KAU in the current study. The most frequently used smartphone application was What's App. Being a female, owners of smartphone for more than 1 year, and spending more time on mobile per day were significantly associated with MP dependency. Students with lower academic achievement had significantly worse scores on many of MP addictions domains; namely the financial problems, dangerous MP usage, and with the total PMPU score compared to the higher achievers. Students suffered from poor sleep quality represented about three-fourths of the participants. MP dependency was significantly associated with poor sleep quality as measured by subjective sleep quality and a long sleep latency. Conduction of educational programs about the dangers of increased MP usage is needed for reducing MP dependency. More studies are needed to be done on other physiological and psychological effects of MP usage.

## Conflict of interest statement

The authors declare that there is no conflict of interests.

---

### Highlights

- Females, owners of smartphone for longer duration & who spent more time on it had more mobile dependency.

- Lower academic achievers had worse score on total Problematic Mobile Phone Use Questionnaire.

- Each of subjective sleep quality score & sleep latency were associated with mobile phone dependency.

- Global Pittsburgh Sleep Quality Index scale was correlated to prohibited mobile phone use.

- Rationale smartphone use is needed for reducing dependency and improving academic achievement.

---

## References

1. Lopez-Fernandez O, Kuss DJ, Romo L, Morvan Y, Kern L, Graziani P, et al. Self-reported dependence on mobile phones in young adults: A European cross-cultural empirical survey. J Behav Addict. 2017; 6(2): 168-77.

2. Demirci K, Akgönül M, Akpinar A. Relationship of smartphone use severity with sleep quality, depression, and anxiety in university students. J Behav Addict. 2015; 4(2): 85-92.

3. Payne KB, Wharrad H, Watts K. Smartphone and medical related App use among medical students and junior doctors in the United Kingdom (UK): a regional survey. BMC Med Inform Decis Mak. 2012; 12: 21.

4. Naeem Z. Health risks associated with mobile phones use. Int J Health Sci (Qassim). 2014; 8(4): V-VI.

5. Parasuraman S, Sam AT, Yee SWK, Chuon BLC, Ren LY. Smartphone usage and increased risk of mobile phone addiction: A concurrent study. Int J Pharm Investig. 2017; 7(3): 125-31.

6. Kuss DJ, Harkin L, Kanjo E, Billieux J. Problematic Smartphone Use: Investigating Contemporary Experiences Using a Convergent Design. Int J Environ Res Public Health. 2018; 15(1): 142-57.

7. 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; 11: 66-75.

8. Sahin S, Ozdemir K, Unsal A, Temiz N. Evaluation of mobile phone addiction level and sleep quality in university students. Pak J Med Sci. 2013; 29(4): 913-18.

9. Hysing M, Harvey AG, Linton SJ, Askeland KG, Sivertsen B. Sleep and academic performance in later adolescence: results from a large population-based study. J Sleep Res. 2016; 25(3): 318-24.

10. Exelmans L, Van den Bulck J. Bedtime mobile phone use and sleep in adults. Soc Sci Med. 2016; 148: 93-101.

11. Wang WEI. Clinical Epidemiology-basic principles and practical applications. 1st ed. Beijing: Higher Education Press Publication; 2012.

12. Rener-Sitar K, John MT, Bandyopadhyay D, Howell MJ, Schiffman EL. Exploration of dimensionality and psychometric properties of the Pittsburgh Sleep Quality Index in cases with temporomandibular disorders. Health Qual Life Outcomes. 2014; 12(1): 10-18.

13. Mollayeva T, Thurairajah P, Burton K, Mollayeva S, Shapiro CM, Colantonio A. The Pittsburgh sleep quality index as a screening tool for sleep dysfunction in clinical and non-clinical samples: A systematic review and meta-analysis. Sleep Med Rev. 2016; 25: 52-73.

14. Barclay NL, Eley TC, Buysse DJ, Rijsdijk FV, Gregory AM. Genetic and environmental influences on different components of the Pittsburgh Sleep Quality Index and their overlap. Sleep. 2010; 33(5): 659-68.

15. Alavi SS, Maracy MR, Jannatifard F, Ojaghi R, Rezapour H. The psychometric properties of Cellular phone Dependency Questionnaire in students of Isfahan: A pilot study. J Educ Health Promot. 2014; 3(1): 71-79.

16. Billieux J, Van der Linden M, Rochat L. The role of impulsivity in actual and problematic use of the mobile phone. Appl Cognit Psychol. 2008; 22(9): 1195-210.

17. Lee KE, Kim S-H, Ha T-Y, Yoo YM, Han JJ, Jung JH, et al. Dependency on Smartphone Use and Its Association with Anxiety in Korea. Public Health Rep. 2016; 131(3): 411-9.

18. Lepp A, Barkley JE, Karpinski AC. The relationship between cell phone use and academic performance in a sample of US college students. SAGE Open. 2015; 5(1): 1-8.

19. Al Shawwa L, Abulaban AA, Merdad A, Merdad A, Baghlaf S, Algethami A, et al. Factors potentially influencing academic performance among medical students. Adv Med Educ Pract. 2015; 6: 65-75.

20. Chen SY, Tzeng JY. College female and male heavy internet users' profiles of practices and their academic grades and psychosocial adjustment. Cyberpsychol Behav Soc Netw. 2010; 13(3): 257-62.

21. Sweileh WM, Ali IA, Sawalha AF, Abu-Taha AS, Zyoud SH, Al-Jabi SW. Sleep habits and sleep problems among Palestinian students. Child Adolesc Psychiatry Ment Health. 2011; 5(1): 25-32.

22. Ibrahim NK, Badawi FA, Mansouri YM, Ainousa AM, Jambi SK. Sleep Quality among Medical Students at King Abdulaziz University: A Cross-sectional Study. J Community Med Health Educ. 2017; 7(561): 2161-711.

23. Christensen MA, Bettencourt L, Kaye L, Moturu ST, Nguyen KT, Olgin JE, et al. Direct Measurements of Smartphone Screen-Time: Relationships with Demographics and Sleep. PLoS One. 2016; 11(11): e0165331.

24. White AG, Buboltz W, Igou F. Mobile phone use and sleep quality and length in college students. IJHSS. 2011; 1(18): 51-8.

25. Lemola S, Perkinson-Gloor N, Brand S, Dewald-Kaufmann JF, Grob A. Adolescents' electronic media use at night, sleep disturbance, and depressive symptoms in the smartphone age. J Youth Adolesc. 2015; 44(2): 405-18.

26. Yen CF, Ko CH, Yen JY, Cheng CP. The multidimensional correlates associated with short nocturnal sleep duration and subjective insomnia among Taiwanese adolescents. Sleep. 2008; 31(11): 1515-25.