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The Effects of Smartphone Addiction, Stress, and Bedtime Procrastination on Sleep Quality

Akıllı Telefon Bağımlılığı, Stres ve Uyku Ertelemenin Uyku Kalitesine Etkisi

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Abstract

The present investigation explores the complex interconnections that exist among university students regarding smartphone addiction, depression, anxiety, stress, bedtime procrastination, and sleep quality. A range of psychological assessments were utilized on a sample of 547 college students. These assessments included the Pittsburgh Sleep Quality Index, the Smartphone Addiction Scale, the Depression, Anxiety, and Stress Scale-21, and the Bedtime Procrastination Scale. The findings suggest that there are noteworthy correlations among psychological distress, sleep quality, smartphone addiction, and bedtime procrastination. It is worth mentioning that anxiety, stress, and procrastination before bedtime emerged as substantial predictors of sleep quality. Conversely, depression and smartphone addiction did not demonstrate any significant effects. Consistent with prior research, these results indicate a robust correlation among psychological distress, delayed bedtime preparation, and substandard sleep quality. Nevertheless, discrepancies in results concerning the influence of depression on sleep quality and smartphone addiction underscore the necessity for additional investigation, specifically utilizing longitudinal designs and encompassing diverse populations. Notwithstanding constraints including sample homogeneity and reliance on self-report measures, this research highlights the criticality of interventions that specifically address anxiety, stress, and bedtime procrastination in order to enhance the quality of sleep among college students.

Keywords: Smart phone addiction, Depression, Anxiety, Sleep quality

Öz

Mevcut araştırma, üniversite öğrencileri arasında akıllı telefon bağımlılığı, depresyon, kaygı, stres, uyku vakti erteleme ve uyku kalitesi ile ilgili mevcut kritik bağlantıları araştırmaktadır. 547 üniversite öğrencisinden oluşan bir örneklem üzerinde çeşitli psikolojik değerlendirmeler kullanılmıştır. Bu değerlendirmeler arasında Pittsburgh Uyku Kalitesi İndeksi, Akıllı Telefon Bağımlılığı Ölçeği, Depresyon, Kaygı ve Stres Ölçeği-21 ve Uyku Vakti Erteleme Ölçeği yer almıştır. Psikolojik stres, uyku kalitesi, akıllı telefon bağımlılığı ve uyku vakti erteleme arasında dikkate değer ilişkiler olduğunu göstermektedir. Kaygı, stres ve uyku vakti ertelemenin uyku kalitesinin önemli belirleyicileri olarak ortaya çıktığını belirtmekte fayda vardır. Tersine, depresyon ve akıllı telefon bağımlılığı ise herhangi bir anlamlı etki göstermemiştir. Önceki araştırmalarla tutarlı olarak, bu sonuçlar psikolojik sıkıntı, yatmadan önce hazırlanmanın gecikmesi ve kötü uyku kalitesi arasında güçlü bir korelasyon olduğunu göstermektedir. Bununla birlikte, depresyonun uyku kalitesi ve akıllı telefon bağımlılığı üzerindeki etkisine ilişkin sonuçlardaki farklılıklar, özellikle uzunlamasına izlem metodu uygulanan ve farklı popülasyonları kapsayan ek araştırmaların gerekliliğini vurgulamaktadır. Örneklem homojenliği ve öz bildirim ölçümlerine güven gibi kısıtlamalara rağmen, bu araştırma, üniversite öğrencileri arasında uyku kalitesini artırmak için özellikle kaygı, stres ve uyku vakti ertelemeyi ele alan müdahalelerin önemini vurgulamaktadır.

Anahtar Kelimeler: Akıllı telefon bağımlılığı, Depresyon, Kaygı, Uyku kalitesi

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Introduction

Sleep quality refers to an individual's overall contentment with their sleep experience, considering factors such as the amount of sleep, the uninterrupted nature of sleep, and the sense of being refreshed upon waking up (Pilcher et al., 1997). Reduced sleep quality mostly involves disruptions in sleep continuity, such as a decrease in sleep length and difficulties with falling asleep and staying asleep, leading to feelings of weariness in the morning. Several factors were acknowledged to have a negative effect on the sleep quality including problematic smartphone use, psychological stressors, and bedtime procrastination (Geng et al., 2021; Wang & Bíró, 2021) which we attempted to investigate in our study.

Since their introduction in 2007, smartphones have rapidly emerged as one of the most rapidly expanding areas in the technology industry and an essential component of our everyday lives worldwide. The global smartphone user base grew from 2.1 billion in 2017 to 2.8 billion by 2020 (Amez et al., 2023). Smartphone addiction is an unhealthy behavior that has evolved in the digital age, alongside Internet addiction, social media addiction, and online gaming. Smartphone addiction is a behavioral addiction characterized by mood tolerance, salience, withdrawal, modification, conflict, and relapse (Choi et al., 2015). Multiple studies have shown a notable correlation between smartphone addiction and the poor quality of sleep (Yang et al., 2020). This is mostly attributed to the interference caused by the emission of blue light on circadian rhythms. Young individuals, who often tend to bring their phones to bed, become more susceptible to the adverse effects of smartphone use (Ratan et al., 2021). Depression, anxiety, and stress have been extensively studied and are known to significantly impact the sleep quality of young people (Du et al., 2020). Excessive worry and repetitive thinking (ruminations) caused by stress and anxiety, have a negative impact on the delicate sleep mechanisms. It is acknowledged that by sensitizing the stress-response system, the neurotoxicity may occur and the depression can increase the risk of sleep disturbances. It is important to underpin that psychological stressors and sleep disturbance have a bidirectional relationship (Kalmbach et al., 2018). Bedtime procrastination is a distinct kind of procrastination characterized by the inability to fall asleep as anticipated which leads to poor sleep quality. It has been shown that engaging in bedtime procrastination might have detrimental effects on emotional self-regulation, potentially leading to depression and anxiety (Geng et al., 2021; Zhang & Wu, 2020). Therefore, it is evident that contribution of these psychological disturbances could affect overall sleep quality.

Considering the established interactions between smartphone addiction, depression, anxiety, stress, and bedtime procrastination with poor sleep quality; it is utmost important to identify these potential relationships among university students whose academic performance and future career might be affected by diminished sleep quality. We hypothesize that higher levels of smartphone addiction, depression, anxiety, stress, and bedtime procrastination would associate with poorer sleep quality among university students.

Material and Methods

Participants and procedure

Five hundred forty-seven individuals participated in the present study. The individuals were all college students whom are attending International University of Sarajevo and native English speakers. We put an advertisement on the Internet and made an announcement through social media platforms for participant recruitment. All students were free to withdraw from participation at any point without penalty. There were no incentives and/or grade compensation for the volunteered participants. The convenience sampling method was used and inclusion criteria were as follow: 1) being 18-65 years old, 2) being able to fill in the applied forms/tests and, 3) having at least one smart phone. The exclusion criterion was the inability to comprehend the tests. All participants approved the written informed consent. The study was approved by the Institutional Review Board of International University of Sarajevo (Meeting date: 06.05.2024, Document no: IUS-REC-01- 1381-24).

Sociodemographic form

The participants' demographic characteristics (e.g., age, gender, grade, daily screen and social media time) were documented with the sociodemographic form prepared by the researchers.

Smartphone Addiction Scale-Short Version (SAS)

The SAS consists of 10-item Likert scale which is utilized to measure the smartphone addiction level of individuals. Each item

in the SAS is graded based on; (1) Strongly Disagree (2) Disagree (3) Partially Disagree (4) Partially Agree (5) Agree (6) Strongly Agree, with an overall score ranging from 10 to 60. The scale has only one factor without any subscales. Higher scores indicate higher risk of smart phone addiction. The internal consistency and concurrent validity of SAS were verified with a Cronbach's alpha of 0.91 (Kwon et al., 2013).

Depression, Anxiety, and Stress Scale-21 (DASS-21)

The present study utilized the DASS-21 to assess levels of depression, anxiety, and stress among participants. The DASS-21 comprises three subscales, each consisting of a 7-item scale: Depression (e.g., "I found it difficult to work up the initiative to do things"), Anxiety (e.g., "I felt I was close to panic"), and Stress (e.g., "I found myself getting agitated"). Each item is rated on a 4-point Likert scale ranging from 0 to 3, with response options as follow: 0 (Did not apply to me at all), 1 (Applied to me to some degree, or some of the time), 2 (Applied to me to a considerable degree or a good part of time), and 3 (Applied to me very much or most of the time). Higher scores refer to more severe psychological symptoms in corresponding trait. The internal consistency and concurrent validity of the DASS–21 were in the good ranges (Cronbach's alpha of 0.89-0.91) (Lovibond & Lovibond, 1995).

Bedtime Procrastination Scale (BPS)

The BPS is a self-report questionnaire consisting of nine individual items, that describe sleep-related behaviors and habits that are considered indicators of a high or low level of bedtime procrastination. The subject is asked to indicate whether given statements apply to him or her, choosing responses on a five-point Likert scale labeled 1 = "(almost) never" and 5 = "(almost) always." Four items are reverse scored. The total BPS score is computed by averaging responses to all individual items and it may range from 1 to 5 points with a scale midpoint of 3 points. The total score reflects the extent to which people unnecessarily delay going to bed, with higher scores indicating more bedtime procrastination. Sample items are "I go to bed later than I had intended" and "I do not go to bed on time" (reverse coded). For the English version of BPS, Cronbach's α of 0.92, 0.89, and 0.90 were obtained in an online survey of users of an Internet crowdsourcing platform (Kroese et al., 2014).

The Pittsburgh Sleep Quality Index (PSQI)

The PSQI is a questionnaire consisting of 19 items, with five questions dedicated to assessing sleep quality. The PSQI evaluates seven dimensions of sleep patterns in adults over a one-month period. These dimensions include sleep duration, disturbances, latency, daytime dysfunction, habitual sleep efficiency, sleep quality, and the use of sleep medications. For example, respondents are asked to rate their overall sleep quality during the past month. The PSQI global score is derived by summing scores across the seven components, with a range from 0 indicating no difficulties to 21 indicating severe difficulties across all areas assessed. The Cronbach's alpha was found to be 0.83 which verified the internal consistency of the scale (Carpenter & Andrykowski, 1998).

Statistical analysis

All analyses were conducted using the Statistical Package for Social Sciences (SPSS) version 21.0 (IBM Corp., Armonk, NY). The normality of distribution was checked by skewness and kurtosis, and visual plots. Pearson's product moment correlations were utilized to analyze the relationship between SAS, DASS-21, BPS, and PSQI. Afterward, a multiple linear regression analysis was executed to identify predictors (SAS, DASS-21 subtests, and BPS) for PSQI, respectively. The level of statistical significance (p) was set at <.05.

Results

1. Characteristics of the participants

In the sociodemographic features of the sample, the mean age was 20.62±2.29, with a slightly higher proportion of females (58%) compared to males (42%). The majority of participants reported a grade point average between 2 and 4. When it comes to daily screen time, the most common category was spending 2-4 hours (32.4%), followed closely by 4-6 hours (38.1%). Fewer participants reported spending less than 1 hour (1.7%) or more than 6 hours (21.2%) on screens daily. In terms of social media usage, the largest group spent 2-4 hours daily (42.6%), while the least common group spent more than 6 hours (4.2%). The proportion of individuals spending 1-2 hours or 4-6 hours was relatively balanced (28.1% and 16.1% respectively). A significant majority (74%) reported checking their smartphones as a first thing in the morning, while 26% did not. Meanwhile, 61% of participants indicated attempts to reduce smartphone usage, with the remaining 39% reporting no such

attempt. Regarding smartphone addiction, nearly half of the participants (48%) considered themselves addicted, while the other half (52%) did not. Finally, 20% of respondents reported experiencing psychiatric symptoms in the past, while 80% did not disclose such symptoms.

Table 1.
Sociodemographic features of the sample

	Mean	S.D.	Count (%)
Age	20.62	2.29	
Gender			
Male			229(42%)
Female			317(58%)
Grade point average			
(out of 4)	3.02	0.61	
Daily screen time			
Less than 1 hour			9(1.7%)
1-2 hours			34(6.3%)
2-4 hours			176(32.4%)
4-6 hours			207(38.1%)
More than 6 hours			115(21.2%)
Social media time			
Less than 1 hour			49(9%)
1-2 hours			153(28.1%)
2-4 hours			232(42.6%)
4-6 hours			88(16.1%)
More than 6 hours			23(4.2%)
Need to check smartphone first in the morning			
Yes			401(74%)
No			142(26%)
Attempt to reduce smartphone usage			
Yes			332(61%)
No			211(39%)
Do you consider yourself addicted to smart phone?			
Yes			260(48%)
No			285(52%)
Do you suffer from any psychiatric symptoms in the past?			
Yes			107(20%)
No			435(80%)

2. The associations between SAS, DASS-21, BPS, and PSQI

The mean values and standard deviations of the utilized tests were reported in Table 2.

Table 2.
The mean values and standard deviations for SAS, DASS-21, BPS, and PSQI

	SAS	DASS-21-D	DASS-21-A	DASS-21-S	BPS	PSQI
SAS	1	.230**	.262**	.258**	.198**	.098*
DASS-21-D		1	.696**	.719**	.134**	.367**
DASS-21-A			1	.761**	.187**	.400**
DASS-21-S				1	.266**	.444**
BPS					1	.366**
PSQI						1

Notes for Table 2: SAS: Smart phone addiction scale-short version, DASS-21-D: Depression, Anxiety, and Stress Scale-21-depression subtest, DASS-21-A: Depression, Anxiety, and Stress Scale-21-anxiety subtest, DASS-21-S: Depression, Anxiety, and Stress Scale-21-stress subtest, BPS: Bedtime Procrastination Scale, PSQI: The Pittsburgh Sleep Quality Index

According to the results of bivariate correlations, SAS demonstrates statistically significant positive correlations with all other scales in the study. Specifically, it has a moderate positive correlation with DASS-21-D, DASS-21-A, and DASS-21-S, all of which are statistically significant at the .01 level. Additionally, SAS exhibits a weak positive correlation with BPS and a statistically significant, albeit weaker, positive correlation with PSQI at the .05 level. Moving on to the DASS-21-D, DASS-21-A, and DASS-21-S, they demonstrate statistically significant strong positive correlations with each other at the .01 level. BPS and PSQI display statistically significant positive correlations with both DASS-21 subscales at the .01 level. The correlational coefficients were shown in Table 3. These correlations, with their corresponding significance levels, provide insights into the relationships between the variables in the study, highlighting potential associations between SAS, DASS-21, BPS, and PSQI.

Table 3.
Pearson product-moment correlation coefficients between SAS, DASS-21, BPS, and PSQI

	Mean	SD
SAS	30.03	8.42
DASS-21-D	6.88	5.29
DASS-21-A	6.99	5.02
DASS-21-S	7.88	4.68
BPS	24.63	5.52
PSQI	6.63	3.13

Notes for Table 3: SAS: Smart phone addiction scale-short version, DASS-21-D: Depression, Anxiety, and Stress Scale-21-depression subtest, DASS-21-A: Depression, Anxiety, and Stress Scale-21-anxiety subtest, DASS-21-S: Depression, Anxiety, and Stress Scale-21-stress subtest, BPS: Bedtime Procrastination Scale, PSQI: The Pittsburgh Sleep Quality Index, $^{*}p < .05$, $^{**}p < .01$

Accordingly, a multiple linear regression model was run amongst significantly associated variables in bivariate correlations to identify the predictors of PSQI. Regression analysis revealed that the DASS-21-A, DASS-21-S, and BPS are significant predictors of PSQI scores. However, SAS and DASS-21-D did not have significant predictive power for PSQI scores. The overall model was significant ($F(5, 514) = 7.095$, $p < .001$), and it represented 29% of the variance in PSQI scores. The regression coefficients are demonstrated in Table 4.

Table 4.
The results of multiple linear regression analysis that show the predictors of sleep quality

Dependent variable	Predicting Factors	*β*	*t*	*p*	R^2
PSQI	SAS	-.076	-1.929	.054	.29
	DASS-21-D	.094	1.645	.101	
	DASS-21-A	.138	2.260	.024	
	DASS-21-S	.211	3.273	.001	
	BPS	.296	7.517	<.001	

Notes for Table 4: SAS: Smart phone addiction scale-short version, DASS-21-D: Depression, Anxiety, and Stress Scale-21-depression subtest, DASS-21-A: Depression, Anxiety, and Stress Scale-21-anxiety subtest, DASS-21-S: Depression, Anxiety, and Stress Scale-21-stress subtest, BPS: Bedtime Procrastination Scale, PSQI: The Pittsburgh Sleep Quality Index

Discussion

The present study investigated the effects of smartphone addiction, depression, anxiety, stress, and bedtime procrastination on sleep quality among university students. Main findings suggest that psychological distress (i.e. anxiety, stress) and bedtime procrastination might be significant predictors in sleep quality in our study. It is important to emphasize that neither smartphone addiction nor depression were identified as factors that significantly affected sleep quality. In accordance with the existing body of literature, we endeavor to elucidate the potential mechanism that underlies these interactions within our sample as we analyze the results.

Our study findings align with previous research indicating a positive association between psychological distress and poor sleep quality (Kim et al., 2022; Thorsteinsson et al., 2019). Thorsteinsson et al. (2019) found that heightened levels of anxiety and stress can induce ruminative thinking, which in turn disrupts the quality of sleep. Moreover, Kim et al. (2022) established a correlation between excessive stress and fatigue, irrespective of the duration of sleep. Similarly, our results support existing literature suggesting a relationship between bedtime procrastination and poorer sleep quality (Ma et al., 2022; Zhu et al., 2022). A recent study conducted by Ma et al. (2022) examined the correlation between bedtime procrastination and perceived sleep quality among 1550 Chinese undergraduates. The results of the study indicate that bedtime procrastination predicts poor sleep quality in an independent manner.

Contrary findings have been reported in the literature, despite the fact that our study was unable to identify a significant effect of smart phone addiction and depression on sleep quality. For example, one research found significant relationship between smartphone addiction, depression and poorer sleep quality among Chinese college students in a longitudinal study (Cui et al., 2021). Conversely, an additional investigation involving college students revealed a positive correlation between smartphone usage and sleep quality. This finding suggested that students might increase their smartphone usage as a means of alleviating stress, which could potentially result in improved sleep quality (Stanković et al., 2021). A separate study conducted recently unveiled, via mediation analysis, that problematic smartphone use did not have any direct impact on sleep quality; rather, it induced bedtime procrastination, which had an indirect effect on sleep quality (Correa-Iriarte et al., 2023). These disparities may be attributed to differences in sample characteristics or cultural factors. For instance, the cut-off score for smartphone addiction was acknowledged to be 33 by Kwon et al. (2013). Considering our sample's smartphone addiction score which was found to be below threshold (M=30.03), it is possible that the association could not reach significance in regression analyses. Additionally, it should be taken into account that the depression score of our sample is low relative to anxiety and stress scores in DASS-21, therefore, depression was opted out to be a significant predictor in sleep quality.

Despite the valuable insights provided by this study, several limitations should be acknowledged. Firstly, the use of self-report measures introduces the potential for response bias and social desirability effects, which may influence the accuracy of participant responses. Additionally, the cross-sectional design of the study precludes the establishment of causal relationships between variables. Future research employing longitudinal designs could provide a more comprehensive

understanding of the dynamic interplay between smartphone addiction, mental health, bedtime procrastination, and sleep quality over time. Moreover, the study sample consisted primarily of college students from a single university, limiting the generalizability of the findings to other populations. To improve the validity of the findings, more study with a wider range of populations that exhibit riskier smart phone addiction and more depressed tendencies is necessary including clinically diagnosed population such as depression.

Conclusion

The findings of this study have several implications for both researchers and practitioners. Firstly, interventions targeting anxiety and stress management and bedtime procrastination could prove beneficial in improving sleep quality among university students. Future research could explore the efficacy of such interventions on sleep quality in this population. Moreover, it is vital to precisely identify the genuine impact of smartphone addiction and smartphone utilization patterns among college students so that they can be designated as therapeutic targets with the intention of enhancing sleep quality. In addition, smartphone applications that emphasize balanced sleep management may prove advantageous for young adults in order to enhance their sleep quality.

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References

Amez, S., Vujić, S., De Marez, L., & Baert, S. (2023). Smartphone use and academic performance: First evidence from longitudinal data. *New Media & Society, 25*(3), 584–608. https://doi.org/10.1177/14614448211012374

Carpenter, J. S., & Andrykowski, M. A. (1998). Psychometric evaluation of the Pittsburgh sleep quality index. *Journal of Psychosomatic Research, 45*(1), 5–13. https://doi.org/10.1016/s0022-3999(97)00298-5

Choi, S.-W., Kim, D.-J., Choi, J.-S., Ahn, H., Choi, E.-J., Song, W.-Y., Kim, S., & Youn, H. (2015). Comparison of risk and protective factors associated with smartphone addiction and Internet addiction. *Journal of Behavioral Addictions, 4*(4), 308–314. https://doi.org/10.1556/2006.4.2015.043

Correa-Iriarte, S., Hidalgo-Fuentes, S., & Martí-Vilar, M. (2023). Relationship between problematic smartphone use, sleep quality, and bedtime procrastination: A mediation analysis. *Behavioral Sciences, 13*(10), 839. https://doi.org/10.3390/bs13100839

Cui, G., Yin, Y., Li, S., Chen, L., Liu, X., Tang, K., & Li, Y. (2021). Longitudinal relationships among problematic mobile phone use, bedtime procrastination, sleep quality, and depressive symptoms in Chinese college students: A cross-lagged panel analysis. *BMC Psychiatry, 21*, 1–12. https://doi.org/10.1186/s12888-021-03451-4

Du, C., Zan, M. C. H., Cho, M. J., Fenton, J. I., Hsiao, P. Y., Hsiao, R., Keaver, L., Lai, C.-C., Lee, H., & Ludy, M.-J. (2020). Increased resilience weakens the relationship between perceived stress and anxiety on sleep quality: A moderated mediation analysis of higher education students from 7 countries. *Clocks & Sleep, 2*(3), 334–353. https://doi.org/10.3390/clockssleep2030025

Geng, Y., Gu, J., Wang, J., & Zhang, R. (2021). Smartphone addiction and depression, anxiety: The role of bedtime procrastination and self-control. *Journal of Affective Disorders, 293*, 415–421. https://doi.org/10.1016/j.jad.2021.06.062

Kalmbach, D. A., Anderson, J. R., & Drake, C. L. (2018). The impact of stress on sleep: Pathogenic sleep reactivity as a vulnerability to insomnia and circadian disorders. *Journal of Sleep Research, 27*(6), e12710. https://doi.org/10.1111/jsr.12710

Kim, H., Kim, S. H., Jang, S.-I., & Park, E.-C. (2022). Association between sleep quality and anxiety in Korean adolescents. *Journal of Preventive Medicine and Public Health, 55*(2), 173. https://doi.org/10.3961/jpmph.21.498

Kroese, F. M., De Ridder, D. T. D., Evers, C., & Adriaanse, M. A. (2014). Bedtime procrastination: Introducing a new area of procrastination. *Frontiers in Psychology, 5*, 89333. https://doi.org/10.3389/fpsyg.2014.00611

Kwon, M., Lee, J.-Y., Won, W.-Y., Park, J.-W., Min, J.-A., Hahn, C., Gu, X., Choi, J.-H., & Kim, D.-J. (2013). Development and validation of a smartphone addiction scale (SAS). *PloS One, 8*(2), e56936. https://doi.org/10.1371/journal.pone.0056936

Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behaviour Research and Therapy, 33*(3), 335–343. https://doi.org/10.1016/0005-7967(94)00075-u

Ma, X., Meng, D., Zhu, L., Xu, H., Guo, J., Yang, L., Yu, L., Fu, Y., & Mu, L. (2022). Bedtime procrastination predicts the prevalence and severity of poor sleep quality of Chinese undergraduate students. *Journal of American College Health, 70*(4), 1104–1111. https://doi.org/10.1080/07448481.2020.1785474

Pilcher, J. J., Ginter, D. R., & Sadowsky, B. (1997). Sleep quality versus sleep quantity: Relationships between sleep and measures of health, well-being, and sleepiness in college students. *Journal of Psychosomatic Research, 42*(6), 583–596. https://doi.org/10.1016/s0022-3999(97)00004-4

Ratan, Z. A., Parrish, A.-M., Zaman, S. Bin, Alotaibi, M. S., & Hosseinzadeh, H. (2021). Smartphone addiction and associated health outcomes in adult populations: A systematic review. *International Journal of Environmental Research and Public Health, 18*(22), 12257. https://doi.org/10.3390/ijerph182212257

Stanković, M., Nešić, M., Čičević, S., & Shi, Z. (2021). Association of smartphone use with depression, anxiety, stress, sleep quality, and internet addiction. Empirical evidence from a smartphone application. *Personality and Individual Differences, 168*, 110342. https://doi.org/10.1016/j.paid.2020.110342

Thorsteinsson, E. B., Brown, R. F., & Owens, M. T. (2019). Modeling the effects of stress, anxiety, and depression on rumination, sleep, and fatigue in a nonclinical sample. *The Journal of Nervous and Mental Disease, 207*(5), 355–359. https://doi.org/10.1097/NMD.0000000000000973

Wang, F., & Bíró, É. (2021). Determinants of sleep quality in college students: A literature review. *Explore, 17*(2), 170–177. https://doi.org/10.1016/j.explore.2020.11.003

Yang, J., Fu, X., Liao, X., & Li, Y. (2020). Association of problematic smartphone use with poor sleep quality, depression, and anxiety: A systematic review and meta-analysis. *Psychiatry Research, 284*, 112686. https://doi.org/10.1016/j.psychres.2019.112686

Zhang, M. X., & Wu, A. M. S. (2020). Effects of smartphone addiction on sleep quality among Chinese university students: The mediating role of self-regulation and bedtime procrastination. *Addictive Behaviors, 111*, 106552. https://doi.org/10.1016/j.addbeh.2020.106552

Zhu, Y., Huang, J., & Yang, M. (2022). Association between chronotype and sleep quality among Chinese college students: The role of bedtime procrastination and sleep hygiene awareness. *International Journal of Environmental Research and Public Health, 20*(1), 197. https://doi.org/10.3390/ijerph20010197