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La adicción a los teléfonos inteligentes y su impacto en la salud mental de los estudiantes: El papel de la calidad del sueño

Smartphone Addiction and Its Impact on Students' Mental Health: The Role of Sleep Quality

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RESUMEN

La adicción al teléfono móvil entre los estudiantes universitarios en China se ha convertido en una preocupación significativa, con un impacto creciente en la salud mental que ha captado la atención de los círculos académicos. Este estudio tiene como objetivo profundizar en la relación entre la adicción al teléfono móvil y la salud mental entre los estudiantes, explorando posibles mecanismos subyacentes. Se realizó una encuesta transversal exhaustiva con 581 estudiantes de la Universidad Huazhong en Wuhan, China, para evaluar este fenómeno. Nuestros hallazgos indican una correlación negativa entre la adicción al teléfono móvil y la salud mental. Además, la calidad del sueño parece actuar como un mediador parcial en esta relación, lo que sugiere que la mala calidad del sueño puede agravar los efectos adversos del uso excesivo del teléfono móvil en la salud mental. Estos resultados subrayan la necesidad urgente de que los administradores universitarios, los proveedores de atención médica y las familias reconozcan y aborden las implicaciones del uso excesivo del teléfono móvil entre los estudiantes. Este estudio contribuye a una mejor comprensión de cómo la adicción al teléfono móvil podría potencialmente alterar el bienestar mental en la población universitaria.

PALABRAS CLAVE

Teléfono inteligente; salud mental; calidad del sueño.

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ABSTRACT

Mobile phone addiction among university students in China has emerged as a significant concern, with its impact on mental health drawing increasing attention in academic circles. This study aims to delve deeper into the relationship between mobile phone addiction and mental health among students, exploring potential underlying mechanisms. A comprehensive cross-sectional survey involving 581 students from Huazhong University in Wuhan, China, was conducted to assess this phenomenon. Our findings indicate a negative correlation between mobile phone addiction and mental health. Furthermore, sleep quality appears to serve as a partial mediator in this relationship, suggesting that poor sleep quality may exacerbate the adverse effects of excessive mobile phone usage on mental health. These insights underscore the urgent need for university administrators, healthcare providers, and families to recognize and address the implications of mobile phone overuse among students. This study contributes to a better understanding of how mobile phone addiction could potentially disrupt mental well-being in the university student population.

KEYWORDS

Smartphone; mental health; sleep quality.

1. INTRODUCTION

Smartphones have become integral to modern communication and daily life activities. While various forms of technology addiction exist, smartphone addiction has recently emerged as a significant concern. The prevalence of smartphone addiction is estimated to range between 10 % and 30 % globally (Olson et al., 2022). The prevalence of problematic smartphone use among children and adolescents has been documented at approximately 10 % in the United Kingdom, 16.7 % in Taiwan, 16.9 % in Switzerland, 30.9 % in Korea, and 31 % in India (Sohn et al., 2019). In China, as of December 2022, mobile phone internet users reached 1.065 billion, representing 99.8 % of all internet users, surpassing other electronic devices such as laptops, tablets, and desktop computers (Jiang & Han, 2024). Although mobile phones undoubtedly enhance convenience, their frequent and excessive use can lead to addiction (Billieux et al., 2015). Smartphone addiction is characterized by an overwhelming dependence on and excessive use of mobile devices, negatively impacting daily life, work, social interactions, and physical and mental health (Bertocchi et al., 2022). Initially, addiction was defined as a pathological condition requiring the continuous administration of substances; however, this definition has expanded to include behavioral addictions, such as excessive gaming and internet use (Di Nuovo & Smeriglio, 2024); these behaviors are associated with various psychological and physiological issues, including low psychological well-being, depression, loneliness, social anxiety, cognitive disorders, and strained interpersonal relationships (Zhang et al., 2024). Research has identified a high level of gamma-aminobutyric acid in the brains of individuals who excessively use smartphones, leading to impaired attention, reduced control, and increased distractibility (Ting & Chen, 2020). The accessibility of information through smartphones has also been linked to shorter attention spans, especially among adolescents, who may rely more on the immediate rewards provided by smartphones rather than engaging in interactions with friends or family or pursuing hobbies. Excessive smartphone use has been found to affect connectivity in brain regions responsible for emotion regulation, decision-making, inhibition, and impulse control.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1. Mobile Phone Addiction and Mental Health

Mobile phone addiction, emerging alongside advancements in communication technology, is often described as a behavioral addiction marked by key symptoms typical of addictive behaviors (Thangavel, 2024). As a form of behavioral addiction, it is classified as an impulse control disorder and can result in outcomes similar to those of substance use disorders and pathological gambling (Amiri et al., 2020). There is ongoing debate among researchers about whether excessive mobile phone use qualifies as a behavioral addiction (Wu & Siu, 2020). Nonetheless, it is generally recognized as an uncontrollable and impulsive urge to use mobile phones (Ma et al., 2024). The predominant view is that mobile phone addiction is associated with various psychological issues, including loneliness, depression, and other psychiatric disorders (Chen et al., 2021). Recent empirical studies have further examined the relationship between mobile phone addiction and mental health (Lei et al., 2020; Li et al., 2020; Vaziri-Harami et al., 2021). Furthermore, Gan et al. (2022) demonstrated a strong link between mobile phone dependency and negative moods in adolescents. This finding is supported by other research indicating that excessive mobile phone use is significantly and negatively correlated with psychological issues such as loneliness, depression, and social anxiety among adolescents (Elhai et al., 2020; Hallauer et al., 2022; Wang et al., 2020) Additionally, Chen et al. (2021) found that mobile phone dependency is closely connected to individuals' mental health and their ability to adjust socially.

2. 2. The Mediating Effect of Sleep Quality

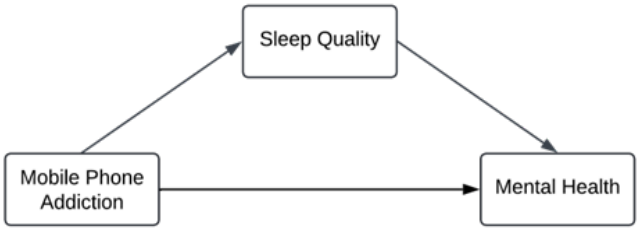
Sleep quality is often defined as the difficulty in initiating and maintaining sleep (Buysse et al., 1989), later redefined by Krystal and Edinger (2008) as "the degree of excellence in sleep." According to the resource model of self-control (Baumeister et al., 1994), individuals experiencing self-depletion of psychological resources struggle to regulate their behavior. Sleep deprivation depletes self-regulatory resources, increasing the likelihood of engaging in risky behaviors (Dickinson & Masclet, 2023). Empirical research has confirmed that poor sleep quality makes individuals more vulnerable to mental health disorders compared to those with good sleep quality (Keyvanfar et al., 2022). Scholars widely agree that poor sleep quality significantly contributes to lower levels of mental well-being among university students (Liu et al., 2021; Mahfouz et al., 2020).

Poor sleep quality has also been strongly linked to mobile phone addiction (Yang et al., 2023). Studies by Kang et al. (2020) indicate that chronic exposure to the light emitted by mobile phones can inhibit melatonin secretion, thereby impairing sleep quality. In other words, excessive mobile phone use can disrupt sleep patterns and delay sleep onset (He et al., 2020). Furthermore, Zhang and Wu (2020) found that sleep quality mediates the relationship between smartphone overuse and clinical health symptoms. Similarly, Yang et al. (2023) confirmed the mediating role of sleep quality in the relationship between Facebook addiction and depression. Excessive mobile phone use negatively affects university students' sleep quality, which in turn leads to mental health problems (Zou et al., 2019). Thus, we propose the following hypothesis:

Hypothesis 1: Mobile phone addiction is negatively associated with mental health.

Hypothesis 2: Sleep quality mediates the negative association between mobile phone addiction and mental health.

Figure 1. Hypothesized research model.



3. METHODOLOGY

3.1. Procedure

The study focused on graduate and undergraduate students from Huazhong University of Science and Technology in the Hongshan District of Wuhan, Hubei Province. China. The university was chosen because it is populous and has good academic records. Furthermore, the choice of Wuhan as the study location was deliberate, given its status as the initial epicenter of the COVID-19 outbreak. This setting presented unique challenges impacting the mental health of its inhabitants, particularly students. We randomly selected students using stratified random sampling. In total, there were 581 students in our study. Of those, 43% (250 students) were studying humanities, 19% (110 students) were studying engineering, and 38% (221 students) were studying science. Table 1 presents the demographic details.

Table 1. Demographic details.

Personal Attributions	Categories	Frequency (n)	Percentage (%)
Gender	Male	211	36.36
	Female	370	63.64
	Total	581	100
Age	18 - 20 Years	157	27.00
	21 to 25 Years	300	51.00
	26 to 30 Years	125	22.00
	Total	581	100
Major	Humanities	250	43.00
	Engineering	110	19.00
	Science	221	38.00
	Total	581	100

3.2. Measures

The questionnaires collected demographic information such as age, gender, educational qualification, daily smartphone usage time, and duration of smartphone ownership. The scales used in the study included the SAS-SV, Basic Psychological Needs Satisfaction and Frustration Scale, Psychological Distress Scale (K-10), and the Mindful Attention Awareness Scale (MAAS).

Shorter Version (SAS-SV) by Kwon et al. (2013)10-item scale was used to measure mobile phone addiction. Sample items include statements like "You have used your mobile phone to make yourself feel better when you were feeling down" and "Your productivity has decreased as a direct result of the time you spend on the mobile phone." The scale demonstrated a high reliability with a Cronbach's alpha of 0.959.

Mental health was assessed using the GHQ-12 scale Goldberg and Williams (1988). The original GHQ scale consisted of 12 items, and we adapted it by utilizing six items on a 4-point Likert scale ranging from (0) not at all to (3) more than usual. The reliability of the scale, assessed by Cronbach's alpha coefficient, was 0.801. The range of Cronbach's alpha values is from 0 to 1,

with a value closer to one signifying high reliability. In comparison, a value more relative to zero is considered to lower the instrument's reliability. The overall scale had values higher than the threshold of 0.70, indicating that the GHQ is highly acceptable and reliable.

Sleep Quality was assessed using a seven-item scale developed by Buysse (2003). Sample items include "How satisfied are you with your current sleep pattern?" and "To what extent do you consider your sleep problem to interfere with your daily functioning?" The scale's reliability was confirmed with a Cronbach's alpha of 0.806.

4. DATA ANALYSIS AND RESULTS

4.1. Descriptive Statistics and Correlations

The descriptive statistics, correlations, and reliability results for the variables of interest are presented in Table 2. The findings reveal a significant positive correlation between mobile phone addiction and sleep quality ($r = 0.960$, $p < 0.01$). On the other hand, a negative correlation was observed between mobile phone addiction and mental health ($r = -0.759$, $p < 0.01$). Additionally, sleep quality itself was negatively correlated with mental health ($r = -0.791$, $p < 0.01$).

Table 2. Means, standard deviations, and correlations among variables.

Variables	1	2	3	4	5	6	7	8
Gender	1							
Age	-0.063	1						
Time using MP	-0.034	-0.201*	1					
Frequency using MP	-0.057	0.085	-0.135**	1				
MPA	0.078*	-0.247**	-0.434**	0.103**	(0.959)			
SQ	0.089*	-0.262**	-0.378**	0.174**	0.960**	(0.860)		
MH	-0.045	0.235**	0.319**	-0.132**	-0.759**	-0.791**	0.704**	(0.959)
Mean	1.448	22.372	4.265	3.546	3.102	2.558	2.176	2.808
SD	0.479	1.623	2.648	5.155	1.059	0.761	0.881	1.155

N = 581. Boldface values indicate Cronbach's alpha. MP, mobile phone; MPA, mobile phone addiction; SQ, sleep quality; PSS, perceived social support; MH, mental health. *p < 0.05, **p < 0.01.

4.2. Hypothesis Testing

As shown in Table 2, mobile phone addiction was found to have a detrimental effect on mental health ($B = -0.763$, $p < 0.001$), thus confirming Hypothesis 1. The data also demonstrate a significant relationship between mobile phone addiction and sleep quality ($B = 0.652$, $p < 0.001$), and sleep quality was significantly associated with mental health ($B = -0.873$, $p < 0.001$). Moreover, the bootstrapped indirect effects indicate that mobile phone addiction negatively impacts mental health through its effect on sleep quality ($B = -0.443$, 95% CI: (-0.483, -0.399). This suggests that sleep quality partially mediates the negative relationship between mobile phone addiction and mental health, supporting Hypothesis 2.

Table 3. Results of mediating hypotheses.

Variables	Sleep Quality	Mental Health	
	Model 1	Model 2	Model 3
Constant	1.042 (0.230) ***	4.859 (0.323) ***	5.516 (0.350) ***
Gender	0.053 (0.092)	0.056 (0.034)	0.087 (0.043) *
Age	-0.005 (0.008)	0.033 (0.054)	0.040 (0.043)
Time using MP	-0.062 (0.009) ***	0.054 (0.009) ***	0.082 (0.009) ***
Frequency using MP	0.004 (0.004)	0.001 (0.003)	0.004 (0.005)
Mobile phone addiction	0.652 (0.015) ***	-0.763 (0.022) ***	-0.033 (0.002) ***
Sleep Quality			-0.873 (0.057) ***
Total effect [95 % CI]		-0.884 [-0.946, -0.857]	
Direct effect [95 % CI]		-0.526 [-0.587, -0.463]	
Indirect effect [95 % CI]		-0.443 [-0.483, -0.399]	
R2	0.770***	0.794***	0.833***

Bootstrap size = 5000. CI, confidence interval. *p < 0.05, ***p < 0.001.

5. DISCUSSION AND CONCLUSION

This study aimed to explore the connection between mobile phone addiction and mental health, along with the mechanisms that might influence this relationship. The results demonstrated that mobile phone addiction has a significant and negative impact on mental health. University students who are excessively engaged with their mobile phones are more susceptible to psychological issues. This conclusion aligns with previous research, which has consistently reported a negative correlation between mobile phone addiction and mental health, leading to issues such as anxiety, depression, and other psychological disorders (Hong, 2021; Wu et al., 2022; Zhang et al., 2023). A study conducted by Caswell (2023) parallels our findings, reporting that younger students not only face mental health challenges due to excessive smartphone use but also experience disruptions in their educational environments. Similarly, research by Awinashe et al. (2023) in India found that students with high smartphone engagement had lower academic performances, mirroring the mediating role of sleep quality observed in our Chinese sample. Furthermore, the study found that sleep quality partially mediates the relationship between mobile phone addiction and mental health. Consistent with prior studies (Mirzaei et al., 2022), our findings confirm that sleep quality plays a mediating role in the connection between mobile phone addiction and mental health within the Chinese university student population. According to technology addiction theory (Wei et al., 2024), addiction to technology can disrupt normal sleep patterns among university students, which in turn increases the risk of mental health problems. Students with higher levels of mobile phone or internet addiction tend to experience poorer sleep quality, which can lead to depressive symptoms and other affective disorders (Liu & Lu, 2022). Moreover, the application of technology addiction theory Xue et al. (2018) is validated by studies from different regions a European study by Rigamonti (2023) confirms that sleep disturbances due to smartphone use significantly

contribute to mental health issues, indicating a universal pattern across different educational systems and cultural settings. Our study strengthens the empirical evidence supporting the notion that sleep quality partially mediates the link between mobile phone addiction and mental health among Chinese university students.

6. PRACTICAL IMPLICATIONS

The study offers several practical implications, particularly for students and university administrators in China. Given the significant impact of mobile phone addiction on mental health, it is advisable for university administrators to consider mobile phone usage as a critical factor when assessing students' self-reported mental health. Early intervention programs, such as classroom education, keynote speeches, and informative brochures, could be effective in preventing mobile phone addiction among students. Furthermore, it is crucial for students to recognize the potential negative effects of excessive mobile phone use on both their physical and psychological well-being, encouraging them to focus more on real-life interactions. Administrators should also take immediate steps to enhance students' sleep quality, as poor sleep is often associated with severe mobile phone addiction. Identifying students at risk through sleep quality surveys and providing appropriate interventions, such as psychological counseling and establishing dormitory support groups, could be beneficial.

7. LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

This research has several limitations that must be acknowledged. First, the cross-sectional design limits our ability to infer causality between the variables. Although the study reveals a negative relationship between mobile phone addiction and mental health among university students, these findings should be interpreted cautiously. Second, the reliance on self-reported data introduces the possibility of common method bias, which may have inflated the correlations observed. And lastly the study was conducted in a single region of southwest China, which limits the generalizability of the findings to other areas, particularly the more developed eastern coastal regions. To addressing these limitations, future research could explore other possible lines of inquiry to deepen our understanding of smartphone addiction and its broader impacts. Investigating the impact of smartphone addiction on other aspects of well-being, such as social relationships or academic performance, could provide valuable insights. Moreover, exploring the role of potential mediators, such as physical activity or academic performance, might offer additional information on the relationship between smartphone addiction and mental health. Another valuable direction for future research could involve examining the role of personality traits as potential moderators in the relationship between smartphone addiction and mental health. By exploring how individual differences in personality might influence this connection, researchers could gain insights that contribute to the development of more personalized interventions and prevention strategies tailored to specific personality profiles. Additionally, it would be important to consider the influence of cultural factors on the relationship between smartphone addiction and mental health, particularly given the study's focus on a population of Chinese university students. Cultural norms, values, and behaviors might shape how smartphone use is perceived and experienced, potentially impacting the extent and nature of its effects on mental health. Future studies could compare these dynamics across different cultural contexts to better understand the role of culture in moderating this relationship.

DATA ACCESSIBILITY AND AVAILABILITY STATEMENT

The content presented in this study is original and can be referenced in the article or supplemental materials. For further information, interested parties are encouraged to contact the corresponding authors.

STATEMENT ON ETHICS

Informed written consent was secured from all participants, adhering to the ethical standards of the Declaration of Helsinki.

CONTRIBUTION OF THE AUTHOR(S)

Each author listed has made a substantial, direct, and intellectual contribution to the work and has approved it for publication.

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