Prevalence of Smartphone Addiction and its Effects on Sub-Health and Insomnia: A Cross-Sectional Study Among Medical Students

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Abstract

Objective

This study aimed to assess the Chinese medical students' smartphone addiction and its effects on sub-health and insomnia.

Methods

A cross-sectional survey was conducted from 14 October 2020 to 14 November 2020, by administering an online questionnaire to the students of Wannan Medical College.

Results

Of 2741 students who completed the survey, 1,447 (52.8%) had smartphone addiction. Don't like the major(p=0.004),alcohol consumption (p=0.001),bring smartphone to bed(p= 0.000),depression(p=0.000) and anxiety(p=0.000) strong associations of smartphone addiction.The impacts of smartphone addiction on sub-health(p=0.000) and insomnia(p=0.000) are significantly.

Conclusion

This survey shows that the smartphone addiction detection rate of medical students was 52.8%. Don't like the major, alcohol consumption,bring smartphone to bed,depression and anxiety students had a higher smartphone addiction detection rate. The sub-health and insomnia of medical students are associated with smartphone addiction.

1. Introduction

In line with the developing economy,the number of people using smart phones has been growing tremendously in recent years and the smart phones have become an organic part of the everyday.Smartphones are powerful devices include many features such as phone, internet browserand social networks, playing games, emailing,communicating.According to a recent report, the current number of smartphone users is 3.8 billion in 2021, which accounts for approximately 48.20% of the global population owns a smartphone[1].Moreover, today's college students are grow up with the company of smartphones, which have become a necessity in their lives[2].Due to the convenience of smartphones, the abuse of smartphones has increased significantly during the COVID-19 pandemic.As the number of smart phones users increases, smartphone addiction has been rising as well.Several studies have reported that smartphone overuse can cause physical health problems for individuals such as musculoskeletal pain, blurred vision, headache and pain in the wrists or neck[3].Moreover, excessive use of smartphones is associated with numerous negative outcomes, including poor academic performance, academic procrastination[4], depression and anxiety,and poor sleep quality[5].Research found that depressive and anxiety symptoms were highly prevalent among university students after the COVID-19 outbreak[6].

Although smartphone addiction is a common public health problem and a high prevalence reported in previous studies, there is a severe lack of epidemiological data about smartphone addiction among medical students during the COVID-19 pandemic in China. It is known that the smart phones use in China is very common in medical students[7].The medical profession is one of the most stressful areas of university education because of its strong professionalism and high academic requirements.There is an influence of smartphone addiction on sleep patterns,insomnia is important for health.The sub-health among medical students are also an issue of academic interest nowadays.Previous studies have already reported the relationship between smartphone addiction and sleep quality[8].Overall, the evidence of sub-health, insomnia and smartphone addiction among Chinese medical students is completely lacking.

The sub-health and sleep quality is severely affected in medical students due to high academic and clinical pressure.Use smartphones wisely plays a vital role in personal health.Although many studies on smartphone addiction have been conducted in China,to date, literature search showed there are no recent studies has investigated the relationship between smartphone addiction, sub-health and insomnia.Therefore, the purpose of this study were to determine the prevalence of smartphone addiction, and to clarify the association between smartphone addiction and sub-health among medical students in a College of Medicine in China.

2. Materials And Methods

2.1 Participants and procedure

This cross-sectional study web-based survey was conducted on the medical students of the Wannan Medical College between 14 October 2020 to 14 November 2020.The investigators of this survey were composed of undergraduates majoring in medicine from freshman to senior year of Wannan Medical College.We invited participants using the widely popular Chinese social networking "QQ"□"WeChat" in the online survey through the Wenjuanxing platform (https://www.wjx.cn/app/survey.aspx).Counselors and student leaders survey data collection were recruited through the personal connections of the corresponding author of this article.Various professional counselors and student leaders assisted in completing this survey.According to the Declaration of Helsinki,the participants were informed of the purpose, signi ficance of this study . In this study, the participants scan the questionnaire QR code and filled out the questionnaire anonymouslyafter class. It took approximately 10 to 15 minutes for participants to complete the questionnaire.

2.2 Measures

2.2.1 General demographic characteristics

Participants' sociodemographic data, including sex, age, School year,Place of residence,daily smartphone use time,etc.

2.2.2 Smartphone Addiction Scale (SAS).

Smartphone AddictionTest is a validated instrument to measure smartphone addiction. It contains 10-items which range from 1 (strongly disagree) to 6 (strongly agree), and cut-off scores are derived from 31/60 in males and 33/60 in females to shows the presence of smartphone addiction[9]. Cronbach's alpha coefficient of the Smartphone AddictionTest in this study was 0.81.

2.2.3 SHS evaluation

The condition of SHS was measured by using the self-reporting questionnaire SHSQ-25[10], which is a widely used 25-item self-report questionnaire that evaluates subjective sub-health status in the previous three months.The 25 items yield seven component scores: fatigue,cardiovascular health, digestive tract, immune system , mental health.For each item, there are five response categories (1 = never or almost never, 2 = occasionally, 3 = often, 4 = very often, and 5 = always).In the data analysis, never or almost never to 0, occasionally to 1, often to 2, very often to 3 and always to 4.The sum of scores for these seven components yields the SHSQ-25 total score, which range from 0 to 100.SHSQ-25 summed scores ≥ 35 were defined as "suboptimal health", as has been demonstrated in the Chinese population.The Cronbach alpha coefficient of this scale in this survey was 0.834.

2.2.4 Insomnia Scale

Insomnia symptoms were measured using the Athens Insomnia Scale (AIS),which consists of eight items. Each item of the scale was a four-point Likert scale from from 0 (no problem) to 3 (very severe problem). The sum of scores of AIS is between 0 and 24, the cutoff score of insomnia is 6[11].AIS were widely used and show good reliability and validity in the Chinese college population.In this present survey, the Cronbach's alpha for AIS was 0.90.

2.3 Statistical analyses

Relationship between the demographic factors and the smartphone addiction was analyzed using the chi-square test.Logistic regression was used to explore the influencing factors of smartphone addiction.All P-values were two tailed,considering a P <0.05 as statistically significant associated with smartphone addiction.

2.4 Ethics

This study design and procedure was approved by the ethics committee of Wannan Medical College.All participants provided their electronic informed consent for inclusion before participating in the study. These participants can withdraw at any time without providing any reason.

3. Results

3.1 Demographic characteristics

In the 2,741 students, a total of 1,447 (52.8%) had smartphone addiction. Medical students with smartphone addiction tend to be Dissatisfied with school life ($\chi2=35.822$, p=0.000),Don't like the major ($\chi2=41.717$, p=0.000),Smoking ($\chi2=6.822$, p=0.009),Alcohol consumption ($\chi2=17.605$, p=0.000),Bring your phone to bed ($\chi2=56.995$, p=0.000),Use smartphones for longer time every day ($\chi2=108.719$, p=0.000)andSelf-perceived smartphone addiction ($\chi2=368.997$, p=0.000).The demographic characteristics of the study participants are presented in Table 1.

 Table 1.Sociodemographic Characteristics of the study sample〔N=2741〕

Variable	Category	Overall n(%)	smartphone addiction n(%)		χ2	P-value
			No	Yes		
Age	≤20	1647(60)	788(47.8)	859(52.2)	0.669	0.413
	≥21	1094(40)	506(46.3)	588(53.7)		
School year	1st year	487(17.8)	260(53.4)	227(46.6)	9.676	0.022
	2nd year	786(28.7)	368(46.8)	418(53.2)		
	3rd year	646(23.6)	297(46)	349(54)		
	4th year	822(30)	369(44.9)	453(55.1)		
Place of residence	Rural	1759(64.2)	816(46.4)	943(53.6)	1.812	0.404
	Town	574(20.9)	274(47.7)	300(52.3)		
	City	408(14.9)	204(50.0)	204(50.1)		
Want to get a scholarship	Yes	2516(91.8)	1192(47.4)	1324(52.6)	0.346	0.556
	No	225(8.2)	102(45.3)	123(54.7)		
Student leader	Yes	809(29.5)	395(48.8)	414(51.2)	1.204	0.273
	No	1932(70.5)	899(46.5)	1033(53.5)		
Only-children	Yes	916(33.4)	462(50.4)	454(49.6)	5.751	0.016
	No	1825(66.6)	832(45.6)	993(54.4)		
In love	Yes	682(24.9)	325(47.7)	357(52.3)	0.072	0.788
	No	2059(75.1)	969(47.1)	1090(52.9)		
School satisfaction	No	186(6.8)	65(34.9)	121(65.1)	35.822	0.000
	General	1263(46.1)	546(43.2)	717(56.8)		
	Yes	1292(47.1)	683(52.9)	609(47.1)		
Like the major	No	139(5.1)	47(33.8)	92(66.2)	41.717	0.000
	General	1081(39.4)	448(41.4)	633(58.6)		
	Yes	1521(55.5)	799(52.5)	722(47.5)		
Smoking	Yes	99(3.6)	34(34.3)	65(65.7)	6.822	0.009
	No	2642(96.4)	1260(47.7)	1382(52.3)		
Alcohol consumption	Yes	232(8.5)	79(34.1)	153(65.9)	17.605	0.000
	No	2509(91.5)	1215(48.4)	1294(51.6)		
Bring your phone to bed	Yes	1910(69.7)	811(42.5)	1099(57.5)	56.995	0.000
	No	831(30.3)	483(58.1)	348(41.9)		
hours of daily smartphone usage	≤1hour	73(2.6)	35(47.9)	38(52.1)	108.719	0.000
	2hours	153(5.6)	101(66.0)	52(34.0)		
	3hours	463(16.9)	264(57.0)	199(43.0)		
	4hours	555(20.2)	294(53.0)	261(47.0)		

	5hours	568（20.7）	280（49.3）	288（50.7）		
	≥6hours	929（33.9）	320(34.40	609(65.6)		
Self-perceived smartphone addiction	Yes	753（27.5）	161(21.4)	592(78.6)	368.997	0.000
	No	1433（52.3）	912(63.6)	521(36.4)		
	Not sure	555（20.2）	221(39.8)	334(60.2)		

* p < 0.05; ** p < 0.01.

3.2 Logistic regression for analysis of the factors associated with smartphone addiction

Multivariate analysis demonstrated that smartphone addiction was significantly associated with like the major, alcohol consumption, bring your phone to bed, depression and anxiety.The associated factors of being at risk of smartphone addiction were don't like the major, alcohol consumption, bring your phone to bed, depression and anxiety (Table 2).

Table 2. Binary Logistic regression analysis of factors influencing smartphone addiction（n = 2741）.

Variables	β	S.E.	Wald	P	OR	OR 95% CI
Like the major			11.064	0.004		
No	reference					
General	-0.13	0.202	0.416	0.519	0.878	0.591-1.304
Yes	-0.389	0.199	3.813	0.051	0.678	0.459-1.001
Alcohol consumption（1）	0.508	0.155	10.764	0.001	1.661	1.227-2.250
Bring your phone to bed(1)	0.593	0.09	43.793	0.000	1.81	1.518-2.157
Depression(1)	0.842	0.114	54.728	0.000	2.321	1.857-2.901
Anxiety(1)	0.591	0.114	26.977	0.000	1.805	1.444-2.255
Constant	-0.826	0.211	15.325	0.000	0.438	

3.3.Relationship between smartphone addiction and sub-health and insomnia

As shown in Table 3, smartphone addiction people's sub-health was higher than not smartphone addiction (r^2=0.365, p<0.001),smartphone addiction people's insomnia was higher than not smartphone addiction (r^2=0.566, p<0.001)

Table 3. Pearson's correlation among Sub-health, Insomnia, and smartphone addiction

variables	Sub-health		Insomnia	
	r	P	r	P
smartphone addiction	0.365**	0.000	0.566**	0.000

4. Discussion

4.1.Key findings

As far as we know, this was the first study on the relationship between smartphone addiction and sub-health, sleep quality, anxiety, and depression among medical students. This study identified the prevalence of smartphone addiction, insomnia, and

sub-health among medical students. The prevalence of smartphone addiction among the medical students in this study was 52.8%. This is slightly higher than another study which found that 29.8% of medical students in China had smartphone addiction[12]. Previous studies have shown that smartphone addiction widespread among medical college students, and smartphone addiction has become a public health problem in China.According to a meta-analysis, the average prevalence of smartphone addiction among Chinese college students was approximately 23%[13].A study of Lebanese university students found that 49% of students had smartphone addiction[14].

Smartphone are a "double-edged" sword that convenient our lives.The lives of many people and students are today increasingly influenced by new new technologies and devices, including smartphones. Due to the COVID-19 pandemic, young people had associated adverse psychological and behavioral effects, mainly related to infection control measures, which caused them to spend more time at home and mainly use technological tools.According to data released by the United Nations Educational Scientific and Cultural Organization (UNESCO), the COVID-19 pandemic is affecting nearly to 363 million students from the kindergartens to universities around the world[15]. In China, more than 220 million students took online study courses at home instead of traditional school teaching models due to the impact of the COVID-19 pandemic[16]. Smartphones provided to students the opportunity to continue schooling.Compared with older people, college students are usually psychologically immature and have poorer self-regulatory ability.Therefore, they are more likely to overuse smartphone[17].

4.2.The impact of smartphone addiction on sub-health

Sub-health is a low-quality status between health and disease in the aspects of the physical, psychological and emotional performance of the subjects[18].World Health Organization (WHO) defines the sub-health without organic pathological changes but functional changes as"the third state", also known as "chronic fatigue syndrome" [19, 20]. Smartphone addiction are well known to be closely associated with sub-health.Studies had shown that long-term online, high-frequency online and Internet addiction are the important risk factors for SHS[21], which is consistent with our research.During the COVID-19 pandemic, the smartphones could be more useful for many students as the main tool for communication, learning, entertainment, and information seeking. Excessive use of smartphones may cause sub-health, such as fatigue, indigestion, and psychopathological problems, such as depression, and anxiety.Average time of the children and adolescents using smartphone per day during the COVID-19 pandemic was higher than before[22].In fact, during the COVID-19 pandemic, students had more sleep disorders, ocular alterations, and musculoskeletal diseases than before. Pain on neck, shoulders, wrists and fingers are the musculoskeletal diseases related to smartphone overuse, reported more frequently[23].Smartphone addiction may also result in diseases such as dry eye disease, burning sensation, conjunctival injection, decreased vision and macular degeneration[24, 25].

4.3.The impact of smartphone addiction on insomnia

Our research indicated that there was a strong association between smartphone addiction and insomnia. (r = 0.566) (P = 0.001) (Table3).Studies had shown that college students with smartphone addiction were more likely to suffer from poor sleep quality. In a longitudinal study, Chen et al. reported that Insomnia and nocturnal awakening difficulties were predictors of smartphone addiction[26].In addition, studies had shown that smartphone addiction was correlated with daytime sleepiness, reduced duration of night sleep[27], later bedtime[27,28] and poor sleep quality.First, excessive smartphones use at bed time might postpone or interfere sleep processes. Second, overuse of smartphones usually resulted in increased psychological stress, which also had a negative impact on sleep and physical recovery. Third, the blue light emitted by the screen might affect the melatonin levels and thus affect sleep and wakefulness. Finally, the electromagnetic fields emitted from smartphones might also be one of the reasons for the poor sleep quality.Due to the COVID-19 pandemic, students' sleep time and wake-up time were delayed during school closures.More and more evidence has shown that smartphone addiction is closely related to anxiety, depression, stress, impulsivity, and poor sleep quality[29-30].

4.4. Differences in smartphone addiction

Based on interpersonal theory, individuals with high levels of smartphone addiction often neglect real-world social interactions, leading to less personal companionship and lower social support, which leads to more anxiety and depression.In this stage,

college students are willing to share their inner world with others, resulting in they can gain social support. As shown in the current study, a high level of smartphone addiction was a positive indicator of anxiety and depression.Anxiety symptoms had a positive relationship with smartphone addiction[31].The main characteristics of COVID-19 are universal susceptibility and strong infectivity.The number of confirmed and suspected patients had increased rapidly in a short period of time, putting people under a high degree of physical and psychological stress. In addition, in order to prevent the spread of the virus transmission, people are at home with restriction to outdoor activities such as, having dinner, traveling, and going to school,which aroused public fear and anxiety.In addition, the shortage of prevention materials [32,33] at the beginning of the pandemic had caused panic and anxiety to the psychology of people.

Similarly, poor lifestyle behaviors such as; drinking and taking smartphone to bed are the main influencing factors of smartphone addiction.Adam summed up that the evening circadian typology was a risk factor[34].Studies have also shown that adolescents with smartphone addiction have poor health[35] and poor academic performance[36].Some experts had found that the lifestyle changes brought about by the COVID-19 pandemic had allowed people to develop enhanced behaviors, such as video gaming, movie watching, using social media, and internet surfing[37,38]. Hysing et al.[39] reported that students who go to bed between 10:00 and 11:00 PM had the best grade point averages, while those who go to bed after 11:00 PM had poorer grade point averages.

4.5 Limitations

This study has several limitations.First, all behavioral￼sleep and smartphone data in this study was derived from self-reported questionnaire results￼which may inevitably have bias.Second, because all participants in this study are enrolled in the same school, our conclusions must be conservative.Therefore, we will conduct follow-up research in the future.

5. Conclusion

The smartphone addiction among Chinese medical students are a cause for concern because it may have a negative impact on their study, mood and physical health.Smartphone addiction has great impact on the sleep quality and sub-health among medical students. The results of this study revealed that like the major,alcohol consumption,Bring your phone to bed,depression and anxiety are related to smartphone addiction.

Declarations

Ethics approval and consent to participate

This study design and procedure was approved by the ethics committee of Wannan Medical College.All participants provided their electronic informed consent for inclusion before participating in the study. These participants can withdraw at any time without providing any reason. All data collection activities for this study were implemented with informed consent of participants. All methods were performed in accordance with the Declaration of Helsinki.

Consent for publication

All authors consent for publication.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author (H. L or M. Z) on reasonable request.

Competing interests

The authors declare that they have no competing interests or other interests that might be perceived to influence the results and/or discussion reported in this paper.

Author Contributions

"Conceptualization, Huan Liu And Ming Zhang; methodology, Huan Liu; software, Zhiqing Zhou; validation, Long Huang, Huan Liu and Ming Zhang; formal analysis, Long Huang; investigation, Ergang Zhu; resources, Ming Zhang; data curation, Liang Yu; writing—original draft preparation, Huan Liu And Ming Zhang. All authors have read and agreed to the published version of the manuscript.

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