Smartphone Addiction and its Associated Factors Among Freshmen Medical Students in China: A Cross-Sectional Study

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Abstract

Background With the widespread smartphone use worldwide, this has brought about addiction and smartphone addiction recognized as an emerging epidemic. The study aims to investigate the prevalence of smartphone addiction among freshmen medical students and explore its association with personal factors, mental health and professional identity.

Methods This cross-sectional study was conducted in October 10th to November 10th, 2020 and included 2182 first-year college students at Wannan Medical College, China. The Smartphone Addiction Test, Professional identity, 12-item General Health Questionnaire were used in this cross-sectional survey. Pearson correlation analysis was performed to examine the correlations between smartphone addiction with mental health and professional identity. Binary logistic regression analysis was conducted to assess examine the factors influencing smartphone addiction.

Results Of the 2182 students, 866(39.7%) were identified as smartphone addiction. The logistic regression analysis shows that four factors (professional identity scale, poor mental health, whether or not smartphone use before sleep, and perceived study pressure) had a significantly associated with smartphone addiction.

Conclusions This cross-sectional study showed that smartphone addiction was common among the chinese freshmen medical students. smartphone addiction was common among the freshmen medical students surveyed. The findings suggest that the promotion program aimed at enhancing the mental health and professional identity among freshmen medical students are beneficial to reducing their smartphone addiction.

1. Introduction

In the last decade, the number of smartphone users has been growing exponentially, and has become an indispensable part of our life. The 45th Statistical Report on China's Internet Development, the current total number of Chinese Internet users was 904 million, nearly 99.3% of them use their smartphones connect to the Internet as of March 2020^[1]. Smartphone is more than just a communication tools, can affording users wide range of features and services, including gaming, shopping, music, viewing videos, online banking, social networking, global positioning system (GPS) navigation, and much more. Although widespread smartphone use have brought many convenience to our lives, the problems caused by overuse of smartphones should not be overlooked. Today, it is apparent that college students have been one of the largest groups of smartphones users, smartphone addiction is a widespread and universal phenomenon among college students.

Smartphone addiction, also referred to as “pathological smartphone use” or “smartphone dependence”, which is defined as an individual's uncontrollable his/her use of the smartphone, which could lead to serious harmful activity on work, study, and daily life, it has properties of saliency, impulsivity, highlight behavior, and withdrawal symptoms^[2]. It is widely acknowledged that smartphone

addiction not only adversely affects mental health, but also can be detrimental to learning, life and physical health. Researchers have also found that smartphone addiction has been associated with many health outcomes, including fatigue^[3], Headache^[4], musculoskeletal pain^[5], blurred vision^[6] and poor sleep quality^[7]. In addition, for college students, smartphone addiction could seriously affect their academic performance^[7], interpersonal competence^[8] and emotional problems^[9]. In light of this, smartphone addiction has become an urgent emerging public health problem that urgently warrants early prevention and intervention because of its great impact on all aspects of individual's life, study, and social interaction. Although extensive research studies have been conducted on smartphone addiction in the past few years, most studies have focused mainly on college students^[10].

When compared to other majors groups, Chinese medical students experience a substantial amount of the long length of schooling, academic pressure, the stress of clinical practice, etc. this is highly likely to cause smartphone addiction^[11]. Thus, it is important to pay close attention to smartphone addiction in Chinese medical students. In contrast, only a few studies in China that have investigated the prevalence of smartphone addiction among medical students. A cross-sectional study by Chen B et al, the prevalence of smartphone addiction in Chinese medical students was 29.8%^[12]. A review of the literature showed that only one study on smartphone addiction among freshmen medical students, Nepal newly admitted undergraduate medical students smartphone addiction was 36.8%^[13]. In a previous publication, some significantly factors influencing of the smartphone addiction which include gender^[12], age^[14], monthly income from the family^[10], negative emotions^[15], high impulsivity and narcissism^[16]. When starting the present study, few studies have focused on the relationship between smartphone addiction, mental health and professional identity among freshman medical students; this is the focus of the current study.

It has been reported that the medical students in China facing the risk of failing to find a job, due to the expansion of the enrollment scale of the medical colleges, the employment rate of medical graduates has become significantly lower than before, leading to numerous problems such as mental health^[17]. Prior research has found that people with poor mental health tend to have greater risk of anxiety and depression^[18]. Although there are bi-directional associations between smartphone addiction and mental health, early mental health problems may indicate later smartphone addiction. However, the evidence between smartphone addiction and mental health among freshmen in Chinese medical schools was limited. Professional identity among medical students refers to their acceptance and recognition of their chosen major, and their willingness to devote themselves to learning with a positive attitude and positive behavior^[19]. The medical college is where medical students are likely to experience professional medicine for the first time. Medical students' professional identity is very important because it will influence the school learning and clinical practice. College is an important transition period for student development, professional identity is an important factor influencing success in college. One study by Wang showed a negative correlation between mental health and professional identity in Chinese medical students^[20]. Therefore, We hypothesized that improved the professional identity of medical students makes an important contribution to improving mental health and smartphone addiction in medical school.

A high prevalence of smartphone addiction among medical students is a concern because it may affect student behavior, cause learning burnout, and ultimately affect their academic performance and graduation. Therefore, the smartphone addiction of medical students is not only related to the physical and mental health, but also has an important impact on the doctor-patient relationship and the quality of medical care they will provide in the future. Smartphone addiction prevention should pay attention to early detection of the risk factors and intervention for addicted students. In this setting, the current study aimed to examine the prevalence of smartphone addiction in Chinese freshman medical students and explore its association with demographic variables, mental health, and professional identity. Hence, this study's main purpose of this cross-sectional study was to investigate the smartphone addiction prevalence and influencing factors of freshmen in a medical school and to provide a reference to reduce the prevalence of smartphone addiction.

2. Materials And Methods

2.1 Participants

This study used convenient sampling to collect data. This is a network-based cross-sectional study on first-year college students conducted in fall 2020 at a medical school in Anhui Province. The medical students participated voluntarily and anonymously in this study. We collected a total of 2222 questionnaires, 40 questionnaires were excluded due to poor filling quality. Finally, our data analysis retained 2182 valid questionnaires for the study, which corresponded to an overall effective response rate of 98.20%. The age of the participants varied from 17 to 22 years, with a mean age of 19.16 years (SD=1.21).

2.2 Measurement

2.2.1 Demographic characteristics

Based on the relevant literature review, the form includes questions on gender, age, marital status, educational background, years of work experience, professional title, etc.

2.2.2 Smartphone Addiction

The degree of smartphone addiction was measured using the Smartphone Addiction Scale-Short Version (SAS-SV), which is a validated scale developed by Kwon in 2013^[21]. It is a self-reported scale consisting of 10 items, each item was rated on a 6-point Likert scale from 1 to 6 (1= strongly disagree; 6= strongly agree). The total scores were 10-items added together, the overall SAS-SV score ranged from 10 to 60, and the higher the SAS-SV score indicated the higher level of smartphone addiction. In this study, we adopted a cut-off point of 31 for male and 33 for female to classify smartphone addiction. The Cronbach's alpha in the present study was 0.81.

2.2.3 Professional identity

The Chinese version of professional identity, translated and revised by Qin Panbo^[22], was used and included four dimensions: cognition, emotionality, behavior and fitness. The questionnaire consists of 23 items with scores ranged from 23 to 115 based on a five-point Likert scale ("complete conformity" = 5, "conformity" = 4, "neutral" = 3, "inconformity" = 2, and "complete inconformity" = 1), the higher the PIQUS score indicating higher the level of professional identity. In this study, Cronbach's alpha was 0.898.

2.2.4 The 12-item General Health Questionnaire

GHQ-12 was used to assess the medical students' mental health^[23]. The 12-item General Health Questionnaire (GHQ-12) is a self-report, 12-item, indicating how often the participants have felt a certain way in the past 2 weeks. All items are answered on a 4-point Likert, which scoring methods 0 (not at all and no more than usual) to 1 (rather more than usual and much more than usual), the final scoring ranges from 0 to 12. Results the higher the score, the more mental health problem, GHQ-12 total score ≥ 3 was poor mental health.

2.2.5 Data collection

Data was collected through an online survey from October 10th to November 10th, 2020. To facilitate the completion of the questionnaires, the questionnaire was performed through the online survey platform using "Questionnaire Star", and the counselors and teachers directly send links to students. All participating medical students need to use the "Questionnaire Star" to submit the questionnaire, and the same IP can only be submitted once. Before issuing the questionnaire, the electronic informed consent form of the medical students was obtained. Participants were told that their participation was entirely voluntary and guaranteed confidentiality, they could terminate the study at any time without reason. The average time needed to complete the questionnaire was approximately 15–25 min.

2.2.6 Statistical analysis

In this study, "Questionnaire Star" was used to directly export data in Microsoft Excel format, which was then exported into SPSS20.0 software for statistical analysis. Continuous variables were represented by means $\pm$ standard deviations, categorical variables were represented by frequencies and percentages. The χ^2 -test were occupied to compare differences in characteristics between the smartphone addiction group and the normal groups. Pearson's correlation coefficient (r) was used to explore the relationship between smartphone addiction and professional identity. Forward stepwise binary logistic regression analysis was used to determine the predictors of smartphone addiction, and to calculate the odds ratio (OR) and 95% confidence intervals (95% CI). A two-tailed P value less than 0.05 was set as statistically significant.

2.2.7 Ethics

This study was reviewed and approved by the Ethics Committee of Wan nan Medical College, China. The research protocol and procedures were conducted following the guidelines and principles of the

Declaration of Helsinki(as revised in 2013).Electronic informed written consent was obtained from all participants prior to the commencement of filling out the questionnaire.

3. Results

3.1 Socio-demographic characteristics of the participants

A total of 2,182 college students were investigated in this study, of which 620 (61.4%) were males and 696 (59.3%) were females.Age ranged from 17 and 22 years with a mean of 19.65 ± 0.83 years.The demographic characteristics of participants (ie, sex,residence,) are described in Table 1.

3.2 Factors associated with smartphone addiction in the univariate analysis

Smartphone addiction was detected in 39.7% (866/2182) based on the smartphone Addiction Scale-Short Version.The results of the χ^2 test are presented in Table 1.There were significant differences between residence, perceived Study pressure, professional satisfaction, whether or not Smartphone use before sleep, whether or not student leader and whether or not mental health($P < 0.001$).No significant relationship was observed between smartphone addiction and gender or whether or not falling in love (all $p > .05$).

Table 1. Univariate analysis of demographic and mental health characteristics (N = 2182).

variables	Smartphone addiction			χ^2	<i>P</i>
	No	YES	Total		
	1316 60.3%	86639.7%	2182100.0%		
Gender				1.011	0.315
Male	620 61.4%	389 38.6%	100946.2%		
Female	696 59.3%	477 40.7%	117353.8%		
Residence				6.096	0.047
Rural area	728 58.4%	519 41.6%	124757.1%		
Town	369 61.4%	232 38.6%	60127.5%		
City	219 65.6%	115 34.4%	33415.3%		
Perceived Study pressure				49.437	< 0.0001
Low	154 71.6%	6128.4%	2159.9%		
Medium	736 64.8%	400 35.2%	113652.1%		
High	426 51.3%	51.3 48.7%	83138.1%		
Satisfaction with professional				26.251	< 0.0001
Low satisfied	5553.9%	4746.1%	1024.7%		
Medium satisfied	610 55.6%	487 44.4%	109750.3%		
Highly satisfied	651 66.2%	332 33.8%	98345.1%		
whether or not smartphone use before sleep				49.115	< 0.0001
No	176 82.6%	3717.4%	2139.8%		
Yes	1140 57.9%	829 42.1%	196990.2%		

whether or not student leader				7.047	0.008
No	903 58.5%	640 41.5%	1543	70.7%	
Yes	413 64.6%	226 35.4%	639	29.3%	
falling in love				0.245	0.621
No	997 60.6%	648 39.4%	1645	75.4%	
Yes	319 59.4%	218 40.6%	537	24.6%	
psychological problems				43.890	< 0.0001
No	934 56.4%	722 43.6%	1656	75.9%	
Yes	382 72.6%	144 27.4%	526	24.1%	

3.3 Relationship between Smartphone addiction and Professional Identity of freshmen

There were statistically significant positive correlations between professional identity scale, cognition scale, emotionality scale, and fitness scores and smartphone addiction scores ($r = 0.794$, $p = 0.000$; $r = 0.448$, $p = 0.000$; $r = 0.566$, $p = 0.000$; $r = 0.710$, $p = 0.000$; and $r = 0.640$, $p = 0.000$, respectively) (Table 2).

Table 2. Correlation between Smartphone addiction and Professional Identity

variables	Smartphone addiction	
	<i>r</i>	<i>P</i>
Cognition	0.448**	0.000
Emotionality	0.566**	0.000
Behavior	0.710**	0.000
Fitness	0.640**	0.000
Professional Identity Scale	0.794**	0.000

3.4 Factors Associated With Smartphone addiction

As Risk factors for increases in the severity of smartphone addiction included being Poor mental health (OR = 1.677, 95% CI = 1.338-2.102), being smartphone use before sleep (OR = 3.120, 95% CI = 2.147-4.536), perceived study pressure medium (OR = 1.265, 95% CI = 0.908-1.762) and perceived study

pressure High (OR =2.005, 95% CI =1.430-2.811). Professional Identity (OR = 0.982, 95% CI = 0.975-0.988) was a protective factor for smartphone addiction (Table 3).

Table 3. Logistic regression analysis for factors associated with Smartphone addiction

Variable	<i>B</i>	<i>SE</i>	<i>Wald</i>	<i>P</i>	<i>OR</i>	<i>95% CI</i>
Professional Identity Scale	-0.019	0.004	26.830	0.000	0.982	0.975-0.988
Poor mental health	0.517	0.115	20.142	0.000	1.677	1.338-2.102
whether or not Smartphone use before sleep	1.138	0.191	35.551	0.000	3.120	2.147-4.536
Perceived Study pressure			29.985	0.000		
Medium	0.235	0.169	1.925	0.165	1.265	0.908-1.762
High	0.696	0.172	16.287	0.000	2.005	1.430-2.811
Constant	-0.719	0.409	3.092	0.079	0.487	

4. Discussion

The prevalence of smartphone addiction among the freshmen medical students in this study was 39.7%, which is slightly higher than another study which found that 29.8% of medical students in China had smartphone addiction^[12]. Interestingly, in our study, the correlation analysis showed that perceived study pressure was positively correlated with smartphone addiction, whereas gender was not correlated with smartphone addiction. The changes in learning and lifestyle brought about by the COVID-2019 epidemic completely rely on the internet and smart devices, such as tablets, laptops and mobile phones. Unfortunately, this total dependence has proven to be a form of addiction^[24]. Smartphone is one of the most accessible substances worldwide. Recently, concern was expressed about the increase in smartphone use among students due to the decrease or absence of supervision. To reduce smartphone use, it is sometimes possible to take action against environmental stress factors; however, in the event of epidemics or natural disasters, it is not possible.

During the current COVID-19 pandemic, smartphone is the easiest available substances for managing stress and can lead to the risk of addiction. Such crisis management procedures including isolation, social distancing, continuous confinement, wearing masks, and cancellation of family, social and cultural activities in addition to individual health issues are all potential stressors^[25,26]. It is suggested that the negative impact of COVID-19 on mental health beyond health-related fears^[27] and can lead to negative psychological effects^[28,29]. COVID-19 could also have negative impact on mental health through a direct

effect of the virus in the brain. Therefore, COVID-19 could strengthen the use of addictive substances as strategies to cope with or relieve stress^[30, 31]. Nevertheless, the results of high prevalence indicate that smartphone addiction may be a serious addiction problem, which has a significant impact on the medical students' own lives and studies. The current COVID-19 crisis requires new ways to identify health conditions, while maintaining the principles of reducing human contact and pollution. In this case, a proactive approach to monitoring smartphone use in the student is essential.

This study indicates that professional identity is a positive personal trait and an important protective factor. It can prevent individuals from being affected by perceived stress, thereby reducing their negative emotions and the possibility of developing smartphone addiction. Many studies have pointed out that the professional identity of medical students has a positive impact on their learning motivation, academic success and professional development, and it is also the most important factor influencing the future career choice and professional achievement of medical students^[32,33]. The professional identity of nursing students could improve their self-confidence, enhance their professional skills^[34]. Professional Identity could help individuals deal with stress effectively and achieve better adaptation and development. When faced with stress, medical college students with higher levels of professional identity might recover quickly with positive psychological capacity, make greater efforts in the pursuit of success, and have positive expectations and attributes for the results. Therefore, improving the professional identity of medical students can play a role in preventing smartphone addiction.

Abundant studies have shown that poor mental health is positively correlated with smartphone addiction^[35]. Poor mental health is one of the most important risks leading to smartphone addiction. A study showed that there is a significant positive correlation between depression and smartphone addiction^[36]. A significant correlation has been shown between perceived vulnerability to disease (PVD) and emotional distress^[37]. The fear of contagion has been shown as one of the causes of anxiety, depression, and stress in the general population. University student's response to the pandemic deserves further attention. The sudden changes in "University" habits (i.e., poor interaction with teachers and colleagues, difficulty in adapting to online learning), the loss of social networks, and other issues have seriously affected the physical and mental health of University students. A study carried out in China found that about one-third of the respondents have moderate-to-severe anxiety, a high prevalence of sleep disorders, and widespread symptoms of anxiety disorder, especially in young people and health professionals^[38,39]. Due to the portability, and wide choice of applications on smartphones, poor mental health individuals will make up for the shortcomings in their real social life by using various applications on smartphones. Elhai et al. found that COVID-19 anxiety was related to the severity of depression, anxiety, and problematic smartphone use (PSU)^[40]. It is increasingly becoming clear that excessive use of smartphones has negative impact on health.

In line with previous studies^[41-43], our research found that perceived stress was positively correlated with smartphone addiction among medical freshmen students. The impact of perceived stress on smartphone addiction has begun to gain research support^[41,44]. As a special group of college students, medical

students have a high level of stress that could be due to academic burden, frequency of examinations, long academic curriculum^[45]. Addictive behavior may be a way to reduce strain or relieve negative emotions. Individuals who feel more stress are more likely to engage in smartphone addiction^[43]. When faced with stress, medical students are more likely to use smartphones to relieve stress^[44]. Perceived stress could make individuals believe they are in a state of stress, which is considered to be a risk factor for the occurrence and recurrence of many addictions, such as drug abuse^[46], internet addiction^[47], and so on. The results shown that it is very important for counselors to improve medical college students' Professional Identity in the context of smartphone addiction. In addition, for future clinical practitioners, we must not only pay attention to the symptoms of smartphone addicts themselves, but also their stress and mental health.

Prior literature have shown that prolonged contact with smartphone screens has been reduce sleep time and lower sleep efficiency. The COVID-19 pandemic home quarantine brought about a sudden and different lifestyle, many students watching movies/series most of the time. Overuse of smartphones usually resulted in smartphone addiction.

Some limitations must be admitted. First, this study was conducted in a sample recruited through mobile application and admitted through face-to-face data collection. Therefore, it is possible that some data could be erroneous. Second, this study was cross-sectional and cannot infer causality. Meanwhile, the representative of the sample may limit the general validity of our results, because our participants were from the same university.

In summary, this research reveals the relationship between smartphone addiction and professional identity, mental health, and perceived stress for the first time. Therefore, it is necessary to conduct a large-scale longitudinal study to further determine the causal relationship between smartphone addiction, mental health, and professional identity.

Declarations

Ethics approval and consent to participate

The design and procedures for this study have been approved by the Ethics Committee of Wannan Medical College, and all participants provide an electronic informed consent form prior to participating in the study. These participants can opt out at any time without providing any reason. All data collection activities for this study were carried out with the informed consent to the participants. All methods are implemented in accordance with the Helsinki Declaration.

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

All authors declare that no potential conflicts of interest and consent for publication.

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Authors' contributions

Huan Liu and Ming Zhang contributed in designed the study and conceived the survey, statistical analysis and wrote the paper. Zhiqing Zhou was involved in the fieldwork. Ergang Zhu played a role in participants' recruitment and data collection within this study. Long Huang and Ming Zhang proposed the research design. All authors have approved the final manuscript.

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