The Current Situation of Internet Addiction and Its Impact on Sleep Quality and Self-Injury Behavior in Chinese Medical Students

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Objective   The purpose of this cross-sectional survey is to explore the current state of Internet addiction (IA) in Chinese medical students and its connection with medical students' sleep quality and self-injury behavior.

Methods   Respondents were came from Wannan Medical College, China. The Young's Internet Addiction Test, Pittsburgh Sleep Quality Index (PSQI), Self-Harm Questionnaire were used in this cross-sectional survey. A total of 3,738 medical students were investigated, 1,552 (41.52%) males, 2,186 (58.48%) females. T-test, chi-square test and MANOVA were used for data analysis.

Results   Of the 3,738 medical students, 1,054 (28.2%) reported having IA, 1,126 (30.1%) reported having poor sleep quality, 563 (15.1%) having self-harm behaviors. IA tends to be more female, upper grade students. The sleep quality of IA was worse than that of non-IA (χ^2=54.882, p<0.001), and the possibility of self-injury was higher than non-IA (χ^2=107.990, p<0.001).

Conclusion   This survey shows that the IA detection rate of medical students was 28.2%. Females, higher grade students had a higher IA detection rate. The low sleep quality and self-injury behavior of medical students are associated with IA.

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Key Words   Internet addition, Medical students, Sleep quality, Self-harm.

INTRODUCTION

Internet addiction (IA) is often defined as uncontrolled, excessive use of the internet.[1] The clinical characteristics of Internet addiction usually include: online time is more than six hours a day, loss of control over the network, lose interest in other things, use the network to break free anxiety and depression.[2,3] In 2015, the World Health Organization (WHO) reported that IA has become a global public health problem.[4] College students become the main users of the Internet because of their easy access to the Internet and flexible time.[5] According to ElSalhy et al.[6] research, Japanese universities have

56.2% of problems due to excessive use of the Internet, and 3.8% of those with more serious problems. In China, Li et al. research[7] shows that the detection rate of adult IA was 10.5%. However, the detection rate of IA in Chinese medical students (about 30.1%) is much higher than that of non-medical students.[8]

Many surveys found that people with IA have very serious anxiety and depression.[9] Regarding the relationship between anxiety and IA, Soulioti et al.[10] study found that anxiety symptoms were moderately correlated with the overall score of IA. Tonioni et al.[11] found that the longer the Internet time, the less communication with people in the real world, the higher the anxiety and depression scores. And previous studies have shown that patients with IA have an increased probability of having attention deficit/hyperactivity disorder (ADHD).[12]

Studies have proved that poor sleep quality is associated with IA. A meta-analysis of 23 studies found that people who were addicted to the internet had significant symptoms of poor sleep quality and reduced sleep time.[13] Bruni et al.[14] survey on 840 teenagers and adults found that after 21:00, the longer the internet time, the more devices used, the greater the negative impact on sleep quality. Studies have reported that the higher the

medical students use the network during sleeping times, the higher of IA score.[15] Steinbüchel et al.[16] conducted a systematic analysis of 10 studies and found that the prevalence for non-suicidal self-injury and suicide rate in IA patients was higher than that in non-IA patients, and the prevalence range was 1.6−18.7%. A cohort study found that Internet addicts without self-harm behavior were 2.41 times more likely to self-injury than non-Internet addicts after one year.[17] In China, there was a research proof that in adolescents, the network experience related to self-harm.[18]

Considering the seriousness of IA and the increasing incidence, the research on medical students IA is less, and the relationship between medical students' Internet addiction status and sleep quality and self-injury behavior needs to be further studied. Therefore, students from Wannan Medical College, China were investigated to understand the detection rate of medical students IA and to explore the relationship between medical students' IA and sleep quality, self-injury behavior.

METHODS

Participants and procedure

This cross-sectional survey was conduction at the Wannan Medical College in Wuhu city Anhui province China, from September 2018 to November 2018. After stratifying according to the class of the college, 2,590 (69.3%) freshmen, 624 (16.7%) sophomores, and 524 (14.0%) juniors were randomly selected. A total of 3,738 medical students were investigated, including 2,186 (58.48%) females and 1,552 (41.52%) males, the average age was (18.80±1.18) years. Studies were anonymous in order to improve validity and authenticity of self-report.[19] The investigators of this survey were composed of graduate student majoring in epidemiology and medical statistics at Wannan Medical College. Various professional counselors assisted in completing this survey. All participants signed an informed consent form. This study was approved by the Ethics Committee of Wannan Medical College (LL-2018BH08). A total of 3,800 questionnaires were sent out and 3,738 valid questionnaires were collected. The response rate was 98.37%.

Measures

Internet Addition Test

Young et al.[20] Internet Addiction Test (IAT) was used for this survey. This test consists of 20 questions, each with a total of 5 options (1=almost no, 2=occasionally, 3=sometimes, 4=often, 5=always). Scored the sum of 20 topic scores, 40−60 for mild internet addiction, 60−80 for moderate internet addiction, and 80−100 for severe internet addiction.[21] The Cronbach alpha coefficient of this scale in this survey was 0.934.

Pittsburgh Sleep Quality Index

Pittsburgh Sleep Quality Index (PSQI) was developed by Dr. Buysse et al.,[22] psychiatrist at the University of Pittsburgh. It consists of 19 self-evaluation items. The scale includes seven components: Subjective sleep quality, sleep latency, effective sleep time, sleep efficiency, sleep disorders, using hypnotic drugs, daytime dysfunction. The PSQI revised by Liu et al.[23] was used in the survey. Each dimension is divided into four grades, namely 0, 1, 2, 3. The total PSQI score is the sum of seven dimensions, a total of 21 points. PSQI score greater than 7 points for poor sleep quality, the higher the score, the worse the sleep quality.[24] The sensitivity and specificity of the scale for determining the normal and non-normal sleep quality were 98.3% and 90.3%, respectively (Kappa=0.89, $p<0.01$). The Cronbach coefficient between the components was 0.84; the Cronbach coefficient between the entries was 0.85, and the coefficient of test-retest reliability was 0.81. Therefore, the scale has high reliability and validity.

Self-Harm Questionnaire

The self-injury behavior questionnaire was compiled on the basis of the existing questionnaire. The respondent needs to fill in whether there have been five self-injury behaviors:[25] 1) Causing psychological damage, such as deliberately degrading or insulting oneself. 2) Causes tissue damage, including intentional burns, bites, scratches, etc. 3) Potentially harmful self-injury, for example deliberate refusal to treat, intentional smoking, alcohol abuse, etc. 4) Highly lethal self-injury, intentional poisoning, deliberate investment in the river, etc. 5) No visible damage to the naked eye, such as deliberately licking your own hair, deliberately hitting your head, etc. Each self-injury behavior is divided into 0 times, 1−2 times, ≥3 times.[26] The total number of self-injury is equal to the highest number of five self-injury behaviors. The test-retest reliability after one week of the scale is 0.863.

Statistical analyses

All statistical analysis was conducted by using SPSS 18.0 (SPSS Inc., Chicago, IL, USA). The Young' Internet Addiction Scale scores will examine the subject into two groups, the IA group with 40 points or more, and the non-IA group with less than 40 points. The t-test was used to compare the age between the two groups. Comparison of gender and grade between the two groups using chi-square test and Fisher's exact test. The relationship between the IA and the seven dimensions in the PSQI scale was analyzed by multivariate analysis of variance (MANOVA), and the relationship between IA and medical students' sleep quality was analyzed by t-test. The relationship between medical students' IA and self-injury behavior was analyzed by using chi-square test. Statistical significance was set at $p<0.05$.

RESULTS

Demographic characteristics

In the 3,738 students, a total of 1,054 (28.2%) have IA (IAT score higher than 40). Among them, 404 (26.0%) male and 650 (29.7%) of female with IA Demographic characteristics of two groups are seen in Table 1. Medical students with IA tend to be female (χ^2=6.150, p=0.013), seniors (χ^2=14.955, p=0.001, P_{trend}=0.001).

Relationship between IA and sleep quality

As shown in Table 2, there were 1,126 people with low sleep quality, accounting for 30.1%. IA people's sleep quality was lower than non-IA (χ^2=54.882, p<0.001). Table 3 shows the relationship between IA and seven components of PSQI. IA tends to have poor subjective sleep quality, long sleep latency, short effective sleep time, low sleep efficiency, many sleep disorders, and more dysfunction during the day (p<0.001).

Relationship between IA and self-injury behaviors

As shown in Table 4, the total self-injury detection rate of IA (24.8%) was higher than without IA (11.3%) (χ^2=107.990, p<0.001). Among the five self-injury behaviors of high lethality, tissue damage, no visible damage, potential harm, and psychological damage, the detection rates of IA were 1.4%, 5.7%, 13.4%, 12.0%, 11.6%, respectively and the non-IA were 0.7%, 2.0%, 5.6%, 4.2%, and 4.1%, respectively. Medical students with IA had a significantly higher detection rate of five self-injury behaviors (all had p<0.001).

DISCUSSION

In this survey, the IA detection rate of medical students in this university was 28.2%.

This detection rate was higher than Zhu et al.[27] findings on medical students in Shandong Province, China. However, another study found that Indian medical students' IA detection rate was 38.2%.[28] The difference in IA detection rate of these

Table 1. Demographic characteristics of medical students with and without IA

Item	No internet addiction (N=2,684) (%)	Internet addiction (N=1,054) (%)	t/χ^2	p	p_{trend}
Gender			6.15	0.013	
Male	1,148 (74)	404 (26)			
Female	1,536 (70.3)	650 (29.7)			
Age (mean±SD)	18.80±1.176	18.79±1.199	0.263	0.793	
Grade			14.955	0.001	0.001
Freshman	1,908 (73.7)	682 (26.3[a])			
Sophomore	427 (68.4)	197 (31.6[b])			
Junior	349 (66.6)	175 (33.4[b])			

Different letters represent differences between groups. a and b indicate different IA detection rates between the two groups, p<0.05. IA: Internet addiction

Table 2. The impact of IA on sleep quality

IA	Poor sleep quality		Normal sleep quality		χ^2	p
	N (%)		N (%)			
No	715	26.6	1,968	1,968	54.882	<0.001
Yes	411	39	643	643		
Total	1,126	30.1	2,612	2,612		

IA: Internet addiction

Table 3. The effect of IA on the seven components of PSQI

IA	Subjective sleep quality	Sleep latency	Effective sleep time	Sleep efficiency	Sleep disorders	Using hypnotic drugs	Daytime dysfunction
Yes (mean±SD)	0.73±0.67	0.63±0.74	0.96±0.44	0.64±0.27	0.60±0.53	0.02±0.24	1.21±0.85
No (mean±SD)	0.97±0.72	0.87±0.84	1.04±.0.46	0.72±0.27	0.81±0.57	0.04±0.27	1.73±0.91
F	89.238	68.240	27.549	71.940	102.378	2.392	273.488
p	<0.001	<0.001	<0.001	<0.001	<0.001	0.122	<0.001

IA: Internet addiction, PSQI: Pittsburgh Sleep Quality Index

Table 4. The effect of IA on self-injury behavior of medical students [N (%)]

IA	Causing psychological damage		Causes tissue damage		Potentially harmful self-injury		Highly lethal self-injury		No visible damage to the naked eye		Total self-injury	
	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Yes												
N	2,573	111	2,630	54	2,571	113	2,666	18	2,533	151	2,382	302
%	95.9	4.1	98	2	95.8	4.2	99.3	0.7	94.4	5.6	88.7	11.3
No												
N	932	122	994	60	928	126	1,039	15	913	141	793	261
%	88.4	11.6	94.3	5.7	88	12	98.6	1.4	86.6	13.4	75.2	24.8
Total												
N	3,505	233	3,624	114	3,499	239	3,705	33	3,446	292	3,175	563
%	93.8	6.2	97	3	93.6	6.4	99.1	0.9	92.2	7.8	84.9	15.1
χ^2	71.662		34.676		63.147		75.838		75.838		107.99	
p	<0.001		<0.001		<0.001		<0.001		<0.001		<0.001	

IA: Internet addiction

studies may be due to 1) the sample sizes, 2) the educational environments, 3) the questionnaires of IA. In addition, our study found that female medical students have higher IA detection rates compared with male medical students (p=0.013). This may be because females were more shy than males, therefore they were more willing to make friends online and shopping rather than socializing, and studies have shown that shyness can predict IA.[29] Our study also found that IA were higher among senior grade medical students than lower grade medical students, that may be because the senior medical students have adapted to the life of the university, so they have more time and energy to go online, which increases their risk of IA.

Many studies have found that IA is related to sleep quality.[30,31] As expected, the relationship between medical students' IA and sleep disorders was confirmed in this study. The study found that IA was associated with mental illness such as depression and anxiety, which affect sleep quality.[11] According to reports, a possible mechanism by which IA caused sleep disorders is that medical students with IA had long-term exposure and light source, leading to inhibition of melatonin secretion.[32] And another mechanism is that the brain is over-excited due to prolonged use of the Internet, leading to a series of sleep problems, such as difficulty falling asleep, easy to wake up, and low sleep efficiency. Shen et al.[33] research proved this mechanism that people who play mobile phones for 60 minutes before going to bed have a higher probability of having a sleep disorder than those who have played for 10 minutes before going to bed. Some other reasons may explain this phenomenon: Radiation from computers and mobile phones can have a negative impact on the user's nervous system, which can lead to headaches, mental discomfort, decreased sleep quality, and in-

creased dysfunction during the day.

Moreover, this study found that the incidence of psychological damage, tissue damage, potential damage, high mortality and no obvious damage in the IA was higher than non-IA. The result is similar to Pan and Yeh[17] study. Huang[34] conducted a study on 27,599 adolescents in Chongqing, China, and reported that the scores of SCL-90 among Internet addicts were higher than those of non-network addicts, and the more serious Internet addiction, the greater the psychological problems, the more impulsive and aggressive the out. The relationship between medical students' IA and self-injury behavior may be because IA people have impulsive control obstacles, and their uncontrollable behaviors that hurt themselves.[35] Dong et al.[36] examined the brain potentials of 12 IA students and 12 non-IA students. They found that the IA's nogo-n2 amplitude was lower, the nogo-p3 amplitude was higher, and the nogo-p3 peak latency was longer compared with the normal group. It indicated that IA patients had low efficiency in processing information and had reduced tolerance to frustration and adverse emotions, so they would relieve stress through self-injury.[37,38]

However, there are several limitations in this study. First, owing to the cross-sectional was used in this survey, there may be recall bias in the process of responding to the survey of Internet, sleep and self-injury in the past period. Second, due to cross-sectional studies, causality may not be verified. Third, because the medical students surveyed are from only one medical university, the representativeness of the sample may be poor. Fourth, because other mental problems may also affect sleep quality and self-injury behavior, this study only considered the impact of IA on sleep quality and self-injury behavior, and the results may have errors. Fifth, there was no corresponding intervention for IA patients in this survey, and no

follow-up of medical students with self-injury in IA.

Overall, this survey found that the IA detection rate of medical students was 28.2%, and the females (29.7%) were higher than males (26.0%), and IA tends to be higher grade students. Medical students' IA was associated with decreased sleep quality. Compared with non-IA, medical students with IA tends to have poor subjective sleep quality, long sleep latency, short effective sleep time, low sleep efficiency, many sleep disorders, and more dysfunction during the day. The detection rate of these five self-injury behaviors (high lethal self-injury behavior, self-injury behavior caused by tissue damage, self-injury behavior with potential harm, no self-injury behavior visible to the naked eye, causing psychological injury self-injury behavior) of medical students were higher than that of non-IA. Based on the findings of this study, some suggestions have been made: Firstly, the harm of IA and how to use the Internet healthily should be popularized by the school in the form of lectures. Then, the counseling room should be established to guide the medical students with IA. Thirdly, the medical college should organize extracurricular activities to increase the amount of medical students' exercise and reduce the time spent online. Finally, I hope that the results of this article will lead to more in-depth research on the attention of experts in IA, sleep quality and self-injury behavior, and provide more detailed strategies for the prevention and treatment of IA.

Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

Author Contributions

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