





# Prevalence of subhealth status and its effects on mental health and smartphone addiction: a cross-sectional study among Chinese medical students

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## SUMMARY

**OBJECTIVE:** This study aimed to investigate the suboptimal health status or subhealth status and their relationship with mental health and smartphone addiction among Chinese medical students.

**METHODS:** A cross-sectional survey was conducted at Wannan Medical College of China in Wuhu.

**RESULTS:** A total of 2,741 students were surveyed in October 2020. Of 2,741 Chinese medical students who completed the survey, 904 (33%) participants reported to have had subhealth status. Anxiety status ( $p < 0.001$ ), depression status ( $p < 0.001$ ), and smartphone addiction status ( $p < 0.001$ ) have strong association with subhealth status.

**CONCLUSION:** This survey shows that the detection rate of subhealth status in Chinese medical students was 33%. Anxiety, depression, and smartphone addiction students had a higher detection rate of subhealth status. The anxiety, depression, and smartphone addiction of Chinese medical students are associated with subhealth status.

**KEYWORDS:** Health. Mental health. Students, Medical. China.

## INTRODUCTION

In parallel with the development of social economy, there is a growing attention for the importance of health. The health status has been categorized into three different types, namely, health, disease, and the intermediate state between health and disease, called suboptimal health status or subhealth status (SHS). The SHS is considered as an intermediate state between health and overt disease. It is characterized by some disturbances in mental behaviors or physiological characteristics or in medical indexes but not typical pathological characteristics<sup>1</sup>. SHS is characterized by a decline in vitality, physiological function, and the adaptability to varying conditions. Suboptimal health is influenced by lifestyle and health awareness and can easily develop into chronic diseases, which is considered to be a subclinical and reversible stage of chronic disease. The prevalence of SHS in China is over 65% and has become a growing concern in many countries<sup>2</sup>.

If SHS is handled properly, the body can transit to a healthy state, or vice versa, or turn into the disease state. It is pointed out that lifestyle behaviors were significantly associated with SHS<sup>3</sup>. More studies suggest that SHS is associated with mental health disorders. Depression and anxiety are considered the most common mental health disorders. Most of the previous surveys of subhealth have mainly focused on specific groups, such as teachers and civil servants. Studies have found that the speed, strength, and endurance of Chinese college students have demonstrated an overall decline since 2010<sup>4</sup>.

The medicine is always recognized as one of the most stressful and demanding occupations. Due to heavy study loads and smartphone abuse, many college students, particularly medical students, do not get sufficient sleep time or exercise adequately. As a result, they may suffer from headaches, insomnia, fatigue, and/or forgetfulness. In addition, studies have pointed out that

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students had a high rate of poor health behavior practices, including poor dietary patterns, tobacco use, and sleeping habits<sup>5</sup>. But no research has been conducted to date on the relationship between the smartphone addiction and SHS among medical students. To explore the association between various lifestyle factors and suboptimal health conditions, we conducted a cross-sectional study among Chinese medical students. The current SHS of the Chinese medical students is poorly known. Therefore, it is very important to pay attention to the physical and mental health of medical students and the relationship between them.

## METHODS

### Participants and procedure

This cross-sectional study was conducted between October 14, 2020 and November 14, 2020 using a web-based questionnaire to analyze the influencing factors related to the SHS among medical college students at Wannan Medical College, China. In the beginning of each survey, questionnaire investigator introduced the purpose and nature of the questionnaire to the participants.

### Research tools

#### Demographic characteristics

The basic sociodemographic information, such as gender, age, student's major, and academic year, were collected.

#### Suboptimal health status

Suboptimal health was evaluated by the Suboptimal Health Status Questionnaires-25 (SHSQ-25)<sup>6</sup>. SHSQ-25 consists of 25 items in total scored on a 5-point Likert scale (i.e., fatigue, cardiovascular health, digestive tract, immune system, and mental health). In the data analysis, "never or almost never" was assigned a score of 0, "occasionally" 1, "often" 2, "very often" 3, and "always" 4, providing a 0–100 total score. The higher the SHS score, the worse a participant's health status. Suboptimal health was defined in this study by a total SHS score  $\geq 35$ . Cronbach's  $\alpha$  for SHSQ-25 in this study was 0.83.

#### The Generalized Anxiety Disorder Scale-7

The scale comprises of seven items with 4-point frequency scale (0=not at all; 1=some of the time; 2=more than half the time; 3=nearly every day) in relation to the past 2 weeks<sup>7</sup>. Scores for 7 items were summed to obtain a Generalized Anxiety Disorder Scale-7 (GAD-7) total score, and the total GAD-7 score ranged from 0 to 21 points. In this study, anxiety symptoms was defined as a total score of GAD-7 $\geq 10$ .

### Patient Health Questionnaire-9

This study used the Patient Health Questionnaire-9 (PHQ-9)<sup>8</sup> to assess the depression status of participants during the past 2 weeks. This scale contains a total of 9 items scored on a 4-point Likert scale (0=not at all; 1=some of the time; 2=more than half the time; 3=nearly every day). The total score ranged from 0 to 27, with a higher score indicating a higher risk for depression symptoms, and a total score of 10 points was defined as having depression symptoms.

### Smartphone addiction

Smartphone addiction was assessed using the Smartphone Addiction Scale-Short Version (SAS-SV) designed by Kwon et al.<sup>9</sup>. SAS-SV is a widely validated questionnaire consisting of 10 items to assess the level of smartphone addiction during the last month. Each item is rated on a 6-point Likert-like scale ranging from "1=Strongly disagree" to "6=Strongly agree". The total score ranged from 10 to 60, and higher total score represents a higher level of smartphone addiction. The cutoff values for SAS-SV used for smartphone addiction were 31 in men and 33 in women.

### Statistical analysis

The data were analyzed using IBM SPSS software version 20. Data are reported using mean $\pm$ SD for continuous variables or as frequencies or percentages for categorical variables. A chi-square ( $\chi^2$ ) test was applied to compare between groups. The influencing factor of SHS was estimated using logistic regression analysis, odds ratio (OR), and their 95% confidence interval (CI). The two-tailed  $p < 0.05$  was considered statistically significant for all tests.

### Ethical consideration

Ethical approval was approved by the Academic Ethics Committee of Wannan Medical College, Wuhu, China. All participants anonymously volunteered to participate in this study and signed an electronic informed consent form before filling out the questionnaire. Completing the electronic questionnaire was deemed consent.

## RESULTS

### Demographic characteristics

Characteristics of the participants are shown in Table 1. Of the respondents, 487 (17.8%) were freshmen, 786 (28.7%) were sophomore, 646 (23.6%) were juniors, and 822 (30.0%) were seniors. The majority of the participants (64.2%) resided

in urban areas. Participants' age ranged from 17 to 24 years with a mean age of 21.752±1.991.

### The prevalence of subhealth status

As shown in Table 2, the prevalence of SHS was 33.0% (904/2741). There were significant differences on anxiety status (p<0.001), depression status (p<0.001), and smartphone addiction status (p<0.001), whereas no differences were found on age (p=0.388), academic year (p=0.388), area (p=0.109), whether class cadres (p=0.109), and love status (p=0.109). The prevalence of SHS by different variables is detailed in Table 2.

### Binary logistic regression analyses of subhealth status

Table 3 displays the results of binary logistic regression analyses for SHS among medical college students. We found that anxiety (OR=2.991, 95%CI 2.285–3.915), depression (OR=4.697, 95%CI 3.468–6.362), and smartphone addiction (OR=3.375, 95%CI 2.728–4.176) were the risk factors for SHS.

**Table 1.** Sociodemographic characteristics of participating medical college students in the survey (n=2741).

Characteristics	Number	%
Age (years)		
≤20	1647	60.1
>20	1094	39.9
Academic year		
First	487	17.8
Second	786	28.7
Third	646	23.6
Fourth	822	30.0
Area		
Rural	1759	64.2
Towns	574	20.9
Cities	408	14.9
Class cadres		
No	1932	70.5
Yes	809	29.5
Only child		
No	1825	66.6
Yes	916	33.4
In love		
No	2059	75.1
Yes	682	24.9

## DISCUSSION

### Key findings

This study found that the overall detection rate of SHS was 33%, almost the same as the previous surveys<sup>10</sup>, which indicates that the SHS occurrence among the medical students were ubiquitous. In late 2019, the COVID-19 pandemic became a serious health threat globally. Lifestyle is an important factor associated with SHS. Poor lifestyles include smoking, alcohol use, skipping breakfast, poor nutrition, lack of exercise, and sleep problems. It is pointed out that SHS was associated with chronic diseases and their development<sup>11</sup>. Due to the COVID-19 pandemic, people were restricted to stay at home for long periods, which leads to reduced physical activity, negative effects on physical health, and increased negative emotions<sup>12</sup>.

**Table 2.** The detection rate of subhealth status in medical students using different variables (%).

Variable	Healthy	SHS	χ <sup>2</sup>	p-value
Age (years)				
≤20	1114 (67.6)	533 (32.4)	0.715	0.398
>20	723 (66.1)	371 (33.9)		
Academic year				
First	321 (65.9)	166 (34.1)	1.064	0.786
Second	529 (67.3)	257 (32.7)		
Third	442 (68.4)	204 (31.6)		
Fourth	545 (66.3)	277 (33.7)		
Area				
Rural	1154 (65.6)	605 (34.4)	4.441	0.109
Towns	399 (69.5)	175 (30.5)		
Cities	284 (69.6)	124 (30.4)		
Class cadres				
No	66.5 (70.2)	648 (33.5)	0.928	0.335
Yes	553 (68.4)	256 (31.6)		
Smartphone addiction				
No	1103 (85.2)	191 (14.8)	368.148	<0.001
Yes	734 (50.7)	713 (49.3)		
Depression				
No	1139 (93.1)	84 (6.9)	681.231	<0.001
Yes	698 (46.0)	820 (54.0)		
Anxiety				
No	1235 (90.2)	134 (9.8)	665.570	<0.001
Yes	602 (43.9)	770 (56.1)		
In love				
No	1385 (67.3)	674 (32.7)	0.227	0.634
Yes	452 (66.3)	230 (33.7)		

**Table 3.** Binary logistic regression analysis for predictors of suboptimal health.

SHS-related factors	$\beta$	S.E.	Wald $\chi^2$	p-value	OR	95%CI
Anxiety (no as a control)						
Yes	1.096	0.137	63.591	<0.001	2.991	2.285–3.915
Depression (no as a control)						
Yes	1.547	0.155	99.914	<0.001	4.697	3.468–6.362
Smartphone addiction (no as a control)						
Yes	1.216	0.109	125.393	<0.001	3.375	2.728–4.176
Constant	-3.514	0.140	626.598	<0.001	0.030	

In China, due to the learning pressure and smartphone abuse, the prevalence of SHS among medical students continues to rise. This study found that anxiety, depression, and smartphone addiction were correlated to low SHS scores. People who are always involved in surfing the Internet tend to have less face-to-face social interaction, less physical activity, and less sleep, all of which contribute to the development of subhealth symptoms.

### The impact of subhealth status on mental health

This study revealed a significant association between SHS and anxiety and depression, with SHS associated with anxious and depressive symptoms. The COVID-19 pandemic has a significant impact on individual mental health. The most common distress responses include anxiety, depression, insomnia, fear of disease, and risky behaviors. The COVID-19 pandemic had created a lot of uncertainty. Due to the restrictions designed to prevent the spread of the virus, people began to experience financial problems, lost work, and often had to be isolated from their families, which made people prone to symptoms of depression and anxiety.

Additionally, sleep disturbances caused by psychological problems can increase the risk of inflammatory disorders and weakened immune system. Psychological problems, such as anxiety and depression, will also cause problems such as biological clock disorders, irregular eating, lack of sleep, and lack of physical exercise, and the accumulation of long-term problems will threaten the people's physical health, leading to subhealth. Anxiety and depression can lead to sleep disorders and increase individual fatigue, not conducive to physical recovery. When facing stressful environment, people with negative emotions are more inclined to choose smoking, alcoholism, or unhealthy diet and other harmful behaviors, which also aggravate subhealth conditions.

### The impact of subhealth status on smartphone addiction

Since the popularity of smartphones began in 2007, smartphone ownership has grown steadily globally. As of 2020, the

current number of smartphone users is 3.8 billion in 2021, which accounts for approximately 48.20% of the global population<sup>13</sup>. Moreover, today's college students grow up with the company of smartphones which become essential in their lives. Studies find that the prevalence of problematic smartphone use, including smartphone addiction, ranged between 10 and 30% among young people<sup>14</sup>.

The impacts exerted by smartphone addiction on health are self-evident. Students addicted to smartphones will have adverse effects on their daily lives, such as difficulty in concentration, abnormal diets, reduction of productivity, broken social relationships, and health disorders such as blurred vision, neck stiffness, wrist pain, and sleep disorders. It is found that spending time more than 4 h a day online can significantly increase the risk of SHS<sup>15</sup>. As it is known, long-time surfing the Internet may cause backache, neck, finger, wrist, and arm pain, as well as anxiety, fatigue, and other SHS symptoms. Therefore, colleges should guide the medical students on physical exercise and psychological counseling in order to promote their physical and mental health development.

### Limitations

The present study has some limitations. SHS is a subjective feeling which lacks objective clinical diagnostics. Social expectations or memory biases may arise due to participants' self-reported methods. Besides, the results were drawn from one medical college, hence these results cannot be simply generalized in all medical students.

### ETHICAL APPROVAL

This study was approved by the Wannan Medical College Ethics Committee. Participants have been informed before answering the questions that participation in the survey was voluntary and anonymous and can be cancelled at any time, and that the results of the questions would be evaluated and published.

## AUTHORS' CONTRIBUTIONS

**HL, MZ:** Conceptualization. **HL:** Methodology. **ZZ:** Software. **LH, HL, MZ:** Validation. **LH:** Formal

Analysis. **EZ:** Investigation. **MZ:** Resources. **HL:** Data curation. **HL, MZ:** Writing – original draft. All authors have read and agreed to the published version of the manuscript.

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