


# Prevalence of problematic Internet use and its association with quality of life among undergraduate nursing students in the later stage of COVID-19 pandemic era in China

Hong Cai PhD<sup>1,2,3</sup>  | Hai-Tao Xi BS<sup>4</sup> | Qianqian Zhu MS<sup>5,6</sup> |  
Zhiwen Wang PhD<sup>7</sup> | Lin Han PhD<sup>8</sup> | Shuo Liu MS<sup>9</sup> | Wei Bai PhD<sup>1,2,3</sup> |  
Yan-Jie Zhao PhD<sup>1,2,3</sup> | Li Chen PhD<sup>4</sup> | Zong-Mei Ge MS<sup>4</sup> | Mengmeng Ji BS<sup>7</sup> |  
Hongyan Zhang MS<sup>8</sup> | Bing Xiang Yang PhD<sup>9</sup> | Pan Chen MS<sup>9</sup> |  
Teris Cheung PhD<sup>10</sup> | Gabor S. Ungvari MD, PhD<sup>11,12</sup> | Fengrong An MS<sup>6</sup> |  
Yu-Tao Xiang MD, PhD<sup>1,2,3</sup>

<sup>1</sup>Unit of Psychiatry, Department of Public Health and Medicinal Administration & Institute of Translational Medicine, Faculty of Health Sciences, University of Macau, Macao SAR, China

<sup>2</sup>Centre for Cognitive and Brain Sciences, University of Macau, Macao SAR, China

<sup>3</sup>Institute of Advanced Studies in Humanities and Social Sciences, University of Macau, Macao SAR, China

<sup>4</sup>Jilin University Nursing College, Changchun, Jilin, China

<sup>5</sup>School of Nursing, Capital Medical University, Beijing, China

<sup>6</sup>Beijing Key Laboratory of Mental Disorders, School of Mental Health, The National Clinical Research Center for Mental Disorders, Beijing Anding Hospital, The Advanced Innovation Center for Human Brain Protection, Capital Medical University, Beijing, China

<sup>7</sup>Peking University School of Nursing, Beijing, China

<sup>8</sup>Lanzhou University School of Nursing, Lanzhou, Gansu, China

<sup>9</sup>School of Health Sciences, Wuhan University, Wuhan, Hubei, China

<sup>10</sup>School of Nursing, Hong Kong Polytechnic University, Hong Kong SAR, China

<sup>11</sup>Division of Psychiatry, School of Medicine, University of Western Australia, Perth, Western Australia, Australia

<sup>12</sup>University of Notre Dame Australia, Fremantle, Western Australia, Australia

**Correspondence:** Fengrong An, MS, Beijing Anding Hospital, No. 5. Ankang Hutong, Xicheng District, Beijing 100088, China.  
Email: [afrylm@sina.com](mailto:afrylm@sina.com)

Yu-Tao Xiang, MD, PhD, Faculty of Health Sciences, University of Macau, 3/F, Building E12, Avenida da Universidade, Taipa, Macau SAR 999078, China.  
Email: [xyutly@gmail.com](mailto:xyutly@gmail.com)

## Funding information

National Science and Technology Major Project for Investigational New Drugs,  
Grant/Award Number: 2018ZX09201-014;  
Beijing Municipal Science & Technology

## Abstract

**Background and Objectives:** The prevalence of problematic Internet use (PIU) in the post-COVID-19 pandemic era is not known. This cross-sectional study aimed to determine the prevalence of PIU among baccalaureate nursing students (hereafter: nursing students) in the post-COVID-19 era.

**Methods:** A total of 1070 nursing students were consecutively invited to participate in this study from the nursing schools of five universities. PIU and quality of life (QOL) were assessed using the Internet Addiction Test (IAT) and the World Health Organization Quality of Life Scale Brief Version (WHOQOL-BREF), respectively. *t* Tests,  $\chi^2$  tests, and Kruskal–Wallis tests were used to compare basic demographic

Hong Cai, Hai-Tao Xi, Qianqian Zhu, Zhiwen Wang, Lin Han, and Shuo Liu contributed equally to this study.

Commission, Grant/Award Number:  
Z181100001518005; 2020 Higher Education  
Teaching Achievement Cultivation Project of  
Gansu Province; University of Macau,  
Grant/Award Number: MYRG2019-  
00066-FHS

and clinical characteristics between participants with and without PIU. Binary logistic regression analysis was used to examine independent correlates.

**Results:** The prevalence of PIU was 23.3% (95% confidence interval [CI]: 20.7%–25.8%). Multiple logistic regression analysis revealed that second- ( $p = .024$ ) and third-year ( $p = .012$ ) students were more likely to suffer from PIU compared with first year students. Students with more severe depressive ( $p = .014$ ) and anxiety symptoms ( $p = .011$ ) were independently and significantly associated with more severe PIU. After controlling for covariates, nursing students with PIU had a lower overall QOL score ( $p = .002$ ).

**Conclusion and Scientific Significance:** Problematic Internet use (PIU) was common among nursing students in the post-COVID-19 era. Considering the negative impact of PIU on QOL and academic performance, regular screening should be conducted and effective interventions implemented for nursing students with PIU. This was the first study on the prevalence of PIU among nursing students in the post-COVID-19 era. The findings of this study could help health professionals and education authorities to understand the patterns of PIU and its influence on QOL among nursing students and to allocate health resources and develop effective measures to reduce the risk of PIU in this population.

## INTRODUCTION

In the past decades, problematic Internet use (PIU) has become a common health problem in adolescent and young adult populations. Internet addiction is characterized by the improper, persistent, and recurrent use of the Internet.<sup>1</sup> Other terms used interchangeably with PIU in the literature are “Internet addiction,” “compulsive Internet use,” and “pathological Internet use.”<sup>2</sup> PIU is associated with a range of negative health outcomes, including poor mental health, reduced physical activity, bad eating habits leading to obesity and diabetes,<sup>3–7</sup> impaired cognition, poor academic performance, reduced sleep time,<sup>8</sup> tendency to sleep late, insomnia disorder,<sup>9–12</sup> and daytime fatigue and drowsiness,<sup>13</sup> which explains the growing attention in PIU.<sup>14</sup> The global prevalence of PIU among students varied greatly between studies; 40% in Jordan, 34% in India, 15% in Japan, and 11% in China.<sup>15</sup> The discrepancy in the prevalence of PIU between studies could be due to the use of different target populations, measurement tools, sampling methods, study sites and timeframe, and access to Internet services. In a meta-analysis, the prevalence of PIU was 9.2% in medical students, 12.6% in science and engineering students, and 8.4% in arts students;<sup>16</sup> while another meta-analysis found that PIU prevalence was 30.1% among medical students in China.<sup>17</sup>

Since the novel coronavirus disease 2019 (COVID-19) was first identified in Wuhan, China in December 2019, it has been reported in more than 200 countries and territories.<sup>18</sup> COVID-19 has been well-contained in China, despite imported cases from other countries.<sup>19</sup> In order to reduce the rapid spread of the

contagion in students, Chinese education authorities postponed the 2020 spring semester in all primary and secondary schools and universities. Consequently, all classroom teaching was suspended during the COVID-19 pandemic and online teaching/learning was widely adopted. All students in China had to communicate with their teachers, classmates, and friends through online social media for the whole semester. The lockdown was also restricted to physical activity. Students were exposed to academic stress due to such sudden changes in the circumstances of traditional learning situations and methods.<sup>20,21</sup>

Internet was an important source of health information during the COVID-19 pandemic.<sup>22,23</sup> It also included a great deal of misinformation about COVID-19, particularly in the early stage of the pandemic, which, together with the fast spread of the novel virus, lack of effective treatment, and relatively high death rate, led to a range of negative health outcomes among different populations, including baccalaureate nursing students (hereafter: nursing students), such as depressive and anxiety symptoms, addiction to substances, and PIU.<sup>24–31</sup> Surfing the Internet is often used to reduce stress, anxiety, and to alleviate depressed mood as coping strategies in crises, but if overused, it could increase the risk of PIU.<sup>27</sup> PIU is greatly influenced by the given socio-economic and cultural context.<sup>32</sup> Therefore, the epidemiology of PIU should be examined in different sociocultural contexts.

In general, PIU was common among students in health-related majors, such as nursing students. For instance, previous studies found that the prevalence of PIU was 17.7% in nursing students in Iran,<sup>33</sup> 10.3% in Poland,<sup>34</sup> and 8.3% in China.<sup>35</sup> However, there

have been no data reporting the prevalence of PIU in nursing students in the later stage COVID-19 pandemic era. It is important to estimate the prevalence of PIU in nursing students because PIU has a negative impact on their studies and the delivery of health services. While the Quality of Life (QOL) scale has been widely used as a general health outcome measure in both research and clinical practice,<sup>36</sup> the association between PIU and QOL during and after the COVID-19 outbreak is still not clarified. This gap in research has given the impetus to conduct this study to examine the prevalence of PIU in a large cohort of nursing students and its association with QOL in the later stage COVID-19 pandemic era.

## METHODS

### Participants and procedure

This was a multicenter, cross-sectional observational study conducted between September 14 and October 7, 2020. All nursing students registered in the nursing schools of five Chinese universities (Jilin University, Capital Medical University, Peking University, Lanzhou University, and Wuhan University) were consecutively invited to participate in the study. To be eligible, students had to be: (1) nursing students, (2) aged between 15 and 28 years, and (3) able to understand the Chinese language and provide written informed consent. The study protocol was approved by the IRB of Beijing An Ding Hospital of Capital Medical University and the other participating universities. Students who provided written informed consent scanned a QR code using their smartphones before they started the assessment. Of the 1,121 nursing students invited to participate, a total of 1,070 met eligibility criteria and were enrolled in the study.

### Measures

Socio-demographic data, such as gender, age, place of residence, being the only child at home (yes/no), school grades, and reported household economic and health status, were collected using an information sheet designed for the study. Additionally, COVID-19-related questions were asked whether during the COVID-19 pandemic (1) they worked as volunteers in clinical settings; (2) they had any negative experiences, such as verbal abuse and threats; (3) they suffered an economic loss; and (4) they had frequent use of social media.<sup>37,38</sup> All these additional questions used a dichotomous response.

PIU was measured using the Chinese version of the self-report Internet Addiction Test (IAT).<sup>39,40</sup> The IAT comprises 20 items ranging from 1 to 5. A higher total score indicated more severe PIU. The severity of depressive symptoms was measured with the Chinese version of the two-item Patient Health Questionnaire (PHQ-2).<sup>41,42</sup> The total score of the PHQ-2 ranges from 0 to 6, with a higher score indicating more severe depressive symptomatology. The severity of anxiety symptoms was assessed with the Chinese version of the 7-item Generalized Anxiety Disorder Scale (GAD-7),<sup>43,44</sup> where a

higher score indicated more severe anxiety symptoms. The severity of overall pain was measured using the Visual Analog Scale for Pain (VAS),<sup>45</sup> which ranged from "0" to "10." A higher score indicated more severe pain. QOL was measured with the first 2 items of the World Health Organization Quality of Life Scale Brief Version (WHOQOL-BREF): "How do you assess your quality of life?" and "Are you satisfied with your current health?"<sup>46,47</sup> A higher score reflected higher QOL.

### Statistical analysis

Data analyses were performed with the SPSS software, Version 26.0 (SPSS Inc.). The normal distribution of continuous variables was tested with p-p plots. Two independent samples t tests,  $\chi^2$  tests, and Kruskal-Wallis tests were used to compare basic demographic and clinical characteristics between nursing students with and without PIU. Analysis of covariance was employed to compare the difference of QOL between the two groups after adjusting for variables with significant differences in the univariate analyses. Binary logistic regression analysis with the "enter" method was used to examine independent correlates of PIU, with PIU as a dependent variable, and those with significant differences in univariate analyses as independent variables. The level of significance level was set as  $p < .05$  (two-tailed).

## RESULTS

### Sample characteristics

A total of 1,070 of the 1,121 nursing students invited to participate in this study met study entry criteria and completed the assessment, yielding a response rate of 95.5%. Table 1 shows the basic demographic and clinical characteristics of the whole sample and separately by PIU. The prevalence of PIU was 23.3% (95% confidence interval [CI]: 20.7%–25.8%) in the whole sample. As for each study site, the prevalence of PIU symptoms was 29.7% (95% CI: 22.9%–36.7%) in Peking University, 19.0% (95% CI: 15.2%–22.9%) in Jinlin University, 23.2% (95% CI: 16.2%–30.2%) in Wuhan University, 27.3% (95% CI: 20.5%–34.2%) in Lanzhou University, and 21.5% (95% CI: 16.0%–27.1%) in Capital Medical University. There were significant differences in school grade, reported economic and health status, PHQ-2 and GAD-7 total scores, pain, and overall QOL scores (all  $p$  values  $< .05$ ). After controlling for variables that significantly differed in univariate analyses, nursing students with PIU had a lower QOL score compared with those without PIU,  $F_{(1, 1,070)} = 9.316, p = .002$ .

Compared with first-year students, students in second ( $p = .024$ , odds ratio [OR] = 1.6, 95% CI: 1.07–2.6), and third years ( $p = .012$ , OR = 1.7, 95% CI: 1.1–2.7) were more likely to suffer from PIU. More severe depressive ( $p = .014$ , OR = 1.2, 95% CI: 1.04–1.64) and anxiety symptoms ( $p = .011$ , OR = 1.07, 95% CI: 1.02–1.1) were independently and significantly associated with more severe PIU (Table 2 and Figure 1).

**TABLE 1** Socio-demographical and scale score of the study sample (nursing students)

Variable	Total (N = 1,070)		Non-PIU (N = 821)		PIU (N = 249)		Univariate analyses		
	N	%	N	%	N	%	$\chi^2$	df	p
Female gender	805	75.2	624	76.0	181	72.7	1.1	1	.28
Rural residence	457	42.7	345	42.0	112	45.0	0.6	1	.40
Only child	457	42.7	359	43.7	98	39.4	1.4	1	.22
School grade							20.6	3	<b>&lt;.001</b>
First year	287	26.8	243	29.6	44	17.7			
Second year	237	22.1	170	20.7	67	26.9			
Third year	249	23.3	174	21.2	75	30.1			
Fourth year	297	27.8	234	28.5	63	25.3			
Volunteer during COVID-19 pandemic	231	21.6	180	21.9	51	20.5	0.2	1	.62
Negative experiences during COVID-19 pandemic	188	17.6	136	16.5	52	20.9	2.4	1	.11
Economic loss during COVID-19 pandemic							2.3	2	.31
None or mild	444	41.5	351	42.8	93	37.4			
Moderate	557	52.1	418	50.9	139	55.8			
Great loss	69	6.4	52	6.3	17	6.8			
Frequent use of social media during COVID-19 pandemic	778	72.7	606	73.8	172	69.1	2.1	1	.14
Reported economic status							6.7	2	<b>.03</b>
Poor	218	20.4	153	18.6	65	26.1			
Fair	776	72.5	607	74.0	169	67.9			
Rich	76	7.1	61	7.4	15	6.0			
Reported health status							31.6	2	<b>&lt;.001</b>
Poor	23	2.1	12	1.5	11	4.4			
Fair	449	42.0	314	38.2	135	54.2			
Good	598	55.9	495	60.3	103	41.4			
	<b>Mean</b>	<b>SD</b>	<b>Mean</b>	<b>SD</b>	<b>Mean</b>	<b>SD</b>	<b>t/Z</b>	<b>df</b>	<b>p</b>
Age (years)	19.7	1.4	19.7	1.4	19.8	1.3	-0.7	1,068	.43
PHQ-2 total	1.0	1.2	0.8	1.1	1.7	1.5	8.8	- <sup>a</sup>	<b>&lt;.001</b>
GAD-7 total	3.1	3.9	2.5	3.3	5.2	4.9	8.6	- <sup>a</sup>	<b>&lt;.001</b>
Pain total	2.4	1.8	2.3	1.7	2.9	2.0	4.6	- <sup>a</sup>	<b>&lt;.001</b>
Overall QOL	6.7	1.5	6.9	1.5	6.0	1.5	8.6	1,068	<b>&lt;.001</b>

Note: Bold value <.05, Internet addiction test total score  $\geq 50$  consider as having problematic Internet use.

Abbreviations: COVID-19, coronavirus disease 2019; *df*, degree of freedom; GAD-7, 7-item Generalized Anxiety Disorder Scale; PHQ-2, 2-item Patient Health Questionnaire; PIU, Problematic Internet use; QOL, quality of life; *SD*, standard deviation.

<sup>a</sup>Mann-Whitney *U* test.

## DISCUSSION

To the best of our knowledge, this was the first study that examined the prevalence of PIU in baccalaureate nursing students in the later stage of the COVID-19 pandemic. PIU was common (23.3%; 95% CI: 20.7%–25.8%) and was associated with lower QOL. Since no data on the prevalence of PIU in nursing students in China could be located, direct comparisons between this and previous findings were not possible. Findings in this study were considerably higher than those

from other countries prior to the COVID-19 pandemic: the prevalence of PIU was 17.7% in nursing students in Iran<sup>33</sup> and 10.3% in Poland<sup>34</sup>. Apart from the different availability of Internet services across countries, factors such as socio-economic conditions, study time, and sampling methods need to be considered and direct comparisons between studies should be made with caution.

The high prevalence of PIU in nursing students in the later stage of COVID-19 pandemic era could be attributed to several reasons. First, the so-called “digital natives”, many university students used

the Internet frequently. Compared with adults, university students have less impulse control, which increased the likelihood of PIU.<sup>17</sup> Second, classroom teaching was suspended during the COVID-19 pandemic in China and was replaced with online teaching. Third, due to quarantine measures, major public transport services were suspended, limiting outdoor activities; thus students had to spend more time at home communicating with their friends via online

social media.<sup>48,49</sup> All these factors probably increased the risk of PIU.<sup>24,27</sup>

**TABLE 2** Independent correlates of Problematic Internet Use by multiple logistic regression analysis

Variable	Multiple logistic regression analysis		
	p	OR	95% CI
<b>School grade</b>			
First year	-	1.0	-
Second year	<b>.024</b>	1.6	1.0-2.6
Third year	<b>.012</b>	1.7	1.1-2.7
Fourth year	.98	0.9	0.6-1.5
<b>Reported economic status</b>			
Poor	-	1.0	-
Fair	.59	0.9	0.6-1.3
Rich	.48	1.2	0.6-2.5
<b>Reported health status</b>			
Poor	-	1.0	-
Fair	.70	1.2	0.4-3.0
Good	.95	0.9	0.3-2.6
PHQ-2 total	<b>.014</b>	1.2	1.0-1.4
GAD-7 total	<b>.011</b>	1.0	1.0-1.1
Pain total	.26	1.0	0.9-1.1

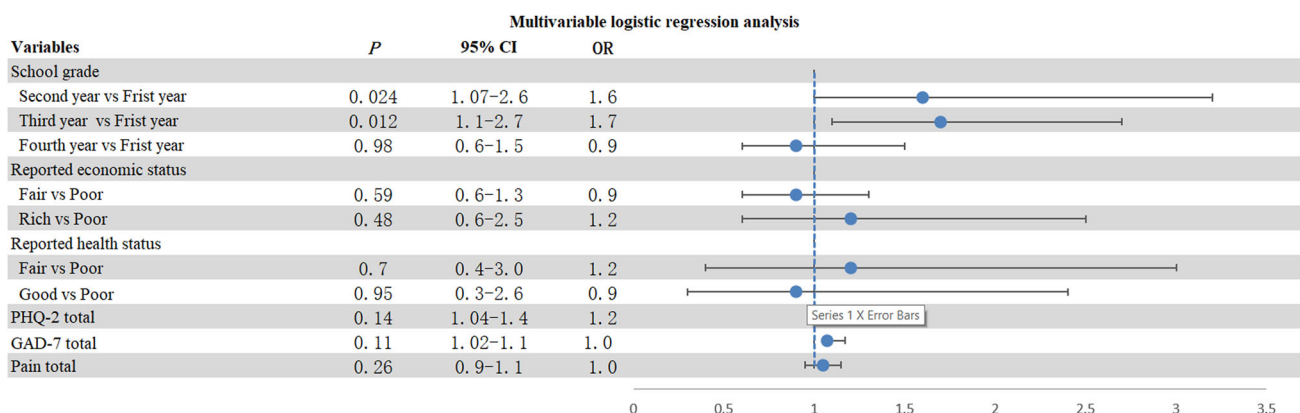
Note: Bold value <0.05.

Abbreviations: CI, confidence interval; GAD-7, 7-item Generalized Anxiety Disorder Scale; IAD, Internet addiction disorder; OR, odds ratio; PHQ-2, 2-item Patient Health Questionnaire.

In this study, students with PIU were more likely to report depressive and anxiety symptoms. The associations between PIU and psychiatric symptoms were bidirectional.<sup>50,51</sup> Comorbidity with addiction including PIU is common in depression, anxiety,<sup>52,53</sup> aggressive behavior,<sup>54-56</sup> and substance use disorder (e.g., alcohol abuse).<sup>57,58</sup> On the other hand, persons with PIU were more likely to develop depressive and anxiety symptoms compared with those without PIU.<sup>59,60</sup> Psychosocial interventions, such as digital cognitive behavior therapy, improve functional health and psychological well-being in people reporting insomnia symptoms<sup>61</sup> and could ameliorate insomnia associated with PIU, thereby reducing the time spent on addictive activities.<sup>62</sup>

In this study, second- and third-year students were more likely to suffer from PIU than first-year students supporting previous findings that the first- and fourth-year university students were at higher risk of PIU compared with second-year students.<sup>63</sup> One possible reason for this discrepancy is the specific characteristics of nursing studies. Unlike non-nursing students, first-year nursing students need to get used to many health-related and nursing subjects, which were not taught in secondary schools; therefore, they need to spend a lot of time adjusting to the new learning environment and knowledge. Final year students receive training in hospitals and start job-seeking and many of them also need to prepare for a postgraduate entrance examination or apply for Master/Ph.D. programs overseas. Thus, they had less time to indulge in excessive Internet use. In contrast, students in second and third years have by then adapted well to the nursing courses and do not attend internship training or engage in job-hunting, so they may have more time to surf the Internet, and are more likely to develop PIU.

Nursing students with PIU reported lower QOL, which is consistent with the findings of a meta-analysis that PIU is associated with lower subjective and objective QOL.<sup>5</sup> PIU may give rise to a range of health problems, such as metabolic syndrome,<sup>64</sup> neck, shoulder, and back pain,<sup>65</sup> increased risk of accidents (falling and bumps/collisions),<sup>62</sup> and poor sleep quality.<sup>66-69</sup> In addition, those with



**FIGURE 1** Independent correlates of Problematic Internet Use by multiple logistic regression analysis. CI, confidence interval; GAD-7, 7-item Generalized Anxiety Disorder Scale; OR, odds ratio; PHQ-2, 2-item Patient Health Questionnaire

PIU often have emotional and social problems, and psychological symptoms.<sup>70</sup> All these factors contribute to lower QOL. In order to reduce the risk of PIU and its negative consequences, it is important to undertake effective measures to reduce Internet use, such as making a daily and weekly activity schedule, having a regular daily routine with learning and relaxation time, and sufficient amount of sleep during lockdowns.<sup>71</sup> Additionally, public education and training courses on COVID-19 should be provided in universities facilitating prevention, early detection, and better control of COVID-19.<sup>72</sup>

The strengths of this study include the relatively large sample size, multicenter design, and consecutive sampling. However, the study had some methodological limitations that need to be addressed. First, this was a cross-sectional study, therefore the causality between PIU and other variables could not be established. Second, relevant factors associated with PIU, such as personality and social support, were not investigated. Third, due to logistical reasons, no age- and gender-matched controls were recruited.

In conclusion, PIU was found to be common among Chinese nursing students in the later stage of COVID-19 pandemic era. PIU was associated with more severe depressive and anxiety symptoms and poorer QOL. Considering the negative impact of PIU on QOL, academics, and work performance, regular screening and effective interventions should be offered to nursing students.

## ACKNOWLEDGMENTS

The study was supported by the National Science and Technology Major Project for Investigational New Drugs (2018ZX09201-014), Beijing Municipal Science & Technology Commission (No. Z181100001518005), 2020 Higher Education Teaching Achievement Cultivation Project of Gansu Province, and University of Macau (MYRG2019-00066-FHS).

## CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

## AUTHOR CONTRIBUTIONS

**Hong Cai, Hai-tao Xi, Qianqian Zhu, Zhiwen Wang, Lin Han, Shuo Liu:** Conceptualization, methodology, software. **Hong Cai, Hai-Tao Xi, Qianqian Zhu, Zhiwen Wang:** Data curation, writing—original draft preparation. **Wei Bai, Yan-Jie Zhao, Li Chen, Zong-Mei Ge, Mengmeng Ji, Hongyan Zhang, Bing Xiang Yang, Pan Chen:** Visualization and investigation. **Fengrong An, Yu-Tao Xiang:** Supervision. **Teris Cheung, Gabor S. Ungvari:** Software, validation. **Fengrong An, Yu-Tao Xiang:** Writing—reviewing and editing.

## ORCID

Hong Cai  <https://orcid.org/0000-0002-7915-1092>

## REFERENCES

- Weinstein A, Lejoyeux M. Internet addiction or excessive internet use. *Am J Drug Alcohol Abuse*. 2010;36(5):277-283.
- Aarseth E, Bean AM, Boonen H, et al. Scholars' open debate paper on the World Health Organization ICD-11 Gaming Disorder proposal. *J Behav Addict*. 2017;6(3):267-270.
- Dubey S, Biswas P, Ghosh R, et al. Psychosocial impact of COVID-19. *Diabetes Metab Syndr*. 2020;14(5):779-788.
- Colizzi M, Sironi E, Antonini F, Ciceri ML, Bovo C, Zocante L. Psychosocial and behavioral impact of COVID-19 in autism spectrum disorder: an online parent survey. *Brain Sci*. 2020;10:6.
- Cheng C, Li AY. Internet addiction prevalence and quality of (real) life: a meta-analysis of 31 nations across seven world regions. *Cyberpsychol Behav Soc Netw*. 2014;17(12):755-760.
- Dong G, Wang J, Yang X, Zhou H. Risk personality traits of Internet addiction: a longitudinal study of Internet-addicted Chinese university students. *Asia Pac Psychiatry*. 2013;5(4):316-321.
- Mei S, Gao T, Li J, et al. Internet addiction in college students and its relationship with cigarette smoking and alcohol use in Northeast China. *Asia Pac Psychiatry*. 2017;9:4.
- Van den Bulck J. Television viewing, computer game playing, and Internet use and self-reported time to bed and time out of bed in secondary-school children. *Sleep*. 2004;27(1):101-104.
- Owens J, Maxim R, McGuinn M, Nobile C, Msall M, Alario A. Television-viewing habits and sleep disturbance in school children. *Pediatrics*. 1999;104(3):e27.
- Zhang MWB, Tran BX, Huong LT, et al. Internet addiction and sleep quality among Vietnamese youths. *Asian J Psychiatr*. 2017;28:15-20.
- Cheung LM, Wong WS. The effects of insomnia and internet addiction on depression in Hong Kong Chinese adolescents: an exploratory cross-sectional analysis. *J Sleep Res*. 2011;20(2):311-317.
- Andretta J, Teh MSc J, Burleigh TL, Gomez R, Stavropoulos V. Associations between comorbid stress and Internet Gaming Disorder symptoms: are there cultural and gender variations? *Asia Pac Psychiatry*. 2020;12(2):e12387.
- Lin M-P, Ko H-C, Wu JY-W. Prevalence and psychosocial risk factors associated with Internet addiction in a nationally representative sample of college students in Taiwan. *Cyberpsychol Behav Soc Netw*. 2011;14(12):741-746.
- Cash H, Rae CD, Steel AH, Winkler A. Internet addiction: a brief summary of research and practice. *Curr Psychiatry Rev*. 2012;8(4):292-298.
- Mak K-K, Lai C-M, Watanabe H, et al. Epidemiology of internet behaviors and addiction among adolescents in six Asian countries. *Cyberpsychol Behav Soc Netw*. 2014;17(11):720-728.
- Li L, Xu DD, Chai JX, et al. Prevalence of Internet addiction disorder in Chinese university students: a comprehensive meta-analysis of observational studies. *J Behav Addict*. 2018;7(3):610-623.
- Zhang MWB, Lim RBC, Lee C, Ho RCM. Prevalence of internet addiction in medical students: a meta-analysis. *Acad Psychiatry*. 2018;42(1):88-93.
- World Health Organization. WHO coronavirus disease (COVID-19) dashboard. 2020. Accessed July 31, 2020. <https://covid19.who.int/>
- National Health Commission of China. Interpretation of the circular on further strengthening the work of infection prevention and control in medical institutions in order to implement the requirements of regular epidemic prevention and control (in Chinese). 2020. Available at <http://www.nhc.gov.cn/yzygj/s7659/202005/bb9787a2a0d3409aa9892c7afcd2ee35.shtml>
- Brooks SK, Webster RK, Smith LE, et al. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *Lancet*. 2020;395(10227):912-920.
- Li X, Lv Q, Tang W, et al. Psychological stresses among Chinese university students during the COVID-19 epidemic: the effect of



- early life adversity on emotional distress. *J Affect Disord.* 2021;282:33-38.
22. Wang C, Pan R, Wan X, et al. Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. *Int J Environ Res Public Health.* 2020;17(5):1729.
  23. Wang C, Pan R, Wan X, et al. A longitudinal study on the mental health of general population during the COVID-19 epidemic in China. *Brain Behav Immun.* 2020;87:40-48.
  24. Sun Y, Li Y, Bao Y, et al. Brief report: increased addictive Internet and substance use behavior during the COVID-19 pandemic in China. *Am J Addict.* 2020;29(4):268-270.
  25. Elhai JD, Yang H, McKay D, Asmundson GJG. COVID-19 anxiety symptoms associated with problematic smartphone use severity in Chinese adults. *J Affect Disord.* 2020;274:576-582.
  26. Huckins JF, daSilva AW, Wang W, et al. Mental health and behavior of college students during the early phases of the COVID-19 pandemic: longitudinal smartphone and ecological momentary assessment study. *J Med Internet Res.* 2020;22(6):e20185.
  27. Király O, Potenza MN, Stein DJ, et al. Preventing problematic internet use during the COVID-19 pandemic: consensus guidance. *Compr Psychiatry.* 2020;100:152180.
  28. Xie Q, Fan F, Fan XP, et al. COVID-19 patients managed in psychiatric inpatient settings due to first-episode mental disorders in Wuhan, China: clinical characteristics, treatments, outcomes, and our experiences. *Transl Psychiatry.* 2020;10(1):337.
  29. Wang Y, Duan Z, Peng K, et al. Acute stress disorder among frontline health professionals during the COVID-19 outbreak: a structural equation modelling investigation. *Psychosom Med.* 2020;83:373-379.
  30. Lee SC, Son KJ, Han CH, Park SC, Jung JY. Impact of COPD on COVID-19 prognosis: a nationwide population-based study in South Korea. *Sci Rep.* 2021;11(1):3735.
  31. Kilinçel Ş, Kilinçel O, Muratdağı G, Aydın A, Usta MB. Factors affecting the anxiety levels of adolescents in home-quarantine during COVID-19 pandemic in Turkey. *Asia Pac Psychiatry.* 2021;13(2):e12406.
  32. Kuss DJ, Griffiths MD, Karila L, Billieux J. Internet addiction: a systematic review of epidemiological research for the last decade. *Curr Pharm Des.* 2014;20(25):4026-4052.
  33. Kiany T, Fallahi Khoshknab M, Dalvandi A, Hosaini MA KN. Internet addiction and its related factors among nursing students in Tehran University of Medical Sciences in 2013. *J Nurs Educ.* 2014; (2):13.
  34. Krajewska-Kułak E, Kułak W, Marcinkowski JT, et al. Internet addiction among students of the medical university of bialystok. *Comput Inform Nurs.* 2011;29(11):657-661.
  35. Ruilin Cao SM, Yueyang Hu, Zeying, Qin, Ying Zhang. Research on the relationship between internet addiction, self-esteem, and sense of life meaning of college students in 3 universities in Northeast China. *Med Soc.* 2019;32(6):3.
  36. Xu D-D, Lok K-I, Liu H-Z, et al. Internet addiction among adolescents in Macau and mainland China: prevalence, demographics and quality of life. *Sci Rep.* 2020;10:10.
  37. Gonzalez-Padilla DA, Tortolero-Blanco L. Social media influence in the COVID-19 Pandemic. *Int Braz J Urol.* 2020;46(suppl 1):120-124.
  38. Gao J, Zheng P, Jia Y, et al. Mental health problems and social media exposure during COVID-19 outbreak. *PLoS One.* 2020;15(4):e0231924.
  39. Chin F, Leung CH. The concurrent validity of the Internet Addiction Test (IAT) and the Mobile Phone Dependence Questionnaire (MPDQ). *PLoS One.* 2018;13(6):e0197562.
  40. Lai CM, Mak KK, Watanabe H, Ang RP, Pang JS, Ho RC. Psychometric properties of the internet addiction test in Chinese adolescents. *J Pediatr Psychol.* 2013;38(7):794-807.
  41. Kroenke K, Spitzer RL, Williams JB. The Patient Health Questionnaire-2: validity of a two-item depression screener. *Med Care.* 2003;41(11):1284-1292.
  42. Liu ZW, Yu Y, Hu M, Liu HM, Zhou L, Xiao SY. PHQ-9 and PHQ-2 for screening depression in Chinese rural elderly. *PLoS One.* 2016;11(3):e0151042.
  43. He XY, Li CB, Qian J, Cui HS, Wu WY. Reliability and validity of a generalized anxiety disorder scale in general hospital outpatient. *Shanghai Arch Psychiatry.* 2010;22:3.
  44. Löwe B, Decker O, Müller S, et al. Validation and standardization of the Generalized Anxiety Disorder Screener (GAD-7) in the general population. *Med Care.* 2008;46(3):266-274.
  45. Hawker GA, Mian S, Kendzerska T, French M. Measures of adult pain: Visual Analog Scale for Pain (VAS Pain), Numeric Rating Scale for Pain (NRS Pain), McGill Pain Questionnaire (MPQ), Short-Form McGill Pain Questionnaire (SF-MPQ), Chronic Pain Grade Scale (CPGS), Short Form-36 Bodily Pain Scale (SF-36 BPS), and Measure of Intermittent and Constant Osteoarthritis Pain (ICOAP). *Arthritis Care Res.* 2011;63(suppl 11):S240-S252.
  46. Skevington SM, Lotfy M, O'Connell KA, Group W. The World Health Organization's WHOQOL-BREF quality of life assessment: psychometric properties and results of the international field trial. A report from the WHOQOL group. *Qual Life Res.* 2004;13(2):299-310.
  47. Cheung YB, Yeo KK, Chong KJ, Khoo EYH, Wee HL. Measurement equivalence of the English, Chinese and Malay versions of the World Health Organization quality of life (WHOQOL-BREF) questionnaires. *Health Qual Life Outcomes.* 2019;17(1):67.
  48. Chao M, Chen X, Liu T, Yang H, Hall BJ. Psychological distress and state boredom during the COVID-19 outbreak in China: the role of meaning in life and media use. *Eur J Psychotraumatol.* 2020;11(1):1769379.
  49. Kumar K, Mehra A, Jha S, et al. Psychological morbidity among people in quarantine. *J Neurosci Rural Pract.* 2021;12(1):67-70.
  50. Ko CH, Yen JY, Yen CF, Chen CS, Chen CC. The association between Internet addiction and psychiatric disorder: a review of the literature. *Eur Psychiatry.* 2012;27(1):1-8.
  51. Ho RC, Zhang MW, Tsang TY, et al. The association between internet addiction and psychiatric co-morbidity: a meta-analysis. *Bmc Psychiatry.* 2014;14:183.
  52. Lai CM, Mak KK, Watanabe H, et al. The mediating role of Internet addiction in depression, social anxiety, and psychosocial well-being among adolescents in six Asian countries: a structural equation modelling approach. *Public Health.* 2015;129(9):1224-1236.
  53. Hoge E, Bickham D, Cantor J. Digital media, anxiety, and depression in children. *Pediatrics.* 2017;140(suppl 2):S76-S80.
  54. Ko CH, Yen JY, Liu SC, Huang CF, Yen CF. The associations between aggressive behaviors and internet addiction and online activities in adolescents. *J Adolesc Health.* 2009;44(6):598-605.
  55. Munno D, Saroldi M, Bechon E, Sterpone SC, Zullo G. Addictive behaviors and personality traits in adolescents. *CNS Spectr.* 2016; 21(2):207-213.
  56. Dai W, Zhou J, Li G, Zhang B, Ma N. Maintaining normal sleep patterns, lifestyles and emotion during the COVID-19 pandemic: the stabilizing effect of daytime napping. *J Sleep Res.* 2021;30:e13259.
  57. Ko CH, Yen JY, Yen CF, Chen CS, Weng CC, Chen CC. The association between Internet addiction and problematic alcohol use in adolescents: the problem behavior model. *Cyberpsychol Behav.* 2008; 11(5):571-576.
  58. Morioka H, Itani O, Osaki Y, et al. The association between alcohol use and problematic internet use: a large-scale nationwide cross-sectional study of adolescents in Japan. *J Epidemiol.* 2017;27(3): 107-111.
  59. Elhai JD, Yang H, Fang J, Bai X, Hall BJ. Depression and anxiety symptoms are related to problematic smartphone use severity in Chinese young adults: fear of missing out as a mediator. *Addict Behav.* 2020;101:105962.

60. Younes F, Halawi G, Jabbour H, et al. Internet addiction and relationships with insomnia, anxiety, depression, stress and self-esteem in university students: a cross-sectional designed study. *PLoS One*. 2016;11(9):e0161126.
61. Espie CA, Emsley R, Kyle SD, et al. Effect of digital cognitive behavioral therapy for insomnia on health, psychological well-being, and sleep-related quality of life: a randomized clinical trial. *JAMA Psychiatry*. 2019;76(1):21-30.
62. Soh HL, Ho RC, Ho CS, Tam WW. Efficacy of digital cognitive behavioural therapy for insomnia: a meta-analysis of randomised controlled trials. *Sleep Med*. 2020;75:315-325.
63. Dai Q. Gender, grade and personality differences in internet addiction and positive psychological health among Chinese college students. *Primary Health Care*. 2016;6(4):6.
64. Eliacik K, Bolat N, Koçyiğit C, et al. Internet addiction, sleep and health-related life quality among obese individuals: a comparison study of the growing problems in adolescent health. *Eat Weight Disord*. 2016;21(4):709-717.
65. Hakala PT, Rimpela AH, Saarni LA, Salminen J. Frequent computer-related activities increase the risk of neck-shoulder and low back pain in adolescents. *Eur J Public Health*. 2006;16:536-541.
66. An J, Sun Y, Wan Y, Chen J, Wang X, Tao F. Associations between problematic internet use and adolescents' physical and psychological symptoms: possible role of sleep quality. *J Addict Med*. 2014;8(4):282-287.
67. Cheung LM, Wong WS. The effects of insomnia and internet addiction on depression in Hong Kong Chinese adolescents: an exploratory cross-sectional analysis. *J Sleep Res*. 2011;20(2):311-317.
68. Chen YL, Gau SS. Sleep problems and internet addiction among children and adolescents: a longitudinal study. *J Sleep Res*. 2016;25(4):458-465.
69. Fu KW, Chan WS, Wong PW, Yip PS. Internet addiction: prevalence, discriminant validity and correlates among adolescents in Hong Kong. *Br J Psychiatry*. 2010;196(6):486-492.
70. Cerniglia L, Zoratto F, Cimino S, Laviola G, Ammaniti M, Adriani W. Internet addiction in adolescence: neurobiological, psychosocial and clinical issues. *Neurosci Biobehav Rev*. 2017;76(Pt A):174-184.
71. Király O, Potenza MN, Stein DJ, et al. Preventing problematic internet use during the COVID-19 pandemic: consensus guidance. *Compr Psychiatry*. 2020;100:152180.
72. Tran BX, Vo LH, Phan HT, et al. Mobilizing medical students for COVID-19 responses: experience of Vietnam. *J Glob Health*. 2020;10(2):020319.

**How to cite this article:** Cai H, Xi H, Zhu Q, et al. Prevalence of problematic Internet use and its association with quality of life among undergraduate nursing students in the later stage of COVID-19 pandemic era in China. *Am J Addict*. 2021;30:585-592. <https://doi.org/10.1111/ajad.13216>