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

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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, χ² tests, and Kruskal–Wallis tests were used to compare basic demographic
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. Other terms used interchangeably with PIU in the literature are "Internet addiction," "compulsive Internet use," and "pathological Internet use." 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, impaired cognition, poor academic performance, reduced sleep time, tendency to sleep late, insomnia disorder, and daytime fatigue and drowsiness, which explains the growing attention in PIU. The global prevalence of PIU among students varied greatly between studies; 40% in Jordan, 34% in India, 15% in Japan, and 11% in China. 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; while another meta-analysis found that PIU prevalence was 30.1% among medical students in China.

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. COVID-19 has been well-contained in China, despite imported cases from other countries. 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.

Internet was an important source of health information during the COVID-19 pandemic. 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. 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. PIU is greatly influenced by the given socio-economic and cultural context. 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, 10.3% in Poland, and 8.3% in China. However, there 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-year (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.
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, 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 Anding 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. All these additional questions used a dichotomous response.

PIU was measured using the Chinese version of the self-report Internet Addiction Test (IAT). 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). 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), where a higher score indicated more severe anxiety symptoms. The severity of overall pain was measured using the Visual Analog Scale for Pain (VAS), 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?” 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, χ² 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).
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 Iran33 and 10.3% in Poland34. 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.\textsuperscript{17} 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.\textsuperscript{48,49} All these factors probably increased the risk of PIU.\textsuperscript{24,27}

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

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.\textsuperscript{63} 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.\textsuperscript{5} PIU may give rise to a range of health problems, such as metabolic syndrome,\textsuperscript{64} neck, shoulder, and back pain,\textsuperscript{65} increased risk of accidents (falling and bumps/collisions),\textsuperscript{62} and poor sleep quality.\textsuperscript{56–69} In addition, those with

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

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

![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. 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. Additionally, public education and training courses on COVID-19 should be provided in universities facilitating prevention, early detection, and better control of COVID-19.

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.

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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, Ping 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.

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