



OPEN ACCESS

EDITED BY

Reza Lashgari,
Shahid Beheshti University, Iran

REVIEWED BY

Emilien Jeannot,
Centre Hospitalier Universitaire Vaudois
(CHUV), Switzerland
Gui-Ying Yao,
Xinxiang Medical University, China

*CORRESPONDENCE

Lin Niu

✉ niulin@xjtu.edu.cn

Shaojie Dong

✉ dongshaojie@xjtu.edu.cn

†These authors have contributed equally to
this work

RECEIVED 25 January 2024

ACCEPTED 17 April 2024

PUBLISHED 03 May 2024

CITATION

Zhang Y, Jia Y, MuLaTiHaJi M, Mi Y, Mei Y,
Sun T, Shi H, Zhang Y, Zhang Y, Zou R,
Niu L and Dong S (2024) A cross-sectional
mental-health survey of Chinese
postgraduate students majoring in
stomatology post COVID-19 restrictions.
Front. Public Health 12:1376540.
doi: 10.3389/fpubh.2024.1376540

COPYRIGHT

© 2024 Zhang, Jia, MuLaTiHaJi, Mi, Mei, Sun,
Shi, Zhang, Zhang, Zou, Niu and Dong. This is
an open-access article distributed under the
terms of the [Creative Commons Attribution
License \(CC BY\)](https://creativecommons.org/licenses/by/4.0/). The use, distribution or
reproduction in other forums is permitted,
provided the original author(s) and the
copyright owner(s) are credited and that the
original publication in this journal is cited, in
accordance with accepted academic
practice. No use, distribution or reproduction
is permitted which does not comply with
these terms.

A cross-sectional mental-health survey of Chinese postgraduate students majoring in stomatology post COVID-19 restrictions

Yuwei Zhang^{1,2†}, Yue Jia^{1,2†}, MaErWa MuLaTiHaJi^{1,2†}, Yiyang Mi³,
Yukun Mei^{1,2}, Tianxiang Sun^{1,2}, Haibo Shi^{1,2}, Yifei Zhang^{1,2},
Yikun Zhang⁴, Rui Zou^{1,2}, Lin Niu^{1,2,5*} and Shaojie Dong^{1,2,5*}

¹Key Laboratory of Shaanxi Province for Craniofacial Precision Medicine Research, College of Stomatology, Xi'an Jiaotong University, Xi'an, China, ²Clinical Research Center of Shaanxi Province for Dental and Maxillofacial Diseases, Xi'an, China, ³Health Science Center, Xi'an Jiaotong University, Xi'an, China, ⁴College of Stomatology, China Medical University, Shenyang, China, ⁵Department of Prosthodontics, College of Stomatology, Xi'an Jiaotong University, Xi'an, China

Background: The psychological status of Chinese postgraduate students majoring in stomatology after the COVID-19 restrictions still remains unclear. The objective of this study is to evaluate the mental status through a cross-sectional survey and gather related theoretical evidence for psychological intervention on postgraduate students majoring in stomatology.

Methods: An online survey was administered, and subjective well-being, anxiety, stress and depression symptoms were assessed using the 5-item World Health Organization Well-Being Index (WHO-5), item Generalized Anxiety Disorder Scale (GAD-7), 10-item Perceived Stress Scale (PSS-10), and Patient Health Questionnaire-9 (PHQ-9), respectively, wherein suicidal ideation and sleep-related problems were measured with PHQ-9 and Insomnia Severity Index (ISI).

Results: A total of 208 participants who completed one questionnaire were considered as valid. It was found that female respondents generally exhibited significantly higher levels of PSS-10, PHQ-9, and GAD-7 scores and shorter physical activity hours than male students. Students from rural areas demonstrated significantly higher levels of PHQ-9, suicidal ideation, and less portion of good or fair family economic support. Additionally, individuals from only-child families reported increased levels of activity hours (1.78 ± 2.07 , $p = 0.045$) and a higher portion (55.10%, $p = 0.007$) of having clear future plan as compared with multiple-child families. The risk factors for anxiety symptoms (GAD-7 score) were higher scores of PSS-10 ($OR = 1.15$, 95% CI = 1.09–1.22), PHQ-9 ($OR = 1.35$, 95% CI = 1.22–1.49), and ISI-7 ($OR = 1.14$, 95% CI = 1.06–1.23), while owning a clear graduation plan was the protective factor ($OR = 0.55$, 95% CI = 0.31–0.98). Moreover, the risk factors for depressive symptoms (PHQ-9) included PSS-10 ($OR = 1.10$, 95% CI = 1.04–1.16), GAD-7 ($OR = 1.38$, 95% CI = 1.25–1.52), suicidal ideation ($OR = 5.66$, 95% CI = 3.37–9.51), and ISI-7 ($OR = 1.17$, 95% CI = 1.09–1.25). Approximately 98.08% of Chinese postgraduates studying stomatology reported experiencing at least moderate stress after the COVID-19 restrictions.

Conclusion: Within the limitations of this study, senior students were more inclined to stress, while anxiety symptoms were related to severer levels of stress, depression, and insomnia. Depressive symptoms were associated with higher levels of stress, anxiety, insomnia, suicidal ideation, and lower levels of self-reported well-being. Thus, psychological interventions for postgraduates

should be timely and appropriately implemented by strengthening well-being, reasonably planning for the future, and good physique, thereby mitigating the psychological issues after COVID-19 restrictions.

KEYWORDS

mental health, COVID-19 restrictions, postgraduate, stomatology, China

Introduction

In response to the outbreak of the coronavirus disease 2019 (COVID-19) pandemic, college students in China and globally encountered multiple instances all over the world had experienced several episodes of school closures. These measures were implemented as a part of general broader containment measures to slow strategies aimed at mitigating the spread of COVID-19 (1, 2). In an effort to mitigate the ongoing worldwide outbreak and protect college students from COVID-19, all educational institutions have been closed at the first step, followed by a consistent restriction on off-campus travel. Given the significant investment in educational support aimed at enhancing the quality of education, most of universities possess multiple distinct functional campuses. However, postgraduate students frequently need to commute between these campuses to complete their studies, particularly for their graduation projects. With the restriction of off-campus, most of students experienced their laboratories closed, projects disrupted, collaborations halted, and financial resources strained. Medical students, being a unique subset within this global pandemic, have to act dual roles as students and potential medical personnel. They had been demonstrated by several analyses that they are at a higher risk of developing mental problems during COVID-19 crisis (3–5). Given the unique nature of stomatology education, the mental issues of postgraduates majored in this subject could not be ignored, especially when the mandatory standardized training initiative for dentists was temporarily halted as a result of stomatology hospitals, either ceasing or partially curtailing their medical services during the COVID-19 pandemic.

It was widely recognized that the COVID-19 pandemic has led to a decrease in virulence and an increase in population immunity. To return to normalcy in both individual life and economy activities, China concluded its nationwide restriction measures on 20 December 2022 (6). However, it remains uncertain whether the impact of COVID-19 will diminish after the restrictions. Previous research studies revealed that there was a slight improvement in mental health since the end of restrictions while still at a lower level than that before the pandemic (7, 8). After the ending of COVID-19 restrictions, students are confronted with a shift in teaching modalities from online and remote learning to on-site instruction, which necessitates a swift adaptation as early in their academic careers when they were not impacted by the pandemic to make up for any missed courses and technical practices within a limited timeframe. Additionally, after the full non-restriction, the inevitable COVID-19 infection adds to the stresses of life events. Therefore, the mental status of Chinese postgraduates majoring in stomatology and how it could provide useful guidance in real world are worth investigating. Now it is the first year after the nationwide restrictions in China, when it is crucial to assess whether the mental state of oral

postgraduates has returned to pre-pandemic levels. Furthermore, it is important to understand the potential long-term effects of COVID-19 on the academic journey of medical students.

Therefore, the primary objective of this study was to evaluate the mental health status of Chinese postgraduates majoring in stomatology in 2023, marking the first year abolishing the COVID-19 pandemic restrictions in China. In especial, we sought to investigate the prevalence of anxiety and depressive symptoms, perceived stress, and sleep-related issues. Furthermore, we aimed to analyze the corresponding measurements based on the potential confounding factors and their associations. This research represents a further step toward gaining a more profound understanding of the long-term implications of the COVID-19.

Methods

Samples

The present cross-sectional survey was conducted from 15 October 2023 to 30 December 2023, a year subsequent to the restriction imposed in late 2022 in China. Sample size was calculated

according to the formula: $n = \frac{Z_{1-\frac{\alpha}{2}}^2 \times p \times (1-p)}{d^2}$, wherein 5% α error

probability was taken, and $Z_{1-\frac{\alpha}{2}}$ was 1.96; the expected incidence rate p was set as 0.67, given the prevalence rate of mental health problems among Chinese medical college students (9), and the results of our pilot study conducted in Xi'an, China, among postgraduate medical students during COVID-19; d (allowable error) was taken as $0.1p$. A sample size of at least 189 respondents was needed.

Subsequently, 25 colleges/universities were selected randomly for this study via the random-number method by numbering nationwide colleges/universities that offering a stomatology postgraduate program. Then, stratified sampling was carried out. The selection process employed a convenience sampling method with a balanced distribution of participant numbers.

Measurements

General demographic characteristics

General information such as current educational institutions, age, gender, grade, place of residence, household formation (multiple-child family or the only-child family), and self-assessed family economic status was recorded accordingly as basic background features.

Well-being

The universal and its Chinese version of the 5-item World Health Organization Well-Being (WHO-5) Index, comprising five self-rating items on a six-point scale, were utilized to assess the general well-being of included participants (10, 11). Each item is scaled from 0 (no time at all) to 5 (all the time) based on the sentiment experienced over the preceding 2 weeks. Subsequently, a cumulative score for all items was calculated ranging from 0 (absence of well-being) to 25 (maximum well-being).

Anxiety

General anxiety disorder and its severity were assessed using the universal and Chinese version of the Generalized Anxiety Disorder-7 (GAD-7). The GAD-7 is comprised of a combination of seven items rated on a four-point scale ranging from 0 (not at all) to 3 (nearly every day). The total score, ranging from 0 to 21 with a cutoff score of 11 points, was assessed for clinically relevant general anxiety disorder symptoms (8, 12).

Stress

The universal and its Chinese version of the 10-item Perceived Stress Scale (PSS-10) were utilized to assess the self-reported stress levels of the respondents. The PSS-10 comprises 10 items rated on a five-point Likert scale ranging from 1 (never) to 5 (always), reflecting the occurrence frequency of each item in the preceding month (13, 14). Scores for six negative items, along with four inverted positive items, were calculated, which lied between 0 (the lowest possible level) and 40 (the highest level of perceived stress). A cutoff score of 14 was established to define moderate stress (8).

Depression

The Patient Health Questionnaire-9 (PHQ-9) was employed to evaluate depressive symptoms. The PHQ-9 comprises nine items, based on the DSM-IV criteria for depression module ranging from 0 (not at all) to 3 (nearly every day), leading to a score from 0 to 27. A clinical threshold of 11 points is established as indicative of depressive symptoms in adolescents (8, 15, 16).

Suicidal ideation

Suicidal ideation was assessed using the ninth item of the PHQ-9: “How often have you been bothered by thoughts that you would be better off dead or of rather hurting yourself in some way over the last two weeks?” A two-point score was set as a cutoff for severe suicidal ideations (8).

Insomnia

The nature, severity, and impact of sleep-related problems were assessed using the Insomnia Severity Index (ISI). The ISI comprises four-point self-report having 7 items ranging from 0 to 28 with a cutoff point of 15 designated as moderate insomnia (8, 17).

Smartphone usage

Smartphone usage appears to be linked with mental health, and excessive use tends to be associated with negative consequences (i.e., technology-related addiction risk) as included in our measurements (18). The frequency of smartphone usage was divided into six options, namely, <1 h/day, 1–2 h/day, 3–4 h/day, 5–6 h/day, 7–8 h/day, and > 8 h/day (8).

Physical activity

Physical activity appears to be also related to mental health, which is often described as a protective factor. Thus, it was included in our measurements (19). The frequency of physical activity was self-reported from number 0 to 7, which represented the number of days with over 60 min of physical activity per week based on the WHO recommendations for healthy physical activity purpose (20).

Self-perceived source of pressure

Self-perceived Source of Pressure was represented by multiple choice questions based on our pilot study in the initial smaller scale population. Additionally, the options were summarized as “worried about academic scores”; “worried about the result of graduation project”; “worried about not being able to graduate”; “worried about not being able to find a job”; and “worried that one’s abilities may not meet the requirements of the employer after employment”.

Future plan

Future plan was assessed based on whether a definitive decision was made or not and then what the decision entailed, such as pursuing a full time/on-the-job PhD, working directly or not.

Measurement reliability

The internal consistency and reliability of the instruments/measurements were assessed by Cronbach’s alpha (α) coefficient.

Statistical analysis

All the continuous data were displayed as mean \pm standard deviation (SD) and median, while categorical data were reported as number and its percentage. T-tests and non-parametric Mann–Whitney U rank-sum tests were utilized for mean comparison between two groups depending on normality (Kolmogorov–Smirnov normality test when $n > 50$) and homogeneity of variance (Levene’s test). Comparisons among multiple groups were evaluated by one-way analysis of variance (ANOVA), if the statistical indicators satisfied the normality. The statistical significances between groups were compared with the Fisher post-hoc least significant difference test (LSD, when equal-variance assumed) or Dunnett’s T3 test (when equal-variance not assumed). Otherwise, Kruskal–Wallis H rank sum test was selected for comparison between multiple independent samples. $R \times C$ table chi-square tests were conducted to compare the prevalence of the related psychological symptoms across groups. Multivariate logistic regression models were utilized for the association between various factors and stress/depression/anxiety. Variance inflation factor (VIF) analysis was conducted before applying multivariate logistic regression models so as to guarantee that no multicollinearity was found. Statistical analyses were conducted by SPSS 22.0 (SPSS Inc., Chicago, IL, USA). $p < 0.05$ (two-tailed) represented statistically significant.

Data collection and ethical approval

The study was approved by the Medical Ethical Committee of Stomatology Hospital of Xi’an Jiaotong University, China (No. 191), and was conducted in accordance with the Declarations of Helsinki. The online Questionnaire Star was utilized via an anonymous,

self-rated method.¹ All the participants were given assurance of confidentiality that the information gathered would be used exclusively for research purposes. Electronic informed consent was obtained from all participants prior to our data collection. To eliminate repeated respondents, each device was limited to one response. Logic check was proceeded by two independent reviewers to avoid invalid questionnaires. Only valid questionnaires were used for further analysis. The online questionnaires encompassed general background demographic features and assessed the impact of COVID-19 restriction on life, particularly the related psychological symptoms and sources of respondents. The aforementioned items of each measurement revealed in the content of questionnaires are shown in [Supplementary Table S1](#).

Results

Finally, 208 out of 235 questionnaires were identified as valid ones for further analysis. Based on Cronbach's α coefficient results, the measurements utilized in the sample presented good internal consistency and reliability ([Supplementary Table S2](#)). The sample of oral medicine postgraduate respondents consisted of 208 individuals, with a gender distribution of 138 women (66.35%) and 70 men (33.65%). When categorizing the data based on gender, a significant higher level of self-reported stress ($f-m$: $30.19 \pm 7.85-26.29 \pm 6.80$, $p < 0.0001$), depression ($f-m$: $7.61 \pm 5.62-6.06 \pm 5.50$, $p = 0.044$), and generalized anxiety disorder ($f-m$: $76.45 \pm 5.22-4.63 \pm 4.51$, $p = 0.017$) were found in women. Meanwhile, we observed a significant decreased level of physical time per week ($f-m$: $1.01 \pm 1.34-2.26 \pm 2.23$, $p < 0.0001$) in female students compared with male students. Additionally, most of the women had clear future plan to get a job (74.58%) after graduation, while only 48.57% of men chose to work and 45.71% of men decided to pursue a PhD degree ($\chi^2 = 6.652$, $p = 0.036$). When considering the place of residence, an increased level of PHQ-9 (depressive symptoms, $R-U$: $8.26 \pm 5.61-6.40 \pm 5.52$, $p = 0.013$) and suicidal ideation (PHQ-No.9 score, $R-U$: $0.45 \pm 0.77-0.23 \pm 0.52$, $p = 0.014$) in students from rural areas than that from urban areas was observed. Furthermore, the basic structure of self-perceived family economic status ($\chi^2 = 24.933$, $p < 0.0001$) and the proportion of students with a clear graduation plan ($\chi^2 = 3.847$, $p = 0.050$) differed in these two areas. A significant higher ratio of students had a clear plan when they are in the families of fair/good economic status or from urban areas. Intriguingly, when data from respondents were divided according to their household formation, a longer physical time per week (one-multiple: $1.78 \pm 2.07-1.12 \pm 1.43$, $p = 0.045$) was observed in the only-child families after the restrictions. Students from the only-child families appeared to be more inclined to make clear further plan ($p = 0.007$). Furthermore, it was noticeable that the total average of PSS-10 scores and the individual score of 98.08% of the participants exceeded the cutoff point, indicating a wide range of participants experienced at least moderate stress (the total and individual analyses are presented in [Table 1](#)).

Grade was another essential variable in our study. The number of students in Grade 1, Grade 2, and Grade 3 was 61, 65, and 82,

respectively ([Table 2](#)). The age of students from each grade was significantly different ($p < 0.0001$). In general, the scores of PSS-10 and GAD-7 showed a hierarchic ascending trend from Grade 1 to 3, with significantly higher levels of stress and anxiety symptoms in Grade 3 than in Grade 1 ($P1-3 < 0.05$). The same trend was found in the level of PHQ-9, with significantly more severe depressive symptoms in Grade 3 and 2 than in Grade 1 ($P1-2 = 0.027$, $P1-3 = 0.007$). Students in Grade 3 (54.88%) were more likely to have a clear further plan ($\chi^2 = 10.183$, $p = 0.006$).

VIF analysis was conducted before applying multivariate logistic regression models, and no multicollinearity was found ([Supplementary Tables S3-S5](#)). Subsequently, considering the factors influencing college students' stress (PSS-10 score, [Table 3](#)), a multivariate logistic regression analysis was conducted. Compared with younger students, senior/older students exhibited a higher risk of self-reported stress symptoms ($OR = 1.15$, 95% CI : 1.01-1.30), wherein age was a significant variable rather than grade level. Furthermore, the longer hours of physical activity per day ($OR = 0.73$, 95% CI : 0.63-0.84) and having a clear graduation plan ($OR = 0.49$, 95% CI : 0.29-0.81) were associated with lower possibility of stress symptoms.

Moreover, students with higher level of PSS-10 score ($OR = 1.15$, 95% CI : 1.09-1.22), PHQ-9 score ($OR = 1.35$, 95% CI : 1.22-1.49), and ISI-7 score ($OR = 1.14$, 95% CI : 1.06-1.23) presented a higher risk of anxiety. Meanwhile, students with clear graduation plan would suffer from less anxiety ($OR = 0.55$, 95% CI : 0.31-0.98) ([Table 4](#)).

In addition, those who reported a higher level of PSS-10 ($OR = 1.10$, 95% CI : 1.04-1.16), GAD-7 ($OR = 1.38$, 95% CI : 1.25-1.52), suicidal ideation ($OR = 5.66$, 95% CI : 3.37-9.51), and ISI-7 ($OR = 1.17$, 95% CI : 1.09-1.25), which could be regarded as risk factors, were associated with a higher risk of depression compared with those with lower levels. Moreover, higher levels of WHO-5 scores were related to lower degree of depression ($OR = 0.94$, 95% CI : 0.89-0.99), as shown in [Table 5](#).

Discussion

In this research, the sample of oral medicine postgraduate respondents consisted of 208 individuals, with a distribution of 66.35% as women and 33.65% as men. This distribution closely aligns with enrollment gender ratio of the annual master in China.

During the pandemic, all educational institutions suspended classes or constantly restricted off-campus travel to mitigate the nationwide and global spread of the virus and protect college students from COVID-19. Given the significant investment in educational support to enhance educational quality, most universities operate multiple functional campuses. Postgraduate students often need to commute between these campuses to complete their studies, particularly for their graduation projects. With the restriction on off-campus activities, most students faced challenges such as closed laboratories, obstructed projects, suspended cooperation, and financial strain on families. Due to the unique nature of the oral medicine postgraduate training program, the mandatory standardized training project for dentists was halted as stomatology hospitals either suspended or partially resumed their medical services, considering that the aerogel in the clinics would accelerate the spread of virus during the COVID-19 pandemic. The impact of the pandemic on

¹ <https://www.wjx.cn>

TABLE 1 Outcomes of the psychological variables based on gender, place of residence, and household formation.

| | Gender | | | | | Place of residence | | | | Household formation | | | |
|------------------------------------|-------------------------|-------------------------|-------------------------|---------------------------------------|----------------|-------------------------|-------------------------|---------------------------------------|----------------|-------------------------|-------------------------|---------------------------------------|----------------|
| | Total | Female | Male | Statistics | <i>p</i> value | Rural | Urban | Statistics | <i>p</i> value | The only child | Multiple-child family | Statistics | <i>p</i> value |
| N | 208 | 138 | 70 | | | 77 | 131 | | | 98 | 110 | | |
| WHO-5 score | | | | | | | | | | | | | |
| mean ± SD (median) | 12.54 ± 5.51 (12.00) | 12.38 ± 5.48 (11.50) | 12.86 ± 5.61 (13.00) | <i>D</i> = 0.083 <i>F</i> = 0.038 | 0.584 | 11.97 ± 5.55 (12.00) | 12.88 ± 5.49 (12.00) | <i>D</i> = 0.116 <i>Z</i> = -1.125 | 0.261 | 12.50 ± 5.70 (12.00) | 12.58 ± 5.36 (12.00) | <i>D</i> = 0.062 <i>F</i> = 0.019 | 0.915 |
| PSS-10 score | | | | | | | | | | | | | |
| mean ± SD (median) | 28.88 ± 7.72 (29.00) | 30.19 ± 7.85 (30.00) | 26.29 ± 6.80 (27.00) | <i>D</i> = 0.052 <i>F</i> = 2.238 | <0.0001*** | 29.78 ± 7.92 (30.00) | 28.34 ± 7.58 (28.00) | <i>D</i> = 0.078 <i>F</i> = 0.452 | 0.196 | 28.66 ± 7.49 (29.00) | 29.06 ± 7.95 (29.00) | <i>D</i> = 0.082 <i>F</i> = 0.502 | 0.710 |
| ≥14, No. (%) | 204 (98.08) | 137 (99.28) | 67 (95.71) | $\chi^2 = 1.520$ | 0.218 | 76 (98.70) | 128 (97.71) | $\chi^2 = 0.0001$ | 1.000 | 96 (97.96) | 109 (99.09) | $\chi^2 = 0.010$ | 0.920 |
| PHQ-9 score | | | | | | | | | | | | | |
| mean ± SD (median) | 7.09 ± 5.62 (6.00) | 7.61 ± 5.62 (7.00) | 6.06 ± 5.50 (4.00) | <i>D</i> = 0.099 <i>Z</i> = -2.014 | 0.044* | 8.26 ± 5.61 (8.00) | 6.40 ± 5.52 (5.00) | <i>D</i> = 0.092 <i>Z</i> = -2.480 | 0.013* | 6.51 ± 5.63 (5.00) | 7.60 ± 5.58 (7.00) | <i>D</i> = 0.147 <i>Z</i> = -1.522 | 0.128 |
| ≥11, No. (%) | 55 (26.44) | 38 (27.54) | 17 (24.29) | $\chi^2 = 0.252$ | 0.615 | 22 (28.57) | 33 (25.19) | $\chi^2 = 0.285$ | 0.593 | 28 (28.57) | 27 (24.55) | $\chi^2 = 0.432$ | 0.511 |
| Suicidal ideation (PHQ-No.9 score) | | | | | | | | | | | | | |
| mean ± SD (median) | 0.31 ± 0.64 (0.00) | 0.28 ± 0.60 (0.00) | 0.37 ± 0.71 (0.00) | <i>D</i> = 0.463 <i>Z</i> = -0.764 | 0.445 | 0.45 ± 0.77 (0.00) | 0.23 ± 0.52 (0.00) | <i>D</i> = 0.490 <i>Z</i> = -2.452 | 0.014* | 0.29 ± 0.63 (0.00) | 0.34 ± 0.65 (0.00) | <i>D</i> = 0.442 <i>Z</i> = -0.777 | 0.437 |
| ≥2, No. (%) | 14 (6.73) | 7 (5.07) | 7 (10.00) | $\chi^2 = 1.097$ | 0.295 | 7 (9.09) | 7 (5.34) | $\chi^2 = 1.085$ | 0.298 | 7 (7.14) | 7 (6.36) | $\chi^2 = 0.050$ | 0.823 |
| GAD-7 score | | | | | | | | | | | | | |
| mean ± SD (median) | 5.84 ± 5.06 (6.00) | 6.45 ± 5.22 (7.00) | 4.63 ± 4.51 (4.50) | <i>D</i> = 0.152 <i>Z</i> = -2.394 | 0.017* | 6.44 ± 4.99 (7.00) | 5.48 ± 5.08 (6.00) | <i>D</i> = 0.161 <i>Z</i> = -1.677 | 0.094 | 5.34 ± 4.80 (5.00) | 6.28 ± 5.26 (7.00) | <i>D</i> = 0.173 <i>Z</i> = -1.397 | 0.162 |
| ≥11, No. (%) | 30 (14.42) | 22 (15.94) | 8 (11.43) | $\chi^2 = 0.767$ | 0.381 | 13 (16.88) | 17 (12.98) | $\chi^2 = 0.599$ | 0.439 | 13 (13.27) | 17 (15.45) | $\chi^2 = 0.201$ | 0.654 |
| ISI-7 score | | | | | | | | | | | | | |
| mean ± SD (median) | 6.38 ± 5.15 (6.00) | 6.55 ± 5.25 (6.00) | 6.04 ± 4.97 (5.00) | <i>D</i> = 0.119 <i>Z</i> = -0.701 | 0.483 | 6.99 ± 5.70 (6.00) | 6.02 ± 4.79 (6.00) | <i>D</i> = 0.167 <i>Z</i> = -1.015 | 0.310 | 6.17 ± 4.97 (5.50) | 6.56 ± 5.33 (6.00) | <i>D</i> = 0.136 <i>Z</i> = -0.485 | 0.628 |
| ≥15, No. (%) | 20 (9.62) | 15 (10.87) | 5 (7.14) | $\chi^2 = 0.742$ | 0.389 | 3 (3.90) | 2 (1.53) | $\chi^2 = 0.370$ | 0.543 | 9 (9.18) | 11 (10.00) | $\chi^2 = 0.040$ | 0.842 |

(Continued)

TABLE 1 (Continued)

| | Gender | | | | | Place of residence | | | | Household formation | | | |
|--|---------------------------|---------------------------|---------------------------|---------------------------------------|----------------|---------------------------|---------------------------|--------------------------------------|----------------|---------------------------|---------------------------|---------------------------------------|----------------|
| | Total | Female | Male | Statistics | <i>p</i> value | Rural | Urban | Statistics | <i>p</i> value | The only child | Multiple-child family | Statistics | <i>p</i> value |
| Smartphone usage | | | | | | | | | | | | | |
| No. (%) | <1 h/day | <1 h/day | <1 h/day | $\chi^2 = 18.62$ | 0.002* | <1 h/day | <1 h/day | $\chi^2 = 7.700$ | 0.174 | <1 h/day | <1 h/day | $\chi^2 = 13.648$ | 0.018* |
| | 14 (6.73) | 3 (2.17) | 11 (15.71) | | | 2 (2.60) | 12 (9.16) | | | 13 (13.27) | 1 (0.91) | | |
| | 1–2 h/day | 1–2 h/day | 1–2 h/day | | | 1–2 h/day | 1–2 h/day | | | 1–2 h/day | 1–2 h/day | | |
| | 19 (9.13) | 10 (7.25) | 9 (12.86) | | | 10 (12.99) | 9 (6.87) | | | 9 (9.18) | 10 (9.09) | | |
| | 3–4 h/day | 3–4 h/day | 3–4 h/day | | | 3–4 h/day | 3–4 h/day | | | 3–4 h/day | 3–4 h/day | | |
| | 59 (28.37) | 44 (31.88) | 15 (21.43) | | | 25 (32.47) | 34 (25.95) | | | 26 (26.53) | 33 (30.00) | | |
| | 5–6 h/day | 5–6 h/day | 5–6 h/day | | | 5–6 h/day | 5–6 h/day | | | 5–6 h/day | 5–6 h/day | | |
| | 61 (29.33) | 45 (32.61) | 16 (22.86) | | | 18 (23.38) | 43 (32.82) | | | 27 (27.55) | 34 (30.91) | | |
| | 7–8 h/day | 7–8 h/day | 7–8 h/day | | | 7–8 h/day | 7–8 h/day | | | 7–8 h/day | 7–8 h/day | | |
| | 27 (12.98) | 20 (14.49) | 7 (10.00) | | | 10 (12.99) | 17 (12.98) | | | 13 (13.27) | 14 (12.73) | | |
| | >8 h/day | >8 h/day | >8 h/day | | | >8 h/day | >8 h/day | | | >8 h/day | >8 h/day | | |
| | 28 (13.46) | 16 (11.59) | 12 (17.14) | | | 12 (15.58) | 16 (12.21) | | | 10 (10.20) | 18 (16.36) | | |
| Physical activity (days more than 60 min per week) | | | | | | | | | | | | | |
| mean \pm SD (median) | 1.42 \pm 1.79 (1.00) | 1.01 \pm 1.34 (0.00) | 2.26 \pm 2.23 (2.00) | <i>D</i> = 0.288 <i>Z</i> = -4.218 | <0.0001 *** | 1.04 \pm 1.35 (1.00) | 1.66 \pm 1.97 (1.00) | <i>D</i> = 0.246 <i>Z</i> = -1.79 | 0.074 | 1.78 \pm 2.07 (1.00) | 1.12 \pm 1.43 (1.00) | <i>D</i> = 0.217 <i>Z</i> = -2.003 | 0.045* |
| Self-perceived family economic status | | | | | | | | | | | | | |
| No. (%) | good | good | good | $\chi^2 = 0.694$ | 0.707 | good | good | $\chi^2 = 24.933$ | <0.0001 *** | good | good | $\chi^2 = 3.426$ | 0.180 |
| | 17 (8.17) | 11 (7.97) | 6 (8.57) | | | 3 (3.90) | 14 (10.69) | | | 11 (11.22) | 6 (5.45) | | |
| | fair | fair | fair | | | fair | fair | | | fair | fair | | |
| | 161 (77.40) | 109 (78.99) | 52 (74.29) | | | 51 (66.23) | 110 (83.97) | | | 76 (77.55) | 85 (77.27) | | |
| | bad | bad | bad | | | bad | bad | | | bad | bad | | |
| | 30 (14.42) | 18 (13.04) | 12 (17.14) | | | 23 (29.87) | 7 (5.34) | | | 11 (11.23) | 19 (17.27) | | |
| Having clear graduation plan | | | | | | | | | | | | | |
| No. (%) | Yes | yes | yes | $\chi^2 = 0.985$ | 0.321 | yes | yes | $\chi^2 = 3.847$ | 0.050* | yes | yes | $\chi^2 = 7.347$ | 0.007** |
| | 94 (45.19) | 59 (42.75) | 35 (50.00) | | | 28 (36.36) | 66 (50.38) | | | 54 (55.10) | 40 (36.36) | | |
| | No | No | No | | | No | No | | | No | No | | |
| | 114 (54.81) | 79 (57.25) | 35 (50.00) | | | 49 (63.64) | 65 (49.62) | | | 44 (44.90) | 70 (63.64) | | |
| Graduation plan | | | | | | | | | | | | | |

(Continued)

TABLE 1 (Continued)

| | Gender | | | | | Place of residence | | | | Household formation | | | |
|-----------------------------|----------------------------------|---------------------------------|---------------------------------|------------------|----------------|---------------------------------|---------------------------------|------------------|----------------|---------------------------------|---------------------------------|------------------|----------------|
| | Total | Female | Male | Statistics | <i>p</i> value | Rural | Urban | Statistics | <i>p</i> value | The only child | Multiple-child family | Statistics | <i>p</i> value |
| No. (%) | PhD | PhD | PhD | $\chi^2 = 6.652$ | 0.036* | PhD | PhD | $\chi^2 = 4.714$ | 0.095 | PhD | PhD | $\chi^2 = 3.062$ | 0.216 |
| | 30 (31.91) | 14 (23.73) | 16 (45.71) | | | 6 (21.43) | 24 (36.36) | | | 21 (38.89) | 9 (22.50) | | |
| | Work | Work | Work | | | Work | Work | | | Work | Work | | |
| | 61 (64.89) | 44 (74.58) | 17 (48.57) | | | 22 (78.57) | 39 (59.09) | | | 30 (55.56) | 29 (72.50) | | |
| | Others | Others | Others | | | Others | Others | | | Others | Others | | |
| | 3 (3.19) | 1 (1.69) | 2 (5.72) | | | 0 (0.00) | 3 (4.55) | | | 3 (5.56) | 2 (5.00) | | |
| Current sources of pressure | | | | | | | | | | | | | |
| No. | No job 138 | No job 98 | No job 40 | $\chi^2 = 2.231$ | 0.693 | No job 55 | No job 83 | $\chi^2 = 0.327$ | 0.988 | No job 58 | No job 80 | $\chi^2 = 1.202$ | 0.878 |
| | Requirements of the employer 134 | Requirements of the employer 95 | Requirements of the employer 39 | | | Requirements of the employer 52 | Requirements of the employer 82 | | | Requirements of the employer 57 | Requirements of the employer 77 | | |
| | Unable to graduate 103 | Unable to graduate 77 | Unable to graduate 26 | | | Unable to graduate 42 | Unable to graduate 61 | | | Unable to graduate 43 | Unable to graduate 60 | | |
| | Scores 55 | Scores 37 | Scores 18 | | | Scores 23 | Scores 32 | | | Scores 19 | Scores 36 | | |
| | Graduation Project 95 | Graduation Project 73 | Graduation Project 22 | | | Graduation Project 36 | Graduation Project 59 | | | Graduation Project 38 | Graduation Project 57 | | |

M, mean score; SD, standard deviation; D, test statistics of normality based on Kolmogorov–Smirnov test (when $n > 50$). F, test statistics of Levene’s test for equality of variances. Z, test statistics of Mann–Whitney rank-sum tests. χ^2 , Chi-square test statistics. WHO-5, World Health Organization Wellbeing Index; PHQ-9, Patient Health Questionnaire 2 Scale; GAD-7, General Anxiety Disorder 7 Scale; ISI, Insomnia Severity Index Score; PSS-10, Perceived Stress Scale 10; PhD, Doctor of Philosophy. Suicidal ideations: item 9 of the PHQ-9: “Thoughts that you would be better off dead or of hurting yourself.” * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

TABLE 2 Outcomes of the psychological variables based on grade.

| | Grade 1 | Grade 2 | Grade 3 | Statistics | p value |
|------------------------------------|-------------------------|-------------------------|-------------------------|--|--|
| N | 61 | 65 | 82 | | |
| Age | 24.39 ± 1.74 (24.00) | 24.35 ± 2.20 (24.00) | 25.27 ± 1.85 (25.00) | Z = 16.58 | <0.0001*** |
| WHO-5 | 12.43 ± 5.26 (13.00) | 12.60 ± 5.17 (11.00) | 12.61 ± 6.00 (12.50) | F' = 0.02 F1-2 = 0.08 F1-3 = 1.43 F2-3 = 2.19 | P1-2 = 0.878 P1-3 = 0.849 P2-3 = 0.966 |
| PSS-10 | | | | | |
| mean ± SD (median) | 27.57 ± 6.49 (28.00) | 28.71 ± 8.02 (29.00) | 29.98 ± 8.23 (30.00) | F' = 1.73 F1-2 = 1.59 F1-3 = 5.52 F2-3 = 0.74 | P1-2 = 0.386 P1-3 = 0.050* P2-3 = 0.350 |
| ≥14, No. (%) | 61 (100.00) | 63 (96.92) | 80 (97.56) | χ² = 2.87 | 0.239 |
| PHQ-9 | | | | | |
| mean ± SD (median) | 5.43 ± 5.20 (4.00) | 7.55 ± 5.65 (7.00) | 7.95 ± 5.68 (8.00) | Z1-2 = -2.21 Z1-3 = -2.70 Z2-3 = -0.51 | P1-2 = 0.027* P1-3 = 0.007* P2-3 = 0.608 |
| ≥11, No. (%) | 13 (21.31) | 16 (24.62) | 26 (31.71) | χ² = 2.11 | 0.349 |
| Suicidal ideation (PHQ-No.9 score) | | | | | |
| mean ± SD (median) | 0.21 ± 0.49 (0.00) | 0.31 ± 0.61 (0.00) | 0.39 ± 0.75 (0.00) | Z1-2 = -0.78 Z1-3 = -1.33 Z2-3 = -0.54 | P1-2 = 0.436 P1-3 = 0.183 P2-3 = 0.589 |
| ≥2, No. (%) | 2 (3.28) | 5 (7.69) | 7 (8.54) | χ² = 1.90 | 0.387 |
| GAD-7 score | | | | | |
| mean ± SD (median) | 4.98 ± 4.96 (5.00) | 5.77 ± 4.69 (6.00) | 6.52 ± 5.35 (7.00) | Z1-2 = -1.26 Z1-3 = -2.03 Z2-3 = -1.00 | P1-2 = 0.207 P1-3 = 0.043* P2-3 = 0.316 |
| ≥11, No. (%) | 5 (8.20) | 7 (10.77) | 18 (21.95) | χ² = 6.38 | 0.041* |
| ISI-7 score | | | | | |
| mean ± SD (median) | 5.57 ± 5.61 (4.00) | 6.63 ± 4.66 (6.00) | 6.78 ± 5.17 (6.50) | Z1-2 = -1.82 Z1-3 = -1.82 Z2-3 = -0.04 | P1-2 = 0.069 P1-3 = 0.068 P2-3 = 0.967 |
| ≥15, No. (%) | 8 (13.11) | 5 (7.69) | 7 (8.54) | χ² = 1.25 | 0.536 |
| Smartphone usage | | | | | |
| No. (%) | <1 h/day 13 (21.31) | <1 h/day 0 (00.00) | <1 h/day 1 (1.22) | χ² = 46.95 | <0.0001*** |
| | 1-2 h/day 4 (6.56) | 1-2 h/day 1 (1.54) | 1-2 h/day 14 (17.07) | | |
| | 3-4 h/day 13 (21.31) | 3-4 h/day 21 (32.31) | 3-4 h/day 25 (30.49) | | |
| | 5-6 h/day 13 (21.31) | 5-6 h/day 24 (36.92) | 5-6 h/day 24 (29.27) | | |
| | 7-8 h/day 10 (16.39) | 7-8 h/day 6 (9.23) | 7-8 h/day 11 (13.41) | | |
| | >8 h/day 8 (13.11) | >8 h/day 13 (20.00) | >8 h/day 7 (8.54) | | |

(Continued)

TABLE 2 (Continued)

| | Grade 1 | Grade 2 | Grade 3 | Statistics | p value |
|--|---------------------------------|---------------------------------|---------------------------------|------------------|--------------|
| Physical activity (days more than 60 min per week) | | | | | |
| mean ± SD | 1.69 ± 2.33 | 1.31 ± 1.56 | 1.33 ± 1.47 | Z1-2 = -0.05 | P1-2 = 0.959 |
| (median) | (1.00) | (1.00) | (1.00) | Z1-3 = -0.10 | P1-3 = 0.920 |
| | | | | Z2-3 = -0.23 | P2-3 = 0.818 |
| Self-perceived family economic status | | | | | |
| No. (%) | good | good | good | $\chi^2 = 3.43$ | 0.489 |
| | 3 (4.92) | 4 (6.15) | 10 (12.20) | | |
| | fair | fair | fair | | |
| | 50 (81.97) | 52 (80.00) | 59 (71.95) | | |
| Having clear graduation plan | | | | | |
| No. (%) | Yes | Yes | Yes | $\chi^2 = 10.18$ | 0.006** |
| | 30 (49.18) | 19 (29.23) | 45 (54.88) | | |
| | No | No | No | | |
| | 31 (50.82) | 46 (70.77) | 37 (45.12) | | |
| Graduation plan | | | | | |
| No. (%) | PhD | PhD | PhD | $\chi^2 = 7.50$ | 0.112 |
| | 14 (46.67) | 4 (21.05) | 11 (24.44) | | |
| | Work | Work | Work | | |
| | 14 (46.67) | 13 (68.42) | 33 (73.33) | | |
| | Others | Others | Others | | |
| | 2 (6.67) | 2 (10.53) | 1 (2.22) | | |
| Current sources of pressure | | | | | |
| No. | No job 33 | No job 46 | No job 59 | $\chi^2 = 7.53$ | 0.480 |
| | Requirements of the employer 42 | Requirements of the employer 42 | Requirements of the employer 50 | | |
| | Unable to graduate 25 | Unable to graduate 30 | Unable to graduate 48 | | |
| | Scores 12 | Scores 17 | Scores 26 | | |
| | Graduation Project 20 | Graduation Project 39 | Graduation Project 36 | | |

Data are expressed as the mean ± standard deviation (median). F, test statistics of ANOVA. F, test statistics of Levene's test for equality of variances. Z, test statistics of Mann-Whitney rank-sum tests. χ^2 , Chi-square test statistics. P_{n1-n2} : p-value based on LSD or Dunnett or Mann-Whitney rank-sum tests between groups of n1 and n2. WHO-5, World Health Organization Well-being Index; PHQ-9, Patient Health Questionnaire 2 Scale; GAD-7, General Anxiety Disorder 7 Scale; ISI, Insomnia Severity Index Score; PSS-10, Perceived Stress Scale 10; PhD, Doctor of Philosophy. Suicidal ideations: item 9 of the PHQ-9: "Thoughts that you would be better off dead or of hurting yourself." * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

professional skills and academic performance was significant, indicating that prolonged isolation, restricted movement within confined spaces, and online remote learning have negative emotional implications (21, 22).

Considering weakened virulence and enhanced immunity in the population of COVID-19, nationwide non-restriction was implemented to restore normal citizen life and the national economy (6). However, whether the effect of COVID-19 ever vanished after the restrictions on 20 December 2022 in China still remains unclear. As approaching the first anniversary for nationwide non-restriction, our study found that 14.42% of postgraduate students reported clinical general anxiety, which was significantly lower than the investigation results derived from Chinese college students (41.1%) during the epidemic (23). It is reasonable to surmise that the outbreak of COVID-19 indicated the peak value of incidence and prevalence of anxiety, and there was a noticeable decline following the period of normalization with

unrestricted social activity. However, the after effect of COVID-19 is inevitable and should be taken seriously.

The transformation of teaching mode from online learning and remote schooling to on-site learning required students to make up for the missed courses and technical practices in a short time, together with the inevitable COVID-19 infection after the full non-restriction, serving as the sources of stressful life events. Thus, we found approximately 98.08% of Chinese postgraduates majoring in stomatology experienced at least moderate stress after the COVID-19 restrictions. Consistent with previous studies (8, 24), women in our studies were more likely to suffer from stress, depression and anxiety, and less active in physical exercise. Female postgraduate students often face challenges, such as marital pressure, age-appropriate childbirth, pressure from the family of origin, and differential treatment in the workplace. Therefore, these factors could potentially influence gender differences in the relationship between life stressors and the onset of psychosis.

TABLE 3 Multivariate logistic regression of factors influencing college students' stress (PSS-10 score).

| Variables | | β | Std. error | Wald | OR | 95%CI | |
|---------------------------------------|---------|-----------|------------|------|-------|------------|------------|
| Age | | 0.14 | 0.07 | 4.47 | 1.15* | 1.01, 1.30 | |
| Grade | Grade 1 | Reference | | | | | |
| | Grade 2 | | 0.04 | 0.32 | 0.01 | 1.04 | 0.56, 1.94 |
| | Grade 3 | | 0.37 | 0.31 | 1.46 | 1.45 | 0.79, 2.65 |
| Gender | Male | Reference | | | | | |
| | Female | | 0.35 | 0.28 | 1.59 | 1.42 | 0.82, 2.46 |
| Self-perceived family economic status | Bad | Reference | | | | | |
| | Fair | | 0.45 | 0.35 | 1.63 | 1.57 | 0.79, 3.11 |
| | Good | | -0.28 | 0.54 | 9.26 | 0.76 | 0.26, 2.19 |
| Physical activity days | | | -0.32 | 0.08 | 17.91 | 0.73*** | 0.63, 0.84 |
| Smartphone usage hours | | | 0.03 | 0.09 | 0.08 | 0.96 | 0.79, 1.16 |
| Having clear graduation plan | No | Reference | | | | | |
| | Yes | | -0.72 | 0.26 | 7.57 | 0.49** | 0.29, 0.81 |

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

TABLE 4 Multivariate logistic regression of factors influencing college students' anxiety (GAD-7 score).

| Variables | | β | Std. error | Wald | OR | 95%CI | |
|---------------------------------------|---------|-----------|------------|------|-------|------------|------------|
| Age | | -0.10 | 0.07 | 1.76 | 0.91 | 0.79, 1.05 | |
| Grade | Grade 1 | Reference | | | | | |
| | Grade 2 | | -0.59 | 0.35 | 2.80 | 0.56 | 0.28, 1.11 |
| | Grade 3 | | 0.03 | 0.34 | 0.01 | 1.03 | 0.53, 2.02 |
| Gender | Male | Reference | | | | | |
| | Female | | 0.11 | 0.31 | 0.14 | 1.12 | 0.61, 2.05 |
| Self-perceived family economic status | Bad | Reference | | | | | |
| | Fair | | 0.68 | 0.39 | 3.03 | 1.97 | 0.92, 4.23 |
| | Good | | 0.26 | 0.62 | 0.18 | 1.30 | 0.38, 4.42 |
| WHO-5 score | | | -0.05 | 0.03 | 2.97 | 0.95 | 0.89, 1.01 |
| PSS-10 score | | | 0.14 | 0.03 | 25.08 | 1.15*** | 1.09, 1.22 |
| PHQ-9 score | | | 0.30 | 0.05 | 32.59 | 1.35*** | 1.22, 1.49 |
| Suicidal ideation (PHQ-No.9 score) | | | 0.13 | 0.28 | 0.21 | 1.14 | 0.66, 1.96 |
| ISI-7 score | | | 0.13 | 0.04 | 12.49 | 1.14*** | 1.06, 1.23 |
| Physical activity days | | | 0.02 | 0.09 | 0.03 | 1.02 | 0.86, 1.20 |
| Smartphone usage hours | | | 0.02 | 0.10 | 0.04 | 1.02 | 0.83, 1.25 |
| Having clear graduation plan | No | Reference | | | | | |
| | Yes | | -0.60 | 0.30 | 4.12 | 0.55* | 0.31, 0.98 |

* $p < 0.05$, *** $p < 0.001$.

Additionally, these variables along with the confounding factor of age in the female group might also explain why our real-world results indicate that most of the women having a clear future plan tended to work (74.58%) after graduation and 48.57% of men chose to work, while 45.71% of men decided to pursue a PhD degree ($\chi^2 = 6.652, p = 0.036$).

Considering the subjective well-being and stressful life events among rural/urban Chinese postgraduates, it was observed that students from rural areas tended to be more depressive, and their suicidal ideation was worth noticeable. The economic status disparity has mentioned in these two regions, and our included population was consistent with the traditional economic pattern of Chinese rural and

TABLE 5 Multivariate logistic regression of factors influencing college students' depression (PHQ-9 score).

| Variables | | | β | Std. error | Wald | OR | 95%CI |
|---------------------------------------|---------|-----------|---------|------------|-------|---------|------------|
| Age | | | -0.04 | 0.07 | 0.40 | 0.96 | 0.84, 1.09 |
| Gender | Male | Reference | | | | | |
| | Female | | 0.13 | 0.29 | 0.19 | 1.14 | 0.64, 2.01 |
| Grade | Grade 1 | Reference | | | | | |
| | Grade 2 | | 0.51 | 0.33 | 2.40 | 1.67 | 0.87, 3.19 |
| | Grade 3 | | 0.58 | 0.32 | 3.23 | 1.79 | 0.95, 3.37 |
| Self-perceived family economic status | Bad | Reference | | | | | |
| | Fair | | -0.59 | 0.37 | 2.50 | 0.56 | 0.27, 1.15 |
| | Good | | -0.61 | 0.57 | 1.16 | 0.54 | 0.18, 1.66 |
| WHO-5 score | | | -0.06 | 0.03 | 3.98 | 0.94* | 0.89, 0.99 |
| PSS-10 score | | | 0.09 | 0.03 | 11.33 | 1.10*** | 1.04, 1.16 |
| GAD-7 score | | | 0.32 | 0.05 | 40.97 | 1.38*** | 1.25, 1.52 |
| Suicidal Ideation (PHQ-No.9 score) | | | 1.73 | 0.27 | 42.73 | 5.66*** | 3.37, 9.51 |
| ISI-7 score | | | 0.16 | 0.03 | 20.16 | 1.17*** | 1.09, 1.25 |
| Physical activity days | | | -0.10 | 0.08 | 1.47 | 0.91 | 0.78, 1.06 |
| Smartphone Usage hours | | | 0.16 | 0.10 | 2.68 | 1.18 | 0.97, 1.43 |
| Having Clear Graduation Plan | No | Reference | | | | | |
| | Yes | | -0.37 | 0.28 | 1.76 | 0.67 | 0.40, 1.20 |

* $p < 0.05$, *** $p < 0.001$.

urban areas. The basic higher ratio of structure of fair/good self-perceived family economic status was found in urban ($\chi^2 = 24.933$, $p < 0.0001$) areas. Students from rural areas are more prone to depression unlikely to make a determined graduation plan, and their suicidal ideation was worth noticeable in case these of stressful life events, leading to more depression and less life satisfaction among Chinese rural-to-urban migrant college students. This may attribute to the gap in urban-rural economic development (25).

Intriguingly, when data from respondents were categorized based on their household formation, longer physical time per week (one-multiple: $1.78 \pm 2.07 - 1.12 \pm 1.43$, $p = 0.045$) was observed in the only-child families after the restrictions. Students from these only-child families seemed to be more inclined to make a clear future plan ($p = 0.007$). It could be attributed to the more family support in traditional one-child Chinese family structure, where all the paternal care and attention were focused on the only child. Consequently, more resource allocation and assistance during growth events can facilitate early goal and ideal setting.

Multivariate logistic regression analysis was a valid tool for fully utilizing the information of data, and eliminating/controlling the influence of confounding variables with an obtained adjusted OR, thereby explaining the relationship between the response variable and the influencing factors after adjusting for confounding factors. Therefore, logistic regression model was selected for assessing the factors that influence the aimed mental symptoms and utilize influencing factors to facilitate the establishment of subsequent symptom prediction models. Our study revealed that senior students

were more prone to stress before January, a period when neither normal job nor study have been settled. Stress symptoms were associated with greater age, less physical activity days, and undetermined future plan, while anxiety symptoms were inclined with greater stress, depression, insomnia level, and undetermined future plan. Depressive symptoms were also associated with greater stress, anxiety, insomnia level, suicidal ideation, and lower level of self-reported well-being.

Generally, high resilience was negatively correlated with suicidal ideation, while academic stress was not negatively correlated only when participants with low or moderate levels of resilience showed a positive association between stress and suicidal ideation (26). However, approximately 98.08% of Chinese postgraduates studying stomatology experienced at least moderate stress after the COVID-19 restrictions, most of whom were considered as having high resilience through regular psychological assessment. However, it is important to notice that suicidal ideation could be heightened by increased academic stress with associated anxiety and depression among postgraduates. Thus, it is necessary to timely guide them, culturing with ideal adaptive coping strategies and greater resilience to mitigate the tendency of academic stress leading to suicidal ideation.

In summary, the present study exhibited several strengths. First, based on the enrollment scale and distribution of dental majors' postgraduates in China, it represented the most extensive and proportional sample survey on the mental health of dental postgraduates after the COVID-19 pandemic restrictions. Second, the

study reveals a significant proportion of mental issues among postgraduate students. Inspired by the findings of this study, we can make valuable suggestions for psychological interventions on postgraduates, which should be timely and appropriately implemented by strengthening well-being and good physique to reduce the psychological harm after the COVID-19 restrictions, when students bothered by the epidemic start to live up with its aftereffect. And provided related guidance for preventing postgraduate students' mental problems, especially for these key susceptible groups and at some essential timepoints, including medical students, female groups, students in Grade 3 or from rural areas and timepoint before graduation earlier than January when job and current/further study were neither settled.

However, the sample size of this study was limited, and the sampling number of 25 universities was limited as well. Considering the aim of this study, the selected universities merely included those undergraduate institutions providing a postgraduate program in stomatology, without vocational and technical colleges. The career plans and psychological qualities of graduates from different universities vary greatly. In addition, given that this is a cross-sectional study, the actual cause-effect could not be inferred. Although logistic regression models were utilized in this study for better control of confounding factors, some mediating variables cannot be fully explained. All these findings should only be interpreted with caution due to potential confounding factors and temporal variations. More rigorous follow-up and intervention research are needed for cause-effect and temporal variation analysis.

Conclusion

Approximately 98.08% of Chinese postgraduates studying stomatology reported experiencing at least moderate stress, following COVID-19 restrictions. Female students were found more likely to suffer from stress, depression and anxiety, and less energetic during physical exercise. Students from rural areas tended to be more depressive, and their suicidal ideation was worth noticeable. Senior students were particularly prone to stress before January when neither employment nor studies had been secured. Risk factors for stress symptoms included older age and higher levels of depression and anxiety. Meanwhile, risk factors for anxiety symptoms included higher levels of stress, depression, and insomnia. Protective factors for relieving anxiety included owning clear graduation plan timely. Depressive symptoms were associated with higher levels of stress, anxiety, insomnia, and suicidal ideation and lower levels of subjective well-being. Therefore, timely and appropriate psychological interventions for postgraduates should implemented by strengthening subjective well-being and good physique to reduce the psychological harm after the COVID-19 restrictions as students begin to cope with the aftermath of the epidemic.

Data availability statement

The original contributions presented in the study are included in the article/[Supplementary material](#), further inquiries can be directed to the corresponding authors.

Ethics statement

The studies involving humans were approved by Medical Ethical Committee of Stomatology Hospital of Xi'an Jiaotong University. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

YuZ: Writing – original draft, Methodology, Data curation, Conceptualization. YJ: Writing – original draft, Methodology, Data curation, Conceptualization. MM: Writing – original draft, Methodology, Data curation, Conceptualization. YMi: Writing – review & editing, Investigation, Data curation. YMe: Writing – review & editing, Investigation, Data curation. TS: Writing – review & editing, Investigation, Data curation. HS: Writing – review & editing, Investigation, Data curation. YifZ: Writing – review & editing, Investigation, Data curation. YikZ: Writing – review & editing, Investigation, Data curation. RZ: Writing – review & editing, Supervision, Methodology. LN: Writing – review & editing, Funding acquisition. SD: Writing – review & editing, Writing – original draft, Funding acquisition.

Funding

The author(s) declare financial support was received for the research, authorship, and/or publication of this article. This study is supported by the National Natural Science Foundation of China (82102221).

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpubh.2024.1376540/full#supplementary-material>

References

- Pan A, Liu L, Wang C, Guo H, Hao X, Wang Q, et al. Association of public health interventions with the epidemiology of the COVID-19 outbreak in Wuhan, China. *JAMA*. (2020) 323:1915–23. doi: 10.1001/jama.2020.6130
- Foulkes L, Blakemore SJ. Individual differences in adolescent mental health during COVID-19: the importance of peer relationship quality. *Neuron*. (2021) 109:3203–5. doi: 10.1016/j.neuron.2021.07.027
- Peng P, Hao Y, Liu Y, Chen S, Wang Y, Yang Q, et al. The prevalence and risk factors of mental problems in medical students during COVID-19 pandemic: a systematic review and meta-analysis. *J Affect Disord*. (2023) 321:167–81. doi: 10.1016/j.jad.2022.10.040
- Chang JJ, Ji Y, Li YH, Pan HF, Su PY. Prevalence of anxiety symptom and depressive symptom among college students during COVID-19 pandemic: a meta-analysis. *J Affect Disord*. (2021) 292:242–54. doi: 10.1016/j.jad.2021.05.109
- Anteneh RM, Dessie AM, Azanaw MM, Anley DT, Melese BD, Feleke SF, et al. The psychological impact of COVID-19 pandemic and associated factors among college and university students in Ethiopia: a systematic review and meta-analysis, 2022. *Front Public Health*. (2023) 11:1136031. doi: 10.3389/fpubh.2023.1136031
- Li Y, Liang M, Gao L, Ayaz Ahmed M, Uy JP, Cheng C, et al. Face masks to prevent transmission of COVID-19: a systematic review and meta-analysis. *Am J Infect Control*. (2021) 49:900–6. doi: 10.1016/j.ajic.2020.12.007
- Humer E, Dale R, Plener PL, Probst T, Pieh C. Assessment of mental health of high school students 1 semester after COVID-19-associated remote schooling measures were lifted in Austria in 2021. *JAMA Netw Open*. (2021) 4:e2135571. doi: 10.1001/jamanetworkopen.2021.35571
- Kaltschik S, Pieh C, Dale R, Probst T, Pammer B, Humer E. Assessment of the long-term mental health effects on Austrian students after COVID-19 restrictions. *Int J Environ Res Public Health*. (2022) 19:13110. doi: 10.3390/ijerph192013110
- Conteh I, Yan J, Dovi KS, Bajinka O, Massey IY, Turay B. Prevalence and associated influential factors of mental health problems among Chinese college students during different stages of COVID-19 pandemic: a systematic review. *Psychiatry Res Commun*. (2022) 2:100082. doi: 10.1016/j.psychom.2022.100082
- Topp CW, Østergaard SD, Søndergaard S, Bech P. The WHO-5 well-being index: a systematic review of the literature. *Psychother Psychosom*. (2015) 84:167–76. doi: 10.1159/000376585
- Fung SF, Kong CYW, Liu YM, Huang Q, Xiong Z, Jiang Z, et al. Validity and psychometric evaluation of the Chinese version of the 5-item WHO well-being index. *Front Public Health*. (2022) 10:872436. doi: 10.3389/fpubh.2022.872436
- Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med*. (2006) 166:1092–7. doi: 10.1001/archinte.166.10.1092
- Jiang C, Ma H, Luo Y, Fong DYT, Umucu E, Zheng H, et al. Validation of the Chinese version of the perceived stress Scale-10 integrating exploratory graph analysis and confirmatory factor analysis. *Gen Hosp Psychiatry*. (2023) 84:194–202. doi: 10.1016/j.genhosppsych.2023.07.008
- Simon PD. The 10-item perceived stress scale as a valid measure of stress perception. *Asia Pac Psychiatry*. (2021) 13:e12420. doi: 10.1111/appy.12420
- Leung DYP, Mak YW, Leung SF, Chiang VCL, Loke AY. Measurement invariances of the PHQ-9 across gender and age groups in Chinese adolescents. *Asia Pac Psychiatry*. (2020) 12:e12381. doi: 10.1111/appy.12381
- Manea L, Boehnke JR, Gilbody S, Moriarty AS, McMillan D. Are there researcher allegiance effects in diagnostic validation studies of the PHQ-9? A systematic review and meta-analysis. *BMJ Open*. (2017) 7:e015247. doi: 10.1136/bmjopen-2016-015247
- Morin CM, Belleville G, Bélanger L, Ivers H. The insomnia severity index: psychometric indicators to detect insomnia cases and evaluate treatment response. *Sleep*. (2011) 34:601–8. doi: 10.1093/sleep/34.5.601
- Dienlin T, Johannes N. The impact of digital technology use on adolescent well-being. *Dialogues Clin Neurosci*. (2020) 22:135–42. doi: 10.31887/DCNS.2020.22.2/dienlin
- Cramer H, Lauche R, Klose P, Lange S, Langhorst J, Dobos GJ. Yoga for improving health-related quality of life, mental health and cancer-related symptoms in women diagnosed with breast cancer. *Cochrane Database Syst Rev*. (2017) 1:Cd010802. doi: 10.1002/14651858.CD010802.pub2
- Bull FC, Al-Ansari SS, Biddle S, Borodulin K, Buman MP, Cardon G, et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *Br J Sports Med*. (2020) 54:1451–62. doi: 10.1136/bjsports-2020-102955
- Inauen J, Zhou G. Health and well-being in the early stages of the Covid-19 pandemic: insights from applied psychology. *Appl Psychol Health Well Being*. (2020) 12:937–45. doi: 10.1111/aphw.12245
- Gibbs H, Liu Y, Pearson CAB, Jarvis CI, Grundy C, Quilty BJ, et al. Changing travel patterns in China during the early stages of the COVID-19 pandemic. *Nat Commun*. (2020) 11:5012. doi: 10.1038/s41467-020-18783-0
- Fu W, Yan S, Zong Q, Anderson-Luxford D, Song X, Lv Z, et al. Mental health of college students during the COVID-19 epidemic in China. *J Affect Disord*. (2021) 280:7–10. doi: 10.1016/j.jad.2020.11.032
- Mansueto G, Faravelli C. Stressful life events and psychosis: gender differences. *Stress Health*. (2022) 38:19–30. doi: 10.1002/smi.3067
- Jiang Y, Zhang J, Ming H, Huang S, Lin D. Stressful life events and well-being among rural-to-urban migrant adolescents: the moderating role of the stress mindset and differences between genders. *J Adolesc*. (2019) 74:24–32. doi: 10.1016/j.adolescence.2019.05.005
- Okechukwu FO, Ogba KTU, Nwufo JI, Ogba MO, Onyekachi BN, Nwanosike CI, et al. Academic stress and suicidal ideation: moderating roles of coping style and resilience. *BMC Psychiatry*. (2022) 22:546. doi: 10.1186/s12888-022-04063-2