

Factors Influencing Mental Health among Chinese Medical and Non-medical Students in the Early Stage of COVID-19 Pandemic

Peng Xiong

Jinan University <https://orcid.org/0000-0002-4092-8028>

Wai-kit Ming

Jinan University

Caiyun Zhang

Jinan University

Jian Bai

Jinan University

Chaohua Luo

Jinan University

Wenyuan Cao

Jinan University

Fan Zhang

Jinan University

Qian Tao (✉ taoqian16@jnu.edu.cn)

Jinan University

Research

Keywords: Anxiety, Depression, Stress, Pandemic of COVID-19, University students.

Posted Date: January 9th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-139929/v1>

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Abstract

Background: The 2019 coronavirus disease (COVID-19) pandemic is a public health emergency of international concern. This study aimed to assess the psychological outcomes and their influencing factors among medical and non-medical university students during the COVID-19 pandemic in China.

Methods: A cross-sectional online survey using structured questionnaires was conducted from 20 February to 20 March 2020. Psychological outcomes were assessed according to the Depression, Anxiety, and Stress Scale (DASS-21). Influencing factors were assessed by COVID-19 knowledge, mindful coping scale, and sense of control scale.

Results: Our sample comprises of 563 university students (male = 172, mean age = 21.52). Among them, 382 are medical students. Among the participants, 12.26%, 18.47%, and 8.53% of them have moderate to severe levels of depression, anxiety, and stress symptoms, respectively. Compared with the non-medical students, the medical students had a higher knowledge level of COVID-19, a higher sense of awareness, and fewer mental health symptoms. After controlling the covariance, perceived constraints of sense of control were negatively associated with depression, anxiety, and stress among both medical and non-medical students. Prevention of negative emotions by mindful coping was negatively associated with depression and anxiety among non-medical students. Knowledge of COVID-19 is not associated with mental distress among medical and non-medical students.

Conclusions: During the COVID-19 pandemic in China, the mental health of university students was affected. Our findings suggested that a sense of control is a protective factor for both medical and non-medical students, while mindful coping is a protective factor for only non-medical students.

Background

An outbreak of novel coronavirus disease-19 (COVID-19) infection is spreading internationally [1]. On January 30, 2020, the World Health Organization (WHO) declared the global COVID-19 outbreak a public health emergency of international concern [2]. According to the statistics released by the WHO, there have been over 62,000,000 confirmed cases of COVID-19 infection worldwide, with at least 1,500,000 deaths as of December 2020. To efficiently cope with the COVID-19 pandemic, the Chinese government implemented rapid and comprehensive public health emergency interventions. For instance, schools and other public places were closed, and students were encouraged to stay at home.

The COVID-19 pandemic has a negative impact not only on physical health but also on psychological well-being, particularly when the outbreak lasts longer and is still developing. The psychological consequences of COVID-19 have been reported to include depressed mood, anxiety, poor sleep, and increased stress level [3]. The COVID-19 pandemic, with its rapid spread and high mortality, constitutes a unique case of an acute, large-scale, and uncontrollable stressor. It is well established that stress can have a significant effect on individuals' psychological well-being, particularly when the individual cannot cope with the stress [4]. Sufficient knowledge and concrete information about the COVID-19 would help to better cope with it. A wide range of medical knowledge was involved in this newly emerging disease, such as the clinical presentations of coronavirus pneumonia, its pathogenesis, current transmission status, and prevention and control methods. We expected that students with more knowledge on COVID-19 would be able to better cope with it.

Coping strategy is another determinant in how individuals would react to major stressors such as the pandemic of COVID-19. Previous literature has found that mindful coping is a protective factor when dealing with stressful events [5]. Four aspects of mindful coping were identified, including awareness, distraction, preventing negative emotions, and constructive self-assertion [6]. Accumulating evidence has suggested that mindful coping effectively reduces stress and anxiety in college students [7]. Facing this critical situation, students with a higher level of mindful coping are expected to be better cope with the pandemic of COVID-19.

Another potential factor influencing psychological outcomes under the effects of the COVID-19 pandemic is a sense of control. Sense of control has been described as a cognitive style that attributes life outcomes to personal behavior and abilities or to external forces such as powerful others, chance, or luck [8]. A high sense of control is related to positive psychological outcomes, whereas an impaired sense of control is associated with depression and anxiety [9, 10]. With regard to university students, a higher sense of control is related to better college adjustment among first-year women students [11] and a higher grade point average (GPA) [12]. When dealing with the COVID-19 outbreak, students with a higher sense of control are expected to be better cope with mental distress.

The present study performed a web-based cross-sectional study to assess the psychological impact of the COVID-19 pandemic on medical students and to compare their responses with non-medical students. We hypothesize that the knowledge of COVID-19, mindful

coping, and a sense of control are protective factors on mental health when the students facing the COVID-19 pandemic.

Methods

Setting and sample

A cross-sectional survey using structured questionnaires was conducted among university students at Jinan University in Guangzhou, Guangdong, China. The data was collected from 20 Feb. to 20 Mar. 2020. During this period, most areas in China were still under the influence of the COVID-19 pandemic. Given the situation, online questionnaires were distributed to university students via WeChat, Whatsapp, and email. Five hundred and sixty-two participants have taken part in the study. The study was approved by the ethics committee of Jinan University, and participants have provided e-written consents before they answer the questions. After completion of the questionnaire, participants would have a chance to win an RMB 20 coupon in a lucky draw.

Instruments

The questionnaires consisted of COVID-19 knowledge, mindful coping, sense of control, and mental health. Participants' demographic information was collected, including age, gender, grade, education level, academic major, residence location during the pandemic, and whether confirmed or suspected patients were around.

COVID-19 knowledge: The knowledge questionnaire items were developed based on the Diagnosis and Treatment of COVID-19, National Health Commission, the People's Republic of China (http://www.gov.cn/zhengce/zhengceku/2020-02/19/content_5480948.htm). In total, there were 23 true/false questions, including two questions regarding the characteristics of coronavirus (e.g., coronavirus is sensitive to heat and UV irradiation), four questions regarding transmission route (e.g., the "silent carriers" who showed no symptoms may also pass the virus to others), four regarding clinical presence (e.g., the light symptoms of COVID-19 include fever and fatigue, and may not show the symptoms of pneumonia), six regarding diagnosis and treatment (e.g., no effective pharmacological treatment for COVID-19 has been developed), and seven questions regarding preventative methods (e.g., using 75% alcohol could be an effective agent against the virus). For each question, participants were asked to respond on a true/false/I don't know basis. A total score, ranging from 0–23, was obtained by counting the total number of correct answers, with a higher score indicating a higher level of COVID-19 knowledge. The Cronbach alpha in our sample was 0.76, indicating good reliability.

Sense of control: The Chinese version of a 12-item sense of control scale was adopted [13]. It includes two subscales: the personal mastery subscale assesses how people feel they can control themselves (e.g., whether I can get what I want with my own hands), and the perceived constraint subscale evaluates how people feel they cannot control the outcome (e.g., I often feel helpless in dealing with the problems of life). Participants were asked to rate on a 7-point Likert scale (1 = strongly agree, 7 = strongly disagree). After reversely coding the items in the personal mastery subscale, the average score of all items was obtained, with a higher score suggesting a greater sense of control. A previous study in a Chinese sample suggested good reliability and validity of the scale [14], and in our sample, a Cronbach alpha was 0.77, 0.82, and 0.85 for the personal mastery subscale, the perceived constraint subscale, and the whole scale, respectively.

Mindful coping

The mindful coping scale developed by Tharaldsen et al. was adopted in our study [6]. The questionnaire was translated from English to Chinese by an author (FZ), and then it was back-translated by two authors (QT and PX) independently. The scale consisted of 23 items, evaluating an individual's level of awareness, distraction, negative emotions prevention, and constructive self-assertion. With a 5-point Likert scale (1 = never/hardly ever, 5 = always), participants were asked to choose how they will react when facing difficulties. Total scores of the whole set and four subscales were generated, with a higher score indicating a higher level of mindful coping. In our sample, the Cronbach alpha was 0.74, 0.82, 0.77, 0.89, and 0.89 for the awareness subscale, distraction subscale, negative emotions prevention subscale, constructive self-assertion subscale, and the whole scale, respectively. It suggested good reliability of the Chinese version.

Mental health

The individuals' mental health was assessed by the Chinese version of the 21-item Depression Anxiety Stress Scale (DASS-21) [15]. The DASS-21 is a well-developed instrument evaluating an individual's level of depression, anxiety, and stress, with seven items in each subscale. Using a four-point Likert scale, it asked participants whether the described situation applies to them by choosing from 0 "did not apply to me at all" to 3 "applied to me very much." The total score of each subscale was multiplied by two and ranged from 0 to 42. A

higher score means a more severe level of depression, anxiety, and stress. The total score 0–13, 0–9, 0–18 of the subscale means a normal to mild level of depression, anxiety, and stress, respectively. A total score equal to and higher than 14, 10, 19 means the moderate to severe level of depression, anxiety, and stress, respectively [16]. In our sample, the Cronbach alpha was 0.81, 0.80, and 0.87 for the depression subscale, anxiety subscale, and stress subscale, respectively. It suggested an excellent reliability.

Data analysis

Descriptive statistics were analyzed for the demographic variables and scores of measurements questionnaires and scales. Continuous variables were described with mean and standard deviation, and the categorical variables were described with cases (n) and percentage (%). Independent two-sample t-tests to compare continuous variables and chi-square tests for categorical variables were conducted between medical and non-medical students, respectively. Pearson correlation was used to calculate the associations between these variables. Linear regression was performed to estimate the associations between knowledge, sense of control, mindful coping, and mental health status. Univariate analyses were used in Model 2. Model 2 was adjusted for all the demographic variables. All the statistical analysis was performed with STATA software 14.2 (STATA Corp., TX, US). P-value < 0.05 with two tails was considered to be statistically significant.

Results

Participants characteristics

A total of 563 university students were recruited. Among them, 382 are medical students, and 181 are from other majors such as economics, law, education, and history. The average age was 21.52 (2.50) years old, and the majority (83.36%) were undergraduate students. Of 12.26%, 18.47%, and 8.53% of students have moderate to severe levels of depression, anxiety, and stress symptoms, respectively. The percentage of those having moderate to severe mental symptoms is higher among non-medical students than medical students. See Table 1.

Table 1
Characteristics of the participants

| Items | All n (%) / mean ± SD | Medical students n (%) / mean ± SD | Non-medical students n (%) / mean ± SD | P value |
|---|-----------------------------|---|--|---------|
| Gender | | | | |
| Male | 172 (30.55) | 126(32.98) | 46(25.41) | 0.069 |
| Female | 391 (69.45) | 256(67.02) | 135(74.59) | |
| Age | 21.52 ± 2.50 | 21.34 ± 2.43 | 21.90 ± 2.59 | 0.324 |
| Education level | | | | |
| Bachelor | 456(83.36) | 322(85.41) | 134(78.82) | 0.012* |
| Master | 83(15.17) | 53(14.06) | 30(17.65) | |
| Doctoral | 8(1.46) | 2(0.53) | 6(3.53) | |
| Residence location during the COVID-19 pandemic | | | | |
| Hubei Province | 9(1.60) | 5(1.31) | 4(2.21) | 0.109 |
| Mainland China (Except Hubei) | 505(89.70) | 342(89.53) | 163(90.06) | |
| Hong Kong SAR, China | 20(3.55) | 12(3.14) | 8(4.42) | |
| Macao SAR, China | 13(2.31) | 13(3.40) | 0(0.00) | |
| Foreign countries | 16(2.84) | 10(2.62) | 6(3.31) | |
| Any confirmed/suspected patients with COVID-19 around you | | | | |
| Yes | 10(1.78) | 4(1.05) | 6(3.31) | 0.057 |
| No | 553(98.22) | 378(98.95) | 175(96.69) | |
| Depression | | | | |
| Normal to mild | 494(87.74) | 341(89.27) | 153(84.53) | 0.109 |
| Moderate to severe | 69(12.26) | 41(10.73) | 28(15.47) | |
| Anxiety | | | | |
| Normal to mild | 459(81.53) | 324(84.82) | 135(74.59) | 0.003** |
| Moderate to severe | 104(18.47) | 58(15.18) | 46(25.41) | |
| Stress | | | | |
| Normal to mild | 515(91.47) | 359(93.98) | 156(86.19) | 0.002** |
| Moderate to severe | 48(8.53) | 23(6.02) | 25(13.81) | |
| Note: * = $p < .05$; ** = $p < .01$ | | | | |

Average scores and associations of measurements among medical and non-medical students

There was a statistical significance of scores on knowledge of COVID-19, awareness subscale of mindful coping scale, and three dimensions of DASS-21. The results indicated that the medical students had a higher level of knowledge, a higher sense of awareness, and fewer mental health symptoms. See Table 2.

Table 2
Average scores of knowledge, mindful coping, sense of control, and mental health among participants

| Items | Medical students (mean ± SD) | Non-medical students (mean ± SD) | <i>P value</i> |
|--|---------------------------------|-------------------------------------|----------------|
| Knowledge of COVID-19 | 15.10 ± 3.36 | 13.29 ± 3.81 | <0.01** |
| Total score of sense of control | 4.41 ± 0.78 | 4.28 ± 0.74 | 0.51 |
| Score of personal mastery subscale | 5.06 ± 0.90 | 4.94 ± 0.91 | 0.88 |
| Score of perceived constraints subscale | 4.08 ± 0.90 | 3.95 ± 0.83 | 0.27 |
| Total score of mindful coping scale | 78.31 ± 11.23 | 76.52 ± 11.78 | 0.08 |
| Score of awareness subscale | 19.88 ± 3.46 | 19.06 ± 3.24 | 0.01* |
| Score of distraction subscale | 23.30 ± 4.85 | 23.22 ± 4.79 | 0.86 |
| Score of preventing negative emotions subscale | 17.08 ± 3.39 | 16.55 ± 3.59 | 0.09 |
| Score of constructive self-assertion subscale | 18.06 ± 3.36 | 17.70 ± 3.55 | 0.24 |
| Score of depression | 2.34 ± 3.13 | 3.23 ± 3.49 | 0.003** |
| Score of anxiety | 2.30 ± 3.03 | 2.96 ± 3.32 | 0.02* |
| Score of stress | 2.78 ± 3.59 | 4.13 ± 4.27 | <0.01** |
| Note: * = $p < .05$; ** = $p < .01$ | | | |

Correlation Results Among Medical And Non-medical Students

Among the medical students, the knowledge score was significantly correlated with the total scores of sense of control ($r = 0.13$), personal mastery subscale ($r = 0.17$), total score of mindful coping scale ($r = 0.20$) and its four subscales, respectively. Total score of sense of control was significantly correlated with scores of depression ($r = -0.46$), anxiety ($r = -0.43$), and stress ($r = -0.44$). Total score of mindful coping scale was also significantly correlated with scores of depression ($r = -0.21$), anxiety ($r = -0.18$), and stress ($r = -0.20$). See Table 3. Among the non-medical students, the knowledge score was significantly correlated with the total score of sense of control ($r = 0.24$), personal mastery subscale ($r = 0.23$), perceived constrains subscale ($r = 0.20$), but not other scales. Total score for sense of control was significantly correlated with scores of depression ($r = -0.50$), anxiety ($r = -0.43$), and stress ($r = -0.43$). Total score for mindful coping scale was also significantly correlated with scores of depression ($r = -0.25$), anxiety ($r = -0.22$), and stress ($r = -0.15$). (Table 4)

Table 3

The associations between knowledge and sense of control, mindful coping, and mental health among medical students

| Items | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|--------|---------|---------|---------|---------|---------|---------|---------|---------|--------|--------|----|
| 1. Knowledge of COVID-19 | 1 | | | | | | | | | | | |
| 2. Total score of sense of control | 0.13* | 1 | | | | | | | | | | |
| 3. Score of personal mastery subscale | 0.17** | 0.72** | 1 | | | | | | | | | |
| 4. Score of perceived constraints subscale | 0.08 | 0.94** | 0.44** | 1 | | | | | | | | |
| 5. Total score of mindful coping scale | 0.20** | 0.46** | 0.49** | 0.34** | 1 | | | | | | | |
| 6. Score of awareness subscale | 0.13* | 0.28** | 0.32** | 0.21** | 0.71** | 1 | | | | | | |
| 7. Score of distraction subscale | 0.15** | 0.32** | 0.34** | 0.25** | 0.81** | 0.39** | 1 | | | | | |
| 8. Score of preventing negative emotions subscale | 0.21** | 0.47** | 0.51** | 0.35** | 0.77** | 0.39** | 0.55** | 1 | | | | |
| 9. Score of constructive self-assertion subscale | 0.11* | 0.30** | 0.32** | 0.22* | 0.67** | 0.40** | 0.32** | 0.36** | 1 | | | |
| 10. Score of depression | -0.003 | -0.46** | -0.30** | -0.45** | -0.21** | -0.10 | -0.17** | -0.27** | -0.08 | 1 | | |
| 11. Score of anxiety | -0.01 | -0.43** | -0.25** | -0.43** | -0.18** | -0.16** | -0.06 | -0.20** | -0.16** | 0.72** | 1 | |
| 12. Score of stress | -0.01 | -0.44** | -0.26** | -0.44** | -0.20** | -0.16** | -0.09 | -0.19** | -0.16** | 0.76** | 0.83** | 1 |
| Note: * = $p < .05$; ** = $p < .01$ | | | | | | | | | | | | |

Table 4

The associations between knowledge and sense of control, mindful coping, and mental health among non-medical students

| Items | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|--------|---------|---------|---------|---------|---------|--------|---------|--------|--------|--------|----|
| 1. Knowledge of COVID-19 | 1 | | | | | | | | | | | |
| 2. Total score of sense of control | 0.24** | 1 | | | | | | | | | | |
| 3. Score of personal mastery subscale | 0.23** | 0.75** | 1 | | | | | | | | | |
| 4. Score of perceived constraints subscale | 0.20** | 0.93** | 0.45** | 1 | | | | | | | | |
| 5. Total score of mindful coping scale | 0.09 | 0.38** | 0.41** | 0.28** | 1 | | | | | | | |
| 6. Score of awareness subscale | 0.12 | 0.18** | 0.21** | 0.13 | 0.61** | 1 | | | | | | |
| 7. Score of distraction subscale | 0.07 | 0.27** | 0.34** | 0.17* | 0.87** | 0.35** | 1 | | | | | |
| 8. Score of preventing negative emotions subscale | 0.04 | 0.41** | 0.43** | 0.31** | 0.81** | 0.29** | 0.67** | 1 | | | | |
| 9. Score of constructive self-assertion subscale | 0.07 | 0.32** | 0.28** | 0.27** | 0.77** | 0.36** | 0.54** | 0.50** | 1 | | | |
| 10. Score of depression | -0.01 | -0.50** | -0.34** | -0.48** | -0.25** | -0.15* | -0.14 | -0.35** | -0.16* | 1 | | |
| 11. Score of anxiety | -0.05 | -0.43** | -0.25** | -0.34** | -0.22** | -0.21** | -0.10 | -0.27** | -0.14 | 0.83** | 1 | |
| 12. Score of stress | -0.04 | -0.43** | -0.23** | -0.46** | -0.15* | -0.16* | -0.04 | -0.26** | -0.04 | 0.84** | 0.82** | 1 |

Note: * = $p < .05$; ** = $p < .01$

Regression Results Among Medical And Non-medical Students

In regression model 1, among medical and non-medical students, perceived constraints of sense of control were significantly associated with depression, anxiety, and stress symptoms, respectively. The significant results remained the same after controlling for the demographic variables in model 2. The distraction subscale of mindful coping was significantly associated with anxiety among medical students. Negative emotion prevention of mindful coping was significantly associated with depression and anxiety among non-medical students. Both awareness and negative emotions prevention of mindful coping were significantly associated with anxiety and stress among non-medical students. Knowledge is not associated with mental distress among medical and non-medical students. See Table 5 and Table 6.

Table 5
Regression model among medical students

| | Items | Depression | | | | Anxiety | | | | Stress | | | |
|---|---------------------------------------|------------|-------|-------|----------|---------|-------|-------|----------|--------|-------|-------|----------|
| | | Coef. | Beta | t | <i>p</i> | Coef. | Beta | t | <i>p</i> | Coef. | Beta | t | <i>p</i> |
| Model 1 | Knowledge | 0.06 | 0.04 | 1.35 | 0.18 | 0.06 | 0.64 | 1.30 | 0.19 | 0.04 | 0.04 | 0.08 | 0.42 |
| | Personal mastery subscale | -0.10 | 0.24 | -1.55 | 0.12 | -0.18 | -0.05 | -0.73 | 0.47 | -0.31 | -0.07 | -1.20 | 0.23 |
| | Perceived constraints subscale | -0.38 | 0.21 | -6.46 | <0.01** | -1.33 | -0.39 | -6.43 | <0.01** | -1.58 | -0.40 | -7.21 | <0.01** |
| | Awareness subscale | 0.03 | 0.05 | 0.60 | 0.55 | -0.07 | -0.08 | -1.25 | 0.21 | -0.07 | -0.07 | -1.16 | 0.25 |
| | Distraction subscale | -0.02 | 0.04 | -0.27 | 0.79 | 0.09 | 0.14 | 2.25 | 0.03* | 0.05 | 0.07 | 1.32 | 0.19 |
| | Preventing negative emotions subscale | -0.12 | 0.06 | -1.79 | 0.08 | -0.07 | -0.08 | -0.97 | 0.33 | -0.02 | -0.02 | -0.23 | 0.82 |
| | Self-assertion subscale | 0.06 | 0.05 | 1.25 | 0.21 | -0.05 | -0.05 | -0.88 | 0.38 | -0.04 | -0.04 | -0.70 | 0.49 |
| Model 2 | Knowledge | 0.04 | 0.05 | 0.89 | 0.37 | 0.05 | 0.06 | 1.10 | 0.27 | 0.03 | 0.03 | 0.64 | 0.52 |
| | Personal mastery subscale | -0.34 | -0.10 | -1.36 | 0.17 | -0.11 | -0.03 | -0.44 | 0.66 | -2.30 | -0.07 | -1.15 | 0.25 |
| | Perceived constraints subscale | -1.36 | -0.39 | -6.43 | <0.01** | -1.38 | -0.42 | -7.01 | <0.01** | -1.62 | -0.42 | -7.79 | <0.01** |
| | Awareness subscale | 0.03 | 0.03 | 0.60 | 0.55 | -0.06 | -0.07 | -1.19 | 0.23 | -0.07 | -0.07 | -1.15 | 0.25 |
| | Distraction subscale | -0.02 | -0.03 | -0.41 | 0.68 | 0.86 | 0.14 | 2.23 | 0.02* | 0.05 | 0.07 | 1.17 | 0.24 |
| | Preventing negative emotions subscale | -0.11 | -0.12 | -1.69 | 0.09 | -0.07 | -0.08 | -0.98 | 0.33 | -0.03 | -0.03 | -0.36 | 0.72 |
| | Self-assertion subscale | 0.09 | 0.09 | 1.59 | 0.11 | -0.02 | -0.03 | -0.42 | 0.67 | 0.007 | -0.01 | 0.11 | 0.91 |
| Note: Model 1 means the rude regression; Model 2 means the regression after control the demographic variables | | | | | | | | | | | | | |

Table 6
Regression model among non-medical students

| | Items | Depression | | | | Anxiety | | | | Stress | | | |
|---------|---------------------------------------|------------|-------|-------|----------|---------|-------|-------|---------|--------|-------|-------|----------|
| | | Coef. | Beta | t | p | Coef. | Beta | t | p | Coef. | Beta | t | p |
| Model 1 | Knowledge | 0.10 | 0.06 | 1.61 | 0.11 | 0.04 | 0.05 | 0.81 | 0.42 | 0.05 | 0.09 | 0.77 | 0.44 |
| | Personal mastery subscale | -0.11 | 0.31 | -1.35 | 0.18 | -0.09 | -0.02 | -0.29 | 0.77 | 0.02 | 0.003 | 0.05 | 0.96 |
| | Perceived constraints subscale | -0.39 | 0.33 | -4.86 | <0.01** | -1.57 | -0.40 | -4.75 | <0.01** | -2.23 | -0.44 | -5.59 | <0.01** |
| | Awareness subscale | -0.07 | 0.07 | -1.11 | 0.27 | -0.18 | -0.17 | -2.50 | 0.01* | -0.20 | -0.15 | -2.21 | 0.03* |
| | Distraction subscale | 0.15 | 0.06 | 1.72 | 0.09 | 0.10 | 0.15 | 1.78 | 0.07 | 0.17 | 0.19 | 2.32 | 0.02* |
| | Preventing negative emotions subscale | -0.30 | 0.09 | -3.19 | <0.002** | -0.20 | -0.21 | -2.26 | 0.03* | -0.34 | -0.29 | -3.45 | <0.001** |
| | Self-assertion subscale | 0.06 | 0.09 | 0.68 | 0.50 | 0.01 | 0.01 | 0.70 | 0.48 | 0.21 | 0.18 | 2.19 | 0.03* |
| Model 2 | Knowledge | 0.10 | 0.11 | 1.70 | 0.09 | 0.04 | 0.04 | 0.62 | 0.53 | 0.07 | 0.06 | 0.93 | 0.36 |
| | Personal mastery subscale | -0.49 | -1.22 | -1.35 | 0.18 | -0.06 | -0.02 | -0.18 | 0.52 | 0.00 | 0.00 | 0.00 | 1.00 |
| | Perceived constraints subscale | -1.51 | -0.36 | -4.58 | <0.01** | -1.67 | -0.41 | -4.66 | 0.86 | -2.20 | -0.42 | -5.10 | <0.01** |
| | Awareness subscale | -0.09 | -0.08 | -1.13 | 0.26 | -0.16 | -0.15 | -2.15 | <0.01** | -0.19 | -0.14 | -1.95 | 0.054 |
| | Distraction subscale | 0.11 | 0.14 | 1.54 | 0.13 | 0.09 | 0.13 | 1.41 | 0.16 | 0.15 | 0.17 | 1.97 | 0.05 |
| | Preventing negative emotions subscale | -0.33 | -0.33 | -3.48 | <0.001** | -0.23 | -0.25 | 2.80 | 0.006** | -0.41 | -0.34 | -3.94 | <0.01** |
| | Self-assertion subscale | 0.13 | 0.13 | 1.36 | 0.18 | 0.14 | 0.14 | 1.76 | 0.08 | 0.28 | 0.22 | 2.67 | 0.008** |

Note: Model 1 means the rude regression; Model 2 means the regression after control the demographic variables

Discussion

By conducting a web-based survey among 563 university students, the current study investigated the psychological effects of the COVID-19 pandemic on university students' mental health and examined the roles of knowledge about the pandemic, mindful coping, as well as sense of control. The findings showed that both mindful coping and a sense of control would benefit mental health for both medical and non-medical students. However, the effects of specific constructs in mindful coping and sense of control varied between medical and non-medical students.

Despite that medical students showed a higher level of knowledge about COVID-19 than non-medical students, knowledge did not exert any significant effect on the mental health of university students. At first glance, the result seemed inconsistent with our hypothesis and several recent findings. For instance, a study reported that a greater level of knowledge was associated with a more optimistic attitude and better preventive practice in a larger sample [17]. It is possible that the effect of knowledge is more important at the behavioral and attitude levels when predicting mental states, such as depression, anxiety, and stress. The role of knowledge could be reduced or even silenced by other psychological constructs, such as coping and sense of control.

In line with existing literature, a positive association between a sense of control and mental health was found among all students. A previous study investigating the relationship between sense of control and depression has found that across 23 countries, a higher sense of control was associated with fewer depressive symptoms among college students [18]. This protective effect could be because a sense of control may prompt individuals to locate attention to solutions and take actions in stressful situations [19]. In other words, people with a higher sense of control might be better prepared for upcoming stressors and find them less unbearable. Therefore, people with a higher sense of control displayed greater resilience in the outburst of COVID-19 and developed fewer symptoms of depression, anxiety, and stress.

Mindful coping, as a specific type of adaptive coping in facing stress, was found to primarily benefit non-medical students. In particular, among non-medical students, greater awareness about the situation was related to lower anxiety, and preventing negative emotions could lead to reduced anxiety, depression, and stress. However, among medical students, no effect was found of awareness and negative emotion prevention, while distraction showed a small but significant effect opposite to our hypothesis. A higher level of distraction (i.e., engaging in different senses such as looking at something beautiful or listening to something enjoyable) was associated with greater anxiety. This finding extended the existing evidence for the benefit of mindful coping and identified that awareness about a situation and preventing negative emotions seems more effective when coping with stress. The negative effect of distraction for medical students could be consistent with a previous study that found medical students have greater difficulties in connecting with the body or sensations, as their anatomic knowledge could intrude when trying to engage in the senses [20]. Meanwhile, it is also possible that they would “think about” the physiological reaction in negative ways instead of directly experiencing it, thus eliminating the relaxation effect of mindfulness. However, it is noteworthy that medical students showed better mental condition in facing COVID-19, i.e., lower depression, anxiety, and stress. This could be a result of their stressful training in daily life, which helps them become more habituated to stressful situations and less susceptible to the effects of COVID-19 and its related consequences.

Our findings have provided an updated profile of medical and non-medical students’ knowledge, coping, and psychological outcomes under the influence of the COVID-19 pandemic and addressed how mindful coping and a sense of control may benefit an individual’s mental health. However, there are a few limitations that should be acknowledged. First, as mentioned above, the effects of knowledge and coping may function at different levels, e.g., attitude, behavioral, or cognitive levels. By adopting more comprehensive assessments of outcomes, a clearer picture might be obtained of how university students face the contextual stress caused by the COVID-19 pandemic. Second, given that the outburst of COVID-19 is a recent situation, it is not possible to collect longitudinal data, which prevents us from understanding the effect of mindful coping and sense of control in the long run. Moreover, based on our findings, experiments, and intervention studies manipulating mindful coping and sense of control should be conducted to further explore the most effective ways of helping university students maintain better psychological health amid a pandemic like COVID-19.

Conclusion

To understand the coping strategies and mental status among medical and non-medical students, we have examined the roles of COVID-19 related knowledge, sense of control, and mindful coping in mental health. Surprisingly, no significant effect was found for knowledge. Meanwhile, sense of control was found to benefit both groups of students, while mindful coping, especially awareness about the situation and preventing negative emotions, was more beneficial for non-medical students. Therefore, to maintain the mental health of university students, support programs should take sense of control and mindful coping into consideration. Moreover, because non-medical students showed more symptoms of anxiety and depression in the pandemic, mindful-based intervention and programs to increase their sense of control should be provided.

Abbreviations

COVID-19: Novel coronavirus disease 2019; grade point average: GPA; DASS-21: 21-item Depression Anxiety Stress Scale.

Declarations

Acknowledgements

The authors would like to thank the student participants to participate the study.

Authors' contribution

PX contributed to data collection, data analysis, discussion on results, writing, and preparation of the manuscript. WM, CZ contributed to data collection, data analyses, writing, and preparation of the manuscript. CL, JB and WC contributed to data collection and data analyses. FZ and QT contributed to study design, data collection, results interpretation, discussion of results, writing, and preparation of the manuscript. All authors read and approved the final manuscript.

Funding

This study was supported by grants “the Fundamental Research Funds for the Central Universities” NO. 21619333 and “Moral Education Research Project for Teaching Science of Education Department of Guangdong” NO. 2019JKDY005.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Consent to participate

The study was approved by the ethics committee of Jinan University, and participants have provided e-written consents before they answer the questions.

Competing interests

The authors have no conflicts of interest to declare.

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