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# Psychological impact on COVID-19 patients during the outbreak in China: A case-control study

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## ABSTRACT

**Background:** The coronavirus disease 2019 (COVID-19) has caused widespread panic due to its highly infectious and pandemic transmission. We aimed to evaluate the psychological impact of the COVID-19 outbreak on infected subjects in China.

**Methods:** This case-control, survey-based study assessed the psychological status of COVID-19 patients and non-infected controls from February 10 to March 18, 2020, in China. Sex, age, education years, marital status, jobs, annual household income, living status, and geographic origin were matched between the two groups. The main outcome measures included anxiety, depression, insomnia, help-seeking behaviors, and treatment for mental problems.

**Results:** A total of 326 patients and 1304 (1:4 ratio) matched non-infected controls were enrolled. Compared with controls, patients had higher scores on the Beck Anxiety Inventory (BAI), Patient Health Questionnaire-9 (PHQ-9), and Insomnia Severity Index (ISI) (all  $p < 0.01$ ). Patients had higher rate of any mental problems (62.6% vs 42.5%,  $p < 0.01$ ), anxiety (27.3% vs 12.2%,  $p < 0.01$ ), depression (26.7% vs 14.6%,  $p < 0.01$ ), suicidal ideation (16.0% vs 10.7%,  $p < 0.01$ ), and insomnia (57.7% vs 36.7%,  $p < 0.01$ ). Among the subjects with mental problems, the proportion of seeking help (15.2% vs 6.9%,  $p < 0.01$ ) and receiving treatment (11.3% vs 4.3%,  $p < 0.01$ ) was higher in patients than controls.

**Conclusions:** Our study showed a higher prevalence of mental problems in COVID-19 patients compared to controls, suggesting a great psychological impact of COVID-19 infection. Our findings highlighted the urgent need for psychological assistance for COVID-19 patients.

## 1. Introduction

The COVID-19 is a novel type of coronavirus infectious disease which may cause the severe acute respiratory syndrome. It was initially reported in Wuhan City, Hubei Province, China, in December 2019 [Paules et al., 2020]. Since then, COVID-19 spread globally at an

unprecedented speed. As of 01 July 2020, the number of confirmed cases in the world has exceeded 10 million [WHO 2020]. Facing the harsh pandemic context, COVID-19 might have a great psychological impact on infected patients.

It was reported that infectious diseases, such as SARS and Ebola, were associated with various mental problems, including anxiety,

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depression, insomnia, and suicidal ideation. A previous study presented that 15% of Ebola virus disease survivors had psychological suffering, including 11 cases of severe depression in 256 subjects [Keita et al., 2017]. Another study reported similar findings that SARS survivors suffered a higher stress level compared with control subjects during the outbreak, and persisted at least 1 year [Lee et al., 2007]. The COVID-19, which has a higher transmission rate than the SARS and Ebola virus and without effective treatment at present, made people fall into an unprecedented state of panic [Epidemiology Working Group for NCIP Epidemic Response 2020]. The mental health of infected patients has been widely concerned, and corresponding measures have been formulated to address the mental problems [National Health Commission of the People's Republic of China 2020].

Although an increased level of mental distress has been reported in both the general public and frontline medical workers [Wang et al., 2020, Kang et al., 2020], the psychological impact of the COVID-19 on infected patients has rarely been systematically reported. The epidemic situation in China has greatly improved, while the psychological impact on patients is still an important issue, which is worthy of timely investigation and intervention. The current study aimed to assess the mental health of patients with COVID-19 during the epidemic in China.

## 2. Methods

### 2.1. Participants and data collection

This case-control study was approved by the Clinical Research Ethics Committee of Zhongnan Hospital of Wuhan University (Ref. No.: 2020030). From February 10, 2020, to March 18, 2020, a self-administered questionnaire was sent to participants via WeChat. We explained the purpose, methods, and cautions at the beginning of the questionnaire. To ensure that the data was not duplicated, each WeChat account or IP address was only allowed to complete the questionnaire once. The survey was conducted anonymously, and confidentiality of information was assured.

The inclusion criteria of the patient group were: 1) infected with COVID-19 and have been recorded in the Chinese Center for Disease Control and Prevention; 2) aged from 18 to 80 years old; 3) Chinese residents. Control subjects were selected from 9,951 non-infected members. The inclusion criteria were: 1) Not infected with COVID-19; 2) aged from 18 to 80 years old; 3) Chinese residents. Non-infected control subjects were matched to patients at a ratio of 4:1 by sex, age, education years, marital status, jobs, annual household income, living status and geographic origin (shown in Table 1), using the “MatchIt” package in R (Version 3.5.1; R Foundation for Statistical Computing, Vienna, Austria).

### 2.2. Measures and tools

The structured questionnaire employed in our study focused on three self-reported scales measuring mental health status, including anxiety, depression, and insomnia. Besides, demographic data and information about whether sought help or receive treatment for mental problems were also collected.

#### 2.2.1. Demographic information

Demographic characteristics, including age, sex, education years, marital status, jobs, annual household income, living status, and geographic origin, were collected.

#### 2.2.2. Scales measuring mental health status

The Beck Anxiety Inventory (BAI), a 21-item scale designed to assess peoples' subjective feelings about anxiety [Beck et al., 1988], was employed to evaluate anxiety symptoms. The responses were rated on a 4-point Likert scale ranging from 0 (not at all) to 3 (severely), with a total score from 0 to 63. Higher scores indicate more severe anxiety

**Table 1**

Demographic characteristics of patients with COVID-19 and non-infected controls.

	Patients with COVID-19 (n=326)	Non-infected controls (n=1304)	p value
Male	130 (39.9)	509 (39.0)	0.78
Age (years)	37.4 ± 10.9	36.8 ± 10.4	0.35
Education years	14.4 ± 3.7	14.5 ± 3.6	0.81
Unmarried status	41 (12.6)	153 (11.7)	0.67
Jobs			0.11
Students	1 (0.3)	11 (0.8)	
Medical workers	107 (32.8)	405 (31.1)	
Agriculture/industry/commerce occupations	40 (12.3)	176 (13.5)	
Management occupations	34 (10.4)	181 (13.9)	
Retired personnel	37 (11.3)	96 (7.4)	
Others	107 (32.8)	435 (33.4)	
Income (<80000 CNY/year)	216 (66.3)	844 (64.7)	0.60
Living alone	43 (13.2)	142 (10.9)	0.24
Geographic origin			0.87
Wuhan City	229 (70.2)	914 (70.1)	
Hubei province (excluding Wuhan City)	91 (27.9)	371 (28.5)	
Other areas in China <sup>a</sup>	6 (1.8)	19 (1.5)	

Data are presented as mean ± standard deviation or n (%).

Abbreviations: COVID-19: Coronavirus Disease 2019; CNY: Chinese Yuan;

<sup>a</sup> Other areas in China: including 22 provinces, 5 autonomous regions, 4 municipalities and 2 special administrative regions.

<sup>b</sup> The participants' exposure to the COVID-19 epidemic was estimated by the regional epidemic parameters.

symptoms. The Chinese version of BAI has been proved to be reliable and valid [Liang et al., 2018]. The suggested cutoff score for clinically significant anxiety is 16 [Beck & Steer, 1993], thus the score for detecting anxiety symptoms was 15 in our study.

The Patient Health Questionnaire-9 (PHQ-9), a 9-item questionnaire, was used to assess the depressive symptoms over the past 2 weeks. The Chinese version of the PHQ-9 has been reported to be valid and efficient for screening depression in the general Chinese population [Wang et al., 2014]. The total score ranges from 0 to 27, with a higher score indicating more severe symptoms [Kroenke et al., 2001]. The standard cut-off score for diagnosing possible major depression is 10 or above, and the cutoff score for depression was 10 in our study. We also estimated the suicidal ideation using the question “have you ever had suicidal ideation?”.

The Insomnia Severity Index (ISI) is a 7-item instrument assessing the severity of insomnia symptoms, the impact of sleep interference on daily activities, and the concern caused by sleep problems over the previous 2 weeks [Bastien et al., 2001]. Previous research has indicated that the Chinese versions of ISI had satisfactory reliability and could effectively distinguish insomnia symptoms [Chung et al., 2011]. Each item of the ISI is rated on a 5-point Likert scale of 0–4 and the total score ranges from 0 to 28. The cut-off score of ISI for diagnosing clinical insomnia in the Chinese population, and a score > 9 was defined as having insomnia symptoms in our study.

#### 2.2.3. Help-seeking or treatment for mental health during COVID-19

We also recorded whether participants have sought help or received treatment for mental problems during COVID-19, including anxiety, insomnia, depressed mood, and suicidal ideation. The question “have you ever sought help from psychiatrists or clinical psychologists since the outbreak of COVID-19?” was used to estimate help-seeking behavior. The question “have you ever received any treatment for psychiatric or psychological problems since the outbreak of COVID-19?” was used to measure treatment history for mental problems.

### 2.3. Statistical analysis

Continuous variables were presented as mean ± standard deviation.

Categorical variables were presented as proportions. Comparisons between the two groups in the demographic variables, mental disorders, help-seeking, and treatment for mental problems were conducted by Mann-Whitney U test or Chi-square test. Two-tailed  $p < 0.05$  indicated a statistically significant difference. Statistical analyses were performed using SPSS version 24.0 for Windows (Armonk, NY: IBM Corp).

### 3. Results

A total of 10,277 subjects completed the questionnaire, including 326 patients and 9,951 non-infected control subjects. After matching, 326 patients and 1,304 controls were finally included in this study. Their demographic characteristics are shown in Table 1. The enrolled patients had an average age of 37.4 years and an average education time of 14.4 years. Among the patients, 39.9% were male, 12.6% were unmarried, and 66.3% had an annual household income of <80,000 CNY per head.

Table 2 shows the prevalence of mental problems in both groups. 62.6% of the enrolled patients experienced mental problems, compared to 42.5% of control subjects ( $p < 0.01$ ). Patients had a higher rate of anxiety (27.3% vs 12.2%,  $p < 0.01$ ), a higher rate of depression (26.7% vs 14.6%,  $p < 0.01$ ), a higher rate of suicidal ideation (16.0% vs 10.7%,  $p < 0.01$ ), as well as a higher rate of insomnia (57.7% vs 36.7%,  $p < 0.01$ ), compared to control subjects. Besides, among the subjects who had mental problems, patients had a higher rate of seeking help from psychiatrists or clinical psychologists than controls (15.2% vs 6.9%,  $p < 0.01$ ), as well as a higher rate of receiving treatment (11.3% vs 4.3%,  $p < 0.01$ ).

Figure 1 displays the mental health scales scores for patients and controls. Compared to controls, patients had significantly higher scores of BAI (median 8.0, IQR 3.0-17.0 vs median 4.0, IQR 1.0-9.0,  $p < 0.01$ ), PHQ-9 (median 6.0, IQR 2.0-10.0 vs median 4.0, IQR 1.0-7.0,  $p < 0.01$ ), and ISI (median 11.0, IQR 5.0-16.0 vs median 6.0, IQR 2.0-11.0,  $p < 0.01$ ).

### 4. Discussion

Our study has shown that COVID-19 patients experienced a higher level of various common mental problems than controls. Besides, they are more likely to seek help and receive treatment to manage mental problems. These findings suggested that there is an urgent need to provide mental health services to those patients with COVID-19. One shall keep in mind that even the controls were experiencing significantly higher mental problems during the pandemic [Wang et al., 2020]. Therefore, the magnitude of the psychological impact on the infected patients shall be higher than what we have estimated.

**Table 2**

Mental disorders, help-seeking and treatment for mental problems of patients with COVID-19 and non-infected controls during COVID-19.

	Patients with COVID-19 (n=326)	Non-infected controls (n=1304)	p value
Any mental problems <sup>a</sup>	204 (62.6)	554 (42.5)	<0.001
Anxiety (BAI $\geq 16$ )	89 (27.3)	159 (12.2)	<0.001
Depression (PHQ-9 $\geq 10$ )	87 (26.7)	190 (14.6)	<0.001
Suicidal ideation	52 (16.0)	139 (10.7)	0.008
Insomnia (ISI $\geq 9$ )	188 (57.7)	478 (36.7)	<0.001
Help-seeking for mental problems <sup>a</sup>	31/204 (15.2)	38/554 (6.9)	<0.001
Treatment for mental problems <sup>a</sup>	23/204 (11.3)	24/554 (4.3)	<0.001

Data are presented as n (%).

Abbreviations: COVID-19: Coronavirus Disease 2019; BAI: the Beck Anxiety Inventory; PHQ-9: the 9-item Patient Health Questionnaire; ISI: the Insomnia Severity Index.

<sup>a</sup> Mental problems include anxiety, depression, suicidal ideation, and insomnia.

The prevalence of anxiety (27.3%), depression (26.7%) and insomnia (57.7%) among COVID-19 patients presented in our study was similar to previous research in China, which revealed that 20.8% of COVID-19 patients presented anxiety and 29.2% had depression [Zhang et al., 2020]. Previous studies also found that infectious diseases had psychological impacts on patients. It was reported that in the early stage of the SARS outbreak, general stress and negative psychological effects were increased in patients, accompanied by a range of mental problems, including persistent anxiety, depression, panic attacks, psychotic symptoms, and even suicidality [Chua et al., 2004, Maunder et al., 2003]. After discharge from the hospital, recovered SARS patients still suffered from mental problems for years [Lee et al., 2007, Cheng et al., 2004].

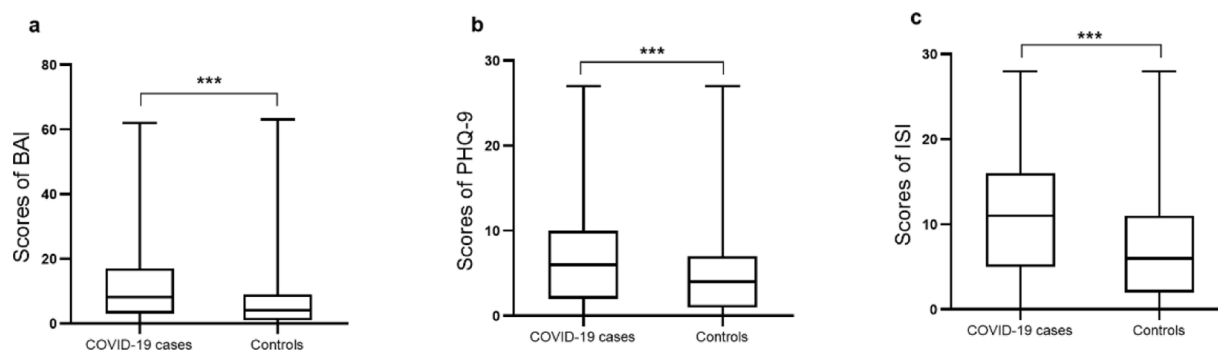
The psychological impact of COVID-19 on patients might be associated with the following reasons. Patients were infected by a new virus with high prevalence and mortality [National Health Commission of the People's Republic of China 2020], but without effective treatment at present. After the diagnosis, patients were kept in quarantine for at least 14 days, suffering from uncomfortable symptoms such as fatigue, fever, and respiratory disorders, experiencing the fear of death caused by disease progression, and lacking the solace of family members and friends. Besides, Human-to-human transmission was considered as a major transmission mode, patients would worry that they might unconsciously transmit the virus to the surrounding people, especially their relatives. Even after treatment and discharge, the uncertainty of still being virus carriers also brought great mental stress on them [Lan et al., 2020]. Moreover, the media's negative reports and hyped rumors exacerbated the panic. Finally, mental problems could interact with each other, which made matters worse. For example, sleep disorder was reported to be related to anxiety, 60-70% of patients with generalized anxiety disorder complained of sleep problems [Belanger et al., 2004, Papadimitriou & Linkowski, 2005]. Given the above-mentioned challenging circumstances, it was unsurprising that patients had a high prevalence of mental problems.

The potential mental problems related to the outbreak of COVID-19 has aroused widespread concern [Bao et al., 2020]. The National Health Commission of China has taken corresponding measures for emergency psychological crisis intervention, including the release of guidelines for psychological assistance hotlines during the COVID-19 epidemic [National Health Commission of China 2020]. In our study, patients were more likely to seek help and receive treatment for mental problems compared to controls, however, the rates were only 15.2% and 11.3% respectively. One reason may be that traditional face-to-face psychological intervention was hindered by the fast spread of the virus. In this particular case, the provision of online mental health services for those in need was a good choice with the popularization of internet services and smartphones [Liu et al., 2020]. Besides, Internet information during this period is very messy. Some bluffing rumors can cause panic, and maintaining communication with regular and accurate updates about the COVID-19 epidemic could help relieve anxiety and stress. [Xiang et al., 2020].

The limitations of the study merit consideration. First, the patient sample size was limited, which might not be representative of all COVID-19 patients in China. However, the nature of the case-control study could give us a relatively comprehensive understanding of the impact of the COVID-19 epidemic on patients' mental health. Second, our research was carried out in an unselected sample without random sampling, therefore, we could not estimate the response rate. Third, our study did not take into account the preexisting mental problems. Fourth, our data were obtained by self-report and have the virtual self-report nature.

The present study found that COVID-19 patients had a higher prevalence of mental problems than controls, confirming that COVID-19 had a great psychological impact on patients. It prompted the need for appropriate measures and timely treatment for the mental problems of patients with COVID-19, a psychologist may be of great help to them. Further research is needed to explore the long-term effect of COVID-19





**Fig. 1.** Box-and-whisker plot showing the scores of BAI (a), PHQ-9 (b), and ISI (c) for patients with COVID-19 and control subjects. The boundaries of the box indicate the 25th and 75th percentiles and the line in the box indicate the median values. The whiskers represent the lowest and highest values. \*\*\*  $p < 0.001$ .

on the mental health of patients.

### Author statement contributors

Xuanzhen Lu and Yu Xie involved in study design, performing the study, data analysis, drafting and revising the manuscript. Hongliang Feng and Zhenxing liu involved in study design and data curation. Keni Ouyang, Botong Hou, Meiyao Wang and Zhaohong Kong involved in performing the study and investigation. Zhiyi Zhu, Wenxin Dao, You Zhou, Jing Cao, Jian Long and Yan Xu involved in performing the study. Yumin Liu and Xiaoxin Yin involved in study design, revising the manuscript.

### Declaration of Competing Interest

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### Reference

- Paules, C.I., Marston, H.D., Fauci, A.S., 2020. Coronavirus Infections-More Than Just the Common Cold. *JAMA* (10.1001/jama.2020.0757). Advance online publication. <https://doi.org/10.1001/jama.2020.0757>.
- WHO. WHO Coronavirus Disease (COVID-19) Dashboard, 2020. <https://covid19.who.int/>. (accessed June 07, 2020).
- Keita, M.M., Taverne, B., Sy Savané, S., March, L., Doukoure, M., Sow, M.S., Touré, A., Etard, J.F., Barry, M., Delaporte, E., PostEboGui Study Group, 2017. Depressive symptoms among survivors of Ebola virus disease in Conakry (Guinea): preliminary results of the PostEboGui cohort. *BMC Psychiatry* 17 (1), 127. <https://doi.org/10.1186/s12888-017-1280-8>.
- Lee, A.M., Wong, J.G., McAlonan, G.M., Cheung, V., Cheung, C., Sham, P.C., Chu, C.M., Wong, P.C., Tsang, K.W., Chua, S.E., 2007. Stress and psychological distress among SARS survivors 1 year after the outbreak. *Can. J. Psychiatry* 52 (4), 233–240. <https://doi.org/10.1177/070674370705200405>.
- Epidemiology Working Group for NCIP Epidemic Response, 2020. Chinese Center for Disease Control and Prevention. *Zhonghua Liu Xing Bing Xue Za Zhi* 41 (2), 145–151. <https://doi.org/10.3760/cma.j.issn.0254-6450.2020.02.003>.
- National Health Commission of the People's Republic of China, 2020. The guideline of psychological crisis intervention for 2019-nCoV pneumonia (in Chinese). <http://www.nhc.gov.cn/jkj/s3577/202002/f389f20cc1174b21b981ea2919beb8b0.shtml>. (accessed January 27, 2020).
- Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., McIntyre, R.S., Choo, F.N., Tran, B., Ho, R., Sharma, V.K., Ho, C., 2020. A longitudinal study on the mental health of general population during the COVID-19 epidemic in China. *Brain, behav. immunity* 87, 40–48. <https://doi.org/10.1016/j.bbi.2020.04.028>.
- Kang, L., Ma, S., Chen, M., Yang, J., Wang, Y., Li, R., Yao, L., Bai, H., Cai, Z., Xiang Yang, B., Hu, S., Zhang, K., Wang, G., Ma, C., Liu, Z., 2020. Impact on mental health and perceptions of psychological care among medical and nursing staff in Wuhan during the 2019 novel coronavirus disease outbreak: A cross-sectional study. *Brain, behav. immunity* 87, 11–17. <https://doi.org/10.1016/j.bbi.2020.03.028>.
- Beck, A.T., Epstein, N., Brown, G., Steer, R.A., 1988. An inventory for measuring clinical anxiety: psychometric properties. *J. Consult. Clin. Psychol.* 56 (6), 893–897. <https://doi.org/10.1037//0022-006x.56.6.893>.
- Liang, Y., Wang, L., Zhu, J., 2018. Factor structure and psychometric properties of Chinese version of Beck Anxiety Inventory in Chinese doctors. *J. health psychol.* 23 (5), 657–666. <https://doi.org/10.1177/1359105316658971>.
- Beck, A.T., Steer, R.A., 1993. Beck Anxiety Inventory manual. Psychological Corporation, San Antonio, TX.
- Wang, W., Bian, Q., Zhao, Y., Li, X., Wang, W., Du, J., Zhang, G., Zhou, Q., Zhao, M., 2014. Reliability and validity of the Chinese version of the Patient Health Questionnaire (PHQ-9) in the general population. *Gen. Hosp. Psychiatry* 36 (5), 539–544. <https://doi.org/10.1016/j.genhosppsych.2014.05.021>.
- Kroenke, K., Spitzer, R.L., Williams, J.B., 2001. The PHQ-9: validity of a brief depression severity measure. *J. Gen. Intern. Med.* 16 (9), 606–613. <https://doi.org/10.1046/j.1525-1497.2001.016009606.x>.
- Bastien, C.H., Vallières, A., Morin, C.M., 2001. Validation of the Insomnia Severity Index as an outcome measure for insomnia research. *Sleep Med.* 2 (4), 297–307. [https://doi.org/10.1016/s1389-9457\(00\)00065-4](https://doi.org/10.1016/s1389-9457(00)00065-4).
- Chung, K.F., Kan, K.K., Yeung, W.F., 2011. Assessing insomnia in adolescents: comparison of Insomnia Severity Index, Athens Insomnia Scale and Sleep Quality Index. *Sleep Med.* 12 (5), 463–470. <https://doi.org/10.1016/j.sleep.2010.09.019>.
- Zhang, J., Lu, H., Zeng, H., Zhang, S., Du, Q., Jiang, T., Du, B., 2020. The differential psychological distress of populations affected by the COVID-19 pandemic. *Brain, behav. immunity* 87, 49–50. <https://doi.org/10.1016/j.bbi.2020.04.031>.
- Chua, S.E., Cheung, V., McAlonan, G.M., Cheung, C., Wong, J.W., Cheung, E.P., Chan, M. T., Wong, T.K., Choy, K.M., Chu, C.M., Lee, P.W., Tsang, K.W., 2004. Stress and psychological impact on SARS patients during the outbreak. *Canadian J. psychiatry. Revue canadienne de psychiatrie.* 49 (6), 385–390. <https://doi.org/10.1177/070674370404900607>.
- Maunder, R., Hunter, J., Vincent, L., Bennett, J., Peladeau, N., Leszcz, M., Sadavoy, J., Verhaeghe, L.M., Steinberg, R., Mazzulli, T., 2003. The immediate psychological and occupational impact of the 2003 SARS outbreak in a teaching hospital. *CMAJ: Canadian Med. Assoc. J.* 168 (10), 1245–1251.
- Cheng, S.K., Wong, C.W., Tsang, J., Wong, K.C., 2004. Psychological distress and negative appraisals in survivors of severe acute respiratory syndrome (SARS). *Psychol. Med.* 34 (7), 1187–1195. <https://doi.org/10.1017/s0033291704002272>.
- National Health Commission of the People's Republic of China, 2020. Update on the COVID-19 outbreak as at 24:00 on March, 19 (in Chinese). <http://www.nhc.gov.cn/xcs/yqtb/202003/0fc43d6804b04a4595a2eadd846c0a6e.shtml>. (accessed March 19, 2020).
- Lan, L., Xu, D., Ye, G., Xia, C., Wang, S., Li, Y., Xu, H., 2020. Positive RT-PCR Test Results in Patients Recovered From COVID-19. *JAMA* 323 (15), 1502–1503. <https://doi.org/10.1001/jama.2020.2783>.
- Belanger, L., Morin, C.M., Langlois, F., Ladouceur, R., 2004. Insomnia and generalized anxiety disorder: effects of cognitive behavior therapy for gad on insomnia symptoms. *J. Anxiety Disord.* 18 (4), 561–571. [https://doi.org/10.1016/S0887-6185\(03\)00031-8](https://doi.org/10.1016/S0887-6185(03)00031-8).
- Papadimitriou, G.N., Linkowski, P., 2005. Sleep disturbance in anxiety disorders. *Int. Rev. psychiatry (Abingdon, England)* 17 (4), 229–236. <https://doi.org/10.1080/09540260500104524>.

- Bao, Y., Sun, Y., Meng, S., Shi, J., Lu, L., 2020. 2019-nCoV epidemic: address mental health care to empower society. *Lancet* 395 (10224), e37–e38. [https://doi.org/10.1016/S0140-6736\(20\)30309-3](https://doi.org/10.1016/S0140-6736(20)30309-3) <https://doi.org/>.
- National Health Commission of China, 2020. Guidelines for psychological assistance hotlines during 2019-nCoV pneumonia epidemic. (in Chinese). <http://www.nhc.gov.cn/jkj/s3577/202002/f389f20cc1174b21b981ea2919beb8b0.shtml>. (accessed Feb 7, 2020).
- Liu, S., Yang, L., Zhang, C., Xiang, Y.T., Liu, Z., Hu, S., Zhang, B., 2020. Online mental health services in China during the COVID-19 outbreak. *Lancet Psychiatry* 7 (4), e17–e18. [https://doi.org/10.1016/S2215-0366\(20\)30077-8](https://doi.org/10.1016/S2215-0366(20)30077-8), 2020<https://doi.org/>.
- Xiang, Y.T., Yang, Y., Li, W., Zhang, L., Zhang, Q., Cheung, T., Ng, C.H., 2020. Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. *Lancet Psychiatry* 7 (3), 228–229. [https://doi.org/10.1016/S2215-0366\(20\)30046-8](https://doi.org/10.1016/S2215-0366(20)30046-8) <https://doi.org/>.