

BMJ Open Knowledge-attitude-practice and psychological status of college students during the early stage of COVID-19 outbreak in China: a cross-sectional study

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ABSTRACT

Objectives This study aimed to investigate the knowledge-attitude-practice (KAP) of Chinese college students regarding COVID-19 and evaluate their psychological status against the background of the COVID-19 outbreak.

Design This was a cross-sectional study.

Setting This study covered 31 provinces, municipalities and autonomous regions of mainland China.

Participants The participants, who were college students with ordinary full-time status, were surveyed anonymously on their KAP regarding COVID-19 by using self-made questionnaires. In addition, the Self-Rating Anxiety Scale was used to assess the psychological status of the students.

Methods The online cross-sectional study among Chinese college students was conducted in February 2020. Logistic regression analysis was used to analyse the predictors of anxiety symptoms.

Primary outcome measures The level of KAP and anxiety symptoms.

Results A total of 740 college students from 31 provinces, municipalities and autonomous regions in China were recruited in the survey. Among them, 139 (18.78%) revealed having anxiety. Multivariable logistic regression analysis revealed that female gender was the risk factor for anxiety symptoms with an increased 2.164-fold risk than male gender (OR=2.164, 95% CI=1.279 to 3.662). The knowledge (OR=0.825, 95% CI=0.779 to 0.873) and attitude (OR=0.822, 95% CI=0.762 to 0.887) regarding COVID-19 were protective factors against anxiety symptoms.

Conclusions The level of KAP regarding COVID-19 was significantly negatively correlated with anxiety symptoms. Thus, understanding the level of KAP among college students during the early stages of major public health emergencies, such as a pandemic, is important. Such understanding plays an important role in adopting targeted health education strategies and reducing the psychological damage caused by these emergencies.

INTRODUCTION

Several cases of pneumonia with unknown causes in Wuhan, Hubei Province, China were identified in December 2019 and confirmed

Strengths and limitations of this study

- This study will be the first to comprehensively evaluate the knowledge-attitude-practice and psychological status of college students during the COVID-19 outbreak in China.
- We will provide evidence for the government to adopt targeted health education and precise prevention and control strategies for similar emerging respiratory infections, along with data support for the psychological intervention of college students during the early stages of major public health emergencies, such as a pandemic.
- In this cross-sectional study, participants were recruited using an online survey, which was a convenient and effective method during the COVID-19 outbreak.
- The online survey could not control the sample size of the study as the subjects voluntarily participated.
- The sample was not randomly selected, thus, a possible selection bias could not be ruled out.

to be COVID-19 by virus typing.¹⁻³ On 11 February 2020, the WHO named the new coronavirus pneumonia as 'COVID-19'.^{4,5} The number of confirmed and suspected cases increased on a daily basis, indicating that the virus has a strong infection capability.^{6,7} On 20 January 2020, the National Health Commission of China classified COVID-19 as a B-class infectious disease and managed it as an A-class infectious disease.⁸ On 31 January 2020, the WHO identified the outbreak as a public health emergency of international concern.^{9,10}

In response to the outbreak caused by the COVID-19, the Chinese government rapidly entered into a state of emergency to curb the spread of COVID-19.¹¹ The first level of response was launched in 30 Chinese provinces.^{12,13} Considering the prolonged lockdown, the isolation and the cessation of

work, the lifestyle of the public was disrupted and their personal income was reduced in addition to the panicky purchases of disinfection and protective equipment. These changes could affect the psychological status of the public. A study on the psychological effects of a workforce returning to work during the COVID-19 epidemic discovered that 63.9% of the subjects considered that strict isolation and lockdown were useful in controlling the spread of the epidemic. The public health response significantly improved the working conditions, which were associated with a lower incidence of psychiatric symptoms in the workforce who reported anxiety (3.8%), depression (3.7%) and stress (1.5%).¹⁴ A longitudinal study conducted during the initial COVID-19 outbreak and the peak, which was 4 weeks later, in China revealed no significant differences in the stress, anxiety and depression scores on the general population between two surveys despite marked increases of COVID-19 cases. Therefore, the stable levels of psychological status indicated that the rapid prevention and control measures taken by the Chinese government played a positive role in protecting the psychological health of the population. However, another important finding of this study, particularly in the second survey, was the adverse effects of strict isolation and long-term lockdown management on the mental health of students aged 12–21.4 years, who experienced aggravated psychological effects of COVID-19.¹⁵

On 27 January 2020, the Ministry of Education in China issued a notice to delay the start of the spring semester of 2020 and required ‘suspension of classes, no suspension of studying’.^{16 17} Teachers and students made full use of network platforms to actively engage in various teaching activities and minimise the effect of the pandemic on learning. As the environment and learning style have changed, students must gradually adapt to the new learning form.^{18 19} The rapid spread of the epidemic coupled with strict control measures and disorganised learning style by prolonged school closure could have a certain effect on the psychological health of students.^{20 21} College students are the frontier group of new technology and new ideas in society.^{22 23} Against the background of the COVID-19 outbreak, college students can be the main force of health education and play an important role in promoting the dissemination of epidemic-related knowledge, which has great significance for epidemic prevention and control.^{24 25} Therefore, the psychological health of students should not be neglected while effective protective measures are taken during this special period.^{26 27}

Therefore, a cross-sectional study was conducted using an online survey involving 740 college students from 31 provinces, municipalities and autonomous regions on February 2020 to understand the coping status of Chinese college students against COVID-19 and the psychological changes under stress. This work aimed to provide a basis for the government to adopt targeted health education and precise prevention and control strategies for similar emerging respiratory infections, along with data support

for the psychological intervention of college students during the pandemic.

METHODS

Participants

In February 2020, a cross-sectional study was conducted using an online survey to access psychological changes under stress among college students, which was a convenient and effective method to recruit participants under national social distancing during the early stage of the COVID-19 outbreak in China. After receiving a detailed explanation of the study, 753 college students filled in the questionnaire, among which 740 with ordinary full-time status from 31 provinces, municipalities and autonomous regions in China were valid, with an effective response rate of 98.27%. These regions can represent the overall conditions of China.

Investigation method

All the questionnaires were edited through the Wenjuanxing platform (<https://www.wjx.cn/app/survey.aspx>). The researchers then sent the two-dimensional code of the electronic questionnaire to all potential participants through QQ and WeChat. Furthermore, all participants had also been encouraged to assist with recruitment by sending the two-dimensional code through QQ and WeChat. Participation in this research was entirely voluntary. The students scanned the two-dimensional code with their mobile phones and filled in the electronic questionnaire in accordance with their actual situation. Every IP address was set to answer only once to prevent students from submitting once again. The questionnaire was submitted anonymously, which did not contain the name and identity information of the participants and did not contain sensitive content. The answering time was automatically monitored starting from when the students successfully obtained the questions to when they submitted the questionnaire. The questionnaire was considered invalid if the response time was less than 180 s.

Questionnaire for knowledge–attitude–practice regarding COVID-19

A self-made questionnaire was used to assess the knowledge–attitude–practice (KAP) status of the participants regarding COVID-19. It consisted of three dimensions: knowledge, attitude and practice. The Cronbach’s alpha coefficient was 0.87. Knowledge of COVID-19 included 19 items, all of which were single choice. Five items on the attitude toward COVID-19 were included. The first four items were scored on a 5-point scale as ‘very dissatisfied’, ‘not satisfied’, ‘general’, ‘satisfied’ or ‘very satisfied’, with 1, 2, 3, 4 and 5 points, respectively. The fifth item was multiple choices. Five items were included in the practice questionnaire, among which four were multiple-choice items and one was a single-choice item. All single-choice items received 2 points for right answers and 0 point for wrong answers. Each correct answer for all multiple-choice

items received 1 point. The scores for each question were added to the total score for each category. The highest scores of the three dimensions of knowledge, attitude and practice were 38, 23 and 18, respectively.

Self-Rating Anxiety Scale

The Self-Rating Anxiety Scale (SAS) was formulated by WKZ and it consists of 20 items.²⁸ These items were scored on the basis of a 4-point scale in terms of 'no or very little time', 'a small part of time', 'a considerable part of time' and 'most or all of the time', with assigned values of 1, 2, 3 and 4, respectively. High scores on the questionnaire indicated severe anxiety symptoms. The total score of the scale was equal to the total score of each item multiplied by 1.25. The critical value in accordance with the Chinese norm is 50. Thus, SAS standard score ≥ 50 indicates the existence of different degrees of anxiety. SAS is a simple, highly effective self-assessment tool for anxiety, with a Cronbach's alpha coefficient of 0.84.

Statistical analysis

SPSS V.22.0 was used for statistical analysis. Number (%) was used to express categorical variables. The mean and standard deviation ($\bar{x} \pm s$) was used to express continuous variables. The χ^2 test and independent-samples t-test were applied to compare the difference between the groups. Pearson correlation analysis was used to study the relationship between KAP and anxiety status against the background of the COVID-19 epidemic. Logistic regression was performed to analyse the risk factors associated with anxiety symptoms. With versus without anxiety symptoms were taken as dependent variables. The stepwise method was used to filter independent variables. The test level of alpha was set at 0.05 (two-sided), and $p < 0.05$ was considered statistically significant.

Patient and public involvement

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

RESULTS

Descriptive characteristics of participants and association with anxiety symptoms

A total of 740 college students from 31 provinces, municipalities and autonomous regions in China were recruited in the survey. Among them, 282 out of 740 (38.11%) were men and 458 out of 740 (61.89%) were women. We divided the school into 985 or 211 universities, general universities and academies. The 985 and 211 universities are the key universities where the state has initiated the largest and highest level of key construction in the field of higher education with the world's advanced level. Therefore, the school levels of 985 or 211 universities, general universities and academies differ, and the entrance scores decrease in accordance to the level. The learning ability, interest in learning and degree of knowledge acceptance

differ among students from schools with different levels. There were 11.22% (83 out of 740) students from 985 or 211 universities, 86.21% (638 out of 740) students from general universities and 2.57% (19 out of 740) students from academies. There were 75.81% (561 out of 740) medical students and 24.19% (179 out of 740) non-medical majors. A total of 58.78% (435 out of 740) were from town area and 41.22% (305 out of 740) were from rural area. The family areas of origin were divided into seven groups in accordance with the geographical area. A total of 32.84% (243 out of 740) were from northeast of China, 15.95% (118 out of 740) were from east of China, 10.95% (81 out of 740) were from north of China, 8.24% (61 out of 740) were from central China, 5.40% (40 out of 740) were from south of China, 18.24% (135 out of 740) were from southwest of China and 8.38% (62 out of 740) were from northwest of China. The severity of the pandemic was divided into groups in accordance with the number of people infected with COVID-19 in the province from where the family originated. The classification criteria were based on the real-time data of the national epidemic situation published by the National Health Commission of China. The SAS scores ranged from 18.75 to 78.75 and the average score was 33.31 ± 10.66 . A total of 139 (18.78%) college students were found to be under anxiety status. Univariate analysis showed that the proportion of male students with anxiety symptoms was lower than that of female students (14.89% vs 21.18%). Refer to [table 1](#) for details.

KAP situation of college students regarding COVID-19 and association with anxiety symptoms

The average KAP scores of the college students regarding COVID-19 were 32.16 ± 4.09 , 16.84 ± 3.18 and 16.27 ± 1.97 , respectively. Approximately 95.95% (710 of 740) of the participants used mass media to acquire knowledge of COVID-19. Around 95.00% (703 of 740) received information from social networks, such as Weibo, Wechat and QQ. Acquired knowledge of COVID-19 through various websites, family discussion, newspapers and other channels accounted for 86.76% (642 of 740), 65.81% (487 of 740), 51.62% (382 of 740) and 6.49% (48 of 692), respectively.

The KAP scores of the college students regarding COVID-19 without anxiety symptoms which were higher than that of students with anxiety symptoms showed a statistically significant ($p < 0.05$). Refer to [table 2](#) for details.

Correlation between KAP situation of college students regarding COVID-19 and anxiety status

The correlation between the scores for KAP regarding COVID-19 among college students showed a significantly positive correlation. The scores for KAP regarding COVID-19 among college students were also significantly negatively correlated with anxiety scores. Refer to [table 3](#) for details.

Table 1 Descriptive characteristics of participants and association with anxiety symptoms

Variables	All participants	With anxiety symptoms	Without anxiety symptoms	χ^2	P value
Gender				4.52	0.0335*
Male	282 (38.11)	42 (14.89)	240 (85.11)		
Female	458 (61.89)	97 (21.18)	361 (78.82)		
The school				3.88	0.1434
985 or 211 universities	83 (11.22)	9 (10.84)	74 (89.16)		
General universities	638 (86.21)	126 (19.75)	512 (80.25)		
Academies	19 (2.57)	4 (21.05)	15 (78.95)		
Major				1.40	0.2373
Medical	561 (75.81)	100 (17.83)	461 (82.17)		
Non-medical	179 (24.19)	39 (21.79)	140 (78.21)		
Family location				2.77	0.0958
Town area	435 (58.78)	73 (16.78)	362 (83.22)		
Rural area	305 (41.22)	66 (21.64)	239 (78.36)		
Family area				8.42	0.2091
Northeast	243 (32.84)	56 (23.05)	187 (76.95)		
East China	118 (15.95)	19 (16.10)	99 (83.90)		
North China	81 (10.95)	10 (12.35)	71 (87.65)		
Central China	61 (8.24)	14 (22.95)	47 (77.05)		
South China	40 (5.40)	4 (10.00)	36 (90.00)		
Southwest	135 (18.24)	25 (18.52)	110 (81.48)		
Northwest	62 (8.38)	11 (17.74)	51 (82.26)		
Severity of the pandemic (Human numbers)				1.00	0.9622
Not clear	29 (3.92)	4 (13.79)	25 (86.21)		
1~9	17 (2.30)	4 (23.53)	13 (76.47)		
10~99	126 (17.03)	23 (18.25)	103 (81.75)		
100~499	437 (59.05)	85 (19.45)	352 (80.55)		
500~1000	80 (10.81)	14 (17.50)	66 (82.50)		
>1000	51 (6.89)	9 (17.65)	42 (82.35)		

Data shown as n (%).

*P<0.05 and the difference between groups were statistically significant.

Logistic regression for analysis of the risk factors associated with anxiety symptoms

Logistic regression was performed to analyse the risk factors associated with anxiety symptoms. The results showed that female gender was the risk factor for anxiety symptoms with an increased 2.164-fold

risk than male gender (OR=2.164, 95% CI=1.279 to 3.662), the knowledge (OR=0.825, 95% CI=0.779 to 0.873) and attitude (OR=0.822, 95% CI=0.762 to 0.887) regarding COVID-19 were protective factors against anxiety symptoms. Refer to [table 4](#) for details.

Table 2 KAP situation regarding COVID-19 and association with anxiety symptoms

Variables	With anxiety symptoms $\bar{x} \pm s$	Without anxiety symptoms $\bar{x} \pm s$	t value	P value
COVID-19 knowledge	29.44±5.10	32.79±3.54	7.34	0.0001
COVID-19 attitude	15.18±3.28	17.22±3.03	7.05	<0.0001
COVID-19 practice	15.40±2.70	16.48±1.70	4.52	0.0001

KAP, knowledge–attitude–practice.

Table 3 Correlation between KAP situation regarding COVID-19 and anxiety status

Variables	COVID-19 knowledge	COVID-19 attitude	COVID-19 practice	Anxiety scores
COVID-19 knowledge	–	–	–	–
COVID-19 attitude	0.12*	–	–	–
COVID-19 practice	0.32*	0.21*	–	–
Anxiety scores	–0.29*	–0.29*	–0.20*	–

*P<0.05 and the difference were statistically significant.

KAP, knowledge–attitude–practice.

DISCUSSION

In this cross-sectional study, approximately 18.78% of the participants had anxiety symptoms during the pandemic. A study conducted on the general population in China during the initial stage of COVID-19 revealed 28.8% of the participants had moderate-to-severe anxiety symptoms.²⁹ Another study investigated the prevalence of psychiatric symptoms in the Philippines during COVID-19 and reported that 28.8% of the respondents had moderate-to-severe anxiety levels.³⁰ In addition, one study evaluated the psychological levels under the first lockdown during COVID-19 in Vietnam and demonstrated 27% of participants with psychological conditions.³¹ The prevalence of anxiety symptoms among college students in China was lower than that among the general population from Asia. According to a systematic review on mental health during COVID-19, the prevalence of anxiety symptoms among the general population worldwide ranged from 6.33% to 50.9%.³² The college students in the present study had a moderate prevalence of anxiety symptoms during COVID-19 compared with the general population worldwide. Thus, all of the above studies demonstrated that effective and rapid measures could safeguard the psychiatric health of college students. Although the prevalence of anxiety symptoms among college students in the present study was at a relatively low level compared with that of the general population, their psychological health problems should not be ignored.

The Chinese government provided psychological health services through various channels. On 27 January 2020, the National Health Commission of the People's Republic of China issued guidelines for emergency psychological crisis intervention during COVID-19 for possible psychological problems experienced by different groups during the epidemic prevention.^{33 34} The National

Health Commission requested provinces to coordinate psychological hotline services with various resources and actively provide standardised psychological assistance services to the public.^{35 36} Meanwhile, the psychological consultation centres in colleges provided intervention and consultation for psychological crisis to students.

In addition, multivariable logistic regression analysis revealed that gender was a risk factor for anxiety symptoms, with an increased 2.164-fold risk in female gender compared with that in male gender. A similar study among students found that female students were more likely to be anxious than male students.^{37 38} In the present study, the knowledge and attitude regarding COVID-19 were protective factors against anxiety symptoms. Therefore, improving the level of knowledge regarding COVID-19 among college students and enhancing their belief in fighting against COVID-19 are beneficial to their psychological health.

College students showed a high level of knowledge regarding COVID-19, with average scores of 32.16±4.09. This result indicated that in the era of scientific progress and information development, the vast majority of college students could autonomously acquire knowledge regarding COVID-19. On 26 January 2020, the Central Office of Network and Information Technology organised websites to set up a special topic on the 'prevention and control of COVID-19' to convey the deployment of COVID-19 prevention and control works of departments at all levels and publicise and report COVID-19 information accurately and in a timely manner. Meanwhile, a special column of COVID-19 prevention and control knowledge was set up to popularise online scientific prevention and control knowledge vigorously. The high level of knowledge regarding COVID-19 among college students also proved that when a public health emergency,

Table 4 Risk factors associated with anxiety symptoms

Variables	β	S_x	Wald χ^2	P value	OR	95% CI
Gender						
Male	Ref					
Female	0.7720	0.2684	8.2723	0.0040	2.164	1.279 to 3.662
Awareness of COVID-19						
COVID-19 knowledge	–0.1929	0.0289	44.5681	<0.0001	0.825	0.779 to 0.873
COVID-19 attitude	–0.1961	0.0387	25.7249	<0.0001	0.822	0.762 to 0.887

such as a pandemic, occurs, the release and dissemination of knowledge by the national government to the public through various manners, including new media platforms, could achieve good results and contribute to lowering the level of anxiety.

The average scores of college students in terms of attitude regarding COVID-19 were 16.84 ± 3.18 , indicating that the students were satisfied with the prevention and control measures and the speed of response to the pandemic. After the outbreak, the National Health Commission immediately sent a national working group and expert group to Wuhan to study and implement epidemic prevention and control measures and perform case treatments, epidemic prevention, and control and emergency response.^{16 39} On 8 January 2020, the National Health Commission announced that it had established a 'daily report, zero report' system and made this system available in real time through media and online platforms. On 24 January 2020, the General Office of the State Council released suggestions for improving and strengthening the prevention and control of the epidemic to the public. A series of measures adopted by the country effectively enhanced the self-protective awareness and belief in overcoming the epidemic among the population.

Univariate analysis also showed that the scores in terms of practices regarding COVID-19 among college students without anxiety symptoms were higher than those among students with anxiety symptoms. Therefore, the practices regarding COVID-19 were protective factors against anxiety symptoms. Improving these practices among college students is beneficial to their psychological health. During the outbreak, most college students were able to change their health behaviour and protect themselves from COVID-19 infection. In the survey, 99.73% of college students used telephones or social media to contact their relatives and friends. Correlation analysis showed a significant positive correlation among KAP scores, indicating that the knowledge regarding COVID-19 could promote the transformation of health behaviour.

As countries around the world continue to suffer from COVID-19, various governments should focus on adopting effective and unbiased prevention and control measures regarding COVID-19. The vast majority of people in China were able to develop good behaviour in response to COVID-19, which was closely related to the extensive dissemination of the prevention and control measures by the Chinese government. A study on the Polish and Chinese during the COVID-19 pandemic found that the preventive measures, such as practising hand hygiene, wearing masks and maintaining social distance, adopted by Chinese respondents were higher than those adopted by Polish respondents.⁴⁰ Another study on the Vietnamese reported a high rate of household income loss, adverse effects on the quality of life and anxiety/depression due to the effect of national social distancing during COVID-19.⁴¹ Thus, several measures were summarised to deal with the adverse effects on psychological symptoms during the epidemic. First, public health education from health

authorities in various governments is needed for the dissemination of the importance of preventive measures during COVID-19. Second, psychological health services should be implemented to alleviate the adverse effects of this pandemic under national social distancing. Psychological interventions could also be carried out through online platforms under national social distancing during COVID-19. Internet-based cognitive-behavioural therapy (CBT) has been verified as effective in treating psychological symptoms, such as anxiety. CBT works by strengthening stress management and teaching relaxation techniques to combat anxiety and alleviate maladaptive coping.^{42–44} Third, to ensure social distancing and avoid the risk of hospital infection, telemedicine is a highly recommended method of health services. It is also an effective and convenient way to provide health services for the people who need healthcare during the outbreak. However, realisation of telemedicine is limited in some rural areas, where the information technology infrastructure is limited and smartphones are lacking.⁴⁵ Fourth, policymakers should adjust appropriate strategies to reduce the economic pressures under national social distancing during COVID-19. Finally, when conducting online teaching, teachers should pay attention to the psychological state of students to carry out early psychological intervention. In addition, teachers should also pay attention to strengthening the dissemination of COVID-19 knowledge and preventive measures to reduce the level of anxiety and depression in the student group.

In this study, college students preferred to acquire COVID-19-related information through various methods, such as mass media, social networks, websites, family discussion and newspapers. A study showed the differences in the accessibility of COVID-19 information between urban and rural populations and between age groups and occupations. Thus, health authorities from various governments should disseminate information related to the epidemic through multiple channels, including traditional mass media and new media, such as short-video platforms, social software like WeChat and the internet, to enhance the coverage of health information to the public.⁴⁶ Furthermore, the latest and accurate health information provided by the health authority could reduce the anxiety levels.^{30 31}

One of the limitations in this study was that the online survey could not control the sample size of the study as the subjects voluntarily participated. Furthermore, the sample was obviously a non-probability sample and a possible selection bias could not be ruled out. Therefore, the prevalence of anxiety among students who were unwilling to participate in the survey could not be assessed.

CONCLUSIONS

Approximately 18.78% of the participants were found to be under anxiety status during the pandemic. Therefore, the psychological health of college students should not be

neglected while effective protective measures are taken during this special period. The level of KAP regarding COVID-19 was significantly negatively correlated with anxiety symptoms. Thus, understanding the level of KAP among college students during the early stages of major public health emergencies, such as a pandemic, is important. Such understanding plays an important role in adopting targeted health education strategies and reducing the psychological damage caused by these emergencies.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Obtained.

Ethics approval This study was approved by the ethical committee of the School of Public Health from Qiqihar Medical University (ref: (2020) 01). We carried out all procedures according to the Helsinki Declaration and its subsequent amendments. This survey was conducted in an anonymous form. All participants had signed online informed consent and selected 'Agree' at the interviewee's informed consent.

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Data availability statement Data are available upon reasonable request. The datasets obtained and analysed during the current study are available from the corresponding author on reasonable request. Correspondence: gejieqiao@126.com.

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REFERENCES

- Ahmed MZ, Ahmed O, Aibao Z, Zahir A, Oli A, Zhou AB, *et al.* Epidemic of COVID-19 in China and associated psychological problems. *Asian J Psychiatr* 2020;51:2092–9.
- Chen H, Guo J, Wang C, *et al.* Clinical characteristics and intrauterine vertical transmission potential of COVID-19 infection in nine pregnant women: a retrospective review of medical records. *The Lancet* 2020;395:809–15.
- Hui J, Qing-Xin K, Hui-Min W, Jin H, Kong QX, Wang HM. COVID-19 prevention and control strategy: management of close contacts in Hangzhou City, China. *J Infect Public Health* 2020;13:897–8.
- Chen P, Mao L, Nassis GP, *et al.* Coronavirus disease (COVID-19): the need to maintain regular physical activity while taking precautions. *J Sport Health Sci* 2020;9:103–4.
- Zhou J, Liu L, Xue P, Yang XR, *et al.* Mental health response to the COVID-19 outbreak in China. *Am J Psychiatry* 2020;177:574–5.
- Cowling BJ, Leung GM. Epidemiological research priorities for public health control of the ongoing global novel coronavirus (2019-nCoV) outbreak. *Euro Surveill* 2020;25:110–4.
- Liu S, Yang L, Zhang C, Cx Z, *et al.* Online mental health services in China during the COVID-19 outbreak. *The Lancet Psychiatry* 2020;7:e17–18.
- Fan J, Liu X, Shao G, *et al.* The epidemiology of reverse transmission of COVID-19 in Gansu Province, China. *Travel Med Infect Dis* 2020;37:101741–9.
- Hui DS, I Azhar E, Madani TA, *et al.* The continuing 2019-nCoV epidemic threat of novel coronaviruses to global health - The latest 2019 novel coronavirus outbreak in Wuhan, China. *Int J Infect Dis* 2020;91:264–6.
- Tang B, Wang X, Li Q, *et al.* Estimation of the transmission risk of the 2019-nCoV and its implication for public health interventions. *J Clin Med* 2020;9:462–75.
- Yang J, Tong J, Meng F, *et al.* Characteristics and challenges of psychological first aid in China during the COVID-19 outbreak. *Brain Behav Immun* 2020;87:113–4.
- Morse JS, Lalonde T, Xu S, *et al.* Learning from the past: possible urgent prevention and treatment options for severe acute respiratory infections caused by 2019-nCoV. *ChemBiochem* 2020;21:730–8.
- Lin K, Yang BX, Luo D, *et al.* The mental health effects of COVID-19 on health care providers in China. *Am J Psychiatry* 2020;177:635–6.
- Tan W, Hao F, McIntyre RS, *et al.* Is returning to work during the COVID-19 pandemic stressful? A study on immediate mental health status and psychoneuroimmunity prevention measures of Chinese workforce. *Brain Behav Immun* 2020;87:84–92.
- Wang C, Pan R, Wan X, *et al.* A longitudinal study on the mental health of general population during the COVID-19 epidemic in China. *Brain Behav Immun* 2020;87:40–8.
- Cook JA, Jonikas JA. The importance of psychiatric rehabilitation services during and after the COVID-19 pandemic. *Psychiatr Serv* 2020;71:883–4.
- Zhang H, Zhao Y, Zou P, *et al.* The relationship between autonomy, optimism, work engagement and organisational citizenship behaviour among nurses fighting COVID-19 in Wuhan: a serial multiple mediation. *BMJ Open* 2020;10:e039711.
- Yan B, Nie G, Huang Y. China's experience on mental health in response to the COVID-19 pandemic. *Asian J Psychiatr* 2020;53:102205–6.
- Liu S, Yang L, Zhang C, *et al.* Online mental health services in China during the COVID-19 outbreak. *Lancet Psychiatry* 2020;7:e17–18.
- Cao W, Fang Z, Hou G, *et al.* The psychological impact of the COVID-19 epidemic on college students in China. *Psychiatry Res* 2020;287:112934.
- Xiao X, Zhu X, Fu S, *et al.* Psychological impact of healthcare workers in China during COVID-19 pneumonia epidemic: a multi-center cross-sectional survey investigation. *J Affect Disord* 2020;274:405–10.
- Gao H, Hu R, Yin L, *et al.* Knowledge, attitudes and practices of the Chinese public with respect to coronavirus disease (COVID-19): an online cross-sectional survey. *BMC Public Health* 2020;20:1816.
- Yousaf MA, Noreen M, Saleem T, *et al.* A cross-sectional survey of knowledge, attitude, and practices (KAP) toward pandemic COVID-19 among the general population of Jammu and Kashmir, India. *Soc Work Public Health* 2020;35:569–78.
- Ferdous MZ, Islam MS, Sikder MT, *et al.* Knowledge, attitude, and practice regarding COVID-19 outbreak in Bangladesh: an online-based cross-sectional study. *PLoS One* 2020;15:e0239254.
- Peng Y, Pei C, Zheng Y, *et al.* A cross-sectional survey of knowledge, attitude and practice associated with COVID-19 among undergraduate students in China. *BMC Public Health* 2020;20:1292.
- Wu JT, Leung K, Leung GM. Nowcasting and forecasting the potential domestic and international spread of the 2019-nCoV outbreak originating in Wuhan, China: a modelling study. *Lancet* 2020;395:260–9.
- Xiang Y-T, Yang Y, Li W, *et al.* Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. *Lancet Psychiatry* 2020;7:228–9.
- Knight RG, Waal-Manning HJ, Spears GF. Some norms and reliability data for the State-trait anxiety inventory and the zung self-rating depression scale. *Br J Clin Psychol* 1983;22:245–9.
- Wang C, Pan R, Wan X, *et al.* Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. *Int J Environ Res Public Health* 2020;17:1729.
- Tee ML, Tee CA, Anlacan JP, *et al.* Psychological impact of COVID-19 pandemic in the Philippines. *J Affect Disord* 2020;277:379–91.
- Le XTT, Dang AK, Toweh J, Nguyen QN, *et al.* Evaluating the psychological impacts related to COVID-19 of Vietnamese people under the first nationwide partial Lockdown in Vietnam. *Front Psychiatry* 2020;11:824.

- 32 Xiong J, Lipsitz O, Nasri F, *et al.* Impact of COVID-19 pandemic on mental health in the general population: a systematic review. *J Affect Disord* 2020;277:55–64.
- 33 Kang C, Tong J, Meng F, *et al.* The role of mental health services during the COVID-19 outbreak in China. *Asian J Psychiatr* 2020;52:102176–7.
- 34 Yao H, Chen J-H, Xu Y-F. Rethinking online mental health services in China during the COVID-19 epidemic. *Asian J Psychiatr* 2020;50:102015.
- 35 Jia R, Ayling K, Chalder T, *et al.* Mental health in the UK during the COVID-19 pandemic: cross-sectional analyses from a community cohort study. *BMJ Open* 2020;10:e040620.
- 36 Li W, Yang Y, Liu Z-H, *et al.* Progression of mental health services during the COVID-19 outbreak in China. *Int J Biol Sci* 2020;16:1732–8.
- 37 Zhou S-J, Zhang L-G, Wang L-L, *et al.* Prevalence and socio-demographic correlates of psychological health problems in Chinese adolescents during the outbreak of COVID-19. *Eur Child Adolesc Psychiatry* 2020;29:749–58.
- 38 Zhu Z, Liu Q, Jiang X, *et al.* The psychological status of people affected by the COVID-19 outbreak in China. *J Psychiatr Res* 2020;129:1–7.
- 39 Cui Y, Li Y, Zheng Y. Mental health services for children in China during the COVID-19 pandemic: results of an expert-based national survey among child and adolescent psychiatric hospitals. *Eur Child Adolesc Psychiatry* 2020;29:743–8.
- 40 Wang C, Chudzicka-Czupala A, Grabowski D, *et al.* The association between physical and mental health and face mask use during the COVID-19 pandemic: a comparison of two countries with different views and practices. *Front Psychiatry* 2020;11:901.
- 41 Tran BX, Nguyen HT, Le HT, *et al.* Impact of COVID-19 on economic well-being and quality of life of the Vietnamese during the National social distancing. *Front Psychol* 2020;11:565153.
- 42 Ho CS, Chee CY, Ho RC. Mental health strategies to combat the psychological impact of COVID-19 beyond paranoia and panic. *Ann Acad Med Singap* 2020;49:155–60.
- 43 Zhang MWB, Ho RCM. Moodle: the cost effective solution for Internet cognitive behavioral therapy (I-CBT) interventions. *Technol Health Care* 2017;25:163–5.
- 44 Soh HL, Ho RC, Ho CS, *et al.* Efficacy of digital cognitive behavioural therapy for insomnia: a meta-analysis of randomised controlled trials. *Sleep Med* 2020;75:315–25.
- 45 Tran BX, Hoang MT, Vo LH, *et al.* Telemedicine in the COVID-19 pandemic: motivations for integrated, interconnected, and community-based health delivery in resource-scarce settings? *Front Psychiatry* 2020;11:564452.
- 46 Tran BX, Dang AK, Thai PK, *et al.* Coverage of health information by different sources in communities: implication for COVID-19 epidemic response. *Int J Environ Res Public Health* 2020;17:3577.