

Health Literacy and Disparities in Knowledge, Attitude and Practice Regarding COVID-19 Among College Students During the COVID-19 Outbreak in China: A Cross-Sectional Study

Yuehui Jia^{1,*}Shuli Ma^{1,*}Lianjie Bai²Qiong Xiao³Yu Wu³Ying Gao⁴Yunfeng Han¹Zhiping Xie¹Xiaowei Tang⁵Jie Ge¹

¹School of Public Health, Qiqihar Medical University, Qiqihar, Heilongjiang, People's Republic of China; ²The Second Affiliated Hospital, Qiqihar Medical University, Qiqihar, Heilongjiang, People's Republic of China; ³School of Nursing, Qiqihar Medical University, Qiqihar, Heilongjiang, People's Republic of China; ⁴School of Mental Health, Qiqihar Medical University, Qiqihar, Heilongjiang, People's Republic of China; ⁵Sanitary Analysis Center, Scientific Research Office, Qiqihar Medical University, Qiqihar, Heilongjiang, People's Republic of China

*These authors contributed equally to this work

Purpose: This study aimed to assess the knowledge, attitude and practice (KAP) towards COVID-19 of Chinese college students during the COVID-19 outbreak and identify the determinants considerably associated with KAP.

Methods: An online cross-sectional questionnaire survey was conducted in February 2020 in China to recruit participants on the Wen-Juan-Xing online platform. A self-made questionnaire was used to assess the KAP towards COVID-19.

Results: The average scores of COVID-19-related KAP among college students were 32.16 ± 4.09 , 16.84 ± 3.18 and 15.36 ± 1.83 , respectively. The average correct response rate of COVID-19-related knowledge was 84.62%. 94.59% of the respondents believed China could control and conquer the pandemic; 98.92% of the respondents wore a mask when they went out. The multiple linear regression showed that the female students had higher scores of COVID-19-related knowledge than male students ($\beta = 0.79$, $P = 0.01$), and the students from 985 or 211 universities ($\beta = -2.22$, $P < 0.01$) were significantly associated with higher knowledge scores. Furthermore, a significantly positive correlation was found between the scores of COVID-19-related KAP among students.

Conclusion: The college students had a good KAP towards the COVID-19 pandemic. The present study was able to access the COVID-19-related KAP among college students during the pandemic and identify their weaknesses in pandemic prevention. Consequently, the results of this study provide theoretical basis for implementing precision health education among college students and reference for campuses to conduct scientific prevention and control during a pandemic. Results also provide beneficial experience to curb similar major public health emergencies in the future.

Keywords: COVID-19, knowledge, attitude, practice, college students

Introduction

The coronavirus disease 2019 was first reported in Wuhan, Hubei Province, China, in the end of December 2019.¹ Later, the World Health Organisation (WHO) named the new coronavirus disease 2019 "COVID-19" on 11 February 2020.² COVID-19 has the characteristics of long latency, strong infectivity, fast and wide spread and rapid disease progression.^{3,4} Thus, the population was generally susceptible. The pandemic had spread rapidly across the country and had caused severe impact and harm to the production and life of the public.^{5,6} On 20 January 2020, approved by the Chinese

Correspondence: Jie Ge
School of Public Health, Qiqihar Medical University, 333 Bukui Street, Jianhua District, Qiqihar, 161000, People's Republic of China
Tel +86452-2663409
Fax +86452-2663755
Email gejieqiao@126.com

State Council and according to the prevention and control of infectious diseases of the People's Republic of China, the National Health Commission of China included COVID-19 into category B infectious disease and managed it in accordance with category A infectious diseases.⁷ Category A infectious diseases are compulsorily managed infectious diseases, referred to as severe infectious diseases that are highly contagious and have a high case fatality rate, which are likely to cause pandemic. According to the law of the People's Republic of China on the prevention and control of infectious diseases, category A infectious diseases include plague and cholera. Category B infectious diseases are strictly managed infectious diseases, including a total of 26 diseases, such as severe acute respiratory syndrome (SARS), acquired immune deficiency syndrome (AIDS), anthrax, avian-human influenza, COVID-19, etc. Among them, SARS, pulmonary anthrax, avian-human influenza and COVID-19 are managed in accordance with category A infectious diseases. On 31 January 2020, the WHO announced that COVID-19 was an international public health emergency.⁸ On 11 March 2020, the WHO announced that COVID-19 had become a global pandemic.^{9,10} Globally, as of 5:41 pm CEST, 2 July 2021, more than 200 regions and countries have reported cases of COVID-19 to WHO (182,319,261 confirmed cases, including 3,954,324 deaths). China, one of the seriously hit countries, has reported 118,644 confirmed cases, with 5508 deaths as of 2 July 2021.¹¹ The COVID-19 pandemic has led to heavy burden and severe challenges to society and economy and has brought tremendous threats to human life.^{12,13}

In response to the COVID-19 pandemic, the Chinese government unified command and deployment to curb the spread of COVID-19, and the whole society was mobilised to fight against the pandemic.¹⁴ The first level of response was launched in 30 provinces, municipalities and autonomous regions in China.¹⁵ Governments and health administrative departments attached great importance to the pandemic and formulated a series of prevention and control measures.¹⁶ All levels of health authorities were rapidly organised to conduct investigations, treatments and collaborations. The confirmed cases were required to be isolated for treatment, close contacts of confirmed cases were required to be isolated for medical observations, enterprises were required to delay recovery work and entertainment places were required to close. Governments and health administrative departments had issued policies successively to encourage the public to stay at home, avoid participating in aggregation activities and wear masks in public places.^{17,18} On January 27, 2020, the Ministry of Education

emphasised that all kinds of schools at all levels of the country must postpone the 2020 spring semester.

As countries around the world continue to suffer from COVID-19, the prevention and control of the pandemic cannot be ignored. Universities are a highly intensive place and have a wide range of sources and great mobility of students; thus, universities need to focus on the prevention and control of the pandemic. At present, COVID-19 is mainly based on symptomatic and supportive treatment.¹⁹ Therefore, prevention and control should be the focus to combat the pandemic.²⁰ Studies have shown that good knowledge, positive attitude and health practice regarding COVID-19 is vital to the effective prevention and control of the pandemic and reduces the negative panic mentality caused by the pandemic during its early stage.^{21–23}

Although a small number of researchers have evaluated the knowledge, attitude and practice (KAP) regarding COVID-19 in the specific group of college students and identified the determinants significantly associated with KAP, there is a lack of investigation at the early stage of the COVID-19 outbreak in China and a lack of research on nationwide sample.

Therefore, to evaluate the effect of COVID-19-related health education and discover the problems and weaknesses of the prevention and control of the pandemic, an online cross-sectional questionnaire survey was conducted among college students through network platforms during the COVID-19 outbreak in China in February 2020. This study assessed the COVID-19-related KAP among college students during the pandemic and identify the determinants significantly associated with KAP. Knowing such information is conducive to discovering the weaknesses of pandemic prevention among college students and provides basis for conducting precision health education and adjusting the strategy of health education. It also provides reference for universities to implement scientific prevention and control and formulate precision prevention and control strategies after the students return to school. Moreover, it provides beneficial experience to curb similar major public health emergencies in the future.

Methods

Participants

In February 2020, an online anonymous cross-sectional questionnaire survey was conducted to assess the KAP towards COVID-19 among college students during the early stage of the COVID-19 outbreak in China and

analyse the determinants significantly associated with KAP on the Wen-Juan-Xing online platform in China (<https://www.wjx.cn/app/survey.aspx>). In the present study, college students with ordinary full-time status in Mainland China were the target population.

Investigation Method

The questionnaires in the present study were edited through the Wen-Juan-Xing online platform. Then, an electronic two-dimensional code of the questionnaire was created. Lastly, the researchers sent the electronic two-dimensional code to the counsellors, and the latter sent it to the potential participants again through QQ and WeChat after editing. Furthermore, respondents were also encouraged to assist with recruitment by sending the electronic two-dimensional code of the questionnaire. The students entirely voluntarily participated in this survey through scanning the electronic two-dimensional code of the questionnaire with their mobile phones and filled in it. We set such that every IP address can only be submitted once and submitted anonymously. The identity information and sensitive content were not contained in the questionnaire. We considered the data invalid if the response time was less than 180 s; response time was automatically monitored by the Wen-Juan-Xing online platform.

Questionnaire for COVID-19-Related KAP

A self-made questionnaire was used to assess the COVID-19-related KAP among college students and analyse the determinants. The questionnaire was designed according to the “Pneumonia Prevention and Control Plan for Novel Coronavirus Infection (Second Edition)”, “Health Education Manual for Novel Coronavirus Pneumonia” and “Guidelines for Public Protection of Novel Coronavirus Pneumonia”.^{24–26} Moreover, through expert consultation, argumentation and pre-survey in the field of public health and health education, the questionnaire was enriched and perfected, and finally the formal questionnaire and the answers to the questionnaire were formed. It contained three parts consisting of 29 items (knowledge [19 items], attitude [5 items] and practice [5 items]), and the Cronbach’s alpha coefficient was 0.87. The single-choice item scored 2 points for correct answers and 0 point for wrong answers, and the multiple choice item worth 1 point for each correct answer. All the COVID-19-related knowledge were single-choice items. The first four items of COVID-19-related

attitude were scored on a 5-point scale as follows: “very dissatisfied” (1 point), “not satisfied” (2 points), “basically satisfied” (3 points), “satisfaction” (4 points) or “very satisfied” (5 points). The fifth item was a multiple choice item. Four items of COVID-19-related practice were multiple-choice items, and one item was a single-choice item. The highest scores for knowledge, attitude and practice were 38, 23 and 17, respectively. The scores of each item were added to the total scores of each part. The actual number of correct answers for each item divided by the number of the research sample was equal to the correct answer rate. All the actual number of correct answers for each part divided by the number of items in each part multiplied by the number of the research sample was equal to the overall correct answer rate.

Statistical Analysis

Statistical analysis was performed using SPSS V.22.0. The Cronbach’s α coefficient and content validity were used to evaluate the reliability and validity of the questionnaire. Categorical variables were expressed as number (%). Normally distributed continuous variables were expressed as mean and standard deviation ($\bar{x} \pm s$). The normality of variables was assessed with a Shapiro–Wilk test. All the scores of COVID-19-related KAP and scores between different groups all followed a normal distribution. One-way analysis of variance (ANOVA) and independent-sample *t*-test were applied to compare the difference between the groups on normally distributed variables. The relationship between COVID-19-related KAP was analysed using Pearson correlation analysis. Multiple linear regression was performed to identify the determinants significantly associated with KAP. The scores of COVID-19-related KAP 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.

Results

Basic Characteristics of Respondents and Association with COVID-19-Related Knowledge

In general, 753 eligible respondents participated in the survey, among which 740 respondents, after manual verification and quality control to exclude invalid questionnaires, were included in the final research sample. The effective response rate was 98.27% (740/753). A total of 282

(38.11%) men and 458 (61.89%) women comprised the research sample; 561 (75.81%) were medical students, and 179 (24.19%) were nonmedical students. A total of 83 (11.22%) students were from 985 or 211 universities, which are the key universities in China; 638 (86.21%) students were from general universities; 19 (2.57%) students were from academies. The 985 and 211 universities are the key universities that had been initiated the largest and highest level of key construction in the field of higher education with the world's advanced level by the Chinese government.

It is a major measure to implement the strategy of “revitalize the country through science and education” and a major decision to develop higher education in China. A total of 435 (58.78%) students were from town areas, and 305 (41.22%) were from rural areas. The current location of surveyed students covered 31 provinces, municipalities and autonomous regions in China; thus, the sample can represent the overall conditions of China. The provincial distribution and basic characteristics of 740 respondents are shown in Figure 1 and Table 1, respectively.

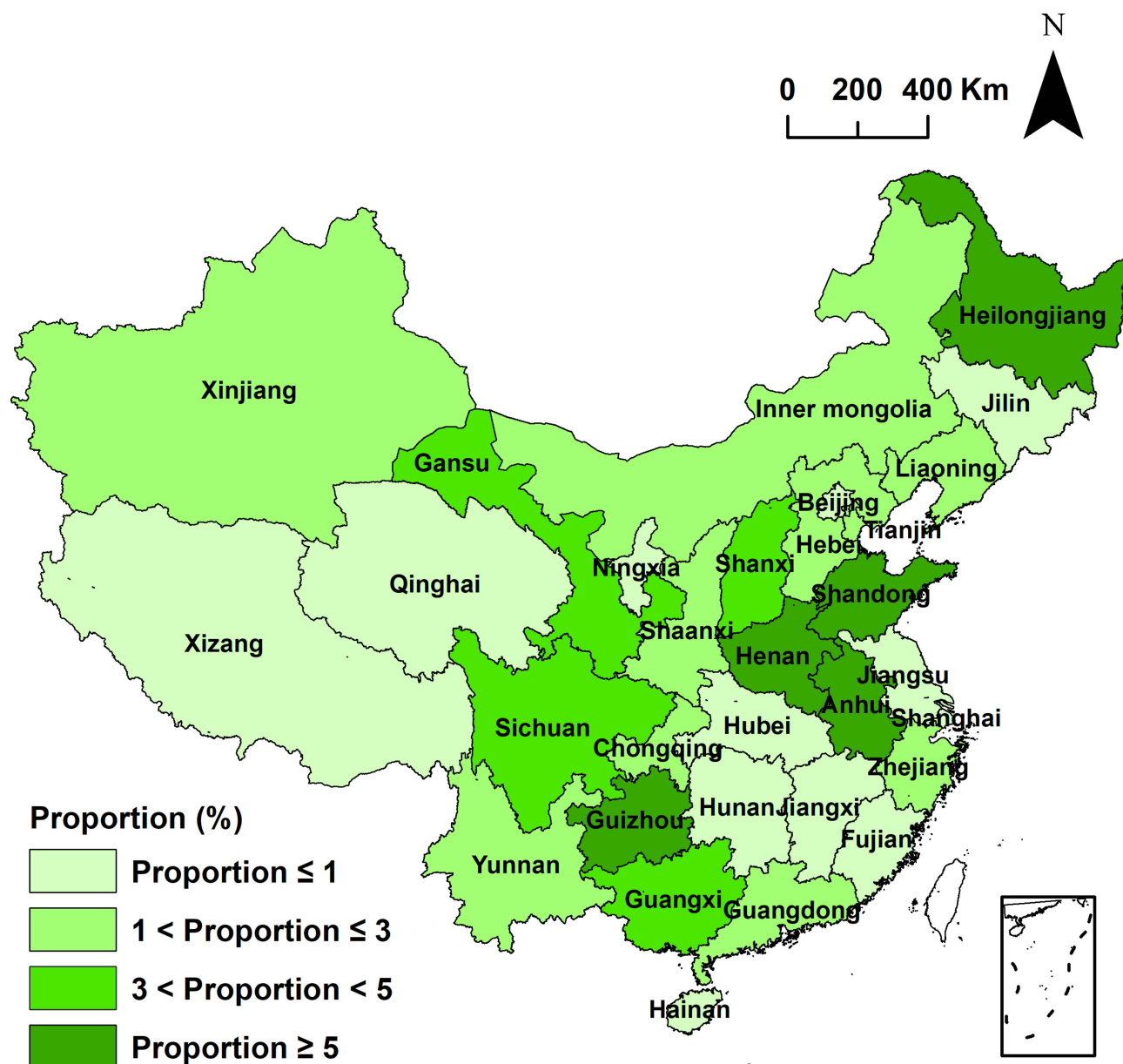


Figure 1 The provincial distribution of 740 respondents.

Note: Colors in the spatial thematic map represent proportion of respondents.

Table I Basic Characteristics of Respondents and Association with COVID-19-Related KAP

Variables	Grouping	Participants [n (%)]	Knowledge Scores ($\bar{x} \pm s$)	Attitude Scores ($\bar{x} \pm s$)	Practice Scores ($\bar{x} \pm s$)	Statistics
Gender	Male	282 (38.11)	31.67 \pm 4.52	16.88 \pm 3.54	15.32 \pm 2.02	t value P value
	Female	458 (61.89)	32.45 \pm 3.78 -2.42 0.02*	16.81 \pm 2.94 0.26 0.80	15.38 \pm 1.70 -0.41 0.68	
The school	^a 985 or 211 universities	83 (11.22)	34.12 \pm 3.22	16.47 \pm 2.93	15.17 \pm 1.74	F value P value
	General universities	638 (86.21)	31.98 \pm 4.04	16.89 \pm 3.18	15.37 \pm 1.85	
	Academy	19 (2.57)	29.47 \pm 4.14 14.75 <0.01*	16.68 \pm 4.24 0.67 0.51	15.68 \pm 1.38 0.77 0.46	
Major	Medical	561 (75.81)	32.30 \pm 4.08	16.80 \pm 3.10	15.37 \pm 1.88	t value P value
	Non-medical	179 (24.19)	31.71 \pm 4.12 1.68 0.09	16.95 \pm 3.42 -0.56 0.58	15.32 \pm 1.64 0.37 0.71	
Family location	Town area	435 (58.78)	32.42 \pm 3.93	16.81 \pm 3.25	15.35 \pm 1.87	t value P value
	Rural area	305 (41.22)	31.78 \pm 4.29 2.08 0.04*	16.88 \pm 3.08 -0.26 0.80	15.37 \pm 1.76 -0.18 0.86	
Family area	Northeast	243 (32.84)	31.97 \pm 4.06	16.84 \pm 3.23	15.35 \pm 1.76	F value P value
	East China	118 (15.95)	32.29 \pm 4.22	16.36 \pm 3.31	15.37 \pm 1.75	
	North China	81 (10.95)	32.96 \pm 3.13	17.21 \pm 3.27	15.57 \pm 1.55	
	Central China	61 (8.24)	32.33 \pm 4.26	16.67 \pm 3.51	15.21 \pm 2.30	
	South China	40 (5.40)	32.95 \pm 3.45	16.63 \pm 3.48	15.78 \pm 1.53	
	Southwest	135 (18.24)	32.10 \pm 3.88	17.07 \pm 2.67	15.26 \pm 1.75	
	Northwest	62 (8.38)	31.03 \pm 5.40 1.69 0.12	17.08 \pm 3.13 0.87 0.52	15.21 \pm 2.36 0.72 0.63	
^b Severity of the pandemic (Human numbers)	Not clear	29 (3.92)	28.69 \pm 4.88	16.97 \pm 3.42	14.66 \pm 2.53	F value P value
	1~9	17 (2.30)	28.71 \pm 4.95	16.76 \pm 2.54	15.29 \pm 1.76	
	10~99	126 (17.03)	31.90 \pm 4.14	16.86 \pm 3.15	15.31 \pm 1.68	
	100~499	437 (59.05)	32.44 \pm 3.84	16.98 \pm 3.09	15.40 \pm 1.87	
	500~1000	80 (10.81)	32.43 \pm 3.51	15.73 \pm 3.46	15.29 \pm 1.62	
	>1000	51 (6.89)	33.02 \pm 4.76 7.99 <0.01*	17.25 \pm 3.42 2.35 0.04*	15.71 \pm 1.65 1.31 0.26	

Notes: * $P < 0.05$ and the difference between groups was statistically significant; ^athe 985 and 211 universities are the key universities that had been initiated the largest and highest level of key construction in the field of higher education with the world's advanced level by the Chinese government; ^bthe severity of the pandemic was divided into groups according to the number of people infected with COVID-19 in the province from where the family originated, and the classification criteria were based on the real-time data of the national pandemic situation published by the National Health Commission of China.

Abbreviation: KAP, knowledge-attitude-practice.

The average score of COVID-19-related knowledge among college students was 32.16 \pm 4.09. The COVID-19-related knowledge scores were significantly associated with gender, school level, family location and severity of the pandemic. The analysis results showed that COVID-19-related knowledge scores were significantly higher in female students ($t = -2.42$, $P = 0.02$), students from town

areas ($t = 2.08$, $P = 0.04$) and students from 985 or 211 universities ($F = 14.75$, $P < 0.01$). A significant difference was found between COVID-19-related knowledge scores and severity of the pandemic; the more severe the pandemic, the higher the scores of COVID-19-related knowledge among college students ($F = 7.99$, $P < 0.01$). Refer to [Table 1](#) for details.

The correct response rate of COVID-19-related knowledge among college students ranged from 49.86% to 98.38%, and the average correct response rate was 84.62%. A total of 13 items of COVID-19-related knowledge had a correct response rate of over 90%. Refer to Table 2 for details.

Attitude of the Respondents Towards COVID-19

The average score of COVID-19-related attitude among college students was 16.84 ± 3.18 . A significant difference was found between the average scores of COVID-19-related attitude among college students and the severity of the pandemic ($F = 2.35$, $P = 0.04$). Refer to Table 1 for details.

Majority of the respondents had a positive attitude towards the COVID-19 pandemic. 87.16% of the respondents had a positive attitude towards the strategy of the government to the COVID-19 pandemic, 95.95% of the respondents had a positive attitude towards the response speed, 86.89% of the respondents had a positive attitude towards transparency, and 94.59% of the respondents believed China could control and conquer the pandemic. 93.92% of the respondents believed in the motherland and believed that the medical staff will overcome the difficulties. Refer to Table 3 for details.

Practice of the Respondents Towards COVID-19

The average score of COVID-19-related practice among college students was 15.36 ± 1.83 . Majority of the respondents had a good practice towards the COVID-19 pandemic. 98.92% of the respondents wore a mask to reduce the risk of exposure to COVID-19 pathogens, 93.92% of the respondents used tissue as cover when sneezing or coughing, 97.30% of the respondents washed hands correctly and promptly, 96.22% of the respondents tried to avoid crowded and closed places, and 96.49% of the respondents did regular exercise and workout, rest and improve self-immunity. Furthermore, 99.73% of the respondents contacted their relatives and friends through phone, WeChat or Internet; only 0.27% of the respondents met up. Refer to Table 3 for details.

Multiple Linear Regression Model for Identification of the Determinants Significantly Associated with COVID-19-Related KAP

The results showed that the female students had higher scores of COVID-19-related knowledge than male students ($\beta = 0.79$, $P = 0.01$), and the school level of 985 or 211 universities ($\beta = -2.22$, $P < 0.01$) was significantly

Table 2 The Correct Response Rate of COVID-19-Related Knowledge

Items	Scores	Average Scores ($\bar{x} \pm s$)	Correct Response Rate [n (%)]
COVID-19-related knowledge	38	32.16 ± 4.09	11898 (84.62)
What are the main symptoms of COVID-19?	2	1.91 ± 0.41	708 (95.68)
What is the designation of the World Health Organization for the coronavirus disease 2019?	2	1.35 ± 0.94	501 (67.70)
What are the sources of COVID-19?	2	1.00 ± 1.00	369 (49.86)
Which of the following is not the route of transmission of COVID-19?	2	1.84 ± 0.54	682 (92.16)
Which of the following should you not do when coughing or sneezing?	2	1.44 ± 0.90	531 (71.76)
Regarding the choice of mask, which is not suitable for COVID-19?	2	1.92 ± 0.39	710 (95.95)
Which of the following statements about the proper use of masks is incorrect?	2	1.81 ± 0.58	671 (90.68)
Which of the following statements about the disposal of discarded masks is incorrect?	2	1.80 ± 0.60	667 (90.14)
Which conditions can kill COVID-19?	2	1.86 ± 0.50	690 (93.24)
How long is the duration of home medical observation for close contacts?	2	1.97 ± 0.25	728 (98.38)
What groups are susceptible to COVID-19?	2	1.13 ± 0.99	419 (56.62)
Do you think COVID-19 can be cured?	2	1.85 ± 0.52	686 (92.70)
On the basis of determining case criteria, can we detect COVID-19 rapidly?	2	1.07 ± 1.00	397 (53.65)
At present, COVID-19 is treated using special drugs and vaccines.	2	1.68 ± 0.74	621 (83.92)
From the outside into the house, which the following behavior is incorrect?	2	1.86 ± 0.50	690 (93.24)
Which of the following statements regarding the preventive measures of COVID-19 at home is incorrect?	2	1.88 ± 0.48	695 (93.92)
Which of the following statements about the measures of self-isolation at home is incorrect?	2	1.87 ± 0.49	693 (93.65)
What will you do if you suspect yourself to have COVID-19?	2	1.96 ± 0.28	725 (97.97)
Which of the following statements about medical treatment is incorrect?	2	1.93 ± 0.36	715 (96.62)

Table 3 Attitude and Practice of the Respondents Towards COVID-19

Items	Categories	n=740/n (%)	$\bar{x} \pm s$ /Total Scores
Attitude Are you satisfied with the strategy (eg, measures, such as traffic control and compulsory isolation of suspected patients) of the government to this pandemic?	Very dissatisfied	33 (4.46)	3.54±1.01/5 —
	Not satisfied	62 (8.38)	—
	Basically satisfied	238 (32.16)	—
	Satisfaction	287 (38.78)	—
	Very satisfied	120 (16.22)	—
Are you satisfied with the response speed of the government to this pandemic?	Very dissatisfied	14 (1.89)	3.93±0.86/5 —
	Not satisfied	16 (2.16)	—
	Basically satisfied	172 (23.24)	—
	Satisfaction	344 (46.49)	—
	Very satisfied	194 (26.22)	—
Are you satisfied with the transparency of the government to this pandemic?	Very dissatisfied	37 (5.00)	3.59±1.04/5 —
	Not satisfied	60 (8.11)	—
	Basically satisfied	214 (28.92)	—
	Satisfaction	288 (38.92)	—
	Very satisfied	141 (19.05)	—
I believe China could control and conquer the pandemic.	Very dissatisfied	17 (2.30)	3.86±0.89/5 —
	Not satisfied	23 (3.11)	—
	Basically satisfied	180 (24.32)	—
	Satisfaction	345 (46.62)	—
	Very satisfied	175 (23.65)	—
How has your psychology changed since this pandemic?	Believe in the motherland, believe that the medical staff will overcome the difficulties.	695 (93.92)	1.92±0.66/3 —
	The pandemic is not terrible, people can find effective ways to prevent it.	556 (75.14)	—
	I can see the good side of COVID-19.	235 (31.76)	—
	The recent COVID-19 is my biggest worry.	169 (22.84)	—
	This pandemic made me anxious and impatient.	48 (6.49)	—
	Difficult to communicate, unable to listen to topics other than the pandemic.	22 (2.97)	—
	I cry often and impose the pain of medical staff on myself.	17 (2.30)	—
Practice How to protect yourself from COVID-19 infections?	Wear a mask to reduce the risk of exposure to pathogens.	732 (98.92)	4.83±0.65/5 —
	Use tissue as cover when sneezing or coughing.	695 (93.92)	—
	Wash hands correctly and promptly.	720 (97.30)	—
	Try to avoid crowded and closed places.	712 (96.22)	—
	Exercise and workout regularly, rest and improve self-immunity.	714 (96.49)	—
At present, what are you main ways to contact your relatives and friends?	Phone or WeChat, Internet	738 (99.73)	1.99±0.10/2 —
	Meet up	2 (0.27)	—

(Continued)

Table 3 (Continued).

Items	Categories	n=740/n (%)	$\bar{x} \pm s$ /Total Scores
If you seek medical treatment for other diseases, how can you take preventive measures?	Try to avoid going to the hospital as much as possible, except for acute and severe patients who must seek medical treatment.	568 (76.76)	2.46±0.70/3
	Make an appointment in advance to minimize consultation time.	589 (79.59)	–
	Try using public transportation to travel to the hospital.	107 (14.46)	–
	After going home after a medical treatment, change clothes immediately, wash hands with running water, and wash clothes as soon as possible.	664 (89.73)	–
What are some of your behavioral changes since this pandemic?	Can maintain natural ventilation in the room.	663 (89.59)	3.28±0.87/4
	Minimize the number of outings.	716 (96.76)	–
	Increased awareness of disinfection (eg washing hands when going home, spraying disinfectant in the room).	648 (87.57)	–
	Change your diet and increase nutrition.	403 (54.46)	–
What is the correct way to address this pandemic?	Pay attention to reliable information, and do not panic blindly.	709 (95.81)	2.79±0.55/3
	Maintain a regular schedule and arrange life reasonably.	677 (91.49)	–
	Avoid negative emotions and maintain a calm mind.	680 (91.89)	–
	Excessive attention to the epidemic and believe in gossips.	78 (10.54)	–

associated with high knowledge scores. Refer to [Table 4](#) for details.

Correlation Between COVID-19-Related KAP Among College Students

The scores of COVID-19-related knowledge had a significant positive correlation with the scores of attitude ($r = 0.12$, $P < 0.01$) and practice ($r = 0.32$, $P < 0.01$). The scores of COVID-19-related attitude had a significant positive correlation with the scores of practice ($r = 0.21$, $P < 0.01$).

Discussion

A high level of COVID-19-related knowledge was found among college students. The average correct response rate was 84.62%, which is relatively higher than the results in a subsequent research. Studies have revealed that the average correct response rates were 68.3% (Sudanese population), 76% (frontline health-care workers in Nepal) and 63% (Indian public).^{27–29} Moreover, a meta-analysis in Ethiopia reported an average correct response rate of 61.78% (95% CI (48.97%, 74.58%)), and another similar research among health professionals in Ethiopia reported an average of 79.4% (95% CI (73.5%, 85.2%)).^{30,31} Furthermore, a survey among pharmacy students in Saudi Arabia showed an average correct response rate of 82%.²² The satisfactory

correct response rate among college students in the present survey could be the result of the extensive dissemination related to the COVID-19 pandemic by the Chinese government, which set up an online special topic about COVID-19-related knowledge with the help of traditional mass media, new media and self-media and enhanced the coverage of health information to the public. However, the average correct response rate in the present study is a bit lower than a study among Chinese older adults in Mainland China with a correct response rate of 87%; a survey among Chinese residents conducted by the researchers in Hubei, China, with the correct response rate of 90%; and a study among Iranians with a correct response rate of 88.35%.^{32–34} The results could be closely related to the difference in the questionnaires used by the researchers and the participants recruited in the survey.

In this study, the COVID-19-related knowledge scores were significantly associated with gender and school level. The analysis showed that COVID-19-related knowledge scores were significantly high in female students ($\beta = 0.79$, $P = 0.01$) and in the school level of 985 or 211 universities ($\beta = -2.22$, $P < 0.01$). A significant correlation between COVID-19-related knowledge and gender was also found by Yang et al¹⁷ (the mean scores for female and male were 47.15 and 45.76, $P = 0.003$) and Yousaf et al²³ (the correct

Table 4 Determinants Significantly Associated with COVID-19-Related KAP

Independent Variables	β	$S_{\bar{x}}$	t Value	P value	Standardized Partial Regression Coefficient
Knowledge					
Constant	35.13	0.93	37.75	<0.01	–
Gender (Male)	0.79	0.30	2.60	0.01	0.09
School (^a 985 or 211 universities)	–2.22	0.41	–5.46	<0.01	–0.20

Notes: () Represent reference; School, 1 = 985 or 211 universities, 2 = General university, 3 = Academy; ^athe 985 and 211 universities are the key universities that had been initiated the largest and highest level of key construction in the field of higher education with the world's advanced level by the Chinese government.

Abbreviation: KAP, knowledge–attitude–practice.

answer rate for female and male were 88.9% and 88.8%, $P = 0.033$). In addition, Zhong et al³³ revealed a positive correlation between COVID-19-related knowledge and educational level ($F = 146.72$, $P < 0.001$). Thus, all these studies demonstrated that precision health education should be implemented among college students during a pandemic, and attention must be focused on male students, particularly those from general universities and academy.

The college students had a positive attitude towards the COVID-19 pandemic, with satisfactory response rates towards the strategy, response speed and transparency of the government to the COVID-19 pandemic (87.16%, 95.95% and 86.89%, respectively). In response to the COVID-19 pandemic, the Chinese government attached great importance to the pandemic and formulated a series of prevention and control measures.¹⁶ A national working group and an expert group were rapidly organised to conduct investigations, perform case treatments and collaborate to prevent and control the pandemic. Another important reason was that the National Health Commission established a pandemic reporting system through online platforms to report the real-time pandemic situation to public. All these measures adopted by the Chinese government effectively enhanced the belief in residents overcoming the pandemic. Therefore, in this study, up to 94.59% of the respondents believed that China could control and conquer the pandemic. However, 22.84% of the respondents considered COVID-19 as their biggest worry, 6.49% of the respondents were anxious and impatient, 2.97% of the respondents had difficulty communicating and listening to topics other than the pandemic, and 2.30% of the respondents cried often and imposed the pain of medical staff on themselves. Thus, these results demonstrated that the psychological health of college students should not be neglected during a pandemic. The colleges should open psychological

hotline assistance services to provide students with psychological intervention and consultation.³⁵

The college students had good practice towards the COVID-19 pandemic. In the present study, 98.92% of the respondents wore a mask; this result is higher than that of other studies: 79.3% (Lebanese), 84% (Nigeria) and 82.3% (Egyptians).^{36–38} The Director-General of WHO launched about how and when to use a mask to protect against COVID-19 on 05 August 2020.³⁹ Our current study and other studies that we are comparing the results are all before the date that the WHO recommended using face masks. In the present study, 97.30% of the respondents washed hands correctly and promptly; this result is higher than that of the studies of Habib et al and Thomas et al (89% and 92%, respectively).^{37,40} In addition, 96.22% of the respondents tried to avoid crowded and closed places, and 99.73% of the respondents contacted their relatives and friends through phone, WeChat or Internet; only 0.27% of the respondents met up. All these results revealed that most college students in China changed their health practice to prevent the COVID-19 pandemic. Furthermore, since the pandemic, the health authorities in China have popularised health practices (eg, properly wearing masks, hand washing steps and home disinfection) through a wide range of channels.

A significant positive correlation was found between the scores of COVID-19-related KAP among college students. These findings clearly indicated the importance of improving COVID-19-related knowledge, which may enhance attitudes towards overcoming the pandemic and promote the transformation of health practices. Thus, several measures were summarised to improve COVID-19-related knowledge. First, when conducting online teaching, teachers can push COVID-19-related knowledge through online teaching platforms to enhance the coverage of health information among students. Teachers can also promote the service of frontline workers to encourage students and enhance their attitudes

towards overcoming the pandemic. Second, schools can implement a competition on the knowledge of COVID-19-related prevention and control to encourage students to learn. Third, schools can conduct online lectures about COVID-19 prevention and control. Fourth, after the students return to school, the school can conduct a drill on prevention and control during a pandemic.

One of the limitations of this study is that the sample size was relatively small because this survey was conducted under the first national lockdown during the rapid rise period of the COVID-19 outbreak in China. Using a web-based online questionnaire survey could not control the sample size. Moreover, given that the online survey was voluntary and consumed time, we tried our best to investigate additional meaningful factors in this survey. Therefore, the basic characteristics of the participants included gender, school, major, family location, family area and severity of the pandemic. However, the basic characteristics regarding living conditions or grades was not included in this survey. Furthermore, the online survey may have resulted in response bias as voluntary participation. Therefore, the status of COVID-19-related KAP among students who did not participate in this survey could not be assessed.

Conclusion

The college students had a good KAP towards the COVID-19 pandemic. A significantly positive correlation was found between the scores of COVID-19-related KAP among students. Consequently, the results of this study provide theoretical basis for implementing precision health education among college students and reference for campuses to conduct scientific prevention and control during a pandemic.

Abbreviations

COVID-19, coronavirus disease 2019; KAP, knowledge, attitudes and practices; WHO, World Health Organization; SARS, severe acute respiratory syndrome; AIDS, acquired immune deficiency syndrome; ANOVA, analysis of variance.

Data Sharing Statement

The datasets obtained and analysed during the current study are available from the corresponding author on reasonable request via email: gejieqiao@126.com.

Ethics Approval and Informed Consent

This study was approved by the ethical committee of the School of Public Health from Qiqihar Medical University (ref: [2020] 01). This study adheres to the Helsinki declaration. Participates in this research voluntarily and conduct anonymously. Thus, participants who select “Agree” at the interviewee’s informed consent were considered as consent to participate in our investigation.

Consent for Publication

The details in present study can be published, and that the persons providing consent have been shown the article contents to be published.

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Author Contributions

All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest in this work.

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