Association between supportive attitudes and adoptive practice of control strategy against COVID-19 among college students in China, a cross-sectional study

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Abstract

Background: This study aimed to explore college students' attitudes and compliance toward the prevention strategy of using non-pharmaceutical interventions (NPIs) in containing coronavirus disease 2019.

Methods: We conducted a cross-sectional online survey in four universities in Guangdong Province (China) based on purposive sampling. We used a self-made questionnaire to measure the supportive attitude towards outbreak control strategy and adoption of NPIs in respondents.

Results: A total of 44,446 college students participated between 31 January and 10 February 2020; 92.7% of respondents supported the outbreak control strategy. 94.8% would avoid public places, 92.8% would wear a facemask, 91.2% would avoid of gatherings and 86.9% would wash hands more frequent. 76.5% respondents adopted all four measures. Supportive attitude was associated with NPI adoption. Students who were female, postgraduate, anxious, and not depressed tended to have higher supportive attitude and higher NPI adoption rate.

Conclusions: Higher supportiveness towards the disease control strategy for public may lead to higher adoption rate of NPIs for individuals. Psychosocial factors are related to supportive attitude and adoption of the NPIs. We believe that our findings are instructive about the prevention and control of emerging infectious diseases like COVID-19.

Background

Coronavirus disease 2019 (COVID-19) is caused by a new coronavirus, severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), which was first reported in Wuhan (Hubei Province, China) in December, 2019 [1]. COVID-19 is an acute respiratory infectious disease that ranges from mild symptoms to severe illness and death. The virus was spread rapidly and caused 1,279,010 confirmed cases and 72,603 deaths in 118 countries between December 2019 and 7th April 2020,the outbreak soon developed into a globalized pandemic that had already infected over 14 million people and killed about 600 thousand people in 7 months□while both number were still skyrocketing [2].

For emerging infectious diseases, due to a lack of efficacious antiviral agents and vaccine, non-pharmaceutical interventions (NPIs) are the most effective interventions to prevent and control their spread [3, 4]. During the epidemic of influenza A (H1N1) in 2009, NPIs helped to decrease transmission [5]. Community participation is very important for any NPI strategy to be successful [6–9]. Negative public perception and practice can impede successful campaigns against the spread of infectious diseases [10, 11].

At the early stages of the COVID-19 outbreak, the National Health Commission of China quickly launched a control strategy containing several measures to prevent and control disease spread: free treatment to confirmed patients; quarantine for people who was likely exposed to SARS-CoV-2 (separation from the

rest of the population); restriction of travelling in and out of Wuhan city; closing down entertainment facilities for public; extended the Spring Festival holidays and delayed time of returning to school [12]. In addition to the strategy for public, Chinese government and its healthcare departments also gave recommendations and guidelines of NPIs for individuals to follow, such as use of a facemask, washing hands frequently. Since COVID-19 is an emerging infectious disease, the public had little knowledge about it. NPI messages were propagated vigorously through television, mobile-telephone messages, social media (e.g., WeChat™), the Internet, and newspapers to all community members.

Under these circumstances, the response and implementation by the public for a new NPI strategy are key elements for epidemic control. Also, timely feedback of this information is very important for health authorities to improve the overall control strategy.

College students (CSs) are important members of the community. They represent the younger, more receptive part of a population. We evaluated CSs' support and practice towards the NPI strategy against COVID-19 created by the Chinese government. The relationship between their support and practice in the initial period of the COVID-19 outbreak in China was also evaluated.

Methods

Study design

From 31 January to 20 February 2020, we provided a cross-sectional online survey for CSs. A purposive sampling method was employed to all CSs from four universities (one medical university and three comprehensive universities) in Guangdong Province, China. The questionnaire used in our study was self-designed and composed of three parts: socio-demographic characteristics, supportive perception, and adoptive action towards an NPI strategy of prevention and control of COVID-19 [13]. (see Additional File 1). The questionnaire was sent through online communities at Southern Medical University and was collected by the website of the latter. The validity of the questionnaire was assessed by experts in public health and epidemiology. All questions were mandatory. The survey was anonymous and consent to participate was not required. Report of this study follows the STROBE statement.

Measures and definitions

The questionnaire consisted of sociodemographic characteristics, Knowledge, Attitude and Practices (KAP) questions, Center for Epidemiologic Studies Depression Scale (CES-D) for depression testing, and Self-Rating Anxiety Scale (SAS) for anxiety testing. The cutoff points of these scales were based on those described previously [14–16]. All participants were required to answer if they had any chance of being exposed to SARS-CoV-2.

In the questionnaire, we defined supportive perception towards control of the outbreak by asking "Do you agree with the country's prevention and disease control policies?" and accordingly the respondents stated

“agree” or “disagree”. Adoption of NPI measures included washing hands frequently, using a facemask followed by recommendations, avoidance of gatherings, and avoidance of public places. Participants were required to answer “complied” or “not complied” to each question. In addition, we defined respondents who adopted all four interventions as “high compliance” and those who did not as “not high compliance”. The outbreak-control strategy and self-protection guidelines were announced on 25 January 2020. Before investigation, we confirmed that participants were aware of the content of the NPI strategy.

We ascertained whether participants had a history of potential exposure to SARS-CoV-2 by asking three questions. That is, whether: (i) they travelled to or through Wuhan in the previous 2 weeks; (ii) their family members had been diagnosed with COVID-19 or quarantined; (iii) their family members had travelled to or through Wuhan in the previous 2 weeks. If the answer to all of these questions was negative, the respondents were defined as having “no exposure history”.

Data analyses

First, collected data were cross-checked and imported into Excel™ (Microsoft, Redmond, WA, USA) in simplified Chinese, coded and translated into English, and analyzed using R 3.6.0 (R Foundation for Statistical Computing, Vienna, Austria). The basic characteristics of respondents were first presented as a number (percentage) for categorical variables.

Second, the difference in supportive attitude to the COVID-19 control strategy and the difference in the prevalence of adoption of this strategy in different subgroups was presented. The number need to treat (NNT) and its 95% interval confidence (CI) were also calculated.

Third, the association between a supportive attitude towards the COVID-19 control strategy and its adoption was examined.

The significance of differences was assessed by the χ^2 test for categorical variables and z-ratio for independent proportions. Multivariable logistic regression was carried out to test the association between a supportive perception towards the NPI strategy and adoption of its measures. Multi-collinearity was ruled out for all covariates based on the collinearity test. Covariates (age, sex, degree course (undergraduate or postgraduate), primary degree (medicine or non-medicine), anxiety score, and depression score were adjusted. Matching of the propensity score based on logistic regression was undertaken to minimize the potential bias in all subgroups, and age, sex, degree course, primary degree, anxiety score, depression score and history of exposure were adjusted accordingly. $P < 0.05$ was considered significant. Missing data were tested by margin plots and considered to be “missing at random”. All missing data were excluded during each analysis.

Results

This section may be divided by subheadings. It should provide a concise and precise description of the experimental results, their interpretation as well as the experimental conclusions that can be drawn.

Characteristics of respondents

From 44,451 respondents, 44,446 questionnaires were eligible. The mean age of all respondents was 21 ± 2.1 (interquartile range, 19–22) years. Overall, 54.5% of respondents were female, 89.4% were undergraduate, and 29.5% were medical students. Among all respondents, 2,138 students had a history of exposure to SARS-CoV-2. Among all students who completed the SAS or CESD questions, 0.6% showed signs of anxiety (score ≥ 50), and ~ 33.1% of students showed signs of depression (score ≥ 16). (Table 1).

Table 1
Characteristics of college students in the study, n = 44446

Characteristic	Number (%)
Age, mean ± SD, years	21 ± 2.4
Female	24231 (54.5)
Grade	
Undergraduate	39723 (89.4)
Postgraduate	4723 (10.6)
Primary degree	
Medicine	13116 (29.5)
Other	31330 (70.5)
History of exposure	
Yes	2 138 (4.8)
No	42308(95.2)
Anxiety score	
< 50	44207 (99.4)
≥ 50	239 (0.6)
Depression score	
< 16	29756 (66.9)
≥ 16	14690 (33.1)
Perception on the strategy to control the epidemic	
Supportive	30040 (92.8)
Not supportive	2340 (7.2)
Using a facemask in accordance with the NPI	
Complied	41264 (92.8)
Not complied	3183 (7.2)
Washing hands frequently	
Complied	38613 (86.9)
Not complied	5833 (13.1)
Avoidance of public places	

Characteristic	Number (%)
Complied	42134 (94.8)
Not complied	2312 (5.2)
Avoidance of gatherings	
Complied	40544 (91.2)
Not complied	3902 (8.8)
Applied all measures	
Yes	34005 (76.5)
No	10041 (23.5)
Note. Data are shown as number (%) unless otherwise stated.	

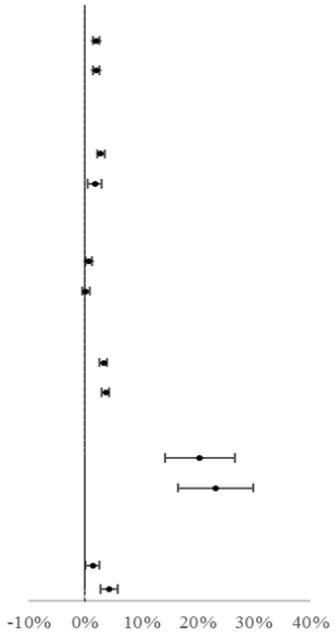
The measures adopted most keenly were avoidance of public places (94.8%), followed by use of a face mask (92.8%), avoidance of gatherings (91.2%) and washing hands frequently (86.9%). Of all, 76.5% respondents reported that they would use all four measures for protection against COVID-19. (Table 1).

Supportive perception towards the non-pharmaceutical intervention strategy in different subgroups

Female and postgraduate students showed a slightly higher percentage of supportive perception towards the NPI strategy against COVID-19 compared with male and undergraduate students (adjusted absolute risk reduction (aARR) of 2.0%, and 1.8%, respectively). Respondents with no sign of depression had a more supportive attitude towards strategies than those who were depressed (94.2% vs. 90.5%, aARR = 3.7%). However, respondents who felt anxious were much more approving towards the NPI strategy (95.8% of respondents) than those who did not feel anxious (23.3%). Those who had been exposed to SARS-CoV-2 tended to have less of a supportive attitude than those who had no exposure history (95.8% vs. 91.5%, aARR = 4.3%).

We compared the adjusted number need to treat (aNNT) in subgroups. The smallest value of aNNT was 4 and was found in the anxiety group, which suggested that anxiety was the most important factor influencing the supportive attitude of respondents. The second most important factor was exposure history(aNNT = 23). (Table 2)

Table 2
Supportive perception on the non-pharmaceutical intervention strategy to control COVID-19 among respondents by subgroup

Subgroup	Percentage of supportiveness	ARR (95%CI)	ARR (forest plot)	P	NNT (95%CI)
Sex					
Male vs female	91.8% vs 93.8%	2.0% (1.4–2.6%)		< 0.001	50 (38–71)
Adjusted†	91.8% vs 93.8%	2.0% (1.4–2.6%)		< 0.001	50 (38–71)
Degree course					
Undergraduate vs postgraduate	92.4% vs 95.2%	2.8% (2.1–3.5%)		< 0.001	35 (29–48)
Adjusted†	93.4% vs 95.2%	1.8% (0.5–3.0%)		0.003	57 (33–200)
Primary degree					
Medicine vs other	93.2% vs 92.5%	0.6% (0.1–1.2%)		0.029	157(83–1000)
Adjusted†	92.7% vs 92.5%	0.2% (–0.4–0.8%)		0.55	540(–250 to 125)
Depression score					
< 16 vs ≥16	93.8% vs 90.5%	3.3% (2.6–3.9%)		< 0.001	30 (26–38)
Adjusted†	94.2% vs 90.5%	3.7% (3.0–4.4%)		0.002	27 (23–33)
Anxiety score					
< 50 vs ≥50	92.9% vs 72.5%	20.4% (14.2–26.6%)		< 0.001	5 (4–7)
Adjusted†	95.8% vs 72.5%	23.3% (16.6–30.0%)		< 0.001	4 (3–6)
Exposure history					

Subgroup	Percentage of supportiveness	ARR (95%CI)	ARR (forest plot)	P	NNT (95%CI)
No vs Yes	92.9% vs 91.5%	1.4% (0.1–2.7%)		0.026	73 (37–1000)
Adjusted†	95.8% vs 91.5%	4.3% (2.8–5.8%)		< 0.001	23 (17–36)

Note: Percentage of supportiveness refers to the proportion of respondents who had a supportive attitude on the NPI strategy to control the spread of COVID-19. ARR, absolute risk reduction. NNT, number need to treat. P with is based on the z-ratio test, and P is two-tailed. †case was adjusted by propensity-score matching based on age, sex, degree course, primary degree, depression score, anxiety score, or exposure history.

Adoption of non-pharmaceutical intervention measures in different subgroups

The measure adopted by most respondents was avoidance of public places (94.8%), followed by use of a facemask (92.8%), avoidance of gatherings (91.2%) and hand washing frequently (86.9%) (Table 2). Being female, having a high level of education, not suffering from depression, being anxious, and having a history of exposure positively influenced adoption of NPI measures (Table 4). The most important influencing factor was anxiety (aARR = 28%, aNNT = 4), followed by depression (9.7% 10), sex (5.9%, 17) and level of education (4.5%, 22); exposure history had only a small influence (2.9%, 34). (Table 3).

Table 3
Adoption of the non-pharmaceutical intervention strategy to control COVID-19 among respondents by subgroup

Subgroup	Percentage of adoption	ARR (95%CI)	ARR (forest plot)	P	NNT (95%CI)
Sex					
Male vs female	73.4% vs 79.1%	5.7% (4.9–6.5%)		< 0.001	18 (15–20)
Adjusted†	73.3% vs 79.2%	5.9% (4.9–6.8%)		< 0.001	17 (15–20)
Degree course					
Undergraduate vs post graduate	75.3% vs 81.6%	6.3% (5.0–7.5%)		< 0.001	16 (13–20)
Adjusted†	77.1% vs 81.6%	4.5% (2.4–6.6%)		< 0.001	22 (15–42)
Primary degree					
Medicine vs other	76.3% vs 76.7%	0.4% (−0.5–1.2%)		0.408	250 (−200 to 83)
Adjusted†	74.9% vs 76.7%	1.7% (0.8–2.7%)		< 0.001	59 (37–125)
Depression score					
< 16” vs ≥16	79.7% vs 70.0%	9.7% (8.8–10.5%)		< 0.001	10 (10–11)
Adjusted†	79.7% vs 70.0%	9.7% (8.7–10.7%)		< 0.001	10 (9–11)
Anxiety score					
< 50 vs ≥50	76.7% vs 48.5%	28.1% (21.8–34.5%)		< 0.001	4 (3–5)
Adjusted†	76.6% vs 48.5%	28.0% (19.7–36.3%)		< 0.001	4 (3–5)
Exposure					
No vs yes	76.8% vs 71.3%	5.5% (3.5–7.5%)		< 0.001	18 (29–13)
Adjusted†	74.2% vs 71.3%	2.9% (0.2–5.6%)		< 0.001	34 (500–18)

Subgroup	Percentage of adoption	ARR (95%CI)	ARR (forest plot)	P	NNT (95%CI)

Note: Percentage of adoption refers to the percentage of respondents who undertook all five measures (hand hygiene, use of a facemask, avoidance of gatherings, and avoidance of public places. ARR, absolute risk reduction. NNT, number need to treat. P with is based on the z-ratio test, and P is two-tailed. †case was adjusted by propensity-score matching based on age, sex, degree course, primary degree, depression score, anxiety score, or exposure history

Associations between a supportive perception towards the non-pharmaceutical intervention strategy and adoption of its measures

There were significant associations between approval perception of the NPI strategy and compliance with all of its measures. People who disagreed with the NPI strategy had a negative association with wearing a facemask (odds ratio, 1.55; 95%CI 1.42 to 1.67), washing hands frequently (1.57; 1.47 to 1.67), avoidance of gatherings (1.25; 1.16 to 1.35), avoidance of public places (1.47; 1.34 to 1.64) and adoption of all measures (1.32; 1.26 to 1.39). (Table 4).

Table 4
Association between supportive perception and adoption of control measures for COVID-19 among respondents (OR, 95%CI)

Perception of the NPI strategy	Measure				
	Using a facemask	Washing hands frequently	Avoidance of gatherings	Avoidance of public places	Adoption of all measures
Overall					
Supportive	1.00 (Reference)				
Not supportive	1.55 (1.42–1.67)	1.57 (1.47–1.67)	1.25 (1.16–1.35)	1.47 (1.34–1.64)	1.32 (1.26–1.39)

Note: Odds ratio (95% confidence interval) was adjusted by age, sex, level of education, primary degree, level of depression, and level of anxiety.

Discussion

We found that 92.7% of respondents had a supportive attitude towards the NPI strategy for control of COVID-19. The time of the survey was in the winter vacation in China. All CSs were at home for the holidays, and they had the same access to information as the general population. A high prevalence of support indicates that the NPI strategy had been well publicized. About 5.5% of respondents reported that they disagreed with the NPI strategy. Compared with respondents who agreed with the NPI strategy, the respondents who disagreed tended to be male, have a low level of education and to suffer from

depression. Studies have shown consistently that men express a lower level of concern towards health risks [17, 18]. This may be the reason why men had a lower supportive attitude than that of women in our study. Postgraduate students had a slightly higher supportive attitude about the NPI strategy than that of undergraduate students. Studies on Middle East respiratory syndrome (MERS)-related knowledge, preventive behaviors, and risk perception among nursing students during the MERS outbreak showed that senior nursing students and female students had a high perception and practice of measures to control MERS [19–21]. That study suggests that intelligence has a positive effect on perception of a health strategy.

It is worth noting that the psychological status of respondents was linked to a supportive perception of the NPI strategy. Depression was a negative influencing factor in supportive perception of the NPI strategy, whereas anxiety had a positive influence regardless of sex or level of education. This result may have been because people suffering from depression frequently lack interest in life [22]. The reasons why anxiety was related to a supportive attitude to the NPI strategy may have been because: (i) anxiety was caused by COVID-19; (ii) COVID-19 caused anxiety in these respondents. Few studies have focused on anxiety and attitudes toward intervention measures to control and prevent disease. This suggests that people have the moderate anxiety caused by public health emergencies can enhance their implementation of relevant control strategies..

The measure adopted by most respondents was avoidance of public places (94.8%), followed by use of a facemask (92.8%), avoidance of gatherings (91.2%) and washing hands frequently (86.9%). Compared with the other three measures, the prevalence of adoption of handwashing was relatively low. Implementation of this measure is related to sanitation facilities: in China, there are not enough facilities for outdoor handwashing. The inconvenience and difficulty of maintaining a NPI measure is a potential obstacle to its adoption. During the epidemic of influenza A (H1N1) in 2009, CSs and the general population had a low acceptance of NPI measures because they disrupted workplace and leisure activities [23, 24].

We found that 76.5% of respondents adopted all four NPI measures. Zottarelli and colleagues showed that in the influenza A (H1N1) epidemic in 2009, when evaluating CSs in the USA, 72.1% of the study cohort reported frequent hand-washing, yet only 10.7% avoided public gatherings [25]. In another study conducted in a USA public university, the proportion of students who took any self-protective measure against influenza A (H1N1) was 64.9% [9, 23]. Those results indicate that more CSs in China implement NPI measures than CSs in USA.

There was a positive correlation between supportive perception and adoption behaviors towards the NPI strategy during the COVID-19 epidemic (Table 4). People with a supportive attitude towards the NPI strategy indicated that they had a high perception of protection against and risk of COVID-19, so it is likely that they would be willing to adopt the measures. A study by Wang and colleagues on the factors that determine adoption of preventive behaviors during the influenza A (H7N9) epidemic revealed that a protective perception positively influenced an individual’s willingness to take recommended actions [26].

Being female, having a high level of education, and being anxious meant that you were likely to adopt the measures of the NPI strategy. Importantly, respondents who reported having anxiety had a 28% higher chance of adopting the measures than those who were not suffering from anxiety. This finding suggested that the anxiety in students may have been caused by COVID-19. These results echo those from a study on perceived risk, anxiety, and behavioral responses in the early phase of the influenza A (H1N1) epidemic in the Netherlands [10]. Depression may negatively influence adoption of NPI measures, which may because of depression made people less willingly to take action and more indifferent about safety.

Medical knowledge did not influence adoption of measures. Interestingly, respondents who did not have an exposure history to COVID-19 patients or epidemic areas had less of a supportive attitude and adoptive behaviors to the measures compared with the ones who had exposure history (Table 3, Table 4). This finding may have been due to two reasons. First, if respondents had been exposed but did not develop COVID-19, their risk perception will be reduced, which is also known as optimistic bias. Parry and colleagues showed that, compared with people who had food poisoning due to Salmonella species, people who had not experienced food poisoning due to Salmonella species perceived their personal risk from food poisoning to be lower 26. Second, may be our respondents had reduced anxiety about COVID-19. Bults and colleagues showed that anxiety decreased over time in the influenza A (H1N1) epidemic in 2009 [10].

Our study had two main limitations. First, it was a cross-sectional study and therefore weak in causation. Second, there may have been an information bias because the study data were time-sensitive and self-reported.

Our study had three main advantages. First, this survey was done shortly after the outbreak, which might indicate how the respondents would actually react where interferences were little. Second, we analyzed the impact on supportive perception and adoptive action towards the NPI strategy by the social demographics and psychological status of CSs, which has been studied scarcely previously. Third, this is the first study focusing on COVID-19-related supportive perception and adoption towards an NPI strategy. These results can provide: (i) insights for public health decision-makers; (ii) helpful information on the NPI measures people are willing to adopt (and the factors affecting adoption) during an emerging epidemic.

Conclusions

Our results suggest that supportiveness towards the disease control strategy for public may lead to higher adoption rate of NPIs for individuals including more-challenging measures like social distancing. It also suggested that the policy maker should pay more attention on anxiety and depression people, who might be less likely to support the policy or prevention measures. Further research is needed to be done to understand differences in responses from other populations, what might affect the supportive perception and how these findings will affect action in future outbreaks of infectious diseases.

Abbreviations

COVID-19:Coronavirus disease 2019; SARS-CoV-2:severe acute respiratory syndrome coronavirus-2; MERS:East respiratory syndrome; NPIs:non-pharmaceutical interventions; CSs:College students;CES-D:Center for Epidemiologic Studies Depression Scale; SAS:Self-Rating Anxiety Scale; ARR:absolute risk reduction; aARR:adjusted absolute risk reduction; NNT:number need to treat; aNNT:adjusted number need to treat; 95%CI:95% confidence interval; OR:Odds ratio

Declarations

Ethics approval and consent to participate

The protocol for collection of information from participants was approved by the ethics committee of Southern Medical University (Guangzhou, China). This protocol was undertaken in accordance with the ethical standards noted in the 1964 Declaration of Helsinki and its later amendments. All questions were mandatory to answer. All the participants signed the informed consent before completed the online questionnaire.

Consent for publication

Not applicable.

Availability of data and materials

The authors declare that the data supporting the findings of this study will be shared on reasonable request to the corresponding author

Competing interests

The authors declare that they have no competing interests.

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Authors ‘contributions

CM is the principal investigator of the study and obtained the necessary funds. Together with DS and DL, MC designed the study and wrote the study protocol. CM and DS contributed to the conception of the study. PC ,ZL and ZW contributed significantly to analysis and manuscript preparation; DS and DL, MC performed the data analyses and wrote the manuscript; YZ and XZ helped perform the analysis with constructive discussions. XW,CM and XY provides resource and design all laboratory methods. All authors have read and approved the manuscript

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