

Association of Knowledge, Attitude and Practice of COVID-19 Prevention with Anxiety Among Residents of Henan Province, China

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Received May 9, 2020

Accepted June 16, 2020

Published August 28, 2020

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ABSTRACT

Background: Coronavirus disease 2019 (COVID-19) has spread rapidly in cities of central China, including Henan Province, since December 2019. Our study aimed to evaluate the knowledge, attitude, and practice of COVID-19 prevention with anxiety among residents of Henan Province, China. **Methods:** We conducted an electronic survey of 385 residents of Henan Province aged ≥ 18 years during the period of 3–15 February, 2020. Participants completed a structured questionnaire on the COVID-19 prevention and Zung Self-Rating Anxiety Scale (SAS). Univariate and multivariate logistic regressions was applied to analyze the associations between the explanatory variables and anxiety. **Results:** 360 participants were enrolled into the study, 45 (12.5%) had anxiety during the COVID-19 epidemic. Primary school or lower education (AOR=4.23; 95% CI = 1.01–15.94), unemployed or retired (AOR=3.11; 95% CI=1.02–9.47), rural (AOR = 3.23; 95% CI=1.54–6.29), low-level attitude toward COVID-19 prevention (AOR= 3.22; 95% CI=1.12–7.30), and medium-level practice of COVID-19 prevention (AOR = 3.17; 95% CI=1.08–9.34) were found to be associated with anxiety. **Conclusions:** Local government and public health agencies need to act as a proactive in the provision of health education about COVID-19 prevention to the residents, particularly who are retired, have low-level education, and living in rural area.

Keywords: anxiety; China; coronavirus disease 2019; residents.

Introduction

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a previously unknown coronavirus that emerged in human populations in China in December 2019. Infection by SARS-CoV-2 causes coronavirus disease 2019 (COVID-19), which manifests as a severe acute respiratory infection [1]. World Health Organization (WHO) defined COVID-19 as a new disease related to the acute respiratory epidemic caused by the SARS-CoV-2 virus [2]. As of March 27, 2020, 509,164 COVID-19 cases have been reported globally [3].

The rapidly growing cases come from close contact with the infected person and spread through respiratory droplets generated when coughing, sneezing, or talking. There is also some evidence that contact transmission and aerosol transmission can cause infections in residents [3]. According to the U.S CDC report, the most common symptoms of COVID-

19 are fever, dry cough, and tiredness. In severe cases, symptoms such as shortness of breath or difficulty breathing, the new loss of taste or smell, and persistent pain or pressure in the chest will appear. Some people will also have diarrhea, fatigue, nausea or vomiting after 2–14 days of exposure [4].

China is one of the most severely affected countries, with 82,078 people having been diagnosed with the COVID-19 [3]. In response, the World Health Organization (WHO) and the Chinese Center for Disease Control and Prevention (CCDC) have issued guidelines for preventing the rapid spread of COVID-19 [5,6], which include measures suitable for use by the general public.

China's surveillance system for infectious diseases is mainly derived from the national online epidemic reporting system and administrative reports on public health emergencies. When a suspected new type of infection occurs in the infectious disease department of

a local hospital, doctors can report it to the National Center for Disease Control within 4 hours through the national online epidemic reporting system, so that the national health department analyzes the epidemic situation and initiates an emergency plan. At the same time, local hospitals will also report cases to the local health administrative department, so that the local health administrative department can initiate emergency management plans for public health emergencies before the National Health Commission issues corresponding measures. During the outbreak of COVID-19, the private Internet industry, community, district level government, and COVID-19 designated treatment hospital cooperation response mechanism was activated for the first time, in order to enable the public to obtain the updated information on epidemic statistics, suspected cases and suspected infection in the community.

Although China has gradually established a direct network report system for infectious diseases after SARS in 2003, the sudden outbreak still exerts great pressure on the Chinese disease control system. The Hubei, Guangdong, Zhejiang, and Henan are most severely affected provinces in China [7]. These provinces have adopted first-level emergency response policies, including closing inter-city highways, suspending public transportation, closing schools, and colleges, and self-isolation at home, to prevent virus transmission.

A recent study found that the cancellation of public gatherings, suspension of classes, remote working, and self-isolation at home all have a positive effect on people's behaviors in preventing transmission of the coronavirus [8]. However, these measures also impact the emotional and psychological states of people [9].

Knowledge, attitude, and practice are regarded to have a significant impact on understanding the adoption of preventive measures and bridging the gap in providing health information. Given the substantial increase in COVID-19 in Henan Province, it was deemed necessary, and even urgent, to gather data on the current status of residents' knowledge, attitudes and behaviors toward COVID-19 prevention, as well as their anxiety status.

Methods

Study design

The study was a community-based cross-sectional survey.

Study setting

The study settings were 660 communities in Henan Province, central China, which is the most populous province in the country, with a population of 109.06 million, consisting of 69 million adults aged ≥ 18 years [10].

Inclusion and exclusion criteria

Participants were required to be residents in the community and aged ≥ 18 years. Individuals who were unable to answer the questions due to mental illness or severe organic disease were excluded.

Study population and sampling technique

Due to the central government's isolation policy during the epidemic, it was not feasible for researchers to collect data through field investigations. For this reason, the researchers used a convenient sampling technique to select 17 communities from five cities in Henan Province as the study sites. Residents aged ≥ 18 years residing in these communities were chosen as the study population, which amounted to a total of 28,850 persons. Out of which, a sample size of 385 were calculated by population proportion sample size formula and selected by their ID numbers using a simple random sampling technique [10,11].

Data collection procedures

Researchers used an electronic questionnaire to collect data from the participants during the period 3–15 February, 2020. The questionnaire used to collect the data on the study variables was designed by the researchers based on a review of the relevant literature and the guidelines for COVID-19 prevention issued by WHO and the CCDC [5,6]. The sections relating to knowledge about COVID-19 prevention included the following questions.

Knowledge about COVID-19 prevention consisted of ten multiple-choice questions. The total score for such knowledge was 10 for all items (100%), with a score of 1 for each correct answer and 0 for an incorrect answer. Knowledge of residents was classified into three levels according to bloom taxonomy: high-level knowledge for scores in the range 9–10 (80–100%), medium-level knowledge for scores in the range 6–7 (60–79.99%) and low-level knowledge for scores of < 6 ($< 60\%$).

Attitude toward COVID-19 prevention included ten questions and the answer to each question had three different scores following the Likert scale: "Disagree" = 0; "Neutral" = 1; "Agree" = 2. A high level of attitude had a proportion of more than 80% (> 16 score), a medium level of attitude had a proportion of 60–80% (12–16 score), and a low level of attitude had a proportion of less than 60% (< 12 score).

The practice of preventing COVID-19 consisted of ten questions, and the answer to each question was assigned to "Always" = 2, "Sometimes" = 1, or "Seldom or none" = 0. Practice was classified into three levels: a high level of practice had a proportion of more than 80% (> 16 score), a medium level of practice had a proportion of 60–80% (12–16 score), and a low level of practice had a proportion of less than 60% (< 12 score).

A questionnaire was evaluated by three experts based on the Item Objective Congruence (IOC) method and found each item of the questionnaire as congruent (>0.5 IOC score). A pilot study was done among 30 samples and identified the Cronbach Alpha score of the research tool at 0.78.

Researchers used the Zung Self-Rating Anxiety Scale (SAS) to assess the anxiety among residents [12]. This scale is a standard anxiety assessment tool, which has been tested many times in the Chinese population and has a high degree of reliability and validity [13,14]. A score in the 20-44 range means normal, the score in the 45-59 range means mild to moderate anxiety level, the score in the 60-74 range means severe anxiety level, the score in the 75-80 range means extreme anxiety level. In this study, all anxiety levels were combined and considered as anxiety, whereas normal level considered as no anxiety.

Statistical analysis

Data management and analysis were performed using IBM SPSS Statistics 24.0 (IBM Corp, Armonk, NY, USA). Participants' general characteristics, knowledge, attitude, and practice of COVID-19 prevention were presented using descriptive statistics. We applied univariate and multivariate logistic regression to analyze the association between the explanatory variables and anxiety.

Ethical approval

This study was approved by the Ethics Review Committee of (Confidentiality due to peer review). The formal permission was sought from the respective community administrations to conduct the study. Then, informed written consent was obtained from the participants.

Results

General characteristics

Of the total of 385 respondents to the electronic questionnaire, a total of 360 respondents were enrolled in this study, and 15 individuals were eliminated for the reasons stated above under Inclusion and exclusion criteria, giving a 93.5% response rate. The majority of

the participants were female (76.9%), about half were aged 18–24 years, 57.2% were urban-dwelling, 64.7% had a high-school education, 41.9% were students, and 39.7% of participants were working staff (Table 1).

Table 1 Participant demographic information (n = 360)

Characteristics	n	%
1. Sex		
Male	83	23.1
Female	277	76.9
2. Age group (years)		
18–24	178	49.4
25–44	112	31.1
45–59	16	4.4
≥ 60	54	15.0
3. Place of residence		
Urban	206	57.2
Rural	154	42.8
4. Education		
Primary school and below	31	8.6
Middle school	49	13.6
High school	233	64.7
Bachelor's degree	47	13.1
5. Occupation		
Student	151	41.9
Working staff	143	39.7
No occupation or retired	66	18.3

Knowledge of prevention of COVID-19 among respondents

From the results, 76.7% of residents had a high-level knowledge of COVID-19 prevention, and 19.7% had a medium-level knowledge. A total of 99.2% of residents knew that masks need to be replaced as soon as they become contaminated. The vast majority of residents ($>90\%$) had a good knowledge of the transmission routes of COVID-19, the cleaning of masks, and the need to keep a safe distance from people in public places. However, regarding methods for inactivating the virus, 37.5% of residents lacked the relevant knowledge (Table 2).

Table 2 Distribution of the knowledge of COVID-19 prevention among respondents (n = 360)

Characteristics	n	%
1. COVID-19 is sensitive to UV and heat	341	94.7
2. Boiling at 56°C or more for more than 30 minutes, diethyl ether, 75% ethanol, chlorine-containing disinfectant and peroxyacetic acid can all inactivate the SARS-CoV-2 virus	225	62.5
3. COVID-19 is infecting people and spreading easily from person to person	314	87.2
4. Hospitals need to use negative pressure ambulance to transfer patients	259	71.9
5. Antibiotics cannot treat COVID-19	249	69.2
6. Disposable medical masks cannot be used after washing with water	347	96.4
7. Masks need to be replaced as soon as they become contaminated	357	99.2
8. SARS-CoV-2 virus can spread through the respiratory tract and as an aerosol	352	97.8
9. Keep as far away from others as possible in public places	340	94.4
10. Try not to use public transportation. When you have to, try to avoid touching items on the way with your hands	264	73.3

Attitude toward COVID-19 prevention among respondents

In terms of attitude toward the prevention of the spread of COVID-19, 60.3% of residents had a high-level attitude toward prevention, whereas 17.2% had a low-level attitude. More than 90% of people agreed with the wearing of personal protective equipment (PPE) in private cars, 81.9% of residents agreed that daily indoor disinfection could help to prevent the spread of COVID-19, and 49.1% of residents agreed with reducing physical contact, such as hugs, handshakes, etc. (Table 3).

Practice of COVID-19 prevention among respondents

This study confirmed that more than half of the residents (53.3%) had a high-level practice of COVID-19 prevention, and 39.7% had a medium level. More than three-quarters of residents regularly monitored their temperature and use a contactless takeaway or courier service. In contrast, more than 20% of residents never, or seldom, covered their mouth and nose with their elbow, clothes, or a tissue when they coughed or sneezed (Table 4).

Table 3 Distribution of attitudes towards COVID-19 prevention among respondents (n = 360)

Characteristics	Disagree		Neutral		Agree	
	n	%	n	%	n	%
1. I think regular indoor disinfection every day helps prevent COVID-19 infection	21	5.8	44	12.3	295	81.9
2. I think if nasal congestion, fever and other symptoms are found during the isolation period, you need to go to a fever department in the hospital immediately	32	8.9	43	11.9	285	79.2
3. I think it's best not to go in and out of crowded places during the epidemic	46	12.8	80	22.2	234	65.0
4. I thought that when I have close contacts with infected patients, I need to use a separate toilet	40	11.1	118	32.8	202	56.1
5. I think it's best not to visit your relatives or take part in a party at will during the epidemic	36	10.0	37	10.3	287	79.7
6. I think I should avoid touching elevator buttons directly with my hands	36	10.0	104	28.9	220	61.1
7. I think anyone returning from a high-risk area should stay at home or be quarantined at a designated place for 14 days	14	3.9	68	18.9	278	77.2
8. I think I should reduce physical contact, such as hugs, handshakes, etc.	78	21.7	105	29.2	177	49.1
9. I think private cars should be equipped with personal protective equipment, such as masks and sanitary wipes	14	3.9	18	5	328	91.1
10. I think tableware should be boiled and sterilized for 15 minutes after cleaning food residues	35	9.7	87	24.2	238	66.1

Table 4 Distribution of practices of COVID-19 prevention among respondents

Characteristics	None or seldom		Sometimes		Always	
	n	%	n	%	n	%
1. Keep up to date with the latest situation and news of COVID-19	36	10.0	104	28.9	220	61.1
2. Cover your mouth and nose with your elbow, clothes or a tissue when you cough or sneeze	78	21.7	105	29.2	177	49.2
3. Keep more than one meter away from others in public places	29	8.1	68	18.9	263	73.1
4. Always monitor your temperature	14	3.9	68	18.9	278	77.2
5. In public places, if there is no facility to clean your hands, do not touch your mouth, nose or eyes directly with your hands	35	9.7	87	24.2	238	66.1
6. Pay attention to washing hands frequently and maintaining hand hygiene	7	1.9	112	31.1	241	66.9
7. Wash hands with running water or disinfect with a disposable hand sanitizer as soon as possible after coughing or sneezing	15	4.2	165	45.8	180	50.0
8. Clean or disinfect your phone frequently	65	18.1	116	32.2	179	49.7
9. Wrap it in paper and throw it in the trash when you spit	13	3.6	161	44.7	186	51.7
10. Using a contactless takeaway or courier service	4	1.1	84	23.3	272	75.6

Prevalence and factors associated with anxiety among respondents

The prevalence of anxiety among participants was 12.5%. Five factors were found to be associated with anxiety after controlling all possible confounding variables: educational background, occupation, place of residence, the attitude of prevention COVID-19, the practice of prevention COVID-19. Residents with primary school or a low level of education had greater odds of anxiety than residents who had a bachelor's degree or higher level of education, with $OR_{adj}=4.23$ (95%CI=1.01-15.94). Unemployed or retired residents had greater odds of anxiety than students, with $OR_{adj}=3.11$ (95%CI=1.02-9.47). Residents who lived in rural areas had greater odds of anxiety than urban-dwelling residents, with $OR_{adj}=3.23$ (95%CI=1.54-6.29). Residents who had a low-level attitude toward

COVID-19 prevention had greater odds of anxiety than residents who had a high-level attitude toward COVID-19 prevention, with $OR_{adj}=3.22$ (95%CI=1.12-7.30). Residents who had a medium-level practice of COVID-19 prevention had greater odds of anxiety than residents who had a high-level practice of COVID-19 prevention, with $OR_{adj}=3.17$ (95%CI=1.08-9.34) (Table 5).

Discussion

This is the first study to have been carried out into the levels of anxiety experienced by Chinese residents in relation to the recent outbreak of COVID-19, and highlights the fact that participants generally experienced an anxiety and had a high level of knowledge about the disease.

Table 5 Logistic regression analysis of anxiety levels among residents

Characteristics	Anxiety		COR ¹ (95% CI)	AOR ² (95% CI)
	Yes; n (%)	No; n (%)		
Gender				
Male	7 (8.4)	76 (91.6)	1.73 (0.74–4.03)	1.48 (0.67–3.50)
Female	38 (13.7)	239 (86.3)	Reference	Reference
Age				
18–24	15 (8.4)	165 (91.6)	Reference	Reference
25–44	12 (10.7)	100 (89.3)	1.30 (0.59–2.90)	0.58 (0.20–1.68)
45–59	3 (18.8)	13 (81.2)	2.51 (0.64–9.79)	2.16 (0.39–8.22)
>60	15 (27.8)	39 (72.2)	4.18 (1.89–9.27)	2.83 (0.99–8.09)
Educational background				
Bachelor degree or above	6 (12.8)	41 (87.2)	Reference	Reference
High school	14 (6.0)	219 (94.0)	0.44 (0.16–1.20)	0.32 (0.09–1.12)
Middle school	11 (22.4)	38 (77.6)	1.98 (0.67–5.87)	1.33 (0.34–5.19)
Primary school or lower	14 (45.2)	17 (54.8)	5.63 (1.85–17.09)	4.23 (1.01–15.94)*
Occupation				
Student	12 (7.9)	139 (92.1)	Reference	Reference
Working staff	19 (13.3)	124 (86.7)	1.78 (0.83–3.80)	1.61 (0.56–4.67)
No occupation or retired	14 (21.2)	52 (78.8)	3.12 (1.35–7.18)	3.11 (1.02–9.47)*
Place of residence				
Urban	14 (6.8)	192 (93.2)	Reference	Reference
Rural	31 (20.1)	123 (79.9)	3.46 (1.77–6.76)	3.23 (1.54–6.29)*
Knowledge level of COVID-19 prevention				
High	29 (10.5)	247 (89.5)	Reference	Reference
Medium	12 (16.9)	59 (83.1)	1.73 (0.84–3.60)	1.38 (0.54–3.53)
Low	4 (30.8)	9 (69.2)	3.79 (1.10–13.07)	1.77 (0.29–10.66)
Attitude toward COVID-19 prevention				
High	12 (5.5)	205 (94.5)	Reference	Reference
Medium	17 (21.0)	64 (79.0)	4.54 (2.06–10.00)	2.61 (0.87–4.63)
Low	16 (25.8)	46 (74.2)	5.94 (2.63–13.41)	3.22 (1.12–7.30)*
Practice of COVID-19 prevention				
High	12 (6.4)	175 (93.6)	Reference	Reference
Medium	26 (18.4)	115 (81.6)	3.65 (1.79–7.47)	3.17 (1.08–9.34)*
Low	25 (78.1)	7 (21.9)	3.75 (1.20–11.74)	3.25 (0.95–10.81)

¹COR: Crude odds ratio, ²AOR: Adjust odds ratio

By reviewing studies carried out during the H1N1 and Middle East Respiratory Syndrome (MERS) outbreaks, we found that the anxiety levels of residents in this study were significantly lower than those in Hong Kong and the Netherlands [15,16]. Compared with similar studies conducted in China during the Asian lineage avian influenza A virus (Asian H7N9) epidemic, our study population also experienced a lower level of anxiety [17]. Media propaganda and government advocacy played obvious major roles in reporting and controlling, respectively, this outbreak. According to the study by Wang et al., 93.5% of Chinese residents obtained information on COVID-19 prevention through the Internet [18], including information on the transmission routes of the disease, the effectiveness of medicines, the correct use of masks, and the distribution of confirmed and suspected cases. In addition, the relevant findings of our study

also show that Chinese residents have an adequate level of knowledge about COVID-19 prevention. Increased knowledge has enabled residents to have greater confidence, which relieves anxiety, and to cooperate more fully with government policies to control the spread of COVID-19 [19].

Although most residents have a high-level knowledge on prevention of COVID-19, their attitude and practice toward COVID-19 prevention have apparent deficiencies, which are also significant factors affecting residents' anxiety levels. Our study findings indicate that some residents have a negative attitude and practice toward reducing physical contact, such as hugs, handshakes, cleaning or disinfecting their phones frequently, and covering their mouth and nose with their elbow, clothes, or a tissue when coughing or sneezing. Such an indifferent attitude, deprived knowledge, and negative practice regarding COVID-19

prevention can induce anxiety and have other adverse effects on people's psychology [20]. In the publicity material put out by local media and community workers, too much attention was paid to popularizing the knowledge of COVID-19 prevention and to the numbers of infected people and suspected cases, while advocating the need for residents to be well informed about SARS-CoV-2 and the good behaviors needed to prevent the spread of COVID-19 was ignored. Therefore, while dispersing preventive knowledge, community workers and the media should also strive to correct negative attitudes and educate people in the correct behaviors needed to control the outbreak.

Our research also suggests that educational background is significantly associated with anxiety. Residents with only elementary or no education have less access to information sources and lack the ability to discern the credibility of the limited sources available to them [21]. Compared with people with higher levels of education, they are more likely to be anxious. The majority of people with low-level of education live mainly in rural areas, resulting in differences in anxiety status between residents of urban and rural areas. In the latter, access to Internet information and online health resources is often limited. In the rural areas of Henan Province, the propaganda channels available to rural managers are more about controlling personal exchanges and cutting off Internet traffic. They have focused less on advocating for residents to adopt better personal protective behaviors and methods. This has led to concerns among residents about personal protection, which echoes the findings of Wu et al. on H7N9 [22].

Unemployed and retired residents are more at risk of anxiety. Studies in the UK and the Netherlands have shown that risk perception is a significant factor in determining residents' anxiety levels during outbreaks, and occupational differences have a substantial impact on risk perception [23,24]. In our study, unemployed and retired residents were concentrated among the elderly, who are less able to perceive the risks associated with COVID-19.

Due to various family and professional reasons, students and vocational workers are more sensitive to COVID-19 information compared to unemployed and retired residents; thus, they are more likely to behave more rationally when identifying and absorbing relevant COVID-19 information, which results in lower levels of anxiety.

This study was limited to some extent. Firstly, this study used an electronic questionnaire for data collection. Secondly, some participants who were not computer literate might not have been able to provide accurate information. Qualitative research would also be useful for providing further evidence and greater insight into the knowledge, attitude and practice (KAP) of COVID-19 prevention and its association with anxiety.

Conclusions

This study has provided Henan residents with valuable insights into the KAP of COVID-19 and its association with anxiety. Local government and public health agencies need to be proactive in the provision of health education about COVID-19 prevention to the residents, particularly who are retired, have low-level education, and living in rural area. So, people will be well informed, take necessary preventive measures, and avoid anxiety. The Chinese government, health department, and policy-makers need to refine management measures in response to public health incidents and have timely exchanged epidemic information with countries related to the epidemic to promote risk control. Advanced technologies such as big data information analysis and artificial intelligence can be used for information management in Chinese government health institutions.

Acknowledgement

The authors would like to thank Xinxiang Medical University for financial support to this study.

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