Assessing Knowledge, Attitudes and Practices of Frontline Chinese Healthcare Practitioners toward COVID-19

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Abstract

Introduction: To investigate the knowledge of COVID-19 among Chinese healthcare practitioners.

Methodology: A survey to address the knowledge, attitudes, and practices of COVID-19 was conducted among Chinese healthcare workers in February 2020. Data was collected by a structured questionnaire distributed to 126 healthcare practitioners participating in the delivery of care during the COVID-19 outbreak. From the collected data, logistic regression modeling was applied to explore the association between knowledge, attitude, and practices regarding care and treatment of COVID-19. The odds ratios and 95% confidence intervals (CI) were obtained from the logistic regression analysis.

Results: Physicians demonstrated a greater level of knowledge of COVID-19 risk and prevention than other practitioners. Social media was the main source (87.6%) for providing information about COVID-19 knowledge. Regarding attitudes of COVID-19, 83.3% of the participants worried about their family members getting COVID-19, and 87.1% were afraid to be in public areas because of COVID-19. Regarding health practices, 93.5% of respondents reported that they could take the proper measures to prevent contracting COVID-19. Logistic regression showed that there was a relationship between occupation and prevention practices (OR=5.21 with 95% CI 1.10-24.76). However, there was no age, gender, or department differences in COVID-19 prevention practices (P-values>0.05).

Conclusions: The presented study indicated that the awareness levels of COVID-19 varied among Chinese healthcare workers. Although COVID-19 did not cause panic among healthcare practitioners, this study demonstrated it would be helpful to update their knowledge of COVID-19 for better prevention practices.

Introduction

The novel coronavirus (COVID-19) was a new emerging infectious disease. The whole society in China knew the pandemic was an outbreak when Wuhan, a city in China was on lockdown on Jan 23, 2020.[1] In the early stage of the COVID-19 outbreak, China, like most countries, wasn't fully prepared for COVID-19. China relied mainly on human resources to combat the epidemic, due to lack of essential medical equipment or effective treatment.[2] Also, at the beginning of the pandemic, few studies addressed the workload and the effectiveness of psychological consulting and their relationship with the position and specialties of the healthcare workers. [3] However, most of those studies are focused on Wuhan, not outside of Wuhan where many healthcare workers were the first frontline to take care of COVID-19 patients.

The battle against COVID-19 is hindered by prevalent misconceptions about the disease among the public. KAP (knowledge, attitude, and practice) is a well-established theoretical model for understanding how to influence individuals' health-related behaviors. It examines the interconnections between knowledge, attitude, and practice.[5] Although WHO recommended conducting KAP at any time during the pandemic, it was more useful in the early stage of pandemic. Knowledge of COVID varied among the residents. [6]

Medical staff play a critical role in controlling new emergency infectious diseases. [7] Health care providers' knowledge, and subsequent attitudes towards SARS-CoV-2 viral infections, are vital for the health care workers who treat COVID-19 patients daily. These providers are a high-risk population and faced an increased risk of contracting COVID-19 as a result of their positions within the health workforce. For example, among a cohort of 1,099 patients with laboratory-confirmed COVID-19 from 552 hospitals in 30 provinces in China, 3.5% of those confirmed positive were healthcare workers. [8] Not only are healthcare workers at an increased risk for contracting COVID-19, but they could also infect others in the hospital setting, further adding to the infected caseload. According to a study of 138 COVID-19 patients from Zhongnan Hospital of Wuhan University, hospital-associated transmission was suspected as the presumed mechanism of infection for affected health professionals (29%) and hospitalized patients (12.3%).[9] Moreover, a cluster outbreak of healthcare workers in Fuxin Hospital in Beijing resulted in the hospital shutting down. [10]

A study from Singapore indicated that none of their 41 health care workers, who were identified as having been exposed via aerosol-generating procedures of infected patients, had acquired the infection. This study instead suggested that surgical masks, hand hygiene, and other standard procedures protected them from being infected.[11] Understanding knowledge, attitudes and subsequence practice towards COVID-19 viral infections was important during the COVID-19 outbreak. This study focuses on the front-line healthcare workers in the hospital who treated COVID-19 patients during the COVID-19 pandemic. Usually, hospitals in China are overcrowded due to the limited medical resources, and over-crowding is a risk factor for transmitting respiratory diseases. [12] According to previous studies, correct infection prevention practices were associated with a high knowledge score on the selected disease. [10]

In the early stage of the pandemic, there was no effective vaccine or medication/treatment available. The medical staff needed to be on the front line to provide the medical service for those patients. The medical staff and physicians, as human beings, are concerned regarding unknown fatal infectious diseases. Hence, a structured questionnaire was designed addressing knowledge of COVID-19 including basic factors, transmission, diagnosis, treatment, prevention, and channels to get that information. This questionnaire was used to understand these topics among the professional healthcare workers involved in the direct clinical care of COVID-19.

2. Methodology

2.1 Study Sample

A cross-sectional descriptive research design was applied to the present study. A survey addressing the KAP of COVID-19 was conducted among healthcare workers in the hospitals that provide treatment for COVID-19 patients from February 10, 2020, to February 15, 2020. The healthcare workers surveyed in this study were recruited for participation from Yijishan Hospital in Anhui Province, and Wenzhou No.[6] People's hospital in Zhejiang Province. A systemic random sampling design was used to designate study subjects for the survey participation. In the end, 126 individuals were surveyed and 108 of them took the survey. The response rate was 85.7%.

2.2 Questionnaire

We used an online questionnaire to collect participant responses and sent out an invitation with the survey link to the target population. A structured questionnaire was adapted from the information released by the National Health and Family Commission of China. The questionnaire was divided into 4 sections including 28 questions. The first section included participants' demographic information. The second section addressed the sources they seek for information related to COVID-19. The third section examined their level of knowledge on COVID-19, and included questions about the transmission, diagnosis, treatment, and preventative measures that could be taken. The fourth section assessed the attitude of the participants related to COVID-19, and the last section addressed the various protection practices of the participants. The knowledge section had 10 items including questions about the basic facts of COVID-19 (1 item); symptoms and latent period (2 items); diagnosis/test, treatment, and prevention methods (7 items). For scoring purposes in this survey, one point was given for the correct answer and zero points were given for incorrect answer. The total score was then calculated and recorded according to the responses provided by the participants. The attitude section had 9 items with the response option for the questions listed as "Yes", "No", and "Do not know.

The link for the online questionnaire, created in Survey Monkey was sent through the mobile phone due to the social-distancing policy implemented during COVID-19 outbreak.

2.3 Statistical Analysis

Descriptive analysis was conducted on the collected data. The distribution of continuous variables was described by means with standard deviations, while the categorical variables were described by percentages. The differences in COVID-19 related KAP among different groups were examined by Chi-square test. The association between the demographic variables and KAP variables including COVID-19 (adequate vs. inadequate), attitude towards COVID-19 (positive vs. negative), and practice (corrected vs. uncorrected) was conducted by logistic regression analysis.

Logistic regression modeling was also applied to explore the association between participant KAP regarding COVID-19. This modeling was adjusted for gender, age, occupation, and department. In addition, logistic regression analysis was applied to evaluate the potential risk factors and Odds Ratios (ORs) with 95% confidence intervals (95% CI) were reported. In this study, statistical significance was set at 0.05 (two sides). SAS 9.4 (SAS Institute, INC, Cary, NC) was used for all statistical analyses in this study. Any p-value found to be lower than 0.05 was judged to be statistically significant in the presented study. This study was approved by the Institutional Review Board of Wenzhou No.6 People's hospital and followed the tenets of the Declaration of Helsinki. A written consent form was obtained from all participants.

3. Results

Of the 126 invited participants, responses were received from 108 healthcare workers, resulting in a response rate of 85.6%. Among them, there were more female than male (58.3% vs 41.7%). In addition, 59.2% were from Anhui province and 40.8% were from Zhejiang province. This study population included 55 (51.4%) physicians, 27 (15.2%) nurses, and 25 other healthcare workers, including administrative staff, interns, support staff, and others. The majority of the survey participants were aged 30 to 39 years (46.3%) (**Table 1**).

Table 1 Sociodemographic characteristics of the studied population (N = 108)

	N	%	χ^2	P-value
Gender			3.0000	0.08
Female	63	58.3		
Male	45	41.7		
Age			53.1111	<0.0001
20-29	41	38.0		
30-39	50	46.3		
40-49	12	11.1		
50-59	5	4.6		
Occupation				<0.0001
Administer	9	8.4	113.0935	
Intern	4	3.7		
Support staff	5	4.7		
Nurse	27	15.2		
Physician	55	51.4		
Others	7	6.5		
Major (department)				
Emergency	1	0.9	103.2336	<.0001
Infectious Disease	22	20.6		
Internal Medicine	23	21.5		
Pneumology	2	1.9		
Others	59	55.1		
Area (province)			92.7407	<0.0001
Anhui	61	59.2		
Zhejiang	41	40.2		

3.1 Information Sources

Table 2 showed that the main source of COVID-19 information reported by participants was from the internet. Mobile phone news apps, and WeChat (like WhatsApp) were also important sources of information on COVID-19, which account for 22.2%, and 15.7%, respectively. A few of respondents reported obtaining their COVID-19 information from TV/radio, newspaper, and posters (less than 5% for total percentages) (**Table 2**).

Table 2 The source of COVID-19 information

Information source	n	%
Internet	58	53.7
Mobile phone news Apps	24	22.2
WeChat	17	15.7
Newspaper	1	0.9
Television	1	0.9
Friends, colleagues, and neighbor	1	0.9
Leaflet, Poster	2	1.9
Others	4	3.7

3.2 Knowledge on COVID-19

Table 3 shows only 63.0% of the participants thought that SARS-CoV-2 virus came from bats. Of the respondents, 20.4% respondents thought that heat, Vinegar, or Chlorhexidine could sterilize and kill SARS-CoV-2. Related to masks, 71.3% of the respondents understood the correct usage and environment for an N95 mask. Only 30.6% demonstrated accurate knowledge of known transmission routes of SARS-CoV-2, including that it could be transmitted by aerosol. Many respondents (26.8%) did not demonstrate accurate knowledge of the symptoms for COVID-19 and only 80.6 % of the respondents correctly reported on the treatment of COVID-19. Almost all of the respondents knew the incubation period for SARS-CoV-2, and 80.6 % of the response knew that there was not a specific medication for COVID-19.

Table 3 Knowledge of COVID-19 among the healthcare (n=108)

Questions of COVID-19	Corrected (n)	%	P
The fact			<.0001
Corrected	68	63.0	
Uncorrected	30	27.0	
Prevention			
The prevention medication of COVID			<.0001
Corrected	103	95.4	
Uncorrected	5	4.6	
The prevention method of COVID			<.0001
Corrected	108	100	
Uncorrected	0	0	
The sterilization of SARS-Cov2			<.0001
Corrected	86	79.6	
Uncorrected	22	20.4	
Transmission			

The fact about the masks			<.0001
Corrected	77	71.3	
Uncorrected	31	28.7	
The correct way to wear mask			<.0001
Corrected	108	100	
Uncorrected	0	0	
The transmission way of SARS-COV2			<.0001
Corrected	73	67.6	
Uncorrected	33	30.6	
The incubation period			<.0001
Corrected	107	99.1	
Uncorrected	1	0.9	
Diagnosis			
The symptom of the COVID-19			<.0001
Corrected	99	91.7	
Uncorrected	9	8.3	
The diagnosis criteria of COVID-19			<.0001
Corrected	79	73.2	
Uncorrected	29	26.8	
Treatment			
How to Treat COVID-19			<.0001
Corrected	87	80.6	
Uncorrected	21	20.4	

3.3 Attitude on COVID-19

Regarding the attitudes and thoughts related to COVID-19 from **Table 4**, 83.3% of the participants worried about their family members getting COVID-19, and 87.1% were afraid to expose to public areas because of COVID-19. Of note, 98.1% of the respondents refused to consume certain animal meats if they believe that the animal could be a reservoir for COVID-19 (even though the exact reservoir of the COVID-19 is still unclear). Additionally, 99.1% of the respondents believed that the COVID-19 outbreak would have a negative impact on the economy. Yet, 91.7% expressed confidence in protecting themselves from infection, 90.7% of the respondents expressed that the government could control the epidemic, and 92.6% believe that COVID-19 could be cured. As for individual protection, 75% perceived themselves as having a high susceptibility to SARS-CoV-2 infection, while 88.1% of respondents thought they had already taken enough precautions to protect themselves.

Compared with others, physicians were less likely to worry about COVID-19 and had more confidence in their ability to undertake personal prevention measures (P<0.05). Young people aged 30-39 years had more confidence in controlling the COVID-19 compared to people from other age groups (P<0.05).

Table 4 Attitude of the COVID-19 among the healthcare (n=108)

Question	n	%	χ^2	P-value
1. Do you worry about your family members getting COVID?			124.2222	< 0.0001
Yes	90	83.3		
No	16	14.8		
Do not know	2	1.9		
2. Are you afraid to go to public areas due to COVID?			142.1667	< 0.0001
Yes	94	87.1		
No	13	12.0		
Do not know	1	0.9		
3. Will you eat the wild animal, if you know it is the reservoir host of COVID?			100.1481	< 0.0001
Yes	2	1.9		
No	106	98.1		
Do not know				
4. Can COVID be controlled?			160.6667	< 0.0001
Yes	98	90.7		
No	2	1.9		
Do not know	8	7.4		
5. Can COVID be cured?			171.1667	< 0.0001
Yes	100	92.6		
No	1	0.9		
Do not know	7	6.5		
6. Can you prevent COVID, if you take the proper measures?			165.7222	< 0.0001
Yes	99	91.7		
No	2	1.9		
Do not know	7	6.5		
7. Does COVID have any negative financial effect?			104.0370	< 0.0001
Yes	107	99.1		
No	1	0.9		
Do not know				

8. Do you think you are at risk of infection?			84.5000	< 0.0001
Yes	81	75.0		
No	15	13.9		
Do not know	12	11.1		
9. Have you taken enough preventive measures for COVID?			112.8889	< 0.0001
Yes	88	81.5		
No	12	11.1		
Do not know	8	7.4		
10. Will you avoid contacting patients can transmit COVID?			108.7222	< 0.0001
Yes	87	80.6		
No	13	12.0		
Do not know	8	7.4		

3.4 Practice on COVID-19

As for practices (**Table 5**), 93.5% of respondents reported that they could undertake the proper measures to prevent COVID-19. As for vaccine, 73.2% expressed the willingness to receive a vaccine due to their working environment if it were available. As for the vaccine, there were disparities in responses within the various health occupations. There is variation on the attitude and practice among different characters (**Table 6**). Compared with physicians, health workers in the "other" categories were more likely to take the vaccine (OR=5.21 with 95% CI 1.10-24.76, P<0.05) (**Table 7**). However, there were no age, gender, area disparity differences in practices to prevent COVID-19 (P>0.05).

Table 5. Practice of the COVID-19 among the healthcare (n=108)

Question	N	%	P-value
Practice			
What measure did you take to prevent COVID?			< 0.0001
I always wash my hands.	5	4.6	
I don't touch my eyes, nose or mouth.	1	0.9	
I wear mask in crowed place.	1	0.9	
All of them.	101	93.5	
Reason to take the vaccine of COVID, if it works			< 0.0001
Operational need	79	73.2	
Recommended by doctors	20	18.5	
Due to my age	2	1.9	
For free price	7	6.5	

Table 6 Attitudes and practices on COVID-19 by demographic characters

Attitudes, n (%) or mean (standard deviation)	Characters													
	Gender		Age				Occupation			Departments			Area	
	Female (n=63)	Male (n=45)	20-29 (n=41)	30-39 (n=50)	40-49 (n=12)	50-59 (n=5)	Nurse (n=27)	Physician (n=55)	Others[#] (n=16)	Infectious Disease (n=22)	Internal Medicine (n=23)	Others[^] (n=62)	Anhui (n=61)	Zhejiang (n=47)
1. Do you worry about your family members getting COVID?														
Yes	54 (85.7)	36(80.0)	35 (85.4)	41 (82.0)	11 (91.7)	3 (60.0)	26 (96.3)	42 (76.4) *	15 (93.7)	18 (81.8)	21 (91.3)	51 (82.3)	53 (86.7)	37 (78.7)
No or don't know	9 (14.3)	9 (20.0)	6 (14.6)	9 (18.0)	1 (8.3)	2 (40.0)	1 (3.7)	13 (23.6)	1 (6.3)	4 (18.2)	2 (8.7)	11 (17.7)	8 (13.1)	10 (21.3)
2. Are you afraid to go to public areas due to COVID?														
Yes	57 (90.5)	37(82.2)	36 (87.8)	43 (86.0)	11 (91.7)	4 (80.0)	26 (96.3)	43 (78.2) *	16 (100.0)	20 (90.9)	20 (87.0)	53 (85.5)	54 (88.5)	40 (85.1)
No or don't know	6 (9.5)	8 (17.8)	5 (12.2)	7 (14.0)	1 (8.3)	1 (20.0)	1 (3.7)	12 (21.8)	0 (0.0)	2 (9.1)	3 (13.0)	9 (14.5)	7 (11.5)	7 (14.9)
3. Will you eat the wild animal, if you know it is the reservoir host of COVID?														
Yes	2 (3.2)	0 (0.0)	1 (2.4)	0 (0.0)	0 (0.0)	1 (20.0)	1 (3.7)	1 (1.8)	0 (0.0)	1 (4.6)	0 (0.0)	1 (1.6)	1 (1.6)	1 (2.1)
No or don't know	61 (96.8)	45 (100.0)	40 (97.6)	50 (100.0)	12 (100.0)	4 (80.0)	26 (96.3)	54 (98.2)	16 (100.0)	21 (95.5)	23 (100.0)	61 (98.4)	60 (98.4)	46 (97.9)
4. Can COVID be controlled?														
Yes	57 (90.5)	41 (91.1)	37 (90.2)	50 (100.0) **	8 (66.7)	3 (60.0)	24 (88.9)	51 (92.7)	15 (93.7)	20 (90.9)	22 (95.3)	55 (88.7)	55 (90.2)	43 (91.5)
No or don't know	6 (9.5)	4 (8.9)	4 (9.8)	0 (0.0)	4 (33.3)	2 (40.0)	3 (11.1)	4 (7.3)	1 (6.3)	2 (9.1)	1 (4.4)	7 (11.3)	6 (9.8)	4 (8.5)
5. Can COVID be cured?														
Yes	60 (95.2)	39 (86.7)	38 (92.7)	47 (94.0)	11 (91.7)	3 (60.0)	26 (96.3)	49 (89.1)	15 (93.7)	21 (95.5)	20 (87.0)	57 (91.9)	56 (91.8)	43 (91.5)
No or don't know	3 (4.8)	6 (13.3)	3 (7.3)	3 (6.0)	1 (8.3)	2 (40.0)	1 (3.7)	6 (10.9)	1 (6.3)	1 (4.5)	3 (13.0)	5 (8.1)	5 (8.2)	4 (8.5)
6. Can you prevent COVID, if you take the proper measures?														
Yes	58 (92.1)	41 (91.1)	38 (92.7)	44 (88.0)	12 (100.0)	5 (100.0)	27 (100.0)	49 (89.1)	13 (81.2)	21 (95.5)	21 (91.3)	56 (90.3)	55 (90.2)	44 (93.6)
No or don't know	5 (7.9)	4 (8.9)	3 (7.3)	6 (12.0)	0 (0.0)	0 (0.0)	0 (0.0)	6 (10.9)	3 (18.8)	1 (4.5)	2 (8.7)	6 (9.7)	6 (9.8)	3 (6.4)

7. Does COVID have any negative financial effect?													
Yes	62 (98.4)	45 (100.0)	40 (97.6)	50 (100.0)	12 (100.0)	5 (100.0)	26 (96.3)	55 (100.0)	16 (100.0)	22 (100.0)	23 (100.0)	61 (98.4)	61 (100.0)	46 (97.9)
No or don't know	1 (1.6)	0 (0.0)	1 (2.4)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.6)	0 (0.0)	1 (2.1)
8. Do you think you are at risk of infection?														
Yes														
No or don't know	47 (74.6)	34 (75.6)	29 (70.7)	42 (84.0)	8 (66.7)	2 (40.0)	23 (85.2)	41 (74.6)	12 (75.0)	20 (90.9)	19 (82.6)	41 (66.1)	42 (68.9)	39 (83.0)
	16 (25.4)	11 (24.4)	12 (29.3)	8 (16.0)	4 (33.3)	3 (60.0)	4 (14.8)	14 (25.5)	4 (25.0)	2 (9.1)	4 (17.4)	* 21 (33.9)	19 (31.2)	8 (17.0)
9. Have you taken enough preventive measures for COVID?														
Yes														
No or don't know														
	50 (79.4)	38 (84.4)	31 (75.6)	43 (86.0)	10 (83.3)	4 (80.0)	22 (81.5)	46 (83.6)	12 (75.0)	18 (81.8)	21 (91.3)	48 (77.4)	47 (77.0)	41 (87.2)
	13 (20.6)	7 (15.6)	10 (24.4)	7 (14.0)	2 (16.7)	1 (20.0)	5 (18.5)	9 (16.4)	4 (25.0)	4 (18.2)	2 (8.7)	14 (22.6)	14 (23.0)	6 (12.8)
10. Will you avoid contacting with patients can transmit COVID?														
Yes														
No or don't know	49 (77.8)	38 (84.4)	27 (65.9)	44 (88.0)*	11 (91.7)	5 (100.0)	16 (59.3)	46 (83.6)*	15 (93.7)	13 (59.1)	21 (91.3)	52 (83.9)*	54 (88.5) *	33 (70.2)
	14 (22.2)	7 (15.6)	14 (34.2)	6 (12.0)	1 (8.3)	0 (0.0)	11 (40.7)	9 (16.4)	1 (6.3)	9 (40.9)	2 (8.7)	10 (16.1)	7 (11.5)	14 (29.8)

Table 7. Results of multiple binary logistic regression analysis on factors associated with practices towards COVID-19

Variable	OR (95%CI)	P-value
Q1: What measure did you take to prevent COVID?		
Gender (male vs. female)	1.01(0.001-999)	0.917
Age (30-39 vs. 20-29)	2.01 (0.17-24.8)	0.564
Age (40-49 vs. 20-29)	0.25 (0.005-12.5)	0.489
Age (50-59 vs. 20-29)	1.86 (0.001-999)	0.972
Occupation (Nurse vs. Physician)	0.22 (0.001-999)	0.994
Occupation (Others vs. Physician)	0.05 (0.001-1.62)	0.091
Major (Internal Medicine vs. Infectious Disease)	1.09 (0.001-999)	0.999
Major (Others vs. Infectious Disease)	15.09 (0.001-999)	0.990
Area (Zhejiang vs. Anhui)	1.86 (0.001-999)	0.930
Q2: Reason to take the vaccine of COVID, if it works.		
Gender (male vs. female)	1.13 (0.29-4.49)	0.862
Age (30-39 vs. 20-29)	1.99 (0.52-7.62)	0.315
Age (40-49 vs. 20-29)	0.77 (0.06-9.44)	0.838
Age (50-59 vs. 20-29)	6.73(0.58-78.83)	0.129
Occupation (Nurse vs. Physician)	2.85(0.46-17.62)	0.259
Occupation (Others vs. Physician)	5.21(1.10-24.76)	0.038
Major (Internal Medicine vs. Infectious Disease)	7.02(0.537-91.753)	0.137
Major (Others vs. Infectious Disease)	2.95 (0.24-36.83)	0.401
Area (Zhejiang vs. Anhui)	0.56 (0.13-2.37)	0.430

Others[#] included Intern, Logistics, Administer and other positions.
Others[^] included Emergency, Pneumology and other departments.
NOTE: Bolded point estimates indicate statistical significance at P<0.05.

4. Discussion

Our study indicated that the Internet, mobile phone apps, and social media are the mainstream sources for health information on COVID-19 for healthcare workers. The health care workers from the infectious disease departments had more correct responses regarding COVID-19 and reported more proper health practices compared to healthcare workers in other departments and areas. Regarding to the gender difference, our result consisted with other similar studies that females observed preventive measures more than males against COVID-19. [13.14]

Also, when compared to non-healthcare worker experiences in China, the relevant KAP score of healthcare were higher.[15] The effects of occupational protection are immensely affected by individual's knowledge, attitude, and practice (KAP).[16.17] Meanwhile, there is difference between the healthcare from different countries, [18] although time of conducting the survey can partly explained the difference in the timeline.

4.1 Source of information

Our results found that that Internet and mobile phone news apps were the main channel of COVID-19 information (75.9%), which is consistent with a previous study on coronavirus disease MERS.[19] Traditional information channels such as television, newspaper, and radio played a key role during the SARS and influenza A/H1N1 outbreaks. [20,22] However, in this study, these traditional channels of information were not found to be the main source of COVID-19 information. This significant change can be attributed to the advancement in technology and greater access to the Internet nationally.[19] When facing emerging infectious diseases, most people did not have enough knowledge to understand how to handle the outbreak and turned to readily available sources for more information. The public, as well as those healthcare workers in this study, are heavily dependent on outside sources for information. Efficient and reliable information sources play a key role in emerging infectious diseases.

However, when social media is a main source of information, information overload can occur, and it then becomes difficult to determine the validity of information from all of the sources. This can lead to misinformation and further confusion on a large-scale. [23] Chinese people like to use the apps to get updated information; however, there are few health promotion or educational apps at the professional level. Most are news media outlets, which may not relay accurate and reliable information. This reminds us that future health information delivery methods must have clear, consistent and reputable information readily available. Few people use the traditional health channels such as newspapers and TV. This could be partly due to the higher education level of the participants as well as most participants being younger in age. This could also signal a shift in the information outlet seeking behavior indicative of the current times. Previous studies found that increases in situational awareness in times of COVID-19 crisis using formal information sources can significantly increase the adoption of protective health behavior, and in turn contain the spread of infectious diseases.[24]

4.2 Knowledge

Our results confirmed that healthcare workers engaged in the daily care of infectious diseases possess significantly higher levels of knowledge compared to those who do not require training in mask-wearing protocols. Those health workers must educate themselves on how to prevent respiratory disease. [25] Our results are consistent with findings from a Pakistan study that demonstrated that there were variations in awareness and attitudes on COVID-19. [26] In that study, health workers were required to use gloves, gowns, eye protection, and N95 respirators for all contact with patients who have respiratory disease, such as SARS. [26]

4.3 Attitude

Our results indicate that 90.7% of respondents expressed that the government could control the epidemic, while a previous study among community residents claimed that 97.1% of respondents had confidence that China could win the battle against COVID-19.[27] It could be due to differences in the study populations, and the fact that healthcare workers are exposed to greater risk on a daily basis and therefore may have less confidence due to their direct contact with COVID-19 and the effects on those infected cases, as compared to the general public.

Our results show that people between the ages of 30 and 39 years have higher confidence in their ability to control contracting COVID-19 compared to the other age groups respondents. Previous studies found that COVID-19 knowledge scores were significantly lower in persons without confidence of controlling the COVID-19 outbreak. [27] Usually, experienced physicians reveal higher rates of knowledge and awareness toward infectious disease compared to other types of healthcare workers. [28]

As for occupation, few physicians worried about their family members getting COVID-19 and were less likely to avoid public areas due to COVID-19. Physicians have lower risk perceptions and more confidence in their ability to enable preventive behaviors. Usually, the attitude of the healthcare workers surrounding COVID-19 is positive, and people perceive the risk to be relatively normal. For example, Choi et al. found that that attitude was the most important variable, and perceived risk was the second most important variable in strengthening preventive behaviors among a population during the MERS outbreak. [29] Negative attitudes toward new emerging infectious diseases may cause unnecessary concerns, rumors, social chaos, and public panic which might aggravate the epidemic.[30]

4.4 Practice

Previous studies pointed out that information alone did not reliably change risky behavior. [31,32] Regarding attitudes, previous studies on MERS found that majority of healthcare workers were eager to apply infection control measures since the onset of MERS-CoV.[33] Logistic regression analysis identified that the occupation of the participants had a significant impact on the prevention of COVID-19 practices put into place. This could be partly attributed to the fact that COVID-19 is an emerging infectious disease, unlike other similar infectious disease that have been around for a longer period of time, which could take a longer time to perceive the specific benefit in prevention measurements.

4.5 Limitations

For healthcare workers, occupational exposure to COVID-19 is an important risk factor for COVID-19 infection. Due to various reasons, it was not accepted and published on time, despite being the pioneering study addressing COVID-19 among healthcare workers. did not get accepted and published on time, although it was the first study addressing the KAP of COVID-19 among healthcare workers. Additionally, the internal relationships was analyzed among KAP. None the less, our study has several limitations. First, participants were sampled from certain areas in China and is therefore not nationally representative, and the results might not be

applicable to the entire population. Second, this study is limited by a cross-section study design; the causal relationship cannot be drawn from this current study. Lastly, other potential factors such as education level, which could influence the results of this study, were not collected.

Despite the limitation, this study has important and relevant implications during the time of an emergency infectious disease battle. The study results highlight the importance of updating knowledge of the front-line healthcare workers related to COVID-19. It also provides solid evidence for health policy makers or hospital management personal to figure out the best way to provide related training programs for healthcare workers during a new emergency infectious disease outbreak. A specific, timely and accurate course or workshop addressing updated information could further improve all types of healthcare worker's knowledge on COVID-19 and other infectious diseases.

Conclusions

The presented study indicates that awareness levels of COVID-19 varied among Chinese health care workers. Although COVID-19 has not caused panic among healthcare worker, better knowledge and/or updated knowledge of COVID-19 prevention strategies is needed. Systemic education based on hospital addressed prevention strategies for new emergency infectious disease are warranted.

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