

Knowledge, Attitude, and Practice of Nurses Towards the Prevention and Control of COVID-19

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Abstract

Background: Coronavirus disease 2019(COVID-19) has been spreading globally, with severe impacts on health and economies. Nursing is an essential component of medical care, and nurses' knowledge, attitude, and practice (KAP) about the prevention and control of the disease directly affects patient's outcomes ,but there is little know about the nurses' KAP during the COVID-19 epidemic.

Methods: An anonymous survey was conducted using customized questionnaires designed by Sojump platform. 1323 nurses in Wuhan were the survey object for the KAP survey. The survey included 48 questions regarding the basic information of nurses and knowledge, attitude, and prevention measures for COVID-19.

Results: A total of 1323 nurses in Wuhan were included in the survey, of whom women (95.7%) under 40 years old (94.6%) accounted for the majority. Nurses have a comprehensive knowledge of problems such as the COVID-19 susceptible population, isolation ward layout process, environmental cleaning and disinfection, hand hygiene measures, infectious disease case reporting processes, standard prevention measures, and personal protection level, with more than 60% accuracy. However, they have a general lack of knowledge about the route of transmission of COVID-19, the use of protective equipment, patient management, medical waste disposal, and occupational exposure emergency response, with less than 45% accuracy. There was a gap between the attitude and the practice of nurses ($p < 0.05$). Moreover, the knowledge level of nurses has an impact on their attitude (OR 1.52, 95% CI 1.10-2.08, $p = 0.008$), and title (OR 1.48, 95% CI 1.01-2.15, $p = 0.042$), place of work (OR 1.59, 95% CI 1.36-1.85, $p < 0.001$), and attitude (OR 1.93, 95% CI 1.52-2.46, $p < 0.001$) had an impact on their practice.

Conclusion: The nurses in Wuhan during the epidemic have insufficient knowledge about COVID-19 infection prevention and control, and there are gaps in attitude and practice, which further affect their attitude and practice. It is therefore necessary to strengthen relevant knowledge training on COVID-19 among nurses.

Background

Coronaviruses are a large family of viruses known to cause common colds and more severe diseases such as Middle East respiratory syndrome (MERS) and severe acute respiratory syndrome (SARS). Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a new species of coronaviruses that was recently found to infect human. It is highly contagious and pathogenic. Pneumonia associated with SARS-CoV-2 infection has been named coronavirus disease 2019 (COVID-19) by the World Health Organization (WHO) [1–3]. Since its outbreak in December 2019, COVID-19 has been spreading globally with severe impacts on health and economies. Since the outbreak, the Chinese government and health authorities have issued a range of prevention and control policies and have actively taken various measures to control the development and spread of the outbreak. The SARS outbreak in 2003 revealed that knowledge, attitude, and practice (KAP) play equally important roles in the prevention and control of

an outbreak. Therefore, many researchers have conducted surveys to investigate the outbreak-related KAP of the general public in China during the outbreak in order to identify gaps for prevention and control and provide a theoretical basis for the development of targeted prevention and control measures [4–8].

Nursing is an essential component of medical care, and nurses' knowledge about disease directly affects patient outcomes. Similarly, during an outbreak, nurses' KAP play positive roles in improving the recovery rate, reducing the length of the hospital stay and mortality, and preventing in-hospital infection and occupational exposure [9, 10]. To date, most studies focus on the KAP of the general public, and few have investigated the KAP of nurses [11, 12]. To further understand the current status of the KAP of nurses towards the prevention and control of COVID-19 during the outbreak, we conducted a cross-sectional survey of some hospital nurses.

Methods

Study population

This voluntary survey was conducted with nurses who worked at designated COVID-19 hospitals, nondesignated hospitals, and Fangcang shelter hospitals in Wuhan between March 5 and March 20, 2020. The inclusion criteria included the following: licensed practicing nurses who participated in the outbreak prevention and control and voluntarily participated in the survey of this study. Visiting nurses and interns were excluded.

Study design

We designed a survey with 48 items to collect the following information:

- 1) Background information, including age, sex, education level, marital status, childbearing history, title, work experience (year), health status, place of work, hospital department, and role (11 items);
- 2) Knowledge about the prevention and control of COVID 19 infection, including susceptibility, route of transmission, ward layout and procedures, cleaning and disinfection, hand hygiene measures, infectious disease case reporting, standard preventive measures, use of personal protective equipment (PPE), level of personal protection, patient management, medical waste disposal, and occupational exposure emergency response (12 items). All items were single-choice responses (1 for correct answer, 0 for incorrect answer; total score: 12). A higher score indicated a better understanding of prevention and control of in-hospital infection;
- 3) Attitude towards the prevention and control of COVID 19 infection, including personal protection, patient management, environmental disinfection, and knowledge training (10 items). A 5-point Likert scale was used, where 1 indicated "strongly disagree", 2 indicated "disagree", 3 indicated "not sure", 4 indicated "agree", and 5 indicated "strongly agree". The total score ranged from 10 to 50, and a higher score indicated more positive attitude towards the prevention and control of in-hospital infection;

4) Practice to prevent COVID-19 infection, including standard preventive measures, personal protection, hand hygiene, prediagnosis and triage, patient management, proper zoning, strict environmental disinfection, proper disposal of medical waste, occupational exposure emergency response, and training regarding in-hospital infection (15 items). For scoring, 1 indicated "rarely", 2 indicated "occasionally", 3 indicated "sometimes", 4 indicated "often", and 5 indicated "always". Some items were scored in reverse, and the total score ranged from 15 to 75. A higher score indicated more standardized prevention and control of in-hospital infection;

5) To "pass" the survey, the KAP scores have to be higher than 7, 24, and 36, respectively.

This survey was conducted via a questionnaire, which was distributed to eligible subjects via a Sojump link and could be completed by the participants in approximately 8–10 minutes [13, 14]. Any question about the questionnaire was addressed by the investigator through telephone communication, etc. This questionnaire was developed and modified based on the study team meetings and consultations with experts on nursing and in-hospital infection.

Ethical approval

Permission for the study was obtained from ethical committee of the hospital. Special item was set on the questionnaire, and participants responding to "agree" were considered as informed consent.

Statistical analysis

We collected the background information of nurses and provided descriptive statistics of KAP towards the prevention and control of COVID-19 infection. SPSS v21.0 was used for the statistical analysis. Count data are expressed as frequency and percent and were analyzed with Pearson's chi-square test or Fisher's exact test. For 5-point items, the responses were divided into 2 groups (≥ 4 vs < 4). Non-conditional logistic regression analysis was performed to identify relevant factors. The significance level was $\alpha=0.05$, and $p<0.05$ was considered statistically significant.

Results

General information

A total of 1453 questionnaires were retrieved, 1323 of which (91.1%) were valid. We collected general information from these 1323 nurses. The highest proportion of nurses were below 40 years of age (94.6%), were female (95.7%), had an undergraduate education (76.7%) and 5-10 years of working experience (47.1%), were married (62.4%) with children (55.9%) and healthy (90.2%), and were engaged in clinical nursing (79.7%) at designated hospitals (66.4%), followed by Fangcang shelter hospitals (25.2%) (Table 1).

Knowledge

The 1323 nurses had a good understanding of COVID-19-susceptible populations (76.9%), isolation ward layout and procedures (70.5%), environmental cleaning and disinfection (60.7%), hand hygiene measures (71.0%), infectious disease case reporting (78.3%), standard preventive measures (61.9%), and level of personal protection (69.7%). However, the nurses had less knowledge about the route of transmission (23.7%), use of PPE (19.6%), patient management (40.7%), medical waste disposal (19.1%), and occupational exposure emergency response (28.6%). See Table 2.

Attitude versus practice

Attitude and practice were concordant on items ranging from personal protection, hand hygiene, prediagnosis and triage, and patient management to training regarding in-hospital infection ($p > 0.05$) and were discordant on items ranging from standard preventive measures, proper zoning, strict environmental disinfection, and proper disposal of medical waste to occupational exposure emergency response ($p < 0.001$), primarily due to a gap in practice. See Table 3.

Factors related to participants' attitude and practice

Unconditional logistic regression analysis showed that attitude were positively related to knowledge (OR, 1.52, 95% CI 1.10-2.08, $p = 0.008$; Table 4), while practice were related to title [OR 1.48, 95% CI 1.01-2.15, $p = 0.042$], place of work (OR 1.59, 95% CI 1.36-1.85, $p < 0.001$), and attitude [OR 1.93, 95% CI 1.52-2.46, $p < 0.001$; Table 5).

Discussion

In this study, we surveyed the current status of the KAP of nurses towards the prevention and control of COVID-19 infection during the outbreak and found that nurses had some knowledge deficiency regarding the prevention and control of COVID-19 infection, thus affecting their attitude and practice and resulting in discordance between attitude and practice.

Knowledge deficiency

The knowledge of nurses about the COVID-19 outbreak directly affects patient outcomes and the prevention and control of COVID-19 infection. This study showed that nurses had a good understanding of isolation ward layout and procedures and infectious disease case reporting procedures, which may be the result of relevant training. In this survey, 91.6% of the nurses worked at a designated hospital or a Fangcang shelter hospital, and they received required training and passed field simulation tests before they started to work, suggesting that continuing education plays a significant role in improving KAP [15,16,17], which also applies to the general public [5]. Strict hand hygiene also plays an important role in disease prevention and control. During the influenza A virus subtype H1N1 (H1N1) outbreak in 2009, some researchers conducted a survey on hand hygiene compliance among medical staff, including doctors and nurses, and found that medical staff had a very good understanding of hand hygiene measures, with a higher compliance rate in nurses ($> 80\%$). This study showed that more than 70% of the

nurses understood hand hygiene measures, a result that is consistent with previous reports [18,19]. However, some studies show that occupational burnout may affect hand hygiene compliance, with a negative impact on nursing, and which should be paid to attention [20]. This study showed that only 23.7% of the investigated nurses knew the routes of COVID-19 transmission. Potential reasons include a lack of adequate information on routes of transmission of this novel virus other than respiratory transmission. In addition, this study showed that nurses generally lacked adequate knowledge about medical waste disposal and occupational exposure emergency response, especially the use of PPE. This may be related to the emergent nature of this public health crisis, the rapid spread, and the lack of nurses with special training in infectious diseases. In this survey, only 22.5% of the nurses were front-line nurses who worked in an isolation ward.

Gap between attitude and practice

This study showed a gap between attitude and practice. The nurses had positive attitude towards personal protection, hand hygiene, prediagnosis and triage, patient management, and training regarding in-hospital infection. They implemented practical preventive measures such as the proper use of PPE, strict hand hygiene measures, setting-up fever clinics, isolation wards, and designated hospitals. However, this study showed discordance between attitude and practice in standard preventive measures, proper division of wards, strict environmental disinfection, proper disposal of medical waste, and occupational exposure emergency response ($p < 0.001$).

Concordance between attitude and practice may be attributed to public media and the enforcement of national policies. Since the outbreak, various guidelines have emphasized personal protection, hand hygiene, and centralized management of suspected and confirmed cases. Medical facilities have been strictly following these guidelines, which explains the concordance between attitude and practice towards common items in this survey. During the SARS outbreak, the general public was very optimistic—70-80% believed that SARS would be successfully controlled or prevented, and 95-100% believed that China would win the war against SARS [21, 22]. At the time, the general public actively took measures such as avoiding crowded places and wearing masks when in public, and these measures were also actively promoted by government policies.

The gap between attitude and practice was consistent with the medical situation in Wuhan during the early outbreak. As the hardest hit area, in the early outbreak Wuhan faced a shortage of medical supplies such as masks and protective equipment, which hampered the efforts to implement standard protective measures in some roles. Moreover, many wards were temporarily reorganized to alleviate the shortage of infectious disease wards, making it difficult to implement the “three zones and two pathways” design. In addition, these may be related to the lack of comprehensive knowledge of the virus in the early stage. As new scientific information emerges, the guidelines and protocols for the diagnosis and treatment of COVID-19 are being updated with clearer instructions regarding environmental disinfection, medical waste disposal, and occupational exposure emergency response. Furthermore, during the outbreak,

medical staff had to rely on self-paced online training, which was not as effective as classroom training and contributed to the gap between attitude and practice.

Factors related to attitude and practice

In this study, we performed nonconditional logistic regression analysis to identify factors related to participants' attitude and practice and found that attitude were related to knowledge (OR 1.52, 95% CI 1.10-2.08, $p = 0.008$), which was consistent with that of the general public during the COVID-19 outbreak [5]. Moreover, practice was related to title (OR 1.48, 95% CI 1.01-2.15, $p = 0.042$), place of work (OR 1.59, 95% CI 1.36-1.85, $p < 0.001$), and attitude (OR 1.93, 95% CI 1.52-2.46, $p < 0.001$). These data indicate that knowledge influences attitude, which then influences practice, which is consistent with the findings during other acute infectious disease outbreaks, such as SARS and H1N1 [18,21,22]. In addition, this study showed that practice were related to title and place of work. Senior nurses were relatively older and may have experienced the SARS outbreak in 2003 and H1N1 outbreak in 2009, which had a direct impact on their practice during the COVID-19 outbreak. Wuhan was the hardest hit area as such, designated hospitals and Fangcang shelter hospitals were set up to admit and treat patients with confirmed cases, all of whom were infectious, requiring nurses to implement strict prevention and control measures to prevent in-hospital infection. As a result, the working place (whether you work in an infectious ward or ICU) affected practice.

This study has some limitations, including a small sample size of both participants and hospitals and a limited survey scope, which may have resulted in certain bias. Further in-depth studies are needed to validate the results.

Conclusion

This study showed that nurses in Wuhan during the epidemic lacked adequate knowledge about the prevention and control of COVID-19 infection, with a gap between attitude and practice that in turn affected both attitude and practice. As important members of prevention and control teams, nurses are on the front line for the prevention and control of in-hospital infection. Therefore, nurses must strictly follow prevention and control measures for in-hospital infection; improve their understanding about COVID-19 prevention and control; ensure proper personal protection, patient management, and environmental disinfection; and minimize occupation exposure in order to facilitate the successful prevention and control of in-hospital infection and the safety of medical staff and patients.

Abbreviations

KAP

knowledge, attitude, and practice; COVID-19: coronavirus disease 2019; SARS-CoV-2: respiratory syndrome coronavirus 2; SARS: severe acute respiratory syndrome; MERS: Middle East respiratory syndrome; WHO: World Health Organization

Declarations

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Authors' contributions

ZJ and XL designed this research and guided the other authors (WZ, ZW, LY, NL) in data collection. Analysis and interpretation of data and literature review were done by ZJ, LL and WZ. ZJ and LL involved in writing up the manuscript and all authors read and approved the final manuscript.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

This study was approved by ethical review committee of Maternal and Child Health Hospital of Hubei Province. Participants responding to the questionnaire were considered as informed consent.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Tables

Table 1
General Information

Item	Response	Subject	
		n	%
Age	20–30	790	59.7
	31–40	462	34.9
	41–50	63	4.8
	> 50	8	0.6
Sex	Male	57	4.3
	Female	1266	95.7
Education level	College and below	303	22.9
	Undergraduate	1015	76.7
	Postgraduate and above	5	0.4
Marital status	Single	477	36.1
	married	826	62.4
	Divorced	17	1.3
	Other	3	0.2
Childbearing history	No	584	44.1
	Yes	739	55.9
Title	Nurse	992	75.0
	Attending nurse	307	23.2
	(Associate) chief nurse	24	1.8
Role	Clinical nursing	1054	79.7
	Nursing management	138	10.4
	Other	131	9.9
Work experience (years)	< 5	350	26.5
	5–10	623	47.1
	11–15	210	15.9
	16–20	74	5.6
	> 20	66	5.0

Underlying disease	Yes	77	5.8
	No	1193	90.2
	Unknown	53	4.0
Place of work	Designated hospital	879	66.4
	Nondesignated hospital	111	8.4
	Shelter hospital	333	25.2
Hospital department	Isolation ward	298	22.5
	General ward	367	27.7
	Intensive care unit (ICU)	273	20.6
	Clinic and emergency department	81	6.1
	Laboratory and imaging	21	1.6
	Other	283	21.4

Table 2
Knowledge about the Prevention and Control of COVID-19 Infection

Knowledge	Correct		Incorrect	
	n	%	n	%
Susceptible populations	1018	76.9	305	23.1
Route of transmission	314	23.7	1009	76.3
Isolation ward layout and procedures	933	70.5	390	29.5
Environmental cleaning and disinfection	803	60.7	520	39.3
Hand hygiene measures	939	71.0	384	29.0
Infectious disease case reporting	1036	78.3	287	21.7
Standard preventive measures	819	61.9	504	38.1
Use of personal protective equipment	259	19.6	1064	80.4
Level of personal protection	922	69.7	401	30.3
Patient management	539	40.7	784	59.3
Medical waste disposal	253	19.1	1070	80.9
Occupational exposure emergency response	379	28.6	944	71.4

Table 3
Preventive Measures Considered Useful by Subjects versus Practice

Preventive Measures	Positive Attitude ("Agree" and "Strongly Agree")		Practice ("Often" and "Always")		p^*
	n	%	n	%	
Standard preventive measures	1215	91.8	456	34.5	< 0.001
Personal protection	1234	93.3	1158	87.5	0.248
Hand hygiene	1234	93.3	1060	80.1	0.459
Prediagnosis and triage	987	74.6	1278	96.6	0.619
Patient management	893	67.5	1310	99.0	0.767**
Proper zoning	876	66.2	643	48.6	< 0.001
Strict environmental disinfection	1089	82.3	789	59.6	< 0.001
Proper disposal of medical waste	1156	87.4	376	28.4	0.021
Occupational exposure emergency response	1065	80.5	432	32.7	< 0.001
Training on in-hospital infection	1226	92.7	1023	77.3	0.614
Note: * chi-square test					
** Fisher's exact test					

Table 4
Logistic Regression Analysis of Factors Related to Participants' Attitude

Factor		Attitude		OR (95% CI)	<i>p</i>
		Positive (%)	Negative (%)		
Age	20–30	495 (62.7)	295 (37.3)	1.08 (0.77–1.53)	0.652
	31–40	300 (64.9)	162 (35.1)		
	41–50	45 (71.4)	18 (28.6)		
	> 50	5 (62.5)	3 (37.5)		
Sex	Male	43 (75.4)	14 (24.6)	1.06 (0.61–1.86)	0.834
	Female	802 (63.3)	464 (36.7)		
Education level	College and below	180 (59.4)	123 (40.6)	1.24 (0.95–1.62)	0.112
	Undergraduate	662 (65.2)	353 (34.8)		
	Postgraduate and above	3 (60.0)	2 (40.0)		
Marital status	Single	293 (61.4)	184 (38.6)	1.05 (0.78–1.40)	0.762
	Married	538 (65.1)	288 (34.9)		
	Divorced	0 (0.0)	3 (100.0)		
	Other	14 (82.4)	3 (17.6)		
Childbearing history	No	361 (61.8)	223 (38.2)	1.07 (0.75–1.53)	0.706
	Yes	484 (65.5)	255 (34.5)		
Title	Nurse	621 (62.6)	371 (37.4)	1.05 (0.74–1.50)	0.779
	Attending nurse	210 (68.4)	97 (31.6)		
	(Associate) chief nurse	14 (58.3)	10 (41.7)		
Role	Clinical nursing	680 (64.5)	374 (35.5)	0.91 (0.76–1.10)	0.327
	Nursing management	82 (59.4)	56 (40.6)		

	Other	83 (63.4)	48 (36.6)		
Work experience (years)	< 5	302 (63.2)	176 (36.8)	0.96 (0.77–1.18)	0.676
	5–10	309 (62.4)	186 (37.6)		
	11–15	138 (65.7)	72 (34.3)		
	16–20	52 (70.3)	22 (29.7)		
	> 20	44 (66.7)	22 (33.3)		
Underlying disease	Yes	51 (66.2)	26 (33.8)	0.95 (0.66–1.37)	0.782
	No	760 (63.7)	433 (36.3)		
	Unknown	34 (64.2)	19 (35.8)		
Place of work	Nondesignated hospital	563 (64.1)	316 (35.9)	0.92 (0.81–1.06)	0.251
	Designated hospital	75 (67.6)	36 (32.4)		
	Shelter Hospital	207 (62.2)	126 (37.8)		
Hospital department	Isolation ward	182 (61.1)	116 (38.9)	1.04 (0.96–1.13)	0.372
	General ward	235 (64.0)	132 (36.0)		
	ICU	184 (67.4)	89 (32.6)		
	Clinic and emergency department	49 (60.5)	32 (39.5)		
	Laboratory and imaging	13 (61.9)	8 (38.1)		
	Other	182 (64.3)	101 (35.7)		
Knowledge	Fail	675 (62.2)	410 (37.8)	1.52 (1.10–2.08)	0.008
	Pass	170 (71.4)	68 (28.6)		

Table 5
Logistic Regression Analysis of Factors Related to Participants' Practice

Factor		Attitude		OR (95% CI)	<i>p</i>
		Positive (%)	Negative (%)		
Age	20–30	740 (93.7)	50 (6.3)	1.02 (0.71–1.46)	0.929
	31–40	449 (97.2)	13 (2.8)		
	41–50	61 (96.8)	2 (3.2)		
	> 50	8 (100.0)	0 (0.0)		
Sex	Male	57 (100.0)	0 (0.0)	0.83 (0.46–1.48)	0.521
	Female	1201 (94.9)	65 (5.1)		
Education level	College and below	287 (94.7)	16 (5.3)	1.01 (0.77–1.33)	0.937
	Undergraduate	966 (95.2)	49 (4.8)		
	Postgraduate and above	5 (100.0)	0 (0.0)		
Marital status	Single	444 (93.1)	33 (6.9)	0.93 (0.70–1.25)	0.650
	Married	795 (96.2)	31 (3.8)		
	Divorced	3 (100.0)	0 (0.0)		
	Other	16 (94.1)	1 (5.9)		
Childbearing history	No	545 (93.3)	39 (6.7)	1.18 (0.82–1.69)	0.378
	Yes	713 (96.5)	26 (3.5)		
Title	Nurse	936 (94.4)	56 (5.6)	1.48 (1.01–2.15)	0.042
	Attending nurse	298 (97.1)	9 (2.9)		
	(Associate) chief nurse	24 (100.0)	0 (0.0)		
Role	Clinical nursing	1004 (95.3)	50 (4.7)	0.93 (0.77–1.13)	0.454

	Nursing management	132 (95.7)	6 (4.3)		
	Other	122 (93.1)	9 (6.9)		
Work experience (years)	< 5	440 (92.1)	38 (7.9)	0.95 (0.76– 1.18)	0.641
	5–10	478 (96.6)	17 (3.4)		
	11–15	202 (96.2)	8 (3.8)		
	16–20	74 (100.0)	0 (0.0)		
	> 20	64 (97.0)	2 (3.0)		
Underlying disease	Yes	75 (97.4)	2 (2.6)	1.03 (0.71– 1.50)	0.859
	No	1131 (94.8)	62 (5.2)		
	Unknown	52 (98.1)	1 (1.9)		
Place of work	Nondesignated hospital	828 (94.2)	51 (5.8)	1.59 (1.36– 1.85)	< 0.001
	Designated hospital	107 (96.4)	4 (3.6)		
	Shelter hospital	323 (97.0)	10 (3.0)		
Hospital department	Isolation ward	283 (95.0)	15 (5.0)	1.07 (0.98– 1.17)	0.135
	General ward	347 (94.6)	20 (5.4)		
	ICU	260 (95.2)	13 (4.8)		
	Clinic and emergency department	78 (96.3)	3 (3.7)		
	Laboratory and imaging	20 (95.2)	1 (4.8)		
	Other	270 (95.4)	13 (4.6)		
Knowledge	Fail	581 (94.9)	31 (5.1)	1.24 (0.90– 1.72)	0.190
	Pass	677 (95.2)	34 (4.8)		

Attitude	Dissatisfied	26 (81.3)	6 (18.8)	1.93 (1.52– 2.46)	< 0.001
	Satisfied	1232 (95.4)	59 (4.6)		