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ORIGINAL ARTICLE

Knowledge, attitudes, and behaviors regarding COVID-19 among hospitalized patients in Taizhou, China

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Abstract

Objection This study investigated the relationship between the knowledge, attitudes, and behaviors among hospitalized patients regarding the prevention and control of COVID-19.

Method An online cross-sectional survey was conducted among hospitalized patients between July 8 and August 11, 2021, at a tertiary hospital in Taizhou, China. We performed descriptive analysis, t test, ANOVA (analysis of variance), and generalized linear regression modeling on the exported data. All data were analyzed using R software, version 4.1.0.

Results A total of 1185 valid questionnaires were returned. The average score of the participants on COVID-19 behaviors was 69.3 (SD = 15.6, with a full score of 87), indicating that most inpatients had good COVID-19 prevention and control behaviors. In addition, we found that inpatients with higher COVID-19 awareness also behaved better (B (95%CI) = 1.00 (0.73–1.27)) and were more willing to recommend vaccination to other people (OR (95%CI) = 1.11 (1.06–1.17)). Moreover, hospitalized patients who had positive attitudes toward implementing COVID-19 prevention and control measures had better practices (B (95%CI) = 2.50 (2.24–2.76)) and more willingness to recommend vaccinations (OR (95%CI) = 1.20 (1.14–1.26)).

Conclusion The research showed that the COVID-19 behaviors of hospitalized patients were positively associated with their knowledge and attitudes. These findings suggested that, for inpatients, hospitals should focus on teaching basic prevention knowledge of COVID-19. Targeted education initiatives should also be developed for patients from rural areas, especially those over 60 years of age, to help improve their knowledge and cultivate good prevention and control behaviors.

Keywords COVID-19 · Knowledge · Attitudes · Behaviors · Hospitalized patients

Introduction

Since it first emerged in late 2019, the COVID-19 pandemic has been an important and urgent public health event that has generated widespread concern around the world (WHO 2020a, b). COVID-19 has seriously affected public health and medical institutions, and large-scale vaccination is considered one of the most important means of preventing further transmission. Nevertheless, breakthrough infections that occur because of mutations mean that high vaccine coverage may not ensure the effective control of COVID-19 transmission (Bergwerk et al. 2021; Zhang et al. 2022). In other words, in addition to vaccination, other self-protective practices need to be adopted to reduce the risk of infection. Ongoing educational outreach that encourages the public to adopt proper preventive behaviors, such as hand-washing and masking, is essential to preventing and controlling the pandemic (Chang et al. 2020; Makhanova and Shepherd

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2020; Uddin et al. 2021). Therefore, the identification of factors associated with individual preventive health behaviors is an extremely important element of dealing with the COVID-19 pandemic.

According to the World Health Organization (WHO), studies and surveys that use the knowledge, attitude, and practice (KAP) models can help to collect information on the KAP of relevant specific groups on a particular issue (WHO 2021). It can also help to explain the relationship between knowledge, attitudes, and behaviors, and further serve as a reference for the evaluation of relevant programs. To date, many studies have explored public perceptions and behaviors regarding COVID-19 using KAP models (Al-Hanawi et al. 2020; Pal et al. 2020; Zhong et al. 2020). Hospital inpatients, as participants in the normalized prevention and control of the epidemic in healthcare institutions, play an important role in the proper prevention and control of infections at key sites. Therefore, it is important to focus on the knowledge, attitudes, and behaviors of newly admitted patients in healthcare institutions. This will help improve hospitals' efforts to educate patients on prevention and control, enhance the health literacy of hospitalized patients, and promote the implementation of prevention and control initiatives in hospitals. Hence, in the context of the COVID-19 pandemic, identifying the factors associated with preventive health behaviors in individuals, especially hospitalized patients who are at high risk of outbreak infection, is an extremely important issue. Although a significant body of research has focused on the relationship of knowledge, attitudes, and behaviors regarding the COVID-19 pandemic (Grewal et al. 2020; Habib et al. 2021; Ssebuufu et al. 2020), studies concentrated on hospitalized patients are still limited.

Considering the limitation of current studies in exploring KAP models among hospitalized patients, it is crucial to focus on inpatients' knowledge, attitudes, and practice toward the COVID-19 pandemic as an extension of behavior-related applications. Therefore, in this article, we aimed to investigate and understand the current status of hospitalized patients' KAP. Moreover, this study also explored the relationship between knowledge, attitudes, and behaviors toward the prevention and control of COVID-19 among hospitalized patients.

Materials and methods

Participants

Our target population was hospitalized patients (except emergency inpatients) who were admitted to a tertiary hospital in Taizhou, Zhejiang, China. We designed an online survey between 8 July and 11 August 2021. The anonymous cross-sectional survey was conducted via the Wen-Juan-Xing Platform, which was the largest online survey platform in China. Patients received the questionnaire via WeChat and the participants answered the self-administered survey by scanning the Quick Response code or visiting the Uniform Resource Location on their smartphones. The inclusion criteria required that individuals should be over 18 years old, have the full civil capacity, and be voluntarily participating in the questionnaire. This research was reviewed and approved by the Ethics Committee (Approval number: K20210521) in China. All procedures were performed following the guidelines of our institutional ethics committee, in adherence to the tenets of the Declaration of Helsinki.

Questionnaires and measures

The survey was completed online and submitted in real-time on the day of the patient's admission. Completion of the questionnaire indicated the interviewee's consent to participant in the study. We first clarified to the interviewee that this questionnaire is conducted to study the behavior in epidemic prevention and control during the COVID-19 pandemic. Moreover, we also told them that the data collected by the questionnaire were only used for statistical analysis. The questionnaire included the following information. (1) Demographic characteristics, such as age, sex, type of residence, education level, and occupation. (2) Knowledge of COVID-19 and hospital prevention and control, attitudes and daily prevention, and control behaviors of the individuals on and before their admission to the hospital. For the knowledge section, we asked respondents about basic COVID-19 knowledge, such as whether COVID-19 was a viral infection. In addition, we also asked about knowledge on COVID-19 prevention and control. The attitude mainly revolved around the patient's attitude toward the preventive measures to be taken when entering the hospital. In terms of behavior, we collected COVID-19 preventive behaviors, including hand washing, mask wearing, and social distancing. More details about the questionnaire are provided in the Supplementary Material. The structured questionnaire was developed in Chinese. Pilot interviews were conducted to test and validate the questionnaire.

Scoring criteria include cognitive questions, whereby a score of 1 was given for a correct answer and no points were given for an incorrect answer. For questions that involved multiple measures of attitudes and behaviors (e.g., strongly disagree - strongly agree; strongly do not support - strongly support; always - never, etc.), a 4-point Likert scale was used. The scores ranged from 0 to 3 for "do not support at all" to "strongly support," respectively. The scores for each question were added together to form the total score for each category. The cognitive profile included patient knowledge of pneumonia related to COVID-19 and personal and hospital prevention and control

initiatives, with a total of 18 items and a score ranging from 0 to 18 points. Seven other items were used to evaluate attitudes, with a score ranging from 0 to 21 points, while 29 items evaluated behaviors, with a score ranging from 0 to 87 points.

Quality control

To ensure that the formal questionnaire was comprehensive, scientific, and unambiguous, we conducted pilot interviews to test and validate the questionnaire. Interviewers who were mainly the healthcare staff participated in a training course on the questionnaire content. The time-point of the survey was chosen to be after the patient was admitted to the ward and before receiving any prevention and control education. This was selected to truly capture the knowledge and attitudes of each newly admitted patient, without hospital education and other interventions. If the patients had difficulty completing the questionnaire on their own, they would be guided by a pre-trained nurse. Questionnaires could not be left blank or submitted with unanswered questions. Survey data were collected electronically using WeChat-incorporated Wen-Juan-Xing platform (Changsha Ranxing Information Technology Co., Ltd., Hunan, China).

Statistical analysis

We used a generalized linear regression model to calculate the effects of predictors on the outcome, assuming an effect size level of 2%, a significance level of 5%, a power of 95%, and seven potential predictors (knowledge, attitude, sex, age, education, occupation, and address). The target sample size was 1099 participants. We allowed for a 10% participant dropout rate (i.e., reluctance to participate in surveys) and therefore selected 1222 participants as a conservative sample size. The sample size was calculated using the software G. Power 3.1.9.6.

A descriptive analysis, t test, ANOVA (analysis of variance), and generalized linear regression model were performed on the exported data. Demographic characteristics were collated and described according to categorical variables, and qualitative information was expressed as frequency or composition ratios. The chi-square test was used to compare results between groups, and differences with $P < 0.05$ were considered statistically significant. All data were analysed using R software (R Project for Statistical Computing), version 4.1.0.

Results

Basic characteristics of the participants

A total of 1223 questionnaires were collected, of which 1185 were valid, with a questionnaire efficiency rate of 96.9%. Table 1 summarized the basic demographic information of the respondents. In this survey, the average age of 1185 inpatients was 51.7 (SD = 16.6) years and mainly concentrated between 30 and 60 years old (52.6%). There were slightly more female patients (54.3%) than males in the sample. The majority of the participants were from rural areas (78.7%) and their education level was generally low, mainly aggregated in primary school or below (41.1%). The most represented professional industry was agriculture (39.2%).

Comparison of the knowledge, attitudes, and behaviors regarding COVID-19 among different population characteristics

Table 2 presented the comparisons of the knowledge, attitude, and behavior among different population characteristics. The highest scores in terms of knowledge, attitudes, and behaviors were found amongst patients under 30 years of age, and the scores decreased as the age increased. The higher the level of education, the better the knowledge, attitudes, and behavioral scores. Participants who lived in either urban or rural areas revealed a decreasing trend in knowledge, attitudes, and behavioral scores, respectively. In terms of occupation, the highest scores were found among white-collar individuals. Those who were willing to recommend vaccination to others had higher scores than those who were unwilling to do so. In terms of sex, there was no statistically significant difference in the awareness level between male and female patients. However, in terms

Table 1 Baseline characteristics of the patients (N = 1185)

Characteristics	Category	Number (%)
Age (years)	<30	164 (13.8)
	30–60	623 (52.6)
	>60	398 (33.6)
Gender	Male	542 (45.7)
	Female	643 (54.3)
Address	Urban	253 (21.3)
	Rural	932 (78.7)
Education	Primary and below	492 (41.1)
	Junior secondary	343 (28.9)
	Senior secondary	171 (14.4)
	College	176 (14.9)
	Graduate	8 (0.7)
Occupation	White-collar	184 (15.5)
	Blue-collar	99 (8.4)
	Farmer	465 (39.2)
	Others	437 (36.9)
Vaccination	Yes	707 (59.7)
	No	478 (40.3)
Recommend vaccine for others	Yes	819 (69.1)
	No	366 (30.9)

Table 2 Comparison of knowledge, attitude, and behavior regarding COVID-19 among different populations

	Knowledge $\bar{x} \pm \sigma$	Attitude $\bar{x} \pm \sigma$	Behavior $\bar{x} \pm \sigma$
Total	13.6 ± 2.8	18.3 ± 2.8	69.3 ± 15.6
Sex			
Male	13.4 ± 3.0	18.1 ± 2.9	67.6 ± 15.8
Female	13.6 ± 2.6	18.5 ± 2.8	70.7 ± 15.3
t / F	1.557	6.638	11.890
P-value	0.212	0.010	<0.001
Age			
<30	14.7 ± 1.8	19.3 ± 2.5	77.5 ± 11.8
30–60	13.6 ± 2.7	18.3 ± 2.8	69.7 ± 15.4
≥60	13.0 ± 3.1	17.9 ± 3.0	65.2 ± 15.9
t / F	20.430	14.200	39.170
P-value	<0.001	<0.001	<0.001
Education			
Primary and below	12.8 ± 3.2	17.8 ± 3.0	64.0 ± 16.3
Junior secondary	13.6 ± 2.6	18.3 ± 2.8	69.7 ± 15.0
Senior secondary	14.3 ± 1.8	19.0 ± 2.5	75.9 ± 12.0
College and above	14.8 ± 1.9	19.1 ± 2.6	76.3 ± 12.1
t / F	30.650	13.390	46.270
P-value	<0.001	<0.001	<0.001
Occupation			
White-collar	14.4 ± 2.2	19.0 ± 2.5	75.9 ± 12.6
Blue-collar	13.3 ± 3.1	18.1 ± 2.8	67.0 ± 15.4
Farmer	12.9 ± 3.2	17.9 ± 2.9	64.9 ± 16.0
Others	14.0 ± 2.3	18.5 ± 2.9	71.6 ± 14.9
t / F	18.700	6.835	29.370
P-value	<0.001	<0.001	<0.001
Address			
Urban	14.1 ± 2.4	18.7 ± 2.8	73.2 ± 13.9
Rural	13.4 ± 2.9	18.2 ± 2.8	68.2 ± 15.9
t / F	10.850	5.186	21.010
P-value	0.001	0.023	<0.001
Vaccination			
No	13.3 ± 2.9	18.1 ± 2.9	68.7 ± 15.5
Yes	13.7 ± 2.7	18.4 ± 2.8	69.6 ± 15.7
t / F	5.506	2.587	0.964
P-value	0.019	0.108	0.326
Recommend vaccines to others			
No	12.6 ± 3.2	17.1 ± 2.8	61.6 ± 15.5
Yes	14.0 ± 2.5	18.8 ± 2.7	72.7 ± 14.4
t / F	70.460	106.100	143.000
P-value	<0.001	<0.001	<0.001

t test was used for comparison between two groups, and F test was for comparison between multiple groups

of attitudes and behaviors, female patients scored higher than male patients, and the difference was significant. Regarding whether or not they were vaccinated, the awareness scores were higher and statistically significant for those who were vaccinated than for those who were not.

Table 3 Generalized linear regression analysis of factors associated with behaviors regarding COVID-19 among hospitalized patients

Variables	Coefficient (95%CI)	P-value
Constant term	11.29 (4.66–17.91)	<0.001
Knowledge	1.00 (0.73–1.27)	<0.001
Attitude	2.50 (2.24–2.76)	<0.001
Sex (Male)		
Female	1.09 (-0.37–2.55)	0.143
Age(<30 yrs)		
30-60	–1.55 (-3.97–0.87)	0.209
≥60	–2.02 (-4.92–0.88)	0.171
Education (Primary and below)		
Junior secondary	2.98 (1.06–4.91)	0.002
Senior secondary	5.33 (2.73–7.95)	<0.001
College and above	3.72 (0.69–6.75)	0.016
Occupation (white-collar)		
Blue-collar	–3.22 (-6.54–0.10)	0.058
Farmer	–2.83 (-5.56– -0.10)	0.042
Others	–1.20 (-3.57–1.17)	0.321
Address (urban)		
Rural	–1.00 (-1.98–2.21)	0.283

Multivariate analysis of prevention and control behavior among hospitalized patients

A generalized linear regression analysis was conducted with behavior as the dependent variable. The results were summarized in Table 3, which showed that the higher the COVID-19 knowledge score among inpatients, the better their daily prevention and control practices (B (95%CI) = 1.00 (0.73–1.27), $P < 0.001$). Furthermore, the more positive their attitude toward prevention and control, the better their prevention and control behaviors (B (95%CI) = 2.50 (2.24–2.76), $P < 0.001$). In addition, compared with those who had primary education levels or lower, participants with higher education levels also had better practices toward the COVID-19 pandemic. Additionally, the difference in influence between patients with different levels of education was statistically significant. Notably, the prevention and control behavior of hospitalized patients who were farmers were worse than those of the white-collar participants.

Multivariate analysis of recommending vaccines to others among hospitalized patients

We also conducted a generalized linear regression model with the item related to whether the participants would

recommend the vaccination to others as the dependent variable. Table 4 presented the results. The model was adjusted for covariates, including knowledge, attitudes, age, sex, education level, occupation, and address. The results showed that the greater the knowledge score of COVID-19 among inpatients, the more likely they were to recommend vaccinations (OR (95%CI) = 1.11 (1.06–1.17), $P < 0.001$). Furthermore, the more positive the attitudes of the hospitalized patients toward the implementation of COVID-19, the more likely they were to recommend vaccination to others (OR (95%CI) = 1.20 (1.14–1.26), $P < 0.001$). There was a statistical difference in the recommendation of vaccinations to other people among inpatients who were farmers, compared to white-collar individuals.

Discussion

This study investigated knowledge, attitudes, and preventive practices related to the COVID-19 pandemic among hospitalized patients. From the perspective of COVID-19 knowledge, we aimed to understand whether participants had basic knowledge about things including symptoms and transmission routes. According to the results, participants had a similar understanding of COVID-19, regardless of gender. Moreover, there was a significant difference in knowledge as a function of age, education level, occupation, or address, which is in accordance with the findings of prior studies (Ali et al. 2021; Kasemy et al. 2020; Lee et al. 2021).

Table 4 Generalized linear regression analysis of factors associated with recommending vaccines to others among hospitalized patients

Variables	OR (95%CI)	P-value
Constant term	0.04 (0.01–0.13)	<0.001
Knowledge	1.11 (1.06–1.17)	<0.001
Attitude	1.20 (1.14–1.26)	<0.001
Sex (male)		
Female	1.08 (0.82–1.42)	0.583
Age (<30 yrs)		
30–60	0.96 (0.57–1.59)	0.866
≥60	0.70 (0.38–1.25)	0.231
Education (Primary and below)		
Junior secondary	0.97 (0.68–1.39)	0.872
Senior secondary	1.12 (0.67–1.89)	0.633
College and above	0.93 (0.51–1.72)	0.814
Occupation (white-collar)		
Blue-collar	0.59 (0.31–1.15)	0.122
Farmer	0.43 (0.25–0.75)	0.003
Others	0.69 (0.41–1.13)	0.148
Address (Urban)		
Rural	1.23 (0.86–1.75)	0.259

Similarly, for attitudes and preventive behaviors among hospitalized patients, there were also significant differences in sex, age, education level, occupation, and address. In this study, women had better attitudes and behaviors toward the pandemic than men, which indicates that they took COVID-19 more seriously and were more proactive in their preventive behaviors (Moradzadeh et al. 2020). In addition, older respondents were less inclined to take preventive behavioral measures; this finding is in contrast with previous studies that found good practices among older participants (Baig et al. 2020; Muto et al. 2020). Therefore, it is recommended to raise awareness of the risk of COVID-19 susceptibility in the elderly population and encourage them to adopt good behaviors to prevent infection.

On the relationship between knowledge, attitudes, and preventive practices, this research found that the COVID-19 awareness levels and attitudes were factors for behaviors. A higher COVID-19 awareness level or more positive attitudes toward prevention and control was associated with better individual daily prevention and control behaviors among individuals. Additionally, those with more knowledge or positive attitudes were more likely to recommend vaccination to others. Medical institutions are an important place for the normalized prevention and control of the COVID-19 epidemic. In addition to medical staff, hospitalized patients encompass a large group of participants who are involved in the prevention and control efforts. The results of this study showed that the higher the level of education, the better the implementation of said knowledge, attitudes, and behaviors for the prevention and control of COVID-19. Hospitalized patients from urban areas had higher scores of knowledge, attitudes, and behaviors than those from rural areas. In addition, inpatients with higher education levels also had a higher KAP score. These findings were in line with the results of other studies that were conducted on other populations (Zhao et al. 2020; Zhu et al. 2020).

At present, the third vaccination dosage (i.e., booster dose) and the vaccination of children aged 3–15 years are being rolled out in an orderly manner throughout the country. The dissemination of information on COVID-19 to the public and children's guardians would undoubtedly contribute to the promotion of this activity. The hospital examined in this study was a municipal tertiary hospital, with a high proportion of patients from rural areas (78.7%). Additionally, 70% of the patients had education below junior high school level, and the overall level of education was low in general. This may be related to the environment in which farming groups live, their daily living habits, labor and work environment, and the way they access information channels on a daily basis. Such behaviors could mean that the study population generally has lower knowledge scores and risk awareness about the prevention and control of COVID-19. During normalized epidemic prevention and control,

hospitals are advised to have patient education measures in place (i.e., direct face-to-face communication and education or simple and easy-to-understand graphics, animation, and videos) for more than half of such admissions, especially those living in rural areas and those over 60 years of age.

This research was not without limitations. First, the research population was selected on a voluntary basis (i.e., potential participants were recruited through referral by health care professionals), which not only had the potential to introduce selection bias, but also resulted in an inevitable Hawthorne effect. Voluntary bias could be defined as the idea that a given sample might contain only those participants who were genuinely willing to participate in the research, and that those who participated in the study and found the subject particularly interesting and were more likely to volunteer for the study in the same way as those who were expected to be evaluated positively. Second, we evaluated only a single teaching hospital due to the pandemic. In addition, the study mainly focused on hospitalized patients, although there might be differences between inpatients and the general public. Hence, in order to further explore the KAP model, the generalization and external validity should be further studied. Third, this research was a cross-sectional study since we only took measurements at a single point in time. Moreover, as the timing was during a relatively stable period of the epidemic (July–August), the patients' prevention and control behaviors could have been easily influenced by the epidemic environment. This might have led to biased findings, under-representation of the whole population, and limited extrapolation of the findings. Therefore, in future studies, researchers should conduct analyses using larger sample sizes, long periods, or more regions to verify these findings.

Conclusion

This study investigated the relationship between knowledge, attitudes, and behaviors regarding the COVID-19 pandemic among hospitalized patients. The findings showed that the higher the level of knowledge on COVID-19 prevention and control, the better the behavior of the inpatients. Additionally, more positive attitudes among inpatients were related to better practices. For inpatients, hospitals should focus on teaching hand hygiene, circumstances when masks should be worn and how to wear them correctly, and maintaining the correct social distance. Targeted education initiatives should also be developed for patients from rural areas, especially those over 60 years of age, to help improve their knowledge and cultivate good prevention and control behaviors.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s10389-022-01796-y.

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Data availability The datasets generated and/or analyzed during the current study are available from the corresponding author on request.

Code availability Not applicable.

Declarations

Ethics approval This research was reviewed and approved by the Ethics Committee of Taizhou Hospital of Zhejiang Province (Approval number: K20210521) in China. All procedures were performed following the guidelines of our institutional ethics committee, in adherence to the tenets of the Declaration of Helsinki.

Consent to participate Not applicable.

Consent for publication Not applicable.

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