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Knowledge and willingness to receive a COVID-19 vaccine: a survey from Anhui Province, China

Huoba Li[a], Lulu Cheng[b], Juan Tao[c], Deyu Chen [d], and Chenchen Zeng[e]

aDepartment of Health and Elderly Care, Anhui Vocational College of City Management, Hefei, Anhui, China; bDepartment of Ophthalmology, Shenzhen Longgang District People's Hospital, Shengzhen, Guangdong, China; cDepartment of Health and Elderly Care, Anhui Vocational College of City Management, Hefei,Anhui, China; dMedical College, Fuyang Normal University, Fuyang, Anhui, China; eFuyang Health School, FuYang Institute of Technology, Fuyang, Anhui, China

ABSTRACT

Objectives: Vaccinations can prevent COVID-19 and control its spread quickly and efficiently. This study aimed to investigate knowledge and willingness of geriatric care facility staff to receive a COVID-19 vaccine, and to provide a basis for the government to promote the COVID-19 vaccine and guide people to get vaccinated.
Study design: A cross-sectional study.
Methods: Data on characteristics of the participants, knowledge about the COVID-19 vaccine, and willingness to get vaccinated for COVID-19 were collected through an online survey from May 19 to June 18, 2021. Statistical analyses were conducted with ANOVA, chi-square, logistic regression.
Results: The survey illustrated that the highest score of COVID-19 vaccine knowledge was 50, the lowest 20, and the average 44.22. It also demonstrated that 91.3% of the participants had a good knowledge of COVID-19 vaccine, and that 97.3% participants were willing to receive the COVID-19 vaccine. The results showed that geriatric care facility staff had varied level of the COVID-19 vaccine knowledge depending upon their age, educational background, and other factors, and correspondingly, their willingness to receive COVID-19 vaccine was affected by their knowledge level of COVID-19 vaccine.
Conclusions: In general, the participants, the staff of geriatric care facilities in Anhui Province, had good mastery of the COVID-19 vaccine, and they were willing to get vaccinated. However, there still existed a few participants with poor knowledge, who were unwilling to get vaccinated against COVID-19. Government can guide people to accept vaccination by enhancing publicity about the effects and adverse reactions of COVID-19 vaccines.

1. Introduction

According to the official website of Anhui Provincial Health Commission, the Office of Anhui Provincial Comprehensive Command for COVID-19 (Coronavirus disease-19) Prevention and Emergency Response issued a report on confirmed cases of COVID-19 in Yu 'an District, Lu 'an City and Feixi County, Hefei City. On the early morning of May 13, 2021, routine nucleic acid testing was conducted by Shili Hospital of Yu 'an District of Lu 'an on the patient Zhang XX, and the recheck produced positive result by Lu 'an Centers for Disease Control and Prevention. On the same day, nucleic acid testing on Li XX in Feixi County, Hefei City, a close contact of Zhang XX, yielded positive result. The number of confirmed cases in Anhui Province increased from 0 to 2. On June 7, 2021, there were no new confirmed cases or asymptomatic infected people for 14 consecutive days in Anhui. All areas in Anhui were reclassified to low-risk areas as of June 7. Then, on July 8, 2021, a positive case of novel coronavirus appeared after nucleic acid testing on a person named Wang XX. What happened in Anhui was also happening around the world, and countless facts illustrated the recurring nature of COVID-19. A number of measures had been

taken to prevent COVID-19, such as, social distancing, mass economic shutdowns and lockdowns. These measures, while effectively controlling the spread of COVID-19, had also resulted in a tremendous impairment of physical and psychosocial wellbeing, social interactions and a decline in the global economy.[1,2] The struggle between humans and the novel coronavirus is protracted, in which the price paid by humans is costly.

Vaccinations can prevent COVID-19 and control its spread quickly and efficiently.[3] After receiving COVID-19 vaccine, antibodies can be produced in the human body.[4,5]High rates of vaccination protect both vaccinated and unvaccinated individuals, create herd immunity and reduce the risk of viral mutations.[6] Countries worldwide have invested huge amounts of human resources, materials and money in the development of vaccines against COVID-19. COVID-19 vaccines have been successively authorized for use in several countries, including the United States, Italy, and China, etc.[7] However, some adverse reactions can occur after vaccination, the most common injection site adverse reaction is pain, and the most commonly reported systematic adverse reactions are fever,

CONTACT Deyu Chen ✉ chendeyu7104@aliyun.com 🏢 Medical College, Fuyang Normal University, No. 100 Qinghe Road, Fuyang, Anhui 236037, China

fatigue, headache, and muscle pain. Most adverse reactions that were reported in all dose groups were mild or moderate in severity.[8]

In accordance with the COVID-19 prevention and control policy, the Chinese government provides free vaccination for every citizen.[6] During the initial phase of COVID-19 vaccination, people indicated rejection and hesitation, and delayed or refused vaccination.[9–15] It was the same case in other countries due to common concerns about vaccine safety and effectiveness.[16–22] A low level of acceptance and hence coverage of vaccination could hamper the success of immunization against COVID-19.[23] The World Health Organization (WHO) named vaccine hesitancy one of the top 10 threats to global health in 2019.[24,25] People's knowledge about the COVID-19 vaccine and their willingness determine whether they will receive the COVID-19 vaccine.[6,26]

The geriatric care facility is a special place whose residents are all elderly people. Elderly people are more likely to be susceptible to COVID-19, since they are fragile to suffer from chronic lung disease, depressed immune, and even a large portion of them fail to carry out daily activities (washing, dressing, eating, taking drugs). Furthermore, it is difficult to control the spread of infection in geriatric care facilities, since the staff work moving from room to room, and touching the elderly intimately. Once COVID-19 enters the geriatric care facility, it spreads rapidly and does not spare anyone – residents, caregivers or support staff-from the risk of infection, hospitalization or even death.[27] Vaccinating the geriatric care facility staff is the best way to prevent COVID-19, it also is the best protection measure for the elderly living in geriatric care facilities.[28] The potential risk of vaccine rejection can reduce vaccination rates among geriatric care facility staff, a serious problem in the fight against COVID-19.

Researchers in the United States,[28] Canada,[29] Greek,[24] Congo,[3] India,[30] Bangladesh,[31] Ethiopia,[32] Nigeria,[33] New Zealand[34] and other countries had been keen to look at people's willingness to receive COVID-19 vaccines.[35] However, due to differences in geography, culture and policies, this cannot serve as a reference for the Chinese government to promote COVID-19 vaccination. Chinese researchers had also conducted surveys on the willingness to get vaccinated against COVID-19, but those studies were mostly about willingness for COVID-19 vaccination in nurses,[7] willingness to pay and financing preferences for COVID-19 vaccination in China,[36] interest in COVID-19 vaccine trials participation among young adults in China,[37] etc. This survey was performed under the authorization of the Department of Civil Affairs of Anhui Province. The purpose of this survey was to investigate geriatric care facility staff's knowledge level about the COVID-19 vaccine and their willingness to accept the COVID-19 vaccination in Anhui, China. The research results will provide a reference for the Department of Civil Affairs of Anhui Province to promote the COVID-19 vaccination in a targeted manner, guide the staff of geriatric care facilities to accept the COVID-19 vaccine with correct methods, and design proper vaccination strategies so as to reach a high vaccination coverage. The findings of the research also help the government make a right decision to control and prevent the current COVID-19 pandemic and future outbreaks.

2. Materials and methods

2.1. Inclusion and exclusion criteria

This was a cross-sectional survey. The inclusion criteria for the geriatric care facilities were as follows: (1) location in Anhui Province; (2) registration and filing occurred before May 1, 2021; (3) the institution in a normal state of operation; and (4) the staff agreed to fill out the questionnaire.

2.2. Sampling procedures

The *Wen Juan Xing* online platform was used to collect data (https://www.wjx.cn/vj/Y0lkQyx.aspx). Participation was voluntary, and the questionnaire was anonymously completed from May 19 to June 18, 2021.

2.3. Data collection tools

An online questionnaire was used to collect the data. The achievements of previous researchers were used as references.[1,7,26,28,32,37] The guidelines and Q&A published on the official website of Chinese Center for Disease Control and Prevention (Novel Coronavirus Vaccine Training Syllabus published on 02 April 2021; Novel Coronavirus Vaccine Q&A (updated 31 March 2021,Novel Coronavirus Vaccine Technical Guide (first edition) published 29 March 2021; Novel Coronavirus vaccine Q&A published on 07 January 2021.) were the basis for questionnaire. The questionnaire was divided into three parts: (1) characteristics of the participants; (2) knowledge about the COVID-19 vaccine (Cronbach's alpha = 0.812); and (3) willingness to get vaccinated for COVID-19 (Cronbach's alpha = 0.923). The characteristic variables included gender, age, ethnicity, marital status, education, region, residence, geriatric care facility type, sources of COVID-19 vaccine knowledge, and two questions ("Have you heard of the COVID-19 vaccine before this survey?" and "Did you know the vaccine is effective at preventing COVID-19 before this survey?"). Fifty questions about the COVID-19 vaccine were answered on a true/false scale. The score ranged from 0 to 50 points. The criteria were as follows: a good level was defined as a score rate of more than 75% of the full score (score ≥37.5 points), and a poor level was defined as a score rate of less than 75% of the full score (score <37.5 points) .[38,39] Willingness to receive COVID-19 vaccination was rated based on three statements: "I would like to receive the COVID-19 vaccine," "I would recommend my friends and relatives receive the COVID-19 vaccine," and "I would support the promotion of the COVID-19 vaccine around the world." A 5-point Likert scale (strongly disagree/disagree/neutral/agree/ strongly agree) was used to assess the related items.[40]

2.4. Data quality control

A pretest was conducted before the study was implemented, and the questionnaire was modified after the pre-survey. To avoid duplicates, only one questionnaire could be filled out on the same mobile phone or computer. In addition, those who took less than 60 seconds to complete the questionnaire were judged as unqualified by the online platform and were excluded from the data.

2.5. Statistical analysis

This survey adopted a descriptive analysis. Microsoft Excel was used for data entry, and SPSS 23.0 was used for analysis of the data. The results are expressed as $\bar{x} \pm s$, and analysis of variance (ANOVA) or the chi-square test was used as appropriate. Logistic regression analysis was also used in this survey. $p < .05$ was considered statistically significant. The findings were presented using simple tables, and texts.

3. Results

A total of 2,176 completed questionnaires were gathered during the survey. Questionnaires that were incomplete or took less than 60 seconds were automatically rejected by the online system. Regarding sources of COVID-19 vaccine knowledge, 841 came from medical staff, 805 from family\friends, 1697 from lecture in geriatric care facility, 1329 from radio\TV \newspaper\ magazine, and 1285 from WeChat\QQ\web page.

Among geriatric care facility staffs who participated in the survey, 880 were male, 1296 female; 858 people aged ≥50; 644 participants' education level was junior middle school or below, and only 38.5% of participants had associate's degree or above. There were 1047 participants living in rural areas, 691 in urban areas, and 438 in suburbs. In terms of the geographical distribution, 522 came from Southern Anhui (referred to as the areas south of the Yangtze River in Anhui Province, including the 6 cities of Huangshan, Wuhu, Ma'anshan, Tongling, Xuancheng, and Chizhou), 652 from Central Anhui (referred to as the areas north of the Yangtze River and south of the Huai River in Anhui Province, including the 5 cities of Hefei, Lu'an, Chuzhou, Huainan, and Anqing), and 1002 from Northern Anhui (referred to as the area north of the Huaihe River in Anhui, including the 5 cities of Suzhou, Huaibei, Bengbu, Fuyang, and Bozhou).

In the survey, the highest score of knowledge about COVID-19 was 50, the lowest score was 20, and the average score was 44.22. Based on the results of One-way analysis of variance (ANOVA), female participants had higher knowledge score about COVID-19 vaccine than the male ($p < .05$). The participants who had heard of COVID-19 vaccine before this survey got higher score than those had not heard of it ($p < .05$). The participants who knew that the vaccine was effective in preventing COVID-19 before this survey got higher score than those did not ($p < .05$), as shown in Table 1.

Multiple Comparison of knowledge scores about COVID-19 vaccine (LSD method) was shown as follows. There was no difference in knowledge scores between two age groups of 40–49 and ≥50 ($p > .05$), but the age group of ≤39 was significantly higher than that of other groups ($p < .05$). The unmarried group scored significantly higher than the married and divorced groups ($p < .05$). In terms of education, the group with associate's degree or above got higher score than the other groups ($p < .05$). There were significant differences in the knowledge scores of COVID-19 vaccine between different regions ($p < .05$). There was no difference in scores between the urban and suburb groups ($p > .05$). Among all residence subgroups, there were significant differences between the rural group and the other two residence groups ($p < .05$). Detailed data analysis was shown in Tables 1 and 2.

According to the frequency statistics, 1987 (91.3%) participants' knowledge level was good and 189 (8.7%) was poor. Logistic regression analysis was performed at entry level $a = 0.05$ and exclusion level $\beta = 0.10$, with COVID-19 vaccine knowledge levels as the dependent variable and participants' gender, age, marital status, education, region, residence, etc. as independent variables. Data analysis results showed that participants' knowledge levels about COVID-19 vaccine were influenced by gender, age, marital status, education, region, residence ($p < .05$). Participants who had heard about COVID-19 vaccines prior to the survey had significantly better knowledge levels than those who had not (OR = 3.525). The equation relationship between the above factors and knowledge level was shown in Table 3.

In the analysis of willingness, 'agree' and 'strongly agree' were considered positive, while 'strongly disagree' and 'disagree' were categorized as negative. There were 2117 (97.3%) participants had positive attitude, while 59 (2.7%) had negative attitude. Two thousand one hundred and seven (96.8%) participants were willing to recommend COVID-19 to their relatives and friends, and 2110 (97.0%) supported promotion of the COVID-19 vaccine worldwide. Knowledge scores and knowledge levels of participants varied among different degrees of willingnesses to receive COVID-19 vaccine ($p < .05$), as shown in Table 4. Taking the good knowledge level as a reference, ordinal logistic regression analysis of willingnesses on knowledge levels had be performed. The results of data analysis in Table 5 suggested that knowledge levels significantly affected vaccination willingnesses ($p < .05$).

4. Discussion

Since the outbreak of COVID-19, the number of confirmed cases and deaths from COVID-19 has rapidly increased. It is well known that vaccination is the best way to prevent COVID-19 infection. A study from Public Health England showed that the likelihood of household transmission was approximately 40% to 50% lower in households of index patients who had been vaccinated 21 days or more before testing positive than in households of unvaccinated index patients.[41] According to relevant research, the current minimum threshold required for herd immunity currently stands between 50 ~ 66.67%, although rates vary across the globe.[42] It was introduced on the website of National Health Commission of the People's Republic of China that five Chinese manufacturers of the COVID-19 vaccine had been approved for conditional marketing or emergency use on April 1, 2021. The willingness of the staff of geriatric care facilities to undergo vaccination affects the vaccination rate, and it directly affects the risk of COVID-19 infection in the elderly persons living in geriatric care ~facilities.

In this investigation, the scores of geriatric care facility staff's knowledge about COVID-19 were between 20 and 50. 91.3% participants had good knowledge of COVID-19 vaccine, while 8.7% poor. That the staff of geriatric care facilities in Anhui Province have such good knowledge of the COVID-19 vaccine can be attributed to multiple measures implemented by the Chinese government to disseminate knowledge about the vaccine. On the other hand, these results also show that the knowledge level of some staff still needs to be improved.

Table 1. Analysis of variance (ANOVA) of knowledge scores about COVID-19 vaccine (n = 2176).

Variables	Category	N(%)	Knowledge scores $\overline{x}\pm s$	F	p
Gender	Male	880 (40.4)	43.91 ± 4.26	8.264	0.004
	Female	1296 (59.6)	44.44 ± 4.20		
Age	≤39	755 (34.7)	45.20 ± 3.59	32.221	<0.001
	40–49	563 (25.9)	43.78 ± 4.58		
	≥50	858 (39.4)	43.65 ± 4.35		
Ethnicity	The Han nationality	2150 (98.8)	44.20 ± 4.23	3.354	0.067
	Other	26 (1.2)	45.73 ± 3.33		
Marital status	Unmarried	220 (10.1)	45.45 ± 2.84	8.844	<0.001
	Married	1881 (86.4)	44.12 ± 4.30		
	Divorce	49 (2.3)	42.71 ± 5.45		
	Widowed	26 (1.2)	43.77 ± 4.06		
Education	Junior middle school or below	644 (29.6)	43.32 ± 4.80	52.973	<0.001
	Senior middle school	695 (31.9)	43.69 ± 4.27		
	Associate's degree or above	837 (38.5)	45.36 ± 3.40		
Region	Southern Anhui	522 (24.0)	44.82 ± 3.98	14.810	<0.001
	Central Anhui	652 (30.0)	43.53 ± 4.60		
	Northern Anhui	1002 (46.0)	44.36 ± 4.04		
Residence	Rural	1047 (48.1)	43.63 ± 4.44	21.203	<0.001
	Urban	691 (31.8)	44.91 ± 3.69		
	Suburb	438 (20.1)	44.56 ± 4.31		
Have you heard of COVID-19 vaccine before this survey?	Yes	2135 (98.1)	44.27 ± 4.18	16.684	<0.001
	No	41 (1.9)	41.56 ± 5.65		
Did you know the vaccine was effective in preventing COVID-19 before this survey?	Yes	2090 (96.0)	44.30 ± 4.19	18.396	<0.001
	No	86 (4.0)	42.31 ± 4.69		

In terms of the sources of COVID-19 vaccine knowledge, 38.6% of participants received COVID-19 vaccine knowledge from medical staff, 37.0% from their family/friends, 61.1% from radio/TV/newspaper/magazine, and 59.1% from the WeChat/QQ/web page. The results found that the internet has become an important method to disseminate knowledge regarding COVID-19 vaccines. Nearly 80% of participants obtained their COVID-19 vaccine knowledge from lectures in geriatric care facilities, because active interventions were adopted in geriatric care facilities to publicize the COVID-19 vaccine. This is one reason that the vast majority of participants were willing to receive the COVID-19 vaccine, to recommend the COVID-19 vaccine to their relatives and friends, and to support the promotion of the COVID-19 vaccine worldwide. Moreover, China has provided free COVID-19 vaccinations for all citizens. As of July 15, 2021, China had administered 1.426347 billion doses of COVID-19 vaccine, according to data released on the official website of the National Health Commission of the People's Republic of China.

Geriatric care facility staff's knowledge scores and knowledge levels are affected by many factors. The staff's knowledge scores of the group (age ≤ 39) were significantly higher than those of the other age groups, which was similar to a previous study.[6] The unmarried group's knowledge scores were significantly higher than those of the other marital status groups. Unmarried people were more receptive to COVID-19 vaccination knowledge at a younger age and had more time and energy to focus on the COVID-19 vaccine for they did not have to take care of their family or children. The knowledge scores of participants whose education were associate's degree or above were significantly higher than those of the other groups. This is explained by education status being a strong predictor of knowledge.[43] In terms of geographical distribution, northern

Anhui had the largest number of participants. This is due to the large population in northern Anhui. There were differences in knowledge scores between different region groups, which were due to their cultural characteristics of learning and accepting new things. Rural participants had the lowest knowledge scores in three residence groups. This is because information spreads faster and knowledge about COVID-19 is more readily available to participants in the city in urban and suburban areas.

Participants who had heard of the COVID-19 vaccine before this survey had significantly higher knowledge scores than those who had not. Participants who knew before this survey that the COVID-19 vaccine was effective against COVID-19 had significantly higher knowledge scores than those who did not know. This suggests that the more attention participants paid to the COVID-19 vaccine, the more they learned about it. There were differences in knowledge scores and knowledge levels among different scores of willingness to be vaccinated against COVID-19. In general, the more people know about the powerful protective benefits of vaccines, the more motivated they are to get vaccinated. Nevertheless, the findings from various clinical trials of COVID-19 vaccines concluded that the vaccines were well-tolerated and had a favorable safety profile,[44] fears, rumors and misconceptions about COVID-19 vaccines persist, especially when it comes to adverse events.[45] Just as in the early days of the outbreak, the fear of COVID-19 came from the lack of knowledge of the Novel Coronavirus. People were reluctant to accept COVID-19 vaccines because they did not know enough about their protective effects and adverse reactions. In other words, people's willingness to accept COVID-19 vaccines was related to their knowledge of COVID-19 vaccines. This result was consistent with the conclusion of one researcher: the less people known about COVID-19 vaccines, the less they were willing to take them.[40] The results of this study also suggest that government

Table 2. Multiple comparison of knowledge scores about COVID-19 vaccine (n = 2176) (LSD method).

	Variables		$\bar{x}_i - \bar{x}_j$	SD	p	95% CI
Age	≤39	40–49	1.426	0.232	<0.001	0.971 ~ 1.881
		≥50	1.554	0.208	<0.001	1.146 ~ 1.962
	40–49	≤39	−1.426	0.232	<0.001	−1.881~−0.971
		≥50	0.128	0.226	0.572	−0.316 ~ 0.571
	≥50	≤39	−1.554	0.208	<0.001	−1.962~−1.146
		40–49	−.128	0.226	0.572	−0.571 ~ 0.316
Marital status	Unmarried	Married	1.331	0.300	<0.001	0.743 ~ 1.918
		Divorce	2.740	0.664	<0.001	1.438 ~ 4.043
		Widowed	1.685	0.872	0.053	−0.025 ~ 3.395
	Married	Unmarried	−1.331	0.300	<0.001	−1.918~−0.743
		Divorce	1.410	0.608	0.021	0.216 ~ 2.603
		Widowed	0.355	0.830	0.669	−1.274 ~ 1.983
	Divorce	Unmarried	−2.740	0.664	<0.001	−4.043~−1.438
		Married	−1.410	0.608	0.021	−2.603~−0.216
		Widowed	−1.055	1.020	0.301	−3.056 ~ 0.946
	Widowed	Unmarried	−1.685	0.872	0.053	−3.395 ~ 0.025
		Married	−0.355	0.830	0.669	−1.983 ~ 1.274
		Divorce	1.055	1.020	0.301	−0.946 ~ 3.056
Education	Junior middle school or below	Senior middle school	−0.378	0.226	0.094	−0.821 ~ 0.065
		Associate's degree and above	−2.044	0.216	<0.001	−2.469~−1.620
	Senior middle school	Junior middle school and below	0.378	0.226	0.094	−0.065 ~ 0.821
		Associate's degree and above	−1.666	0.212	<0.001	−2.082~−1.251
	Associate's degree or above	Junior middle school and below	2.044	0.216	<0.001	1.620 ~ 2.469
		Senior middle school	1.666	0.212	<0.001	1.251 ~ 2.082
Region	Southern Anhui	Central Anhui	1.294	0.247	<0.001	0.810 ~ 1.778
		Northern Anhui	0.456	0.227	0.045	0.011 ~ 0.900
	Central Anhui	Southern Anhui	−1.294	0.247	<0.001	−1.778~−0.810
		Northern Anhui	−0.838	0.211	<0.001	−1.253~−0.424
	Northern Anhui	Southern Anhui	−0.456	0.227	0.045	−0.900~−0.011
		Central Anhui	0.838	0.211	<0.001	0.424 ~ 1.253
Residence	Rural	Urban	−1.279	0.205	<0.001	−1.682~−0.876
		Suburbs	−0.933	0.238	<0.001	−1.401~−0.466
	Urban	Rural	1.279*	0.205	<0.001	0.876 ~ 1.682
		Suburb	0.346	0.256	0.177	−0.156 ~ 0.847
	Suburb	Rural	0.933	0.238	<0.001	0.466 ~ 1.401
		Urban	−0.346	0.256	0.177	−0.847 ~ 0.156

Table 3. Binary logistic regression analysis for variables and knowledge level (n = 2176).

Variables		β	SE	Wald	p	OR	95% CI
Gender	Male	Reference group					
	Female	0.085	0.154	0.306	0.580	1.089	0.805 ~ 1.473
Age	≤39	Reference group					
	40–49	−1.014	0.223	20.748	0.000	0.363	0.234 ~ 0.561
	≥50	−0.978	0.209	21.874	0.000	0.376	0.250 ~ 0.566
Marital status	Unmarried	Reference group					
	Married	−1.297	0.421	9.471	0.002	0.273	0.120 ~ 0.624
	Divorce	−1.399	0.628	4.970	0.026	0.247	0.072 ~ 0.844
	Widowed	−1.537	0.740	4.312	0.038	0.215	0.050 ~ 0.917
Education	Junior middle school or below	Reference group					
	Senior middle school	0.404	0.171	5.589	0.018	1.498	1.072 ~ 2.094
	Associate's degree or above	1.441	0.215	44.721	0.000	4.224	2.769 ~ 6.443
Region	Southern Anhui	Reference group					
	Central Anhui	−0.577	0.211	7.451	0.006	0.561	0.371 ~ 0.850
	Northern Anhui	−0.117	0.210	0.310	0.578	0.890	0.590 ~ 1.342
Residence	Rural	Reference group					
	Urban	0.636	0.188	11.477	0.001	1.888	1.307 ~ 2.727
	Suburbs	0.405	0.206	3.852	0.050	1.500	1.001 ~ 2.247
Have you heard of COVID-19 vaccine before this survey?	No	Reference group					
	Yes	1.260	0.372	11.472	0.001	3.525	1.700 ~ 7.308
Did you know the vaccine was effective in preventing COVID-19 before this survey?	No	Reference group					
	Yes	0.661	0.311	4.512	0.034	1.937	1.052 ~ 3.564

departments involved in COVID-19 prevention and control need to strengthen the dissemination of knowledge about COVID-19 vaccines, including vaccine effectiveness and adverse reactions. In view of the particularity of the service objects of geriatric care facilities: old age, low immunity, living together, prevention and control of COVID-19 is particularly important. Vaccination of geriatric care facility's staff is the best protection against COVID-19. In the peer survey, the majority of the findings were just about the willingness to vaccinate and the willingness to pay.[1,26] Some researchers

Table 4. Knowledge scores and knowledge levels between different willingness (n = 2176).

Variables	Category	N	Percentage (%)	Knowledge scores $\bar{x}\pm s$	F	p	Knowledge level low(%)	high(%)	χ2	p
I would like to receive COVID-19 vaccination	Strongly disagree	38	1.7	44.55 ± 4.30	8.578	< 0.001	3(7.9)	35(92.1)	18.027	0.001
	Disagree	1	0.05	42.00			0(0.0)	1(100.0)		
	Neutral	20	0.9	43.00 ± 4.13			3(15.0)	17(85.0)		
	Agree	453	20.8	43.24 ± 4.67			61(13.5)	392(86.5)		
	Strongly agree	1664	76.5	44.50 ± 4.06			122(7.3)	1542(92.7)		
I would recommend my friends and relatives to receive COVID-19 vaccination	Strongly disagree	39	1.8	44.59 ± 4.00	18.516	< 0.001	3(7.7)	36(92.3)	46.467	< 0.001
	Disagree	6	0.3	42.17 ± 4.83			1(16.7)	5(83.3)		
	Neutral	24	1.1	40.67 ± 5.29			8(33.3)	16(66.7)		
	Agree	512	23.5	43.081 ± 4.85			72(14.1)	440(85.9)		
	Strongly agree	1595	73.3	44.64 ± 3.90			105(6.6)	1490(93.4)		
I support the promotion of COVID-19 vaccine in the world.	Strongly disagree	42	1.9	43.95 ± 4.73	20.502	< 0.001	6(14.3)	36(85.7)	50.498	< 0.001
	Disagree	7	0.3	38.14 ± 4.14			3(42.9)	4(57.1)		
	Neutral	17	0.8	38.41 ± 7.83			7(41.2)	10(58.8)		
	Agree	454	20.9	43.30 ± 4.68			58(12.8)	396(87.2)		
	Strongly agree	1656	76.1	44.57 ± 3.93			115(6.9)	1541(93.1)		

Table 5. Ordinal logistic regression analysis of willingness on knowledge levels (n = 2176) .

Variables	β	SE	Wald	p	95% CI
I would like to receive COVID-19 vaccination.	−0.618	0.160	14.855	<0.001	−0.932~-0.304
I would recommend my friends and relatives to receive COVID-19 vaccination	−0.865	0.153	32.152	<0.001	−1.164~-0.566
I support the promotion of COVID-19 vaccine in the world.	−0.837	0.156	28.945	<0.001	−1.143~-0.532

have also investigated knowledge and attitudes about COVID-19 vaccines,[46–48] but there were few retrievable studies on the knowledge and willingness of elderly care facilities' staffs to receive COVID-19 vaccine.

Some problems were also found in the survey. 59.6% of the participants were female, 40.4% were male; 39.4% of the participants were over 50 years old. 61.6% of the participants did not go to college, 29.6% participants' education level was junior middle school or below. Differs from their target population with regard to the main sociodemographic (e.g., age, gender, etc.) were more female, older and less educated. These characteristics of the participants coincide with China's official statistics of geriatric care facility staff. This may be due to the widespread perception in China that service for the old-aged is a relatively menial job. So men, young, highly educated people do not want to work in geriatric care facility. China is in urgent need of a batch of young and highly educated professionals to provide services for the old-aged. The government can take some measures to attract talents, such as improving salaries, welfare treatment and social status. At the same time, it is necessary to establish a talent training mechanism for old-age service personnel, establish reasonable professional qualification evaluations and clarify the career prospects for geriatric care facility staff.

5. Conclusions

The vast majority of the staff in geriatric care facilities in Anhui Province, China, had good knowledge regarding the COVID-19 vaccine. The rate of willingness to receive the vaccine found in this survey was a positive sign and was affected by the level of knowledge concerning the COVID-19 vaccine. At the same time, there were still a few participants with poor knowledge levels and a few people who were not willing to be vaccinated against COVID-19. Government can guide the staff of geriatric care facilities to get vaccinated by strengthening publicity about the effects and adverse reactions of COVID-19 vaccines.

5.1. Strength and limitations of the study

An online survey was used to avoid face-to-face contact, which can reduce the chance of infection with COVID-19. While the strength of this survey is very clear, there are some limitations. First, the data were collected by an online platform, selection bias may occur in sample selection. In order to avoid this problem, we did not sample, but invited all the staff of geriatric care facilities in Anhui to participate in the survey, with the help of the competent unit of

geriatric care facilities (the Department of Civil Affairs of Anhui Province). Second, the cross-sectional design meant that we could not draw any conclusions on the direction of causality. However, our study aim was not to clarify causal direction, but rather to identify the proportion of the vaccine good knowledge level, willingness to get vaccinated against COVID-19, and their related factors. Therefore, the cross sectional design was not considered to have any adverse effect on the relevancy of our results.

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Author contributions

Conceptualization: Juan Tao.
Data curation: Chenchen Zeng.
Formal analysis: Chenchen Zeng, Huoba Li, Lulu Cheng.
Investigation: Huoba Li, Juan Tao, Chenchen Zeng, Lulu Cheng.
Methodology: Huoba Li, Deyu Chen.
Project administration: Deyu Chen.
Supervision: Deyu Chen.
Writing-original draft: Huoba Li, Deyu Chen, Lulu Cheng.
Writing-review and editing: Huoba Li,Deyu Chen, Juan Tao,Lulu Cheng.

Ethical approval

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ORCID

Deyu Chen ⓘD http://orcid.org/0000-0002-5416-9050

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