Willingness of The COVID-19 Vaccine Uptake: A Cross-Sectional Study of Community Residents in China

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Research

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Abstract

Background

The pandemic of coronavirus disease 2019 (COVID-19) brought great disaster to the world. Vaccination for COVID-19 is one of the most important preventative measures to reduce the disease transmission. Our study aims to estimate residents' willingness to accept COVID-19 vaccination and its influencing factors in the general adult population in Chinese community.

Methods

3000 questionnaires were posted from December,2020 to January,2021 to residents in Kaifeng with 89.60% response rate. Results of the 2688 respondents on their willingness to accept the COVID-19 vaccine were analyzed.

Results

89.06% of respondents were willing to accept a COVID-19 vaccine if vaccines were available. People who were 46–59 years old (OR = 0.311; 95% CI: 0.188–0.512), often live in the town (OR = 3.979; 95% CI: 2.473–6.402) and pay attention to the development of the COVID-19 vaccine (OR = 0.301; 95% CI: 0.203–0.447), and agreeing that the COVID-19 vaccine can prevent COVID-19 (OR = 0.106; 95% CI: 0.050–0.224) were significantly associated with their willingness to accept receive COVID-19 vaccination.

Conclusion

A high acceptance of COVID-19 vaccination had been shown among Chinese residents although it was not during the pandemic period, while concerns about vaccine safety and effectiveness might hinder the promotion of vaccine uptake.

1 Background

Around March 2020, the outbreak of COVID-19 caused by a new type of SARS-CoV-2 has spread all over the world, reaching the level of pandemic [1, 2]. Global attention was soon focused on the situation because of the increasing number of new cases and the high rate of death associated with the infections [3]. Since COVID-19 has caused huge casualties and serious economic losses, posing a threat to the world, it is urgent to understand the current situation and formulate strategies to curb the spread of the virus [4]. However, there are currently no specific antiviral treatments for COVID-19 [5], so immunization is one of the most successful and cost-effective health interventions to prevent infectious diseases. WHO has recommended several candidate vaccine viruses for the development of COVID-19 vaccines for the purpose of pandemic preparedness [5]. In December 2020, Polack's study showed that the BNT162b2

mRNA COVID-19 vaccine conferred 95% protection against COVID-19 in persons 16 years of age or older [6]. Therefore, vaccination is a critical part of COVID-19 pandemic preparedness [7].

Although the development of vaccine has made great progress, there are still important challenges regarding future immunization against COVID-19. For example, As of January 10, 2021, the Daily Mail and other media reported that there were two deaths of doctors vaccinated with the Pfizer COVID-19 vaccine in the United States; on January 14, 2021, the Norwegian drug administration said that 23 people in Norway who were vaccinated by Pfizer and BioNTech died. It has deepened the public's doubts and trust in the safety and effectiveness of the vaccine. Understanding residents' willingness to accept the COVID-19 vaccine and its main related factors may enable policy makers to take measures for vaccination coverage improvement. Five surveys had been conducted in China [8, 9, 10, 11, 12], four of them were in the research and development stage of the COVID-19 vaccine, while the other one focused on young adults preference for COVID-19 vaccines. The epidemic situation in China has been basically controlled and the developed vaccine is on the market now. Under the current situation, what are the willingness of Chinese community residents to be vaccinated with COVID-19 and its influencing factors? At present, there is a lack of research. In this study, a questionnaire survey was conducted among 3000 residents in Kaifeng City to evaluate the willingness of community residents to receive COVID-19 vaccination, and to determine the related possible factors.

2 Methods

2.1 Research objects

In this study, residents were recruited by a multistage sampling approach [13]. Initially, two urban districts were randomly selected to be sampled. From each selected district, three towns or streets were randomly selected. And then two communities were randomly selected in each of these towns or streets. In total, 12 communities were confirmed as the survey locations. To meet the sample size requirement (3000 questionnaires), 250 families were randomly selected from each community, and each family was responsible for a questionnaire. We had gotten rid of people under the age of 18.

2.2 Research questionnaire

The survey was carried out using an anonymous questionnaire, which consisted of four sections: (1) Demographics information (gender, age, permanent residence, marital status, educational level, occupation, religious belief, per capita monthly income of family, a chronic underlying disease and medical insurance); (2) Residents' perceptions regarding COVID-19 listed as follows: 'severity of COVID-19'; 'worrying about infection with COVID-19'; 'possibility of suffering from COVID-19'. (3) Residents' views on vaccines listed as follows: 'the safety and effective of vaccines approved by the states'; 'you ever heard of the COVID-19 vaccine' 'Do you often focus on the development of the COVID-19 vaccine' 'the COVID-19 vaccine can prevent COVID-19'. (4) Residents' willingness to accept a future COVID-19 vaccine if it is available with the response options of 'yes' and 'no', meanwhile, the questionnaire also contains the

reasons why the participants were willing or unwilling to be vaccinated and other related issues. All the questions were based on evidence in the existing literature.

2.3 Data collection

We conducted the survey from December,2020 to January,2021, and we had contacted general managers of the twelve communities to obtain approval to send questionnaires to their residents. Within each survey location, all the households were randomly numbered according to the address numbers. Then we use random number table method to select 250 families in each community, and an adult in each family is responsible for a questionnaire. 3000 anonymous questionnaires were posted to general managers of communities who then passed these questionnaires to the community residents, which will be mailed to us after filling in. All questionnaires were received within a 2-week period.

2.4 Statistical analysis

Descriptive results were cross-tabulated. χ^2 test was used to examine demographic characteristics between community residents who were willing to accept COVID-19 vaccination against those who were not willing to accept it. We conducted univariate analyses to identify apparent associations between perceptions regarding COVID-19 factors, perceptions regarding vaccines and the willingness to take a future COVID-19 vaccine. Logistic regression models were then performed to examine the factors associated with residents' willingness to accept a future COVID-19 vaccine. The level of statistical significance was set at a p-value of < 0.001 .

3 Results

3.1 Demographic characteristics of participants

According to Table 1, 56.25% participants were female and 77.23% participants lived in the town. Among the respondents, 69.64% were 18–45 years old; 55.80% had married; 76.23% ever had COVID-19 around them. The distribution of educational level was as follows: Primary school or below: 6.69% (n = 180), Junior middle school: 16.41% (n = 441), High school or technical secondary: 14.17% (n = 381), University: 47.32% (n = 1272) and Graduate or above: 14.51% (n = 390). The per capita monthly income (RMB) of families ≤ 2000 , 2000–4000, 4000–6000 and ≥ 6000 accounted for 19.98%, 38.95%, 28.57% and 12.50% respectively.

Table 1
Demographic characteristics on residents' willingness to receive COVID-19 vaccination

	Total Number	Number of residents accepting	Number of residents declining	χ^2	<i>p</i>
Gender(n = 2688)				1.364	0.243
Male	1176(43.75%)	1038(88.27%)	138(11.73%)		
Female	1512(56.25%)	1356(89.68%)	156(10.32%)		
Age (n = 2688)				65.599	<0.001
18–45 years	1872(69.64%)	1683(89.90%)	189(10.10%)		
46–59 years	495(18.42%)	465(93.94%)	30(6.06%)		
≥ 60 years	318(11.83%)	243(76.42%)	75(23.58%)		
Permanent residence (n = 2688)				25.015	<0.001
Town	2076(77.23%)	1815(87.43%)	261(12.57%)		
Village	612(22.77%)	579(94.61%)	33(5.39%)		
Marital status (n = 2688)				0.090	0.764
Married	1569(58.37%)	1395(88.91%)	174(11.09%)		
Unmarried	1119(41.63%)	999(89.28%)	120(10.72%)		
Educational level (n = 2688)				41.489	<0.001
Primary school or below	204(7.59%)	156(76.47%)	48(23.53%)		
Junior middle school	441(16.41%)	399(90.48%)	42(9.52%)		
High school or technical secondary	381(14.17%)	354(92.91%)	27(7.09%)		
University	1227(45.65%)	1143(93.15%)	129(10.51%)		
Graduate or above	390(14.51%)	342(87.69%)	48(12.31%)		
Occupation (n = 2688)				0.340	0.560
Medical staff	528(19.64%)	474(89.77%)	54(10.23%)		
Non-medical staff	2160(80.36%)	1920(88.89%)	240(11.11%)		
Religious belief(n = 2688)				0.209	0.647
Yes	228(8.48%)	201(88.16%)	27(11.84%)		

	Total Number	Number of residents accepting	Number of residents declining	χ^2	p
No	2460(91.52%)	2193(89.15%)	267(10.85%)		
Per capita monthly income of family (RMB) (n = 2688)				10.551	0.014
≤ 2000	537(19.98%)	486(90.50%)	51(9.50%)		
2000–4000	1047(38.95%)	915(87.39%)	132(12.61%)		
4000–6000	768(28.57%)	702(91.41%)	66(8.59%)		
≥ 6000	336(12.50%)	291(86.61%)	45(13.39%)		
A chronic underlying disease(n = 2688)				7.635	0.006
Yes	240(8.93%)	201(83.75%)	39(16.25%)		
No	2448(91.07%)	2193(89.58%)	255(10.42%)		
Medical insurance (n = 2688)				1.261	0.261
Yes	2460(91.52%)	732(89.27%)	88(10.73%)		
No	228(8.48%)	198(86.84%)	30(13.16%)		

3.2 The situation of willingness vaccination and related factors

86.80% of participants would like to accept the COVID-19 vaccine when it is available. The main reasons were that they worried about being infected in the future (78.95%) and spreading the infection to people around them (71.55%). Meanwhile, only 13.20% participants do not want to receive the COVID-19 vaccine. The main reasons why they don't plan to get vaccinated with vaccines were that not believing the safety (68.37%) and effectiveness (40.82%) of vaccines and thought vaccines had side effects (36.74%). See Table 2 for details.

Table 2
Reasons for accepting or declining the COVID-19 vaccine

Reasons for willingness to vaccinate(n = 2394)	N (%)
being infected in the future	1890(78.95%)
spreading the infection to people around them	1713(71.55%)
being quarantined after being infected	942(39.35%)
believing the safety and effectiveness of vaccines	1632(68.17%)
recommended by doctors	486(20.30%)
recommended by family or friends	381(15.91%)
The vast majority of people around are willing to vaccinate	570(23.81%)
Reasons for unwillingness to vaccinate(n = 294)	
the safety of vaccines	201(68.37%)
the effectiveness of vaccines	120(40.82%)
be well	87(29.59%)
side effects	108(36.74%)
domestic epidemic had been basically controlled	75(25.51%)
Other concerns (vaccination contraindication, no time and poor physical activity)	<30(<0.1)

3.3 Difference analysis of vaccination willingness

The demographic characteristics of respondents who were willing to accept COVID-19 vaccination and with those who were not willing to accept it were compared by χ^2 test and were presented Table 1. Residents who were willing to receive the COVID-19 vaccine were different from those who were not willing to receive the COVID-19 vaccine with respect to “age, permanent residence and educational level”. There were no statistically significant differences in other characteristics as analyzed by chi-square test.

The relationship between demographic and other characteristics of the community residents and their willingness to accept vaccination were analyzed further using logistic regression (Table 3). the variables that were significantly associated with a higher likelihood of reporting willingness to accept the COVID-19 vaccine were people who were 46–59 years old (OR = 0.311; 95% CI: 0.188–0.512) and often live in the town (OR = 3.979; 95% CI: 2.473–6.402), people who often pay attention to the development of the COVID-19 vaccine (OR = 0.301; 95% CI: 0.203–0.447) and agreeing that the COVID-19 vaccine can prevent COVID-19 (OR = 0.106; 95% CI: 0.050–0.224).

Table 3
Logistic regression analysis for the factors associated with residents' willingness of the COVID-19 vaccine uptake

Variables	B	Odds ratio	95% CI	<i>p</i>
Age				
18–45 years	-0.431	0.650	0.411–1.028	0.066
46–59 years	-1.168	0.311	0.188–0.516	<0.001
≥ 60 years		Reference		
Permanent residence				
Town	1.381	3.979	2.473–6.402	<0.001
Village		Reference		
Educational level				
Primary school or below	0.830	2.294	1.196–4.397	0.012
Junior middle school	0.042	1.043	0.586–1.854	0.887
High school or technical secondary	-0.436	0.647	0.364–1.150	0.138
University	-0.088	0.916	0.630–1.333	0.647
Graduate or above		Reference		
Severity of COVID-19				
Serious	-1.162	0.313	0.160–0.611	0.001
kind	-0.492	0.612	0.281–1.333	0.216
Not serious		Reference		
The safety and effective of vaccines approved by the states				
Yes	-1.070	0.343	0.146–0.805	0.014
No		Reference		
Do you often focus on the development of the COVID-19 vaccine				
Yes	-1.199	0.301	0.203–0.447	<0.001
No		Reference		
The COVID-19 vaccine can prevent COVID-19				
Yes	-2.242	0.106	0.050–0.224	<0.001
No		Reference		

4 Discussion

In this cross-sectional study, residents showed that they had a high acceptance of COVID-19 vaccination, which was consistent with the survey results of Malik and Reiter [14, 15]. The high acceptance of COVID-19 vaccination among the residents reflects the strong demand for the vaccine and the high awareness of the importance of the vaccine in controlling the epidemic. The reasons that affect the vaccination of residents are believing in the safety and effectiveness of the COVID-19 vaccine and worrying about being infected in the future and spreading the infection to people around you and being quarantined after being infected. It shows that the risk perception of residents was an important predictor for vaccination acceptance, as those who perceived a high risk of infection were more likely to get vaccinated as soon as possible.

As the majority of respondents had the intention of getting vaccinated, it is meaningful to identify barriers or facilitators to their vaccination decision on whether to accept vaccination. Public concerns about vaccine safety are often reported as a major obstacle to vaccination decisions, especially for new vaccines. Our study confirmed the positive role of belief in safety and effectiveness of the COVID-19 vaccine and the constant attention to the development of the COVID-19 vaccine in accepting COVID-19 vaccination, which was consistent with previous studies [9, 11]. Our study found that residents who often live in the town were more willing to vaccination than those who live in the village. It may be because of the high mobility of urban population, they seldom stay at home and travel more. These behaviors may lead to their higher perceived risk of being infected with COVID-19, and may eventually lead to higher acceptance of the vaccine. Our study also found that both medical staffs and non-medical staffs were willing to get the COVID-19 vaccine, Perhaps the severity of the epidemic, the high infectivity of the virus and the publicity of the role of the vaccine by the media are the driving factors for them to decide to vaccinate [16]. Inconsistent results were shown in previous studies from the Indonesia, Turkey or the United States concerning the impact of demographic characteristics on the acceptance of the COVID-19 vaccine [14, 15, 17, 18], and we found that, among the residents, respondents aged 46 to 59 were more likely to accept vaccination, while respondents' income or medical insurance may not influence their intention as shown in the results of logistic regression analysis. This shows that people aged 46 to 59 are strongly aware that vaccines provide not only personal protection, but also family protection. However, the income and medical insurance have nothing to do with the willingness to vaccination, which may be free of charge for the COVID-19 vaccination in China, and Chinese medical insurance has basically reached universal coverage.

There are still a small proportion of residents who are not willing to accept a future COVID-19 vaccine. Similar to the finding of Polack [6], we showed that the main reason why residents don't want to be vaccinated with the COVID-19 vaccine was to worry about the side effects and the efficacy and safety of the new vaccine. At the same time, Dubé [19] found that the uncertainties about new vaccine would lower the vaccine confidence of the public; Henrich's research showed concerns about using new vaccines during a pandemic were to differ from those of established products in a non-crisis situation [20]. So we can infer that the actual coverage of COVID-19 vaccination would be lower than our estimate of 89.60%

in residents' willingness to accept COVID-19 vaccination. Research shows that the higher the coverage rate of vaccination, the higher the level of preventing the spread of the disease [18]. Therefore, to make sure the COVID-19 vaccine fully covered, the health departments and other sectors should strengthen the regular vaccination education of the vaccine to improve overall vaccine confidence and the compliance of the public.

We conducted the investigation under the condition of stable epidemic situation in China, which can highlight the public's willingness to receive vaccination during the stable period. Meanwhile, we investigated the influencing factors of residents' vaccination willingness, the exploration of barriers and facilitators of vaccination was helpful for government to design effective immunization strategies to increase the vaccine uptake in the prevention and control of COVID-19. A limitation of our study is that we have only one center, but considering the diverse epidemic strength, income levels and healthcare access across regions, we should adopt multicenter research. And compared with the general population of China, our sample is younger and has limited universality.

5 Conclusion

Our study reflected a high level of acceptance of COVID-19 vaccination among the community residents in China although it is not during the pandemic period. Concerns about vaccine safety and effectiveness by the public may hinder the promotion of vaccine uptake in the future. To expand vaccine uptake in response to prevent the spread of the disease, health education and communication from authoritative sources will be important to alleviate public concerns about vaccine safety.

Abbreviations

COVID-19

coronavirus disease 2019

Declarations

Ethics approval and consent to participate

This study was conducted according to the guidelines that were laid down in the Declaration of Helsinki, and all procedures involving human subjects were approved by the Ethics Committee of Kaifeng CDC. In addition, those participants were informed about the purpose of the study, the importance of their participation, and their ability to withdraw at any time. Written consent was obtained prior to data collection.

Consent for publication

Individual respondent consent to participate in the study.

Availability of data and material

If you want data information, please contact our corresponding author.

Competing interests

The authors declare that they have no conflicts of interests.

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Authors' contributions

WX designed the study, drafted the manuscript. LG performed the data collection. JR analyzed the data. CC revised the manuscript. All authors have read and approved the final version of the manuscript.

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Disclosure

Ruiying Jia was the co-first author.

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