

RESEARCH PAPER



## Willingness and influential factors of parents of 3-6-year-old children to vaccinate their children with the COVID-19 vaccine in China

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### ABSTRACT

The impact of Coronavirus disease 2019 (COVID-19) on children aged 3–6 can be severe. Vaccination for COVID-19 is one of the most important primary preventative measures to reduce disease transmission. Parents are hesitant to vaccinate their children against COVID-19 because it was reported in the news that some adults have had adverse reactions to the vaccine. This study aims to investigate the willingness of Chinese parents of 3–6 year old children to vaccinate them with the COVID-19 vaccine and identify what factors influence their decisions. A survey was conducted using a two-stage stratified random sampling method from December 2020 to February 2021. We used univariate analysis and multivariate binary logistic analysis to explore potential factors that may determine the acceptance of the COVID-19 vaccine. Of the 468 parents who participated, 86.75% were willing to vaccinate their children with the COVID-19 vaccine. Parents who were female (OR = 2.591; 95% CI: 0.432–4.689), recognized their children in the high-risk category (OR = 2.494; 95% CI: 1.244–5.002), often followed-up with COVID-19 vaccine-related information (OR = 9.065; 95% CI: 3.220–28.654), believed in the safety of the COVID-19 vaccine (OR = 3.068; 95% CI: 1.313–7.168), or thought the COVID-19 vaccine could prevent COVID-19 (OR = 13.750; 95% CI: 2.516–75.140) were more willing to vaccinate their children. To ease parents' hesitation about vaccines, the authority organization should release updated information on the safety and reliability of vaccines, target gender-specific health education for parents, and ask the media to report scientifically support information.

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## 1. Introduction

In March 2020, the rapidly growing outbreak of COVID-19 caused by a new type of SARS-COV-2 soon reached the level of a pandemic.<sup>1,2</sup> Because of its high contagiousness, the number of new cases was increasing, arousing attention worldwide.<sup>3</sup> It is urgent to understand the current situation and formulate strategies to curb the spread of the virus,<sup>4</sup> as COVID-19 has caused great numbers of casualties and serious global economic losses. However, there are currently no specific antiviral treatments for COVID-19,<sup>5</sup> and immunization is one of the most successful and cost-effective health interventions to prevent infectious diseases. So far, vaccines targeting adults, such as the American Pfizer-BioNTech COVID-19 vaccine, Chinese Sinovac's COVID-19 vaccine, and Russian "Sputnik V" COVID-19 vaccine, have been well tested and put into large-scale use. But the COVID-19 vaccine for children aged 3–6 is being developed and not yet in use.

Children have not fully developed their physical function and their immunity is low; therefore, they can benefit more from vaccination. Background factors are also known to influence vaccination, as they can influence parents' perceptions and attitudes.<sup>6</sup> COVID-19 is currently under control in China, as the number of new people infected each day is small and the probability of infection is relatively low,<sup>7</sup> parents believe that the environment is safe and, therefore, the need for parents to

vaccinate their children against COVID-19 is compromised. At the same time, there are news agencies reporting the side effects and severe adverse reactions after vaccination, leading to many parents' hesitation whether to vaccinate their children. In addition, the studies found that many factors, such as religious beliefs, vaccination policies and the security assurance capabilities of the entire vaccine industry chain, also influence vaccine hesitancy and rejection.<sup>8–10</sup> To improve the vaccination rate for children in China, we need to investigate parents' willingness to vaccinate their children and identify the influencing factors for their decision.

Past literature has identified many factors that influence parents' willingness to vaccinate their children. Firstly, perception of a child's risk significantly affects parents' intention to vaccinate their children. Goldman's research showed that parents who thought their children were at risk of influenza were more likely to get their children vaccinated,<sup>11</sup> while Li's research found that, no perceived susceptibility of children to influenza was pivotal barrier hindering parents from having their children vaccinated.<sup>12</sup> Secondly, perceived vaccine risk also significantly affects parents' intention to vaccinate their children. Concern about side effects was an important factor in parents opting in for the novel inactivated enterovirus 71 vaccination for their children, according to the results of a study in Guangzhou, China,<sup>13</sup> The results of a Thai study

showed that parents preferred lower side effects from vaccines when deciding upon vaccinations for their children.<sup>14</sup> Thirdly, individuals' have different health-related beliefs, which will affect their behaviors.<sup>15</sup> Lau's study showed that parents who thought vaccinations would be ineffective or cause side effects were less likely to want to get them.<sup>16</sup> Zhao's study showed that parents who believed the vaccine was effective were more likely to support vaccinating their children.<sup>10</sup> Fourthly, parents' knowledge about diseases and vaccines also influences their willingness to vaccinate their children. The results of a Chinese research study found that poor knowledge of disease and vaccines among parents contributed to the poor acceptance of vaccines.<sup>17</sup> The results of an Italian study showed that, good cognitive ability could promote behavior change.<sup>18</sup> Fifthly, demographic factors can affect parents' willingness to vaccinate their children. A Chinese study found that sociodemographic factors such as gender, education level, and family income affected parents' willingness to vaccinate kindergarten children against influenza.<sup>11,13,19</sup> These studies are based on various theories of health behavior, including the health belief model,<sup>20</sup> planning behavior theory,<sup>21</sup> and protective motivation theory, among others.

In the past, researchers studied parents' willingness to vaccinate their children to prevent epidemic diseases such as hand, foot, and mouth disease (HFMD), meningitis B, and influenza.<sup>12,22,23</sup> However, different from previous epidemics, COVID-19 is highly contagious, spreads quickly, and there was a short time to develop a vaccine. Thus, investigating whether parents are willing to vaccinate their children against COVID-19 has become a hot topic of research currently, and many countries, such as the United States, China, the United Kingdom, and Italy have conducted relevant studies.<sup>24–27</sup> However, these foreign scholars' researches were carried out against the background of the COVID-19 pandemic. At present, COVID-19 has been effectively controlled in China, and people's daily work and life routing are completely unaffected. Therefore, Chinese parents' willingness to vaccinate their children against COVID-19 may be different from foreign countries, considering that COVID-19 is effectively controlled in China. The purpose of this study is to understand the willingness of Chinese parents to vaccinate their children aged 3–6, and to find out the influencing factors of parents' willingness to vaccinate their children against COVID-19 from the perspective of demographic characteristics and knowledge, attitude and behavior of COVID-19 vaccination. This will provide scientific support for promoting COVID-19 vaccine and other vaccines in the future.

## 2. Materials and methods

### 2.1. Research sample

A cross-sectional survey using anonymous self-administered questionnaires was conducted among parents of kindergartners in Kaifeng, China from December 2020 to February 2021. There are 5 urban areas in Kaifeng. Two-stage stratified random sampling was adopted to select participants. First, we numbered all the kindergartens in each urban area, then started from a random starting point in the random number table, and

began to select five kindergartens from left to right. A total of 25 kindergartens were selected. Second, 20 children from each chosen kindergarten were randomly selected to participate in our study, and the children took the survey home for one of the parents to fill in. In total, 25 kindergartens with 500 parents participated in our study.

This study was conducted under the guidelines of the Declaration of Helsinki, and all procedures involving human subjects were approved by the Ethics Committee of Kaifeng CDC. Participants were fully informed of the purpose of the study and were invited to participate voluntarily. Written consent letters were obtained from the kindergartens and each participating parent. Each participant received a separate survey, including an invitation letter stating the confidentiality of the study and ensuring informed consent, as well as questionnaires. The questionnaires were sent out in sealed envelopes.

### 2.2. Research questionnaire

The survey used anonymous questionnaires, which consisted of four sections: (1) Demographic information: gender of parents, parent's age, if the family has only one child, marital status, educational level, occupation, per capita monthly income of the family, current residence, and whether children received an influenza vaccine in the last 12 months. (2) Knowledge of COVID-19: Based on the literature and interview results with parents of children, we preliminary designed the COVID-19 knowledge questionnaire, and then, the questionnaire was reviewed and revised by a panel of two epidemiologists and a psychologist. Finally, we conducted a pilot test on the revised questionnaire. The questionnaire assessed five aspects that include routes of transmission, main symptoms, the severity of disease, risk of infection in children, and medication. Each item was given a score of 0–2, with a maximum total knowledge score of 10. Participants were classified into three groups based on total score: <6, low knowledge; 6–8, moderate knowledge; and >8, high knowledge. (3) The COVID-19 vaccine-related information: “Have you ever heard of the COVID-19 vaccine?”; “the frequency of attention to the COVID-19 vaccine-related information”; “Do you believe in the safety of the COVID-19 vaccine?”; “Do you think the COVID-19 vaccine could prevent COVID-19?” (4) A dichotomous (yes/no) question, “Are you willing to vaccinate your children with the COVID-19 vaccine if it is available?” was used to assess the main study variable, which was the parents' willingness to vaccinate their children. The questionnaires also ask participants to explain why they were willing or unwilling to be vaccinated.

### 2.3. Data collection

We surveyed from December 2020 to February 2021, and we had contacted the kindergartens to obtain approval to send questionnaires to their students. Teachers distributed the questionnaires combined with consent letters in a sealed envelope, which were then completed by the parents. We allowed a maximum of one month to collect the questionnaires, but over 70% of them were sent back in one week and the rest were

received in two weeks. In total 500 questionnaires were distributed with 468 (93.60%) parents providing valid information. Questionnaire completion was anonymous; therefore, it was impossible to follow up with non-responders.

#### 2.4. Statistical analysis

Univariate analyses were performed to explore potential factors (including demographic information, COVID-19-related knowledge, the COVID-19 vaccine-related information) that were associated with parents' willingness to vaccinate their children with the COVID-19 vaccine. Then we used multivariate binary logistic analysis to examine whether these factors had a statistically significant impact on the predictive variables. The level of statistical significance was set at a  $p$ -value of  $< 0.05$ .

### 3 Results

#### 3.1. Demographic characteristics of participants

A description of the analysis results of the target population is listed in Table 1. Of the total sample, 320 (68.38%) participants were female and 148 (31.62%) were male; the mean age was 35.23 ( $\pm 5.30$ ) years. The majority of parents were living in town and reported that their children had ever been vaccinated with the influenza vaccine in the last 12 months. The distribution of educational level was as follows: Junior middle school or below: 41 (8.76%), High school or technical secondary: 78 (16.67%), University: 155 (33.12%) and Graduate or above: 194 (41.45%). The per capita monthly income (RMB) of families  $\leq 2000$ , 2000-4000, 4000-6000 and  $\geq 6000$  accounted for 8.33%, 24.79%, 38.03% and 28.85% respectively.

#### 3.2. Knowledge of COVID-19

Participants tended to know about a high risk of infection in children, the routes of transmission, symptoms and severity of the COVID-19, with more than 80% of participants answering these questions correctly. However, participants didn't know much about medication for COVID-19 (76.13% correct as listed in Table 2). The mean score for COVID-19 knowledge was 8.20 ( $\pm 1.18$ ), revealing a high level of COVID-19 understanding. Univariate analysis showed that parents who thought that their children had a high risk of COVID-19 infection were more willing to have them vaccinated.

#### 3.3. The situation of willingness to vaccinate and related factors

Of all participants, 86.75% would like their children to receive the COVID-19 vaccine when it is available. The reasons they reported were because they worried about their children being infected in the future (78.57%), spreading the virus to people around them (40.15%), being quarantined after being infected (70.69%), and believing in the safety and effectiveness of vaccines (68.97%). Meanwhile, only 13.25% of participants did not want to vaccinate their children with the COVID-19 vaccine. The reasons are summarized as below: 67.74% did not believe

in the safety of vaccines, 56.45% did not perceive the effectiveness of vaccines, 41.94% considered vaccines had side effects, and 24.19% showed that their children have contraindication to vaccination.

#### 3.4. Difference analysis of vaccination willingness

The results of univariate analysis showed that the willingness to receive the COVID-19 vaccine for their children were related to the "gender of parents" and "children having received an influenza vaccine in the last 12 months" (Table 1). However, there were no statistically significant differences in other demographic characteristics based on the univariate analysis results.

The results of logistic analysis (Table 3) showed that, parents were more likely to have their children vaccinated against SARS-CoV-2 if they were female (OR = 2.591; 95% CI: 0.432–4.689), or recognized the high risk for their children to COVID-19 (OR = 2.494; 95% CI: 1.244–5.002), or often pay attention to the COVID-19 vaccine-related information (OR = 9.065; 95% CI: 3.220–28.654), or believed in the safety of the COVID-19 vaccine (OR = 3.068; 95% CI: 1.313–7.168), or thought the COVID-19 vaccine could prevent COVID-19 (OR = 13.750; 95% CI: 2.516–75.140).

### 4 Discussion

Vaccination of children will help boost their immunity, reduce the risk of disease, and enable them to participate in other activities – sports, games, socializing with friends – that are so important to their health and development. And now the US pharmaceutical company Pfizer has started large-scale trials of the COVID-19 vaccine in children under 11 years of age,<sup>28</sup> suggesting that a vaccine for children is not far off. When a new vaccine is available for children, the parents' willingness to take it will affect the children's vaccination rate.<sup>29</sup> In the context of vaccine hesitation, this study provided important insights for understanding the willingness of parents of preschoolers in China to vaccinate their children against COVID-19 and identified relevant factors. The overall willingness of parents to accept COVID-19 vaccine for their children was quite high, and it was significantly influenced by the gender of the parents, the high risk of COVID-19 to children, the constant attention to the COVID-19 vaccine-related information, and trust in the safety and effectiveness of the COVID-19 vaccine.

Different from Goldman's research on caregiver willingness to vaccinate their children against COVID-19,<sup>24</sup> our study found that mothers were more willing than fathers to vaccinate their children in China. This may be because Chinese mothers spend more time with their children than fathers and are more concerned about their children's health related illnesses. This finding can be applied to create strategy such as providing gender-specific parental education campaigns to maximize the acceptability of vaccines.

Moreover, our study found that parents who often pay attention to the COVID-19 vaccine-related information were more likely to vaccinate their children. It suggests that public health interventions should report scientific and objective

**Table 1.** Demographic characteristics on the kindergarten children parents' willingness to receive COVID-19 vaccination.

	Total number	Willing to vaccinate their children		95%CI	<i>p</i>
		Yes (n = 406)	No (n = 62)		
Gender of parents(n = 468)					0.006
Male	148(31.62%)	119(80.41%)	29(19.59%)	1.13–1.26	
Female	320(68.38%)	287(89.69%)	33(10.31%)	1.07–1.14	
Parent's age(n = 468)					0.067
20–30 years	96(20.51%)	85(88.54%)	11(11.46%)	1.05–1.18	
31–40 years	286(61.11%)	253(88.40%)	33(11.54%)	1.08–1.15	
≥41 years	86(18.38%)	68(79.07%)	18(20.93%)	1.12–1.30	
If the family has only one child(n = 468)					0.239
Yes	281(60.04%)	248(88.26%)	33(11.74%)	1.08–1.16	
No	187(39.96%)	158(84.49%)	29(18.35%)	1.10–1.21	
Marital status(n = 468)					0.260
Married	451(96.37%)	389(86.25%)	62(13.75%)	1.11–1.17	
Divorced	14(2.99%)	14(100.00%)	0(0.00%)	1.00–1.00	
Widowed	3(0.64%)	3(100.00%)	0(0.00%)	1.00–1.00	
Educational level(n = 468)					0.658
Junior middle school or below	41(8.76%)	36(87.80%)	5(12.20%)	1.02–1.23	
High school or technical secondary	78(16.67%)	70(89.74%)	8(10.26%)	1.03–1.17	
University	155(33.12%)	136(87.74%)	19(12.26%)	1.07–1.17	
Graduate or above	194(41.45%)	164(84.54%)	30(15.46%)	1.10–1.16	
Occupation(n = 468)					0.207
Medical staff	33(7.05%)	31(93.94%)	2(6.06%)	0.97–1.15	
Non-medical staff	435(92.95%)	375(86.21%)	60(13.79%)	1.11–1.17	
Per capita monthly income of the family(n = 468) (RMB)					0.649
≤ 2000	39(8.33%)	33(84.62%)	6(15.38%)	1.04–1.27	
2000–4000	116(24.79%)	104(89.66%)	12(10.34%)	1.05–1.16	
4000–6000	178(38.03%)	155(87.08%)	23(12.92%)	1.08–1.18	
≥ 6000	135(28.85%)	114(84.44%)	21(15.56%)	1.09–1.22	
Current residence(n = 468)					0.556
Town	446(95.30%)	386(86.55%)	60(13.45%)	1.10–1.17	
Village	22(4.70%)	20(90.91%)	2(9.09%)	0.96–1.22	
Whether children received an influenza vaccine in the last 12 months(n = 468)					0.005
Yes	428(91.45%)	377(88.08%)	51(11.91%)	1.09–1.15	
No	40(8.55%)	29(7.25%)	11(2.75%)	1.13–1.42	

**Table 2.** Knowledge of COVID-19.

Questions	Correct response		
	Frequency	Response	Percentage (%)
Do the children have a high risk of COVID-19 infection?	402	468	85.90%
What are the routes of transmission of COVID-19? (multiple choice)	1545	1649	93.69%
What are the main symptoms of COVID-19? (multiple choice)	2015	2136	94.34%
Can COVID-19 infection lead to severe disease or death?	426	468	91.03%
Are there any effective drugs for COVID-19?	354	465	76.13%

**Table 3.** Logistic regression analysis for the factors associated with parents' willingness of the COVID-19 vaccine uptake for their children.

Variables	B	Odds ratio	95% CI	<i>p</i>
Gender of parents (Male)				
Female	0.952	2.591	0.432–4.689	0.002
Do the children have a high risk of COVID-19 infection? (No)				
Yes	0.914	2.494	1.244–5.002	0.010
The frequency of attention to the COVID-19 vaccine-related information (Never)				
Often	2.262	9.605	3.220–28.654	0.000
Seldom	1.340	3.819	1.335–10.924	0.012
Do you believe in the safety of the COVID-19 vaccine? (No)				
Yes	1.121	3.068	1.313–7.168	0.010
Do you think the COVID-19 vaccine could prevent COVID-19? (No)				
Yes	2.621	13.750	2.516–75.140	0.002

vaccine-related information through internet and television channels, and positively guide public opinion, to reduce parents' doubts about the COVID-19 vaccine, thus increasing the vaccination rate.

Consistent with the results of the previous studies, we found the positive role of belief in safety and effectiveness of the COVID-19 vaccine in COVID-19 vaccination acceptance. Our study also found that the common factor influencing parents' willingness or unwillingness to vaccinate is their trust in vaccines, which were also consistent with other studies.<sup>20,30,31</sup> Thus, public health workers should focus on providing more education on improving parents' overall confidence in the safety and effectiveness of the vaccine, as this is the main reason that leads to the rejection of the COVID-19 vaccine.

In addition, in our study, parents who believed their children were susceptible to COVID-19 were more willing to accept vaccination in the future. This is similar to the H1N1 pandemic studies that showed a strong association between vaccine intentions and adult's fear of children being infected with diseases.<sup>32</sup> The reason is that good cognition can lead to better behavior and improved the attitude toward vaccination.<sup>33</sup>

However, unlike Lin's study of Chinese mothers' intentions to vaccinate their daughters against the human papillomavirus,<sup>34</sup> our study found no significant correlation between income, education level, and vaccination intention. That's because, first, China's free vaccination policy makes

social and economically disadvantaged groups no longer have the burden of vaccination. Second, due to the particularity of COVID-19, the knowledge of COVID-19 and the COVID-19 vaccine-related information are widely disseminated, people with different education levels have little difference in understanding of it.

Furthermore, different from previous studies that showed that the higher the parents' knowledge of the disease, the higher their willingness to vaccinate,<sup>17,18</sup> we found that there was no significant association between knowledge of COVID-19 and the intention to vaccinate their children with the COVID-19 vaccine in our study population. A possible explanation for this is that because COVID-19 is highly contagious and harmful, the more people learn about it, the more they fear it, coupled with concerns about the short time it takes to develop a vaccine, have made people less willing to vaccinate their children.

Although vaccination hesitancy is pervasive worldwide across all socioeconomic groups, it varies between countries and even among individuals belonging to the same country.<sup>17,35</sup> Our results provided insight in helping parents of kindergarten age children accept the COVID-19 vaccine and other vaccines such as providing a scientific and objective report of vaccine-related information, gender-specific health education for parents, and vaccine safety and reliability information in a timely way.

This is the first study to investigate the willingness of parents to vaccinate 3–6 years old children in the broader context of vaccination hesitancy. At the same time, we investigated the influencing factors of parents' vaccination willingness. The results provide baseline information for future vaccination campaigns to help improve vaccine rates. The exploration of barriers and facilitators of vaccination will be helpful for public health workers to design effective immunization strategies to increase the vaccine uptake in the prevention and control of COVID-19. Meanwhile, three limitations of this study must be noted. First, we only surveyed parents in Kaifeng, while considering the differences in the diverse epidemic strength, income levels and healthcare in different regions, so we should also take samples from other parts of China. Second, we set the attitude questions as closed questions, and the answer options are “yes” and “no,” which may not capture parents' real attitudes. To minimize this bias, it is recommended that further studies use a 5-point Likert scale ranging from “certainly yes” to “certainly no” instead of “yes” or “no.” Third, our study was conducted at a time when vaccines were just being introduced, and parents' beliefs and perceived barriers to vaccination may change over time.

## 5 Conclusion

Our study indicated several significant determinants for parents' willingness to vaccinate their children aged 3–6, including parents who were female, their perception of children's susceptibility to the disease, and those who often followed the COVID-19 vaccine-related information, or who believed in the safety and effectiveness of vaccines. In order to reduce parents' doubts about the COVID-19 vaccine, first, specific publicity of health education should

be established to increase parents' acceptance of the COVID-19 vaccine, thus helping to achieve a high vaccination coverage. Second, relevant government authorities should release updated information on the safety and reliability of vaccines and ask the relevant media to report the information scientifically and objectively, thus guiding public opinion.

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## Disclosure of potential conflicts of interest

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