

Explore the attitudes of children and adolescent parents towards the vaccination of COVID-19 in China

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Abstract

Background

With the increasing incidence of asymptomatic carriers or milder symptoms, children and adolescents are likely to become a silent source of infection. In view of the efficacy and safety of vaccines in the treatment of novel Coronavirus pneumonia, population-wide vaccination will be an inevitable trend to control the spread of COVID-19. However, there is no survey on the attitudes of Chinese parents of children and adolescents towards their children's COVID-19 vaccination.

Methods

We used online questionnaires to find out the attitudes of Chinese parents toward their children's immunization against COVID-19. Logistic regression was used to explore the influencing factors.

Results

A total of 2019 parents participated in the survey. Overall, 74.38% parents said they would actively get vaccinated, 8.90% refused to get vaccinated, 4.60% said they would delay vaccination and 12.12% were still undecided.

Conclusions

In general, Chinese parents have a high desire to be vaccinated against COVID-19, and most parents have a positive attitude towards their children's vaccination. However, many people still hesitate or even refuse to be vaccinated. Education background, attitudes towards children's vaccination, children's age, recent illness and other factors have a certain impact on Chinese parents of children and adolescents towards their children's COVID-19 vaccination.

Introduction

Novel Coronavirus infections pose a serious threat to the health and safety of the public, with over 260 million COVID-19 cases and over 5.21 million deaths worldwide as of December 1, 2021[1]. COVID-19 has been mostly seen in adults since the outbreak, and children consistently accounted for a small proportion of the total number of coronavirus disease cases in 2019, with pediatric cases accounting for only 2% of the 80,900 COVID-19 cases during the surge in China[2, 3]. Although the majority of pediatric cases of COVID-19 are asymptomatic or mild, with a good prognosis and low mortality, novel coronavirus infection of severe acute respiratory syndrome (SARS) has been reported in children of all age groups[2, 4]. In addition, the disease may progress to multisystem inflammatory syndrome (MTIS), a life-threatening complication of COVID-19 infection[5]. Complications of MTIS include myocardial

dysfunction, shock, and respiratory failure and require intensive care; and study indicated that 18.4 out of 100,000 children aged 0–4 years and 10.6 out of 100,000 children aged 5–17 years required hospitalization, of which one third required intensive care[4].

There has recently been increasing evidence that people who are fully vaccinated with the mRNAs (BNT162b2 or mrna-1273) are less likely to develop symptomatic infections and transmit SARS coronavirus 2 (novel coronavirus) to others than those who are not vaccinated[5, 6]. Vaccines tested in young adults over the age of 12 were reported to be safe and effective, including mRNA vaccines produced by Moderna and pfizer-biontech[7, 8]. In addition, phase I/II clinical trial results of two inactivated Chinese vaccines produced by Sinovac and Sinopharm showed that the vaccines were well tolerated, safe and could induce humoral reactivity in children and adolescents aged 3–17 years[9]. While vaccinating children and adolescents is seen as key to ending the epidemic, Vaccine Hesitancy (VH) – the delayed acceptance or refusal of a vaccine despite its availability – remains a barrier to full population vaccination[5, 10]. Alfieri et al.'s study showed that 33% of parents were hesitant to vaccinate their children against COVID-19[11]. Separate data from the US showed that 33% of parents said it was very unlikely that their children would be vaccinated against COVID-19 and 12% said they were not sure[12].

As the incidence of asymptomatic carriers is getting higher and higher, the symptoms of patients with COVID-19 infection are getting lighter and lighter, children and adolescents are likely to become a silent source of infection and remain a threat, becoming an important source of sustained transmission[5, 13]. In order for vaccines to be effective in controlling the spread of COVID-19, it is estimated that 67% of the population needs to be vaccinated to achieve herd immunity[11, 14], and a comprehensive push to vaccinate adults, children and adolescents is an inevitable trend in controlling the spread of COVID-19. In addition, for children under the age of 18, such as parents' behaviors and values tend to have a great impact on their children. This paper mainly explores parents' attitudes towards COVID-19 vaccination and related influencing factors, so as to provide corresponding guidance for popularizing vaccination for children and adolescents.

Method

Population and Sampling

This study was a nation-wide cross-sectional study in China(Figure 1).The ethics committee of Hangzhou Stomatological Hospital approved all the procedures performed, and an anonymous online cross-sectional survey was conducted on Wen Juan network (<https://www.wenjuan.com>), set by Shanghai Zhongyan Network Technology. It is the largest free online survey platform in China, which can provide questionnaire creation, release, management, collection, and analysis services for enterprises or individuals. Their personal information can be confirmed,authentic,diverse and representative samples can be obtained.Participants are parents of Chinese children and adolescents (<18 years old). Questionnaires were filled anonymously and 2019 copies were included apart from 131 invalid and wrong questionnaires.

Questionnaire Design

Informed consent had been designed. We set that if the respondent agrees to answer, they can continue to complete the questionnaire. Otherwise they cannot continue.

This questionnaire involved the following aspects(Supplementary File 1):

The twelve basic personal information such as gender, age, family role, level of education, habitual residence, annual household income, the number, gender and age of children, insurance coverage for the children, whether a single parent family and household health care workers or not; and other five aspects of the opinions about the vaccine, for example, "Have you been vaccinated against COVID-19", "Have your children had a history of other diseases in the last 3 months" , Have you explained the COVID-19 vaccine to your children" ,"What's your attitude towards children's vaccination" ,"Do you think there are vaccine side effects". The explanation for the COVID-19 vaccine is for children over the age of 3.

Statistical Method

A descriptive statistical analysis was conducted on the social and demographic characteristics of the sample, and the corresponding proportion was calculated accordingly. Parental acceptability of COVID-19 vaccination was used as the dependent variable. A univariate logistic regression model first assessed the significance of the association between each of the background characteristics and the dependent variable. All relationships between the predictor and criterion variables were represented as odds ratios(OR) with 95% confidence intervals. The statistical tests were two-sided, and the effects with $p < 0.05$ were considered to be statistically significant. All statistical models were constructed using R software version 3.6.0 (R Foundation for Statistical Computing, version 3.6.1; <http://www.Rproject.org>).

Results

Demographic Information

A total of 2019 valid questionnaires, and the basic information of the respondents was summarized in Table 1. Among the respondents, 738 (36.6%) were males, 1281 (63.4%) were females, and 422 (20.9%) were under the age of 30 years. 41.2% had a junior high school degree, 30.4% had a bachelor's degree, 21.6% had a junior college degree, and the rest 6.8% had a master's degree or above. In terms of place of residence, 10 parents came from Hong Kong, Macao and Taiwan, 1,103 from central China, 139 from western China and 767 from eastern China. As for the annual household income, 26.7% of respondents reported less than 20,000 RMB per year, 22.3% between 20,000 and 50,000 RMB, 31.3% between 50,000 and 150,000 RMB, and 19.7% over 150,000 RMB. A total of 1,501 parents of children and adolescents said they would be willing to be vaccinated against COVID-19 and another 518 said they would not. More than 80% of the parents had explained information about COVID-19 vaccine to their children, and more than 90% of the respondents had received COVID-19 vaccine therapy. Most (54.0%) of the children were aged 3–8, and 57.3% of them were boys. Furthermore, most children had health insurance (93.1%), with

10% having commercial insurance, 67.7% having medical insurance and 15.4% having both types of insurances.

Table 1
Baseline data.

	Unwillingness(N = 518)	Willingness(N = 1501)	p value
Your role in the family	197(38.0)	541(36.0)	0.449
Father	321(62.0)	960(64.0)	
Mother			
Your age	117(22.6)	305(20.3)	0.302
<30 years old	401(77.4)	1196(79.7)	
≥30 years old			
Has your child had a history of other diseases in the last 3 months	317(61.2)	417(31.4)	< 0.001
Yes	201(38.8)	1084(72.6)	
No			
Habitual residence	4(0.8)	6(0.4)	0.627
Hong Kong Macao and Taiwan	290(56.0)	813(54.2)	
Central China	35(6.8)	104(6.9)	
Western China	189(45.9)	578(38.5)	
Eastern China			
The gender of your child	280(54.1)	876(58.4)	0.098
Boy	238(45.9)	625(41.6)	
Girl			
The age of your child	105(20.3)	163(10.9)	< 0.001
0–2 year	291(56.2)	800(53.3)	
3–8 year	85(16.4)	237(15.8)	
9–12 year	37(7.1)	301(20.1)	
13–17 year			
Number of children in your family	282(54.4)	831(55.4)	0.23
One	215(41.5)	583(38.8)	
Two	21(4.1)	87(5.8)	
Three or more			

	Unwillingness(N = 518)	Willingness(N = 1501)	p value
Your attitude towards children's vaccination	191(36.9)	1428(95.1)	< 0.001
Active	64(12.4)	4(0.3)	
Refuse	85(16.4)	15(1.0)	
Delay	178(34.4)	54(3.6)	
Hesitate			
Do you think there are vaccine side effects?	331(63.9)	715(47.6)	< 0.001
Yes	187(36.1)	786(52.4)	
No			
Insurance coverage for your children	74(14.3)	66(4.4)	< 0.001
Commercial insurance	84(16.2)	227(15.1)	
Both commercial and health insurance	61(11.8)	141(9.4)	
None	299(57.7)	1067(71.1)	
Health insurance			
Annual household income	94(18.1)	446(29.7)	< 0.001
0-20000	100(19.3)	350(23.3)	
20000–50000	175(33.8)	456(30.4)	
50000–150000	118(22.8)	201(13.4)	
150000–500000	31(6.0)	48(3.2)	
> 500000			
Your level of education	202(39.0)	630(42.0)	0.027
Junior-senior high school	163(31.5)	451(30.0)	
Undergraduate college	49(9.5)	88(5.9)	
Graduate or above	104(20.1)	332(22.1)	
junior college			
Have you been vaccinated against COVID-19?	123(23.7)	50(3.3)	< 0.001
No	395(76.3)	1451(96.7)	
Yes			

	Unwillingness(N = 518)	Willingness(N = 1501)	p value
Whether it is a single parent family	338(65.3)	1021(68.0)	0.872
No	180(34.7)	480(32.0)	
Yes			
Whether members of the household have health care workers?	251(48.5)	685(45.6)	0.290
Yes	267(51.5)	816(54.4)	
No			

Related Factors Affecting Parents' Willingness To Vaccinate Their Children Against Covid-19

Several factors were taken into consideration as for parents' willingness (Table 2). Gender, age, place of residence, number of children in the family, gender of children, whether a single parent family or not, and whether there was a doctor in the family had no statistical significances ($p > 0.05$), indicating that these factors had no significant impact on parents' willingness to vaccinate their children against COVID-19. The children with no history of other diseases (such as cold, fever, diarrhea, etc.) were more likely to be vaccinated than those with other diseases in the last 3 months (OR = 1.29; 95% CI 1.24–1.36, $p < 0.001$). We analyzed parents' perceptions of their children's vaccinations. Research showed children and adolescents were less likely to be vaccinated when their parents showed refusal (OR = 0.03; 95% CI 0.01–0.04), delay (OR = 0.02; 95% CI 0.01–0.04) and hesitation (OR = 0.04; 95% CI 0.03–0.06) respectively comparing with children whose parents maintained positive attitudes. Parents' perceptions of vaccine side effects also influenced children's willingness to be vaccinated, with parents feeling that vaccines had no side effects, children were more likely to be vaccinated (OR = 1.51; 95% CI 1.42–1.73, $p < 0.001$). Besides, when parents were vaccinated against COVID-19, their children were more likely to be vaccinated (OR = 3.29; 95% CI 1.10–9.85, $p = 0.033$). Compared with uninsured children, insured children were more likely to be vaccinated, especially those with health insurances (OR = 4.00; 95% CI 2.80–5.71, $p < 0.001$). Children of parents with graduate education or above were also more likely to be vaccinated (OR = 0.58; 95% CI 0.39–0.85, $p = 0.005$).

Table 2
Analysis of influence factors.

	OR	95%CI	p [¶]
Your role in the family	ref	0.89–1.34	0.419
Father	1.09		
Mother			
Your age	ref	0.9–1.46	0.277
<30 years old	1.14		
≥30 years old			
Has your child had a history of other diseases in the last 3 months	ref	1.24–1.36	< 0.001
Yes	1.29		
No			
Habitual residence	ref	0.52–6.67	0.335
Hong Kong Macao and Taiwan	1.87		0.311
Central China	1.98	0.53–7.43	0.274
Western China	2.04	0.57–7.3	
Eastern China			
The gender of your child	ref	0.69–1.03	0.088
Boy	0.84		
Girl			
The age of your child	ref	1.34–2.34	< 0.001
0–2 year	1.77		< 0.001
3–8 year	1.80	1.27–2.55	< 0.001
9–12 year	5.24	3.44–7.98	
13–17 year			
Have you explained the COVID-19 vaccine to your child? (> 3 years old)	ref	4.16–6.65	< 0.001
Yes	5.26		
No			

	OR	95%CI	p [¶]
Number of children in your family	ref	0.93–2.52	0.09
One	1.53		0.43
Two	1.09	0.88–1.34	
Three or more			
Your attitude towards children's vaccination	ref	0.01–0.04	< 0.001
Active	0.03		< 0.001
Refuse	0.02	0.01–0.04	< 0.001
Delay	0.04	0.03–0.06	
Hesitate			
Do you think there are vaccine side effects?	ref	1.42–1.73	< 0.001
Yes	1.51		
No			
Insurance coverage for your children	ref	2.00-4.59	< 0.001
Commercial insurance	3.03	1.66–4.05	< 0.001
Both commercial and health insurance	2.59		< 0.001
None	4.00	2.80–5.71	
Health insurance			
Annual household income	ref	0.54–1.01	0.058
0-20000	0.74		< 0.001
20000–50000	0.55	0.41–0.73	< 0.001
50000–150000	0.36	0.26–0.49	< 0.001
150000–500000	0.33		
> 500000		0.20–0.54	
Your level of education	ref	0.7–1.13	0.326
Junior-senior high school	0.89	0.39–0.85	0.005
Undergraduate college	0.58		0.866
Graduate or above	1.02	0.78–1.34	
junior college			

	OR	95%CI	p [¶]
Have you been vaccinated against COVID-19?	ref	1.10– 9.85	0.033
No	3.29		
Yes			
Whether it is a single parent family	ref	0.83– 1.27	0.829
No	1.02		
Yes			
Whether members of the household have health care workers?	ref	0.73– 1.09	0.267
Yes	0.89		
No			

The regional distribution of parents' willingness to vaccinate their children against COVID-19

Figure 2 depicted the regional distribution of parents' willingness to be vaccinated against COVID-19. Overall, 74.38% parents said they would actively get vaccinated for children or adolescents, 8.90% refused to get vaccinated, 4.60% said they would delay vaccination and 12.12% were still undecided. Our results showed that the willingness of parents in central China to be vaccinated was more than 75%. While the hesitation rate of parents in Hong Kong, Macao and Taiwan were 23.08%.

Discussion

This study contributed to a better understanding of parents' attitudes towards their children's COVID-19 vaccination. In this study, 74.38% would actively get vaccinated. Overall, Chinese parents have high willingness to vaccinate children and adolescents against COVID-19. In addition, the study found that 80.19% of parents said they would actively vaccinate their children against COVID-19, 3.37% refused to vaccinate their children, 4.95% said they would delay vaccination, and 11.49% were still hesitant. More and more evidences reveal that vaccination against COVID-19 is currently an important tool to reduce the burden of the COVID-19 epidemic. Rhodes et al showed parents scored below the midpoint on the willingness to vaccinate their children ($M = 3.55$, $SD = 2.13$)[15]. Our research showed that nearly 15% of parents were still refusing to vaccinate their children or are hesitant to do so. Therefore, it is necessary to conduct our questionnaire to encourage and publicize the importance of COVID-19 vaccination, so as to control the COVID-19 epidemic earlier in the world.

There is growing evidence that genetic and viral vector COVID-19 vaccines prevent not only severe disease but also asymptomatic infection[16]. And a study from the United Kingdom found that adults infected 3 weeks after receiving a dose of Pfizer-Biotech or Astrazeneca vaccine were 38–49% less likely

to pass the virus on to their family contacts than unvaccinated individuals[17]. However, trust in vaccines is still a significant factor influencing vaccination willingness. The main reasons cited by the study for parents' reluctance to vaccinate their children against COVID-19 included a lack of adequate scientific research (84.8%), concerns about safety and side effects (76.9%), and potential inefficacy of the vaccine due to mutations (36.7%)⁵. Our research suggests that parents believe the COVID-19 vaccine has no side effects, and that children are more likely to be vaccinated (OR = 1.51; 95% CI 1.42–1.73, $p < 0.001$). Therefore, access to more positive information about the safety and effectiveness of adolescent COVID-19 vaccines, as well as school COVID-19 vaccination requirements, are the most frequently reported factors that increase the willingness of parents and adolescents to be vaccinated[18, 19]. In addition, Marquez et al. found that 39.2% of parents refused to vaccinate their children against COVID-19, while 27.8% agreed that they would allow their children to be vaccinated against COVID-19 if their doctor recommended it²⁰. Health workers' advocacy of COVID-19 vaccines is one of the most important sources of reliable vaccine information for the public. Increased clear public communication about the benefits and safety of COVID-19 vaccines for children and adolescents, especially by healthcare professionals, will help increase parents' confidence in COVID-19 vaccines and their willingness to vaccinate their children against COVID-19. Our result showed their children were more likely to be vaccinated when parents were vaccinated against COVID-19. It's very critical to educate clear information and transparent communication from public health, governments and leaders about the safety of childhood COVID-19 vaccines[12, 20].

We analyzed the factors that may influence children's willingness to be vaccinated against COVID-19 and found that gender, age, place of residence, number of children in the household, gender of children, whether it's a single parent family and whether there is a doctor in the household had no significant influences on the willingness of children and adolescents to be vaccinated against COVID-19. Children who did not get sick were more likely to get vaccinated than those who had other illnesses in the last three months. Different from the previous studies, which showed that younger adolescents were more likely to receive COVID-19 vaccination than older adolescents[21], while our study found that older children (13–17 years old) were more likely to be vaccinated against COVID-19. This may be due to China's implementation of the COVID-19 vaccination program by age, which partially affected the results of the study. Lack of knowledge about COVID-19 and vaccines may increase misunderstandings about COVID-19 vaccines, thereby reduce the willingness of parents to vaccinate children and adolescents.

Parents do have significant effects on their children. On the one hand, studies have found that children and adolescents are less likely to get vaccinated when their parents show signs of rejection, delay, and hesitation. Children were more likely to be vaccinated if their parents felt there were no side effects; and when their parents have been vaccinated against COVID-19, children are more likely to be vaccinated. Our study suggests that parents play a non-negligible and even decisive role in the vaccination of children and adolescents against COVID-19. Parents' attitudes towards vaccination and their views on vaccines will affect their children's vaccination willingness. On the other hand, research from Italy shows the lower the education level of the parents, the greater the harm they think the COVID vaccine will do to their children[22]. Our result showed children of parents with graduate education or above were more likely to

be vaccinated too. Therefore, it is necessary to raise parents' awareness of the effectiveness and safety of the vaccine, so as to increase the COVID-19 vaccination rate in children and adolescents.

There did exist some shortcomings in our study. Firstly, we adopted the form of online questionnaire, which was mainly written by parents and indirectly investigated the vaccination intention of children and adolescents. There may be some errors in the data and relevant information to a certain extent. Secondly, the sample size of Hong Kong, Macao and Taiwan was too small, so it's very necessary to gather more different regions to participate the survey.

Conclusion

In general, Chinese children and adolescents have high desires to be vaccinated against COVID-19, and most parents have positive attitudes towards their children's vaccination. However, many people still hesitate or even refuse to be vaccinated. From the study, we find that parents' COVID-19 vaccine behaviors, education backgrounds, attitudes towards children's vaccination, children's age, recent illness and other factors do have certain impacts on children and adolescents' willingness to vaccinate against COVID-19.

Abbreviations

COVID-19 Coronavirus Disease 2019

SARS Severe Acute Respiratory Syndrome

MTIS Multisystem Inflammatory Syndrome

Declarations

Ethics approval and consent to participate

The ethics committee of Hangzhou Stomatological Hospital approved all the procedures performed.

Consent for publication

Not applicable.

Availability of data and materials

Availability of data and material at corresponding author.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

L W, W W and C C conceptualized and designed the study, drafted the initial manuscript, designed the data collection instruments, collected data, and reviewed and revised the manuscript. J T and C W carried out the statistical analysis and reviewed and revised the manuscript. M Z, Y C and X Z performed the stimulation tests and reviewed and revised the manuscript. M W, Z F and W W conceptualized and designed the study and critically reviewed the manuscript for important intellectual content. W W conceptualized and designed the study, carried out the statistical analysis, drafted the initial manuscript, coordinated and supervised the data collection, and reviewed and revised the manuscript. All authors contributed to the article and approved the submitted version.

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Figures

Figure 1

The respondents of our questionnaire came from Eastern Region, Central Region, Western Region, Hong Kong region, Macau region and Taiwan region, China.

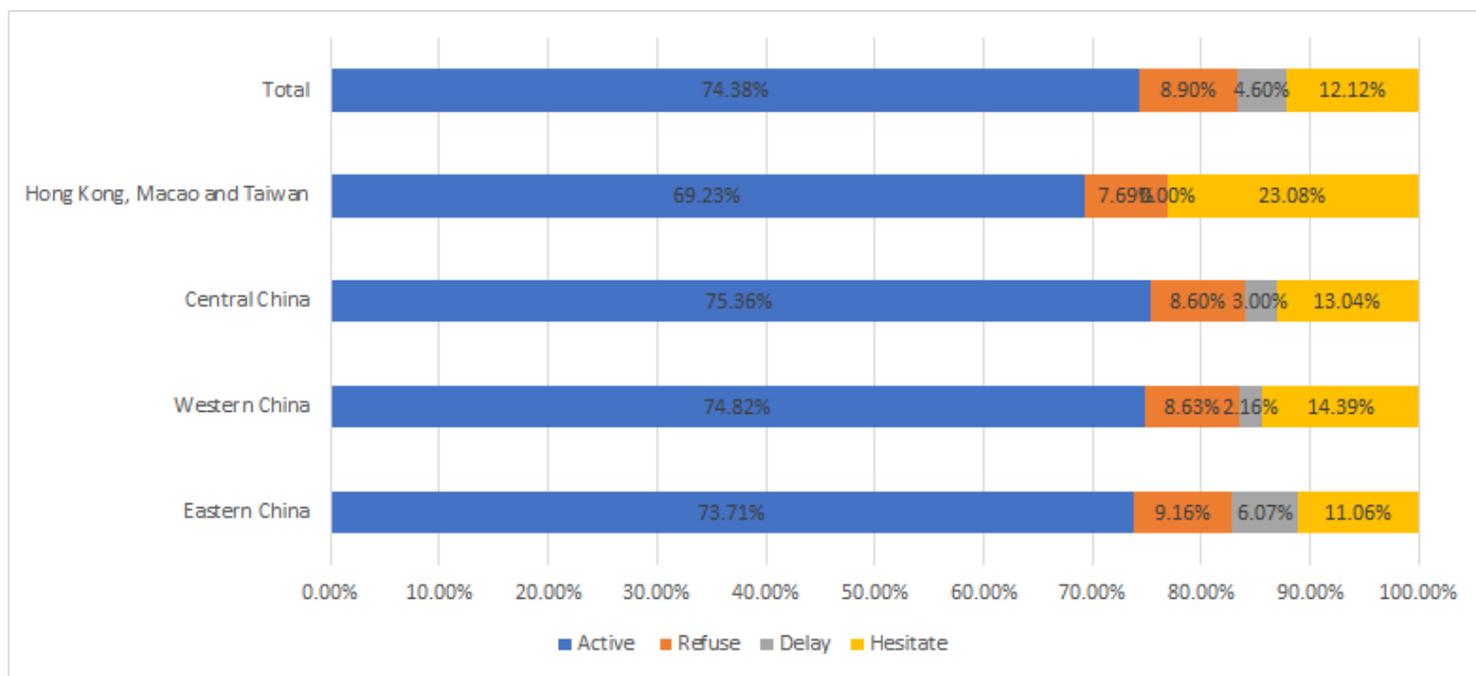


Figure 2

The regional distribution of parents's willingness to be vaccinated against COVID-19

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [SupplementaryFile1.xlsx](#)