The cross-sectional survey on COVID-19 vaccine hesitancy and its predictors among Chinese parents of 3–17 years aged children in Shenzhen City

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Abstract:

Introduction and Objective. Vaccination programs on 3–17 years aged children in China have been launched in some cities since July 2021; and comparative evaluations are important to push the programs forward. Therefore, this study is conducted to explore the COVID-19 vaccine hesitancy and its predictors among Chinese parents of 3–17 years aged children; and their willingness to vaccinate their child/children.

Materials and method. A cross-sectional study was conducted based on the online survey; and 3484 participants were recruited in health centers of Shenzhen, China.

Results. The prevalence of COVID-19 vaccine hesitancy was 20.7% among Chinese parents of 3–17 years aged children; and 2976 participants (89.0%) were reported to be willing or very willing to accept a COVID-19 vaccine for their child/children. Perceived trust degree of a COVID-19 vaccine (OR: 0.766), and perceived effectiveness of a COVID-19 vaccine (OR: 0.455) were negatively associated with vaccine hesitancy. Perceived risk degree of a COVID-19 vaccine (OR: 1.485) positively predicted vaccine hesitancy. Parents with a higher educational level (OR: 0.518) and working in public institution (OR: 0.741) had a lower level of vaccine hesitancy; whereas, parents with liberal professionals had a higher level of vaccine hesitancy (OR: 1.378).

Conclusions. These findings indicated that Chinese parents of 3–17 years aged children in Shenzhen City had a higher level of COVID-19 vaccine acceptability, compared with adults in Western counties. The significant factors of perceived trust degree, effectiveness, and risk degree of a COVID-19 vaccine, parents' educational level and occupation could predict COVID-19 vaccine hesitancy. The research results can be useful in supporting the development of effective and targeted children COVID-19 vaccination campaigns in China and worldwide.

Keywords

COVID-19; vaccine; vaccine hesitancy; Chinese parents; children; public health

INTRODUCTION

Since the outbreak of the coronavirus disease 2019 (COVID-19) pandemic, the infectious disease has caused the worldwide detrimental consequences on social and economic development, with negatively profound impacts on the work and daily life of everyone [1, 2]. As of 22 November 2021, there have been over 256 million cases of COVID-19, including 5.2 million deaths, reported to World Health Organization (WHO) [3]. Even though the implementation of Public Health and Social Measures (PHSM) to limit the spread of COVID-19 such as mask wearing, limits and restrictions on public and private gatherings [4], vaccination still can be a key protective measure against COVID-19 to alleviate the devastating effect of the pandemic, and to reduce the considerable burden of public health systems [5–7]. Up to November 2021, the vaccine candidates worldwide were 326, of which 132 were in clinical testing [8].

As the generally acknowledged solution to preventing the coronavirus spread [9], the global herd immunity based on vaccination is dependent on not only vaccine safety and efficacy [10], but also individuals’ willingness to be vaccinated [11]. An international survey across 19 countries reported that approximately 28.5% of participants would not be vaccinated [11]. An international survey across 19 countries reported that approximately 28.5% of participants would not consider taking a COVID-19 vaccine [12]. This hesitancy and refusal may alleviate the pandemic and put more pressure on health systems [13]. Previous studies already predicted that vaccine hesitancy could be a significant challenge for COVID-19 vaccine rollout [14, 15, 16]. The definition of vaccine hesitancy is the delay in acceptance or refusal of vaccination despite availability of vaccine services [17]. In recent years, vaccine hesitancy among not only citizens but also health professionals has become an emerging issue, as...
it could exacerbate vaccine refusal [18, 19]. As one of the top 10 global health threats listed by WHO [20, 21], vaccine hesitancy varies across time, place, and type of vaccine, and is affected by various factors [22]. Thus, it is necessary to assess vaccine hesitancy of the COVID-19 vaccine and the factors that influence it in each country, in order to tailor educational activities to increase acceptance of the vaccine.

Since July 2021, vaccinations programs on 3–17 years aged children in China have been launched in some cities and may be covered the whole country step by step [23]. British research on COVID-19 vaccine described that parents were more likely to vaccinate themselves than their child/children, and the main concerns about children vaccination were as follows: not enough evidence, safety concerns, and the belief that children are hardly affected [24]. Actually, children can also become infected and transmit, and develop clinical complications from the COVID-19, so that there is an urgent need to approve children’s COVID-19 vaccine uptake [25]. It is noted that the success of vaccinating these children of 3–17 age groups mainly relies on the parents’ self-acceptance of COVID-19 vaccine and their willingness to vaccinate their child/children. However, little is known about COVID-19 vaccine hesitancy among Chinese parents of 3–17 years aged children and their willingness to vaccinate their child/children. Moreover, it has been not clear that what factors could predict these parents’ vaccine hesitancy.

COVID-19 vaccine hesitancy is an ongoing issue and a better understanding of its determinants, within the special population of parents with 3–17 years aged children, can be useful in supporting the development of effective and targeted children COVID-19 vaccination campaigns in China and worldwide [26]. Therefore, this study is conducted to explore the COVID-19 vaccine hesitancy and it predictors among Chinese parents of 3–17 years aged children; and their willingness to vaccinate their child/children.

MATERIAL AND METHOD

Research design and participants

The cross-sectional study was conducted based on the Sojump online survey platform. The participants were recruited when they had a physical examination in health centers of two hospitals in Shenzhen city. Recruitment was taken place from October to November of 2021 via recruiting posters and leaflets. The inclusion criteria were as follows: (1) being parents of 3–17 years aged children; (2) living in Shenzhen City (3) willing to participate this study; (4) being parents of 3–17 years aged children and their willingness to vaccinate their child/children. However, little is known about COVID-19 vaccine hesitancy among Chinese parents of 3–17 years aged children and their willingness to vaccinate their child/children. Moreover, it has been not clear that what factors could predict these parents’ vaccine hesitancy.

RESULTS

Data analysis

Data analyses were carried out by IBM SPSS Statistics, version 21. Descriptive statistics were used to describe the socio-demographic characteristics and other responses of participants by means (SD) for continuous data, and frequencies (proportions) for categorical data. The chi-square ($\chi^2$) was used to detect any significant difference between various groups on the percentage of vaccine hesitancy. A multiple logistic regression analysis was used to identify the potential variables that can predict vaccine hesitancy. Multicollinearity was assessed via computing the variance inflation factor (VIF). The Hosmer and Lemeshow test was conducted to evaluate the goodness of fit of the model. The odds ratios (ORs) and 95% confidence intervals (CIs) were used, and statistical significance was set at alpha < 0.05.

Participant profile

Overall, 3484 participants responded to the survey, but 142 participants with incomplete data provided were excluded from data analysis. Finally, in total of 3342 questionnaires were included in the analysis set. The mean age of participants...
The profile of participants (n=3342)

| Variables                      | N=3342 | Vaccine Hesitant |
|--------------------------------|--------|------------------|
|                                | n (%)  | Numbers (n) | Percentage (%) | \( \chi^2 \) Value | p-Value |
| Gender                         |        |             |               |                   |         |
| Male (Father)                  | 1204 (36.0) | 232 | 19.3 | 2.367 | 0.124 |
| Female (Mother)                | 2138 (64.0) | 460 | 21.5 |       |         |
| Nationality                    |        |             |               |                   |         |
| Han nationality               | 3192 (95.5) | 654 | 20.5 | 2.048 | 0.152 |
| Ethnic minority                | 150 (4.5) | 38  | 25.3 |       |         |
| Registered residence           |        |             |               |                   |         |
| City residents                 | 1162 (34.8) | 256 | 22.0 | 1.904 | 0.168 |
| Floating population            | 2180 (65.2) | 436 | 20.0 |       |         |
| Education                      |        |             |               |                   |         |
| High school or lower           | 1300 (38.9) | 206 | 15.9 | 60.728 <0.001* |         |
| University or college          | 1898 (56.8) | 426 | 22.4 |       |         |
| Master or above                | 144 (4.3) | 60  | 41.7 |       |         |
| Occupation                     |        |             |               |                   |         |
| Public institution             | 612 (18.3) | 96  | 15.7 | 21.169 <0.001* |         |
| Health professionals           | 350 (10.5) | 98  | 28.0 |       |         |
| Liberal professionals          | 872 (26.1) | 186 | 21.3 |       |         |
| Unemployed                     | 176 (5.3) | 34  | 19.3 |       |         |
| Others                         | 1332 (39.8) | 278 | 20.9 |       |         |
| Marital status                 |        |             |               |                   |         |
| Married                        | 3224 (96.5) | 668 | 20.7 | 2.405 | 0.301 |
| Divorced                       | 84 (2.5) | 14  | 16.7 |       |         |
| Single                         | 34 (1.0) | 10  | 29.4 |       |         |
| Family income per month (RMB)  |        |             |               |                   |         |
| <10000 (USD < 1566)           | 1326 (39.7) | 256 | 19.3 | 9.862 | 0.007* |
| 10000-20000 (USD 1566-3132)    | 1166 (34.9) | 228 | 19.6 |       |         |
| >20000 (USD >3132)            | 850 (25.4) | 208 | 24.5 |       |         |
| Number of children             |        |             |               |                   |         |
| 1                              | 1152 (34.5) | 234 | 20.3 | 6.545 | 0.088 |
| 2                              | 1886 (56.4) | 378 | 20.0 |       |         |
| 3                              | 254 (7.6) | 66  | 26.0 |       |         |
| 4 or more                      | 50 (1.5) | 14  | 28.0 |       |         |
| Age of becoming a parent for the first time |        |             |               |                   |         |
| 18–22 years                    | 270 (8.1) | 52  | 19.3 | 24.063 <0.001* |         |
| 23–25 years                    | 1026 (30.7) | 166 | 16.2 |       |         |
| 26–30 years                    | 1514 (45.3) | 336 | 22.2 |       |         |
| ≥31 years                      | 532 (15.9) | 138 | 25.9 |       |         |
| Whether parents gave children any other self-funded vaccination |        |             |               |                   |         |
| Yes                            | 2354 (70.4) | 468 | 19.9 | 3.302 | 0.069 |
| No                             | 988 (29.6) | 224 | 22.7 |       |         |
| Whether parents got vaccination against COVID-19 |        |             |               |                   |         |
| Yes                            | 3216 (96.2) | 636 | 19.8 | 44.939 <0.001* |         |
| No                             | 126 (3.8) | 56  | 44.4 |       |         |

* p<0.05

Willingness and attitude of participants regarding COVID-19 vaccination

In this study, 2976 participants (89.0%) were reported to be willing or very willing to accept a COVID-19 vaccine for their child/children; while 66 participants (2.0%) were reported to be reluctant or very reluctant to accept it for children. In terms of a COVID-19 vaccine for their elderly parents, 3162 participants (94.6%) were reported to be willing or very willing; and 38 participants (1.1%) were reported to be reluctant or very reluctant. Willingness and attitude of participants regarding COVID-19 vaccination were shown in Table 2.
Responses to questions about vaccine hesitancy among participants

In total of 2650 participants (79.3%) with a score of 10 to 24 as measured by the aVHS were categorized as vaccine acceptance, while 692 participants (20.7%) with a score of 25–50 were considered as vaccine hesitancy. The mean scores of ten items in the aVHS were described in Table 3.

Table 3. The mean scores of ten items in the aVHS

| Items                                                                 | Mean±SD      |
|----------------------------------------------------------------------|--------------|
| 1. Vaccines are important for my health                             | 1.69±0.95    |
| 2. Vaccines are effective                                           | 1.75±0.93    |
| 3. Being vaccinated is important for the health of others in my community. | 1.68±0.93    |
| 4. All routine vaccinations recommended by the CDC are beneficial    | 1.64±0.92    |
| 5. New vaccines carry more risks than older vaccines.               | 3.09±1.24    |
| 6. The information I receive about vaccines from the CDC is reliable and trustworthy. | 1.76±0.82    |
| 7. Getting vaccines is a good way to protect me from disease.       | 1.66±0.80    |
| 8. Generally, I do what my doctor or healthcare provider recommends about vaccines for me. | 1.63±0.79    |
| 9. I am concerned about serious adverse effects of vaccines.       | 3.08±1.16    |
| 10. I do not need vaccines for diseases that are not common anymore. | 2.61±1.27    |

Predictors of COVID-19 vaccine hesitancy

The results of logistic regression analysis were showed in Table 4. Perceived trust degree of a COVID-19 vaccine (OR: 0.766), and perceived effectiveness of a COVID-19 vaccine (OR: 0.455) were negatively associated with COVID-19 vaccine hesitancy. Perceived risk degree of a COVID-19 vaccine (OR: 1.485) positively predicted COVID-19 vaccine hesitancy. Parents with a higher educational level (OR: 0.335, 0.518), working in public institution (OR: 0.741), and got vaccination against COVID-19 (OR: 0.399) had a lower level of vaccine hesitancy; whereas, parents with liberal professionals had a higher level of vaccine hesitancy (OR: 1.378).

DISCUSSION

A vaccine is well recognized to be one of the most powerful and cost-effective methods for diminishing community spread of COVID-19 in large population [10, 28]. However, COVID-19 vaccine hesitancy among not only citizens but also health professionals has become an emerging issue [18, 19]. An international survey reported that COVID-19 vaccine acceptance has high heterogeneity across different countries; therefore, it is important to clarify the acceptance of a vaccine in each country or region [12]. Nowadays, COVID-19 vaccinations programs on 3–17 years aged children in China have been launched in some cities [23]. To the best of my knowledge, this is the first study to explore the predictors of COVID-19 vaccine hesitancy among Chinese parents of 3–17 years aged children, and their willingness to vaccinate their child/children. The research results can be useful in supporting the development of effective and targeted children COVID-19 vaccination campaigns in China and worldwide, by a better understanding of vaccine hesitancy and its predictors, within the special population of parents with 3–17 years aged children.

In this study, we found that the prevalence of COVID-19 vaccine acceptability in Shenzhen City was 79.3% among Chinese parents of 3–17 years aged children, much higher than the previous study findings from other countries. For instance, a recently study explored the current COVID-19 vaccine acceptability and hesitancy situation in Japan, and found that 62.1% of Japanese adults would be willing to receive a COVID-19 vaccine [28]. It has been reported that the prevalence of vaccine acceptability in Europe approximately ranged from 60.0% to 78.0% [29, 30, 31, 32], i.e., COVID-19 vaccine hesitancy was 31.1% in Italy [20] and 38.0% in France [32]. Previous research in the U.S. showed that 25.0%–43.1% of respondents reported to be hesitant [33, 34, 35]. These findings indicated that Chinese parents of 3–17 years aged children in Shenzhen City had a higher level of COVID-19 vaccine acceptability, compared with adults in Western counties.

In this study, 2976 participants (89.0%) were reported to be willing or very willing to accept a COVID-19 vaccine for their child/children; 3162 participants (94.6%) were reported to be willing or very willing to accept for an elderly parent; and 3208 participants (96.0%) were reported to be willing or very willing to accept a COVID-19 vaccine for themselves. The findings were well aligned with the previous studies [13, 24] that indicated parents were more cautious about COVID-19 vaccine for their child/children and less likely to vaccine their child/children than their parents or themselves. Therefore, more explanations need to be conducted to alleviate parents’ concerns about COVID-19 vaccine for children.

Our research found that parents’ attitudes of safety and effectiveness regarding COVID-19 vaccination played an important role in COVID-19 vaccination acceptability and hesitancy. For instance, perceived trust degree of a COVID-19 vaccine (OR: 0.766), and perceived effectiveness of a COVID-19 vaccine (OR: 0.455) were positively associated...
with COVID-19 vaccine acceptability; while perceived risk degree of a COVID-19 vaccine (OR: 1.485) positively predicted COVID-19 vaccine hesitancy. Prior study likewise described that parents showed a substantial shift in attitudes towards the COVID-19 vaccine based on safety and effectiveness [13]. To be specific, the majority of the respondents would accept a vaccine with high levels of safety and effectiveness, but only one-third of them would accept a vaccine with lower levels of safety and effectiveness [13]. Unlike previous vaccines with years or decades of clinical trials, COVID-19 vaccines were developed at “wrap speed” [36]. Therefore, parents’ concerns over the speed of its development and concerns about safety and effectiveness may be even more prominent for the COVID-19 vaccine. According to the multiple regression analysis, parents with a higher educational level (OR: 0.518) had a lower level of vaccine hesitancy. By contrast, the univariate analysis in Table 1 presented that a significantly higher proportion of participants with a higher educational level had a higher level of COVID-19 vaccine hesitancy (p < 0.05). The influence of confounding factors in univariate analysis and the most parents having higher education in the study could lead to the opposite results.

In the present research, occupation of parents was reported to predict COVID-19 vaccine hesitancy. For example, parents working in public institution (OR: 0.741) had a lower level of vaccine hesitancy; whereas, parents with liberal professionals had a higher level of vaccine hesitancy (OR: 1.378). These findings indicated that health professionals should pay more attention to these parents likely to have relatively high COVID-19 hesitancy levels in this context: Chinese parents of 3–17 years aged children with lower education level, and parents with liberal professionals.

Some limitations need to be noted. Firstly, the cross-sectional surveys are to only provide researchers with a snapshot of a sample of population at a single point in time, and cannot enable researchers to capture any changes in COVID-19 vaccine acceptability and hesitancy over time. Secondly, as in studies of this nature, the respondents were the parents who were willing to respond to the questionnaire; and some less motivated parents or those who are less willing to get vaccine were prone to be non-respondents that could lead to a bias in the study. Thirdly, owing to the time and financial limitations, the study focused on parents of 3–17 years aged children merely from one city, which could cause that the group surveyed was not representative of all Chinese parents. In consideration of regional diversity, this study could be replicated in other cities or regions of China.

CONCLUSION

Vaccination programs on 3–17 years aged children in China have been launched in some cities since July 2021; and comparative evaluations are important to push the programs forward. COVID-19 Vaccine hesitancy is an ongoing issue and a better understanding of its determinants, within the special population of parents with 3–17 years aged children, can be useful in supporting the development of effective and targeted children COVID-19 vaccination campaigns in China and worldwide. Therefore, this study is conducted to explore the COVID-19 vaccine hesitancy and it predictors among Chinese parents of 3–17 years aged children; and their willingness to vaccinate their child/children. Research found the prevalence of COVID-19 vaccine hesitancy was 20.7% among Chinese parents of 3–17 years aged children in Shenzhen City. Among these parents, 2976 participants (89.0%) were reported to be willing or very willing to accept a COVID-19 vaccine for their child/children. These findings indicated that Chinese parents of 3–17 years aged children in Shenzhen City had a higher level of COVID-19 vaccine acceptability, compared with adults in Western counties. The significant factors of perceived trust degree, effectiveness, and risk degree of a COVID-19 vaccine, parents’ educational level and occupation could predict COVID-19 vaccine hesitancy among Chinese parents of 3–17 years aged children.

Acknowledgements

This study was funded by the General Program of Stable Support Plan for Universities in Shenzhen City (202000840110756002).

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