

RESEARCH PAPER



## Willingness of parents to vaccinate their 6–60-month-old children with EV71 vaccines: a cross-sectional study in rural areas of northern Jiangsu Province

Yuanyuan Wang<sup>a\*</sup>, Fanyu Meng<sup>b\*</sup>, Jingxin Li<sup>b</sup>, Guifan Li<sup>c</sup>, Jialei Hu<sup>b</sup>, Jiaqian Cao<sup>a</sup>, Qiufan Yu<sup>d</sup>, Qi Liang<sup>b</sup>, and Fengcai Zhu<sup>a,b,e</sup>

<sup>a</sup>School of Public Health, Nanjing Medical University, Nanjing, PR China; <sup>b</sup>Vaccine Clinical Evaluation Department, Jiangsu Provincial Center for Disease Control and Prevention, Nanjing, PR China; <sup>c</sup>Department of Registration, Beijing Minhai Biotechnology Co. Ltd., Beijing, PR China; <sup>d</sup>School of Public Health, Southeast University, Nanjing, PR China; <sup>e</sup>Center for Global Health, Nanjing Medical University, Nanjing, PR China

### ABSTRACT

Enterovirus 71 (EV71) is the dominant pathogen in severe and fatal hand–foot–mouth disease (HFMD) cases. Since 2015, three inactivated EV71 vaccines have been approved in China. The vaccination coverage of the EV71 vaccine has been relatively low, especially in rural areas. A cross-sectional survey from July 19 to August 22, 2018, was conducted in three rural counties of northern Jiangsu Province among parents of children aged 6–60 months. We adopted a pretested validated questionnaire to assess knowledge, awareness, and attitude of HFMD and EV71 vaccines among respondents and used univariate and multivariate binary logistic analyses to explore potential factors associated with the acceptance of EV71 vaccines. Of the 1,112 parents who participated, 87.8% were willing to vaccinate their children with EV71 vaccines. Parents over 40 y old were less likely to have their children vaccinated [adjusted odds ratio (aOR) = 2.12, 95% confidence interval (CI): 1.13–3.97]. Parents who lived in Ganyu (aOR = 0.50, 95% CI: 0.31–0.79) or Xinyi county (aOR = 0.33, 95% CI: 0.20–0.53), had a university or higher degree (aOR = 0.26, 95% CI: 0.11–0.64), had good knowledge of EV71 vaccines (aOR = 0.81, 95% CI: 0.67–0.98), perceived their children's disease susceptibility, and worried about the severity of HFMD had a higher willingness to vaccinate their children. Most parents were willing to vaccinate their children against EV71-related HFMD. Parental age, location, education level, knowledge of EV71 vaccines, concern about susceptibility, and severity of HFMD were all factors that influenced willingness to vaccinate.

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### Introduction

As one of the most common contagious diseases in children under 5 y old, hand–foot–mouth disease (HFMD) is primarily caused by Enterovirus 71 (EV71) and coxsackieviruses A16.<sup>1</sup> Usually, HFMD is self-limiting, but some patients may experience severe systemic and neurological complications that may be fatal; this is particularly true in cases caused by EV71.<sup>2,3</sup> Recently, HFMD has become a prolonged epidemic in the Asia-Pacific region – as observed in China,<sup>4</sup> Japan,<sup>5</sup> Korea,<sup>6</sup> Malaysia,<sup>7</sup> Vietnam,<sup>8</sup> and Singapore,<sup>9</sup> – where it is responsible for millions of cases each year.<sup>10,11</sup> After 2 y, the outbreak recorded 6,049 cases and 22 deaths<sup>4</sup> which led to HFMD being classified as a category C infectious disease by the Chinese government on May 2, 2008. Between 2008 and 2015, about 13.8 million cases of HFMD were reported in China, with an average annual incidence of 147 per 100,000 persons. Of these cases, children under the age of 5 y account for 90% of the reported infections. Among the laboratory-diagnosed cases, the proportion of EV71 was up to 44%,<sup>12</sup> which poses a serious threat to public health.

Routine preventive measures against HFMD are seemingly ineffective and difficult to achieve because it is mainly transmitted through close contact,<sup>10</sup> and the recessive infection rate of EV71 is as high as 50.5% among healthy individuals.<sup>13</sup> In addition, there is still no specific antiviral drug for HFMD. Therefore, vaccination has become the most effective and economic way to prevent and control the spread of HFMD. Since 2015, three inactivated EV71 preventative vaccines have been approved in China in order to prevent and control the spread of HFMD. Thus far, the EV71 vaccine Phase III clinical trials (of the three companies which obtained licensure) have confirmed that EV71 vaccines display a good rate of efficacy against the disease – 90.0%, 94.8%, and 97.3%.<sup>14–16</sup> Moreover, the EV71 vaccines are reportedly able to provide continuous protection for healthy children 5 y after receiving the vaccination.<sup>17</sup> A recent study estimated that a national EV71 vaccination program would annually avert 567,500 cases of EV71-associated HFMD and, by extension, 435 deaths and 14,000 disability-adjusted life years among children under the age of 5 y.<sup>18</sup>

**CONTACT** Fengcai Zhu ✉ [jszfc@vip.sina.com](mailto:jszfc@vip.sina.com) School of Public Health, Nanjing Medical University, 101 Longmian Avenue, Nanjing 211166, China; Qi Liang ✉ [jscdclq@126.com](mailto:jscdclq@126.com) Vaccine Clinical Evaluation Department, Jiangsu Provincial Center for Disease Control and Prevention, 172 Jiangsu Rd, Nanjing 210009, China

\*These authors contribute equally to this article and should be considered co-first authors.

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Even with the availability of the EV71 vaccines, vaccination coverage remains low, ranging from 13.7%<sup>19</sup> to 37.6%<sup>20</sup> and insufficiently able to form a stable immune barrier. In rural areas, the coverage of EV71 vaccines was even lower. For the vaccination of young children, the parental intention was often considered as the strongest predictor of vaccine uptake.<sup>21,22</sup> However, only one study regarding the parental willingness to have their children vaccinated with EV71 vaccines has been conducted in Guangzhou city so far, in the south of China.<sup>23</sup> Jiangsu Province is located in the eastern region of China, where two large reported outbreaks of HFMD in 2011 and 2014 present a severe illness burden.<sup>24</sup> However, the willingness of the parents to vaccinate their children in Jiangsu's rural areas was unknown. This study aims to assess the parental knowledge and the willingness to have their children vaccinated against EV71-related HFMD and to identify possible factors influencing parental intention to have their children vaccinated with EV71 vaccines in Jiangsu's rural areas.

## Materials and methods

### Study design and participants

This is a cross-sectional survey administered to parents of children aged between 6 and 60 months and who live in Jiangsu's rural areas.

We adopted two-stage stratified sampling to obtain participants. First, Sheyang, Ganyu, and Xinyi counties were selected from 38 counties in northern rural areas of Jiangsu Province. Second, we selected two towns from each of the three counties. Parents of children aged 6–60 months in selected towns were provided written informed consents to questionnaire by community doctors, during which all questions on the questionnaire were asked and filled out by well-trained investigators.

Ethical approval for this study was received from the Ethics Committee of Jiangsu Provincial Center for Disease Control. All parents were fully informed about the aim of the study and were invited to participate in the study voluntarily. Written informed consents were provided by each participating parent prior to enrollment.

### Study variables

We used a 31-item self-administered questionnaire to investigate parental knowledge and awareness of HFMD and EV71 vaccines and parental willingness to have their children vaccinated against EV71-related HFMD. The questionnaire, which had been reviewed by the expert panel, was subdivided into the following four parts (Supplement 1):

- The basic sociodemographic information, such as parental age, sex, education background, type of occupation, economic status, child's age, gender and number of brothers or sisters, and history of past episodes of HFMD were recorded;
- Knowledge of HFMD was evaluated with seven questions on familiarity of disease, typical symptoms,

susceptible population, routes of transmission, superinfection, familiarity of EV71, and pathogen of severe HFMD (eTable 1 in Supplement 2). The Cronbach's alpha of these seven items was 0.72, indicating the good internal consistency (eTables 2 and 3 in Supplement 2). For a single choice, each correct answer was given a score of 1, whereas a wrong response was given a score of 0. A multiple choice has the same weight as a single choice, with a total score of 1. A maximum total score of seven questions is seven points. Furthermore, awareness of HFMD was measured by two questions: "Do you think your children are susceptible to HFMD?" and "Do you think HFMD is serious?";

- Parental knowledge of EV71 vaccines was assessed with four questions (eTable 1 in Supplement 2). The Cronbach's alpha of the four items was 0.79, indicating the good internal reliability (eTables 2 and 3 in Supplement 2). The scoring method is the same as outlined above. A maximum total knowledge score is 4, and higher scores indicate a better knowledge. Participants were also asked to indicate whether they had received information about EV71 vaccines from each of the following five sources and select all options that applied: TV, the Internet, magazines or newspapers, community activities, and friends or relatives. Parents were asked to detail the specific source if it did not belong to these five categories;
- A dichotomous (yes/no) question, "Are you willing to vaccinate your child with EV71 vaccines?", was used to assess the main study variable, which was the parental willingness to vaccinate their children with EV71 vaccines.

### Quality control

Three qualified community physicians were trained in standardized investigation methods to avoid the induced questions during the inquiry. To validate the questionnaire, we did a pre-survey to assess the reliability of the questionnaire in the three counties (Sheyang, Ganyu, and Xinyi); the questionnaire was adjusted as follows: (1) the maximum number of children increased to 5; and (2) we replaced "EV71 vaccines" with "EV71 vaccines/HFMD vaccine." During and after the investigation, special quality control personnel checked the abnormal and missing values. Furthermore, the data of the questionnaire were double entered.

### Statistical analysis

A total of 447 participants were needed as a minimal sample size according to the following assumptions: (1) 95% confidence level, (2) 50% acceptance rate of EV71 vaccines, (3) 5% margin of error, and (4) a 10% non-response rate.

There were five and four missing values, respectively, in "monthly household income" and "having child who suffered from HFMD" variables; these absences were filled by mean substitution and hot deck imputation methods.<sup>25</sup> We adopted

descriptive analyses to describe demographic characteristics of the participants, cognition of HFMD and EV71 vaccines, and willingness to vaccinate. We used univariate binary logistic analyses to explore each potential factor associated with the acceptance of EV71 vaccines, resulting in the estimation of odds ratios. Then, multivariate binary logistic regression analyses were used to select variables while reporting results in adjusted odds ratio (aOR), following which a robust final model was built. All the statistical tests were done with a two-sided  $\alpha$  of 0.05 and analyzed using SPSS (version 20.0).

## Results

### Basic data

From July 19, 2018, to August 22, 2018, the survey was conducted among 1,146 parents of children aged between 6 and 60 months in Sheyang, Ganyu, and Xinyi counties, Jiangsu Province, China. A total of 1,112 (97.0%) participants who completed the questionnaire were included in the analysis. The characteristics of these respondents are given in Table 1 and eTable 4 of supplement. Of them, 356 (32.0%) participants were male and 756 (68.0%) were female. The average age of parents was 30.87 y with 45.3% of those aged 20–29 y, 47.1% of those aged 30–39 y, and 7.6% of those aged  $\geq 40$  y, respectively. The proportion of parents with primary school or lower, high school, and university or higher degree was 9.9%, 76.5%, and 13.6%, respectively. There were 24.5%, 32.4%, 3.4%, and 39.7% of participants working as farmer, private employee, civil servant, and freelancer, respectively. Overall, the average monthly household income of participants was 6,603.53 RMB. Of their children ( $n = 1,112$ ), 52.7% were boys and 47.3% were girls, with an average age of 31.42 months. In addition, 43.8% children

were the only child in the family. As reported by their parents, 158 (14.2%) children aged 6–60 months had been diagnosed with HFMD before.

### Factors associated with parental willingness to have their children vaccinated with EV71 vaccines

A total of 87.8% of the parents expressed their willingness to have their children vaccinated with EV71 vaccines.

Overall, 2.7% of participants answered all HFMD-related questions correctly, and the mean score was 3.40 (with a standard deviation of 1.67) of the total score out of 7.0. Most parents in our study had heard of HFMD (89.8%) and knew that children were a susceptible population for HFMD (82.0%). Over half of the parents knew transmission ways (65.3%) and the typical symptoms (50.3%) of HFMD. Some parents knew that children who previously diagnosed with HFMD could be infected with other HFMD-related pathogens again (39.8%). However, few parents had heard of the EV71 virus (8.4%) and knew it was the main pathogen causing severe HFMD (4.5%).

In terms of the knowledge on EV71 vaccines, only 2.5% of participants had full scores, with a mean score of 0.82 (and a standard deviation of 1.20) out of 4.0. 35.4% and 30.9% of parents had received information of EV71 vaccines and had heard about its protective effect, respectively. Participants obtained the information of EV71 vaccines primarily through friends or relatives (46.9%), followed by community activities (32.4%) and the Internet (21.6%). However, parents knew little about the virus-preventing type (9.5%) and price (6.1%) of EV71 vaccines.

As shown in Table 2, the willingness of giving EV71 vaccines to their children in the parents varied among the different counties. Parents who had both a high school degree and a university or higher degree had a higher acceptance for EV71 vaccines compared to those had a primary school or lower degree [unadjusted OR = 0.47, given a 95% confidence interval (CI) of 0.29–0.77; unadjusted OR = 0.19, 95% CI: 0.08–0.44]. Additionally, higher parental scores of the knowledge on HFMD and EV71 vaccines correspond to a higher willingness for their children to receive EV71 vaccines, with an OR of 0.80 (given a 95% CI of 0.72–0.89) and 0.78 (given 95% CI of 0.66–0.93) associated with one point of the scores, respectively. Furthermore, parents who recognized the susceptibility of their children, and who were worried about the severity of HFMD, also had a higher willingness to vaccinate their children with EV71 vaccines compared to those who did not recognize their children's susceptibility or who were not worried about the severity of HFMD (unadjusted OR = 0.55, 95% CI: 0.37–0.82; unadjusted OR = 0.34, 95% CI: 0.24–0.50). Moreover, parents over 40 y old were less likely to vaccinate their children with EV71 vaccines compared to those aged 20–29 y (unadjusted OR = 3.17, given a 95% CI of 1.78–5.64). In addition, parents living in Ganyu or Xinyi county were more likely to vaccinate their children with EV71 vaccines compared to those living in Sheyang county (unadjusted OR = 0.41, 95% CI: 0.27–0.64; unadjusted OR = 0.31, 95% CI: 0.20–0.49).

A parent's sex, age, and occupation, along with monthly household income, having a family member who is engaged in medicine, the child's gender and age, the child's attendance of kindergarten, the number of brothers or sisters of the child,

**Table 1.** Demographic characteristics of participants.

Parameter	N (%)
Parental sex	
Male	356 (32.0)
Female	756 (68.0)
Mean parental age $\pm$ SD, years	30.87 $\pm$ 5.27
20–29	504 (45.3)
30–39	524 (47.1)
$\geq 40$	84 (7.6)
Education level	
Primary school or lower	110 (9.9)
Junior/senior high school	851 (76.5)
University graduate or higher	151 (13.6)
Occupation	
Farmer	273 (24.5)
Private employee	360 (32.4)
Civil servant	38 (3.4)
Freelancer	441 (39.7)
Mean monthly household income $\pm$ SD, RMB	6,603.53 $\pm$ 3,927.94
Missing date	5 (0.5)
Children's sex	
Male	586 (52.7)
Female	526 (47.3)
Mean age of children $\pm$ SD, months	31.42 $\pm$ 14.99
Number of brothers and sisters	
0	487 (43.8)
$\geq 1$	625 (56.2)
Having child who suffered from HFMD	
Yes	158 (14.2)
No	954 (85.8)
Missing date	4 (0.4)

SD, standard deviation; N (%), number (percentage) of participants in each category.

**Table 2.** Knowledge and attitude about HFMD or EV71 vaccines and associated with the willingness to vaccinate their children with HFMD vaccines.

Parameter	TotalN (%)	Willing to vaccinate with EV71 vaccinesn (%)	Unadjusted OR	95%CI for OR	P
County					
Sheyang	360 (32.4)	287 (29.4)	1.00		
Ganyu	358 (32.2)	324 (33.2)	0.41	0.27-0.64	0.0000
Xinyi	394 (35.4)	365 (37.4)	0.31	0.20-0.49	0.0000
Parental sex					
Male	356 (32.0)	309 (31.7)	1.00		
Female	756 (68.0)	667 (68.3)	0.88	0.60-1.28	0.4974
Parental age (years)					
20-29	504 (45.3)	456 (46.7)	1.00		
30-39	524 (47.1)	457 (46.8)	1.39	0.94-2.06	0.0982
≥40	84 (7.6)	63 (6.5)	3.17	1.78-5.64	0.0001
Education level					
Primary school or lower	110 (9.9)	85 (8.7)	1.00		
Junior / Senior high school	851 (76.5)	748 (76.6)	0.47	0.29-0.77	0.0020
University graduate or higher	151 (13.6)	143 (14.7)	0.19	0.08-0.44	0.0001
Occupation					
Farmer	273 (24.5)	238 (24.4)	1.00		
Private employee	360 (32.4)	307 (31.4)	1.17	0.74-1.86	0.4937
Civil servant	38 (3.4)	34 (3.5)	0.80	0.27-2.39	0.6896
Freelancer / Unemployed	441 (39.7)	397 (40.7)	0.75	0.47-1.21	0.2403
Monthly household income (RMB)					
<4000	187 (16.8)	165 (16.9)	1.00		
4000~7999	565 (50.8)	493 (50.5)	1.10	0.66-1.82	0.7258
≥8000	360 (32.4)	318 (32.6)	0.99	0.57-1.72	0.9730
Having family member who engaged in medicine					
Yes	242 (21.8)	39 (4.0)	1.00		
No	870 (78.2)	937 (96.0)	1.37	0.48-3.91	0.5517
Children's sex					
Male	586 (52.7)	511 (52.4)	1.00		
Female	526 (47.3)	465 (47.6)	0.89	0.62-1.28	0.5416
Children's age (months)					
6~11	126 (11.3)	110 (11.3)	1.00		
12~23	259 (23.3)	239 (24.5)	0.58	0.29-1.15	0.1190
24~35	299 (26.9)	253 (25.9)	1.25	0.68-2.30	0.4743
36~47	247 (22.2)	218 (22.3)	0.92	0.48-1.76	0.7883
48~60	181 (16.3)	156 (16.0)	1.10	0.56-2.16	0.7779
Attend kindergarten					
Yes	308 (27.7)	270 (27.7)	1.00		
No	804 (72.3)	706 (72.3)	0.99	0.66-1.47	0.9460
Number of brothers and sisters					
0	487 (43.8)	428 (43.8)	1.00		
≥1	625 (56.2)	548 (56.2)	1.02	0.71-1.46	0.9175
Having child who suffered from HFMD					
Yes	158 (14.2)	137 (14.0)	1.00		
No	954 (85.8)	839 (86.0)	0.89	0.54-1.47	0.6605
Mean knowledge of HFMD ± SD, scores	3.4 ± 1.7	3.5 ± 1.7	0.80	0.72-0.89	0.0000
Mean knowledge of EV71 vaccines ± SD, scores	0.8 ± 1.2	0.9 ± 1.2	0.78	0.66-0.93	0.0059
Consider children are not susceptible to HFMD					
Yes	242 (21.8)	199 (20.4)	1.00		
No	870 (78.2)	777 (79.6)	0.55	0.37-0.82	0.0033
Consider HFMD is not serious					
Yes	311 (28.0)	244 (25.0)	1.00		
No	801 (72.0)	732 (75.0)	0.34	0.24-0.50	0.0000
Consider EV71 vaccines is expensive					
Yes	858 (77.2)	751 (76.9)	1.00		
No	254 (22.8)	225 (23.1)	0.91	0.59-1.40	0.6527

n (%), number (percentage) of participants who were willing to vaccinate their children in each category; unadjusted OR, unadjusted odds ratio; 95% CI, 95% confidence interval.

having a history of HFMD before, and the parent's attitude toward vaccine prices showed no significant association with parental willingness to vaccinate their children with EV71 vaccines.

### Multivariate binary logistic regression analyses

A final model is shown in Table 3. For every one increase in parental scores of knowledges of EV71 vaccines, the probability of parents who were not willing to have their children vaccinated with EV71 vaccines was 0.81 times as much as that of those who were (aOR = 0.81, given a 95% CI of 0.67–0.98). Parents who live

in Ganyu (aOR = 0.50, given a 95% CI of 0.31–0.79) or Xinyi county (aOR = 0.33, given a 95% CI of 0.20–0.53), had a university degree or higher (aOR = 0.26, 95% CI: 0.11–0.64), recognized the susceptibility of their children to HFMD (aOR = 0.61, 95% CI: 0.40–0.93), or were worried about the severity of HFMD (aOR = 0.43, 95% CI: 0.29–0.63) were more likely to have their children vaccinated against EV71-related HFMD as compared to those that did not.

However, parents aged over 40 y old were negatively associated with willingness to vaccinate their children with EV71 vaccines compared to those aged 20–29 y old (aOR = 2.12, given a 95% CI of 1.13–3.97). Four models were built to



**Table 3.** Final model of factors associated with the parental willingness to vaccinate their children.

Parameter	P	Adjusted OR	95% CI for OR
County (Sheyang)			
Ganyu	0.0033	0.50	0.31–0.79
Xinyi	0.0000	0.33	0.20–0.53
Parental age (20–29) (years)			
30–39	0.2933	1.25	0.83–1.88
≥40	0.0194	2.12	1.13–3.97
Education level (primary school or lower)			
Junior/senior high school	0.0965	0.64	0.37–1.08
University graduate or higher	0.0030	0.26	0.11–0.64
Good knowledge of EV71 vaccines	0.0279	0.81	0.67–0.98
Consider children are not susceptible to HFMD (yes)			
No	0.0218	0.61	0.40–0.93
Consider HFMD is not serious (yes)			
No	0.0000	0.43	0.29–0.63

evaluate the sensitivity of the final model. All the significant variables in the final model were also statistically significant in the other models, indicating that the results of the final model are robust (eTable 5 in Supplement 2).

## Discussion

This study provided important insights into the parental willingness to have their children vaccinated with EV71 vaccines and its associated factors among parents of children aged 6–60 months in rural areas of Jiangsu Province, China. The overall willingness of parents to vaccinate their children with EV71 vaccines was quite high, which was positively associated with good knowledge of EV71 vaccines, high education level of parents, and the correct awareness of HFMD.

A previous study<sup>23</sup> also found that good knowledge of EV71 vaccines had positive associations with parental acceptance of EV71 vaccines. Interestingly, there was no association between knowledge of HFMD and the intention to vaccinate their children with EV71 vaccines in our study population. A possible explanation for this is that the prevalence rate of HFMD-related knowledge was higher than that of EV71 vaccine-related knowledge, indicating that education of EV71 vaccines for parents is urgently needed.

In addition, we found that a higher education level played a positive role in decision-making among parents regarding EV71 vaccination for their children. However, a study on an inactivated EV71 vaccine in Guangzhou<sup>23</sup> indicated that a higher education background was negatively associated with willingness to vaccinate. Highly educated parents, on the one hand, had a strong ability to learn about EV71 vaccines from different sources. On the other hand, they also had more opportunities to be exposed to negative vaccine incidents, which could reduce trust in the safety of vaccines.<sup>26,27</sup>

A higher parental intention to have their children vaccinated with EV71 vaccines was also positively associated with perceived susceptibility of HFMD. In an inactivated EV71 vaccine context, this finding accorded with that from a previous study on parental willingness to administer EV71 vaccines.<sup>23</sup> In other vaccination contexts, an association of perceived susceptibility with a higher willingness to vaccinate was also found with the H7N9 influenza vaccine<sup>28</sup> and human

papilloma virus (HPV) vaccine.<sup>29</sup> These findings revealed that rectifying the misconceptions about the susceptibility of children to HFMD, among parents, could increase their acceptance of new vaccines.

Moreover, parents who were concerned about the severity of HFMD were more willing to vaccinate their children against EV71-related HFMD compared to those who were not. These results were similar to a previous finding from Colombia.<sup>30</sup> This may be explained by considering that good cognition can produce better behavior and improve the attitude toward vaccination, which are two important factors for vaccine acceptance.<sup>31,32</sup>

Parents showed different acceptance toward the vaccination of their children with the EV71 vaccine in different areas. Since Ganyu and Xinyi counties had a higher incidence of HFMD than Sheyang, it is not surprising that parents living in Ganyu or Xinyi county had a higher intention to vaccinate their children against EV71-related HFMD.

Furthermore, our results showed that the price of the EV71 vaccine had no association with parental intention to vaccinate their children, remaining consistent with a previous study.<sup>23</sup> There were two possible explanations for this result. First, the mean monthly household income of parents in our study was high enough to cover the cost of the EV71 vaccines (280 RMB). Second, the price of EV71 vaccines may not be a crucial determinant which influences parental willingness to vaccinate their children with EV71 vaccines.

Although a previous study<sup>23</sup> reported that parental age had no association with parental acceptance of EV71 vaccines, we found that parents 40 y and older had a lower vaccination acceptance compared to those aged between 20 and 29 y. The possible explanation of this was the differences in tertiary education rates between the parents 40 y and older (1.99%) and those aged between 20 and 29 y (45.03%) (eTable 4 in supplement). This finding indicated that educational activities directed at parents aged 40 y and older are urgently needed to increase their acceptance of EV71 vaccines.

Four limitations of this study must be noted. First, the site of this study is in the rural areas of northern Jiangsu, which may affect the generalizability of study results. Therefore, further studies are needed in other regions. Second, we cannot exclude the social desirability bias in which parents might give advantageous answers to some questions.<sup>33</sup> 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, the measured knowledge questions were different from the previous study; furthermore, each question might not have a direct association with willing to vaccinate against EV71. Fourth, the proportion of parental willingness to vaccinate their children with EV71 vaccines could not truly reflect its actual vaccination status, as the EV71 vaccination rate was often lower than the willingness rate. In this study, the variable “EV71 vaccination” was not included in the analysis as the value of the missing data was over 65.38%.

## Conclusion

Our study indicated that there were several significant determinants for parental willingness to vaccinate their children,

including parents who had a good knowledge of EV71 vaccines, who had a college degree or higher, who perceived their children's susceptibility to the disease, who were worried about the severity of HFMD, or who were aged over 40 y old and lived in Ganyu or Xinyi county. These findings demonstrated that specific publicity and targeted education should be established to increase parental acceptance of EV71 vaccines and to achieve a high vaccination coverage. First, rectifying the misconceptions about HFMD among parents, such as susceptibility and seriousness, is also needed to increase their awareness of EV71 vaccines. Second, educational activities aimed at parents aged 40 y and older, as well as those with low education, will be helpful to improve their acceptance of EV71 vaccines.

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## Disclosure of potential conflicts of interest

No potential conflicts of interest were disclosed.

## Authors' contributions

Jingxin Li, Qi Liang, Fanyue Meng, and Fengcai Zhu contributed to conception and design of the study; Guifan Li and Qi Liang contributed to training staffs; Yuanyuan Wang, Jiaqian Cao, and Qiufan Yu contributed to collecting data; Yuanyuan Wang contributed to analyzing the data; Yuanyuan Wang and Jingxin Li wrote the paper; all authors read and approved the final manuscript.

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