



## Willingness and influential factors of parents to vaccinate their children with novel inactivated enterovirus 71 vaccines in Guangzhou, China



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### ABSTRACT

Hand, foot and mouth disease (HFMD) primarily affects children younger than 5 years of age. Recently, HFMD has ranked as the top notifiable infectious disease in China. In December 2015, China approved two novel inactivated enterovirus 71 vaccines (EV71 vaccines) for HFMD. Parents' acceptance is often essential for vaccination program success. The goal of this study was to identify willingness and influential factors to vaccinate among parents of kindergarteners in Guangzhou, China. A cross-sectional survey of face-to-face interviews was conducted from March to July 2016. Fifty-five kindergartens were randomly selected from 11 districts of Guangzhou. An anonymous self-designed questionnaire was used to investigate awareness, knowledge and attitude towards HFMD and EV71 vaccines. A total of 868 parents participated in the survey. Mean(±standard deviation) knowledge score of HFMD was 6.32(±1.70). Approximately 32.03% of parents had heard of the EV71 vaccines with 22.58% receiving information before this study. Nearly 44.24% of parents showed willingness to vaccinate their children. Previously receiving EV71 vaccine-related information [adjusted odds ratio (aOR) = 1.48, 95% confidence interval (CI): 1.04–2.11], no fear of adverse effects (aOR = 4.25, 95%CI: 2.77–6.53), perceived susceptibility of children to HFMD (aOR = 2.15, 95%CI: 1.42–3.25) and children not previously diagnosed with HFMD (aOR = 1.56, 95%CI: 1.07–2.27) were positively associated with EV71 vaccination acceptability. However, parental education background (aOR = 0.54, 95%CI: 0.37–0.80) was negatively correlated with vaccination acceptability. Our study provides baseline information for future vaccination campaigns to help improve the EV71 vaccine uptake rate. Special efforts are urgently needed to improve the awareness and knowledge of EV71 vaccines in China.

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### 1. Introduction

Hand, foot and mouth disease (HFMD) is a common infectious disease caused by a group of enteroviruses, primarily enterovirus 71 (EV71) and coxsackieviruses A6 and A16. Monitoring data showed that HFMD primarily affects infants and children younger than 5 years of age [1,2]. Many counties and regions have reported HFMD epidemics, especially in Asia-Pacific countries [3–6]. Recently, China has experienced a steady state of high mortality due to HFMD epidemics. From 2008 to 2012, nearly 6.5 million

pediatric HFMD cases were reported, with more than 2000 deaths [1]. As such, HFMD has posed a considerable disease burden and economic impact in China [7], leading to the concern of public health authorities about increased morbidity and mortality.

As there is currently no approved antiviral drug for HFMD, vaccination has become a necessary and important action to prevent and control disease spread. In December 2015, the Chinese Food and Drug Administration approved the use of inactivated EV71 vaccines for HFMD among children (produced by the Chinese Academy of Medical Sciences and Sinovac Biotech) [8,9]. A phase 3 trial showed that the vaccine efficacy rate was >90% against EV71-associated HFMD and the seroconversion rate was 88.1–91.7% [10–12]. Moreover, a prior study estimated that a national EV71 vaccination program would be expected to annually avert 567,500 cases of EV71-associated HFMD and 14,000 disability-

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adjusted life years among children younger than 5 years of age [13].

An understanding of parents' willingness to have their children vaccinated is critical to develop an effective vaccine delivery program, as it has been demonstrated that perceived benefits and barriers of vaccines among parents were two of the strongest predictors of vaccine uptake among children, especially for EV71 vaccines that target children younger than 59 months of age [14–16]. Multiple studies exploring factors correlated with parents' intention to have their children vaccinated have suggested knowledge level related to the disease and vaccines, concerns about vaccine safety and adverse effects and uncertainty about vaccine efficacy were influential factors [17–20]. A multicenter national survey in China among 2899 parents of young adolescents (11–17 years of age) found knowledge about the vaccine significantly increased parental acceptability of vaccination for their children, and prior consultation regarding vaccine information was observed in relation to higher vaccine acceptability [21]. Low risk perception was also found to affect parents' acceptance of an offer to vaccinate their child in a study carried out in the United States [22]. Other factors such as high cost, household income, number of children and vaccine accessibility also influenced vaccination acceptability [23,24].

Guangzhou, the largest metropolis in southern China with a population of over 13 million, has suffered from a serious HFMD epidemic since 2012. The number of reported cases was as high as 61,255 in 2016 with an incidence rate exceeding 40/10,000 annually, which was more than three times the national average. Considering the high morbidity, understanding information concerning the acceptance and obstacles associated with EV71 vaccination among parents is of great importance. However, as a novel vaccine targeting young children, no previous studies have been conducted to address parental perceptions regarding child vaccination for EV71-associated HFMD, including influential factors. Thus, the aims of the present study were to elucidate the awareness, knowledge, attitude and acceptability of HFMD and EV71 vaccines to identify factors affecting parents' willingness to have their children vaccinated against HFMD in Guangzhou.

## 2. Materials and methods

### 2.1. Sample and procedure

A cross-sectional survey using an anonymous self-administered questionnaire was conducted among parents of kindergarteners in Guangzhou, China between March and July 2016. There are 11 districts in Guangzhou with 60–80 kindergartens in each district. Two-stage stratified random sampling was adopted to sample the participants. First, five kindergartens were randomly selected from each district of Guangzhou. Second, 20 parents from each chosen kindergarten were randomly selected to participate in our study. In total, 55 kindergartens with 1100 parents were finally selected to participate in our study.

### 2.2. Data collection

An agreement between Guangzhou Center for Disease Control (GZCDC) and each kindergarten was reached, and a protocol along with study procedures and information documents (e.g., purpose and survey process) were presented to each kindergarten and teachers. Teachers distributed the questionnaires combined with consent letters in a sealed envelope, which the children delivered to their parents, and kept track of each questionnaire. We allowed a maximum of 1 month after administration to collect the questionnaire. When completed questionnaires were collected, the

kindergartens mailed them back to us. Over 80% sent back in one week and we collected all questionnaires in two weeks. One thousand one hundred questionnaires were distributed; 956 parents agreed to participate in the study with 868 (79%) parents providing usable information. Questionnaire completion was anonymous, therefore, it was not possible to follow up with non-responders.

### 2.3. Ethical statement

This study was approved by the Ethics Committee of GZCDC. Participants were fully informed of the purpose of the study and were invited to participate voluntarily. Written consent letters were obtained from the school and each participating parent.

### 2.4. Measures

A 22-item self-administered questionnaire was developed to assess the awareness and knowledge of, attitude toward and acceptability of HFMD and EV71 vaccines.

#### 2.4.1. Main outcome

The main study outcome was acceptance of EV71 vaccines, which was measured by the dichotomous (yes/no) question: "Are you willing to have your child vaccinated with EV71 vaccines?" (0 = no, 1 = yes).

#### 2.4.2. Sociodemographic information

Parental age and sex, Child's age, educational background, monthly income and prior diagnoses of HFMD were recorded.

#### 2.4.3. Awareness assessment

Although some research argued the assessment with a single item on other vaccines was insufficient [25], HFMD and EV71 vaccines were the only descriptions widely used to promote the disease and vaccine related information through the Internet, newspaper, or other public media. Therefore we used the following items measuring the awareness: "Have you heard of HFMD?" and "Have you heard of EV71 vaccines?"

#### 2.4.4. Knowledge assessment

Knowledge was assessed with five questions on epidemic seasons, high-risk groups, main symptoms, severity of disease and medication. In the absence of standardized survey instrument recently, the questions were designed based on our pilot study and it has been reviewed by a panel of experts. 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. The question "Have you previously received EV71 vaccine-related information?" was used to assess whether they got vaccine-related knowledge before.

#### 2.4.5. Source of information

Parents were asked to indicate whether they had received EV71 vaccine-related information from each of the following nine sources and which source they wished to obtain additional information from in the future: print media from a health department, TV or radio, newspaper/magazine, school lecture, the Internet, children's feedback, physician/medical professional, friends or relatives and community activities. Parents were asked to select all responses that applied.

#### 2.4.6. Attitude assessment

Attitude was assessed on six issues including vaccine safety (Do you have any concerns about safety of EV71 vaccine?), effectiveness (Do you think the EV71 vaccines are effective of preventing

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