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# Determinants of willingness to pay for self-paid vaccines in China

Zhiyuan Hou [a], Jie Chang [b], Dahai Yue [a], Hai Fang [a], Qingyue Meng [a,*], Yuting Zhang [c]

[a] China Center for Health Development Studies, Peking University, Mailbox 505, 38 Xue Yuan Road, Haidian District, Beijing 100191, China
[b] Center for Health Management and Policy, Shandong University, 44 Wenhua Xi Road, Jinan 250012, China
[c] Department of Health Policy and Management, Graduate School of Public Health, University of Pittsburgh, 130 De Soto St, Pittsburgh, PA 15261, United States

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ABSTRACT

*Background:* While vaccines not covered by China's Expanded Program on Immunization can be received voluntarily with out-of-pocket payment, the uptake of self-paid vaccines in China is low.
*Objective:* To investigate willingness to pay (WTP) for self-paid vaccines and its determinants in China.
*Methods:* We interviewed 2160 randomly selected households with children 0–3 years old, in 108 communities from three provinces in 2013. A bidding game method was used to elicit WTP for two self-paid vaccines: 7-valent pneumococcal conjugate vaccine and influenza vaccine. We conducted multivariate linear regressions to determine factors affecting the WTP.
*Results:* Median WTP for pneumococcal conjugate vaccine and influenza vaccine were Chinese Yuan 200 and 60 (10 US Dollars). 92% and 55% of respondents, respectively were not willing to pay the market price for these two vaccines. Lower price barrier and higher ability to pay were associated with higher WTP. Those with better vaccine or disease-related knowledge, higher perceived vulnerability and severity of diseases were willing to pay more. However, perceived effectiveness and safety barriers to vaccination had no significant effects on the WTP. Recommendations from peers and healthcare providers increased the WTP. Fathers and grand parents of children had a higher WTP than their mothers. The WTP decreased with age, but was not affected by education and occupation.
*Conclusions:* The majority of individuals, in our study, were not willing to pay the market price for self-paid vaccines against high-burden diseases in China. The economic barriers to vaccination should therefore be removed to increase the demand. Region-specific information about disease burden, fiscal capacity and cost-effectiveness is important for the development of local financing policy in order to cover vaccination costs. Interventions targeting psychosocial factors, such as health education and communication with providers and peers, could also be effective in increasing the uptake of these vaccinations.


## 1. Introduction

Immunization has been proven as one of the most cost-effective health investments [1]. China established the Expanded Program on Immunization (EPI) in 1978, covering four vaccines against: bacillus Calmette–Guérin, oral polio, measles, and combination diphtheria, tetanus and pertussis [2]. In 2002, the national EPI added hepatitis B vaccine [3]. In 2007, the program was expanded to include vaccines against meningococcal meningitis, Japanese encephalitis, hepatitis A, rubella and mumps [2]. The EPI vaccines are provided free of charge, and are required for school enrollment [4]. Vaccines not covered by the EPI can be received voluntarily, but these must be paid for [4].

Among children under 5 years old, pneumococcal pneumonia causes a major burden of diseases associated with infection in China [5]. The Global Burden of Diseases, Injuries, and Risk Factors Study 2010 [6] reported that in China, the number of child deaths from lower respiratory infections, including seasonal influenza and pneumococcal pneumonia, reached 26,900 and accounted for 13% of all child deaths in 2010; being the leading causes of death due to infectious diseases. The WHO 2012 position paper recommends influenza vaccination for children aged from 6 months to 5 years,

*Abbreviations:* EPI, the Expanded Program on Immunization; PCV-7, 7-valent pneumococcal conjugate vaccine; WTP, willingness to pay.

* Corresponding author. Tel.: +86 10 8280 5705; fax: +86 10 8280 5695.
*E-mail addresses:* hou@bjmu.edu.cn (Z. Hou), longstreet925@126.com (Jie Chang), yuedahai218@163.com (D. Yue), hfang@bjmu.edu.cn (H. Fang), qmeng@bjmu.edu.cn (Q. Meng), ytzhang@pitt.edu (Y. Zhang).

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because of a high burden of influenza in this group [7]. However, China's EPI currently does not cover vaccines against these high-burden diseases, such as the influenza vaccine and 7-valent pneumococcal conjugate vaccine (PCV-7), which are recommended by the WHO for targeted populations [7,8].

It was reported that the coverage rates of non-EPI vaccines in China were quite low—only 10% children had received PCV-7 in 2011 [9], and 26% for influenza vaccine in urban areas [10]. The demand-side factors play an important role in affecting vaccination rates. The literature to date has mainly focused on the psychosocial factors associated with vaccination and suggests knowledge, attitudes and beliefs towards vaccines affect vaccination behaviors [11–14]. However, the high cost of vaccines may be a major barrier to non-EPI vaccination in China [15–17] and other countries [1].

Since Chinese individuals have to pay the full cost, out-of-pocket, for non-EPI vaccines and some self-paid vaccines are very expensive, it is important to assess how much individuals are willing to pay (WTP) for these vaccines and factors affecting the WTP. Unfortunately, such information is limited in China. In this study, we evaluated the individuals' WTP for two self-paid vaccines against high-burden diseases: PCV-7 and influenza vaccine. This information is critical for improving vaccination coverage and policy-making as China expands its national EPI or some provinces or cities consider covering them in their local EPI programs or health insurance coverage [18,19]. It could also be useful for other developing countries to promote self-paid vaccination.

## 2. Materials and methods

### 2.1. Study design, population and sampling

We conducted a cross-sectional survey in January 2013 in 108 communities selected from three provinces, Jiangsu, Hubei and Gansu, with different socio-economic environments in China. A stratified sampling method was used but we did not perform formal sample size calculations because this would have required information about the joint distribution of dependent and independent variables [20], which was unknown prior to the survey. Provinces and districts/counties were stratified by level of social-economic development (high, moderate, low), and communities/villages and households were selected randomly.

Fig. 1 shows the sampling process in detail. Jiangsu, Hubei and Gansu provinces are located in eastern, central and western China, respectively: Jiangsu represents a high level of socio-economic development, Hubei a moderate level, and Gansu a low level. All sampling households consented to participate in the survey, resulting in a total sample of 2160 households. The parents or grandparents, who made decisions on children's vaccination, were interviewed for each household. The study population was representative of the selected regions rather than the whole country. Due to missing values in some variables, the final sample consisted of 1924 respondents in multivariate regression. The study was approved by the Institutional Review Board of Peking University Health Science Center.

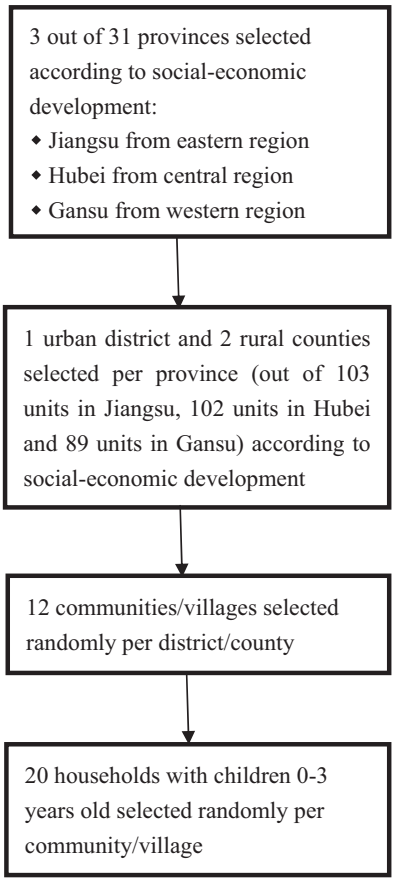


**Fig. 1.** Flowchart of the sampling process.

### 2.2. Measures

#### 2.2.1. Dependent variable—the willingness to pay

To assess WTP for self-paid vaccines, the respondents were given a scenario where information on pneumonia andPCV-7 (influenza and influenza vaccine) was introduced, and then they were asked to state their WTP for each vaccine using a bidding game approach [21]. This is a commonly used contingent valuation method to elicit WTP [22–24]. The following vaccine properties were informed to the respondents before asking their WTP: PCV-7 vaccine, which requires four doses, can protect around 97% of the vaccinated children; annual influenza vaccination is recommended, particularly for high-risk groups, whereby 70–80% of vaccinated individuals get protection. At the time of the survey, the prevailing market prices for PCV-7 and influenza vaccine were Chinese Yuan (CNY) 860 and 80 (13 US Dollars). The respondents were not informed about these market prices; instead, they were asked according to a series of price cards, ranging from CNY 0 to 1200 for PCV-7 and CNY 0 to 250 for the influenza vaccine (Table 1). They were asked in this order—either starting from the lowest value or the highest value of the series of price cards. The starting bid point, either the lowest or highest price points, was randomly rotated among respondents. Our data confirmed that respondent characteristics were comparable between two groups starting from the lowest or highest bidding point.

#### 2.2.2. Independent variables

We assessed four main categories of factors that would affect WTP: respondent characteristics, economic factors, psychological factors, and social influence factors. First, respondent characteristics included demographics (household role, age, education and occupation), and previous vaccination experience (previous infectious diseases, self-paid vaccination and its effectiveness). Second, economic factors were measured by price barrier to general vaccination, which refers to any self-paid vaccine in general, and the ability to pay. Third, based on the Protection Motivation Theory [25,26], psychological factors included vaccine or disease-related knowledge, threat appraisal (perceived vulnerability and severity of diseases), and coping appraisal (effectiveness and safety barriers