Hepatitis B vaccination coverage rates among adults in rural China: Are economic barriers relevant?

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ABSTRACT

Background: Hepatitis B virus (HBV) infections cause major health problems in China. The Expanded Program of Immunization has succeeded in reducing infection rates among infants and children, but HBV vaccination coverage rates among adults remain low.

Objective: The objective was to investigate how individual adult HBV vaccination decisions are influenced by economic factors, socioeconomic status, and demographic characteristics, and to assess how potential vaccination policies could affect HBV vaccination coverage rates among adults.

Methods: We interviewed 22,618 adults, aged 15–59 years, from 7948 households, in 45 villages from 7 provinces. A questionnaire was used to collect information. The actual vaccine status was modeled using a polychotomous logistic regression with three outcomes; unvaccinated, partial vaccination, and complete vaccination. A subsample of unvaccinated adults gave responses to a hypothetical vaccination policy that offered HBV vaccination free of charge and various amounts of money to compensate for direct and indirect vaccination-related costs.

Results: The polychotomous logistic regression results suggest that vaccination user fees, time needed to get a vaccination, and vaccination-related travel costs were negatively associated with HBV vaccination coverage rates. Higher income was associated with higher coverage rates, and coverage rates decrease with age, with no significant difference between the genders. In the subsample that responded to the hypothetical policy, 55–72% (depending on the amount of money offered as compensation) stated they would accept a vaccination if it was offered free of charge.

Conclusions: Our polychotomous logistic regression results suggest that higher HBV vaccination coverage rates among adults are obtainable and that user fees, time needed to get a vaccination, and travel costs have acted as economic barriers to vaccination. This is supported by the responses to the hypothetical policy, which suggest that adult coverage rates could surge if HBV vaccine is offered at no cost.

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1. Introduction

Infections by the hepatitis B virus (HBV) cause major health problems in China. It is estimated that 120 million people are chronically infected, 30 million suffer from chronic hepatitis B, and that HBV-related diseases have an annual death toll of about 300,000 individuals [1,2]. Extensive efforts have been made to curb HBV transmission, and the protection of infants and young children, who are most prone to developing long-term complications following HBV infection, has been given high priority [3–6].

According to an authoritative Chinese national serosurvey, the Chinese Expanded Program of Immunization had reduced the HBV prevalence among children aged less than five years old to 1.0% in 2006 [2]. Compared with a previous estimate from 1992, this amounted to a 90% reduction [3–5]. For adults, the prevalence of HBsAg (a marker for current acute or chronic infection) was 5.4% for the 15–19-year-old age group and 8.5–10.5% for older age groups. The prevalence of anti-HBc (a marker for current or past infection) increased gradually from 25.0% for the 15–19-year-old age group to 50.0% for the 55–59-year-old age group [2,7]. These results may suggest that a substantial share of the new HBV infections occurred in the adult population. The authors of the serosurvey concluded with a call for expanded vaccination of older children and adults.

It has not been assessed to what extent adults would be willing to participate in an expanded HBV vaccination program. We

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Table 1
Variable definitions and descriptive statistics ($N = 21{,}783$).

Variable	Variable definitions	Mean	Std. dev.
Complete vaccination	1 if received at least three doses of HBV vaccine; 0 otherwise	0.164	
Incomplete vaccination	1 if received one or two doses of HBV vaccine; 0 otherwise	0.044	
Unvaccinated	1 if received zero doses of HBV vaccine; 0 otherwise	0.792	
Time	Total time spent traveling or waiting, per vaccine dose (hour)	0.455	0.163
User fee	Vaccine fee and service fee paid, per vaccine dose (10 Yuan)	3.276	1.886
Travel cost	Round-trip cost of travel to health facility, per dose (10 Yuan)	0.442	0.432
Age 15–19	1 if aged 15–19; 0 otherwise	0.103	
Age 20–24	1 if aged 20–24; 0 otherwise	0.153	
Age 25–29	1 if aged 25–29; 0 otherwise	0.123	
Age 30–34	1 if aged 30–34; 0 otherwise	0.101	
Age 35–39	1 if aged 35–39; 0 otherwise	0.101	
Age 40–44	1 if aged 40–44; 0 otherwise	0.117	
Age 45–49	1 if aged 45–49; 0 otherwise	0.114	
Age 50–54	1 if aged 50–54; 0 otherwise	0.093	
Age 55–59	1 if aged 55–59; 0 otherwise	0.096	
Female	1 if female; 0 otherwise	0.497	
Male	1 if male; 0 otherwise	0.503	
Low education	1 if years of schooling (y.o.s) is less or equal to 6 years; 0 otherw.	0.326	
Medium education	1 if y.o.s is higher than 6 and less or equal to 9 years; 0 otherwise	0.494	
High education	1 if y.o.s is higher than 9 years; 0 otherwise	0.180	
Farmer	1 if Farmer; 0 otherwise	0.547	
Migratory workers	1 if Migrant worker; 0 otherwise	0.247	
Student	1 if student; 0 otherwise	0.129	
Other occupation	1 if not Farmer, Migratory worker or Student; 0 otherwise	0.077	
Poor health status	1 if reports health status as 'fair' or 'poor'; 0 otherwise	0.197	
Good health status	1 if reports health status as 'good' or 'excellent'; 0 otherwise	0.803	
Insurance, none	1 if no insurance; 0 otherwise	0.039	
Insurance, NRCMCS	1 if got NRCMCS only; 0 otherwise	0.907	
Insurance, other	1 if got other insurance; 0 otherwise	0.037	
Ins., NRCMCS and oth.	1 if got NRCMCS and other insurance; 0 otherwise	0.017	
Income group 1	1 if income in the bottom quintile; 0 otherwise	0.201	
Income group 2	1 if income in the second lowest quintile; 0 otherwise	0.197	
Income group 3	1 if income in the middle quintile; 0 otherwise	0.245	
Income group 4	1 if in the second highest quintile; 0 otherwise	0.200	
Income group 5	1 if income in the top quintile; 0 otherwise	0.158	
True transm. route ind.	No. of identified true routes of transmission	2.062	1.789
False transm. route ind.	No. of identified false routes of transmission	0.752	0.796
Perceived protection 1	1 if vaccine is unknown or protection last 0–1 year; 0 otherwise	0.440	
Perceived protection 2	1 if protection last 1–5 year; 0 otherwise	0.331	
Perceived protection 3	1 if protection last 5–10 year; 0 otherwise	0.097	
Perceived protection 4	1 if protection last 10–20 year; 0 otherwise	0.040	
Perceived protection 5	1 if protection last more than 20 years; 0 otherwise	0.092	

investigated this issue using a sample of adults from the general population in rural China. Our main analysis took an economics perspective on the current HBV vaccination coverage rates among adults. Previous studies have found that socioeconomic factors are associated with HBV vaccination coverage rates, which is indicative of existing economic barriers to vaccination [8–10]. We employed a polychotomous regression model in which both socioeconomic factors and three potential barriers—vaccination user fee, travel costs, and time needed to obtain vaccination—were among the explanatory variables. Supplementary analysis was based on individuals' responses to hypothetical vaccine policies, where the HBV vaccine was offered free of charge and where indirect vaccination-related costs were compensated by various amounts of money.

Increasing the HBV vaccination coverage rates among adults would almost eliminate the vaccinees' risk of HBV infection and related illness [7,11]. It would also provide indirect protection of their children and partners. This is particularly relevant in some rural areas where the infant and child coverage rates among several birth cohorts were lower than the national average [6].

2. Materials and methods

2.1. Study population and sampling procedure

The data presented here were collected as part of a larger project and further results are presented in companion papers.

Geographically, the project focuses on rural areas where coverage rates have been lower than in urban areas.

We collected data using a household survey, covering 33,995 individuals from 8812 households, in 45 villages from 7 provinces with notable regional, economic, and epidemiological diversity; Hainan, Hebei, Heilongjiang, Henan, Jiangsu, Ningxia, and Shandong. Counties within each province were stratified by level of economic development (low, medium, high), and villages in a county were stratified based on short, medium, and long travel distance to the vaccination sites. In small villages, all households were invited while in larger villages, households were randomly selected using household size as sampling weights (probability proportionate to size). The sampling strategy ensured that two presumably important factors, income and travel distance, showed substantial variation in the resulting sample. We did not perform formal sample size calculations because this would have required information about the joint distribution of dependent and independent variables [12–14], which was unknown prior to the survey. In the planning process, we balanced the expected benefits of including more villages and obtaining more between-village variation (user fee, time, and travel cost vary little within each village) against the managerial costs of surveying more villages. The precise sample weights, in relation to the total rural population in the selected provinces, are unknown, and this will be discussed further below. The participation rate was about 82%, and the predominant reason for nonparticipation was that all household members had moved to