



Routine immunization services costs and financing in China, 2015

Wenzhou Yu^{a,1}, Ming Lu^{b,1}, Huaqing Wang^{a,1}, Lance Rodewald^{c,1}, Saisai Ji^a, Chao Ma^a, Yixing Li^a, Jingshan Zheng^a, Yifan Song^a, Miao Wang^a, Yamin Wang^a, Dan Wu^a, Lei Cao^a, Chunxiang Fan^a, Xuan Zhang^a, Yanmin Liu^{a,*}

^a National Immunization Program, Chinese Center for Disease Control and Prevention, No. 27, Nanwei Road, Xicheng District, Beijing, China

^b National Health and Family Planning Commission of the People's Republic of China, No. 1, Xizhimenwai Street, Xicheng District, Beijing, China

^c World Health Organization Office in China, 401, Dongwai Diplomatic Office Building, No. 23, Dong zhi men wai Street, Beijing, China



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ABSTRACT

Objective: To estimate the costs of routine immunization (RI) services in China in 2015, to provide objective data relevant to investment in the Expanded Program on Immunization, and to contribute to global data on costing and financing of RI.

Methods: The study was conducted between January and March 2016. We selected 276 villages, 138 townships, 46 counties, and 40 prefectures from 15 provinces as investigation sites at random, stratified by eastern, middle, and western regions. Direct cost items included vaccines, personnel, cold chain, surveillance, communication, training, and supervision at the national, provincial, prefecture, county, township, and village levels. We obtained financial data from governmental and external sources. Indirect costs of RI included parents' transportation costs and productivity lost due to taking their children for vaccination.

Results: Total direct costs were \$92.42 for each child fully immunized (\$4.20/dose), which equates to \$1529.55 million per birth cohort. RI costs were higher in the eastern region than in the western region, and higher than that of the central region. Vaccination coverage was positively associated with direct routine immunization costs. The cost of the recommended vaccines was \$19.08/child and vaccine only accounted for 20.64% of total costs. Operational cost, including surveillance, communication, training and supervision, was \$217.31/child, accounting for 14.21% of total cost. The indirect cost per child was \$72.86; the total indirect cost was \$1205.83 million for the birth cohort. Government investment in RI accounted for about 70% of total costs. Revenue from sales of private-sector vaccine supported the remaining 30% of RI costs.

Conclusions: While government financing has increased, some operating costs continue to be provided from revenue generated by sales of Category 2 (private-sector) vaccines to families. China could benefit from bringing new and underutilized vaccines into the EPI system based on evidence that includes routine immunization vaccine and operations costs.

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1. Introduction

Vaccination is one of the most cost-effective means of preventing infectious diseases and improving population health [1,2]. Immunization programs not only reduce disease burdens, but also produce significant social benefits [3]. Vaccination programs are recognized as high-efficiency public health activities [4]. China has significantly reduced the incidence of vaccine-preventable diseases (VPDs) among children through the implementation of

routine immunization (RI), which has saved tens of thousands of children's lives [5–7]. China's Expanded Program on Immunization (EPI) work has played an extremely important and beneficial role for health and society [8].

In China, EPI laws and regulations stipulate clearly the responsibilities of governments at all levels [9–11]. However, inadequate investment in the immunization program is a problem that has not been solved for a long time and has become a key issue for the sustainable development of China's immunization program [12]. Due to increasing vaccination services and management costs, the need to update cold chain equipment, and other factors associated with expansion of the set of program vaccines, the demands for immunization funding have increased [12,13]. Improving efficiency and

* Corresponding author.

E-mail address: liuym@chinacdc.cn (Y. Liu).

¹ These authors contributed equally to this article.

Table 1
Routine immunization cost categorization.

| Categorization | Category name | Details |
|----------------------|---------------|--|
| Vaccine | Vaccine | Including routine vaccines (BCG, Hepatitis B, IPV/OPV, DPT, DT, MR, MMR, Hepatitis A, MenA, MenAC, JE), syringes, diluent, and other supplies used for administration vaccines. There are 22 doses of vaccines for routine immunization for each fully vaccinated child. |
| Operational activity | Surveillance | Covering the investigation of VPD cases, emergency response, and laboratory monitoring (including specimen collection, delivery, and testing). |
| | Communication | Including the expenditures on development and distribution of publicity materials for the routine and advocacy work, Childhood Vaccination Day and World Hepatitis Day. |
| | Training | Including expenditures on organization of training courses and meetings. |
| Logistics | Supervision | Including travel and accommodation costs during supervision activities. |
| | Personnel | Including wages and other subsidies of full-time and part-time EPI staff in health facilities at different levels. |
| | Cold chain | Including cold chain equipment and vaccine management. The cost of cold chain equipment is calculated with the formula of $(\text{Purchased price} \times 0.03) / [1 - (1 + 0.03) - \text{Useful Life of Equipment}]$. |
| | Others | Including office equipment and miscellaneous expenses. The office equipment cost is estimated like cold chain equipment. |

Note: BCG -Bacillus Calmette-Guérin, IPV-inactivated polio vaccine, OPV-oral live attenuated polio vaccine, DPT-diphtheria pertussis tetanus vaccine, DT-diphtheria tetanus vaccine, MR-measles and rubella vaccine, MMR-measles mumps and rubella vaccine, MenA-meningococcal meningitis A vaccine, Men AC-meningococcal meningitis A+C vaccine, JE-Japanese Encephalitis vaccine.

sustainability is difficult without understanding how funds are currently spent. Governments at all levels need to invest in vaccination program, however, they should know the direct cost of RI and how much they should invest in EPI.

In China, the public sector (government) provides immunization services for the children. The vaccines are classified as Category 1 (government-recommended and purchased vaccines) and Category 2 (family-paid, family-option vaccines). Local health departments and EPI clinicians can make money (revenue) from sale and administration of Category 2 vaccines. Revenue from the Category 2 vaccines, therefore, supports in part delivery of routine immunization with Category 1 vaccines. The central government provides all EPI (Category 1) vaccines at no charge to families, regardless of socioeconomic status. Provincial, prefecture, and county level governments are responsible for vaccine storage and handling; village-level government clinics provide vaccination services to children. Provincial, prefecture, and county-level governments provide EPI personnel salaries and operating expenses for routine immunization services. Some prefecture, county, township, and clinics depend on profits from sales of Category 2 (private-sector) vaccines supplement government financing in personnel and program operation to avoid operating at a loss. Village doctors have no fixed salary; they are paid from clinic profits and sales of Category 2 vaccines and other project fundings.

In 2004, China's Ministry of Health conducted a study to determine EPI costs and inputs in several provinces [14–16]. The survey provided a baseline reference for governmental investment in EPI, including the vaccination subsidy standards for the central and other levels of government. In 2007, the EPI system was expanded by adding vaccines to prevent 5 infectious diseases, resulting in 14 vaccines to prevent 15 infectious diseases [17]. However, there are only 11 vaccines for children, and some Category 2 vaccines, such as Hib vaccine, varicella vaccine, and rotavirus vaccine are not included in China's EPI system.

We conducted a cost and investment survey of routine immunization services in several provinces to understand the direct cost and sources of the investment for China's EPI system. The survey will provide objective data relevant to investment in EPI system for the governments at different levels. Our study was conducted between March and June 2016, and evaluated the total costs of routine immunization services in 2015. We believe that the results will contribute to building a stronger evidence-base for the development of China's National Immunization Program (NIP).

2. Methods

2.1. Setting

We selected 15 of China's 31 provinces at random to be representative provinces for the 3 traditionally-recognized developmental and geographical regions: 5 eastern provinces, 5 middle provinces, and 5 western provinces. From these provinces, we selected at random 3 or 4 counties, for a total of 46 counties in 40 prefectures. We selected at random 2 townships and 1 community from each county, and two villages were randomly selected from each township or community. The study setting was thus comprised of 15 provinces, 40 prefectures, 46 counties, 138 townships or communities and 276 villages.

2.2. Routine immunization cost analysis

RI costs included vaccines and syringes, personnel, cold chain equipment and vaccine management, disease surveillance, communication, training, supervision, and other expenditures (Table 1). Chinese Center for Disease Control and Prevention trained 10 investigators to collect data about costs and financing in 2015 at each level from March to June 2016. The investigators checked purchasing records to determine the costs of vaccines and syringes and cold chain equipment, went through the accounting data to figure out personnel salaries with the help of health facility accountants. Accountants in each facility listed wages and subsidies for EPI staff in 2015. For part-time staff, labor time for RI was assessed with time-related question (e.g., what portion of your working hours is spent on all RI related activities?).

Face-to-face interviews were conducted for EPI managers and financing staff about the operation of routine immunization activities at each level. For surveillance cost, we obtained travel expenditures for VPD case investigations and emergency responses and to determine the costs of sample collection, delivery, and testing. For communications costs, we identified all communications activities and communications materials and determined the expenditures. For training costs, investigators recorded times and expenditures for EPI training courses and meetings. For supervision costs, we identified each RI supervision activity and recorded travel expenditures of the activities.

An ingredients-based, bottom-up approach was used to determine relevant financial immunization costs at the facilities and higher levels of the health system (i.e. central, provincial, prefec-

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