# STUDY ON FEASIBILITY AND LOGISTICS OF VACCINATION WITH TYPHOID VI-VACCINE ON SCHOOL CHILDREN IN NORTH JAKARTA INDONESIA: ANALYSIS OF THE VACCINATION COST

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***ABSTRAK***

*Pembiayaan untuk imunisasi di negara-negara berkembang cenderung mengalami peningkatan, dan diproyeksikan bahwa pada masa yang akan datang akan terjadi peningkatan terus. Pada saat ini pemerintah Indonesia sangat peduli terhadap hal-hal yang menyangkut pembiayaan terutama vaksin untuk anak-anak, dan program-program imunisasi lainnya termasuk vaksin untuk deman tifus. Pencegahan untuk penyakit tifus adalah merupakan keharusan, namun demikian banyak orang meyakini bahwa biaya vaksinasi untuk pencegahan deman tifus adalah mahal. Tujuan dari analisis ini adalah untuk memberikan sumber informasi pilihan, dan untuk memberikan data yang dapat dimengerti yang dianalisis dari data penelitian dan kelayakan dari logistik dan vaksinasi Typhoid Vi-Vaccine terhadap anak-anak usia sekolah di Jakarta Utara Indonesia. Manfaat dari analisis ini adalah pemahaman secara detail dari biaya untuk imunisasi khususnya vaksin tifus untuk anak-anak usia sekolah, dan memberikan bukti kepada pengambil kebijakan sebagai pertimbangan pengembangan program imunisasi khususnya untuk memberantas penyakit deman tifus. Analysis ini menjelaskan bahwa tantangan dari penyelenggaraan penelitian tersebut oleh proyek DOMI (Diseases of the Most Impoverished) belum dapat diaplikasikan sebagai bagian dari program imunisasi di Indonesia khususnya yang diberikan oleh sektor publik. Hal yang penting untuk dapat dipertimbangkan bahwa harga dari vaksin tifus tersebut adalah mahal dan program vaksinasi tifus ini lebih cocok diberikan oleh sektor kesehatan swasta.*

***Kata kunci:*** *Logistik, biaya vaksinasi, demam tifus*

***ABSTRACT***

***Background****: In recent years, Indonesia government has become increasingly concerned with the issues of financing childhood vaccines and immunization programs including vaccine for typhoid fever. The objective of the analysis is to provide alternative resources and to provide understandable data generated from the Study on Feasibility and Logistics of Vaccination School Age Children With Typhoid Vi-Vaccine in North Jakarta Indonesia.* ***Methods****: The analysis was focus on measurement of the cost for vaccinating school children with Typhoid Vi-vaccine from 18 selected primary schools in North Jakarta. The primary source of data was generated from the actual expenditures that were used in the vaccine delivery program in Indonesia.* ***Results****: The Vaccination Cost from the Study on Feasibility and Logistics of Vaccination School Age Children with Typhoid Vi-Vaccine conducted by DOMI project is not applicable for public vaccination program. The program might be feasible to be delivered only in private health sector settings*

***Key words:*** *Immunization expenditure, vaccine for typhoid fever, North Jakarta Indonesia*

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## INTRODUCTION

Immunizations are both a basic public health intervention and a personal health service, benefiting society as well as the protected individual. In contrast with many personal health care interventions, the benefit of immunizations to nearly all individuals is undisputed, and their cost-effectiveness is both documented and widely recognized (Sisk et al., 1997). However since 2000, expenditures for routine immunization in the middle and less income countries have seen an upward trend and are projected to increase in the future. In recent years, Indonesia

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government has become increasingly concerned with the issues of financing childhood vaccines and immunization programs including vaccine for typhoid fever.

Typhoid fever is a systemic infection caused by *Salmonella enterica* serotype Typhi (*S. typhi*). The disease remains an important public health problem in developing countries including Indonesia. In 2000, it was estimated that over 2.16 million episodes of typhoid occurred worldwide, resulting in 216 000 deaths, and that more than 90% of this morbidity and mortality occurred in Asia (Crump, 2004). Prevention through immunization is needed for this disease. Although, many believed that the vaccination cost for preventing typhoid fever is expensive.

The general objective of the analysis is to provide alternative resources and to provide understandable data generated from the Study on Feasibility and Logistics of Vaccination School Age Children With Typhoid Vi-Vaccine in North Jakarta Indonesia for health decision makers. The specific objectives are to analyze the records of the institutional cost acquired the vaccine during the storage, delivery and administration to the school children, including other additional costs and to estimate the average of delivery per child vaccination during the line of the program.

It's also recognized the data with regard to the source of total finance, which was divided into the number of individual/child vaccination. Private costs, which were associated with the vaccination, were also analyzed including the additional cost associated with vaccination activities. Moreover, this study was also measured the opportunity cost of children and teachers, medical costs and transportation costs.

The valuing benefit of this analysis is to understand more details of the cost of immunization particularly the Typhoid Vi-vaccine for school children and to provide evidence for health policy makers in order to consider in developing immunization program particularly for elimination the typhoid fever.

## METHODS

The analysis was focus on measurement of the cost for vaccinating school children with Typhoid Vi-vaccine from 18 selected primary schools in North Jakarta. The primary source of data was generated from the actual expenditures that were used in the vaccine delivery program in Indonesia.

The unprocessed data from the study of the Diseases Of Most Impoverished (DOMI) for financial records, which consisted of budget and expenditure squandered by the vaccination program for school children in North Jakarta in 2004, was analyzed through developing the themes.

There were two major objectives in data arranging on this activity. The first was to calculate a detailed cost per vaccinated individual. The second was to obtain a number for the total cost per vaccinated individual and disaggregate the cost into several components by activities such as vaccination process, cold chain, social promotion and resource types of vaccines, labor cost, supply equipment. Moreover, the costs were collected including data on storage, delivery and administration both actual and opportunity costs of immunization programs.

The data collection process was divided into three categories:

1. The total number of doses administered in a day.
2. The amount of hours spent by each health worker.
3. The quantities of supplies and materials required per vaccination.

The direct expenditure for all resources, which was used in vaccine delivery program such as the utilization of cold chain or other equipments and facilities, was analyzed. The opportunity cost of the teachers who participated in immunization campaign was also analyzed.

The methodology of the study was designed in order to estimate the costs of the inputs as describes in the following table 1 below.

In this study, the cost of introducing typhoid fever for a national immunization program, was analyzed in order to achieve the objectives of the study.

### Vaccine Delivery Activities

This analyzes were disaggregated by activities including direct activities related to vaccination and the supporting activities. The direct chain of events led to the outcome of an individual being vaccinated. The vaccines that produced and transported to the location of immunization, and the vaccines administered to the school children. Each activity used various resources.

The various activities occurred before, during and after the vaccines administered were also analyzed.

**Table 1.** Inputs and Outputs of DOMI Vi-vaccination Program in Jakarta Utara

| Measure | Unit of Measure | Duration of the Study |
|---|---|---|
| Output | Number of individual vaccinated | 2 months |
| Staff | Total compensation given to each category of staff dealing with vaccine delivery | 2 months |
| Vaccine | Quantify of vaccine used measured in quantity units as package and acquired (e.g. vials, doses) | 2 months |
| Capital Item | Physical quantity of each capital good related to vaccine delivery | 2 months |
| Other supplies and Operating expenses | Physical quantity of each community measured in quantity units as acquired (e.q. boxes or gallon) | 2 months |

**Table 2.** The Institutional Cost Components for Two Months Period Project

| Items | Total Expenditure in US$ | Percent |
|---|---|---|
| Personal | 9,401.00 | 14.05 |
| Vaccines | 51,651.83 | 77.19 |
| Equipments and Cold Chain | 1,276.70 | 1.91 |
| 1. Equipment used in vaccination | 51.70 | 0.08 |
| 2. Equipment used in cold chain | 850.00 | 1.27 |
| 3. Miscellaneous equipment | 125.00 | 0.19 |
| 4. Facility space | 250.00 | 0.37 |
| Supply and Miscellaneous Expenditures | 4,586.00 | 6.85 |
| 1. Supplies used in vaccination | 4,550.41 | 6.80 |
| 2. Wasted disposal | 35.63 | 0.005 |
| Total | 66,915.57 | 100 |
| Total vaccines | 4,832 | |
| Average vaccination cost per child | 13.85 | |

For example, before the vaccines administered, the vaccination personnel had received an orientation and training, then they informed the community and encouraged their participation in the vaccination program. Along with vaccination activities, general administration and oversight activities were carried out.

### Vaccination Operational Logistics

The study described and quantified the following measures to assess the logistical feasibility of typhoid immunization in the schools.

- Resources including personnel needed for vaccine procurement, storage and transport and vaccine delivery.
- Efficiency of vaccine storage, transport and handling.
- Safe vaccination practices including vaccine administration and disposal of sharps.

The assessment of resources and personnel needed was conducted by creating a list of items related to vaccine procurement, quantities used, storage, transport and distribution.

The data immunization campaign was analyzed including various items such as vaccines, supplies, consumables and non-consumable materials, and physical facilities at study sites, transportations, publicity, and data management.

This analyzed was come across at the private vaccine costs that were incurred in the household and teachers or other school personnel who involved in the immunization campaign. The type and cost of transportation used on the day of vaccination, time spent at the vaccination center, wage loss due to the vaccination school hours/day missed were also analyzed.

## RESULTS

### Vaccine Acquisition Cost

The project used a single dose of 0.5 ml Vi-polysaccharide typhoid vaccine. Glaxo Smith

Klein donated 5,250 doses and 4,832 out of them were administered 344 vaccines were returned at the end of the project and 38 vaccines were destroyed during the vaccination. Price per unit of vaccine was Rp. 84.849. (US$10.61) including 10% value added tax. This project, assumed control of vaccine was administered at study sites in 18 selected primary schools in North Jakarta.

**The institutional Cost Components and Cumulative Costs Incurred During Storage, Delivery and Vaccination**

In general, there are three different categories of costs allocated to vaccination program, which consisted of investment, maintenance and operational for vaccination program. However, in this study, the resources were utilized for short duration (two months), and all capital goods belong to the EPI facilities. Results of the study estimated all capital goods (building space and cold chain equipments) as actual rented by adjusting the replacement cost of each capital items (for cold chain equipments) or by adjusting the rental price of building space for neighboring office buildings. Thus, all inputs used in this project were calculated as operational costs.

Table 2 depicted the institutional cost component for two-month period of vaccination campaign. For institutional costs, the highest share of cost was the vaccines item (77.19%) followed by personnel cost (14.05%) and supply and miscellaneous expenditures (6.85%) and equipment and cold chain costs (1.91%).

**The Private costs associated with the DOMI Vi-Vaccines Project**

The following tables present the results of the assessment of private vaccine costs incurred by the household, teachers and other school staffs due to delivery of the DOMI vi-vaccination project.

The average number of school staffs participating for that study was 9 persons and those persons allocated 925.11 minutes for supporting 252 students,

**Table 3.** The average time allocated by school staffs per vaccinated student in Jakarta Utara

| Schools | Number of Student Vaccinated | Number of School Staff Participating in the project | Time allocated minutes | Time allocated per staff (minutes) |
|---|---|---|---|---|
| Rawa Badak Utara 08 Petang | 99 | 6 | 1025 | 1.73 |
| Rawa Badak Utara 13 Pagi. | 238 | 8 | 930 | 0.49 |
| Rawa Badak Utara 03 Pagi. | 237 | 9 | 935 | 0.44 |
| Rawa Badak Utara 15 Pagi | 239 | 9 | 1170 | 0.54 |
| Sunter Agung 01 Pagi | 261 | 8 | 835 | 0.40 |
| Rawa Badak Utara 17 Pagi | 247 | 10 | 1325 | 0.54 |
| Sunter Agung 13 Pagi | 414 | 12 | 840 | 0.17 |
| Tanjung Priok 01 Pagi | 225 | 6 | 650 | 0.49 |
| Tanjung Priok 06 Petang | 118 | 8 | 400 | 0.42 |
| Sunter Agung 03 Pagi | 185 | 9 | 807 | 0.48 |
| Rawa Badak Utara 24 | 293 | 9 | 535 | 0.20 |
| Tugu Selatan 01 Pagi | 245 | 9 | 860 | 0.39 |
| Tugu Selatan 02 Petang | 308 | 10 | 820 | 0.27 |
| Warakas 05 Pagi | 279 | 10 | 1415 | 0.53 |
| Warakas 01 Pagi | 318 | 13 | 995 | 0.24 |
| Sunter Agung 05 Pagi | 224 | 8 | 830 | 0.46 |
| Rawa Badak Utara 19 Pagi | 322 | 11 | 1415 | 0.40 |
| Warakas 07 Pagi | 292 | 10 | 785 | 0.27 |
| Total | 4545 | 165 | 16652 | |
| Avarage | 2525 | 9.17 | 925.11 | |
| Average time allocated per staff per student | | | | 0.32 |

who were vaccinated by the DOMI vi-vaccine campaign. On average time, each school staff allocated 0.02 minutes for supporting each student. All selected schools provided one class for vaccinating, and all selected students in each school took around 3 hours per day.

The average time spent by the observed student was 26 minutes. It means that the students, who left one school program/subject on vaccination day, could continue the daily learning process in the class.

Since the program was conducted in the public schools, there was no replacement class or activity for delayed or postponed class activities due to the program. The opportunity cost of teachers, other school staffs or students was zero.

## DISCUSSION

The study of DOMI vaccine demonstration, most of costs were observable and directly attributable to the vaccination. However, all input used in the production of this program were used in very short time period, so that the results were more likely not the case for the proposed cost that will be used in the general practice. In such case, the total cost of resources used in this project was quite efficient and need adjustment in such a way for a real implementation.

In weighing the pros and cons of Vi use in North Jakarta, the “pros” include the fact that typhoid is clearly endemic in the country, children in North Jakarta were shown to be at high risk, and a safe, single-dose vaccine exists. The “cons” include: the need for more local incidence data, the relatively low perceived case fatality from the disease (1-2%), a vaccine efficacy of <80%, and the need to produce the vaccine locally to make it affordable (Merieux Foundation, 2007).

The issues of how to measure the impact of mass vaccination and the need to have a longer term plan following initial catch-up vaccination of school children were raised during the discussion. An Indonesian participant suggested getting private physicians to report typhoid cases and examining school absenteeism rates pre- and post-vaccination as possible means of measuring impact.

A bigger coverage and a longer period of the program implementation would help to measure the real allocation of costs which are covered the investment, maintenance and operational of the program.

## CONCLUSION

The findings have confirmed the challenges of The Vaccination Cost from the Study on Feasibility and Logistics of Vaccination School Age Children With Typhoid Vi-Vaccine conducted by DOMI project is not applicable for public vaccination program. The important insight which should be considered in this case is typhoid vaccine price is quite high so that the typhoid vaccination program might be feasible to be delivered only in private health sector settings.

## REFERENCES

Crump JA, Luby SP, Mintz ED. The global burden of typhoid fever. *Bull World Health Organ* 2004; 82: 346–53.

DeRoeck D. and Leven A. (1998). Review of Financing of Immunization Programs in Â Developing and Transitional Countries. PHR. Abt Associates Inc. Bethesda, Maryland USA.

Lydon P. (2006). Immunization Financing Analyzes. A look across 50 countries. WHO Immunization and Vaccines Biologicals.

Khaleghian P (2001). Immunization Financing and Sustainability: A Review of the Literature. Partnership for Health. USAID.

Levin A, England S, Jorissen J, Garshong B, Teprey J. (2001). Case Study on the Cost and Financing of Immunization Services in Ghana. Partners for Health Reformplus. Maryland Baltimore. USA.

Merieux Foundation (2007). Report of the Meeting on Typhoid Fever, a Neglected Disease: Towards a Vaccine Introduction Policy *Annecy, France, Les Pensières*, April 2–4, 2007

Ochiai LR, Acosta CJ, Danovaro-Holliday MC, Baiqing D, Bhattacharya SK, Agtini MD, Bhutta ZA, Clemens JA, the Domi Typhoid Study Group (2008). A study of typhoid fever in five Asian countries: disease burden and implications for controls. Bulletin WHO. Volume 86, Number 4, 241–320

Rokx C, Schieber G, Harimurti P, Tandon A, Somanathan A. (2004). Health Financing in Indonesia. The World Bank.