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Estimation of immunization providers' activities cost, medication cost, and immunization dose errors cost in Iraq

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ABSTRACT

The immunization status of children is improved by interventions that increase community demand for compulsory and non-compulsory vaccines, one of the most important interventions related to immunization providers. The aim of this study is to evaluate the activities of immunization providers in terms of activities time and cost, to calculate the immunization doses cost, and to determine the immunization dose errors cost. Time-motion and cost analysis study design was used. Five public health clinics in Mosul-Iraq participated in the study. Fifty (50) vaccine doses were required to estimate activities time and cost. Micro-costing method was used; time and cost data were collected for each immunization-related activity performed by the clinic staff. A stopwatch was used to measure the duration of activity interactions between the parents and clinic staff. The immunization service cost was calculated by multiplying the average salary/min by activity time per minute. 528 immunization cards of Iraqi children were scanned to determine the number and the cost of immunization doses errors (extraimmunization doses and invalid doses). The average time for child registration was 6.7 min per each immunization dose, and the physician spent more than 10 min per dose. Nurses needed more than 5 min to complete child vaccination. The total cost of immunization activities was 1.67 US$ per each immunization dose. Measles vaccine (fifth dose) has a lower price (0.42 US$) than all other immunization doses. The cost of a total of 288 invalid doses was 744.55 US$ and the cost of a total of 195 extra immunization doses was 503.85 US$. The time spent on physicians' activities was longer than that spent on registrars' and nurses' activities. Physician total cost was higher than registrar cost and nurse cost. The total immunization cost will increase by about 13.3% owing to dose errors.

1. Introduction

The goal of the immunization system is to increase the number or proportion of children who are immunized by all vaccination doses under the context of child health care [1–3]. The proportion of fully immunized children is related to the health clinic activities of primary care staff. For this reason, immunization-related activities must be taken into account.

All children should have made more than five health-care visits for immunization by the age of 2. These visits are necessary for childhood care because vaccinations, physical checkups, and other essential immunization services are given during this period [4–9].

The United States Preventive Services Task Force recommended 25 visits for healthy children and 34 interventional visits for unhealthy children through well-child care [10]. The American Academy of Pediatrics, on the other hand, recommends six interventional visits in the first year of life. However, most children make less than five visits and poor children make even fewer visits [4–9].

As well as the number of visits, the duration of visits also needs to be measured. The number of visits multiplied by time duration of each visit provides an estimation of the time needed to complete the immunization process in a child health-care program [11]. LeBaron et al. [11] recommended three parameters for measuring visit duration time: the mean length of the immunization visit, the time spent on the immunization visit by each member of staff, and the duration taken for discussion. In addition, the cost of vaccination is important in improving the status of child immunization.

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Table 1
Immunization-related activities.

Immunization registry activities	Physician activities	Nursing activities
1) Enter history and demographic data. 2) Prepare for upcoming appointments. 3) Solve registry problems.	1) Child checks up. 2) Vaccination discussion. 3) Enter injections into registry database.	1) Health care discussion. 2) Review medical record for vaccination history. 3) Physical examination. 4) Complete vaccination log in chart. 5) Give vaccine.

If free public health clinics and free vaccines for children became available, the proportion of children with full immunization compliance would increase among the population [2,3,12]. Many incentives influence the immunization profile. The immunization rate in adults and the up-to-date immunization rate in children will improve with financial incentives [13–15].

Many studies hypothesized that different types of immunization providers and the cost of these providers will influence child healthcare willingness [1,11,16]. Thus, it is necessary to determine the variable costs of vaccine administration by different providers.

Table 2
Vaccine cost (medication cost).

Vaccine name	Vaccine container	Vaccine cost per dose (US$)
BCG	0.5 mg/1.0 ml 20 doses/set	0.245
OPV	Box of 10 vials of 20 doses	0.15
HEP. B	10 doses/vial	0.45
DTP	Box of 10 vials of 10 doses	0.51
MMR	Box of 10 vials of 10 doses + diluents	1.22
Measles	Box of 10 vials of 10 doses	0.42

1 United States Dollar (US$) = 1118 Iraqi Dinar (ID).

2. Method

2.1. Immunization service system costs

Five public health clinics in Mosul participated in the study. The health clinics varied in location and size. Each clinic had two staff members for registration, while the number of physicians in the participating clinics ranged from two to four, and the number of nurses ranged from five to eight. As shown in Table 1, each staff member had their own activities related to immunization.

Micro-costing method was used in this study because it estimated two types of cost; variable and fixed cost, time and cost data were collected for each immunization-related activity (variable cost) performed by the clinic staff, as well as the cost of immunization doses (fixed cost). All staff members from each health clinic were required to complete time diaries in order to record all immunization activities undertaken for a minimum of 2 days, or for 50 vaccine dose administrations. Fifty (50) vaccine doses were required to achieve stability of the time and cost estimates.

A stopwatch was used to measure the duration of activity interactions between the parents and clinic staff (medical register, physicians, and nurses). All were aware that time measurements were being performed and they had all been informed that the aim was to determine differences in the duration of activities. Activities outside of the specified interactions were not recorded (waiting, telephone calls, obtaining supplies). Average salaries were used to convert time into costs [17]. In order to calculate activity time and costs associated with vaccination administration, the averaged times reported for each activity across all health clinics were used. Then, the immunization service cost was calculated by multiplying the average salary/min by activity time per minute. For example, if the monthly salary of a nurse was 300 US$ and the nurse was worked 20 days/month, 4 h/day or 240 min/day, then 4800 min/month. The cost of the nurse was 0.0625 US$/min; if the immunization required 20 min, then the cost of the immunization activity for this nurse was 0.13 US$.

2.2. Medication costs

This part of the study comprised a fixed medication cost study. This study analysed six types of vaccines and the cost or price of each vaccine was provided by the Ministry of Health, as shown in Table 2. The children received seven immunization doses; each immunization dose contained one or more than one type of vaccine. To determine the immunization dose costs, the cost of the vaccines included in each dose was calculated.

Table 3
Immunization system service time and cost.

Activities	Staff	Mean time spent per shot (min)	% from total time	Cost per shot (US$)	% from total cost
• Enter history and demographic data	Registrar	2.6	11.5%	0.101	6%
• Prepare for upcoming appointments	Registrar	1.8	8%	0.07	4.2%
• Solve registry problems	Registrar	2.3	10.3%	0.09	5.4%
Total registrar activities		**6.70 ± 1.99**	**29.8%**	**0.261**	**15.6%**
• Child checks up	Physician	4.4	19.6%	0.484	29%
• Vaccination discussion	Physician	3.9	17.3%	0.426	25.5%
• Enter injections into registry database	Physician	2.2	9.8%	0.242	14.4%
Total physician activities		**10.48 ± 3.09**	**46.7%**	**1.152**	**68.9%**
• Health care discussion	Nurse	1.15	5.1%	0.056	3.4%
• Review medical record for vaccination history	Nurse	0.6	2.9%	0.029	1.8%
• Physical examination	Nurse	1.2	5.3%	0.059	3.5%
• Complete vaccination log in chart	Nurse	1.1	4.9%	0.054	3.3%
• Give vaccine	Nurse	1.2	5.3%	0.059	3.5%
Total nurse activities		**5.25 ± 1.60**	**23.5%**	**0.257**	**15.5%**
Total		22.43	100%	1.67[a]	100%

[a] Total costs per one visit were 1.67 US$. Note: vaccination card cost is 0.85 US$.