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Cost of Delivering Child Immunization Services in Urban Bangladesh: A Study Based on Facility-level Surveys

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ABSTRACT

This facility-based study estimated the costs of providing child immunization services in Dhaka, Bangladesh, from the perspective of healthcare providers. About a quarter of all immunization (EPI) delivery sites in Dhaka city were surveyed during 1999. The EPI services in urban Dhaka are delivered through a partnership of the Government of Bangladesh (GoB) and non-governmental organizations (NGOs). About 77% of the EPI delivery sites in Dhaka were under the management of NGOs, and 62% of all vaccinations were provided through these sites. The outreach facilities (both GoB and NGO) provided immunization services at a much lower cost than the permanent static facilities. The average cost per measles-vaccinated child (MVC), an indirect measure of number of children fully immunized (FIC—the number of children immunized by first year of life), was US$ 11.61. If all the immunization doses delivered by the facilities were administered to children who were supposed to be immunized (FVC), the cost per child would have been US$ 6.91. The wide gap between the cost per MVC and the cost per FVC implies that the cost of immunizing children can be reduced significantly through better targeting of children. The incremental cost of adding new services or interventions with current EPI was quite low, not significantly higher than the actual cost of new vaccines or drugs to be added. NGOs in Dhaka mobilized about US$ 15,000 from the local community to support the immunization activities. Involving local community with EPI activities not only will improve the sustainability of the programme but will also increase the immunization coverage.

***Key words*:** Immunization; Costs and cost analysis; Health facilities; Non-governmental organizations; Community participation; Bangladesh

INTRODUCTION

The Expanded Programme on Immunization (EPI) aims to reduce morbidity and mortality from six vaccine-preventable diseases: tuberculosis, diphtheria, pertussis, tetanus, measles, and poliomyelitis. A fully-immunized child (FIC) receives six standard EPI antigens through eight vaccinations given in the first year of life. The recommended schedule is: one shot of Bacille Calmette Guerin (BCG) at birth, three doses of oral polio vaccine (OPV) together with three shots of diphtheria-pertussis-tetanus (DPT) at age 6, 10, and 14 weeks, and one shot of measles vaccine at age 9 months. Along with these six antigens, the routine EPI also included

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two doses of tetanus toxoid (TT) for pregnant women and one dose of vitamin A for children at the time of the study. The main EPI programme (the routine EPI) is supplemented by other interventions, such as National Immunization Day (NID), mop-up after NID, acute flaccid paralysis (AFP) surveillance, and maternal and neonatal tetanus (MNT) surveillance.

EPI has reduced morbidity and mortality from vaccine-preventable diseases in Bangladesh, but little is known about costs and effectiveness of urban EPI. A comprehensive review in 1998 and two studies on the cost-effectiveness of the Bangladesh EPI have pointed out the need for collecting cost information from urban areas (1-4). Unlike rural Bangladesh, urban EPI is delivered through a partnership between the public sector and the private sector. In fact, the private service providers, especially NGOs, play such an important role in urban EPI that estimates based on national-level expenditure or cost data will be a significant underestimate of total costs if the contribution of NGOs is not included. However, the exact level of involvement of NGOs in EPI delivery was not known at the time of the study. The national-level data do not include all the costs incurred by NGOs and, therefore, an attempt to estimate the costs of urban EPI will be extremely useful for calculating the actual cost of immunization in Bangladesh.

MATERIALS AND METHODS

Study design and sampling

This facility-based study estimated the costs of providing routine EPI services from the perspective of EPI service providers. A comprehensive list of all the facilities involved in the delivery of EPI services in Dhaka city was used as the sampling frame to select a random sample of facilities. The then Urban Health Programme of ICDDR,B prepared the list to better understand the supply environment of primary healthcare services in Dhaka city (5). Information contained in the list was used for stratifying the EPI delivery sites by type (static and outreach) and location (zone within Dhaka city). For the classification of the EPI sites by type, health centres operating one day or less per week were defined as outreach sites, while all others were categorized as static sites. From each of the strata defined, 25% of the facilities, chosen at random, generated a sample of 132 EPI delivery sites. The classification of health facilities by ownership (government/NGO) could not be carried out prior to drawing of the sample due to lack of information. Since the study selected a large proportion (25%) of all EPI sites, the results of the survey should indicate the relative importance of the Government of Bangladesh (GoB) and NGO service providers in urban Dhaka.

Data collection

Facility-based data were collected from the EPI delivery sites for 1999. Two approaches were followed for collecting data on the use of resources, costs, and number of immunizations delivered. The first approach obtained information on the use of resources and the number of vaccinations administered from the record-keeping and accounting books of the facility. The second approach interviewed facility staff to obtain relevant additional information. In most cases, the manager or the vaccinator of the facility was interviewed. To ensure that the enumerators collect all the relevant data from the health facilities, a structured questionnaire was designed. The cost part of the instrument collected data on all the resources used in the process of delivering EPI services, including donated items, volunteer time, resources provided through other health activities, and space provided by the communities. The resources reviewed included a comprehensive list of capital and recurrent items. The capital items of EPI included vehicle, equipment, e.g. refrigerator, cold boxes, etc., furniture, e.g. tables, chairs, etc., and training of facility staff to increase human capital endowment (long-term training leading to a diploma or a degree). The recurrent items of EPI included salary (salaries and benefits of manager, vaccinator, physician, etc.), rent (rent, utilities, operation, and maintenance), vaccines, supplies, e.g. syringe, ice-pack, etc., transport, and recurrent training (short-term training for maintaining skills and knowledge of the service providers). For obtaining the annualized value of land and buildings, the study collected information on the current rent for all facilities. If the facility was owned by the service provider rather being rented from others, e.g. GoB facilities, the rent value for the facility was imputed at the average rent for sites of the same type (static/outreach) and location (zone).

Capital costs were annualized using a discount rate of 5%, and the economic life of all EPI-relevant capital items was assumed to be five years. For health-sector cost-effectiveness analysis, most researchers prefer

using a low discount rate of 3-5%. Since a number of EPI costing studies used a 5% discount rate, using the same rate will allow an easy comparison of results of the study with prior studies. For non-exclusive resources, such as resources used in delivery of other primary healthcare services as well, costs were apportioned to EPI based on the proportion of time spent by the service providers on EPI activities. Cost data obtained were for 1999. All the local currency values were converted into US dollars using the 1999 exchange rate of US$ 1.00=Tk 49.50 (6). For costing the vaccines, the 1997 UNICEF prices were inflated by a factor of 2.5% per year. The survey collected information on other variables relating to EPI service-delivery, such as days of operation of the facility per year, hours of operation per day, and number of vaccines delivered per year. This study did not collect any information on household-level costs, such as travel costs of the mother and child to the EPI delivery facility.

RESULTS

EPI delivery sites and EPI sessions

The EPI delivery sites were usually located in or near residential areas of urban Dhaka. A typical static facility was located in a large building with multiple rooms providing health and non-health services to the population in the area. The types of services delivered include: maternal and child health services, curative care, family planning, microcredit activities, literacy sessions, etc. A typical outreach facility was located in a much smaller building in a residential area not well-connected to other parts of the city by main roads. Outreach sites do not have resident EPI staff, and teams travel there from other static sites.

Of the 132 sites surveyed by the study, less than a quarter were GoB-run facilities, and about 60% of all the sites were NGO-run outreach centres. In 1999, 38% of 11,028 EPI sessions in the surveyed sites were organized by the government static sites, 3% by the government outreach sites, 29% by the NGO static sites, and 31% by the NGO outreach sites. On average, the EPI delivery sites organized 84 (range 12-288) EPI sessions per site per year. NGOs played a very important role in the delivery of EPI services in urban Dhaka. About 77% of the EPI delivery sites in Dhaka city were under the management of NGOs, and these sites organized 60% of the EPI sessions. The predominance of NGOs in the delivery of EPI in urban Bangladesh is in sharp contrast to the delivery structure in rural areas, where it is almost exclusively a publicly-run programme.

Cost of EPI services

The cost of EPI service-delivery by various cost items is shown in Table 1. The total annual cost of routine EPI services in the surveyed EPI delivery sites was US$ 467,171. The capital cost constituted 24% of the total cost. Since EPI is a labour-intensive programme, personnel cost constituted 51% of the total cost. Table 1 shows that about 53% of the total EPI cost in urban Dhaka was due to the activities of NGOs. If we consider cost allocation within the GoB and NGO structures, about half of all EPI costs in the NGO sector was due to service-delivery through the outreach sites, while it was only 8% for the government sector outreach sites. This indicates the emphasis NGOs assign on delivering EPI services from outreach sites rather than from static sites.

Table 2 reports the average cost per facility by ownership-type and facility-type categories. The average cost of running an EPI facility was US$ 3,500 per year in Dhaka city in 1999. However, the costs varied significantly by ownership type, i.e. whether the facilities were run by NGOs or GoB. In general, the static sites were more expensive to organize than the outreach sites for both the GoB and NGO sectors. The average cost of running a static and an outreach delivery site was about US$ 7,500 and US$ 2,100 respectively. The cost of running a GoB static site was US$ 8,300 compared to US$ 6,500 for NGOs. NGOs needed less money to run the outreach sites—US$ 1,300 per site per year—compared to US$ 2,900 for the government sites. The NGO outreach sites had a much lower salary cost, as they usually had only vaccinators to provide services. As expected, the permanent static sites used capital items much more intensively than the outreach sites. On average, the capital cost of the static sites was about 30% of the total EPI cost and only about 5% for outreach sites.

Effectiveness of delivery structure

Table 3 presents a number of effectiveness or output measures of urban EPI. The surveyed EPI delivery sites provided 508,188 vaccinations through 11,028 EPI sessions in 1999. The distribution of the number of vaccinations administered was as follows: BCG 10%, DPT 24%, OPV 30%, measles 7%, vitamin A 13%, and TT 15%. The highest number of vaccinations was due

Table 1. Total annual cost (US$) of immunization in surveyed sites in 1999

Cost	GoB static (n=24)	GoB outreach (n=6)	NGO static (n=22)	NGO outreach (n=80)	Total cost (n=132)	% of total cost
Capital cost						
Vehicle	0	0	212	300	512	0.11
Equipment	1,913	127	4,341	2,687	9,067	1.94
Furniture	46,392	106	2,584	1,071	50,154	10.74
Training (non-recurrent)	26,397	0	21,998	4,400	52,794	11.30
Subtotal	74,702	233	29,134	8,457	112,526	24.20
Recurrent cost						
Salary	90,740	13,480	73,622	59,308	237,149	51
Rent	7,585	507	9,143	3,624	20,860	4.47
Vaccine	24,904	2,669	29,895	29,568	87,036	18.63
Supplies	944	148	1,129	1,560	3,781	0.81
Training (recurrent)	380	202	970	1,846	3,398	0.73
Transport	1,078	144	631	568	2,421	0.52
Sub-total	125,631	17,150	115,390	96,474	354,645	75.80
Total cost	200,333	17,383	144,524	104,931	467,171	

GoB static: Government-run static sites; GoB outreach: Government-run outreach sites; NGO static: NGO-run static sites; NGO outreach: NGO-run outreach sites

to the delivery of OPV, and the lowest was for measles. DPT and OPV doses were supposed to be delivered together, but the number of DPT doses delivered was about 19% lower than that of OPV. This probably indicates the relative difficulty of delivering injectables compared to an oral vaccine. Table 3 indicates that 34% of all vaccinations was carried out by the government static sites, 4% by the government outreach sites, 38% by the NGO static sites, and 24% by the NGO outreach sites. The static sites immunized more children and women compared to the outreach sites for all six antigens in the routine EPI. On average, 46 vaccinations were provided per EPI session organized or about 12 vaccinations per hour of session. A number of delivery sites reported zero vaccinations during their EPI sessions. An EPI session providing no vaccination at all indicates the presence of slack time of EPI delivery staff due to lack of demand. All the EPI delivery sites also reported a significant wastage of vaccines, and the wastage rates were used for estimating the total cost of immunization.

Table 2. Average cost (US$) per facility by type and ownership of facility in 1999

Cost	GoB static	GoB outreach	NGO static	NGO outreach	Average cost/site
Mean capital cost					
Vehicle	0	0	10	4	4
Equipment	80	21	197	34	69
Furniture	1,933	18	117	13	380
Training (non-recurrent)	1,100	0	1,000	55	400
Sub-total	3,113	39	1,324	106	852
Range	12-44,548	11-59	26-13549	6-4435	6-44548
Mean recurrent cost					
Salary	3,781	2,247	3,346	741	1,797
Rent	316	85	416	45	158
Vaccine	1,038	445	1,359	370	659
Supplies	39	25	51	20	29
Training (recurrent)	16	34	44	23	26
Transport	45	24	29	7	18
Sub-total	5,235	2,858	5,245	1,206	2,687
Range	1,493-47,958	808-4,141	556-13,829	278-6,427	278-47,958
Total (mean)	8,347	2,897	6,569	1,312	3,539
Range	1,601-49,507	838-4,187	592-23,235	312-6,670	312-49,507

Table 3. Total annual number of vaccinations delivered by type and ownership of facility in 1999

Vaccine	GoB static (n=24)	GoB outreach (n=6)	NGO static (n=22)	NGO outreach (n=80)	Total A	Vaccination/ facility B=A/132	Vaccination/ session C=A/11,028	Vaccination/ hour of session D=C/4*
BCG	18,276	1,500	17,580	14,256	51,612	391	4.68	1.17
DPT	47,352	5,424	45,780	25,884	124,440	943	11.28	2.82
OPV	59,892	6,240	53,760	33,912	153,804	1,165	13.95	3.49
Measles	15,228	1,668	11,424	8,988	37,308	283	3.38	0.85
Vitamin A	12,672	2,712	31,092	19,368	65,844	499	5.97	1.49
TT	21,876	2,364	31,284	19,656	75,180	570	6.82	1.71
Total	175,296	19,908	190,920	122,064	508,188	3,850	46.08	11.52

*The number of facilities surveyed was 132, and these facilities organized 11,028 sessions during 1999. Since the average duration of a session was 4.0 hours, total hours of sessions can be calculated by multiplying the number of sessions by 4
BCG=Bacille Calmette Guerin; DPT=Diphtheria-pertussis-tetanus; OPV=Oral polio vaccine; TT=Tetanus toxoid

Average cost of delivering EPI

Using the numbers reported in Tables 1 and 3, we can calculate the average cost per unit of output produced by the EPI delivery sites. Table 4 reports the average costs per unit of various outcome measures. The average cost per EPI session in 1999 was about US$ 42, while the average cost per dose administered, excluding vitamin A and tetanus toxoid, was US$ 1.18. Since measles is the last vaccine a child should get in the EPI schedule, the number of children immunized against measles can be used as an indirect measure of fully-immunized children. The average cost per measles-vaccinated child (MVC) was US$ 11.61, and the average cost was lower for the NGO facilities compared to that for the government facilities. We do not have any information on the number of children fully immunized by 12 months of life (FIC). In our sample, the estimated number of children immunized against BCG, DPT, OPV, and measles was 51,612, 41,480, 51,268, and 37,308 respectively. Since the number of children immunized against measles was lower compared to other vaccinations, we can use MVC as a rough guide of FIC. Therefore, US$ 11.61 may be considered an approximation of per FIC cost in urban Dhaka.

Table 4 also reports a hypothetical number, cost per FVC, and cost of providing all the EPI vaccinations to all infants without incomplete vaccinations (some children receiving only few vaccines) or double-dosing. This hypothetical cost per FVC is simply the total cost of providing three doses of DPT, three doses of OPV,

Table 4. Average cost (US$) per unit of output in 1999

Cost	GoB static	GoB outreach	NGO static	NGO outreach	Average cost
Cost per session	48	60	46	31	42
Cost per hour of session	11.56	17.25	7.92	8.00	10.06
Cost per dose (without TT and vitamin A)	1.40	1.13	1.02	1.06	1.18
Cost per dose (with TT and vitamin A)	1.14	0.87	0.76	0.86	0.92
Cost per FVC	8.07	6.81	6.19	6.16	6.91
Cost per MVC (without TT and vitamin A)	12.93	10.07	11.50	9.80	11.61
Cost per MVC (with TT)	13.05	10.17	11.65	9.97	11.75
Cost per MVC (with vitamin A)	13.03	10.32	12.51	11.51	12.38
Cost per MVC (with TT and vitamin A)	13.16	10.42	12.65	11.67	12.52

Cost per session and cost per hour of session include TT and vitamin A
Tables with numbers of EPI sessions and hours of EPI session not shown
Cost per dose (without TT and vitamin A)=[total cost–TT vaccine cost–vitamin A vaccine cost–transport cost*2/6–supply cost*3/10] / [total dose–TT dose–vitamin A dose]
Cost per MVC (without TT and vitamin A)=[total cost–TT vaccine cost–vitamin A vaccine cost–transport cost*2/6–supply cost*3/10] / [measles dose]
Cost per MVC (with TT)=[total cost–vitamin A vaccine cost–transport cost*1/6–supply cost*1/10]/[measles dose]
Cost per MVC (with vitamin A)=[total cost–TT vaccine cost–transport cost*1/6–supply cost*2/10]/[measles dose]
FVC=Fully vaccinated child; MVC=Measles-vaccinated child

one dose of BCG, and one dose of measles vaccines to a child. FVC was computed in two steps: first, cost per specific antigen was calculated, and then FVC was computed (Tables 5 and 6 in Appendix). The average estimated cost per FVC is only about US$ 6.91, implying that many children received partial immunizations (lower completion rate due to drop-outs), and some might have received the same vaccines more frequently than the EPI schedule suggests. The cost per MVC (US$ 11.61), in general, should be close to the hypothetical cost per FVC (US$ 6.91) in the absence of significant partial vaccinations or double-dosing. The high cost of MVC compared to the hypothetical minimum cost indicates that the system (for both GoB and NGOs) can be made much more effective if children are identified and vaccinated in a timely manner without significant mistargeting or double-dosing. For the purpose of estimating the costs without mistargeting or double-dosing, it is not necessary to identify the mistargeted cases. If the number of children receiving measles vaccination were fully immunized, we can calculate the total vaccination cost for the cohort. The ratio of this hypothetical cost and actual cost may be used as a measure of degree of mistargeting by both GoB and NGOs.

Cost per vaccinated child, either the cost per MVC or the hypothetical cost per FVC, can be used as a measure of efficiency of the EPI delivery system. Table 4 indicates that the cost per MVC was the highest (US$ 12.93) for the government static sites and was the lowest (US$ 9.80) for the NGO outreach sites. Between the government and the NGO delivery structures, the NGO static facilities were more cost-effective (US$ 11.50) than the government static facilities (US$ 12.93). The NGO outreach sites were also more cost-effective than the government outreach sites (US$ 9.80 and US$ 10.07 per MVC respectively). If the cost of delivering TT vaccines is included with other vaccines, the average cost per MVC increases by about 14 cents. If the cost of distributing vitamin A is added, the average cost per MVC increases by 77 cents. Therefore, adding these other services with the traditional vaccine does not increase the cost per child significantly. The incremental cost of adding a new vaccine will be slightly higher than the cost of the vaccine itself. The additional cost of administering the vaccine or distribution of vitamins appears relatively low.

Financing of EPI

The EPI activities of the Ministry of Health and Family Welfare (MoHFW), GoB, are supported by a donor consortium comprising GoB, World Bank, United Nations Children's Fund, World Health Organization, U.S. Agency for International Development, Japanese International Cooperation Agency, and Department for International Development-UK. Additional donor involvement was found in the surveyed EPI delivery sites of Dhaka City Corporation (DCC), such as Norweigian Aid, Swedish International Development Agency, Ford Foundation, Action Aid, etc. These additional sources of support can be categorized into three groups: (a) agencies providing both monetary and logistical (vaccines, supplies, training) support, (b) agencies providing only monetary support, and (c) agencies providing only logistical support. The resources received by all EPI service implementers from the EPI Headquarters were vaccines, supplies, EPI-related training, and some capital equipment. If we exclude these common resources, the additional resources that NGOs mobilized for EPI were about US$ 177,460 for the surveyed facilities. If we project this cost for urban Bangladesh, the additional resources mobilized by NGOs for EPI services become US$ 1.4 million. Since these resources do not show up in the macro-level cost accounting of EPI, the cost of delivering EPI is usually underestimated. Furthermore, NGOs in Dhaka were able to generate about US$ 15,000 (of US$ 177,460) from local community resources. This was estimated from the resources used by the NGO outreach sites where most space (rent) and furniture were provided by the local community, such as a room in private households, schools, pharmacy, cultural clubs, etc. Thus, even the poor communities of the city can potentially support some EPI activities.

DISCUSSION

EPI is one of the most cost-effective health interventions with high potential benefits and low costs (3,4,7-12). Most cost studies of EPI used national- or regional-level secondary data without supplementing information by collecting facility-level data. This study estimated the cost of delivering EPI in urban Bangladesh using facility-based surveys. The survey results indicate that the secondary data sources would have underestimated the urban EPI costs by at least 40-50%. The NGO outreach-delivery structure is highly dependent on community-level resources, and none of these are accounted for in the secondary data. Even the government delivery system solicits additional resources from the communities around their outreach sites. Despite the underestimation of costs, EPI remains a highly cost-effective intervention. If we use cost per MVC as a

measure of cost per fully-immunized child, the cost remains less than US$ 15 per child. This excludes the societal costs of vaccination that were not assessed in this study.

An important conclusion of this study is that it is feasible to generate a significant amount of local resources for delivering EPI services. All the NGO outreach sites mobilized resources from the communities in which they work. Therefore, it is feasible to generate some local resources even from poor regions for conducting immunization services. Involving the local community with EPI activities not only will improve the sustainability of the programme but will also help increase rates of immunization coverage. Furthermore, in the absence of community involvement, GoB and NGOs would have to supply these resources, especially if emphasis is put on the delivery of EPI through static sites. The additional resources generated by NGOs included resources from local communities and from additional donor agencies. The estimated additional resource generated by NGOs in urban Bangladesh was about US$ 1.4 million per year. If we add this cost with the estimates of Levin *et al*. (4), total cost of EPI for Bangladesh becomes about US$ 31 million, about 6% higher than their estimate. Although it is not a very significant increase in total cost, it is important to derive the actual resource use in the EPI programme for planning and policy analysis.

If the average costs of delivering different types of services are considered, it is clear that the outreach facilities (both government and non-government) are more cost-effective than the static facilities. The NGO-outreach sites delivered EPI services at the lowest average cost, probably due to the externality created by community participation, using capital items less intensively and having minimal staff providing services. It is usually assumed that the public sector must organize and deliver preventive services, especially in poor countries where the demand for preventive services is expected to be low. The fact that NGOs delivered 62% of all immunizations in urban Dhaka clearly demonstrates no inherent disadvantage of NGOs compared to the public sector in providing immunization services. Furthermore, NGOs in Dhaka delivered EPI services at a lower cost than the government sites, which suggests that NGOs can successfully organize and deliver preventive services in a poor community and, in the case of urban Dhaka, they were more efficient than the GoB.

Another important finding of the study is that the incremental cost of adding services should not be significantly higher than the actual cost of new vaccines or drugs to be added. The new vaccine will obviously increase the cost of acquiring the commodities and supplies, but the current delivery structure has enough slack in the system to be able to deliver the new vaccine without employing additional personnel or other inputs. For example, the number of vaccine doses delivered, including the distribution of vitamin A capsules, was less than 12 per hour of EPI session in urban Dhaka. This number can be increased by 50% without changing the size of the facilities or the number of personnel involved with delivery.

This study also indicates that the current EPI delivery structure could be made more efficient. Apart from the wastage of vaccines and slack time of personnel, better targeting of children alone should significantly lower the average cost of EPI. If the completion rate of vaccination can be improved and double-dosing avoided, cost per MVC should decline to about US$ 7. The estimated cost per MVC was US$ 11.61, indicating that perfect targeting can reduce the cost per FVC by about 60%. However, no system can be 100% efficient in terms of targeting or completion rates, but it should be possible to reduce the cost per MVC by at least US$ 2-3 by better managing the delivery structure, training providers, and mobilizing the community. Better use of existing human resources and vaccines should reduce the cost per FVC even further without increasing the service-delivery costs.

One of the important aspects of the EPI delivery structure identified by the study is the complex nature of the system in urban Dhaka. The predominance of NGOs in the delivery of EPI in urban Bangladesh is in sharp contrast to the EPI delivery structure in rural areas, where it is almost exclusively a publicly-run programme. Despite the high degree of involvement of the private sector in urban EPI, the delivery structure has remained relatively inefficient. Therefore, sub-contracting health activities to the private sector, by itself, may not improve efficiency in the delivery of EPI. It is important to identify the factors affecting the efficiency of NGO and government facilities, including the payment mechanisms adopted by the contracting arrangement.

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Appendix

Table 5. Average cost (US$) per specific antigen in 1999

Vaccine	GoB static	GoB outreach	NGO static	NGO outreach	Average cost
BCG	1.79	1.82	1.23	1.03	1.39
DPT	0.73	0.54	0.52	0.62	0.63
OPV	0.63	0.55	0.49	0.52	0.55
Measles	2.20	1.72	1.93	1.71	1.98
Vitamin A	2.41	1.04	0.97	1.42	1.38
TT	1.41	1.09	0.65	0.70	0.90

Cost per specific antigen=[capital cost/6+salary/6+rent/6+recurrent training/6+transport cost/6+supply cost*1/10+specific vaccine cost]/no. of specific vaccine doses administered
Supply cost multiplied by 2/10 if vaccine is injectable
GoB static: Government-run static sites; GoB outreach: Government-run outreach sites; NGO static: NGO-run static sites; NGO outreach: NGO-run outreach sites
BCG=Bacille Calmette Guerin; DPT=Diphtheria-pertussis-tetanus; OPV=Oral polio vaccine; TT=Tetanus toxoid

Table 6. Costs (US$) of specific antigens* in 1999

Vaccine	GoB static	GoB outreach	NGO static	NGO outreach	Total cost
BCG	3,492.10	277.47	2,422.82	2,050.59	8,242.99
DPT	5,605.08	476.07	4,891.88	3,453.77	14,426.80
OPV	8,772.95	1,011.09	7,067.38	5,093.21	21,944.64
Measles	4,231.01	410.37	2,915.01	2,801.80	10,358.18
Vitamin A	1,308.62	372.84	11,273.04	15,068.46	28,022.95
TT	1,494.05	121.57	1,324.49	1,100.54	4,040.65
Total	24,903.81	2,669.40	29,894.61	29,568.38	87,036.21

*Costs for antigens included doses administered and doses wasted