

Effectiveness of Combined Strategies to Improve Low Coverage of Child Immunization in Urban Slums of Bangladesh



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Effectiveness of Combined Strategies to Improve Low Coverage of Child Immunization in Urban Slums of Bangladesh

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Abstract

Rapid urbanization, high density of population, and low coverage of immunization in urban slums call for the increased emphasis on immunization coverage for vulnerable urban poor children where spread of infection is faster. The study assessed the impact of an EPI intervention package to improve the coverage of child immunization in urban slums. This was an intervention trial with pre- and post-test design. The intervention package was tested for 12 months during September 2006–August 2007 in two purposively-selected urban slums of Dhaka city. The interventions package included: (a) a modified EPI service schedule, (b) training for service providers on valid doses, (c) a screening tool to identify immunization needs among clinic attendants, and (d) an EPI support groups for social mobilization. Data were drawn from the following three main sources: the random sample surveys to assess the immunization coverage (interview with mothers of children aged 12-23 months), service statistics, and qualitative data. Analysis of quantitative data was based on a before and after assessment of the selected immunization-coverage indicators by Pearson's chi-square test/proportions test and to compare means by *t*-test for continuous variables. Qualitative data collected through in-depth interviews and observations were analyzed using content analysis. The findings of the study revealed that 99% of 526 children were fully immunized after the implementation of the interventions while it was only 43% before their implementation, and the difference was highly significant. Antigen-wise coverage after the implementation of the interventions was also higher compared to before their implementation, and the difference was also highly significant. Only 1% drop-out was found after the implementation of the interventions while it was 33% before their implementation, and the difference was also highly significant. Not a single invalid dose was found after the implementation of the interventions while 22% of the children had invalid doses before their implementation. Although it was not possible to assess the individual contribution of each component intervention with great accuracy because of overlapping effects, the findings suggest that each intervention contributed to improving the coverage. Therefore, the policy-makers and programme managers should implement the package of successful interventions in all the slums of Bangladesh for improving the coverage of child immunization among this marginalized group of people. Manuals and guidelines need to be developed and distributed among service providers, and training for them is essential before scaling up of the interventions. Moreover, a team consisting of the partners of the study should provide technical assistance in scaling up the interventions.



এই টিকাদান কেন্দ্রে সকাল ১০ ঘটিকা হইতে বিকাল ৫ ঘটিকা পর্যন্ত টিকা দেওয়া হইবে।
পানার শিশুকে জন্মের ১ বৎসরের মধ্যে ৭টি রোগের বিরুদ্ধে টিকা দিন।
(০-১ বছর বয়সের শিশুদের টিকাদান সময়সূচী)

রোগের নাম	টিকার নাম	ডোজের সংখ্যা	টিকা শুরু করার বয়স ও মধ্যবর্তী বিরতি
যক্ষা	বিসিজি	১	জন্মের পর
ডিপথেরিয়া	ডিপিটি	৩	৬ সপ্তাহের পর, একমাস অন্তর
ডিফটেরিয়া	ডিপিটি	৩	৬ সপ্তাহের পর, একমাস অন্তর
প্রতি	প্রটি	৪	৬ সপ্তাহের পর, একমাস অন্তর ৩ তোলা এবং হামের টিকার সাথে ১ তোলা
হামের টিকা	হামের টিকা	১	৯ মাস পূর্ণ হওয়ার পর

রিচালনায়ঃ সিডব্লিউএফডি



ঢাকা সিটি কর্পোরেশন

ইসিডিডিআর,বি



Introduction

Improving the health of the extremely-poor people is essential for improving the health of the public more generally and for promoting equity. Disease, illness, and mortality are disproportionately concentrated among the extremely poor. Extreme poverty is inexorably linked to poor environmental conditions, such as crowding and lack of clean water and sanitation, poor nutritional status as a result of poverty and lack of food, and frequent childbearing, and all these contribute to a greater burden of diseases. Furthermore, the extremely poor often lack resources, which are essential for preventing or treating diseases. They lack access to basic health services, lack awareness of the importance of their timely use, lack the time and money needed to use health services, and often need to address other more pressing issues. One of the most basic of all health services is immunization (1).

The rate of urban population growth has been 6% per year (meaning that, in only 10 years, the number of people will be double if this same rate of population growth persists) compared to the national population growth rate of 1.5% in Bangladesh (2-4). Dhaka city is one of the fastest growing cities in the world, and the greater Dhaka city metropolitan area is anticipated to reach 22.8 million people in 2015, at which time it will be the second largest city in the world after Tokyo (5). The rate of urban slum population growth, particularly in Dhaka city, is even greater than that of urban areas generally (1).

One-quarter of the population of the Dhaka City Corporation (DCC), which is located within the formal boundaries of the city proper, lives in slum households (1).

In their comprehensive review of urban immunization services in developing countries, Atkinson and Cheyne pointed out some unique challenges that are not faced in rural areas (6). Among these are rapid population growth, especially in slums, multiplicity of types of service providers in the public and private sectors, the need to give priority to other more pressing challenges, and the need to use different strategies to reach marginal groups (6).

While infectious diseases affect poor children disproportionately, in most countries in South Asia, the immunization coverage is higher in wealthier households. In many cases, children living in urban slums and rural remote areas have less access to immunization. This immunization gap represents a devastating toll on the world's population. Every year, there are three million unnecessary premature deaths because too many children have not been given vaccines that could have saved their lives. This is not only a health issue, it is an issue of fundamental equity and human rights (7).

The immunization gap also exists within Bangladesh. Although 71% of children aged 12-23 months are fully immunized, the immunization coverage is still low in some areas, particularly in urban slums. A study conducted in slum areas of Dhaka city showed that the proportion of fully-immunized children aged 12 months was only 54% (8). Furthermore, in Dhaka city, a persistent gap exists in the coverage of those living in slum households compared to those living in better-off circumstances (2,4).

There are barriers to achieving optimal protection for the whole population, and strategies are required for reduction of 'drop-outs' (incomplete immunization), invalid doses, and 'left-outs' (no immunization). Studies have shown that lack of information and knowledge (on need

for immunization, need for subsequent dose(s), and the importance of completing the entire course) contributes to low immunization coverage (9-13). Invalid immunization doses, which contribute in decreasing true coverage, are common because the immunization schedule has not been adhered to (8). Invalid doses refer to “doses administered at an age earlier than that recommended and/or at the wrong interval; administered before the minimum age in the case of DPT/polio 1st doses and measles vaccine, or with less than four weeks interval in the case of DPT or polio vaccines.” Some field workers do not adequately screen children before giving vaccines. Only by regularly reviewing EPI registration books can supervisors and mid-level managers verify that field workers give valid doses of vaccine. However, a clear concept of invalid/valid dose appears to be lacking among most providers at all levels of the health service-delivery system.

Overall, 7% of all DPT doses were found to be invalid nationally, with a variation between rural and urban areas (8). A recent study found that 7% of vaccination drop-out rates in urban areas for DPT1-measles (14). Perry *et al.* identified the following reasons for drop-outs among urban children: irregular holding of EPI sessions, mothers were at work during EPI sessions, fear about side-effects relating to immunizations, and inadequate information about session (1).

Studies in different countries have found evidence of the effectiveness of interventions to improve the full immunization coverage. A study in Madagascar found that the immunization coverage was improved and drop-out reduced through intensified efforts at system strengthening and community mobilization (15). Local leaders participated in a comprehensive approach to immunization that included better planning and mobilization of local political, administrative and religious leaders to promote EPI (15). Another study in Benin found that lack of community involvement was one of the major constraints to improving the EPI coverage (16). An earlier study in Bangladesh showed that monitoring of activities of local health centres by the community resulted in regular attendance of providers, a longer period of stay, elimination of the practice of charging money from clients, and serving patients with respect (17). A study conducted on National Immunization Day (NID) found that the community played a significant role in increasing the coverage of polio vaccine (18). Over 46% of parents learned about the NID from community volunteers who also actively participated with the health providers in child-to-child search (18). A study found that members of self-help organizations could mobilize children for the completion of vaccination (19). Community participation and appropriate behaviour-change communication (BCC) may be particularly important in low-coverage areas of Bangladesh, and effective means of ensuring the involvement of the community needs to be developed and tested.

The majority of urban mothers, particularly in slums, are working women, and it can be difficult for them to take their children for immunization during normal EPI session hours, resulting in drop-outs and left-outs (1). A modified EPI service schedule may change the situation.

Findings of a study showed that the use of a screening tool in ESP clinics could be effective for identifying unmet need for immunization. For every 100 clients that requested immunization services at NGO clinics, 13 other clients attending for other services were found to have a need of immunization for their children (20). A study conducted by ICDDR,B in six municipalities revealed that almost one-fourth of children aged less than two years in urban areas had unmet need for immunization (21).

A study in Indonesia found that training for providers helped improve the immunization coverage (22). The training programme included sending experienced and high-performing immunizers

to health centres where immunizers were inexperienced or poor performers. They provided job training and assistance for 1-2 week(s). The coverage of DPT1, polio3, and measles vaccine in intervention areas rose about 40% while the coverage in non-programme group remained nearly constant over a two-year period (22). In Bangladesh, current training for EPI providers includes training on valid doses but does not have any special focus on it. Refresher training for EPI providers addressing the issue of valid doses could be an important strategy for low-coverage areas of Bangladesh. A workshop at ICDDR,B, involving the London School of Tropical Medicine & Hygiene, United Nations Children's Fund, World health Organization, Government of Bangladesh, ICDDR,B, and NGO Service Delivery Programme (NSDP), suggested that the implementation of a combination of strategies might improve the coverage of child immunization in low-performing areas. The present study tested the combination of strategies to assess the effectiveness of strategies to improve the coverage of child immunization in urban slums of Bangladesh.

Research objectives

The overall aim of the research was to assess the effectiveness of a combination of strategies for improving the coverage of child immunization in urban slums of Bangladesh. The study attempted to determine whether the combination of strategies could improve the coverage of child immunization in urban slums.

The specific objective was to assess the effectiveness of a combination of strategies for increasing the immunization coverage in urban slums: (a) modified EPI service schedule; (b) training for service providers on valid doses; (c) a screening tool to identify immunization needs among clinic attendants; and (d) an EPI support group to ensure provision of regular services.



Methods and Materials

Research design

This study was a quasi-experimental pre- and post-test design, monitoring indicators over time and documenting operational issues. The indicators relating to the coverage of child immunization and invalid doses were measured before and after the implementation of the strategies to assess the intervention-related changes. The strategies were tested for a 12-month period during September 2006–August 2007.

The study was carried out in two-purposively selected slums (12/D-Baguntilla and Kalapani slums) in Zone 8 of DCC area, with a predominantly-slum population served by the DCC and NGO EPI spots. The slums complied with the following criteria: (a) unlikely to be demolished in the 12-month study period; (b) the mobility of the population is limited; and (c) the slums have some educational facilities.

Interventions

All the four strategies were tested in one area while three of them were tested in another area. The combinations of strategies implemented in the slum areas are summarized in Box 1

Box 1. Combination of strategies implemented in slum areas of Dhaka city	
Intervention area 1	Intervention area 2
Modified EPI schedule Training on valid/invalid doses and management of side-effects Screening tool	Modified EPI schedule Training on valid/invalid doses and management of side-effects Screening tool EPI support group

a. Modified EPI service schedules: Normally, the EPI services are provided from 10:00 am to 2:00 pm. In active collaboration with the DCC and NGOs, the EPI service hours were extended up to 5:00 pm, which enabled working mothers to bring their children for vaccination at a more suitable time.

b. Training for service providers on valid/invalid doses and management of side-effects: Training is an important component for service providers to update their knowledge about their job activities and responsibilities. Most city corporation (CC) vaccinators who are responsible for EPI had inadequate/incorrect information, especially about invalid doses and appropriate management of side-effects. Therefore, a three-day refresher training was imparted to providers and their supervisors to ensure a clear concept of valid/invalid doses and management of side-effects.

c. Use of a screening tool in health centres other than EPI spots: A screening tool was introduced for assessing unmet needs of children for immunization. An unmet need was considered to be the number of children, or the percentage of children, who need to vaccinate, but for various reasons, including lack of access to information or services, are not currently vaccinated. Data from the checklists used by the providers was analyzed to assess the unmet needs identified and addressed. The screening checklists were used by service providers in health facilities (government and any NGO clinics). Mothers who visited a health facility for reproductive health or child-health services, were asked about the immunization status of their children

of eligible age (accompanying children and others at home). If a child was found to require immunization, it was provided at the clinic if available; otherwise, the child was referred to an EPI session or another facility where vaccination was available.

d. EPI support groups: EPI support groups were formed in one of the selected slum areas to involve the community with the programme. The other areas had no support group; however, there were paid service promoters of concerned NGOs who performed the same work as EPI support groups did. The support group consisted of house owners of EPI spots, mothers of children who had completed all doses of vaccines, school, or college senior students (both boys and girls), school teachers, *Imams*, local elites, and health service providers from the DCC and NGOs working in the slum. In total, 12 members were in each support group, and the elected local female member of the local government acted as chairman of the group. The staff members involved from NGOs and the DCC worked for organizing the group in collaboration with other providers of the slums. The functions performed by the groups were to: assist in ensuring that all scheduled EPI sessions are held; assist in ensuring registration of the EPI target population; assist providers in the implementation of strategies to reduce drop-outs, invalid doses, and left-outs; and organize meetings with service providers to review EPI performance. The groups also facilitated the implementation of other components of the study. Terms of reference were developed for the support groups. The project staff provided necessary orientation to the groups about their functions, the importance of immunization, the importance of completion of all doses, the concept of invalid/valid doses for a child, and the role of the groups in improving the immunization coverage.

Study population

The study population included mothers of children aged 12-23 months, members of EP support groups, and service providers.

Sampling and sample size

Selection of a sample of children for the estimation of changes in the immunization indicators were based on the following: the predominantly slum sections were mapped and divided into sub-areas (based on geographical boundaries and roads). Within the two slums where the strategies were implemented, two subsections were randomly selected; each subsection has about 2,000 households, i.e. about 260 children aged 12-23 months. It was estimated that about 13% of these households would have children aged 12-23 months, i.e. 260 children. Enumeration was done before conducting interviews. Mothers of children aged 12-23 months in these selected sub sections were interviewed to assess the immunization status of their children. The sample of about 260 children was sufficient to assess the statistical significance of anticipated changes in the immunization-coverage indicators, including 7% invalid doses, based on 95% confidence interval with 90% power. For example, an increase in the full immunization coverage from 50% to 65% would be statistically significant as would the greater increase that is anticipated. The total samples interviewed in the two sections of a slum were 520 at baseline and 520 at endline.

Data collection

Data were obtained from three main sources: random sample surveys to assess the immunization coverage (interviews with mothers of children aged 12-23 months), service statistics, and

qualitative data. Data were collected before and after the implementation of the strategies to measure their impact. Since the study aimed at measuring the impact of programmes, data were not collected from the same mothers during the endline survey with whom interviews were conducted during the baseline survey. Box 2 summarizes the study groups and the source of data for each.

Box 2. Study groups and sources of data		
Study sub groups	Sources of data	Number of respondents
Mothers of children aged 12-23 months	Survey through a structured questionnaire	1,040 (260x2x2)
Mothers of children aged 12-23 months	In-depth interviews	10 (mothers of fully-immunized children)
EPI support group members	In-depth interviews	8 (one from each category of members)
Service providers	In-depth interviews	8

Survey and service statistics

Survey data: Baseline and endline survey data were collected in the two months immediately before and immediately after the 12-month intervention period. At both the points, children aged 0-23 month(s) were first enumerated. From the enumeration list, mothers of children aged 12-23 months were selected and interviewed. Interviews were conducted by trained interviewers recruited and supervised by researchers. Information was sought from mothers about the date of birth of their most recent children to identify those aged 12-23 months. They were asked about the number of each type of vaccination received (card validated; self-reported), and dates on the cards were identified where possible to assess validity. Data were also collected on reasons for full immunization, drop-outs and left-outs, and experience of side-effects after vaccination.

Service statistics: Service statistics (session-wise daily/monthly target, monthly attendance, and immunizations provided according to EPI registers) were collected and reviewed to ascertain the changes in performance and the quality of recording and reporting. In addition, data were collected on the number of EPI sessions held, the number of EPI support group meetings held and their activities, and the number of special sessions held outside normal hours. Data on the use of the screening tool were also collected (number screened for immunization needs, number of needs identified, follow-up to ascertain if immunization was done).

Qualitative components

In-depth interviews with mothers: Experienced Field Research Assistants (FRAs) conducted in-depth interviews with 10 mothers of children who had completed all the doses. Data were collected on reasons for completing all the doses; who motivated them to complete vaccination; and if the members of support groups contacted them for vaccination of their children.

In-depth interviews with EPI support group members: In-depth interviews were also conducted with members of the EPI support group. Eight group members covering all categories, such as chairman, member-secretary, and members were interviewed. Data were collected on perceptions of group activities, advantages and disadvantages of the group, the process followed for organizing sessions that were not held, and barriers faced in implementing group activities.

In-depth interview with service providers: To ascertain perceptions of service providers about the strategies, in-depth interviews were conducted with six randomly-selected service providers from NGOs (vaccinator and their supervisors), one EPI supervisor, and one Assistant Health Officer of the DCC. Data were collected on perceptions of service providers about the strategies, the process followed to implement these, and barriers faced during the implementation.

Observations: Field activities were observed, and information was documented during the entire study period. Observation focused on activities of EPI sessions, daily targets and performance, implementation of the strategies, problems faced by the providers in the implementation of the strategies, and the process followed to solve the identified problems.

Research instruments

A structured questionnaire for collection of data from mothers was developed for the survey and pretested prior to data collection. Guidelines/checklists for in-depth interviews and observations were also developed and used.

Analysis of data

Two types of childhood-vaccination coverage—crude coverage and valid coverage—were assessed in this study. Crude coverage was assessed in terms of the dose(s) of any antigen—both valid and invalid—that a child received regardless of whether s/he received them by or after one year of age. An invalid dose was the dose given before the recommended age or during the interval, i.e. less than four weeks from the prior dose. Valid coverage, on the other hand, was assessed in terms of valid doses(s) of any antigen administered to a child by age one year. A valid dose is a recommended dose of an antigen administered at the recommended age and during the appropriate interval. Both valid coverage and crude coverage were assessed for each specific antigen for all the antigens taken together. The comparison between the crude coverage and the valid coverage shows how much coverage was lost due to the failure to give antigens to children at appropriate times.


Full vaccination was also calculated. Full vaccination was defined as vaccination with all the recommended doses of all the antigens at the recommended age and interval by age one year.

The coverage of childhood vaccination was assessed using the following information gathered in the survey: whether the child received any antigen, the date of each antigen/each dose of antigen received, and whether or not the child received all the antigens. As stated earlier, information was obtained from the vaccination card, if available. If the card was not available, information was obtained from the mother of the child or caretaker asking some questions, such as: How many times the child went to EPI centre? How many injections were pushed to the child in each visit? How many oral drops were given to the child during whole visits to EPI centre?

Quantitative data were entered into visual Basic/FoxPro and analyzed using the SPSS software (version 11.5). The analysis of quantitative data was based on a before and after assessment of the selected immunization-coverage indicators by Pearson's chi-square test/proportions test and to compare means by *t*-test for continuous variables. It was not possible to assess the individual contribution of each component strategy with any great accuracy because of overlapping effects. However, the contribution of the screening tool to changes in the immunization coverage was assessed through calculation of the needs identified using the tool and the needs met. The effectiveness of the modified EPI service schedules was assessed on the basis of any increase in attendance at sessions compared to the previous year (based on service statistics). The additional

effect of the support group was assessed by comparing the change in the immunization-coverage indicators in areas that did and did not receive this intervention.


Qualitative data collected through in-depth interviews and observations were transcribed and then translated into English. When field activities commenced, analysis of qualitative data involved reading field note. Data were coded, categorized, and abstracted manually. Data were then analyzed using content analysis.



 এই টিকাদান কেন্দ্রে সকাল ১০ ঘটিকা হইতে বিকাল ৫ ঘটিকা পর্যন্ত টিকা দেওয়া হয়।
 আপনার শিশুকে জন্মের ১ বৎসরের মধ্যে ৭টি রোগের বিরুদ্ধে টিকা দিন।
 (০-১ বছর বয়সের শিশুদের টিকাদান সময়সূচী)


রোগের নাম	টিকার নাম	ডোজের সংখ্যা	টিকা শুরু করার বয়স ও মধ্যবর্তী বিরতি
১ যক্ষা	বিসিজি	১	জন্মের পর
২ ডিপথেরিয়া	ডিপিটি	৩	৬ সপ্তাহের পর, একমাস অন্তর
৩ ছপিকশি			
৪ ধনুষ্টংকার			
৫ হেপাটাইটিস-বি	হেপাটাইটিস-বি ভ্যাকসিন	৩	৬ সপ্তাহের পর, একমাস অন্তর
৬ পোলিও মাইলাইটিস	এপিভি	৪	৬ সপ্তাহের পর, একমাস অন্তর ৩ ডোজ এবং হামের টিকার সাথে ১ ডোজ
৭ হাম	হামের টিকা	১	৯ মাস পূর্ণ হওয়ার পর

কেন্দ্র পরিচালনায় : সিডব্লিউএফডি

সহায়তায়ঃ


 ইপিআই


 ঢাকা সিটি কর্পোরেশন


 আইসিডিডিআর,বি



Results

Sociodemographic characteristics

There was no significant difference in terms of age, education of mothers, sex of children, and monthly family expenditure of the respondents interviewed at baseline and endline (Table 1). More than two-fifths of the mothers (both at baseline and endline) were working mothers—either garment workers or domestic helpers/day labourers. Most mothers had access to mass media, although the rate was higher among mothers interviewed at baseline compared to mothers interviewed at endline. The mean monthly expenditure for families was approximately Tk 6,000. The expenditure for family food during the last week of data collection was significantly higher among mothers interviewed at endline compared to mothers interviewed at baseline.

Table 1. Sociodemographic characteristics

Characteristics	Percentage		p value
	Baseline (n=529)	Endline (n=526)	
Age (years) of mothers			
<25	52	48	0.193
25-29	25	29	0.143
30+	23	23	1.000
Education of mothers			
No education	22	22	1.000
Primary (up to class V)	34	39	0.091
Above primary	44	39	0.099
Education of fathers			
No education	22	19	0.227
Primary (up to class V)	23	33	0.000
Above primary	55	48	0.022
Occupational status of mothers			
Non-working	79	73	0.326
Working	21	27	0.036
Parity			
1	45	46	0.744
2	26	32	0.031
3+	29	22	0.009
Sex of children			
Male	53	50	0.329
Female	47	50	0.329
Access to mass media (radio, TV, newspapers)	97	93	0.002
Mean/mode monthly family expenditure (Tk)	6,002 5,000	6,224 5,000	0.290
Mean/mode family food expenditure of the last week (Tk)	744 700	1,072 1,000	0.000

Childhood immunization

Levels of crude coverage

The crude coverage was significantly higher after the implementation of the strategies compared to before their implementation (99% vs 65%) (Table 2). The drop-out rate was only 1% after the

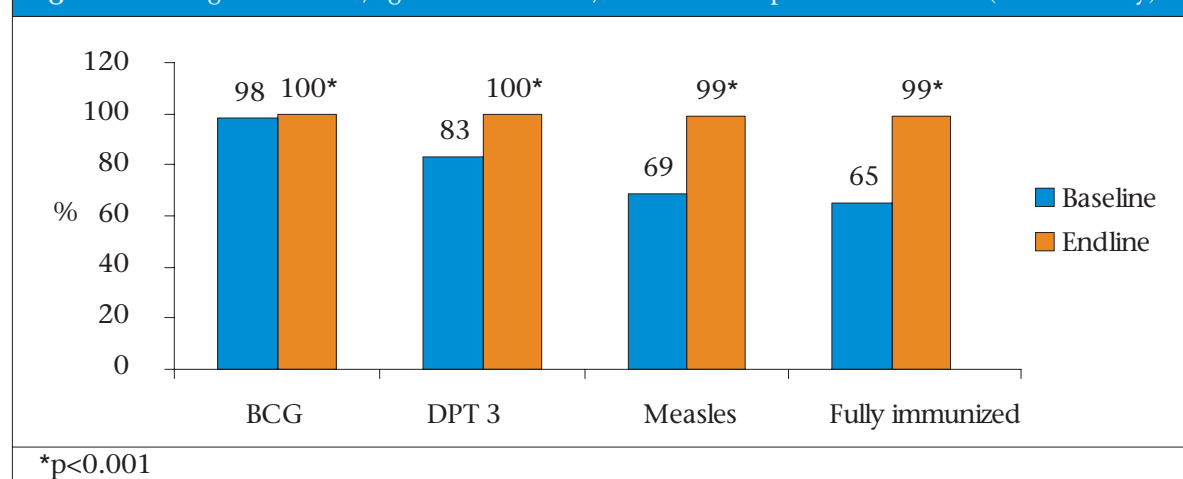
implementation of the strategies while it was 33% before their implementation, a statistically significant difference. No left-outs were found after the implementation of the strategies. However, the left-out rate was 2% before the implementation of the strategies in the study areas

Table 2. Crude coverage among 12-23 months old children (card + history)

Category	Coverage (%)		p value
	Baseline (n=529)	Endline (n=526)	
Fully immunized	65	99	0.000
Drop-outs	33	1	0.000
Left-outs	2	0	

The antigen-wise crude coverage after the implementation of the strategies was higher for every antigen compared to before their implementation, and the difference was significant (Fig. 1). At endline, 99% of children had each antigen while at baseline the coverage ranged from 69% for measles to 98% for BCG.

Fig. 1. Percentage of children, aged 12-23 months, who received specific vaccination (card + history)



Levels of valid coverage

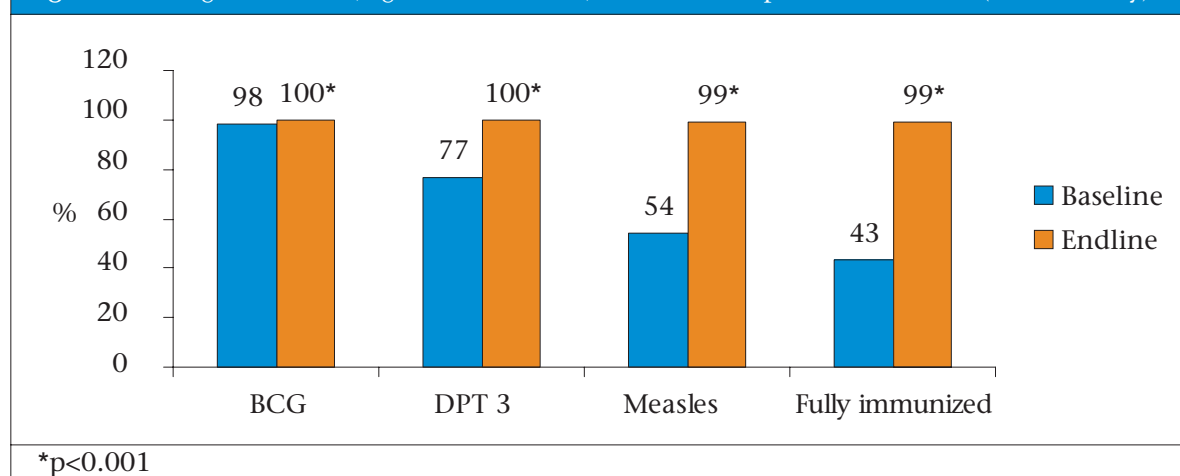
The valid coverage improved dramatically after the implementation of the strategies. Ninety-nine percent of the children were fully immunized after the implementation of the strategies compared to only 43% before their implementation (Table 3). Fully valid immunization included 10% and 9% of the children at baseline and endline respectively who were vaccinated after their one year age, and this was done following the calculation technique used in the national coverage survey. Tremendous improvement was observed in terms of reduction of drop-outs after the implementation of the strategies. Only 1% drop-out was found after the implementation of the strategies while it was 33% before their implementation, and the difference was highly significant. Marked reduction of invalid doses was observed after the implementation of the strategies compared to before their implementation. The table shows that not a single invalid dose was found after the implementation of the strategies while 22% of the children had invalid doses before their implementation.

The antigen-wise valid coverage was also significantly higher for all antigens compared to before implementation (Fig. 2). Although the BCG vaccine coverage was 98%, the coverage of measles vaccine was markedly lower (54%) in the study areas before the implementation of the strategies. However, after the implementation, the coverage of measles vaccine was almost the same (99%) as the BCG vaccine coverage.

Table 3. Valid coverage among 12-23 months old children (card + history)

Category	Coverage (%)		p value
	Baseline (n=529)	Endline (n=526)	
Fully immunized	43	99	0.000
Drop-outs	33	1	0.000
Left-outs	2	0	-
Invalid doses (card only)	22	0	-

Fig. 2. Percentage of children, aged 12-23 months, who received specific vaccination (card + history)



The findings revealed that the proportion of valid doses of fully-immunized children of non-working mothers was significantly higher (75%) than working mothers (14%) at baseline (coverage) (Table 4). The table also shows that, although the number of fully-immunized children of both non-working and working mothers was significantly higher at endline compared to baseline, the number of fully-immunized children of working mothers was dramatically improved at endline (99%) compared to baseline (14%).

Table 4. Status of fully-immunized children of non-working and working mothers before and after implementation of interventions

Mothers	Percentage of fully-immunized children	
	Baseline	Endline
Non-working	75 (n=252)*	99 (n=284)*
Working	14 (n=277)	99 (n=242)*

*Significantly higher than working mothers, p<0.001
*Significantly higher than baseline, p<0.001

Knowledge and perceptions of mothers about reasons for complete immunization

Mothers whose children completed all the doses were asked a question about reasons for full immunization. Most (88%) mothers said, "Incomplete vaccination has no benefits to protect the children" whereas only 5% stated this before the implementation of the strategies (Table 5).

Table 5. Knowledge and perceptions of mothers about complete vaccination of children aged 12- 23 months

Knowledge and perception*	Percentage	
	Baseline (n=345)	Endline (n=521)
Incomplete vaccination has no benefits to protect children	5	88
Protect from vaccine-preventable diseases (any vaccine-preventable diseases)	61	59
Protect from vaccine-preventable diseases and any other illnesses	14	22
Protect from any illness (other than vaccine-preventable diseases)	35	12
This is a rule	1	3
Advised by doctors and health workers	3	6
As others give vaccine to their children	7	3
*Multiple answers		

Reasons for non-vaccination

A question was asked to mothers of left-out children interviewed at baseline about reasons for not vaccinating their children. The most common reason for not vaccinating the child was that the mother did not think that it was important. Other reasons mentioned included: the mother was at work when EPI session was held and the shortage of vaccines at EPI centre (Table 6).

Table 6. Reasons for not vaccinating (left-out) children aged 12-23 months

Reason for not vaccinating children*	Percentage
	Baseline (n=11)
Did not give importance	55
Mother was at work	31
Shortage of vaccine at EPI centre	29
Required money	25
The child was sick	18
Fear about side-effects	14
*Multiple responses	

Retention of vaccination cards

Table 7 shows that both before and after the implementation of the strategies, most vaccinated children received an EPI card. Of the children who received an EPI card, 64% and 68% retained it before and after the implementation of the strategies respectively.

Table 7. Retention status of vaccination cards among children aged 12-23 months

Vaccination card	Percentage		p value
	Baseline (n=518*)	Endline (n=526)	
Received card	99	100	0.021
Status of card retention			
Received and has card	64	68	0.172
Received but dose not have the card	36	32	0.172

*Excluded 11 left-out children

Effects of individual strategies

Modified EPI service schedules

Knowledge and practice of mothers about modified EPI service schedules: Before the implementation of the strategies, no mothers surveyed had any knowledge about afternoon/evening sessions; however, 81% of the mothers knew about this after their implementation (Table 8). Information they had about afternoon/evening sessions included: vaccines provided up to 5:00 pm from EPI centres (98%), and doctors provide vaccines at their chambers (2%). Mothers who were aware of afternoon/evening sessions were asked if they took their children to afternoon/evening sessions for vaccination, 65% gave affirmative answer, and 99% visited afternoon EPI centres of NGOs.

Table 8. Knowledge and practice of mothers about afternoon/evening EPI sessions

Knowledge about afternoon/evening EPI sessions	Percentage	
	Baseline (n=529)	Endline (n=526)
Knew about afternoon/evening EPI sessions	0	81
Type of information available with mothers about afternoon/evening EPI sessions		
Provide vaccines up to 5:00 pm	0	98
Doctors provide vaccines at their chambers	0	2
Mothers took their children to EPI centres in the afternoon/evening for vaccination		
Yes	0	65
No	0	35
Facilities they visited in the afternoon for vaccination of their children		
Afternoon EPI centres of NGOs	0	99
Doctors' chambers	0	1

Status of holding of EPI sessions: Reported data about holding of EPI sessions during the study period and preceding the one year were collected and analyzed. During the year preceding the study period, 31% of the planned sessions was not held while, during the study period, only 4% was not held (Table 9). The reasons for not holding planned EPI sessions during the study period were: faulty planning of sessions, i.e. the sessions were planned on government holidays and meeting days. There was no information from service providers about reasons for not holding the planned sessions before the study period.

Table 9. Number of EPI sessions planned and held during the study period and the preceding one year

Month	Before (September, 2005–August 2006)		Study period (September 2006–August 2007)	
	No. of sessions planned	No. of sessions held	No. of sessions planned	No. of sessions held
September	16	12	13	12
October	17	16	14	10
November	16	12	17	16
December	16	14	12	11
January	16	9	16	16
February	16	7	16	16
March	16	8	16	16
April	16	10	16	16
May	16	10	16	16
June	16	12	16	16
July	16	15	16	16
August	16	9	16	16
Total (%)	193	134 (69)	184	177 (96)

Number of children vaccinated at the study areas during the study period and in the preceding year: Administrative data of the study period and the preceding one year were collected and analyzed to assess the attendance of children in EPI centres for vaccination. The number of children vaccinated in all antigens markedly increased during the study period compared to the preceding one year, although the total population in the study areas was less during study period. Due to demolishing of some parts of slums in the study areas, the population decreased from 48,381 to 35,029 during the study period. However, administrative data showed that the number of children vaccinated increased during the study period compared to the same period in the preceding year. Figure 3 shows the status of number of children who received BCG, DPT3 and measles vaccines during the study period compared to the same period of the preceding year.

Service-use during morning and afternoon sessions: During the study period, the number of children vaccinated in the afternoon sessions was higher than the number of children vaccinated during the morning sessions. Figure 4 shows the number of children who was provided BCG, DPT3, and measles vaccines in the morning and afternoon sessions.

Fig. 3. Number of children vaccinated during the study period compared to the preceding one year

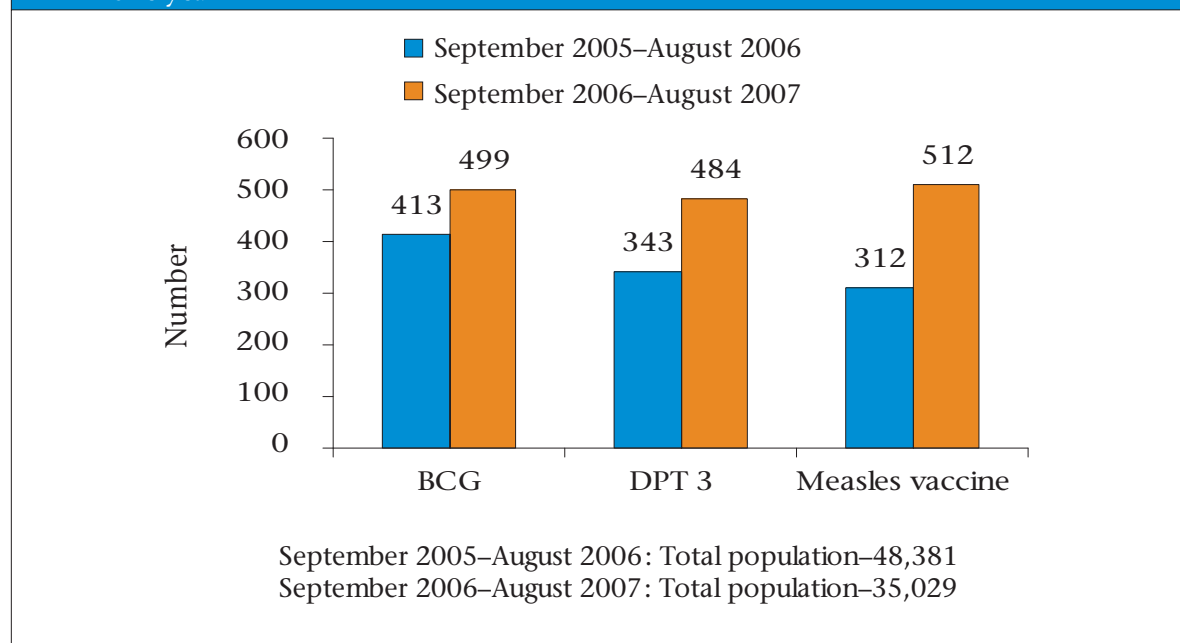
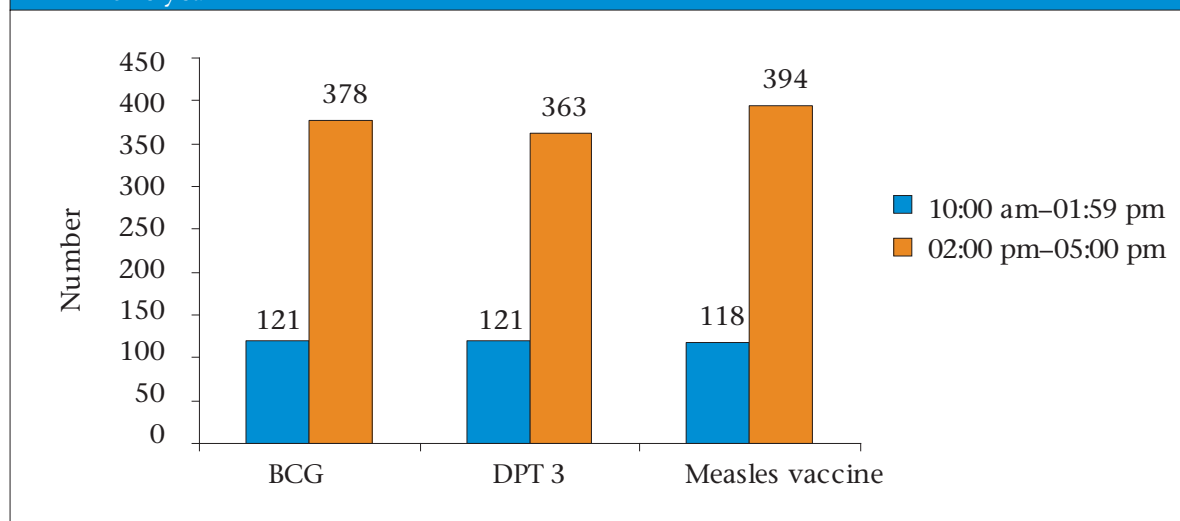


Fig. 4. Number of children vaccinated during during the study period by time one year



Advantages of modified EPI service schedules: Qualitative data showed that the mothers, support group members, and service providers highly appreciated the modified EPI service schedules. The Assistant Health Officer of Zone 8 of the DCC commented that the extended timing is a great opportunity for working women to vaccinate their children. She said that the working mothers could immunize their children as per their convenient time. The garment workers could use their leisure time for vaccination of their children. She also added that follow-up of children by the field staff had increased after the extension of service-delivery hours as they got enough time.

Four mothers who completed all doses said, "It would not have been possible for us to complete all the doses for our children if this system was not introduced."

The support group members, some of whom were working people, also appreciated the extension of service-delivery hours. Since they were less busy in the afternoon, it was easier for them to motivate mothers to visit the EPI centres at that time. They reiterated the views of mothers that it was easier for working mothers to attend and added that the increased flexibility also benefited non-working mothers in receiving services more conveniently.

All the service providers reported that one of the main reasons for increasing the coverage was the extension of service-delivery hours. They said that, as the service providers stayed for a longer time at the EPI centres, the working mothers can bring their children to the EPI centres whenever they are available at home. They further added that the non-working mothers also could vaccinate their children in their convenient time due to the extension of the service-delivery time.

Problems encountered while implementing modified EPI service schedules: The service providers of NGOs reported the following two problems they encountered while implementing the strategy:

- a. One NGO maintained the 'Ward EPI Room' from where all the service providers received vaccines in the morning and returned the vaccine carriers after the completion of EPI sessions after 5:00 pm. The office of the NGO was kept open from 9:00 am to 4:00 pm. Whenever the service providers came to the NGO office to drop the vaccine carriers, the office was closed. Therefore, the management of the office finally involved their security guard to receive and keep the vaccine carriers at an appropriate place of the office.
- b. The EPI sessions were mostly held in the houses of slum-dwellers. Four of 16 house owners sometimes objected to continuing vaccination sessions up to 5:00 pm because they did not have space to take rest in the afternoon. However, with the help of support group members, the service providers were eventually able to manage suitable houses to continue their sessions up to 5:00 pm.

Training for service providers on valid/invalid doses and management of side-effects

As stated earlier, training was imparted to services providers and their supervisors in the study areas regarding the clear concept of valid/invalid doses and side-effects. The findings of the study showed that a marked decrease of invalid doses was observed after the training (Table 3). The incidence of side-effects following any dose of vaccination was calculated to assess the safety of injections for children. This rate of side-effects was calculated as the proportion of recipients of vaccines (injections) who had side-effects after receiving any of the antigens. Mothers were asked if their children had any problem (abscess/infections, fever, and pain) after vaccination. Following training, a few mothers reported side-effects other than pain (Table 10). The abscess was defined as infection after vaccination-excluding BCG scar. Reports of abscess and infections decreased from 9% at baseline to <1% at endline. Convulsions/swelling decreased from 5% to 1%.

Use of screening tool in health centres other than EPI sites

Figure 5 shows the status of unmet needs identified and addressed in the study areas during the one-year study period from September 2006 to August 2007. The figure shows that, of 1,716 mothers

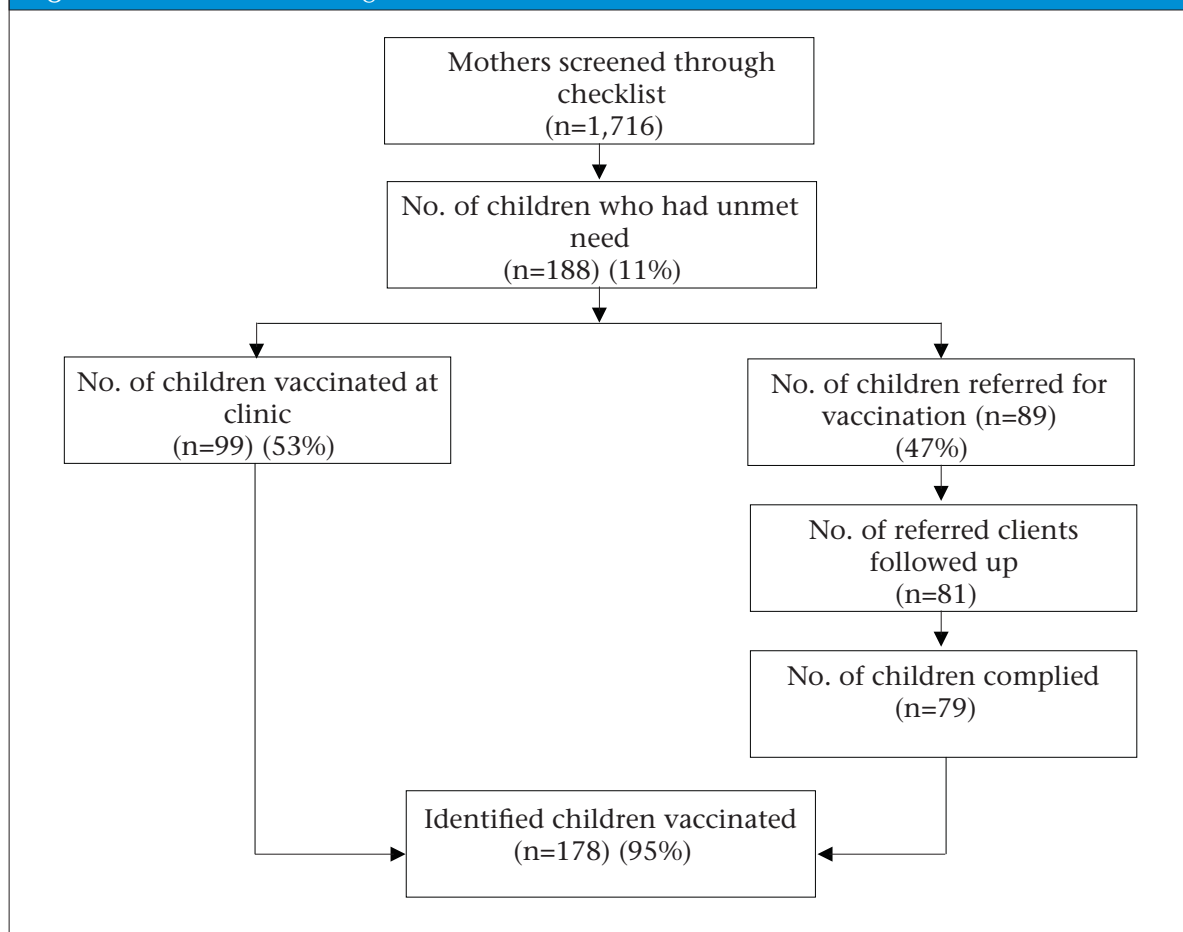
screened through the checklist, 188 children (11%) were identified who had unmet need for immunization. Of the 188 children, 99 (53%) were vaccinated at the same clinics where they were identified, and the remaining 89 children were referred to the nearest EPI centres for vaccination. Eighty-one of the 89 referred children were followed up by the project staff and supervisors of vaccinators, and 79 of them visited referral clinics and received vaccines. Overall, 95% of children in need of vaccination identified through the screening checklist were vaccinated.

Table 10. Incidence of side-effects following vaccinations among children aged 12-23 months

Type of side-effect*	Percentage	
	Baseline (n=518)	Endline (n=521)
Abscess/infections	9	<1
Fever	95	89
Pain	73	77
Others (convulsion, swelling)	5	1

*Multiple answers

Fig. 5. Status of the screening checklist used and of identified and addressed unmet needs



All the service providers reported that, although this was a new system, the screening checklist helped them reduce the number of drop-outs. They suggested introducing the checklist among

drug-sellers of local pharmacies to further improve the vaccination coverage. Observational data showed that, on average, 1-2 minute(s) was/were required for each client to use the screening checklist. None of the service providers reported any problem in using the checklist.

EPI support groups

Knowledge of mothers about EPI support groups: The mothers were asked, during the survey, if they knew about any group/*samitee* or committee involved in improving the coverage of child immunization. Although none of them had any knowledge at baseline, at endline, 66% of the mothers said that they knew about a committee (Table 11). When asked about the name of the committee, all of them informed that they knew about 'Tika Committee' (local name of EPI support group). In addition, they all knew a member of the committee. Ninety-seven percent of the mothers said that a member of the group had met them and inquired about child immunization. Group members requested the mothers to vaccinate their children in the extended hours of EPI services, mentioning the need to complete vaccination within the first year of life and benefits of full immunization.

Table 11. Knowledge of mothers about EPI support group		
Knowledge	Percentage	
	Baseline (n=268)	Endline (n=265)
Heard about any group/ <i>samitee</i> who work for EPI programme	0	66
Which committee is this?		
<i>Tika</i> committee (local name of EPI support group)	0	100
Knew any member of the committee	0	100
Ask any member of the committee anything about child immunization	0	97
Type of information given by group members to mothers*		
Vaccines are given now up to 5:00 pm at EPI centres	0	89
Complete vaccination within one year of age of children	0	57
Children may be affected by six diseases if they are not given all doses of each vaccine	0	27
*Multiple answers		

Mothers who participated in in-depth interviews told that members of *Tika* Committee visited them several times and motivated them to vaccinate their children. Two mothers said, "it would not have been possible to completely vaccinate our children if the members of the Tika Committee did not remind us again and again."

The service providers working in the areas of the support groups and participating in in-depth interviews stated that the support groups did excellent work and contributed to mobilizing the community and reducing drop-outs and left-outs. They said that the houses in every slum are very compact, and the slum-dwellers were aware of most problems of others surrounding their houses. They have regular information about pregnant mothers, newborns, which children of their surrounding are vaccinated, and which children are yet

to be vaccinated. Therefore, their involvement facilitates contacting and helps keep tracking of child immunizations. The NGO service providers also added that, since the members of the groups are respected persons among the slum dwellers, they were acceptable. The service providers also informed that it was difficult for them to visit all the households of the catchment areas of the EPI centres, especially if the areas are large. Therefore, the rate of drop-outs and left-outs was high before the formation of the groups. They said that, after the formation of the groups, they did not have such a problem. They just provided the target list to the concerned members of the support groups and on the morning of an EPI session day, the group members visited the houses of the targeted children, motivated the mothers, and sent the children to the EPI centres for vaccination. They suggested that existence of EPI support groups is essential to improve the coverage of child immunization, especially in large areas with more targeted children. About sustainability of the support group activities, the service providers suggested that the group members may be supported by providing some facilities that are available for the poor people in the community, such as vulnerable group feeding (VGF) card, giving priority in distribution of relief materials whenever available.

The members of the support groups who participated in in-depth interviews felt that they had played a very important role in reminding the mothers about the due dates of EPI doses for their children. They stated that the slum mothers cannot keep in mind the date of the due doses. The service providers provided a target list of children of the areas containing their detailed particulars, including the date of the due doses for every child one day before the EPI session day. We visited the children of my assigned areas with the target list, reminded them of the due dose and EPI session day, and sent them to the centre for vaccination of children. Regarding their activities, all the group members interviewed informed that they collected the particulars of newborn babies during the last one year and provided the list of the newborns to the service providers. One group member said, "as we are residing with other families, we know when a mother becomes pregnant. We also know the expected date of delivery of pregnant mothers. Therefore, we keep keen observation on them, and whenever a mother gives birth, we enlist the particulars of the baby, send the list to the service providers, and also motivate mothers to vaccinate the newborn as soon as possible". Another important activity they performed as they stated was keeping track of migrated-in and migrated-out families which is an important reason for drop-out and left-out in urban slums. The members of the support groups informed that the service providers (appas) could not visit all the areas of locality, because the area is large. Therefore, the support group members focused their activities on more distant areas from the EPI centres. The members added that, although slum mothers are very poor, they listen to the advice of the group members about vaccination of their children. They suggested keeping close contact by the service providers with them, which inspired them to do work. Two group members raised the issue of getting any sort of allowance/financial support for their work. They said that such support would encourage them to do more work on child immunization.

Table 12 presents some basic information relating to the EPI support groups. The table shows that three groups were formed with 12 members in each group. Of 28 meetings of the support groups planned, 20 were held during the study period. The average number of group members attended the group meeting was nine.

Table 12. Information on activities of EPI support group	
Activity	Status
Number of EPI support groups formed	3
Number of members in each group	12
Number of group meetings planned	28
Number of group meetings held	20
Average number of group members attended meetings	9
Total number of children sent to EPI centres with ticket during the study period	195

Information from the minutes of meetings of the EPI support groups was analyzed to assess the problems identified, decisions taken, and decisions implemented by the support groups during the study period. Table 13 shows that most problems identified by the groups were finally implemented.

The findings of the study showed that the coverage of child immunization increased after the implementation of the strategies, and there was no difference between the support group areas and the non-support group areas. This suggests that there was no value added due to support groups. As stated earlier that the support group members were non-paid volunteers and were involved with social mobilization, and in the non-support group areas, the service promoters who are paid workers of concerned NGOs were involved for doing the same work relating to EPI (Table 14). The table shows that almost same activities were performed by the paid service promoters and non-paid support group members relating to EPI services. The findings suggest that the support groups had important roles in improving the coverage, although there was no difference relating to EPI between the support group areas and the non-support group areas.

Table 13. Problems identified, decisions taken, and decisions implemented by EPI support group members

Activities/problems identified	Decisions taken	Implementation
Informing community about modified EPI service schedules	Group members would provide information to 20 households of their adjacent families about afternoon sessions	Survey data showed that 81% of mothers of the area knew about afternoon sessions
Providing information to mothers about EPI session days	Group members would provide information to mothers of their areas one day ahead of the sessions scheduled	Support group members informed mothers about the date of holding the next session
High drop-outs	Identify drop-out children and motivate their mothers to complete all doses	Support group members identified 65 drop-out children during the project period, of which 32 were motivated and sent by the members to EPI centres for vaccination. They provided a list containing the particulars of the remaining 33 dropped-out children to concerned service providers, which were followed, motivated, and vaccinated by the service providers
Registration of newborn children	Identify newborn children and inform service providers	Support group members identified 119 newborns, motivated their mothers to vaccinate the children, and handed over the list of newborns to service providers
Tracking of families migrating in and out of study areas	Collect information about shifting households from session area	Support group members collected information about in and out-migration families in the slums. They registered 54 houses that were migrated in and 71 households that were migrated out during the study period
Existence of invalid doses	Efforts for reduction of invalid doses are needed from support group members	Support group members informed all the mothers to start the first dose of DPT and OPV after completion of one and half months, measles after 9 months, and give the 2nd and the 3rd dose of DPT and OPV at an interval of 28 days
Caretakers bring children to EPI centres without the EPI card	Advise working mothers to leave the card with the caretaker so that the caretaker can bring children to EPI centres with card	Support group members provided message to the working mothers of their area
Difficult to understand if the support group members send any child to EPI centre for vaccination	Introduce a ticket that would be provided by the group members to mothers when any child is send to EPI centre	In total, support group members sent 195 children to EPI centres with a ticket during the study period
Extensive publicity about child immunization needed	Group members would extensively involve with publicity for coverage of child immunization	Support group members distributed leaflets and ensured miking on EPI session days for publicity about child immunization

Table 14. Major activities performed by service promoters and support group members

Activities done by service promoters in non-support group areas	Activities done by support group members in support group areas
Inform the community about modified EPI service schedule	Inform the community about modified EPI service schedule
Assist paramedics in preparing a target list for each session	-
Visit households one day ahead of the EPI session, update the target list, inform mothers about the place and time of the EPI session that would be held next day, and motivate them to bring their children in the EPI centre for vaccination	Support group members announce about the EPI session to be held on the following day through miking from local mosques and individual contact
Miking about EPI session, visit households with the target list, motivate mothers, and bring the targeted children to EPI centres for vaccination on the EPI day	The service providers give the target list to support group members on the session day. The support group members informed mothers about the place and time of the EPI session being held on the EPI day and motivate mothers to bring their children to EPI centres for vaccination. Miking was done from local mosques
Search drop-out and left-out children and include them in the target list for the next session	Search drop-out and left-out children, motivate and send children to EPI centres for vaccination. They also provide names and addresses of drop-out and left-out children to service providers on meeting days
Include names and addresses of eligible children who migrated in from other slums in the target list	Include names and addresses of eligible children who migrated in from other slums in the target list on the monthly meeting day
Keep track about the migrated-out children. If any child is migrated out from a slum but remains in their working area, they enlist the name of the child in the target list of concerned area	Keep track about migrated-out children, inform service providers in the monthly meeting, and assist them to update the target list
Include the name of newborn in the target list and arrange to provide BCG as soon as possible	Inform service providers about newborns and send the newborn to EPI centre for BCG vaccination
Inform the community if any change is made in EPI session	Service providers inform support groups if any change is made in vaccination session and the group members communicate it with the community
Provide special focus on vaccination of children whose mothers are garment workers	Support group members make visits to houses of children whose mothers are garment workers, inform them about changed timing of EPI sessions, advise mothers to keep the EPI card with any caretaker, and send children to EPI centres with caretaker if they cannot manage time
Assist paramedics in organizing EPI sessions in the slums	Assist service providers in getting suitable place for organizing EPI centres



টিকাদান কেন্দ্রে সকাল ১০ ঘটিকা হইতে বিকাল ৫ ঘটিকা পর্যন্ত টিকা দেওয়া হয়।
শিশুকে জন্মের ১ বৎসরের মধ্যে ৭টি রোগের বিরুদ্ধে টিকা দিন।
(০-১ বছর বয়সের শিশুদের টিকাদান সময়সূচী)

নাম	টিকার নাম	ডোজের সংখ্যা	টিকা শুরু করার বয়স ও মধ্যবর্তী বিরতি
বিসিজি	বিসিজি	১	জন্মের পর
ডিপিটি	ডিপিটি	৩	৬ সপ্তাহের পর, একমাস অন্তর
হেপাটাইটিস-বি	হেপাটাইটিস-বি আকসিন	৩	৬ সপ্তাহের পর, একমাস অন্তর
মহিলাইটিস	এপিডি	৪	৬ সপ্তাহের পর, একমাস অন্তর ৩ ডোজ এবং হামের টিকার সাথে ১ ডোজ
আইসিডিডিআর.বি	আইসিডিডিআর.বি	১	৯ মাস পূর্ণ হওয়ার পর



Conclusions and Recommendations

The findings of the study revealed that the implementation of a combination of strategies contributed lots to improving the coverage of child immunization in urban slums. Although it was not possible to assess the individual contribution of each component strategy with great accuracy because of overlapping effects, the findings suggest that each strategy had contribution to improving the coverage. Therefore, the strategies tested can be considered an effective 'package of strategies' in improving the coverage of child immunization that could be replicated in all urban slums of Bangladesh. However, the following recommendations need to be considered in scaling up the strategies:

1. Special attention should be given in planning EPI sessions. The EPI session plan should be prepared very carefully so that the planned session days do not fall on any weekly or any other holidays.
2. Strict care should be taken so that any planned session does not miss to reduce the number of drop-outs and left-outs. If any session is missed in any case, the session should be organized one or two day(s) later.
3. The service providers should prepare a target list for each EPI session well ahead of the session day. The target list should provide details of eligible children, not projected numbers. The detailed target list could be prepared with the help of the EPI register, drop-out and left-out cases of a session, and house-to-house visits.
4. The operational-level managers should take steps to select suitable venues where the field staff do not face any problem to continue their sessions at the extended hours.
5. The findings of the present study showed that attendance of children was much higher in the afternoon EPI sessions than in the morning sessions. It indicates that afternoon is a more convenient for mothers to vaccinate their children. Therefore, EPI service schedules should be modified considering the convenience of service recipients.
6. The findings also revealed that the screening checklist helped identify drop-out cases. Therefore, a system should be developed to use the screening checklist in all the static and satellite clinics to identify the unmet needs of immunization, which ultimately helps improve the coverage of child immunization.
7. Special attention should be given to follow-up of children who have unmet needs and who have been identified through using the screening checklist. If any child is found who has not yet visited the referral place for vaccination, motivation may be done by the staff member who followed up the child.
8. As the findings revealed that the screening checklist helped reduce the number of drop-outs and the service providers suggested introducing a system to use the checklist by drug-sellers at local pharmacy, the introduction of the checklist through local drug-sellers may, therefore, be tested.
9. The findings showed that the support groups were essential in the areas where the working area of the worker is large. The staff members cannot visit all the households of their areas due to their large working areas. Therefore, support groups might help the providers in those areas.

10. Special attention should be given to visits to houses of eligible children by field staff on previous and EPI session days to motivate and bring children to the EPI centres for vaccination.
11. The existing system of performance review at DCC zonal meeting and Ward EPI committee meeting should focus more on reduction of drop-outs, left-outs, and invalid doses.
12. Specific decisions should be available about who would be responsible to receive vaccine carriers at offices where there is an 'EPI Ward Room'.

Nevertheless, the policy-makers and programme managers should come forward to implement the package of successful strategies in all the slums of Bangladesh for improving the coverage of child immunization among this marginalized group of people. Manuals and guidelines need to be developed and distributed among service providers, and training for them is essential before scaling up the strategies. Moreover, a team consisting of the partners of the study should do work for providing technical assistance in scaling up the strategies.

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