



IOCH

Immunization and Other Child Health Project

**Vaccination Coverage Survey in the
Kishoreganj Municipality - April 2000**

Survey Report No. 14

**This survey was conducted by IOCH, a project of Management Sciences for Health,
funded by USAID under AID contract No. HRN-I-01-98-00033-00, Task Order No. 01**

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September 2000

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Acronyms

BCC	Behavior Change Communication
BCG	Bacillus of Calmette and Guerin
CES	Coverage Evaluation Survey
COSAS	Coverage Survey Analysis System
DPT	Diphtheria, Pertussis and Tetanus
EPI	Expanded Program on Immunization
FWC	Family Welfare Center
IOCH	Immunization and Other Child Health
Mahallah	Smaller localities (smaller than a village)
MOHFW	Ministry of Health and Family Welfare
Mouza	Smallest administrative locality in an Upazila
MSH	Management Sciences for Health
NGO	Non Governmental Organization
NID	National Immunization Day
OPV	Oral Polio Vaccine
TT	Tetanus Toxoid
WHO	World Health Organization

Terminology

This provides the meaning of some of the more technical terms used in this report and a brief explanation of their use.

By card: An immunization given to a child is termed as by card if the date of the dose is entered on an immunization card. Only doses recorded by card are treated as valid data in this survey.

By history: Immunization history collected from a parent's recall is termed as by history. Often no date will be mentioned. This information is only included in crude data.

Crude coverage rate is calculated from the doses recorded by card and/or by history. It is not ascertained whether the doses were given at the correct age and/or following the correct interval (where applicable). Crude data however, helps us to understand how much additional coverage could be achieved if all vaccines were given at the optimum age for the child and following the optimum interval. It also provides useful information on access to the EPI program and on the operational aspects of the provision of health services.

Valid coverage rate is calculated from the vaccinations recorded by card. Valid data includes only the doses of vaccines that were given after the minimum date of eligibility and/or after the minimum interval necessary to be effective and to protect the child. There is no maximum interval for a dose and therefore a dose administered after 52 weeks is still regarded as valid. By comparing crude coverage with valid coverage data of any particular antigen, one can determine how much coverage was lost due to the inability to give vaccine at the appropriate time.

Invalid doses are those administered at the wrong age and/or at the wrong interval. Doses 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 are classified as "invalid" doses.

The **criteria for a valid dose** used in this survey is the criteria recognized by the Bangladesh EPI program: minimum age for DPT/Polio 1st dose - 6 weeks old; minimum DPT/Polio interval - 4 weeks; minimum age for Measles vaccine - 38 weeks old.

Program access is measured by the percentage of children surveyed who received DPT 1st dose (crude data – by card and history) in the routine immunization session.

Fully immunized means the child has received all the doses it requires (BCG, OPV 1-3, DPT 1-3 and measles).

Missed Opportunity refers to a visit of a child to a vaccination center for a dose that he received. However at that time he was also eligible for another dose of antigen that he did not receive. If the missed dose was provided at a later date, it is a *corrected missed opportunity*. If not, it is an *uncorrected missed opportunity*.

Executive Summary

Background

Between April 4-10, 2000, a coverage evaluation survey was conducted by IOCH in Kishoreganj municipality as a part of ongoing evaluation of EPI program with the following objectives,

Objectives

The principal objectives of the survey were to assess:

- a) the levels of routine immunization coverage of children (12-23 months);
- b) the levels of TT immunization coverage in women of child bearing age (15-49 years) regardless of their marital status and
- c) the OPV and Vitamin A coverage levels achieved during the sixth round of NIDs conducted in November-December 1999.

Coverage Levels for the Routine Immunization of Children

Access: 90% of the children received at least one dose of antigen (DPT 1st dose in this case) from routine immunization sessions based on crude data (card plus history). However, 10% of the children did not receive any immunization.

Crude coverage between 12-23 months: 91% children received BCG, 74% received three doses of OPV, 74% received three doses of DPT and 67% received measles vaccine.

Valid coverage between 12-23 months: 91% children received BCG, 70% received three doses of OPV, 70% received three doses of DPT and 65% received measles vaccine.

Valid coverage by 12 months: 91% children received BCG, 67% received three doses of OPV, 67% received three doses of DPT and 56% received measles vaccine.

Source of immunization and distance of immunization center: Childhood immunization is provided by EPI outreach centers in 42% of the cases, 48% from Government hospitals and the remaining from other sources. EPI vaccination center is within half-an-hour walking distance from client's residence in 82% of the cases.

Reasons for non-immunization and partial immunization of children: The main reasons for non-immunization and partial immunization were the lack of knowledge of the parents/caretakers about the importance of immunization and in particular the need to return for the subsequent doses. Fear of side reactions and 'Sickness of the child' were also cited by some parents as reasons for non-compliance to immunization schedule.

Problems detected: although access to immunization was fairly high, there was high drop out rate (18% from DPT1 to DPT3 and 25% from DPT1 to Measles vaccine) and a small number of invalid doses due to early immunization (2% for DPT1 and 3% for Measles vaccine). Prevalence of uncorrected missed opportunities was very low (range 0% to 1% for different antigens, except for measles vaccine) Uncorrected missed opportunities for Measles vaccine was 3%. Child immunization cards were available in only 48% of the cases and were lost in another 41% of cases.

Coverage Levels for the Routine TT Immunization of women

70% of women of childbearing age (15-49 years) had received a first dose of TT. Only 23% women had received the five doses of TT vaccine. 30% of the women had not received any immunization.

Reasons for non-immunization and partial immunization of women: The major reason cited for non-immunization was that the women were unaware of the need for immunization and fear of taking injections. Whereas the major reasons for partial immunization were that they were either unaware of the need for due doses of TT immunization or the health worker did not specified the date to return for the next dose of TT vaccine.

Coverage Levels for the sixth NID Campaign

In Kishoreganj Municipality, the NID coverage figures were very good. 94% children received a dose of OPV during the first round and 92% of the children received OPV during the second round of sixth NID campaign. 89% of the children received OPV in two rounds of sixth NID campaign and 4% of the children received no dose of OPV.

The main reasons for most of the non-immunization cases during the NIDs were that the parents were either unaware of NID or vaccine was not available at the immunization site.

Health workers, miking and television were the main source of information about the campaign. Effectiveness of other printed/mass media as a source of information and motivation was very low.

Vitamin A capsules were given to 81% of the eligible children on the second round of the sixth NID campaign.

Suggested solutions

The survey indicates a need for appropriate information being given to parents / caretakers in an effective way about the importance of each child being fully immunized (preferably before 12 months) and about how to achieve full immunization (the time and place of the immunization sessions and the number of doses required). Women of childbearing age require more education about how to prevent neonatal tetanus with 5 doses of TT vaccination. There is also a need for training to be given to the service providers to help them keep up to date with EPI policies and guidelines and increase their capacity for counseling parents about EPI.

Introduction

The routine EPI program in the municipalities is carried out by a variety of private and public providers at fixed (hospitals, clinics, dispensaries, etc.) and at outreach sites. NGOs and private practitioners also provide immunization services in many places. The doses of immunization provided are supposed to be reported to the municipal Health authority either at the end of each immunization session (if it is provided by municipality) or on a monthly basis. After compilation, the data is submitted to the concerned Civil Surgeon's office that aggregates it with other Upazila EPI results within that district and sends it on to the EPI HQ in Dhaka.

For many reasons (e.g. immunization provided to children older than the target age group, tendency for over reporting, underestimated target etc.) routine EPI coverage data is generally unreliable^{5,7,8}. There are also clear indications that the health situation in most of the urban areas are worse than in the rural areas^{5,7,8,10,11}.

IOCH therefore decided to carry out a survey based on the WHO recommended EPI 30 cluster survey method¹ to obtain data on the status of the immunization coverage of the children and women living in Kishoreganj municipality as well as on the operational profile of the provision of immunization services. Kishoreganj municipality was taken as a unit and 30 clusters were chosen through random sampling method (please see map).

Objectives

The overall objective of the survey was to assess the level of immunization coverage in Kishoreganj Municipality. The specific objectives were to:

- a) assess the level of routine immunization coverage of the children (12-23 months) and find out the reasons for non immunization and partial immunization
- b) assess the level of TT immunization coverage among women of 15-49 years of age irrespective of their marital status and find out the reasons for non immunization and partial immunization
- c) assess the coverage levels of OPV and vitamin A administered during the sixth round of NID campaign.

Methodology and its Limitations

The survey followed the WHO recommended 30-cluster survey method¹, which has been widely used in many developing countries to assess immunization coverage. It is relatively simple and can be done at low cost. (The detailed survey methodology and its limitations are presented in **Annex A**). Briefly, the immunization information is collected on a randomly selected group of 210 children/women from 30 clusters (7 children/women per cluster) in a given community. It gives an estimate of immunization coverage to within +/- 10 percentage points of the true population proportion with 95% statistical confidence, assuming a design effect of 2.

In this survey 7 children between 12-23 months (children born between April 4, 1998 to April 3, 1999) were selected from each cluster to ascertain their routine vaccination status. **Annex B** describes how the dates of eligibility of different antigens in routine immunization were determined for children. The sixth NID campaign was conducted on November 2-10, 1999 and December 2-8, 1999 in two rounds respectively in urban areas. Children born between December 2, 1994 and December 1, 1999 were selected for collecting information on NIDs. Seven women between 15-49 years of age, irrespective of their marital status were selected to ascertain their tetanus toxoid vaccination status for routine immunization.

The 30 clusters (mouzas/mahallahs) were chosen randomly by IOCH from a list of the populations of mouzas and mahallahs in Kishoreganj municipality from the Bangladesh Population Census 1991. The list of selected clusters is given in **Annex C** and their location is shown on the following map. The WHO standard questionnaire was used in this survey for documenting the routine immunization status of children and women. Separate questionnaires were used for collecting the data on the NID campaign.

Data was collected by IOCH monitoring team. Data collection period was from April 4-10, 2000. Data entry and analysis was done by IOCH using COSAS 4.3³ and "EPI Info" programs. The final report was prepared by the Monitoring and Evaluation Unit, IOCH/MSH Project.

Limitations of the 30-cluster survey method

Although the 30-cluster survey method is relatively simple, it has several limitations² that can be grouped into two types:

Linked to the sampling method:

- As an inherent bias in the sampling technique in 30 clusters, bigger mouzas are more likely to be selected as a cluster. The survey leaves out scattered small mouzas with poor access to services. It also does not reflect the lack of uniformity in service availability or the behavior of particular populations.
- There is a wide confidence interval (+/- 10%). It means that if the result shows 56% of children received a valid dose of measles before 12 months of age, then the “true” figure of measles immunization of children could be anywhere between $(56-10) = 46\%$ and $(56+10) = 66\%$. This type of survey is useful when the coverage is low but is less relevant to assess higher coverage or to compare surveys – unless there is a big difference between two surveys.
- To be relevant the analysis of valid data must apply to a relatively high percentage of available cards.

Linked to the implementation:

- The selection of the index house is key. Too often the proper method is not followed because the surveyors do not make the effort to number all the houses from their location to the end of the mouzas along the direction indicated by the bottle or by the pencil.
- If a household includes an eligible child who is not at home for a few hours, the surveyor often does not return later on but skips the house and substitutes another child. This is, of course, an incorrect procedure that introduces a bias.

It is also important to remember that this survey coverage data gives little information about the current program as it documents the activities of a year earlier.



Results

General information

210 children were surveyed. 48% of them were boys and 52% were girls. 21% of the infants were away of their home for more than 2 months in their first six months of life. 94% of them live in a building or tin shade house. Survey findings show that 82% of the immunization centers are within half an hour walking distance of the children's home, 17% were located between half an hour to one hour walking distance and in 1% of the cases it was located more than one hour walking distance.

216 women were surveyed. 16% of the women interviewed were unmarried at the time of the survey. 14% of the women were away for more than 2 months at one time from their normal residence within last two years. 95% of the women live in a building or tin shade house. Immunization centers were within half an hour walking distance in 92% of the cases, 8% within half an hour to one hour walking distance.

A. Routine Immunization coverage of children

Coverage Levels (card plus history data of COSAS analysis)

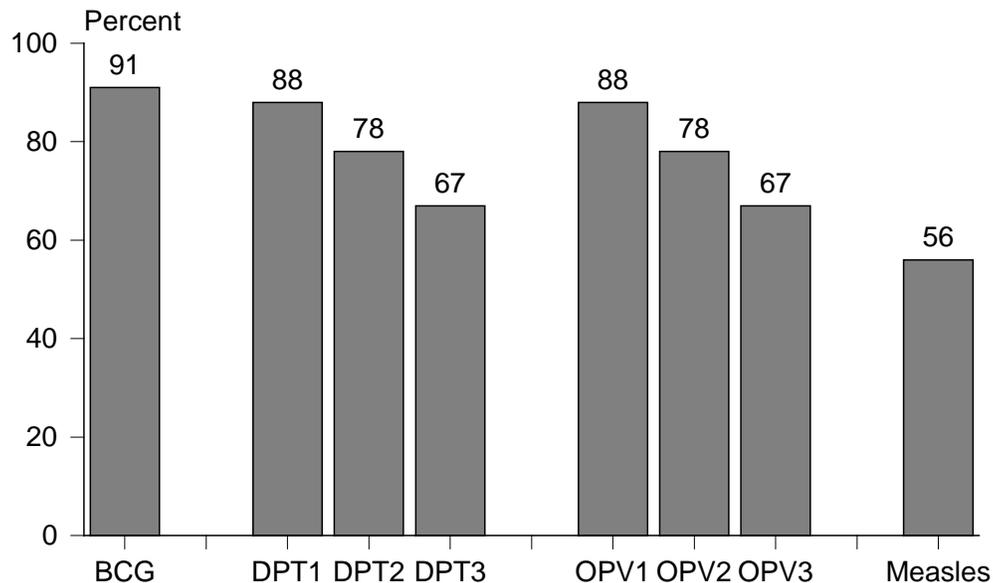
Table 1 shows the coverage levels of children between 12-23 months and their vaccination status at 12 months of age. The crude data figures for the 12-23 month age group indicate that 74% of the children received three doses of OPV, 74% received three doses of DPT and 67% were vaccinated against measles. The valid coverage levels are however considerably lower for DPT/OPV 2nd does and 3rd doses. 70% of the children received three doses of OPV, 70% received three doses of DPT and 65% were vaccinated against measles. Only 10% of the children surveyed had not been immunized at all and were therefore not reached by the routine EPI program.

Table 1: Routine Immunization coverage levels of the children

	Coverage (%) Immunization of 12 - 23 month age group		Coverage (%) Immunized by 12 months Valid data
	Crude data (Access)	Valid data	
BCG	91%	91%	91%
Polio 1	90%	88%	88%
Polio 2	83%	78%	78%
Polio 3	74%	70%	67%
DPT 1	90%	88%	88%
DPT 2	83%	78%	78%
DPT 3	74%	70%	67%
Measles	67%	65%	56%
Fully immunized	65%		
Zero dose	10%		

Table 1 shows little or no difference between the valid data of immunization by 23 months age group and the valid data by 12 months except for measles coverage (65% versus 56%). **Chart 1** shows the actual coverage for children of less than 12 months. Proportion of fully immunized children under one year of age (valid data) among immunization card holder's were 55%.

Chart 1: Immunization coverage among children less than 12 months old



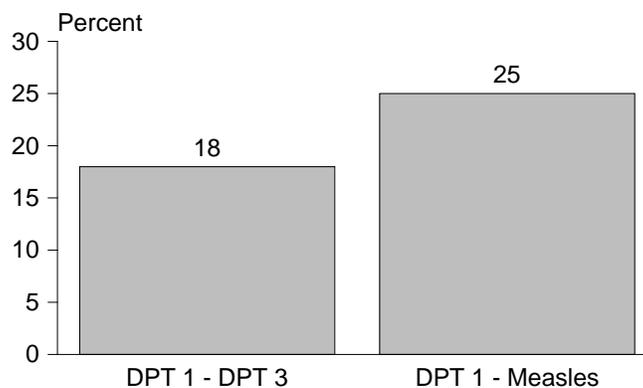
Program access [(percent of children surveyed who received DPT 1st dose (crude data - by card or history)].

Access to immunization was very good as 90% of children received a 1st dose of DPT.

Program continuity (dropout rate)

Crude data for antigens received by 12-23 months of age is used for calculating the dropout rate. In this survey, the DPT1 to DPT3 dropout rate was 18% and DPT 1 to measles drop out rate was 25% (**Chart 2**).

Chart 2: Drop out rates for childhood immunization



Program quality

Adherence to the immunization schedule – invalid doses

Adherence to the immunization schedule is generally considered to be the major indicator of program quality. The data indicates that the provider's performances related to program quality was fairly satisfactory. In Kishoreganj municipality the number of invalid doses⁴ were very low for different antigens. 2% of children received an invalid dose of DPT1 and 3% received an invalid dose of measles vaccine. 1% children received a DPT second dose less than 4 weeks after the first dose of DPT and another 1% children received DPT third dose less than 4 weeks after the second dose of DPT.

BCG vaccination

91% of the children surveyed received BCG vaccine based on card plus history data. 81% of the children were found with a BCG scar but 11% did not produce a visible scar.

Missed opportunities of immunization

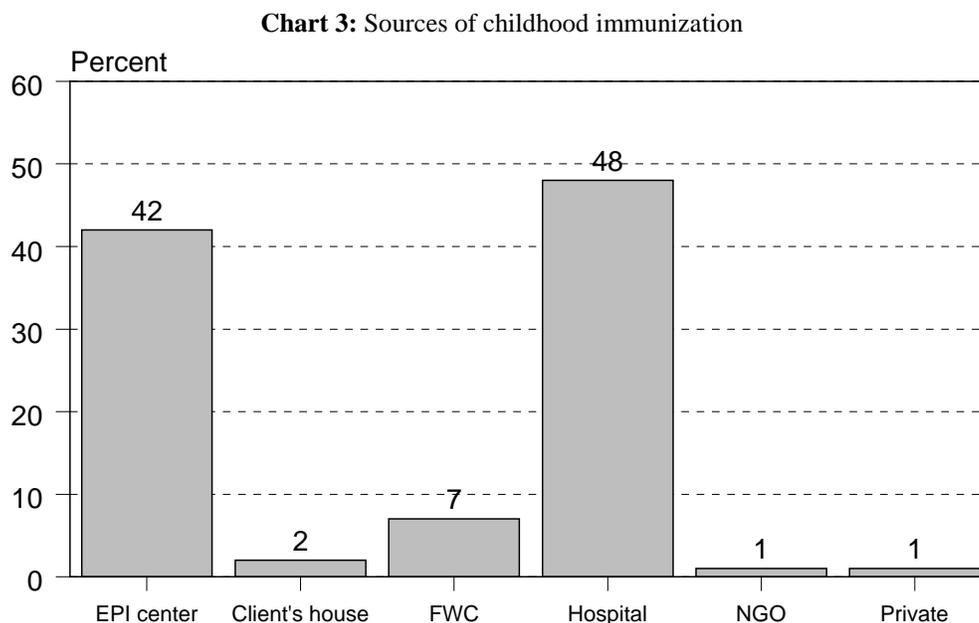
The prevalence of uncorrected missed opportunities for immunization was very low (range 0% to 1% for all antigens except for measles). Uncorrected missed opportunities for measles immunization were 3%. Overall measles coverage would be 3% higher if there were no missed opportunity.

Availability of documentation of immunization

Child immunization cards were available in only 48% of the cases and were lost in another 41% cases.

Sources of immunization

Chart 3 shows that childhood immunization is being provided mostly by EPI outreach centers (42%) and from Government hospitals (48%). In rest of the cases immunization is being provided by different sources.



Reasons for non-immunization and partial immunization of the children

The reasons cited by parents for non-immunization and partial immunization are shown in **Table 2**. 10% of the children were not immunized. Most of the parents of those children were either unaware of the need for immunization (65%) or they had fear of side reactions (20%). 25% of the children were partially immunized. 51% of those children were not fully immunized as their parents were not aware that they had to take the children to the immunization session to complete the series and another 13% were not fully vaccinated as their parents had fear of side reactions.

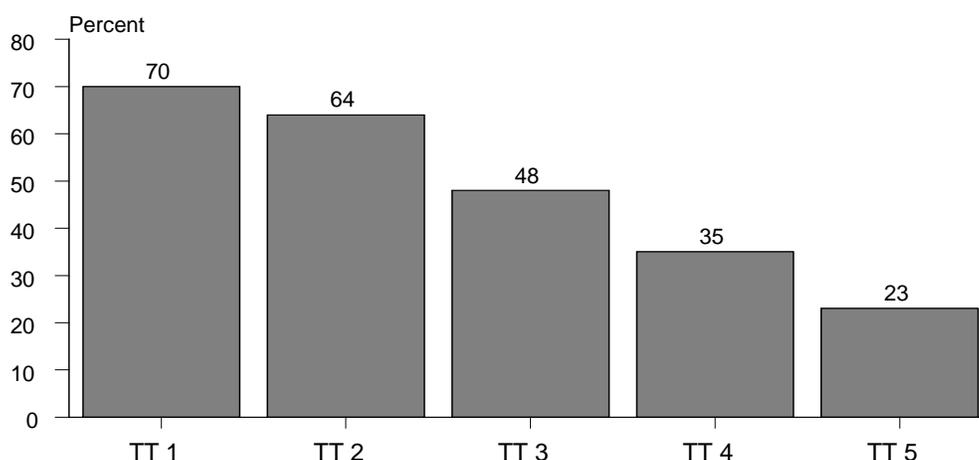
Table 2: Reasons for non-immunization and partial immunization of the children

Reasons	Not immunized	Partially immunized
Did not know about the need to vaccinate the child	65%	-
Mother did not know that she need to return for 2nd/3rd dose	5%	51%
Place and/or time of immunization unknown	-	2%
Fear of side reactions	20%	13%
Wrong ideas about contraindications	5%	2%
Mother too busy to take the child to immunization session	-	4%
Vaccine was not available in the vaccination site	-	-
Vaccinator was not available at the vaccination site	-	2%
Child was sick and not taken to the vaccination session	-	9%
Child was sick, taken to the vaccination site but not given vaccine	-	11%
Mother was sick / family problem	-	6%
Cultural / religious reasons	5%	-

B. Routine TT immunization coverage levels of the women

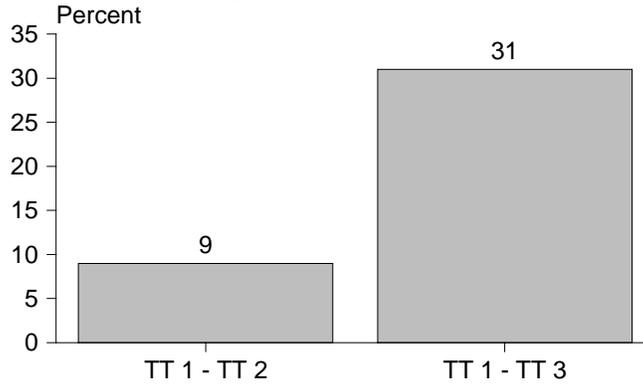
70% of the women had access to a first dose of TT vaccine (based on crude data). 64% of the women received two or more doses of TT vaccine. Only 23% had received all the 5 required doses (**Chart 4**). 30% of the women surveyed had not received any doses of TT vaccine.

Chart 4: Routine immunization coverage levels for TT of the women (15-49 years)



The dropout rate from first dose of TT vaccine to second dose of TT vaccine was 9% and the dropout rate from first dose of TT vaccine to third dose of TT vaccine was 31% (**Chart 5**). Survey findings indicate that no women missed an opportunity for a first dose of TT immunization during their antenatal check-ups. Only 12% of the women had TT immunization cards and they were lost in another 41% cases.

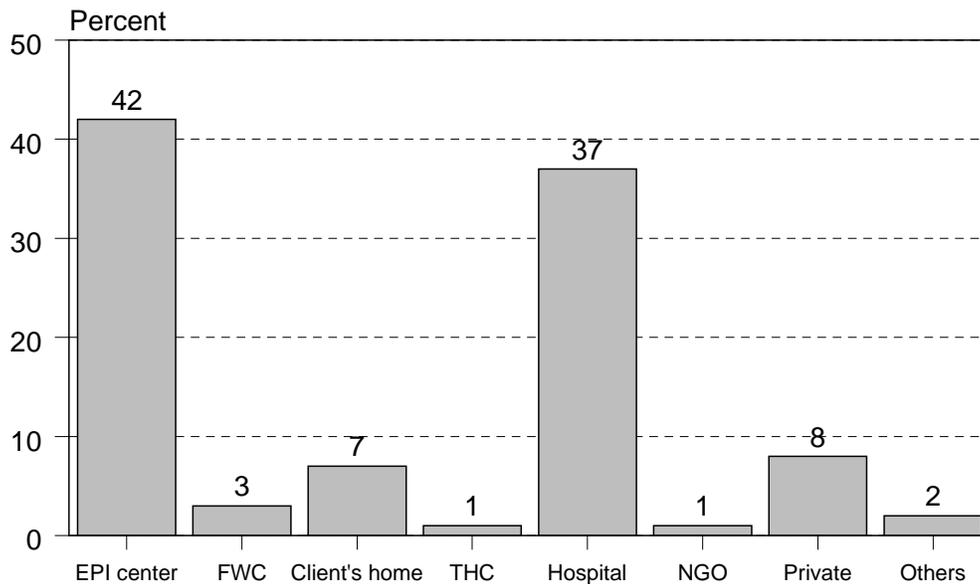
Chart 5: Drop out rates for TT immunization



Source of TT immunization

Chart 6 shows that TT immunization is being provided mostly by EPI outreach centers (42%) and from Government hospitals (37%). In rest of the other cases immunization is being provided by different sources.

Chart 6: Sources of TT immunization



Reasons for non-immunization and partial immunization of the women

30% women were not immunized and 47% were partially immunized. **Table 3** indicates that the major reasons cited for non-immunization of women were: a) unaware of the need for immunization (89%) and b) fear of taking injections (8%). Whereas the major reasons cited for partial immunization were: a) unaware of need to return for subsequent doses of immunization (59%) and b) health worker did not specify the date to return for the next dose (13%).

Table 3: Reasons for non-immunization and partial immunization for TT of the women

Reason	Non immunization	Partial immunization
Next dose is not yet due	-	6%
Unaware of need for immunization	89%	7%
Health worker did not specify the date to return for next dose	-	13%
Unaware of need to return for subsequent doses	-	59%
Place and time of immunization not known	-	1%
Other reasons related to lack of information	2%	-
Postponed until another time	-	1%
Place of immunization too far	-	1%
Fear of taking injection	8%	5%
Vaccine was not available in the session	-	-
Vaccinator was absent	-	1%
Women was too busy to go to the session	-	3%
Women was ill, and did not go to the session	-	3%
Woman was ill, went to immunization session, but not given immunization	-	1%

C. Coverage Levels in the sixth NID Campaign

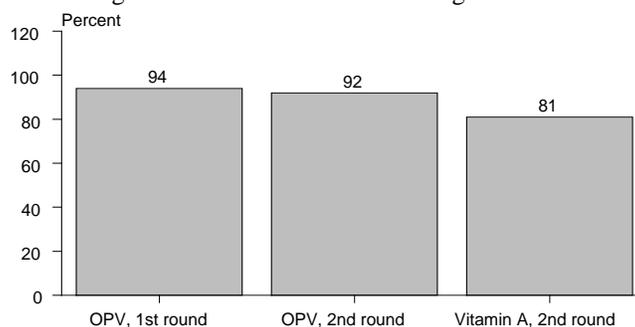
OPV Coverage

94% of children below 5 years of age received OPV during the first round of NID campaign and 92% received OPV during second round of the sixth NID campaign (**Chart 7**). In 89% of the cases children received OPV in both rounds of NID campaign and 4% of the children received no dose of OPV during sixth round of NID campaign.

High potency Vitamin A coverage

During the second round of the sixth NID campaign a high potency vitamin A capsule was also administered to 81% of the children between one and five years of age (**Chart 7**).

Chart 7: Coverage of OPV and Vitamin A during the sixth NID campaign



Reasons for not receiving vitamin A

19% of the children did not receive vitamin A during NID. **Table 4** indicates that 68% of the children did not receive it due to the fact that their parents felt that it is not required and 18% of the children did not receive it due to their parents were unaware of NID campaign.

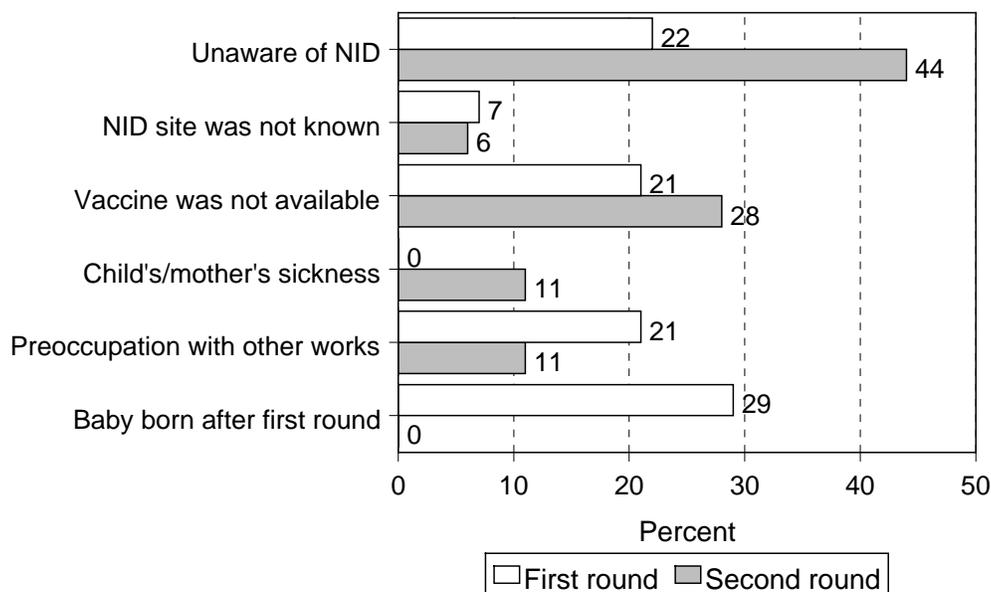
Table 4: Reasons for not receiving Vitamin A

	Reasons
Unaware of NID	18%
NID site was not known	2%
Vitamin A was not available	5%
Child's/Mother's sickness	5%
Preoccupation with other work	2%
Not required	68%

Reasons for non-immunization of OPV

6-8% of the children were not vaccinated with OPV during first and second round of sixth round of NIDs. The main reasons invoked for not being immunized during NIDs were lack of knowledge of campaign and vaccine was not available. These together with other reasons are shown in **Chart 8**.

Chart 8: Reasons for non-immunization of OPV during sixth NID campaign

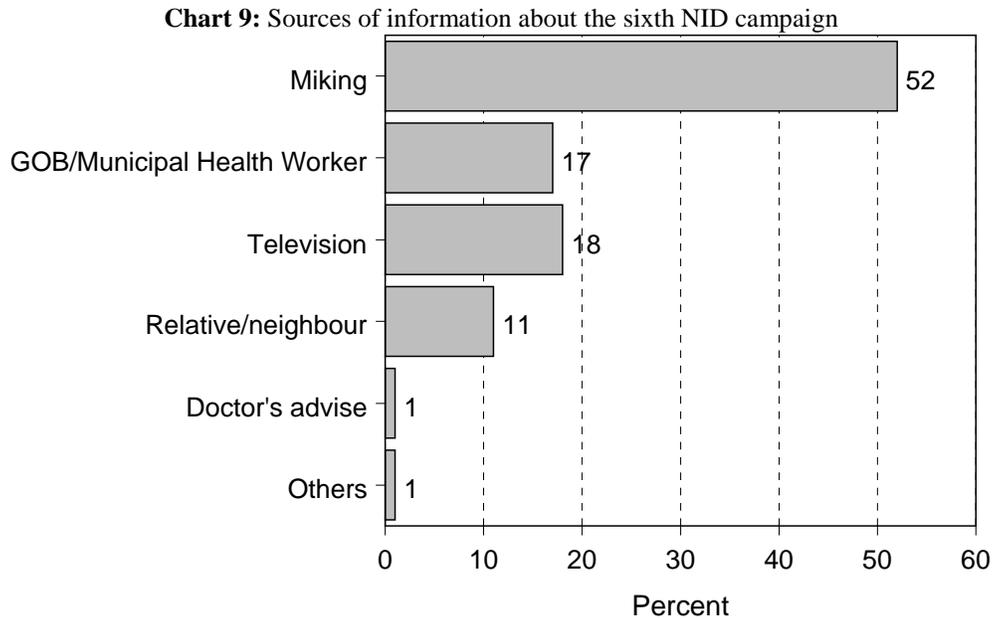


Places of vaccination during the sixth NIDs

97% children received OPV vaccine from the NID vaccination sites and 3% at their home during the first round. The places of immunization were almost the same during the second round.

Source of information about the second round of sixth NID campaign

52% of the respondents said that they got the information from miking, 17% received information from Government and municipal health workers. Television also found to be effective as a media (18%) in dissemination of NID information. These along with other sources of information are shown in **Chart 9**.



Discussion

The survey showed that 90% of the children of 12-23 months of age had access to routine immunization. But the promising start was eroded by a high dropout rate (e.g. 18% from DPT1 to DPT3 and 25% from DPT1 to measles vaccine) and by a small percentage of invalid doses (2% for DPT1 and another 3% for measles vaccine). 10% of the children had not been immunized at all. Child immunization cards were available in only 48% of the cases and were lost in another 41% of cases. Only 12% of the women had TT immunization cards and another 41% women had lost their cards. The absence of cards has got serious implications as it may mean that when a child comes to the immunization session for the second or subsequent doses, the vaccinators will have to immunize without accurately knowing the date of birth of the child and the date of previous immunization. This is another factor likely to increase the number of invalid doses given. This is also true for TT immunization where there is often a long interval between doses.

It is a very good achievement that 94% of the children between 0-5 years of age surveyed received a dose of OPV during the first round and 92% received during the second round. 89% received OPV during both rounds. 4% of the children did not receive any dose of OPV. This occurred at a time when the goal of each of the NID campaigns is to vaccinate each and every child under five years of age with two doses of OPV.

Conclusions and Recommendations

Coverage levels for routine immunization of children

Access to routine immunization and low full immunization

This survey found that the access to routine immunization for children in Kishoreganj Municipality was very good with 90% of the children receiving a first dose of DPT, but this percentage was not maintained for subsequent immunizations. This important shortcoming can be mainly attributed to the lack of knowledge on the importance of full immunization leading to high drop out rates and also but to a least extent to the number of invalid doses and uncorrected missed opportunities.

The dropout rates

The high drop out rates could be reduced to acceptable levels^{5,6,9} by:

- providing better counseling to parents/caretakers about the importance of each child receiving all the required antigens before 12 months. They also require advise about when and where they should take their child for the next dose. Most children will need to attend 4 immunization sessions. 51% of the children dropped out simply because their parents/caretakers did not know that they were required to return to the EPI center for subsequent doses.
- undertaking appropriate Behavior Change Communication (BCC) activities through the mass media and service providers to increase awareness of the need for children to receive all the doses of each of the antigens.
- providing refresher training and orientation to the service providers for counseling parents. It is apparent from the results of the survey that they lack the relevant technical skills and/or motivation for counseling. Some parents reported that they had never received any immunization information from a health worker and others complained that they had not been spoken to at all.

Coverage levels for TT vaccination

Access to TT vaccine (TT1) was fairly good but the rate of drop out after the second dose was very high. The coverage of 70% for TT1 reduced to 23% for TT5 and 30% had not been immunized at all. A woman of reproductive age needs to receive 5 doses of TT at appropriate intervals to acquire immunity for rest of her reproductive life. TT coverage is likely to be improved by:

- checking the TT status of all women between 15-49 years at antenatal check ups and at routine child immunization sessions to see whether the mother or female caretaker is eligible for any dose of TT and provide a dose of TT if it is required
- undertaking appropriate BCC activities to increase awareness of the women of childbearing age of the need for 5 doses of TT vaccinations
- providing refresher training to the service providers of the TT vaccination requirements.

Coverage levels for the sixth round of NIDs

The coverage levels of the sixth NID campaign were at a satisfactory level (94% of the children received OPV during two rounds and in 92% of the cases they received at least one dose of OPV.

89% of the children received both doses of OPV and 4% of the children did not receive any dose of OPV. This occurred at a time when every child under five years old should receive a dose of OPV in each round of NID campaign in order for Bangladesh to achieve its goal of being a “polio free country”. Improvements might be made by:

- increasing and improving the BCC activities to ensure that each parent/caretaker is aware that each and every child must receive polio vaccine during both rounds of each NID campaign planned in 2000;
- paying particular attention to immunization in remote areas, where there is a shortage of health staff and in those areas known to have low OPV coverage in earlier NIDs.

Reference and Resource materials

1. WHO EPI Mid Level Managers module: Evaluate Vaccination Coverage (WHO/EPI/MLM/91.11)
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Annex - A

The following are extracts from **Anthony G Turner, Robert J Magnani and Muhammad Shuaib's** article entitled **"A not quick as quick but much cleaner alternative to the Expanded Programme on Immunization (EPI) cluster survey design"** published in the *International Journal of Epidemiology* in 1996, volume 25, Issue No. 1, pages 198-203.

The standard EPI Cluster Survey Design

"The sample design for the EPI Cluster Survey is a two stage design involving the selection of 30 primary sampling units or 'clusters' (usually village or other area units), from which 210 children with a target age range (usually 12-23 months) are chosen, seven children per cluster. The sample size of 210 children (per domain or stratum) is mandated by the desire to estimate the level of immunization coverage to within +/- 10 percentage points of the true population proportion with 95% statistical confidence, assuming a design effect (i.e. *deff*) of 2.0. Based upon prior experience with immunization coverage surveys (primarily in the US), 30 clusters are generally thought to be necessary to yield sufficiently reliable estimate."

"In the standard design, clusters are chosen from a list of primary sampling units (i.e. villages, urban communities, census enumeration areas etc.) through systematic random sampling with probability proportional to estimated size (*ppes*). The latest estimates of cluster population sizes, which are assumed to be proportional to the number of children in the target age group in each cluster, are typically used as measures of size. The 30 clusters so chosen are then visited by survey field staff who carry out the second stage of sample selection and conduct the household interviews. "

"The original EPI design called for sample children to be chosen randomly from a list of all eligible children in each sample cluster. However, because the creation of lists of households and children tends to be time consuming, costly, and unfeasible in some settings, this procedure is only infrequently used in actual practice. Instead, one of several simplified second stage sampling procedures is commonly used. In one variant, children are selected by first choosing a random direction from a central location in a village or community (e.g. by spinning a bottle). The number of households in that direction to the edge of the community is then counted, and one household is randomly chosen to be the first sample household. Subsequent households are chosen by visiting the nearest neighboring households until information has been gathered on seven children. In a yet simpler variant, a direction from a central starting point is randomly chosen as described above and households are contacted as the interviewer moves in the chosen direction until the required information has been gathered for seven children."

"The second stage sampling methods described above are 'quota sampling procedures' and some of the problems resulting from the use of this approach have been noted over the years."

"First, quota sampling does not ensure that every eligible member of the target population has a known, non-zero chance of being selected. Hence, the standard EPI design, as it is usually applied, is not a true probability sample design."

"A second problem concern sampling weights. However, since measures of size in sampling frames are often inaccurate due to census errors and changes in population since the census was taken, application of the standard EPI Cluster Survey method does not automatically result in a self weighting sample. The survey data must be weighed in order to yield unbiased estimates. However, since selection probabilities are not known in most EPI Cluster Survey applications, sampling weights can not be calculated."

"Thirdly, a computer simulation study demonstrates that the EPI Cluster Survey based upon quota sampling at the second stage of sample selection is considerably more prone to sampling bias than conventional cluster sampling, particularly where immunized children are 'pocketed' within clusters. "

"Finally, there is the issue of how second stage sample selection should proceed in surveys with multiple measurement objectives."

Annex C

EPI Coverage Survey in Kishoreganj Municipality

List of clusters identified for survey

Mouza/area	Population	Cumulative population	Cluster Number
Gaital	4185	4185	1,2
Rakhual	1082	5267	3
Sreedhar Khila	1710	6977	4
Shulakia	5917	12894	5,6,7
Char Shulakia	5679	18573	8,9,10
Puran Thana	3585	22158	11
Batrish	7620	29778	12,13,14,15
Binnagaon (Part)	5171	34949	16,17,18
Haibat Nagar	1809	36758	19
Harua	7337	44095	20,21,22
Kishoreganj Bazar	2050	46145	23
Nagua	4633	50778	24,25,26
Ekrampur	691	53016	27
New town	1539	55017	28
Tara Pasha	4331	60269	29,30

Acknowledgements

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Survey Reports

1. Vaccination Coverage Survey of the Slums of Rajshahi City Corporation- January 2000. Survey Report No. 1. May 2000
2. Vaccination Coverage Survey of the Selected Unions along the North-western Border of Bangladesh- February 2000. Survey Report No. 2. June 2000
3. Vaccination Coverage Survey of the Selected Unions along the South-west Border of Bangladesh- February 2000. Survey Report No. 3. July 2000
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18. Results of Coverage Evaluation Survey of Routine EPI and August 2000 OPV + TT (NNT) Campaign, Dhaka City Corporation Slums – September 2000. Survey Report No. 18. November 2000

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1. Vaccination Coverage Survey of the Teknaf and Ukhia Upazilas- February 2000. Survey Report No. 01, August 2000
2. Vaccination Coverage Survey of the Brahmanbaria Sadar Upazila- February 2000. Survey Report No. 02, August 2000
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5. Vaccination Coverage Survey of the Maulvi Bazar District- February 2000. Survey Report No. 05, August 2000
6. Vaccination Coverage Survey of the Raumari Upazila - February 2000. Survey Report No. 06, August 2000
7. Vaccination Coverage Survey of the Gangachara Upazila - February 2000. Survey Report No. 07, August 2000
8. Vaccination Coverage Survey of Chittagong Hill Tracts - February 2000. Survey Report No. 08, August 2000

Technical Report

1. Joint National/International Review of EPI Program in Urban Areas of Bangladesh—23 January – 3 February 2000. Technical Report No. 01, July 2000

Additional copies of any of these reports, if needed, will be provided free of cost on request to:
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