Original Research Article

Coverage evaluation of vaccines using 30×7 cluster survey in rural area of Dhule, Maharashtra

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ABSTRACT

Background: Infectious diseases are a major cause of morbidity and mortality in children. One of the most cost-effective and easy methods for child survival is immunization. The objective of study was to assess the immunization coverage in the rural area of Dhule.
Methods: A community based cross-sectional study was conducted by using WHO 30x7 cluster sampling technique in Primary Health Centre, Kheda catchment villages among children aged 12-23 months on the day of survey. The total sample size was found out to be 210. Identification of clusters was done as per WHO manual on 30×7 cluster survey. Interviews were conducted as per a structured interview format in households with eligible children. Data feeding was done in MS Excel sheet.
Results: Full immunization coverage (FIC) was found out to be 58.6%. Drop-out rate was calculated to be 22.95%. The main reason for not completing the immunization was unaware to return for subsequent vaccine doses.
Conclusions: Coverage evaluation of vaccines was found out to be 58.6%. Drop-out rate is high.

Keywords: Immunization, Cluster sample, Coverage evaluation, Drop-outs

INTRODUCTION

Infectious diseases are a major cause of morbidity and mortality in children.[1] Globally, 3 million children die each year of vaccine preventable diseases. Most of these children reside in developing countries.[2] One of the most cost-effective and easy methods for child survival is immunization.[3] Though all efforts are put in, by the governmental and non-governmental agencies, there are pockets of low coverage areas.[1]

Based on DLHS-4 study conducted by the Government of India and published in 2012-13, in rural area of Maharashtra, the percentage of children aged 12-23 months who were fully immunized was 67%.[4] Further,

partially immunized and unimmunized children are more susceptible to childhood infectious diseases.[5]

The present study was planned to evaluate the coverage of vaccines using WHO 30×7 cluster sampling technique in the catchment villages of primary health center, Kheda in district Dhule, Maharashtra. The objective of the study was to assess the immunization coverage in the rural area of Dhule.

METHODS

The Catchment villages of primary health centre, Kheda, Dhule, Maharashtra were the survey setting while, coverage evaluation by WHO 30x7 cluster survey was the survey design for the study.

The standard WHO 30x7 cluster survey method was used to evaluate the immunization coverage.[6] This is a cluster sampling technique. Cluster sampling requires that samples be taken from only a sample of the subgroups. The 30×7 cluster sampling is often referred to as "two-stage sampling". The first stage of the sampling is probability proportionate to size (PPS) and the second stage is random. Children aged 12–23 months on the day of survey were the target age group. Since this survey was conducted to represent the most recent performance of the immunization system, the youngest possible children were chosen. Children aged 12–23 months are usually the most commonly chosen target population. The determination of sample size was done as per the WHO "Immunization coverage cluster survey".[6] For sample size determinations to estimate the coverage, the following were determined, estimated or assumed beforehand:

- Anticipated level of immunization coverage
- Desired precision of the estimate
- The level of statistical confidence of the estimate (confidence level)
- Magnitude of differences of coverage among and within the clusters (design effect)

The total sample size was estimated (the total number of children to be surveyed) using the equation below.

$$n_{min} = DE \times \frac{z^2{}_{1-\alpha/2} \times p \times (1-p)}{d^2}$$

The minimum total sample worked out to 192. Since we were going to use 30 clusters, the sample size per cluster worked out to $192 \div 30 = 6.2$. Rounded off, number of children to be surveyed in each of the 30 clusters was 7. Thus 210 children was the total sample size for 30 cluster survey. The study was conducted from 2nd November 2015 to 14th November 2015.

A cluster is a collection of households with identifiable geographical boundaries. The clusters used for this immunization coverage assessment were villages under PHC Nakane. Based on the projected 2016 village wise population, cumulative populations, sampling interval and selection of random number, all the 30 clusters were identified. The details of cluster selection were done as per WHO 30X7 cluster survey.[6] Survey tools and data entry tools were developed. Inputs and comments were taken. Pre-testing of the survey tools was done on the day of the field coordinators' orientation, before the field survey. Pre-tested in the field was done by same field coordinators who conducted the field activities of the survey under supervision. No major concerns came up regarding the survey tools during the pre-testing.

MS Excel based data management tools were developed. The pre-testing was done by entering data collected during pre-testing of survey tools.

The field implementation for the survey was conducted as per a detailed plan devised beforehand. Establishing of households of the selected clusters was not going to be possible. Therefore the core team decided that in every cluster, the geographical center of the cluster would be visited. From there, the investigators (FCs and Supervisor) would move in a randomly chosen direction. The first house would be the house corresponding to a random number chosen beforehand. Both, the direction in which the investigator would move and the random number for choosing the first house, were generated using the computer for each cluster.

After visiting the first household the second household to be visited was the one that was nearest to the first. The nearest household is defined as the household reachable in the shortest time on foot from the household just visited. The nearest household need not be in direct line of vision or on the same side of the street or road. If there are two or more households equally near to the one just visited, select the one on the immediate right as one stands in the doorway of the house looking out. Interviews were conducted as per a structured interview format in households with eligible children. Each investigator was directly supervised by a supervisor during each interview. The child was considered as fully immunized if he/she has received a dose of BCG, 3 doses of DPT and OPV and a dose of Measles vaccine. The child was considered as unimmunized if he/she did not receive any of these vaccines and partially immunized if some vaccine doses were given.

Data entry was done internally. A strict 3-stage quality check mechanism instituted –

- Every format submitted by FCs was scrutinized by survey focal point; most errors and omissions could be corrected at submission point.

- In-built checks and balances were introduced in the data entry tool at the time of development.

- 10% random check of entered data against actual forms.

RESULTS

Table 1 indicates the distribution of 30 clusters among all the 12 villages under PHC, Kheda catchment areas. The sampling interval was calculated out to be 1282 and random number was 1117. The total population covered by the PHC was 38465. Bigger villages namely; Morane, Chaugao and Kheda had 4 or more clusters.

Out of the 210 children, 51% were male, 43.8% were the 1st child, 73.3% had institutional delivery, only 42% had their immunization cards available and parents were mostly literate. Further, 77% resided in a joint family (Table 2).

Table 1: 30×7 clusters- visiting details.

	Subcentre	Village (cluster)	Type	Population	Cumulative population	Cluster no.	Direction from centre of cluster	Number of 1st house from centre of cluster in this direction
PHC Kheda	Morane	Morane	Rural	6932	6932	1,2,3,4,5	North	13
	Morane	Nakane	Rural	3047	9979	6,7	East	12
	Morane	Mahindale –Haranmal	Rural	2859	12838	8,9,10	West	11
	Udane	Udane	Rural	3625	16463	11,12	North	15
	Udane	Var	Rural	3457	19920	13,14,15	South	23
	Udane	Kundane	Rural	2798	22718	16,17	East	27
	Chaugao	Chaugao	Rural	4427	27145	18,19,20,21	West	3
	Chaugao	Gotane	Rural	3213	30358	22,23	South	2
	Chaugao	Hingane	Rural	402	30760	24	North	7
	Kheda	Kheda	Rural	5817	36577	25,26,27,28	West	57
	Kheda	Sutrepada	Rural	747	37324	29	East	8
	Kheda	Sanjori	Rural	1141	38465	30	North	14

Sampling interval= 1282; Random number: 1117.

Table 2: Profile of sampled children.

Profile	Children	
	Number	**Percentage (%)**
Total	210	100
Residence		
Rural	210	100
Sex		
Male	107	51
Female	103	49
Birth order		
1	92	43.8
2	80	38.1
3	28	13.3
4	7	3.3
5	3	1.4
Place of delivery		
Institutional	154	73.3
Home	56	26.7
Availability of immunization card		
Available	88	42
Not available	122	58
Social categories		
SC	25	11.9
ST	66	31.4
OBC	98	46.6
Others	21	10
Educational status of mother		
Illiterate	68	32.3
Some middle school	17	8
Some high school	96	45.7
Some junior college	23	11
Graduate	6	2.9

Continued.

Profile	Children	
	Number	**Percentage (%)**
Educational status of father		
Illiterate	38	18
Some middle school	20	9.5
Some high school	89	42.4
Some junior college	46	21.9
Graduate	17	8.1
Type of family		
Joint	162	77.1
Nuclear	48	22.9

Table 3: Distribution of children as per the immunization status.

Variables	Fully immunized	Partially immunized	Un-immunized
Total	58.6	37.1	4.3
Sex			
Male	63.5	31.8	4.7
Female	53.4	42.7	3.9
Birth order			
1	60.9	38	1.1
2	60	36.3	3.7
3	57.1	35.7	7.1
≥ 4	30	40	30
Place of delivery			
Institutional	69.5	29.9	0.6
Home	28.6	57.1	14.3
Availability of immunization card			
Available	78.4	21.6	0
Not available	44.3	48.3	7.4
Social categories			
SC	56	44	0
ST	22.7	65.2	12.1
OBC	77.5	21.4	1
Others	85.7	14.3	0
Inter-personal communication			
IPC-2 messages given	64.8	35.2	0
IPC-1 message given	32	68	0
Educational status of mother			
Literate	70.4	29.6	0
Illiterate	33.8	52.9	13.2
Type of family			
Joint	59.9	36.4	3.7
Nuclear	54.2	39.6	6.2

The percentage of children who were fully immunized, partially immunized and unimmunized was found out to be 58.6%, 37.1% and 4.3% respectively. The coverage evaluation among various variables is also given in the Table 3.

The Table 4 shows distribution of availability and non-availability of immunization cards based on the sex of the child. Out of the 88 children having cards available, 53.4% were male.

Out of the 113 children not having cards available, 48.7% were male. 9 children had no card as they were unimmunized .

BCG coverage was 93.3%. Measles coverage was 71.9%. Drop-out rate (BCG to Measles) was 22.95% (Table 5).

Unaware of need for returning for subsequent doses was the reason among 60.3% of children who were partially immunized (Table 6).

Table 4: Distribution based on availability or non-availability of immunization card.

Immunization card	Available	Not available	No card
	N (%)	N (%)	N (%)
Total	88 (41.9)	113 (53.8)	9 (4.3)
Sex			
Male	47 (53.4)	55 (48.7)	5 (55.6)
Female	41 (46.6)	58 (51.3)	4 (44.4)

Table 5: Coverage of vaccines among children.

Vaccine	Percentage (%)
BCG	93.3
DPT1	94.3
DPT2	89.5
DPT3	69.5
OPV1	94.3
OPV2	89.5
OPV3	69.5
Measles	71.9
Vitamin A	67.1
Immunization status	
Fully immunized	58.6
Partially immunized	37.1
Unimmunized	4.3

Table 6: Reasons for not completing immunization/non-immunization.

Reasons for not completing immunization	Number	%
Unaware of need for returning for subsequent doses.	47	60.3
Fear of adverse effects	11	14.1
Unaware of need for immunization	9	11.5
Mother too busy	9	11.5
Vaccine not available	2	2.3
Reasons for non-immunization		
Unaware of need for immunization	6	66.7
Fear of adverse effects	3	33.3

DISCUSSION

The WHO 30×7 cluster sampling technique for evaluating vaccine coverage among children has been found to be very useful, convenient and operationally feasible by the investigators and public health administrators in developing countries. This technique allows a small number of the target population to be sampled while providing statistically valid data that can be extrapolated to the whole population.

In the current community based survey in the rural area of Dhule, Maharashtra, the percentage of children who were fully immunized, partially immunized and unimmunized was found out to be 58.6%, 37.1% and 4.3% respectively.

The District Level Health Survey-4 (DLHS-4) study conducted by the Government of India and published in 2012-13 showed that in rural area of Maharashtra the percentage of children who were fully immunized, partially immunized and unimmunized was found out to be 66.7%, 31.5% and 1.8% respectively [4]. Our findings are lower than the state average for fully immunized, partially immunized and unimmunized children. Our findings also revealed that the percentage of children belonging to ST (schedule tribe) who were fully immunized, partially immunized and unimmunized was 22.7%, 65.2% and 12.1% respectively which is strikingly much lower than the other population. Additionally, Dhule has a larger proportion of ST population. We would like to suggest it to be one of the possible explanations of lower coverage of vaccines in our study than the state average.

To the best of our knowledge and extensive review of literature we did not find any study on coverage evaluation of vaccines in Dhule, Maharashtra. So we were not able to compare our findings with other studies of the region. However, a similar study conducted by Jatti et al in Miraj, Maharashtra revealed that 60.5% children were fully immunized.[2] Negligence of parents towards immunization was the main reason for incomplete immunization in their study. Our findings show that unaware for the need of returning for subsequent doses was the main reason for not completing immunization in 60% of children.

A study conducted by Gupta et al in rural area of Pune, Maharashtra revealed that the fully immunized children were 83.6%.[1] While, Malkar et al in a study in rural area of Beed, Maharashtra concluded that 78.5% children were fully immunized.[7] Goyal et al in a study in rural area of Haryana showed the fully immunized and partially immunized percentage to be 73.15% and 23.85% respectively.[3] However, Pandey et al in their study found that fully immunized and partially immunized to be 76.19% and 22.86% respectively.[5]

BCG coverage in our study was found out to be 93.3%. Similar findings are reported by DLHS-4 study for Dhule and Maharashtra as well.[4] Jatti et al and Pandey et al in their studies also reported the BCG coverage to be around 93%.[2] BCG to Measles drop-out rate was calculated to be 22.95%. Similar higher rate of drop-out was reported by Jatti et al.[2]

Higher drop –out rate indicates the failure of the parents to bring their children for subsequent vaccine doses. Our study highlights that the parents/mother were unaware to return for subsequent vaccine doses as the main reason for not completing the immunization was. It emphasizes the importance of health workers providing vaccination

services to inform and reinforce the mother/parents to return for subsequent vaccine doses.

Our study also shows an association between sex of child, birth order, place of delivery, availability of vaccine card, social category of child, educational status of mother and immunization status of child. Higher rate of FIC (full immunization coverage) was found in male child, 1st birth order child, child born in an institution, mother having vaccine card, social category except SC and ST and literate mother.

CONCLUSION

Coverage evaluation of vaccines was found out to be 58.6%. Drop-out rate is high. Unaware to return for subsequent doses of vaccines was the main reason for high drop-out. Schedule tribe seems to be socially excluded among all the social categories as far as immunization coverage is concerned. Further, male child, 1st birth order, child born in an institution, mother having vaccine card and literate mother improved immunization coverage. Though, it requires further testing.

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