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 30x7 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 30x7 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.

\[
n_{\text{min}} = \text{DE} \times \frac{2^2 - 1 - 2 \times p \times (1 - p)}{d^2} \]

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 2\(^{nd}\) November 2015 to 14\(^{th}\) 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.

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 1\(^{st}\) 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: 30x7 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 |
|-----------------|-------------------|---------|------------|------------------------|-------------|---------------------------------|-------------------------------------------------------------|
| Morane Kheda    | Morane            | Rural   | 6932       | 6932                   | 1,2,3,4,5   | North                           | 13                                                          |
| Morane          | Nakane            | Rural   | 3047       | 9979                   | 6,7         | East                            | 12                                                          |
| Morane Kheda    | 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.
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     |

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 3x7 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. 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. 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%. While, Malkar et al in a study in rural area of Beed, Maharashtra concluded that 78.5% children were fully immunized. 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. However, Pandey et al in their study found that fully immunized and partially immunized to be 76.19% and 22.86% respectively.

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. Jatti et al and Pandey et al in their studies also reported the BCG coverage to be around 93%. BCG to Measles drop-out rate was calculated to be 22.95%. Similar higher rate of drop-out was reported by Jatti et al.

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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