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AN EVALUATION OF LOGISTIC MANAGEMENT OF VACCINES IN ANAND DISTRICT

Tushar A Patel[1], Rakesh M Patel[2]

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Author's Affiliation:
[1]Associate Professor; [2]Third year Resident, Dept. of Community Medicine, Pramukh Swami Medical College, Karamsad

Correspondence:
Dr. Tushar Patel
trushar_9@yahoo.com

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ABSTRACT

Background: To achieve good vaccination coverage it is essential that vaccines are supplied in appropriate quantity at appropriate time. This demands evaluation of logistic management of vaccines. The objectives of the study were to assess management of vaccine logistic at PHC and Sub-centre level and to identify weaknesses in the processes of acquisition, storage, distribution and utilization of vaccines.

Method: An observational study was conducted among PHCs of Anand District, Gujarat. Data from 20 PHCs was collected with pre tested questionnaire mainly from vaccine stock register. Data included Date and amount of vaccine delivery, Opening balance on the day of receipt and closing balance after receipt.

Results: Nearly three-fourths of time (72%) OPV was received below minimum level. More than one third (40%) and nearly half (46%) of vaccine deliveries of DPT and Hepatitis B took place below minimum level. Significant proportion of vaccine deliveries resulted in excess stock with number for measles (96%) and BCG (84%) being highest. OPV (average 18 days) and BCG (average 27 days) were most likely vaccines to go out of stock. Duration of stock outs for these vaccines was also longer. Observed rates of wastage for all vaccines exceeded estimated wastage of 25%. Nearly one third of sessions were conducted without measles (33%) and OPV (29%). OPV, BCG and Measles had wastage rate of 46%, 45% and 40% respectively.

Conclusion: Delayed placement of the orders and inequitable distribution both are contributing to unavailability of vaccines. To avoid shortage of the vaccines it is essential that either wastage is reduced by reducing number of dose per vial or wastage factor increased at the time of calculation of requirement.

Keywords: Logistic Management, Vaccines, Evaluation.

INTRODUCTION

Immunization is one of the major thrust areas of public health. India has world's largest national immunisation programme both in terms of number of beneficiaries and annual budget (more than USD 500 million including polio eradication programme).[1] Considering the immense financial burden incurred in immunising children against vaccine preventable diseases, it becomes imperative to develop some sense as far as vaccine utilisation and wastage are concerned. Until accurate estimation of wastage for each vaccine is made at each vaccine store point, adequate estimation of need and thus procurement would not be possible.[1] Such erroneous estimation would result in frequent shortage or stock-outs and impact vaccination coverage.[2] Besides, high wastage rates arbitrarily

inflate vaccine demand and result in unnecessary procurement and thus, increase cost.[1] Thus it is crucial that vaccine wastage is monitored at each vaccine store point so corrective action can be taken promptly.

The present study is intended to assess management of vaccine logistic at PHC and sub-centre level and to identify weaknesses in the current processes of encompassing, acquisition, storage, distribution and utilisation of vaccines.

MATERIALS AND METHODOLOGY

An observational study was conducted in Anand district of Gujarat state between October to December 2012. For administrative convenience Anand district has been divided into 5 health blocks: Anand, Petlad, Anklav, Khambhat and Umreth. There are 46 primary health centres (PHC) in the district under 5 health blocks.

It was decided to collect data from (50%) 23 PHCs which were selected by systematic random sampling in each block. However data from 3PHCs were not available and finally data of 20 PHCs were analyzed.

Pre-tested questionnaire was used to collect necessary information. Information regarding yearly and monthly requirement of each vaccine was calculated based on previous year's consumption from vaccine stock reports. Study tool included data on date of vaccine delivery, amount, opening balance on the day of receipt of vaccine and closing balance after receipt of vaccine. Information was collected for vaccines administered during period of infancy (children below one year of age) as a part routine immunization.

Information on stock-outs and whether 25 percent buffer stock maintained at the time of receipt of new stock during preceding one year was obtained from vaccine stock register maintained by PHC pharmacist.

To estimate number of outreach sessions, conducted over a one month period, with minimum one vial of all vaccines, relevant information was sought from vaccine stock register (of pharmacist) and vaccine issue register (of Female health supervisor (FHS)).

Since substantial vaccine wastage occurs at delivery level, wastage rate was calculated for each PHC and sub-centre separately for previous month from Management Information System (MIS) report of that particular month (to obtain number of children vaccinated in each sub-centre during that month) and vaccine issue register maintained by Female health supervisor of PHC. Vaccine wastage which occurs during an outreach session was estimated on the basis of observation and information recorded in immunisation register, maintained by the Female health worker (FHW) of sub-centre.

Calculation of wastage rate and wastage multiplication factor was based on following formula:

Wastage rate (%) = 100 – utilisation rate

Wastage multiplication factor = 100/ (100 – wastage rate)

Outcome variables included minimum and maximum vaccine stock at the time of delivery, duration of stock-out for each vaccine, number of outreach sessions which received minimum one vial of each vaccine, wastage rate for each vaccine etc.

Collected data was compiled into Microsoft Excel spreadsheet. Frequency and proportions were calculated for categorical variables. Informed consent was obtained from concerned PHC Medical Officers as well as Pharmacists, Female Health Supervisors and Female Health workers after thorough explanation of purpose of the study.

RESULTS

Guidelines suggests that optimum frequency of vaccine supply is once a month. Frequency of delivery of vaccines was observed in terms of number of times in a month a PHC had received vaccine stock. During 33% of months observed vaccines were delivered more than once a month and no vaccine delivery took place for 10% of months. Further, of 20 PHCs, only 4 received vaccines for every month of the year. Rest (15 PHCs) did not receive vaccine for a month (9 PHCs) or more (7 PHCs) in a given year. All except two PHCs obtained vaccines more than once a month.

To maintain the uninterrupted supply of vaccines to the outreach immunisation sessions, besides regular vaccine delivery, it is essential that adequate buffer stock (atleast 25% of monthly vaccine requirement) is maintained to cover for the period required for obtaining monthly vaccine indent from the district vaccine

store. Level of stock at the time of delivery of vaccines was estimated for 14 PHCs for all vaccine deliveries that occurred during previous year (table 1). It was found that for nearly three-fourths of time (72%), Oral polio vaccine (OPV) was received at a stock below critical level (<25%). More than one-third (40%) and nearly half (46%) of vaccine deliveries, of DPT and Hepatitis B respectively, took place while less than adequate stock (<25%) was remaining. Corresponding percentages for BCG and Measles were 31.5% and 13% respectively.

Table 1: Level of stock at the time of vaccine delivery and after receipt of vaccine stock

Type of vaccine (total deliveries in a year)	Stock at receipt		Stock after receipt	
	<25%	>/=25%	<125%	>125%
	Deliveries (%)	Deliveries (%)	Deliveries (%)	Deliveries (%)
BCG (n=108)	34 (31.5)	74 (68.5)	17 (16)	91 (84)
Oral Polio Vaccine (n=150)	108 (72)	42 (28)	103 (69)	47 (31)
DPT (n=144)	57 (40)	87 (60)	60 (42)	84 (58
Measles (n=76)	10 (13)	66 (87)	03 (04)	73 (96)
Hepatitis B (n=124)	57 (46)	67 (54)	43 (35)	81 (65)

Table 2: Duration of stock-out of each vaccine during previous year at PHCs (n=20)

Type of vaccine	PHCs experienced stock-out with duration (%) (in previous year)				Total
	</=15 days	15 days - 1 month	>1-2 months	>2 months	
BCG	2 (12)	5 (29)	6 (35)	4 (24)	17
OPV	1 (5)	0 (0)	6 (30)	13 (65)	20
DPT	7 (58)	2 (17)	3 (25)	0 (0)	12
Measles	5 (45)	4 (36)	1(9)	1 (9)	11
Hepatitis B	5 (71)	2 (29)	0 (0)	0 (0)	7

Though storing adequate amount of vaccines (one month of requirement) at primary health centre level is essential, excess stock should also be avoided. Otherwise, vaccine wastage would occur due to expiration before use. Of 14 PHCs studied, significant proportion of vaccine deliveries resulted in excess stock (more than 125%) with number for Measles (96%) and BCG (84%) being highest (table 1). DPT and Hepatitis B were oversupplied for 58% and 65% of deliveries respectively.

Vaccine stock-out adversely affects immunization programme as beneficiaries remain unvaccinated. Table 2 provides details of stock-out of each vaccine over one year period.

It is evident that OPV (20 PHCs) and BCG (17 PHCs) were most likely vaccines to go out of stock (table 3). Further, duration of stock-outs for these vaccines was also likely to be longer (>1 month duration in 19 and 10 out of 20 PHCs for OPV and BCG respectively) compared to other vaccines (considerably fewer number of PHCs encountered nil stock situation for DPT, Measles and Hepatitis B vaccines and, if occurred, it lasted for a month or less).

Furthermore, average duration of stock-outs for BCG (mean=27 days) and Oral Polio vaccine (mean=18 days) was significantly higher than other vaccines (8, 10 and 12 days for DPT, Hepatitis B and Measles respectively).

It is imperative to ensure that each outreach immunization activity receives minimum one vial of all vaccines. However, it was evident that 64% of sessions were missing one or more vaccines.

Table 3: Sessions conducted without particular vaccine in a month (n=558 outreach sessions of 20 PHCs)

Type of vaccine	Sessions which didn't receive minimum one vaccine vial (%)
BCG	265 (47)
OPV	163 (29)
DPT	67 (12)
Measles	186 (33)
Hepatitis B	118 (21)

Further, of 558 outreach sessions conducted during previous month, approximately one-half of sessions (47%) did not receive BCG vaccine vial (Table 3). Also, nearly one-third of sessions were conducted without Measles (33%) and OPV (29%) vaccines (Table 3).

Table 4: Vaccine specific wastage rates (at PHC level)

Type of vaccine	Wastage rate (%)	Wastage factor
BCG	45	1.82
DPT	30	1.43
Oral polio vaccine	46	1.85
Hepatitis B$	33	1.49
Measles	40	1.67

Substantial vaccine wastage occurs at delivery level. Assessment of vaccine wastage at PHC level reflects that observed rates of wastage for all vaccines exceeded recommended wastage rate (25%). OPV had the highest rate of wastage (46%), followed by BCG (45%) and Measles (40%). (Table 4) DPT had the least wastage (30%).

Furthermore, observations at 16 outreach sites (belonging to 3 sub-centres; one each of 3 PHCs) over one month period also witnessed considerable wastage. More than fifty percent wastage rates were reported for OPV (60%) and BCG (55%) with DPT having least wastage (31%).

DISCUSSION

Our study shows that merely over third of sessions were conducted without measles and OPV.BCG was not available in almost half of the sessions. Stock out at PHCs within shows that BCG and OPV were most likely vaccines to go out of stock and duration of stock out were also long. Our previous study has also shown that 15% of infants missed vaccination because of unavailability of it.[3] To achieve 100% vaccination coverage, it is essential to make all vaccines available throughout the years at all session sites.

Possible cause of unavailability of vaccine at PHCs can be lack of supply from higher level, inequitable distribution among PHCs as delayed demand from lower level. Inadequate supply can also result from large wastage which in turn can be due to error in planning.

Even for DPT and Hepatitis B for which stock out is less common 40% and 46% of orders were placed when stock was below minimum level respectively, suggesting delayed placement of orders. Significant proportion of vaccine deliveries have resulted in excess stock particularly with BCG and measles vaccine in our study. Thus delayed placement of order and inequitable distribution both are contributing to unavailability of vaccines.

Overall picture suggests that vaccines are not distributed from higher level (District level) to PHCs at fixed date once in a month, neither district level has list of monthly requirement of PHCs based on which amount to be supplied can be calculated. Thus guidelines of logistic management of vaccine are not followed in the field. Monthly requirement of PHCs should be calculated on the basis of previous year's consumption and the ideal formula because all children do not receive vaccine from government service and proportion is different among different PHCs.

Immunization sessions are organized per 1000 population. Considering birth rate of 21 per 1000 population approximately 21 infants will be there in 1000 population. On the basis of new vaccination schedule it can be estimated that total 105 OPV doses, 63 pentavalent doses, 21 doses of each BCG and hepatitis B will be given in one year if all children receive vaccination from government service.[4] Thus in each session 9 OPV doses, 5 pentavalent doses and 2 doses of each BCG, measles and Hepatitis B will be consumed. Based on no. of doses it can be calculated that BCG, Hepatitis B and DPT will have wastage of 80%, while measles, OPV and pentavalent will have wastage of 60%, 55%, 50% respectively. This will increase further if few children receive vaccine from private sector. A study in Bangladesh has also reported wastage of 84.9%, 69.7% and 44.4% for BCG, measles and DPT respectively.[5] A study in Delhi has also reported wastage of 70.9%, 48.1%, 38.6% and 39.4% for BCG, OPV, DPT and Measles on the basis of previous immunization schedule.[2] Study conducted in Surat has also reported that BCG and Measles vaccine has Wastage Factor greater than 1.33. Wastage Factor was more at ICDS and mobile sites than fixed sites like sub-centres.[6] However Government procure vaccine at the wastage rate of 25% (1.33) which leads to shortage of vaccine.

Wastage rate of vaccine depends on population covered by each session, frequency of immunization session, proportion of children receiving Govt. service and number of doses per vial. Though clubbing of immunization sessions can reduce wastage of vaccines, outcome will be limited as different vaccines have different number of doses per vials as well as are given at different frequency. Also villages have different population and it will be difficult to achieve optimum population for all villages. Reducing numbers of doses per vial is must. Studies

conducted on measles vaccine vial has shown that no difference in economic cost after reducing doses per vial.[7,8] However to prevent shortage of vaccines it is essential that either doses per vial are reduced or wastage factor increased at the time of calculation of requirement.

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