

*Original Article*

**Structure and Process Evaluation of Cold Chain Management and Routine Immunization Services in Rural Western Gujarat**

Pithadia Pradeep R, Shah Viral R, Makwana Naresh R\*, Parmar Dipesh

Department of PSM, M P Shah Government Medical College, Jamnagar, India

\*Corresponding Author: [dmareshm@yahoo.com](mailto:dmareshm@yahoo.com)

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**Keywords:**  
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**Abstract:** Maintenance of cold chain points are vital for preserving potency of vaccines for immunization of children and thereby averting vaccine preventable diseases in the community. Cold chain handlers should have sufficient knowledge and skills related to cold chain equipment handling and immunization practices. The present study aims to evaluate maintenance of cold chain facilities at primary health care centers (PHCs), related logistics and observation of Mamta Day (Immunization Day). The observations include knowledge and practice of health workers about immunization activities, their communication skills, training status etc. **Methods:** There are total 31 Primary Health Centers in Jamnagar district, out of which, we decided to include 50% (15) of primary health centers and observed their cold chain, and Immunization day at a subcentre or Anganwadi centre of the selected PHC to assess the quality of immunization services. We included equal number of cold chain points from each block of the district to make it representative of entire district.

**Results:** Average population served by a cold chain point is 21985. Vaccine related logistics like cold boxes, vaccine carriers etc. were adequate in all facilities. All cold chain equipments were placed as per standard guidelines. The posts of medical officers and pharmacists were vacant in almost one fourth of cold chain points and they were run on deputation from other facilities. The knowledge and skills of health workers related to immunization practices were found to be satisfactory. **Conclusion:** We observed that routine immunization program was implementing in the district satisfactorily. The posts of medical officers and pharmacists need to be filled up at the earliest for smooth functioning of immunization program in primary health centres.

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**INTRODUCTION**

India has one of the largest program related to immunization in the world (Govt of India, 2010). Immunizing under-five children is very cost-effective approach to eliminate burden of vaccine preventable diseases in the community. It must be ensured to maintain potency of vaccines till it reaches targeted population, thus protecting them against vaccine preventable diseases and averting adverse events following immunization.

Cold chain is a system of storing and transporting vaccines at recommended temperatures from the point of manufacture to the point of use (Park K, 2013). It is sometimes referred to as the vaccine supply chain, or the immunization supply chain. A health personnel engaged in a cold chain point is expected to maintain temperature of 2-8 degree Celsius for ILR and -15 to -25 degree Celsius for deep freeze (WHO, 2015).

Immunization is one of the most important and effective interventions for reducing infant mortality and morbidity due to various vaccine preventable illnesses. It has been observed that focused efforts are required to strengthen immunization services and WHO also recommends areas like planning, financing, surveillance, staff and management, outreach activities to be monitored at district and national level (Parmar A et al, 2014). Cold chain and vaccine logistics are key drivers among them (National EVM Assessment Draft, 2013).

The present study aims to evaluate maintenance of cold chain system at primary health care centers (PHC) across Jamnagar district, logistics and observation of Mamta Day (Immunization Day) at a sub Centre or an anganwadi centre of a PHC. The observations includes knowledge and practice of health workers about immunization activities, their communication skills, training status etc.

## MATERIALS AND METHODS

There are total 31 Primary Health Centers in Jamnagar district, out of which ,we decided to include 50% of primary health centers. Thus, we included 15 primary health centres, observed their cold chain, and Mamta day (Immunization day) at a sub Centre or Anganwadi centre of the selected PHC to assess the quality of immunization services. There are six Tehsils in Jamnagar district, namely Jamnagar, Lalpur, Dhrol, Jamjodhpur, Kalawad and Jodiya, we tried to include equal number of PHCs from each Tehsil to make it representative of the entire district (Table No.1)

Table 1. Selection of PHCs according to Tehsils of the district

Sr. No.	Tehsil	No. of PHCs selected
1	Jamnagar	3
2	Lalpur	3
3	Dhrol	2
4	Jamjodhpur	2
5	Kalawad	3
6	Jodiya	2
Total		15

A predesigned checklist was used to collect relevant data. The information was collected from medical officer, pharmacist and paramedical workers involved in routine immunization activities. The information included status of cold chain system their maintenance, vaccine and logistics management, vaccine storage and temperature monitoring practices, immunization waste disposal practices, record keeping etc. Study design: It was a cross-sectional study involving rural peripheral health institutions of Jamnagar district.

Table 3. Cold Chain Handling and maintenance practices at Cold Chain Points.

Parameters	No.(%)
<b>ILR</b>	
1. Placed on a stand properly	15(100)
2. 10 cm away from wall	15(100)
3. Stabilizer connected	15 (100)
4. Not exposed to direct sunlight	15 (100)
5. Things other than vaccine found	15(100)
6. Functional thermometer placed inside	14 (93.33)
7. Temperature log book available	15(100)
8. Temperature log book up-to date	15(100)
9. Correct Storage of Vaccines (in Baskets and T series vaccines on the top)	15 (100)
10. Any damaged or frozen vial found in ILR	
11. Any open vial without date/time found in ILR	15 (100)
12. ILR containing things other than vaccines	1 (6.67)
13. Vaccine diluents stored at least 24 hours in ILR before issue	0 (0)
	15 (100)
<b>DF</b>	
1. Placed on a stand properly	15 (100)
2. 10 cm away from wall	15 (100)
3. Stabilizer connected	15 (100)
4. Not exposed to direct sunlight	15 (100)
5. Ice packs arranged properly	10(66.67)
6. Functional thermometer placed inside	15 (100)
7. Temperature log book available	15 (100)
8. Temperature log book up-to date	15 (100)
9. Any Vaccine found in Deep Freeze	0(0)
<b>Others</b>	
1. Cold boxes properly stored	11 (73.33)
2. Vaccine carrier properly stored	11 (73.33)

Study Period: July 2018 to April 2019.

Ethical Approval: We obtained approval from institutional ethical committee before initiation of the study.

The Objective of the study was to evaluate cold chain and logistics management and maintenance at primary health centers, to assess knowledge, attitude and practices of health workers involved in immunization services, to identify discrepancies in current immunization services and cold chain system and to make recommendations to strengthen routine immunization services and cold chain management by rectifications of such discrepancies.

## RESULTS

Table 2. Basic information of Cold Chain Points.

Parameter	No. (%)
Average Population of Cold Chain point (CCP) (n=15)	21985 (Range 14000-31392)
Average No. of Sub Centers catered per CCP(n=15)	6.46 (Range 4-9)
Average No. of Sessions held in a month	25.13 (Range 14-43)
No. of PHCs with adequate quantity of functional voltage stabilizers	15 (100)
No. of PHCs with adequate quantity of cold boxes	15(100)
No. of PHCs with adequate quantity of vaccine carriers	15 (100)

We observed that average population per cold chain point was 21985, with mean number of sub centers per cold chain point was 6.46. All cold chain points were connected with voltage stabilizers and had adequate vaccine carriers.

All ILRs and DFs were placed in cold chain room in cold chain points as per standard guidelines. Temperature log books were available and were up to date till the day of visit. Vaccine carriers were properly stored in 11 cold chain points out of 15.

Table 4. Knowledge and Practice of cold chain handler at Cold chain Point.

Parameter	No. (%)
<b>Medical Officer</b>	
Full time appointment	11 (73.33)
Deputation	4 (26.67)
Trained for latest immunization module	12 (80.00)
Disposal of vaccine wastage by authorized bio-waste agency	15 (100)
Return of open vials from session with report same day	15 (100)
Vaccine delivery to session site	
ANM	2 (13.33)
AVD	11 (73.34)
Both	2 (13.33)
Any recent breakdown of cold chain in last 3 months	4 (26.67)
Knowledge about whom to contact in case of cold chain breakdown	15 (100)
Visits by higher health officials in last 3 months	13 (86.67)
<b>Pharmacist</b>	
Full time appointment	11 (73.34)
Deputation	4 (26.67)
Trained for latest immunization module	12 (80.00)
Correct demonstration of ice pack conditioning	15 (100)
Availability of vaccine stock and issue register	15 (100)
Upto date maintenance of vaccine stock and issue register	14 (93.33)
Twice daily recording of temperature in log book of ILR/DF	15 (100)
Sufficient supply of vaccine and related stocks from district	15 (100)
Correct knowledge about freeze sensitive vaccines	15 (100)
Knowledge about whom to contact in case of cold chain breakdown	15 (100)
Preservation of BCG/MR vials returned from the session in separate VC for 24 hours	15 (100)

## DISCUSSION

Childhood immunization is very cost effective approach for prevention and control of vaccine preventable diseases and it can only be achieved if we can ensure sero-conversion of all vaccinated children in our community. The seroconversion in children depends on many factors, internal and external. The external factors are related to maintenance of cold chain and effective vaccine management at primary health center level in rural areas and urban health center level in urban areas. Practicing small things in vaccine management like FIFO (first in first out), FEFO (first expiry first out), avoiding unnecessary opening of vaccine vials, knowledge of correct timing of vaccination (neither too late nor too early) can make a big difference in sero-conversion among immunized children.

The present study found overall adequate infrastructure and satisfactory ongoing immunization activities in rural areas of the district. All of visited facilities had functional thermometers inside cold chain equipment and twice daily recording of temperature. In a study by AIIMS Patna, functional thermometers were placed inside cold chain equipment in only 28.6% of health centers, and twice daily temperature recording was also observed in 78.6% of cold chain points (Pandey S et al, 2018). A study conducted by Naik et al in Surat city observed that twice daily temperature recording was present in all cold chain points (Naik AK et al, 2013). In a study in Delhi, the twice daily temperature recording activities were observed in only 72% of facilities (Sachdeva S et al, 2010). According to a study conducted in Chandigarh, 98% temperature charts were updated in all cold chain equipment (Goel NK et al, 2005). A study conducted in Jamnagar observed that temperature logbooks weren't properly maintained in more than half of Primary health centers (Sanghavi MM et al, 2013).

Table 5. Observation of Mamta (Immunization) Day

Parameter	No. (%)
Banner/Poster displayed at session site	11 (73.33)
Due list of beneficiaries available	11 (73.33)
Correct knowledge of ANM about open vial policy practice for BCG and MR vaccine	15 (100)
Correct knowledge of ANM about usage of Vitamin-A bottle after opening it.	9 (60.00)
Correct knowledge about conditioning of ice pack	15 (100)
No. of session with vaccine vials without date/time written on it	2 (13.33)
All four key messages answered or practiced	12 (80.00)
Correct segregation and disposal of immunization waste	15 (100)
Correct knowledge of ANM for following vaccines to be given at a particular age of a child	
BCG	13 (86.67)
Pentavalent	14 (93.33)
OPV	14 (93.33)
IPV	11 (73.33)
MR	10 (66.67)
DPT	6 (40.00)
Hepatitis B	9 (60.00)

In current study, vaccine were correctly stored in ILR according to prescribed guidelines, no open vials found without mentioning of date and time. A study in Jamnagar revealed similar findings and observed that about 92.86% of facilities had correct storage of vaccines (Sanghavi MM et al, 2013). Our study revealed that all facilities had their cold chain equipment (ILR and DF) placed in cold chain room as per standard guidelines. Similar findings were observed in a study carried out in same city (Jamnagar), where all CCPs had cold chain equipment placed as per guidelines (Sanghavi MM et al, 2013) Mallik S et al observed that in only half of CCPs, these equipment were placed 10 cm away from the wall and in one fourth of them, equipment

were kept on wooden platform (Mallik S et al, 2011).

Ice packs should be in a criss-cross pattern in deep freeze for proper freezing of icepacks. A study in Jamnagar in 2018 showed that criss cross pattern of icepacks was observed in 76.7% of total deep freezes (Patel N et al,2018). Training of cold chain handlers is also a vital component in cold chain management. Our study found that 80% of cold chain handlers were trained in latest cold chain module. In a study conducted in Chhattisgarh, in 98% of cold chain points, cold chain handlers were trained in latest cold chain module (Mendhe H et al, 2018).

Updated due list of expected beneficiaries which was very essential component, was missing in about one-fourth of session sites in this study. This might lead to more left outs and drop outs from the immunization program. A study in Baroda revealed that due list of not available in almost all session sites (Parmar A et al, 2014). In a study conducted in Bhavnagar also revealed that no sessions shared list of children due for vaccination on Mamta day and no active tracking of dropouts using due list of beneficiaries (Kotecha I et al, 2012).

## CONCLUSION

The study findings suggest that most of the Cold chain points scored very good in parameters like available updated micro-plan, adequate space for icepack conditioning and disposal of immunization waste properly indicating that the facilities were keeping pace with the recent updates and good practices. The availability of trained and skilled manpower was reflected from the findings such as VCCH trained in latest VCCH module, they knew what to do in case the CCP break down and they also knew about icepack conditioning.

The overall impression comes out that most CCPs in both districts are doing good enough, though in some of the parameters the CCPs are lagging behind the expected quality, there is scope of further improvement in all the parameters by means of ongoing project of strengthening of Supportive Supervision of Routine Immunization in both the districts.

## RECOMMENDATIONS

Vaccine cold chain handlers should continue following standard operating protocols for cold chain maintenance which would help to maintain the vaccine effective and potent.

Supportive supervision of routine immunization services should be continued at primary care level by Medical officers and district officials with refresher trainings of vaccine and cold chain handlers at regular intervals to stay updated about introduction of newer vaccines or guidelines. The vacant posts of cold chain handlers should be filled at the earliest to ease extra burden on them.

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## CONFLICT OF INTERESTS: Nil

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