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Evaluation of Cold Chain Practices in A Rural District of Madhya Pradesh

KEYWORDS: Cold Chain, Ice Lined Refrigerator, Deep Freezer

Amarnath Gupta

Assistant Professor, Department of Community Medicine, Bundelkhand Medical College, Sagar (MP).

INTRODUCTION: vaccine is an immunobiological substance designed to produce specific protection against a given disease. It stimulates production of specific antibodies and other immune mechanisms. **(1)** Vaccination is one of the most effective disease prevention strategies when implemented properly across all sections of the at risk population. Immunization against a disease is achieved only if a potent vaccine is administered. The system of transporting, storing and distributing vaccines in a potent state at the recommended temperature from the point of manufacture to the point of use is the cold chain. Vaccine potency once lost cannot be restored**.** The cold chain remains a highly vulnerable point for national immunization program. **(2)** In order to realize the full benefits of immunization, coverage of vaccination has to be increased and more importantly potent vaccines should reach the beneficiaries for which cold chain maintenance is crucial.**(3)** Concurrent efforts made to strengthen cold chain system at government level by providing right cold chain equipments.

With this back ground, this study was carried out with the objective of assessing the cold chain practices, with particular reference to assessing the availability of cold chain equipment, vaccine storage practices, monitoring of cold chain in Community health centers of Umaria district of Madhya Pradesh.

MATERIAL AND METHOD: This cross sectional study was conducted during Oct. to Dec. 2014 in Umaria district of Madhya Pradesh. It is a small district in north-eastern part of Madhya Pradesh with an area of 4548 square kilometers and population of 643,579 (2011 census). The district is served by a district hospital, three community health centers and twelve primary health centers. Evaluation of cold chain practices was done in all the three CHCs of the district viz. CHC Pali, CHC Manpur and CHC Chandia. Cold chain equipment and cold chain maintenance process was noted following direct observation by the investigator on uninformed visits. Information was collected on a pre-designed and pre-tested questionnaire regarding demographics, electrically powered vaccine storage instruments (e.g. ice lined refrigerators, deep freezers, voltage stabilizer); non electrical vaccine storage equipments (e.g. cold box, vaccine carriers); ice packs, power generator and temperature monitoring chart; set-up and maintenance record of electrical equipment. Data was compiled analyzed using percentages and proportions.

Table-1
VACCINE STORAGE AND HANDLING PRACTICES

(A) ILR AND DF		YES (%)	NO (%)
1	Placed on wooden blocks and at least 10 cm away from walls and surrounding equipment	3 (100%)	0 (0%)
2	Each equipment is connected through functional Voltage Stabilizer	2 (66.66%)	1 (33.33%)
3	Functional thermometer placed inside every ILR and DF	3 (100%)	0 (0%)
4	No frost OR frost less than 5mm on inside walls of every ILR	2 (66.66%)	1 (33.33%)
(B) TEMPERATURE LOG BOOK		YES (%)	NO (%)
1	Twice daily monitoring of temperature in respective log books	3 (100%)	0 (0%)
2	Record of power failures/ cuts (if any) and Record of Defrosting ILRs & DFs	1 (33.33%)	2 (66.66%)
3	Periodic checks of Temperature Log Books by Facility in-charge (evidence of signature)	3 (100%)	0 (0%)
(C) ICE LINED REFRIGERATOR (ILRS)		YES (%)	NO (%)
1	Cabinet Temperature between +2 to +8°C	2 (66.66%)	1 (33.33%)
2	All vaccine vials correctly arranged inside labeled cartons (expiry date, batch)	2 (66.66%)	1 (33.33%)
3	No T-series or Hepatitis B vaccine vials placed in the bottom of ILR	2 (66.66%)	1 (33.33%)
4	Diluents placed in ILR, at least 24 hours before distribution (observe)	3 (100%)	0 (0%)
(D) DEEP FREEZERS (DF)		YES (%)	NO (%)
1	Cabinet temperature of DFs between -15 to -25°C	2 (66.66%)	1 (33.33%)
2	Correct placement of ice packs inside DF (in crisscross manner, while freezing)	2 (66.66%)	1 (33.33%)
3	No RI vaccines stored inside DFs (including reconstituted vaccines)	3 (100%)	0 (0%)
(E) GENERATOR		YES (%)	NO (%)
Functional generator availability		2 (66.66%)	1 (33.33%)

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RESULT AND DISCUSSION: It was observed from the study that in all the three (100%) CHCs, ILR and DF were properly placed on wooden blocks and at least 10 cm away from walls and surrounding equipment. ILR and DF were connected to functional Voltage Stabilizer in only two (66.66%) CHCs; the third CHC had two voltage stabilizers but both of them were non functional. A functional thermometer was placed inside every ILR and DF of all the three (100%) CHCs. There was no frost or frost less than 5mm on inside walls of ILR in only two (66.66%) CHCs. Santosh M .Biradar et al in a similar study vaccine at Bijapur Karnataka observed that in only 76.1% health centers ILR and DF were properly placed, ILR and DF were connected to functional Voltage Stabilizer in 91.3% health centers. A functional thermometer was placed inside ILR and DF only in 76.1% health centers**. (4**) Goel NK et al in a similar study in Chandigarh observed that all (100%) the ILR and DF were correctly installed with functional thermometer. **(5)** The proper positioning of ILR/DF is important for correct functioning and improving durability of the equipments.

Twice daily recording of temperature in temperature log book by cold chain handler was observed in all the three CHCs (100%). Record of Power failures/cuts (if any) and Defrosting of ILRs & DFs was maintained by only one (33.33%) CHCs. Periodic checking of temperature log books by medical officers was observed in all the three (100%) CHCs. Santosh M .Biradar et al reported that temperature log books were monitored twice daily in 95.6% health centers. Record of power failures and defrosting ILRs & DFs was maintained by only 65.2% health centers and periodic checking of temperature log books by medical officers was reported in 86.9% health centers. **(4)** Goel NK et al reported that temperature chart was updated in 97.5% and record of breakdown was noted in 80% of health centers and the temperature log book was countersigned by 95.3% Supervisor/Medical officers.

It was observed that in only two (66.66%) CHCs the cabinet temperature of ILR was maintained between $+2^0$ C to $+8^0$ C. T-series or Hepatitis B vaccine vials were found correctly placed i.e. not placed in the bottom of ILR in only two (66.66%) CHCs. It was observed that in only two (66.66%) CHCs, vaccine vials were correctly arranged inside labeled cartons. It was observed that diluents were placed in ILR, at least 24 hours before distribution in all the three (100%) CHCs. Santosh M .Biradar et al reported that temperature of ILR was maintained in 93.5% health centers. T-series or Hepatitis B vaccine vials were correctly placed in ILR in 84.8% health centers and in 95.6% health centers diluents were placed in ILR, at least 24 hours before distribution.**(4)** Tushar Patel et al in a similar study in rural areas of Gujarat reported that ILR temperature was maintained in 90.9% and vaccines were correctly stored in 93.2% health centers.**(6)**

Keeping vaccines properly in labeled cartoons is important prevent mixing of different vaccines and avoid use of expired vaccines. T series vaccines are freeze sensitive hence they should not be kept at the bottom of ILR.

Diluents need to be kept in ILR for at least 24 hours before vaccination because vaccine and diluents should be of similar temperature during reconstitution.

It was observed that the Cabinet Temperature of DFs was maintained between -15 to -25°C in only two (66.66%) CHCs. The Correct placement of ice packs inside DF (in crisscross manner) was found in only two (66.66%) CHCs. It was also observed that in none of CHC had vaccines stored inside DFs. Santosh M .Biradar et al in their study found that the correct cabinet temperature of DFs was maintained in 91.3% health centers and the ice packs were correctly placed inside DF only in 73.9% health centers**.(4)** Goel NK et al in their study reported that all the icepacks were properly placed in Deep freezer**.(5)**

Good quality icepacks are requisite for field transportation of vaccine in vaccine carrier and these can be obtained from DF only if proper temperature is maintained with correct placement of ice packs (i.e. in crisscross manner).

Functional generator was available in only two (66.66%) CHCs. The generator in the third CHC was found in non-functioning condition. Samant et al in a similar study found that only 45% health centers had power generator. **(7)** Rao S et al in a similar study in coastal south India reported that 94.2% health centers had generator facility**.(2)**

CONCLUSION: The quality of vaccination program can be increased by proper storage and management of vaccine in cold chain at all the health facilities. There is a need to improve methods of ILR and DF maintenance in terms of installation, temperature maintenance and regular defrosting with record keeping. The correct placement of vaccines in ILR and exclusive use of ILR for storage of vaccine is vital factor for successful immunization program. Relevant training of health staff involved in handling the cold chain with continuous supportive supervision is recommended. Strengthening immunization services will not only include the cold chain equipment availability but also the right attitude and practice of cold chain handling by the cold chain handlers.

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