

Status of Knowledge and Skills of Cold Chain Handlers in District Meerut, Uttar Pradesh, India

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Abstract: Immunization is one of the most cost effective measures to prevent childhood diseases. Vaccines are sensitive biological products and their potency can diminish irreversibly when exposed to inappropriate temperatures. Hence for effective implementation of the immunization programme, Cold Chain and Vaccine Management need a great focus and attention. Cold Chain Handler (CCH) is the most crucial person at a Cold Chain Point as his/her correct knowledge and skills regarding cold chain practices, vaccine management and handling are immensely vital for the success of Universal Immunization Programme. Keeping this in mind, this cross-sectional study was carried out at all 26 Cold Chain Points in district Meerut, Uttar Pradesh. Globally validated WHO-UNICEF Effective Vaccine Management (EVM) tool was used for this study. It was found out that all 26 CCH could correctly read and interpret Vaccine Vial Monitor (VVM), know about vaccines that could be damaged by freezing, know the correct storage temperature for vaccines, know about Open Vial Policy and know and correctly identify the diluents of BCG and Measles Vaccines. However only 57.6% could demonstrate the correct way of reading the thermometer and only 11.6% had knowledge about when and how to conduct a shake test. Only 69.2% CCH actually carried out conditioning of ice-packs as per the guidelines. The present study contemplates for periodic training and capacity building of all the Cold Chain Handlers. Medical officers supported by District Immunization Officer should be actively involved in the monitoring and supervision of the Cold Chain Handlers.

Keywords: Knowledge, Skills, Cold Chain Handler, Effective Vaccine Management, Meerut

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I. Introduction

Every year, globally about 5.9 million children die before the age of 5 years.^[1] Over two-thirds of these deaths are due to conditions that could be prevented or treated with simple and affordable interventions.^[2] Immunization is one of the most cost effective preventive health intervention. It can prevent morbidities, mortalities and disabilities.^[3] Experience with smallpox eradication programme showed the world that immunization is the most powerful and cost effective weapon against vaccine preventable diseases. It is estimated that immunization against vaccine preventable diseases can save 2-3 million lives every year. Vaccines are the most commonly used immunizing agents. A vaccine is an immuno-biological substance designed to produce specific protection against a given disease. Vaccines are sensitive biological products. Some vaccines are sensitive to freezing, some to heat and others to light. Vaccine potency i.e. its ability to adequately protect the vaccinated person, can diminish when exposed to inappropriate temperatures. Once lost, vaccines potency cannot be regained.^[4] Hence for effective implementation of the Universal Immunization Programme factors like Cold Chain and Vaccine Management needs greater focus and attention and knowledge and skills of the cold chain handler becomes important as far as the success of the UIP is concerned.^[5,6] India spends about 20,000 million rupees every year on Immunization. Ministry of Health and Family Welfare, Government of India publishes Vaccine and Cold Chain Handlers Handbook to enable Cold Chain Handlers efficiently manage the vaccine and cold chain system by equipping them with the required technical and practical guidance.^[7] Cold Chain Handler is the most crucial person at a Cold Chain Point as his/her correct knowledge and skills regarding cold chain practices, vaccine management and handling are immensely vital for the success of Universal Immunization Programme. Hence the present study was carried out with the objectives to assess the knowledge and skills of Cold Chain Handlers regarding cold chain and vaccine management practices in district Meerut and to identify any shortcomings and suggest recommendations for improvement.

II. Material And Methods

An observational cross-sectional study was carried out from November 2016 to October 2017. There are 26 Cold Chain Points in district Meerut.

All the 26 Cold Chain Points were visited and assessed using globally validated WHO-UNICEF standardized Effective Vaccine Management (EVM) assessment tool. Cold Chain Handlers at these Cold Chain Points were interviewed and cold chain system was observed. Data was compiled in MS-Excel and analysed using percentages and proportions.

Definitions and Explanation of the Terms used in the Study:

- a) **Cold Chain Handler:**
Any staff (regular/contractual), as assigned by the facility in charge, with the responsibility of vaccine and cold chain management at any level of vaccine stores is known as Cold Chain Handler.
- b) **Cold Chain Equipment:**
It is a set of equipment, which helps in providing recommended temperature for the vaccines to preserve their quality during storage and transportation from the site of manufacture till their administration to the target beneficiary.
- c) **Recommended Temperatures:**
All vaccines under the National Immunization Programme are stored at a temperature range of +2°C to +8°C. Diluents of vaccines should also be stored at a temperature range between +2°C to +8°C at least 24 hours before use.
- d) **Regular Defrosting:**
It is recommended that the Cold Chain Equipment be defrosted when frost thickness on the inner wall is more than 5 mm or once in a month (whichever is earlier).
- e) **EEFO principle:**
EEFO stands for —Early Expiry First Out. Vaccines, diluents, Syringes should be stored in a way that the one with early expiry is used first.
- f) **Exception to EEFO principle:**
While following the EEFO, the VVM status of the vaccine should be given priority. It means the vaccine with VVM stage nearer to discard point should be used first.
- g) **Freeze-sensitive vaccines:**
Following vaccines used under National Immunization Schedule are freeze-sensitive vaccines: Hepatitis B Vaccine, Pentavalent Vaccine, Inactivated Polio Vaccine (IPV), Diphtheria Pertussis and Tetanus (DPT) Vaccine and Tetanus Toxoid (TT). These vaccine can be damaged by temperatures below 0°C.
- h) **Conditioning of the Ice-Packs:**
Before placing ice packs inside a cold box or vaccine carrier, they need to be kept at room temperature to prevent damage to the freeze-sensitive vaccines. This process is called conditioning. An ice pack is correctly conditioned when the water covers its surface and the sound of water is heard on shaking it.
- i) **Shake Test**
This test is done to check if there is a suspicion that a vaccine vial has been exposed to freezing.
- j) **Open Vial Policy:**
This policy calls for the reuse and storage of open vaccine vials of specific types that still contain a few doses at the end of a vaccination session if certain conditions are met. It applies to multi-dose vials of the DPT, TT, Hepatitis B, Oral Polio Vaccine (OPV) and Liquid Pentavalent. This policy does not apply to Measles, BCG, Japanese Encephalitis (JE) vaccines.

III. Results

There are 26 Cold Chain Points in district Meerut and each Cold Chain Point had one Cold Chain Handler. Therefore a total of 26 Cold Chain Handlers were interviewed. It was found out that 61.6% Cold Chain Handlers were males and 38.4% were females. Most of the Cold Chain Handlers were in the age group 50-60 years (38.4%) and majority (69.2%) of Cold Chain Handlers were aged more than 40 years. Maximum number of the Cold Chain Handlers (46.1%) were educated up to graduation or above. It was also found out that 46.1% of Cold Chain Handlers were having a work experience of 3-5 years followed by 38.4% which had an experience of 1-3 years. (TABLE 1)

TABLE 1: Characteristics of Cold Chain Handlers (N=26)

S.No	Variables		No. (%)
1	Gender		
		Male	16 (61.6)
		Female	10 (38.4)

2	Age (in years)		
		18-30	4 (15.4)
		30-40	4 (15.4)
		40-50	8 (30.8)
		50-60	10 (38.4)
3	Education Qualification		
		High School	8 (30.8)
		Intermediate	6 (23.1)
		Graduation and Above	12 (46.1)
4	Work Experience (in years)		
		1-3	10 (38.4)
		3-5	12 (46.1)
		5-10	1 (3.9)
		≥10	3 (11.6)

It was found out that all 26 Cold Chain Handlers could correctly read and interpret Vaccine Vial Monitor (VVM), know about vaccines that could be damaged by freezing (i.e. Pentavalent, Hepatitis B, Inactivated Polio Vaccine, Diphtheria-Pertussis-Tetanus Vaccine and Tetanus Toxoid) know the correct storage temperature for vaccines (+2° C to +8° C), know about Open Vial Policy (OVP) and know and correctly identify the diluents of BCG and Measles Vaccines (normal saline and sterile water respectively). However only 57.6% could demonstrate the correct way of reading the thermometer and only 11.6% had knowledge about when and how to conduct a “shake test”.

Although all 26 Cold Chain Handlers had knowledge of conditioning of ice-packs but only 69.2% actually carried out conditioning of ice-packs as per the guidelines. Temperature log book was filled twice a day by 61.6% Cold Chain Handlers and 92.3% updated their vaccine stock register within one day of the transaction. It was observed that only 61.6% carried out regular defrosting of the Cold Chain Equipment. It was found that all the Ice-Lined Refrigerators (ILR) and Deep Freezers (DF) were kept on wooden and plastic blocks at 65.3% Cold Chain Points.

Correct order of storing vaccines in an ILR was known to all the Cold Chain Handlers but vaccines were stored as per the correct order at 92.3% Cold Chain Points. It was found that 96.1% Cold Chain Handlers had knowledge about Early Expiry First Out (EEFO) principle and 69.2% had knowledge about its exception according to VVM status. Regarding Contingency Plan, It was observed that 65.3% Cold Chain Handlers knew what to do in case of emergency situations like long power failure, equipment breakdown etc. (TABLE 2)

TABLE 2: Knowledge and skills of Cold Chain Handlers regarding Vaccine and Cold Chain Management (N=26)

S.No	Variables	Yes (%)	No (%)
1	Read and Interpret Vaccine Vial Monitor Correctly	26 (100)	0 (0)
2	Knowledge of Vaccines that can be damaged by freezing	26 (100)	0 (0)
3	Knowledge of correct temperature range for storing vaccines	26 (100)	0 (0)
4	Knowledge of Open Vial Policy	26 (100)	0 (0)
5	Knows and correctly identify the diluents of BCG and Measles Vaccine	26 (100)	0 (0)
6	Demonstrate correct way to read thermometer	15 (57.6)	11 (42.4)
7	Knowledge of “Shake Test”	3 (11.6)	23 (88.4)
8	Knowledge about conditioning of ice-packs	26 (100)	0 (0)
9	Actually carry out conditioning of ice-packs	18 (69.2)	8 (30.8)
10	Completes temperature log book twice daily	16 (61.6)	10 (38.4)
10	Updates stock register within one working day	24 (92.3)	2 (7.7)
11	Carry out regular defrosting	16 (61.6)	10 (38.4)
12	ILR / DF kept on wooden or plastic blocks	17 (65.3)	9 (34.7)
13	Knows correct order of storing vaccines in ILR	26 (100)	0 (0)
14	Actually storing vaccines in correct order in ILR	24 (92.3)	2 (7.7)
15	Knowledge of EEFO principle	25 (96.1)	1 (3.9)
16	Aware of exception to EEFO principle	18 (69.2)	8 (30.8)
17	Knows what to do in an emergency situation	17 (65.3)	9 (34.7)

IV. Discussion

This study was carried out at district Meerut, Uttar Pradesh which is about 70 km from New Delhi (Country's capital). There are 26 Cold Chain Points in district Meerut and each Cold Chain Point had one designated Cold Chain Handler so a total of 26 Cold Chain handlers were interviewed.

In the present study it was found out that majority of Cold Chain Handlers were males whereas in a study done by Choudhury et al^[8] in Chirang (Assam) majority of Cold Chain Handlers were females. In the present study it was found that most of the cold chain handlers (69.2%) were aged 40 years or more. This is similar to the finding of study done by Immunisation Technical Support Unit (ITSU)^[9] which revealed that 67% of Cold Chain Handlers in Bareilly and Shahjahanpur districts of Uttar Pradesh were aged 46 years or more. However in the study done by Choudhury et al^[8] found that majority of Cold Chain handlers (91.6%) were aged less than 40 years. The present study revealed that maximum number of the Cold Chain Handlers in district Meerut were educated up to graduation or above (46.1%). However the study by ITSU^[9] in Bareilly and Shahjahanpur districts of Uttar Pradesh revealed that most (52%) of the Cold Chain Handlers were educated up to intermediate (12th Class). The present study concluded that 46.1% of Cold Chain Handlers were having a work experience of upto 5 years similar to the results by Choudhury et al^[8]

The Present study revealed that all Cold Chain Handlers had knowledge about VVM, Open vial Policy, Freeze sensitive vaccines, correct temperature range and diluents which is a quite commendable finding. It was found in the present study that knowledge of "Shake Test" was present in only 11.6% of Cold Chain Handlers which is very less than as observed by Sinha et al^[10] in Durg (52.63%), Naik et al^[11] in Surat (66.7%) and Gupta et al^[5] in Madhya Pradesh (66.7%) but similar finding was reported by National EVM Assessment^[12] (19%) and Uttar Pradesh Comprehensive EVM Assessment^[13] (22%) and Rao et al^[14] in South India (22.4%). Our finding that all Cold Chain Handlers knew about conditioning of ice-packs but only 69.2% actually carried it out stresses on the fact that implementation is important than mere knowledge. Similar results were reported by Sharma et al^[15] in Kheda and Uttar Pradesh Comprehensive EVM Assessment (2016)^[13]. It was found in our study that complete temperature record in the log book was found in 61.6% of Cold Chain Points which is lower than 70.1% and 76% reported by National EVM Assessment^[12] and Uttar Pradesh Comprehensive EVM Assessment^[13] respectively. Even Choudhury et al^[8] and Sinha et al^[10] reported it as 83% and 95%. All vaccine arrivals and dispatches were updated in the stock inventory within one working day of transaction at 92.3% Cold Chain Points as revealed by the present study which is higher as reported by Sinha et al^[10] (61.1%) and Naik et al^[11] (85%). In the present study, evidence of regular defrosting of the equipment was found at 61.6% of the Cold Chain Points whereas Sinha et al^[10] reported it at only 25% but Choudhury et al^[8] reported it at 91.6% of Cold Chain Points. We found out that all ILR/DF were kept at wooden or plastic blocks at 65.3% Cold Chain Points. However, Choudhury et al^[8] found that 83% Cold Chain Points had all ILR/DF kept at wooden or plastic blocks. In our study, correct order of placing vaccines in an ILR was found out at 92.3% of Cold Chain Points. This was reported as 85%, 66.7%, 84.8%, 93.2%, 90% and 67% by Sinha et al^[10], Gupta et al^[5], Mallik et al^[16], Patel et al^[17], Sharma et al^[15] and Naik et al^[11] respectively.

V. Conclusion and recommendations

Vaccines worth crores of rupees and most importantly health of millions of infants and children are in the hands of Cold Chain Handlers. Hence they need regular training to keep their knowledge and skills updated. Cold Chain Handlers need reinforcement in skills like correct way of reading thermometer, conducting shake test, conditioning of ice-packs and executing contingency plan. Medical officers of the health facility supported by District Immunization Officer should be actively involved in the monitoring and supervision of the Cold Chain Handlers on regular basis.

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