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EVALUATION OF EFFECTIVE VACCINE MANAGEMENT AT COLD CHAIN POINTS IN URBAN MEERUT, UTTAR PRADESH, INDIA

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ABSTRACT

Background: Every year globally about 5.9 million children die before the age of 5 years. It is estimated that immunization against vaccine preventable diseases can save 2-3 million lives every year. Immunization is one of the most cost effective preventive health measure to prevent childhood diseases. Vaccines are sensitive biological products and their potency can diminish irreversibly when exposed to inappropriate temperatures. Hence for effective implementation and success of the universal immunization programme, proper maintenance of Cold Chain needs a great focus and attention. In 2010, WHO and UNICEF launched the Effective Vaccine Management (EVM) initiative to help countries upgrade their immunization supply chains. EVM is a diagnostic tool which assesses Process, Practices and Policies of the health system required for efficient cold chain and vaccine logistics management. About 60% of children from urban Meerut receives vaccination from a public health facility. Therefore, it is necessary to evaluate Cold Chain Points in Urban Meerut by EVM tool. *Methods:* There are 14 Cold Chain Points at Urban Meerut. It includes one Regional Vaccine Store, one District Vaccine Store and 12 Health Facility level stores. A cross-sectional study was carried out at all of these 14 Cold Chain Points. Globally validated WHO-UNICEF EVM tool was used for this study. Data was compiled in MS-Excel and analysed using percentages and proportions. Criteria wise and Consolidated EVM scores were calculated as per WHO guidelines. *Results:* None of the Cold Chain Point at Urban Meerut achieved a consolidated EVM score of ≥ 80% as per WHO recommendation. They were found to be lacking on various crucial factors like condition of building, availability of functional generator set, provision for disposal of sharps waste. *Conclusions:* The present study contemplates for upgrading the Cold Chain Points at Urban Meerut in terms of building, infrastructure and maintenance along with periodic training and capacity building of all the Cold Chain Handlers.

KEYWORDS: Cold Chain, Effective Vaccine Management, Urban, Meerut, India.

INTRODUCTION

Urbanization in India began to accelerate after independence, due to the country's adoption of a mixed economy, which gave rise to the development of the private sector. Urbanisation is taking place at a faster rate in India. Population residing in urban areas in India, according to 1901 census, was 11.4%. [1] This count increased to 28.53% according to 2001 census, and crossing 30% as per 2011 census, standing at 31.16%. [2][3] According to a survey by UN State of the World Population report in 2007, by 2030, 40.76% of country's population is expected to reside in urban areas.[4]

Meerut, is a city in the Indian state of Uttar Pradesh. The city lies 70 km northeast of the national capital New Delhi, and 453 km northwest of the state capital Lucknow. Meerut is the second largest city in the National Capital region, and as of 2011 the 33rd most populous urban agglomeration and the 26th most populous city in India. About 51% of the city's population live in urban areas.[5] About 13% of under 5 children of Meerut resides in urban areas.[5]

Globally, about 5.9 million children die before the age of 5 years every year.[6] Over two-thirds of these deaths are due to conditions that could be prevented or treated with simple and affordable interventions.[7] Immunization is one of the most cost effective preventive health intervention that can prevent morbidities, mortalities and disabilities especially in children.[8] 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.[9] Hence for effective implementation of the Universal Immunization Programme, factors like Cold Chain and Vaccine Management needs greater focus and attention.[10,11] In 2010, WHO and UNICEF launched the Effective Vaccine Management (EVM) initiative to help low and lower-middle income countries upgrade and strengthen their immunization supply chains.[12] about 60% of children from urban Meerut receives vaccination from a public health facility.[13] Therefore, it is necessary to evaluate Cold Chain Points in Urban Meerut by EVM tool.

AIMS AND OBJECTIVES

1. To assess Effective Vaccine Management at urban cold chain points in district Meerut by using global WHO-UNICEF standardised Effective Vaccine Management Assessment tool.
2. To identify gaps in Effective Vaccine Management and to give recommendations for its strengthening.

MATERIAL AND METHODS

There are 14 Cold Chain Points in Urban areas of Meerut. It included one Regional Vaccine Store (Primary Level), one District Vaccine Store (Lowest Distribution Level) and rest were Block/Health Facility Vaccines Stores (Service Point Level).

An observational cross-sectional study was carried out from November 2016 to October 2017. All these 14 Cold Chain Points were visited and assessed using globally validated WHO-UNICEF standardized Effective Vaccine Management (EVM) assessment tool. EVM assessment tool consists of about 356 questions, many of which are divided into sub-questions. EVM assesses 9 global criteria as mentioned below:
a) E1 (Pre-Shipment and Arrival Procedures)
b) E2 (Vaccine and Diluent Storage Temperature)
c) E3 (Capacity of Cold Chain, Dry Storage and Transport)
d) E4 (Status of Buildings, Equipment and Transport)
e) E5 (Maintenance of Buildings, Equipment and Transport)
f) E6 (Stock Management System and Procedures)
g) E7 (Effective Distribution between each Supply Chain)
h) E8 (Vaccine Management and Handling)
i) E9 (Information System and Supportive Management).

An area of vaccine management is considered ―Effective if its criterion score is greater than or equal to 80% which is called the ―EVM standard.

Cold Chain Handlers were interviewed and cold chain system was observed. Data was compiled in MS-Excel based EVM tool and analysed using percentages and proportions.

Definitions and Explanation of the Terms used in the Study

1. **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.

2. **Satisfactory electrical system**
Satisfactory electrical system means that wiring, circuit breakers, electrical sockets and light fittings are in good condition and securely fixed in place and all circuits are properly earthed.

3. **Good condition of Roof**
It means that roof should be free from any leaks and dampness.

4. **Severe Crack**
A crack 5mm or greater in width extending through the thickness of the wall is a severe crack.

5. **Major damage**
A damage due to distortion, subsidence or damage caused by an earthquake.

6. **Urban area of Meerut**
Area of district Meerut under Municipality, Municipal Corporation or Cantonment Board.

7. **Primary level Store**
Vaccine stores that receive vaccine direct from an international vaccine manufacturer or distributors or a local vaccine manufacturer.

8. **Lowest distribution level**
Vaccine stores that receive vaccine from a primary level store and supply vaccine to one or more Block/ health facility level store.

9. **Service point level**
Facilities that receive vaccine from any higher level store and supply immunization services to the beneficiary.

RESULTS

There are 14 Cold Chain Points in urban Meerut and each Cold Chain Point had one Cold Chain Handler. Therefore a total of 14 Cold Chain Handlers were interviewed. It was found out that majority of Cold Chain Handlers were females (57.2%). Maximum number of the Cold Chain Handlers (42.8%) were educated up to high school only. It was also found out that 57.2% of Cold Chain Handlers were having a work experience of less than 3 years. (Table 1).

Table 1: Characteristics of Cold Chain Handlers at Cold Chain Points (N=14).

S. No	Variables		No. (%)
1	**Gender**	Male	6 (42.8%)
		Female	8 (57.2%)
2	**Age (in years)**	18-30	4 (28.6%)
		30-40	2 (14.2%)
		40-50	4 (28.6%)
		50-60	4 (28.6%)
3	**Education Qualification**	High School	6 (42.8%)
		Intermediate	4 (28.6%)
		Graduation and Above	4 (28.6%)
4	**Work Experience (in years)**	1-3	8 (57.2%)
		3-5	5 (35.7%)
		≥5	1 (7.1%)

It was found that no Cold Chain Point received a consolidated score of ≥80% which is recommended by WHO. Almost all Cold Chain Points in Urban Meerut received scores between 60-79%. (Table 2).

Table 2: Categorization of Cold Chain Points as per Consolidated EVM Scores.

S. No	Score Category (in %)	No. of Cold Chain Points	Percentage (%)
1	≥ 80	0	0
2	60-79	13	92.8
3	40-59	1	7.2
4	< 40	0	0.0
	TOTAL	14	100.0

As E1 criteria is applicable only on Primary Level stores, so only Regional Vaccine Store (RVS) which is a Primary Level store was assessed for this criteria. RVS Meerut scored 100% in E1 criteria. Further it was found that during the study period, RVS Meerut received 17 vaccine shipments and all vaccines shipments received were accompanied by a separate Vaccine Arrival Report (VAR) which was found to be complete and correct in all respects. No vaccine during the last 3 months was found to be damaged or exposed to excessive heat or cold.

Categorization of Cold Chain Points on the basis of Criteria wise EVM scores can be seen from Table 3. It can be concluded that the Urban Cold Chain Points lacks behind in E4, E5, E6 and E9 criteria as only a few of them can achieve a WHO recommended score of ≥80% in these criteria.

Table 3: Categorization of Cold Chain Points as per Criteria-wise EVM Scores.

S. No	EVM Criteria[#]	≥80%	60-79%	40-59%	<40%	TOTAL
1	E2	6 (42.8%)	6 (42.8%)	1 (7.2%)	1 (7.2%)	14 (100%)
2	E3	8 (57.2%)	4 (28.5%)	0 (0%)	2 (14.3%)	14 (100%)
3	E4	1 (7.2%)	5 (35.6%)	7 (50.0%)	1 (7.2%)	14 (100%)
4	E5	1 (7.2%)	5 (35.6%)	7 (50.0%)	1 (7.2%)	14 (100%)
5	E6	3 (21.4%)	8 (57.2%)	3 (21.4%)	0 (0%)	14 (100%)
6	E7	8 (61.6%)	0 (0%)	4 (30.7%)	1 (7.7%)	13 (100%)*
7	E8	5 (35.6%)	9 (64.4%)	0 (0%)	0 (0%)	14 (100%)
8	E9	1 (7.1%)	4 (28.5%)	9 (64.4%)	0 (0%)	14 (100%)
[#]*E1 criteria is applicable only to primary level stores*						
**E7 criteria was not applicable to one of the Cold Chain Points*						

It was observed that only 28.5% of Cold Chain Points had a safe disposal pit for sharps waste. Half of the Cold Chain Points in urban Meerut has good condition of roofs and external walls free from damages. Satisfactory electrical system was found at 78.5% Cold Chain Points.

It was found that only 42.8% Cold Chain Points had a functional generator set for power back up. Most of the Cold Chain Points lack fire extinguishers. However, majority of these Cold Chain Points had been visited by District Immunization Officer for supervision. (Table 4).

Table 4: Some Key-issues related to Cold Chain Points (N=14).

S. No	Variables	Yes (%)
1	Presence of safe disposal pit for sharps waste	4 (28.5%)
2	Good condition of roofs	7 (50.0%)
3	External walls free from severe cracks or major damage.	7 (50.0%)
4	Satisfactory Electrical system	11 (78.5%)
5	Presence of functional generator set	6 (42.8%)
6	Presence of Fire extinguishers	3 (21.4%)
7	Visit by District Immunization Officer in past 3 months for supervision	8 (57.1%)

DISCUSSION

The present cross sectional study was carried out at all 14 Cold Chain Points of urban Meerut with the objectives to assess Effective Vaccine Management by using global WHO-UNICEF standardised Effective Vaccine Management Assessment tool and to identify gaps and give recommendations for its strengthening.

This study revealed that each Cold Chain Point in urban Meerut had one designated Cold Chain Handler so a total of 14 Cold Chain handlers were interviewed.

In the present study it was found that maximum number of the Cold Chain Handlers in urban Meerut were educated up to high school (42.8%). However a study by Immunisation Technical Support Unit (ITSU)[14] revealed that most (52%) of the Cold Chain Handlers in Bareilly and Shahjahanpur, Uttar Pradesh were educated up to intermediate (12th Class).

The present study revealed that all the vaccine shipments arriving at RVS Meerut were accompanied by a vaccine arrival report (VAR) which was found complete in all respects. This is in contrast to the result of National EVM Assessment (2013).[15] which revealed that none of the VAR were found complete at any Primary level vaccine store in the country.

It was found in the present study that no Cold Chain Point could achieve a consolidated EVM score of ≥80% as recommended by WHO. National EVM Assessment (2013)[15] and Uttar Pradesh Comprehensive EVM Assessment (2016)[16] also revealed similar results.

The present study revealed that fire extinguishers were present at only 21.4% of Cold Chain Points. It was also found that half of the Cold Chain Points had roof in good condition with no internal leakages, however the results of Uttar Pradesh Comprehensive EVM Assessment (2016).[16] showed 70% Cold Chain Points had roof in good condition which were free from internal leakages. However, EVM Concurrent Monitoring (2017).[17] revealed that 87% Cold Chain Points had roof in good condition with no internal leakages.

The present study noted that 50% Cold Chain Points in urban Meerut had external walls free from severe cracks and major damage which is lower than the result of EVM Concurrent Monitoring (2017)[17] which found this in

80% Cold Chain Points in Uttar Pradesh. Satisfactory electrical system was found in 78.5% of Cold Chain Points whereas Uttar Pradesh Comprehensive EVM Assessment (2016)[16] revealed that 63% of Cold Chain Points had a Satisfactory electrical system.

It was found in the present study that 42.8% Cold Chain Points in urban Meerut had a functional generator set which is higher than 19% as indicated by Uttar Pradesh Comprehensive EVM Assessment (2016).[16]

We found that 57.1% Cold Chain Points were visited by District Immunization Officer (DIO) in the last 3 months for supervision and review similar to 57% reported by EVM Concurrent Monitoring (2017).[17]

Present study reported 28.5% of Cold Chain Points had a on-site safe disposal pit for waste sharps which is lower than 51% reported by EVM Concurrent Monitoring (2017).[17]

CONCLUSION AND RECOMMENDATIONS

Although half of the population of district Meerut lives in urban areas and about 13% population under the age of 5 years with majority of them receiving vaccination from a public health facility, still Cold Chain Points lacks in certain crucial areas of Effective Vaccine Management. The present study contemplates for upgrading the Cold Chain Points at urban Meerut in terms of building, infrastructure and maintenance. Provision of safe disposal pit and fire-extinguishers should be at all Cold Chain Points.

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