Assessment of Effective Vaccine Management in Government Health facilities of Jammu District- A cross-sectional study

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ABSTRACT

Background: Maintenance of the cold chain is critical to the effectiveness of vaccination. Maintaining the Cold Chain properly requires a lot of attention to implement Universal Immunization Programme and make it success. Effective Vaccine Management was introduced by UNICEF and WHO in 2010. EVM evaluates the logistical management of the vaccination supply chain. **Aim & Objective**: The study's objective was to assess iSC's performance at the government health facilities of Jammu District's cold chain points and find the existing gaps. **Methodology**: In the UT of J&K's Jammu district, cross-sectional study was conducted which was facility based. Using the questionnaire WHO-UNICEF for EVM assessment created on EVM assessor app. Version (v1.7-March 2014) of Site selection tool of the WHO EVM was used to determine the sample size and site selection. 31 HFs were evaluated. The EVM assessor app was used to generate scores. **Results**: The consolidated overall scores generated for CCPs ranged from 62% to 66%. The total scores of these CCPs were below the desired score of 80%. Consolidated scores generated for Management criteria (M1-M4) revealed that M1 has achieved ≥80% for all CCPs. **Conclusions**: The Jammu district 's cold chain overall performance fell short of proposed level. Supportive supervision, vaccine transportation facility, power backup, training of Cold Chain Handlers can aid in improving EVM.

KEYWORDS

Cold Chain & Logistics; Effective Vaccine Management; Immunization Supply Chain Management; Vaccine Handlers

INTRODUCTION

Essential role is played by Immunization supply chain to ensure the continuous availability of quality vaccines from the level of manufacturer to beneficiary. Cold chain maintenance has a significant impact on vaccination success.(1) The system for keeping vaccines at right temperature while being transported from producer to immunization site is called Immunisation supply chain(iSC).(2) The well-being of individuals globally improve when every link in the supply chain is efficiently tracked, evaluated, and improved.(3) Six rights of each iSC to ensure a right functional system are: -Right **vaccine** at Right **place** in the Right **quantity** in Right **condition** at Right **cost** in Right **time**.(2) For successful Universal Immunisation Programme, a great focus is needed for maintenance of Cold Chain. In the year 2010, the initiative of Effective Vaccine Management (EVM) was launched, by WHO and UNICEF.(4,5,6) EVM is an international program that give nations the resources and instruments need to track and evaluate Immunization supply chain Management.(5) EVM begins with an evaluation that informs a strategy for putting changes into practice and tracking performance.(7) The study's objective was to assess iSC's effectiveness in the cold chain points(CCPs) of Jammu District, find any gaps, and offer suggestions for improving it. Till date very less literature is available regarding

assessment of CCPs in various Government Health Facilities of Jammu. This study will help to assess the cold chain system and identify the challenges that can be utilised by Health administrators for its improvement.

Aim & Objective(s): The study's objective were: 1) to assess iSC's performance at the government health facilities' cold chain points in the Jammu District, and

2) to identify existing gaps in EVM & give recommendations to strengthen it.

MATERIAL & METHODS

Study type & Design: In the UT of J&K's Jammu district, cross-sectional study was carried out which was facility based.

Study setting: Government Health Facilities (CCPs) of Jammu district of UT of Jammu & Kashmir

Study duration: The study was carried out for one year from 1st November 2021 to 30th October 2022

Study population: At Subnational level (SN) there is one Divisional Vaccine store in Jammu which supplies vaccines to all the districts of Jammu Division. In Jammu District there is one District vaccine store (lowest distribution level, LD). In addition, there are 79 cold chain points at service point level (SP) in Jammu district. These facilities comprised our sampling units.

Sample size: Sample size was determined using the version (v1.7 – March 2014) of Site Selection tool of WHO EVM.(4)Hence, 31 facilities were assessed in the study which included: 1 District Vaccine Store Jammu and 29 SP level facilities- Primary Health Centers (PHCs), Govt Hospital (GH), New Type PHCs (NTPHCs) , UHCs (Urban Health Centers), CHCs (Community Health Centers) and Health &Wellness Centers (H&WCs). In addition, Divisional vaccine store Jammu was also assessed. For SP level facility the target population catered was drawn and using the method of Probability Proportional to target population, Cold Chain Points (CCPs) were identified to be included in the study sample. The CCPs at SP level were coded using numeric codes for the purpose of anonymity/confidentiality.

Data Collection: Using EVM Assessor app (Technet-21 website, v1.01 version of EVM assessor guide), the questionnaire of WHO-UNICEF for EVM assessment was generated which is standalone. EVM assesses 9 criteria (E1-E9), Categories (C1-C6), management criteria (M1-M4), Outputs (O) and Performance (P) as below(5)

CODE CRITERIA	CODE CATEGORY
E1 Vaccine arrivals	C1 Infrastructure
E2 Temperature management	C2 Equipment
E3 Storage & transport capacity	C3 Information technology
E4 Facility infrastructure & equipment	C4 Human resources management
E5 Maintenance	
E6 Stock management	C5 Procedures & policies
E7 Distribution of vaccines & dry goods	C6 Financial resources management
E8 Vaccine management	
E9 Management of Waste	**CODE Management Criteria**
Output (O)- include records, charts or reports produced by staff while implementing the iSC functions	M1 forecasting Annual needs
	M2 Annual work planning
Performance (P)- category includes key outcomes of input and output	M3 Supportive supervision
	M4 Equipment

One facility was assessed in a day and the staff working in the facility was not informed beforehand.

At all the levels, health personnel in charge of vaccine management (cold chain handlers) were administered the EVM assessment standalone questionnaire. This included:

a) Interview Questions that were asked by the assessor directly to the assesse.(5)

b) Verification Questions that required the assessor to verify if the assesse knew or did something.(5)

A minimum of 80% score in criteria and category is recommended by WHO-UNICEF EVM guidelines for a healthy immunization supply chain.(8,9,10).

c) Observation Questions: The assessor used direct observation of certain aspects of the medical facility to answer.(5)

The primary data was collected directly by asking questions to assesse and the secondary data was collected from the available records.

Ethical issues & permission: Due permission was taken from Director General, Family welfare, MCH and Immunization UT of Jammu & Kashmir and IEC approval was taken vide no IEC/GMC/2022/883 dated 28/02/2022.

Explanation of the terms used in the study:

1. Sub-national level store: Which receives vaccine supply form primary level and distribute vaccines to

whole division/state/UT is called as sub-national level store.(5)

2. Lowest distribution level: Vaccine stores which receive vaccines from sub-national and supply vaccine to one or more cold chain points.(5,6)

3. Service point level: cold chain point which receives supply from any higher-level store (LD, SN levels) and provide immunization services.(5)

4. Cold chain points: The health facilities which receives, store or supply, and provide immunisation services to the beneficiaries are called cold chain points.(11)

Data Analysis:

For each CCP the EVM assessor app generated a standalone questionnaire which had 36 levels having subset of questions for assessment.(5) The data so collected was incorporated in EVM assessor app and the scores for criteria, category, management criteria, output and performance were generated. Scores less than 80% were regarded to be below acceptable performance. Further, the data so collected was coded, compiled, entered into Microsoft excel sheet, tabulated and then analysed. The qualitative data and quantitative data was presented as percentages (%) and Mean ± standard deviation respectively.

RESULTS

Effective vaccine management assessment was conducted in a total of 31 government health facilities of Jammu district which included 29 Service Points (GH, UHCs, CHCs, PHCs/NTPHCs & H&WCs. In addition, LD level (Distt Vaccine store) and SN level (Divisional Vaccine store Jammu) were also assessed.

Figure 1 shows the total scores of the CCPs and none of them achieved the desired score of 80% and above.

Figure 2 heat map shows that the criteria of storage and transport capacity(E3) and distribution of vaccines and dry goods scores(E7) at 49% and 39% respectively. None of the SPs had vehicle for transportation of vaccines. Only one insulated non-refrigerated vehicle for transportation of vaccines was available in entire District at LD level which was also used by the SN level as and when required. There was no contingency plan for transportation emergencies in the vehicle. The temperature management(E2) criteria showed a score of 71%. 95.2% & 96.4% of Deep freezers (DFs) & Ice-lined refrigerators (ILRs) were in good physical condition. Voltage regulator was not connected to 3.5% ILRs and 7.14% DFs. 5.2% of ILRs and 14.2% of DFs had frost and ice on the walls. None of the ILRs/DFs had automatic defrosting function and door open alarms. 3.5 % ILRs and 7.14% DFs were placed within 5cm of the wall and other appliances leaving

very little space in between. Waste management(E9) criteria score was 59%. Immunization waste collection was outsourced to a private agency. Most of the SPs of Jammu district. 10.3% of CCPs practiced burial of immunization waste while rest practised both burial and collection methods. Burial pit site was subject to flooding at 6.89% of the SPs. None of the CCPs had protective eye wears, boots, apron, trousers, shovels, wheel barrows for handling immunization waste. The category (C1-C6) scores for SPs showed that none of the scores achieved the recommended level of 80%. Only the score of Annual needs forecasting(M1) was more than 80%. All the CCPs had records of supervisory visits but only 3.44% of SPs had written feedback, rest of the SPs had received only verbal feedback.

Criteria scores for LD level (E4-83%, E9-86%) and for SN level (E4-83%, E9-86%) achieved the recommended level ≥80%. Category scores C1 and C6 for LD and SN level both were ≥80%. Performance scores of LD were 90% and SN were 89%. For rest of the groups the scores were below the recommended level of 80%.

Figure 3 shows that for Output none of the CCPs achieved the recommended level whereas for performance DVS, GH, CHC/SDH/AH & PHC had reached the recommended level ≥80%.

Consolidated scores generated for Management criteria (M1-M4) for various CCPs assessed as shown in Figure 4 revealed that the Management criteria (M2 to M4) were below the recommended level**.**

The gaps identified were grouped under various headings (Infrastructure, Waste management, Cold chain equipment, Human resources, Transportation, Information technology, Supportive supervision and Vaccine management practices) are as:

Infrastructure: Buildings had leaks & cracks, broken window panes, no grills & poor electric wiring condition. Preventive maintenance, power back up were not available at many CCPs.

Waste management: Colour coded dustbins, bin liners and Waste segregated area were not present. Waste was not disposed properly in the burial pit and was subject to flooding. Personnel Protective Equipment was not available to the staff except gloves.

Cold Chain Equipment: Some ILRs/DFs needed replacement and some were not equipped with voltage regulators. Non-vaccine products like water were placed in Cold Chain Equipment.

Human Resources: The Cold Chain Handlers were not trained in handling vaccines

Transportation: Only one insulated non-refrigerated vaccine van was available in the entire district.

Information technology: Computer and Internet connection was not available at some places.

Supportive supervision: Supervisory visits to CCPs were not regular, only verbal feedback was given.

No instructions were provided to CCHs in written format.

Vaccine management practices: The storage of vaccines in CCE, MDVP, safe injection practices were not followed in some CCPs.

Figure 1 Spider graph showing consolidated overall scores generated for CCPs (LD and SP level) assessed during EVM assessment in Jammu district.

Figure 2 Heat map dashboard showing the criteria, category, management, output & performance scores of SP level assessed during EVM assessment in Jammu district

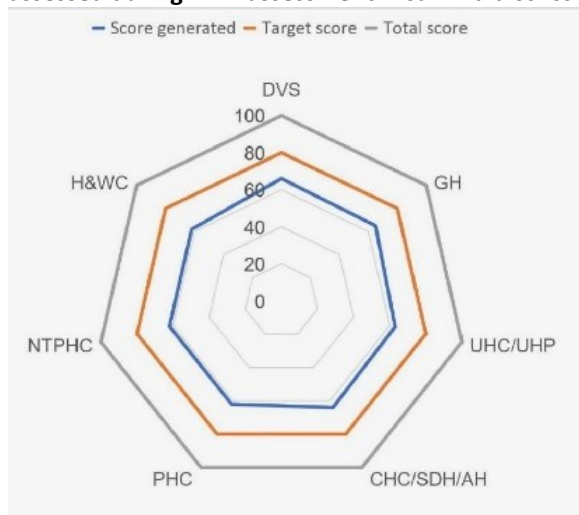|		infrastructure	equipment	IT	HR	P&P	FR	output	Performance	Total
		C1	C2	C3	C4	C5	C6			
Temperature management	E2			33	60	21		77	100	71
Storage & transportation capacity	E3			45	97	7		67		49
Facility infrastructure & equipment	E4	66	80	100				67		49
Maintenance & repair	E5				92	14		40	81	63
Stock management	E6			90	64	12		67	42	62
Distribution of vaccines & dry goods	E7		100		19			86	70	39
Vaccine management	E8				60	12		100		73
Waste management	E9		49		45	9		83	81	59
Annual needs forecasting	M1				100	7		100	92	83
Annual work planning	M2				83	10	62	43	90	57
Supportive supervision	M3							3		3
iSC performance monitoring	M4				25	14		7		16
Total		66	56	71	63	12	62	62	79	63

Figure 3 Spider graph showing consolidated scores generated for various variables (Output & performance) for CCPs (LD and SP level) assessed duting EVM assessment in Jammu district.

Figure 4 Spider graph showing consolidated scores generated for Management criteria for various CCPs assessed during EVM assessment in Jammu district.
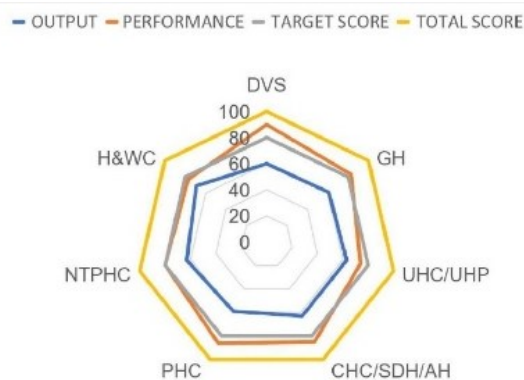
DISCUSSION

The current study evaluated how well vaccines are managed in health facilities of public sector at Sub-national (SN) level which included one Divisional vaccine store, Lowest distribution (LD) level one district vaccine store and Service point (SP) level which includes (GH, UHCs, CHCs, PHCs/NTPHCs & H&WCs) in UT of J&K's Jammu District using tool for EVM assessment created by WHO & UNICEF. The results elucidated an total average score of 63% at service point (SP) level. In a study conducted by
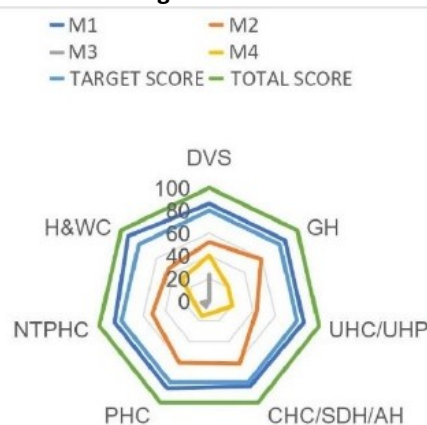
Mishra N in Jabalpur district of India higher overall scores were reported(12) whereas Sadru G in a study from Mwanza, Tanzania reported lower overall scores at 53%.(13) The findings of this research are well below the minimum of 80% score in criteria and category as recommended by WHO-UNICEF EVM guidelines. A variety of reasons have been identified for the low overall score which include non-training of Cold Chain Handlers in handling vaccines, supervisory visits not regular, availability of only one insulated non-refrigerated

vaccine van in the entire district etc. Lack of supportive supervision was abysmal in the present study and it calls for an urgent attention for skill training of workers in the health facilities. Sadru G and Feyisa D also reported that majority of vaccine workers were not well-versed in vaccine handling procedures.(7,8) It is pertinent to mention that below par knowledge of vaccine handlers is a risk in vaccine storage with collateral damage of injecting low-quality vaccines to prevent Vaccine Preventable Diseases. (13,14)

As per National EVM assessment of 2018, the highest score was reported in Storage Capacity (94%) while lowest score was in distribution and supportive function (52%). EVM Gujarat in 2019 reported maintenance/repair and MIS/supportive functions below the desired 80% mark. Further, laying down of standard operating procedures (SOPs) to fix responsibility of cold chain handlers have contributed to best practices. But some experts have reported that inappropriate use of SOPs had contributed to exposure to temperatures out of the recommended range.(15)

In the present study, the category policies & procedures (C5) as well as human resources (C4) were well below the desired levels. For effective vaccine management, having at least two vaccine handlers is mandatory to monitor temperature of vaccine refrigerator. Sadru G reported low monitoring for temperature management performance.

Stock management (E6) criteria in the present study was low at 62% but it was similar to that reported to Sadru G from Tanzania. In contrast, higher score of 79.3% and 85.4% were reported by studies from Jabalpur (India) and Ethiopia.(12,14)

Financial resources (C6) in the present study were found to be only 62% which reflected poor support to cold chain maintenance. The results are in agreement with those reported by Sadru G from Tanzania where this rate was abysmally low at 26%. The authors recommend adequate funding for effective vaccine management in general and remote temperature monitoring operations in particular.(13)

Unstable power supply has been reported by some CCPs in the present study and these results are in consonance with those reported by Sadru G from Tanzania.

It has been recommended to ensure availability of trained staff for maintenance and cold chain equipment repair.(11)Supportive supervision and training of cold chain handlers goes long way to achieve effective vaccine management, practices and performance.(16)

The Jammu district's cold chain's total performance fell short of the WHO-recommended threshold (≥ 80%). Most CCPs scored well in management criteria of Annual needs forecasting(M1). The criteria, category and management criteria require improvement especially safe disposal pits provision, supportive supervision, power backup, training of CCHs, micro plan, and facility for vaccine transport can aid in maintaining potency of vaccines, reducing wastage rate and overall improvement in effective vaccine management.

RECOMMENDATION

The authors proposed the following recommendations: These recommendations are critical for advancing public health goals. Civil works of the buildings should be conducted on priority basis. Emergency electricity grid connection & alternative provision of power backup (generator, solar panels, inverters should be made available at the CCPs. The CCHs should be trained for latest Bio medical waste (BMW) guidelines, SOPs for immunization waste disposal should be provided at all levels, the charts of guidelines should be displayed in the immunization room.

Planned preventive maintenance of CCE at regular intervals should be carried out as per SOPs. The CCH should be given a detailed training regarding the use of CCE.

Regular updating and providing hands on training for holding immunization sessions is required. SOPs for collection and distribution of vaccines from district vaccine store and block headquarters should be developed and followed. Computer and Internet connection should be made available.

Designated supervisory staff for iSC operations should be trained and instructed to visit CCPs. The charts/posters concerning the knowledge of storage of vaccines, MDVP, safe injection practices etc. should be made available. There is a need to implement the proposed recommendations and meticulous monitoring required to strengthen the immunization supply chain and prevention of vaccine preventable diseases. More researches of this kind ought to be carried out in UT of Jammu & Kashmir to fill up the gaps identified in the current study. The authors communicated the proposed recommendations to the Family Welfare Department, Govt. of Jammu & Kashmir.

LIMITATION OF THE STUDY

The present study findings are limited to one district only. Since this study was conducted using cross-sectional design, a longitudinal study would have enabled us to compare results over time and track changes.

RELEVANCE OF THE STUDY

In the UT of Jammu & Kashmir, no such studies carried out in the past. The study was conducted with the aim to evaluate the performance of iSC in Government Health Facilities 's Cold Chain Points of UT of J&K's Jammu District and to identify existing gaps in EVM & give recommendations to strengthen it.

AUTHORS CONTRIBUTION

All authors have contributed equally.

CONFLICT OF INTEREST

There are no conflicts of interest.

DECLARATION OF GENERATIVE AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The authors haven't used any generative AI/AI assisted technologies in the writing process.

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