RESEARCH ARTICLE

Evaluation of Application of Effective Vaccine Management in Wassit Governorate, Iraq

Jalal A R Zayer*, Ishraq A Chiad

College of Medical and Health Technology, Middle Technical University, Iraq

Received: 20th March, 2020; Revised: 22nd April, 2020; Accepted: 25th May, 2020; Available Online: 25th June, 2020

ABSTRACT

Background: Immunization helps save a life, protect serious illness, and improve quality of life. It is recognized as one of the most cost-effective public health interventions available around the globe. However, the success of this program is heavily dependent on strong immunization supply chain practices. Proper immunization supply chain management ensures availing potent and live vaccines to the community.

Objective: To evaluate the application of effective vaccine management in health facilities of Wassit Governorate, Iraq.

Subjects and Methods: It was a cross-sectional study involving a multistage sampling. A total of 45 health facilities sites were selected, as follows: one sub-national store (SN), six district store (LD), and thirty eight service point (SP) by using effective vaccine management (EVM) questionnaire, interview, reviewing the records, and observations for the agreed review period.

Results: The overall scores of this assessment for all levels (SN, LD, and SP) of the supply chain 66.6% demonstrates a need for more improvement in most areas of the vaccine and supply management system as only two criteria (storage capacity E3 and vaccine management practices E8) exceeds the WHO recommended minimum score of 80%. Performance levels of one criteria (building, equipment E4) were about 72% storage temperature (E2), maintenance(E5) and stock management (E6) were between 61 and 68%, while the vaccine distribution (E7), and information management (E9) were notably very weak with performance in each category less than 60%.

Conclusions: The national average percentage at all levels was below the WHO recommended minimum score of 80%.

Recommendation: The future vaccine storage capacity must be recalculated and stored to enter any new vaccine, receive large quantities of the influenza vaccine, and replace vaccine refrigerators at the sector level with cold rooms to accommodate current and future increases.

Keywords: Effective Vaccine Management, EPI, Evaluation, Supply chain, Wassit Governorate.

International Journal of Pharmaceutical Quality Assurance (2020); DOI: 10.25258/ijpqa.11.2.9

How to cite this article: Zayer JAR, Chiad IA. Evaluation of Application of Effective vaccine management in Wassit Governorate, Iraq. International Journal of Pharmaceutical Quality Assurance. 2020;11(2):242-246.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Vaccination has caused a dramatic reduction in the threat of diseases that were once widespread and often times fatal. It remains the most cost-effective preventative health intervention presently known.[1,2] Vaccines are sensitive biological substances that gradually lose their potency with time.[3] This loss of potency can be accelerated, any loss of potency in a vaccine is permanent and irreversible, all childhood vaccines, except the oral polio vaccine, should be kept at 2 to 8°C, since the vaccine potency can be damaged by heat or freezing temperature. When stored out of the recommended range of temperature.[3,4] The efficient practice of cold chain management is, therefore, key to ensuring that the benefits of vaccination are sustained. With the increasing cost of vaccines, the greater storage capacity now required at every level of the cold chain. In addition, in the next years, at least many additional vaccines that target many diseases will become available to lower and middle-income countries.[5] These vaccines must travel along what is called supply chains, which include all personnel, systems, equipment, and activities involved in ensuring that vaccines are effectively delivered from the point of production to the people who need them.[6,7] In 2010, WHO and UNICEF launched the EVM initiative to help countries evaluate the performance of their immunization supply chains, and benchmark this performance against best-practice standards. To this end, an EVM assessment tool was developed and set standards in nine areas of vaccine management.[8,9]

Objective of the Study

To evaluate the application of effective vaccine management in health facilities of Wassit Governorate, Iraq.

*Author for Correspondence: ebrahimjalal5@yahoo.com

Subjects and Methods

Study Design

This cross-sectional study was conducted at 45 randomly selected health facilities in Wassit Governorate, Iraq. A total number of the health facilities was 45 distributed in one sub-national store, six sectors and 38 centers (main and sub) (50% from total) were selected randomly by a multistage sampling technique from all sectors, then simple random sampling was taken from each sector according to sector catchment map.

EVM Assessment

An EVM assessment uses a template designed to evaluate the four distinctly different levels in the supply chain; only the national or primary level (PR) does not exist at the governorate level, only one store in Iraq/ Baghdad. Its tool is based on nine basic criteria: E1 vaccine arrivals procedures, E2 temperature monitoring, E3 storage and transport capacity, E4 buildings and equipment, E5 maintenance, E6 stock management, E7 vaccine distribution, E8 vaccine management practices, E9 information systems, and supportive management functions. Every criterion is divided into a series of requirements and sub-requirements and is given a score out of 100%, the target score is set at a minimum of 80% for each criterion at each level of the supply chain in the country to be considered reliable. At the same time, E1 is assessed at the Primary level only from WHO in 2012-19.[10]. The data collection was made by using EVM questionnaire, which consists of a series of focused questions, which are numerically scored based on interviews, reviewing the records and observations for the agreed review period, against recommended standards. The questions under the nine indicators can be divided into seven management implementation categories: building, storage capacity, equipment, management issues, repair and maintenance, training and vehicles.[11]

Elements Effective Vaccine Management (EVM)

EVM launched by WHO and UNICEF in 2009-2010, is a quality improvement process to compare their effectiveness against best-practice benchmarks. EVM is a comprehensive evaluation of the supply chain system of the immunization program to identify the strengths and weaknesses of the system at all levels to enhance the development of an effective roadmap for improvement.[10]

EVM measures a wide spectrum of programmatic activities, including the following:

- *Vaccine arrival (E1):* All pre-shipment and arrival procedures ensure that every international shipment of vaccines from a manufacturer reaches its first destination in a country (a primary vaccine store or central medical store).[11,12]
- *Temperature control (E2):* All vaccines and their diluents are stored and distributed within a cold-chain system that maintains, at all times, the WHO-recommended temperatures ranges for all types of vaccines.[9]
- *Storage capacity (E3):* The national supply chain system has sufficient and quality cold storage, dry storage, and transport storage capacity to accommodate all vaccines, diluents, and injection supplies needed for the national immunization program.[10]
- *Infrastructure (E4):* The status and the layout of storage buildings, cold-chain equipment, and vehicles enable the supply chain system to function effectively.[11]
- *Maintenance (E5):* Preventive and curative maintenance systems are standard and operational for storage buildings, cold-chain equipment, and vehicles used to distribute vaccines.[12]
- *Stock management (E6):* Systems and procedures for managing the stocks of vaccines are effective, in terms of vaccine handling, physical inventory, stock-control systems, adequate stock-level policy, good store practice, and disposal procedures for damaged and expired vaccines.[12]
- *Distribution (E7):* The transport of vaccines between each level in the supply chain is effective, including the correct use of passive containers (cold boxes), packing practices with coolant packs (conditioned ice-packs or cool water packs), temperature indicators, and maintaining transport contingency plans.[10,13]
- *Vaccine management (E8):* All recommended policies for vaccine management are adopted and implemented, including the use of vaccine vial monitors (VVMs), the shake-test, the multi-dose vial policy (MDVP), the use of diluents, and the monitoring of vaccine wastage rates.[14]
- *Information systems (E9):* Logistics management information systems (LMIS) and supportive management functions are effective, including standard operating procedures, and vaccine-needs forecasting.[15]

RESULTS

The current study showed that the national average percentage for the summary criteria scores of different levels of stores. Table 1 shows sub-national stores, lowest delivery stores, and service point stores have achieved more than 80% scores in few of the criteria in E2 and E8 criteria, At all levels of the supply chain the criteria E7 and E9 distribution, and MIS, and supportive management functions were particularly the weakest performance ranging from 40 to 56%, stock management and maintenance (E5 and E6) are also notably weak ranging from 61 to 68%. At the sub-national level, three criteria exceeded 80% (E3, E6, and E8). Other criterias were below 80%, lowest deliver stores only one criteria have achieved more than 80% scores in storage capacity (E3) criteria. In comparison, service points average is more than 80% in two criteria building, CC equip. and transport (E4), and vaccine management practices (E8), the weakest performance in service points was 33% in MIS and supportive functions (E9). vaccine arrival process (E1) is not applicable in all level stores only in the national (primary)store.

Table 2 shows category scores of seven different EVM categories. Three categories were more than 80% in capacity, equipment, and training categories in At the sub-national level, capacity and training were exceeded 80% (100 and 92%, respectivelly), while other criterias were below 80% Average,

Table 1: Effective vaccine management (EVM) indicator score summary by level.

No.	*Global Criteria (Minimum target is 80)*	*1 Sub National Stores (%)*	*6 Lowest Deliver Stores (%)*	*38 Service Point Stores (%)*	*National Average (%)*
1	Vaccine arrival process (E1)	NA	NA	NA	NA
2	Vaccine storage temperature (E2)	72	71	57	66
3	Storage capacity (E3)	100	89	76	88
4	Building, CC equip. and transport (E4)	70	69	80	73
5	Maintenance and repair (E5)	77	57	51	61
6	Stock management (E6)	81	66	57	68
7	Distribution (E7)	61	63	44	56
8	Vaccine management practices (E8)	84	77	82	81
9	MIS and supportive functions (E9)	50	38	33	40

Table 2: Effective vaccine management (EVM) category score summary by level.

No.	*Category*	*1 sub national stores*	*6 lowest deliver stores*	*38 service point stores*	*National average*
1	Building	74	59	77	70
2	Capacity	100	86	73	86
3	Equipment	75	87	78	80
4	Management	69	62	56	62
5	Repair and maintenance	77	57	51	61
6	Training	92	75	77	81
7	Vehicles	38	41	NA	40

especially in the weakest performance in vehicles was 38%. Lowest delivery stores have achieved more than 80% scores in capacity and equipment categories. Service points have not achieved more than 80% scores in any of the categories, while vehicles are not applicable in service points.

In Table 3, average percentage of indicators for all sectors (lowest level of delivery) was 66.52%; only one category was above 80% (storage capacity 88.8%). The performance level was below 80% in all sectors. The lowest scores have been in maintenance (57.6). Azizia sector has the highest score among all sectors, around 76.1%**,** while Al fist Kut sector had a score of 60.5%, which is the lowest criteria, and the average percentage of category indicators for all sectors (lowest level of delivery) was 67.02%, only two categories were above 80% (capacity 86.6 and equipment 87.5). In comparison, the performance level is poor across for others level below 80% in all sectors; the lowest scores have been in vehicles (41.6). But the best scores recorded in Azizia sector about 78.2%**,** while Al Hayi sector had is the lowest score criteria 59.2%.

DISCUSSION

This study was conducted to evaluate effective vaccine management in Wasit governorate, central Iraq, launched for improving the vaccine management system. It is an innovation that focuses on strengthening the vaccine cold chain and logistics system by identifying gaps in the supply chain system and sufficiently act upon improvement in the accepted global vaccine management indicators.[2,16] The current study showed that there are clear deficiencies according to the following criteria; E2: temperature monitoring; the average percentage of temperature monitoring in the current study was 66%. stores had completed temperate records (twice daily, everyday) for each and vaccine refrigerator and vaccine freezer throughout the review period. However, some of them had no temperature recording during the weekends and national holidays with no evidence of internal review of their temperature records, while more of these sites were unable to demonstrate documentary evidence of this practice. The main reason for forgetfulness and carelessness of the responsible staff and, in addition, to the weakness in follow up and supervision. This study result agrees with other results studies conducted in India, Senegal and Uganda,[2,17,18] In addition to global EVM assessment in 2009-2018, which not meet EVM standard.[14] E 3: storage and transport capacity; the score of these criteria exceeds the minimum of WHO-recommended except service point (PHC centers). Most poor indicators were the majority of stores had unsufficient ice-pack freezing capacity and had sufficient passive container capacity due to lack of awareness about the health hazards related about this practice, but the presence of quantities of influenza vaccine in large quantities and receipt of some quantities for vaccination campaigns that take place from time to time outside the vaccination schedule, so the storage capacity must be recalculated and expanded according to the need future capacity. This result agreed with EVM assessment study done by WHO, showed that among 89 countries in the world had achieved a minimum target percentage. Also, the same result was in Ghana, India, and

Table 3: Evaluating EVM criteria score by district/division or lowest level of delivery (LD).

			Score%					
No.	*Criteria*	*Target%*	*National average*	*Azizia*	*Numanynia*	*Sawira*	*KUT*	*2KUT 1*	*Hayi*
	E1: Vaccine arrival	80	0	0	NA	0	0	0	0
	E2: Temperature	80	71.1	81	71	62	71	71	71
	E3: Storage capacity	80	88.8	100	92	83	92	83	83
	E4: Buildings, equipment, transport	80	69.5	81	73	78	63	60	62
	E5: Maintenance	80	57.6	66	53	59	59	49	60
	E6: Stock management	80	66.6	81	57	69	67	58	68
	E7: Distribution	80	63.5	71	55	71	75	68	41
	E8: Vaccine management	80	77	84	73	94	77	73	61
	E9: MIS, supportive functions	80	38.1	45	26	42	45	22	49
	Total	80	66.52	76.1	62.5	69.7	68.6	60.5	61.8
			Category					
	Buildings	80	59	76	72	89	39	35	43
	Capacity	80	86.6	100	90	80	90	80	80
	Equipment	80	87.5	93	83	81	88	92	88
	Management	80	62.1	71	53	66	66	55	62
	Repairs/ maintenance	80	57.6	66	53	59	59	49	60
	Training	80	74.8	92	75	75	75	75	57
	Vehicles	80	41.6	50	50	25	50	50	25
	Total	80	67.02	78.2	68	67.8	66.7	62.2	59.2

Benin.[1,5,18] E4: buildings, equipment, and transport; study shows all stores un sufficient daily hours of electricity for the installed equipment throughout the year, particularly in the summer season. All stores do not the generator have a working auto-start system. More than 94% of ILR/DFs are without voltage stabilizers. The main reasons for this problems due to increasing malfunctions in the electrical network and continuous blackouts particularly in the summer months, in sub-national store, and district (sectors) vehicles, for which the program is responsible, were in bad mechanical condition, also all stores of locations do not had a fuel available throughout the year, All this is due lack of financial resources in recent years in addition to the lack of experience of the maintenance department. This disagreed with another study in Ghana and Oman had good score.[1,12] E5: maintenance; the current study result showed majority displayed evidence of a facility maintenance program, however there are no written plans, visual evidence or maintenance records in any site. Also, vehicles service not in accordance with the manufacturer's service manual and there was no documentary evidence that the service manual is being followed except PHC centers (vehicles not applicable) because of the poor performance and the low number of responsible maintenance personnel. These results are similar to results in Ghan, India, Uganda, and Senegal. E6: stock management; no computerized stock control system is implemented at all stores. Also, in most of the sites, conditioned icepacks do not use to transport freeze sensitive vaccines except in subnation store, this may be due to no active following to health care providers staff and less activation of follow up of leaders supervisors, in additional carelessness of the storekeeper. This result is disagree with another study in the EVM evaluation in India in 2018.[18] E7: distribution; a low score indicator was reported in this study because ice packs conditioning and packing are not done in accordance with WHO guidelines in 85%, and only 22% reported use of freeze indicators. This result due to lack of supervision and/ or knowledge of surveillance staff about the importance about the use of freeze indicators in the cold box during transport particularly in vaccines sensitive to freezing like hepatitis B, toxiod vaccine. this differs from results conducted in study 2018 in Oman and studies in Bihar in India that showed good performance[4,12.]E8: vaccine management; majority PHC centers do not have an effective waste segregation system. Also, not found a safe method of waste disposal, either on-site or off-site due to lack of awareness about the health hazards related to healthcare waste, inadequate training, and in proper waste management. A similar picture was showed in results in Ghana and recent global EVM assessments.[8,17] E9: MIS and supportive functions; it is the lowest criteria because the store does not use the standard method for estimating the annual needs for the vaccine, injection equipment, also, they had no work on plan/budget, which covers most of the criteria, most stores receive frequent supervisory visits from

the EPI team, but without documentation, this weakness due to the responsibility of the immunization unit in the Wasit health department and the lack of interest, as well as, the lack of training. This study result disagreed with other EVM assessment conducted by the World Health Organization (2009–2018), which showed that the presentation in many countries is better than this result.[14]

CONCLUSION

We concluded that the national average percentage for the summary criteria scores of different levels of stores below the WHO recommended a minimum score of 80%.

RECOMMENDATION

The future vaccine storage capacity must be recalculated and stored to enter any new vaccine, receive large quantities of the influenza vaccine, and replace vaccine refrigerators at the sector level with cold rooms to accommodate current and future increases and a written preventive maintenance plan for buildings and cold chain equipment must be developed, and routine maintenance must be carried out regularly and documented.

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