

Assessment of Expanded Program on Immunization with Emphasis on Vaccine Management in Sennar State 2016, Sudan

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ABSTRACT: Across-sectional descriptive study was conducted in Sennar State in 2016 aimed to assess the service and utilization in the knowledge and practices of vaccine management among health staff at immunization sites. The information was collected through questionnaire for 213 care standard check list from a number of 230 health centers. The study showed that there were only 179 of vaccination sites had working refrigerators out of 230 vaccination sites in the state. The vast majority of immunization centers (79%) have functional equipments. However, 71.7% of centers have thermometers in cold chain refrigerators with 48.7% of centers maintaining of an optimum temperature of all cold chain equipment (+2 - +8 C°) and 15-25C°. Only 67% have Sufficiency of cold boxes and vaccine carriers. The entire vaccine store manager gives the correct storage temperature range for each of the vaccines on the schedule and 72% of the service sites have adequate storage capacity including for mass campaigns. The temperature and recording practices was found in 69.3% centers. In conclusion, the vaccine management in Sennar State still faced many gaps and deficit such as cold chain functionality, trained of health workers on vaccine management, vaccine storage capacity. While the strength points were all the storekeepers were given the correct storage temperature range for each of the vaccines on the schedule, but they need to inform to register the temperature during the holidays especially at localities and service delivery sites. It was suggested that urgent maintenance and replacement equipment's for the not functioning refrigerators by state ministry of health. In addition to introduce of new equipment's to increase capacity at all fixed vaccination sites in the state.

Key words: EPI, Vaccine management, Sennar State

1.1.Introduction: The success of routine immunization programs has been measured by the coverage achieved with the third dose of diphtheria, tetanus, pertussis vaccine (DPT) among children aged 12-23 months⁽¹⁾. Immunization currently averts more than 2.5 million deaths every year in all age groups from diphtheria, tetanus, pertussis (whooping cough) and measles⁽²⁾. Vaccine preventable diseases continue to kill large numbers of young children each year United Nations International Children's Emergency Fund (UNICEF) estimates that 1.2 million deaths to children under five years of age could be prevented at low cost by vaccinating children. Despite the continuing high death, tremendous progress has been made in reducing deaths from vaccine preventable causes. For example, it is estimated that measles related deaths have been reduced from about 2.5 million per year in 1980 to less than one million in 1990⁽²⁾a decline of more than 60 percent during the decade of the 1980s⁽³⁾. Much of this success is due to the Expanded Program of Immunization (EPI), which has substantially increased vaccination coverage in many countries throughout the world. For example, the global coverage of one-year-old children with measles vaccine is estimated to have increased from just 13 percent in 1983 to 80 percent in 1990. The management, monitoring and evaluation of immunization programs require the regular measurement of vaccination coverage⁽⁴⁾ Immunization coverage refers to the proportion of individuals in the target population who have been immunized. An immunization coverage survey examines a small number of individuals to determine their immunization status. It involves visiting homes, examining immunization records and asking the individual, parent or caretaker about immunizations received. This is done in a systematic way so that only a small sample of homes and individuals need to be surveyed in order to obtain valid results for a larger population⁽⁵⁾.The Expanded Program of Immunization was established by the World Health Organization (WHO) in 1974 to ensure universal access to routinely recommended childhood vaccines. Six vaccine-preventable diseases initially were targeted: Tuberculosis, Poliomyelitis, Diphtheria, Tetanus, Pertussis, and Measles. In 1974, fewer than 5% of the world's infants were fully immunized⁽³⁾.Many countries in Africa have severe constraints in maintaining coverage levels at 80 percent. These constraints include inadequate financing; insufficient equipment and supplies; cold chain and transport; inadequate access to facilities; inadequately trained personnel;

inadequate information to the populace as well as poor receptivity⁽⁶⁾. An assessment of the activities of the program therefore is vital in realizing the extent to which the immunization service, which is regarded as a child survival intervention, is being utilized by the target population in the respective districts. However Sennar State has boarders interconnected with neighboring States, mainly, the White Nile State and Blue Nile State in addition to its boards with Southern Sudan Country. The current study aimed to assess the expanded program on immunization service and utilization in Sennar State - Sudan 2016.

1.2.Material and methods:

1.2.1. Study design:It was a descriptive cross- sectional facility based study.

1.2.3. Study area:The study was conducted in Sennar State. Sennar State bordered in north by Gezeira state, east Gadriaf state, west White Nile state and country of South Sudan and south Blue Nile state and Ethiopia. The population size is about 1.400.000 inhabitants according to the registration of the Expanded Program of immunization (EPI) in Sennar State. Climate of the Study Area the temperature ranges from (6.2oc - 47.5oc) relative humidity 28%, and average rainfall is 121.4mm. Wind directions during the winter is Northerly, during the summer is southwesterly.Sennar State is divided into seven localities and 21 administrative units which composed of 894 villages. There are (13) hospitals (192) health centers (205) Health units, and (30) sub health units to provide community health services.

1.2.4. Sample size and sampling technique:

A statistical calculator used to compute the raw figures. The sample size was estimated using the following assumptions;

- Anticipated level of immunization coverage was 50 percent.
- The level of statistical confidence of the estimate (confidence interval) of 95%.
- Desired precision of the estimate was $\pm 5\%$.
- Magnitude of differences of coverage among and within the clusters of With reference to these assumptions, the sample size was calculated using the formula:

$$N_{min} = DE \times Z^2 \times (1-\alpha/2) \times P \times (1-P) / d^2$$

Where: N.min= minimum number of children sampled,

DE= design effect, the ratio between the variance from the cluster design to the variance that would be obtained from a simple random sampling.

Z= the desired confidence level (α).

P= expected coverage

d= the desired width of the confidence internal.

Assuming a design effect of 2, confidence level of 95 percent (for $\alpha= 0.05$, Z= 1.96),

expected coverage (P) of 50 % (0.5) and a desired width of the confidence interval of ± 10 percent (d= 0.1), the minimum number of children used as the sample size was calculated as follows; Minimum number of children = $2 \times (1.96)^2 \times 0.5 \times 0.5 / (0.1)^2 = 2 \times 3.8416 \times 0.5 \times 0.5 / 0.01 = 2 \times 0.9604 / 0.01 = 2 \times 96.04 = 192.08 \approx 193$ respondents; 10% of non-response was calculated to be; $0.1 \times 193 = 20$ children. The minimum number of children selected was $193+20 = 213$ care taker's and A sample of thirty clusters was chosen and therefore a minimum of $213/30 = 7.1$ and rounded up to eight (8) care taker's and care taker per cluster. Using of stratified sample ($n=N/1+N(e)^2$); Where: n= Sample size; N= population of study; e= degree of precision; n= $538/1+538x (0.05 \times 0.05 = 230)$, therefore sample size for Fixed centers was $(81/230 \times 100) = 35$ for outreach was $(447/230 \times 100) = 191$ and for mobile centers was $(10/230 \times 100) = 4$

1.2.5.Data collection methods:The data was collected through Questionnaires presented to households in the residential area according to sample size selection. In addition to standard EPI check list to evaluate the performance of EPI sites and Focus Group discussion with immunization employees, immunization reports.

1.2.6. Data analysis:Data was analysis using statistical analysis software; Statistical Package for the Social Sciences (SPSS) version 19.0. Cross tabulations of quantitative data was used in relation to the study objectives to find out associations or relationships amongst them. Summary of the various results in forms of tables and figures.

1.2.7. Ethical considerations:Ethical clearance for this research obtained first from the AlzaiemAlazhari University. Circulars were disseminated to the targeted areas, and all Assembly members within the study area. Verbal consents were obtained from the chiefs of the communities as well as individuals involved in the research.

2. Result: In figure 1.2, most of EPI centers from Sennar locality (21.3%) followed by East Sennar (19.1%). The vast majority of EPI centers (95%) were governmental (fig.2.2). The most types of refrigerators equipments used in vaccine keeping were refrigerators boxes (40.4%) and ice-lining tube refrigerators as shown in figure3.2. About 71.7% of EPI centers have functional equipments (fig.4.2) with 71.7% have thermometers in cold chain refrigerators (fig.5.2). Nearly 70% of EPI centers were maintaining of an optimum temperature of all cold chain equipment +2 - +8 C° and 15-25C° as displayed in figure 6.2. Approximately 50% of EPI centers have electric regulators in case of instability of electricity (fig.7.2). However, 67% of EPI centers have sufficiency of cold boxes and vaccine carriers (fig.8.2). In table 1.2, the overall temperature and recording practices was 69.3% with high knowledge of staff for vaccine damage (83.0%) and with low percentage (54.3%) for temperature and alarm registration forms been analyzed within a month to determine the reasons for the change in temperature and treatment. The sufficiency of storage capacity was 72.2%.The table 2.2 shows that, the written instruction about using flask monitor existed in (67%) of EPI centers.Most of (65.7%) of EPI Center in SennarStat used (fixed expired first out method)and in(21%)of used (first in first out method).In (59%) of EPI centers the vaccine ad diluents wastage was registered while in (41%) were not registered. The monthly reports about vaccine wastage were available in (55%) of EPI centers in Sennar State.The data of wastage for assessing vaccine need were used in (52%) of EPI centers.More than half (53%) of EPI centers the vaccinators did not know the lower and upper level of stock and needs.Most (67.8%) of vaccinators in EPI centers knows how to perform shake test.In (72%) of EPI centers the multi-dose vial policy was used and applied.The majority of vaccinators(73%) of in EPI centers know the strategy of multi use of open vial policy.Table 3.2 indicates that, most (60%) of vaccinators In EPI centers received on job training where (40%) did not. Only (23%) of vaccinators had certificates documenting received training.Most of

(91%) of EPI centers supervised by higher level. Nearly two thirds (59%) of EPI centers there were written feedback documenting the conducted supervisory visits.

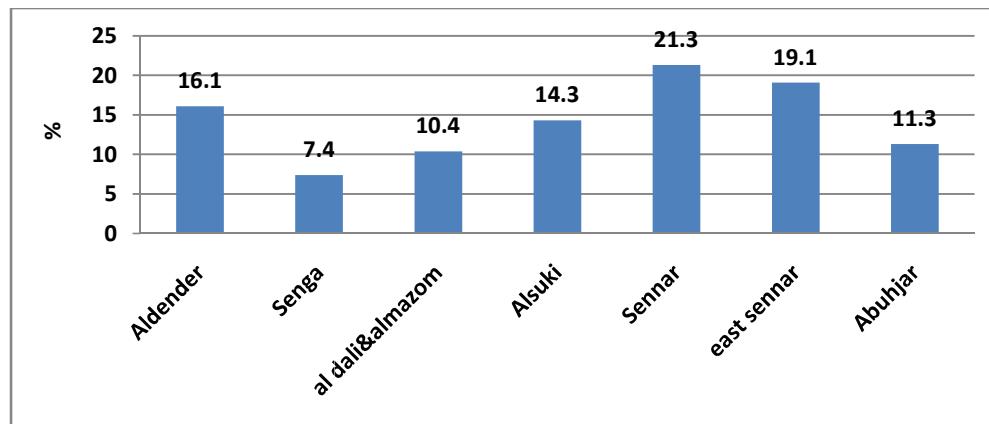


Fig (1.2): Distribution of EPI centers in Sennar state by localities (N=230)

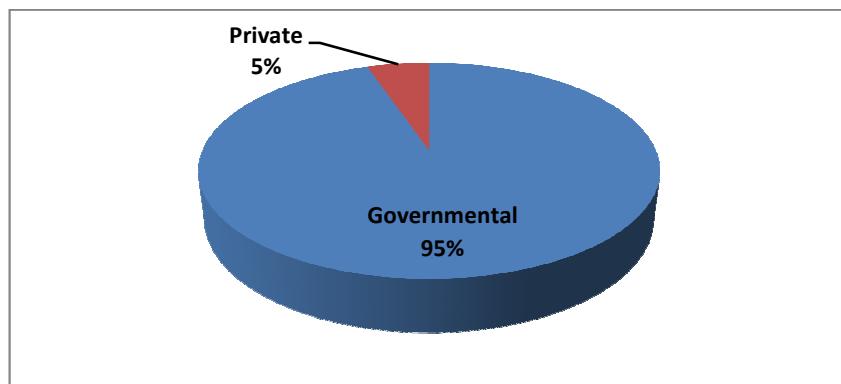


Fig (2.2): Distribution of EPI centers in Sennar state by type of centers (N=230)

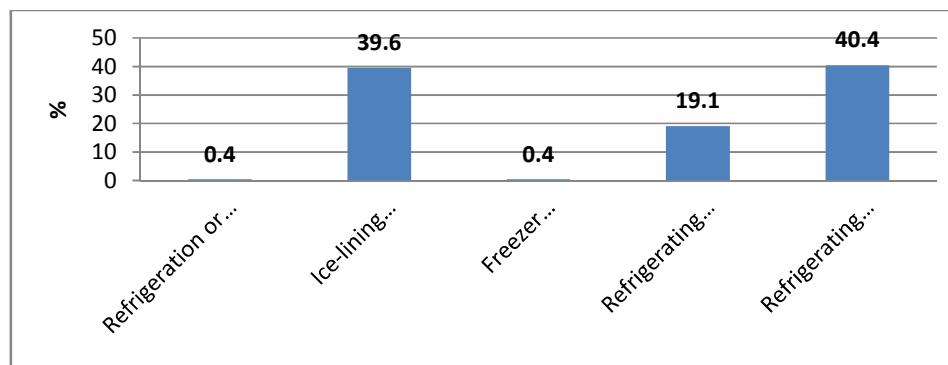


Fig.(3.2): Types of refrigerators equipments used in vaccine keeping(N=230)

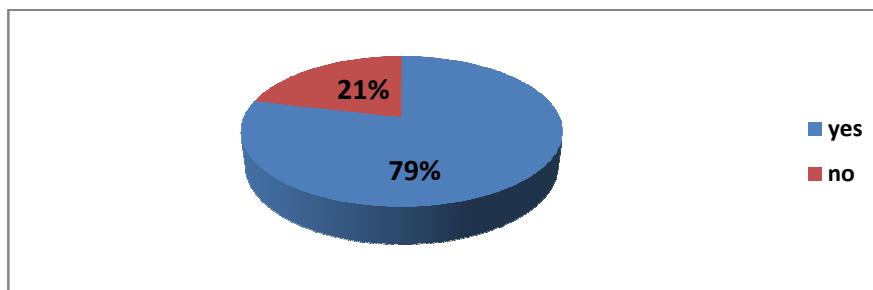
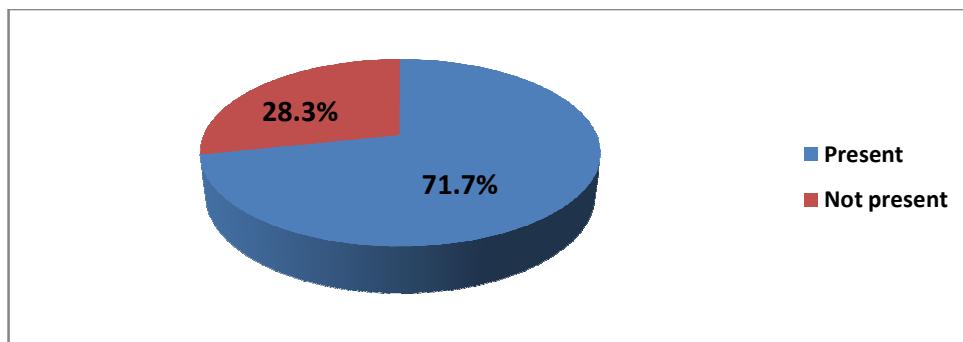


Figure (4.2): Functionality of equipment's of EPI centers (N=230).



Fig(5.2): Presence of thermometers in cold chain refrigerators (N=230)

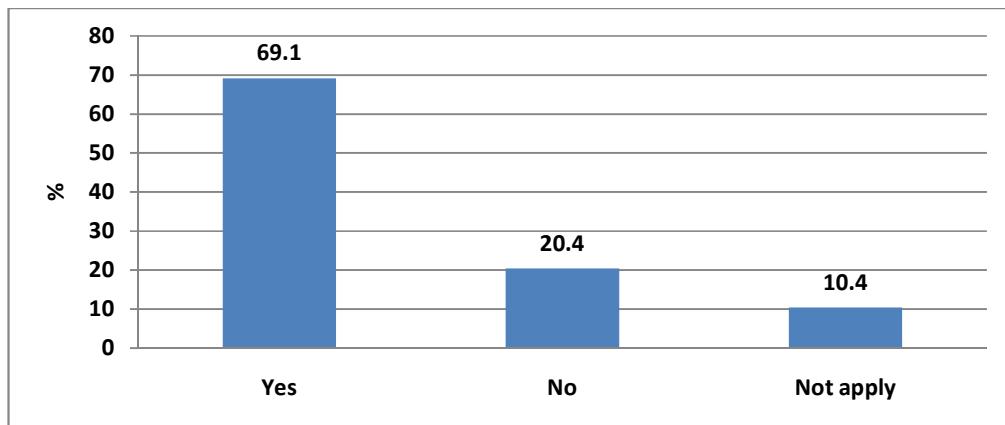


Fig.(6.2): Maintaining of an optimum temperature of all cold chain equipment (+2- +8 C°) and 15-25C°) (N=230)

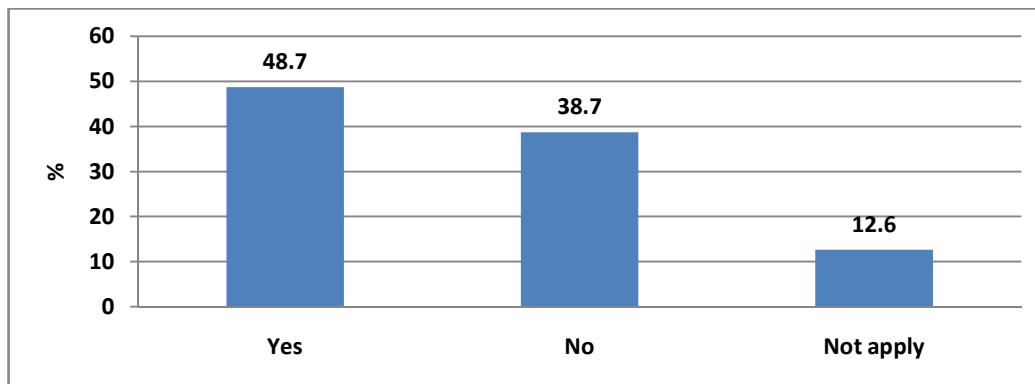


Fig. (7.2): Presence of electric regulators in case of instability of electricity (N=230)

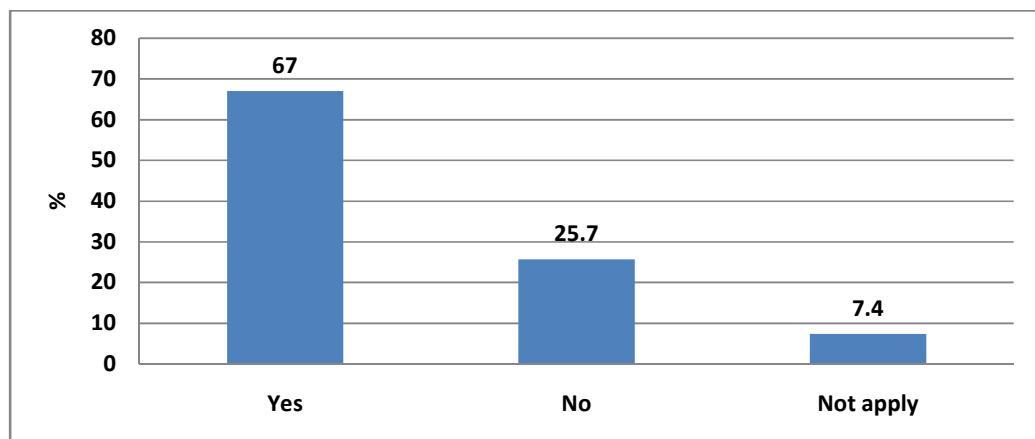


Table (1.2.): Temperature and recording practices (N=230):

Question	yes		No	
	No.	%	No.	%
1 Are the temperature of the refrigerators to be registered manually at least twice a day	149	64.8	81	53.2
2 Are temperature records complete and stored in a safe place during the evaluation period?	159	69.1	71	30.9
3 Have temperature and alarm registration forms been analyzed within a month to determine the reasons for the change in temperature and treatment?	125	54.3	71	30.9
4 Can warehouse workers give the correct temperature range for keeping each vaccine in the vaccination schedule?	166	72.2	64	27.8
5 Do Center staff know that vaccines are damaged by freezing	191	83.0	39	17.0
6 re freezing indicators used	167	72.6	63	27.4
Average		69.3		31.7

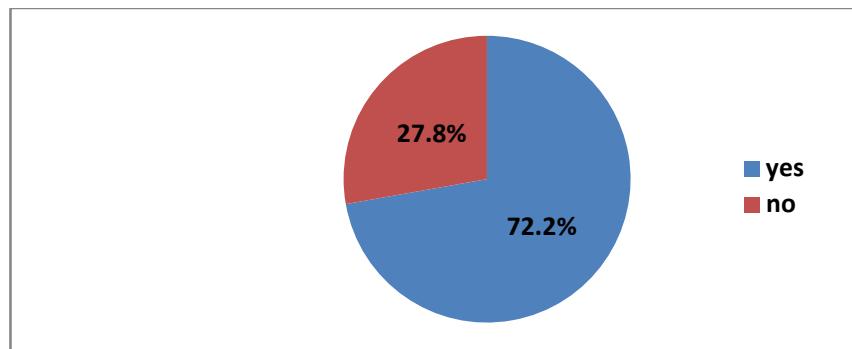


Figure (10.2) Sufficiency of storage capacity (N=230)

Table (2.2): vaccine management(N=230)

Vaccine management	Response	Frequency	%
Presence of written instructions for using of flask monitor	Yes	155	64.7
	No	75	32.6
	Total	230	100
Methods of dispatching vaccine	The exchange is done randomly without a base	30	13
	The one who enters the refrigerator first is distracted first	49	21.3
	Which expired first to be paid first	151	65.7
	Total	230	100
Registration of vaccine and diluents wastage	Yes	136	59.0
	No	94	41.0
	Total	230	100
Presence of monthly vaccine	Yes	127	55.2

wastage monitoring reports	No	103	44.8
	Total	230	100.0
Using of wastage data in assessment of vaccine needs before requesting	Yes	121	52.6
	No	109	47.4
	Total	230	100.0
Skills of vaccinators about estimation the minimum stock and demand	Yes	106	46.0
	No	124	54.0
	Total	230	100.0
Knowledge about shake test for frozen vaccines	Yes	156	68.0
	No	74	32.0
	Total	230	100.0
Using of Open Vial Strategy	Yes	166	72.2
	No	64	27.8
	Total	230	100.0
Knowledge distribution of vaccinators about Open Vial Strategy and how to use it	Yes	73.5	169
	No	26.5	61
	Total	100.0	230

Table (3.2): Distribution of milestones (training, supervision, feedback) (N=230)

Milestones	Response	Frequency	%
Providing on job training for the vaccinators about vaccine management	Yes	138	60.0
	No	92	40.0
	Total	230	100
Presence of certificates or any documentation for conducted trainings	Yes	53	23.0
	No	177	77.0
	Total	230	100
Conducting of supervisory visits by higher levels	Yes	210	91.3
	No	20	8.7
	Total	230	100
Presence of written feedback reports or remarks for the	Yes	137	59.6
	No	93	40.4

conducted supervisory visits	Total	230	100.0
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3.1. Discussion: This descriptive Cross- Sectional study; which was conducted in order to assess the EPI in Sennar State with emphasis on vaccine management in a total of 213 of care taker's in 230EPI centers. The study showed that (21.3%) of EPI centers in Sennar State are located in Sennar locality followed by East Sennar locality; this may be because these localities have great immunization targets. The assessment showed that most of the equipment's (79%) were fully functional during the evaluation period; In addition 71.7% of refrigerators have thermometers but there was no internal thermometer because all vaccines are sensitive to heat, some vaccines are more sensitive to heat than others. Polio vaccine is the most sensitive to heat, while tetanus toxoid is the least sensitive. Vaccines do not change their appearance when their potency is lost. A complete laboratory test is the only means to assess whether a vaccine in a vial has lost its potency. Despite the high percentage of functioning equipment but unfortunately it was lower than the proportion recommended by world health organization ⁽⁷⁾. The study showed that nearly 70% of EPI centers were maintaining an optimum temperature but still there is a gap because for vaccines to be effective, it is important that they are stored within the temperature range recommended by manufacturers [+2°C to +8°C] to ensure that they remain potent ⁽⁸⁾. Also the study revealed that nearly half of EPI centers were equipped with an electric regulator and 38.7% have not. A voltage stabilizer is mandatory because voltage fluctuations are many and power cuts are frequent, so that all equipment's should be with electric regulators ⁽⁸⁾. Moreover, the study showed that more than two thirds of EPI centers were recording temperature twice a day but still there were 34.7% did not register temperature in a log especially during weekends and holidays. This is not going with the recommendation that the temperatures should be recorded at least twice a day, seven days/week ⁽⁹⁾. The centers under study (69.1%) of them maintain complete temperature records in a safe place during the assessment period. A temperature log must be maintained regardless of temperature alarm, a chart recorder thermometer, or a digital data logger. The log helps to identify recurring problems and loss of function in ageing units in order to take fast action in case of out of range temperatures ⁽⁹⁾. Only 72.2% of warehouse workers give the correct temperature range for keeping each vaccine in the vaccination schedule. Still there were 28% of warehouses have

not sufficient storage. This is not meeting WHO standard which recommend that the refrigerator capacity is large enough to store the vaccine supply, and there must also be enough room to allow air to circulate around the vaccine packages⁽⁹⁾. There were 27.8% of EPI centers have not sufficient storage capacity. These centers may affect the vaccination coverage during the year; therefore a reasonable amount of safety stock is needed for unpredicted increases in demand, emergencies, or transportation delays. A stock management system must be simple. Its purpose is to move supplies, not to create paperwork all details of each consignment must be checked and recorded in the stock register⁽⁷⁾. Management practice should always be implemented to assure sufficient stock of vaccine for the whole country in a specific period⁽¹⁰⁾. More than 65% of EPI centers in Sennar State were using first expired first out (EEFO) method and in (21%) of centers using (first in first out method. This not compliance with WHO requirements which is FEFO for all centers⁽⁷⁾. In 59% of EPI centers, the vaccine and diluents wastage were registered while in 41% were not registered while in 55% of EPI centers monthly reports about vaccine wastage were available. All immunization points monitor their performance by monitoring immunization coverage. The monitoring of vaccine and diluents wastage rates on a regular basis by all immunization points brings additional value to this quality performance indicator⁽⁹⁾. The multi-dose open vial policy was used and applied in 72% of EPI centers and 73% of vaccinators in EPI centers knows the policy. The multi-dose open vial policy must be used with some vaccines. Multi-dose vials of OPV, DTP, TT, DT, hepatitis B, and liquid formulations of Hib vaccines from which one or more doses of vaccine have been removed during an immunization session may be used in subsequent immunization sessions for up to a maximum of four weeks⁽¹¹⁾.

In EPI centers vaccinators 60 were received on job training where 40% did not. However, only 23 % of vaccinators had certificates documenting that they received training. The majority of EPI Centers (91%) were supervised by higher levels and (59% of it have written feedback documenting the conducted supervisory visits. Supportive supervision implies providing onsite training to health workers at the time of a supervisory visit or at regular district meetings. These findings indicated the importance of supervision; the supportive supervisors solve problems locally and follow up regularly with supply and resource issues⁽²⁴⁾. In conclusion, the vaccine management in Sennar State still faced many gaps and deficit such as cold chain functionality, trained of health workers on vaccine management,

vaccine storage capacity. While the strength points were all the storekeepers were given the correct storage temperature range for each of the vaccines on the schedule, but they need to inform to register the temperature during the holidays especially at localities and service delivery sites. It was suggested that urgent maintenance and replacement equipment's for the not functioning refrigerators by state ministry of health. In addition to introduce of new equipment's to increase capacity at all fixed vaccination sites in the state.

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