



Assessment of factors affecting vaccine cold chain management in routine immunization session sites in North 24 Parganas, West Bengal A Scopic Review

Authors

Dr Soumya Sarkar¹, Dr Pinaki Sensarma^{2*}, Mr. Jitumoni Rajkonwar³

¹MBBS, MPH, Surveillance Medical Officer, National Public Health Surveillance Project (NPSP), World Health Organization, North 24 Parganas, West Bengal

²MBBS DMCW MBA MPH, Associate Professor, Department of Environment and Public Health, NSHM Institute of Health Sciences, NSHM Knowledge Campus, Kolkata

³BS Optom, MPH (Clinical Research), MBA (Gen), PGDEMA, PhD (Scholar), School of Public Health, SRM University, Sikkim

*Corresponding Author

Dr. Pinaki Sensarma, MBBS DMCW MBA MPH

Introduction

Immunization against vaccine preventable diseases remains the most cost effective public health strategy for child survival India¹. The vaccine used are BCG, Bivalent OPV ,IPV, Pentavalent and Measles (with Rotavirus, PCV, HPV, JE and MR being new addition to the immunization services provision basket Cold chain system remains the backbone of immunization programme to maintain the potency of the vaccine. Breakdown of cold chain would lead to loss of potency of vaccine and may result in adverse events following immunization³. These events could hamper immunization programs and failure to achieve the full immunization target of 90% for government of India⁴.

In India, UIP vaccines are procured by Government of India and supplied from manufacturer to Government Medical Store Depot (four stores across India). Here vaccines are stored for about 3 months and then transported to state vaccine stores. From the state vaccine stores they are transported to the divisional and district vaccine stores. The last cold chain point is the vaccine store in the primary health centers, community health centers and cold chain points in municipalities/corporations from where the vaccines are distributed to session sites.

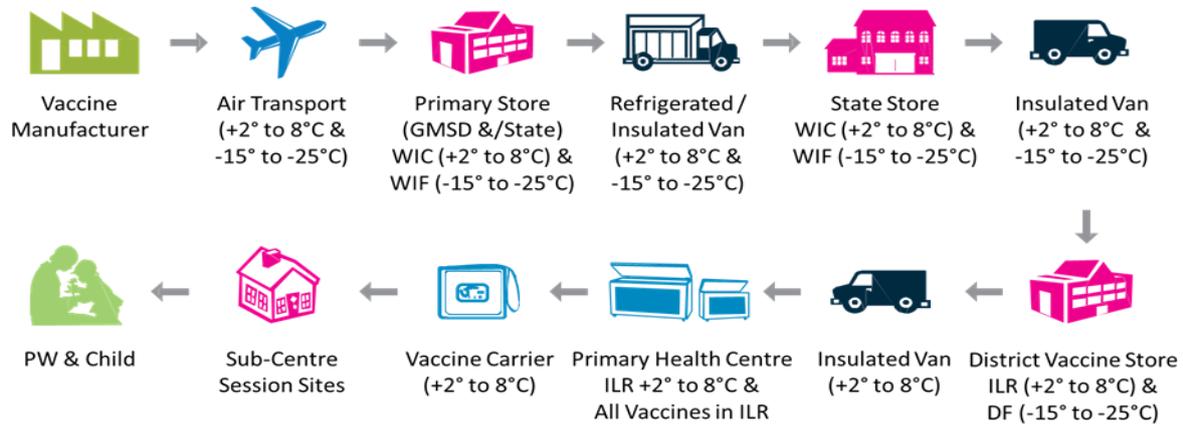


Figure 1: Vaccine movement (adapted from Handbook for Vaccine and Cold Chain Handlers 2nd Edition, India 2016)⁵

Vaccination session sites can be broadly categorized in two types. One is Cold chain-fixed session sites (collocated with the cold chain point) and the other is outreach sites (not collocated with the cold chain points). These sites may be ICDS centers, PRI offices, schools, clubs, ward offices, NGO run clinics etc. Generally there is a well-established system for transportation of vaccines to and fro from the cold chain sites. Vaccines are kept inside the cold chain system throughout the transportation process to the last point of use. For the urban areas urban sub centers / other immunization centers are thus the last point of cold chain and urban vaccinator cadres serve as an important link in the cold chain system⁶.

Immunization services delivery is the responsibility of municipal health authority in urban areas of West Bengal². Almost 32% of West Bengal's population are resident of the urban areas and thus dependent on the municipal health care delivery system.(census 2011). At present there are 127 urban local bodies (117 municipalities/6 Corporation /3 notified area authority/township). With rapid urbanization and urban migration, this trend is ever increasing. This is important in North 24 parganas (West Bengal) as it has shown an increase of urban population from 54.3 to 57.03 of total population from 2001 to 2011. Census has not been conducted in 2021 possibly due to Covid 19 scenario.

These municipalities/corporations are independent self-governing bodies with a four-tier health

infrastructure under the chairperson/ mayor. Health officer is the nodal authority, who is assisted by Assistant Health officers and Part Time Medical Officers or NUHM Medical Officers. There are two tiers of supervisors namely First tier supervisor(FTS) and Second Tier Supervisors(STS) who supervise the grassroots level health workers called Honorary Health Workers. There is a variation of vaccinator pattern in different municipalities and all of the above cadres of staffs (AHO/PTMO/STS/FTS/HHWs) are employed as vaccinators⁴.

But development of urban health system has not been at par with the rural health care delivery system. This is the result of lack of well-structured urban health policy. First tier supervisors/second tier supervisors (who are the counterpart of rural ANMs and Supervisors), differ in the selection process, educational background and training. (Ref: urban health strategy-department of health and family welfare). Their understanding of cold chain is thus an important tool for success of UIP in urban areas^{6,8}.

In the municipal level, cold chain points (Deep Freezer/Ice Lined Refrigerators) are located in the Health Administrative Unit/Sub Center level. There is a lack of well-structured AVD system. Vaccines are delivered to outreach sites by vaccinators/ supervisors or other staffs or AVDs in vaccine carriers. So the vaccinators working at the peripheral levels are mostly concerned with vaccine carriers and ice packs and the present

study will be limited to how well the vaccinators are familiarized with these three cold chain equipment^{6,8}.

This study was conducted to assess the knowledge, attitude and practices of the health workers for evaluating immunization program at the peripheral level.

Materials and Methods

As the study primarily aims to measure cold chain related knowledge among the vaccinators working under the urban local bodies, so a cross-sectional survey design is adopted. The vaccinators are selected through simple random sampling method by computer generated random numbers from a disordered name-based list of all working vaccinators who were not on long sick or maternity leave during the study period. The investigators were blinded to the list.

Going by most conservative estimated prevalence of 50% knowledgeable workers, the sample size at 99% confidence level, 10% precision and an anticipated non-response-rate of 15%, is calculated to be 196, rounded up to 200. The study was conducted in the year January February 2022 before the start of Intensified Mission Indradhnu 4.0.

A review of existing literature and analysis of the existing training tools of National Cold Chain and Vaccine Research Management Centre (NCCVRMC) was done and two dependent variables were identified. Work (immunization session) supervised by Medical Officers posted at the Health Administrative Unit or Urban Primary Health Center level regularly (at least visiting 1 session site per day following definite schedule) is one of the dependent variable. The other dependent variable is training (vaccine and cold chain handler who have undergone 2 days training of Vaccine and Cold Chain Handler (VCCH) at the designated center authorized by District Immunization Officer or similar competent authority)

After securing informed consent verbally on condition of aggregate anonymity, data has been

collected by face-to-face interviews through a pre-tested close ended questionnaire. Questionnaire can be classified into three groups – knowledge indicators on vaccines and cold chain equipment (questions no 1 to 5), correct practice for vaccine management (Questions no 6 to 9), critical questions on routine vaccine practices. (remaining questions 10 to 35) Vide Table 1.

The data was collected in MS Excel based tool and analyzed using SPSS Release 20.0. Separate Pearson Chi Square test and Fischer Exact Test was used to assess the difference between two dependent variables groups mentioned earlier.

Ethical issues

Permission to conduct this study was obtained from competent health authority of the district. Vaccinators were selected on a basis on a simple random sampling. Consent was obtained verbally from the respondents. There no identifiers in which a particular response can be linked to a particular respondent nor it is possible to link any vaccinator with any particular cold chain point.

Results

Table 1 shows the frequency distribution table for correct responses. The figure in parenthesis is the percentage. .knowledge indicators on vaccines and cold chain equipment (questions no 1 to 5), correct practice for vaccine management (Questions no 6 to 9), critical questions on routine vaccine practices. (remaining questions 10 to 35) Out of 202 respondents, 103 (50.9%) had received training on Vaccine and Cold Chain Handler training module.

Table 2 shows the response to the questions asked and its relation to training. Statistical significance using Pearson Chi Square test was done and for values less than 5 in each group Fischer Exact test was used. P value <.05 was considered significant. The results where P value is <0.05 and also the proportion of respondents answering in excess of 50% are enumerated below.

Knowledge indicators on cold chain points- storing vaccines correctly, identifying the cold

chain equipments, knowledge on heat and cold sensitivity of the vaccines.

Practice indicator for vaccine management: carrying diluents to the session site, checking Vaccine Vial Monitor and date of expiry before reconstitution

Critical questions on routine vaccine practices: can a partially used OPV vials be used in the next session, what is unusable/discard VVM point, can a partially used vials from previous session be used in the next session if VVM is in usable state or within expiry date, how do you assess conditioning of ice pack, placing of the open vials in zipper bag or separate box, using oral polio vaccines during Pulse Polio and routine immunization, Is the pulse polio session interrupted if ice pack melts

Out of 202 respondents, 169 (83.6 %) had work supervised by medical officers. Table 3 shows the response of the vaccinators to various questions and its relation to the supportive supervision.

Knowledge indicator:: (greater than 50 % respondent answering correctly) could- enumerate correctly all the cold chain equipment, freeze sensitivity of the vaccine and vaccines requiring diluents.

Practice indicator: packing vaccine carrier correctly and transporting to the session site, knowledge on reconstituting vaccines, checking the Vaccine Vial Monitor before use and before reconstituting freeze dried vaccines, duration of using reconstituted vaccines, duration of using vaccines which follows open vial policy. Critical knowledge scores on routine vaccine practices- (greater than 50 % respondent answering correctly) :mechanism of conditioning of ice pack, assess conditioning of ice pack, need for conditioning ice pack in routine immunization, keeping oral polio vaccine vials during routine immunization, or IPPI rounds (NID/SNID).

Critical knowledge score on routine vaccine vaccine practices: Less than 50% respondents answering correctly even if respondent have

undergone Vaccine and Cold Chain Handlers training or Medical Officer's conducting supportive supervision at the session.

In this survey 103 out of 202 respondent have undergone training of Vaccine and Cold Chain Handler. However there are questions where less than 50% were able to respond correctly even after training.

Issue of open vial policy: number of respondents answering correctly on various conditions of open vial policy are as follow

- a)VVM useable/ unusable(VVM discard point)- 24 (23.8%).
- b) Can a pentavalent/DPT/TT vaccine vial be placed on a ice pack 5 (4.9%) respondent,
- c) Can a vaccine once taken out of ILR be returned if VVM is in useable stage or within expiry date 33 (32.3%),
- d)How many times partially used vials of DPT/TT/Pentavalent be used 25 (24.3),
- e) How do you carry polio vaccine during pulse polio immunization drive 30 (29.1%),
- f) Can Ice pack be exchanged with loose ice during routine immunization drive 14 (13.5%)

In this survey 147(83.7%) respondent out of 202 replied that their work is supervised by medical officers. Among them less than 50% respondent answered correctly to the following Critical questions on routine vaccine practice questions.

- a) What is a unusable VVM (discard point) – 43(25.2%),
- b)Can a pentavalent/ DPT/TT vial be kept on icepack 7 (4.1%),
- c)Can a vaccine once taken out of the ILR taken out be returned if VVM if it is in useable stage or within expiry date 49 (29.9),
- d) How many times a partially reuse of partially used vials of DPT/TT/Pentavalent be used 31 (18.3%),
- e)How do you carry polio vaccine during pulse polio immunization drive 75 (44.3%),
- f)Can Ice pack be exchanged with loose ice during pulse polio immunization drive and Can Ice pack be exchanged with loose ice during routine immunization drive 23 (13.6%),

Results

Table 1: Frequency distribution table showing sample characteristics

	Parameters to assess knowledge	Responders (%) with correct knowledge
1.	Vaccines should be stored at: <i>designated cold chain point</i>	174 (86.1)
2.	Which of the following are cold chain equipment at the last cold chain point a. <i>Ice lined refrigerator</i> b. <i>Cold box</i> c. <i>Vaccine carrier</i> d. <i>Ice pack</i>	181 (89.6)
3.	Which of the following vaccines cannot be frozen a. <i>BCG</i> b. <i>Measles</i> c. <i>OPV</i> d. <i>DPT</i> e. <i>TT</i>	168 (83.2)
4.	Which vaccine is most freeze sensitive? a. <i>Hep B</i>	104 (51.5)
5.	Which of the following the vaccine require diluents (all the three correct response) a. <i>BCG</i> b. <i>Measles</i> c. <i>Japanese Encephalitis</i>	198 (98.2)
6.	How diluents should be carried from cold chain point to outreach site- <i>Inside vaccine carrier with the vaccines</i>	151 (74.8)
7.	What do you do if you find any diluents frozen <i>Discard the frozen diluents</i>	189 (93.6)
8.	What are the diluents to be used for reconstitution of BCG/Measles/Japanese Encephalitis? <i>Diluent of particular batch supplied by the manufacturer</i>	159 (78.7)
9.	Do you check the VVM status and date of expiry of the vaccine before reconstitution? <i>Yes</i>	126 (62.4)
10.	Do you write time of reconstitution on the label vial at the beginning of session? <i>Yes</i>	108 (53.5)
11.	Reconstituted vials are used for <i>Only a single session site</i>	121 (59.9)
12.	How long a vial of reconstituted BCG/Measles/Japanese Encephalitis vaccine can be used <i>4 Hours (All the three correct responses)</i>	200 (99.0)
13.	Can partially use polio vaccine vial from a previous session used in the next routine immunization session? <i>Yes</i>	155 (76.7)
14.	When will you say that VVM has crossed discard point? <i>Inner circle color matches or darker than the outer circle</i>	62 (32.7)
15.	How do you return the unused / partially used Pentavalent DPT/TT/Hep B and OPV to cold chain point? <i>R You label and put them separately in zipper bag/</i>	200 (99.0)
16.	Can DPT and Hepatitis B be kept in ice pack while conducting a session? <i>No</i>	7 (3.5)
17.	Can a vaccine once taken out of the ILR taken out be returned if VVM if it is in useable stage or within expiry date <i>Yes</i>	52 (25.7)
18.	Where do you place a vaccine carrier/ vaccine in the field It should always be placed under shade or under a tree never left unattended under the sun <i>No</i>	175 (86.6)
19.	Can a vaccine once taken out of the ILR taken out be returned if VVM if it is in useable stage or within expiry date <i>Yes</i>	200 (99.0)
20.	How many times a partially reuse of partially used vials of DPT/TT/Pentavalent be used. <i>There is no limit within 28 days period</i>	43 (21.7)

21.	How do you condition a icepack <i>Take a completely frozen icepack and keep it in room temperature</i>	200 (99.0)
22.	How do you understand when an icepack is adequately conditioned (R) <i>Both hearing the tinkling noise and observing water droplets</i>	137 (68.5)
23.	.Is conditioning of the ice pack needed for routine immunization? <i>Yes</i>	200 (99.0)
24.	Is conditioning of ice pack needed for pulse polio immunization? <i>Yes</i>	156 (78.4)
25.	How do you store a open vial for the next session (<i>vaccines kept in zipper bag/separate card board box</i>)	188 (83.1)
26.	. For which vaccine ‘Shake Test’ is used? - (R) <i>DPT/TT/Hep B</i>	185 (81.6)
27.	. How to carry polio vaccines vials during house to house activity during pulse polio (R) <i>Always inside the vaccine carrier</i>	75 (73.1)
28.	Should you keep the vial inside the vaccine carrier after vaccinating every child while working in a pulse polio booth? (R) <i>Yes</i>	154 (76.2)
29.	Can ice pack be exchanged with loose ice during routine immunization? <i>No</i>	23 (11.4)
30.	Can Loose ice and ice pack be used together in pulse polio activity? <i>No</i>	23 (11.4)
31.	. Discard vaccine vial in case any one of the following conditions is met: <i>1 If expiry date has passed.</i> <i>2 VVM reached discard point (for freeze dried vaccine, before reconstitution only) or Vaccine vials without VVM or disfigured VVM.</i> <i>3 No label or partially torn label or writing on label is not legible.</i> <i>4 Any vial thought to be exposed to non-sterile procedure for withdrawal.</i> <i>5. Open vials that have been under water or vials removed from a vaccine carrier that has water.</i> <i>6. If vaccine vial is frozen or contains floccules.</i>	132 (65.3)
32.	Inspect for and discard vaccine vial with visible contamination (i.e. checking for any change in the appearance of vaccine or any floating particles) or breaches of integrity (e.g. cracks, leaks) <i>Yes</i>	190 (94.1)
33.	Note the manufacturer, batch and expiry date of the vaccine and diluent in the tally sheet. <i>Yes</i>	199 (98.5)
34.	Always pierce the septum with a sterile needle for drawing vaccine from the multi-dose vials used. Except oral polio vaccine which is given 2 drops orally, cap needs to be closed after each use. <i>Yes</i>	200 (99.0)
35.	Will you interrupt booth/house-to-house visit if all the ice pack supplied to you are melted during pulse polio campaign during pulse polio? <i>Yes</i>	166 (88.2)

Table 2: impact of training on knowledge indicators, correct practices for routine vaccination practices, critical knowledge for routine vaccination practices

Have you received training in the last 2 years				
Characteristics		Yes N=103	No N=99	P value
Knowledge indicators on cold chain points	Where can you store the vaccines used in UIP: any domestic refrigerator or specified cold chain point			
	Correct answer N=174 (86.1)	98 (56.3)	76 (43.7))	.000
	Incorrect answer N=28 (13.9)	5 (17.9)	23 (82.1))	
	Correctly enumerate all the cold chain equipment			
	Correct answer N =181(89.6)	98 (54.1)	83 (45.9)	.008
	Incorrect answer N= 21	5 (23.8)	16 (76.2)	
	What are the vaccines not to be frozen			
	Correct answer N=168 (83.2)	97 (57.7)	71 (42.3)	.000
	Incorrect answer N=34 (16.8)	6 (17.6)	28 (82.4)	
	Which is the most freeze sensitive vaccine			
	Correct answer N = 104 (51.5)	89 (86.4)	15 (15.2)	.000
	Incorrect answer N=98 (48.5)	14 (84.8)	84 (84.8)	
	What are the diluents for the reconstituting vaccine like BCG/Measles/Japanese Encephalitis			
	Correct answer N= 159 (78.7)	88 (55.3)	71 (44.7)	.017
Incorrect answer N= 43 (21.3)	15 (34.9)	28 (65.1)		
Correct practices for routine vaccine practices	How diluents should be carried from cold chain point to outreach site			
	Correct answer N =151 (74.8)	98 (64.9)	53 (35.1)	.000
	Incorrect answer N =51 (25.2)	5 (9.8)	46 (90.2)	
	Do you check Vaccine Vial Monitor and date of expiry before reconstitution			
	Correct answer N= 126 (62.4)	101 (80.2)	25 (19.8)	.000
	Incorrect answer N= 76 (37.6)	2(2.8)	74 (97.6)	
Critical questions on routine vaccine practices	Can partially use polio vaccine vial from a previous session used in the next routine immunization session			
	Correct answer N=155 (76.7)	92 (59.4)	63 (40.6)	.000
	Incorrect answer N= 49 (23.3)	11 (23.4)	36 (76.6)	
	What is a unusable VVM discard point			
	Correct Answer N= 62 (31.2)	24 (38.7)	38 (61.3)	.022
	Incorrect answer N= 137 (68.8)	77 (56.2)	60 (43.8)	
	Can a vaccine once taken out of the ILR taken out be returned if VVM if it is in useable stage or within expiry date			
	Correct answer N = 52 (25.7)	33 (63.5)	19 (36.5)	.037
	Incorrect answer N= 150 (74.3)	70 (46.7)	80 (53.3)	
	How do you assess conditioning of ice pack			
Correct answer N= 137 (68.5)	80 (58.4)	57 (41.6)	.002	
Incorrect answer N= 65	23 (35.4)	43 (64.6)		

	(31.5)			
	How do you carry polio vaccine during pulse polio immunization drive			
	Correct answer N= 75 (37.1)	30 (40.0)	45 (60.0)	.016
	Incorrect answer N = 157 (63.9)	73 (57.6)	54 (42.5)	
	Do you Interrupt a pulse polio session if ice pack melts			
	Correct answer N= 166 (82.2)	97(58.4)	69 (41.6)	.000
	Incorrect answer N=36 (17.8)	6 (16.7)	30 (83.3)	
Critical questions on vaccine management	Where do you keep polio vaccine during routine immunization session sites			
	Correct answer N= 154 (76.2)	91(59.1)	63 (41.9)	.000
	Incorrect answer N=48 (23.8)	12 (25.0)	36 (75.0)	
	Incorrect answer N= 12 (5.9)	5 (41.7)	7 (58.3)	

Table 3: Is your work supervised by medical officers

	Is you work supervised by medical officer			
		Yes N=169	No N= 43	P value
Knowledge on cold chain points	Correctly enumerate all the cold chain equipment			
	Correct answer N =181(89.6)	158 (87.3)	23 (12.7)	.000
	Incorrect answer N= 21(11.4)	11(52.4)	10 (47.6)	
	What are the vaccines not to be frozen			
	Correct answer N=168 (83.2)	143 (85.1)	25 (14.9)	.000
	Incorrect answer N=34 (16.8)	26 (76.5)	8 (23.5)	
	Which is the most freeze sensitive vaccine			
	Correct answer N=104 (51.5)	93 (89.4)	11 (11.6)	.023
	Incorrect answer N=98 (48.5)	76 (77.6)	22 (22.4)	
	Which of the vaccine require diluents			
	Correct answer N= 198 (98.0)	168 (84.8)	30 (15.2)	.001
	Incorrect answer N=4 (2.0)	1 (25.0)	3 (75.0)	
	What are the diluents for the reconstitute vaccine BCG/Measles/Japanese Encephalitis			
	Correct answer N= 159 (78.7)	144 (90.6)	15 (9.4)	.000
Incorrect answer N= 43 (21.3)	25 (58.1)	18 (41.9)		
Correct practices for vaccine management	How diluents should be carried from cold chain point to outreach site			
	Correct answer N =151 (74.8)	136 (90.1)	15 (9.9)	.000
	Incorrect answer N =51 (25.2)	33 (64.7)	18 (35.3)	
	Do you check Vaccine Vial Monitor and date of expiry before reconstitution			
	Correct answer N= 126 (62.4)	113 (89.7)	13 (10.3)	.003
	Incorrect answer N= 76 (37.6)	56 (73.7)	20 (26.3)	
	How long can you use the reconstituted BCG/measles/JE vaccine			
	Correct answer N=200 (99.0)	169 (84.5)	31 (14.5)	.036
	Incorrect answer N=2 (1.0)	0 (0.0)	2 (100.0)	
	Can partially use polio vaccine vial from a previous session used in the next routine immunization session			
	Correct answer N=155 (76.7)	136 (87.7)	19 (12.3)	.004
	Incorrect answer N= 49 (23.3)	33 (70.2)	14 (29.8)	
	What is a unusable VVM discard point			
	Correct Answer N= 62 (31.2)	43 (69.4)	13 (31.6)	.000
Incorrect answer N= 137 (68.8)	123 (89.8)	14 (10.2)		
How do you return the unused / partially used Pentavalent				

	DPT/TT/Hep B and OPV to cold chain point?			
	Correct answer N =200 (99.0)	169 (84.5)	31 (14.5)	.024
	Incorrect answer N=2 (1.0)	0 (0.0)	2 (100.0)	
	Can a vaccine once taken out of the ILR taken out be returned if VVM if it is in useable stage or within expiry date			
	Correct answer N = 52 (25.7)	49 (94.2)	3 (5.8)	.017
	Incorrect answer N= 150 (74.3)	120 (80.0)	30 (20.0)	
	How many times a partially reuse of partially used vials of DPT/TT/Pentavalent be used			
	Correct answer N= 43 (21.7)	31 (58.1)	12 (41.9)	.025
	Incorrect answer N=159 (78.3)	138 (68.3)	21(31.9)	
	How do you condition a ice pack			
	Correct answer N= 200 (99.0)	169 (84.5)	31 (14.5)	.036
	Incorrect answer N=1 (1.0)	0 (0.0)	2 (100.0)	
	How do you assess conditioning of ice pack			
	Correct answer N= 137 (68.5)	125 (91.2)	12 (8.8)	.000
	Incorrect answer N= 65 (31.5)	44 (67.7)	21 (32.3)	
	Is conditioning needed for Routine Immunization			
	Correct answer N= 200 (99.0)	169 (84.5)	31 (14.5)	.026
	Incorrect answer 1 (1.0)	0 (0.0)	2 (100.0)	
	Is conditioning needed for pulse polio immunization			
	correct answer N= 156 (78.4)	137 (87.8)	19 (12.2)	.001
	Incorrect answer N= 46 (21.6)	29 (64.8)	14 (35.2)	
	How do you store a open vial for the next session (vaccines are stored in a zipper bag/separate bag)			
	Correct answer N= 188 (83.1)	158 (88.1)	30 (11.9)	.706
Incorrect answer N=14 (16.9)	11 (78.6)	3 (21.4)		
How do you carry polio vaccine during pulse polio immunization drive				
Correct answer N= 75 (37.1)	66 (88.0)	9 (12.0)	.200	
Incorrect answer N= 157(63.9)	103 (81.1)	24 (18.9)		
Critical questions on routine vaccine practices	Where do you keep polio vaccine during routine immunization session sites			
	Correct answer N= 154 (76.2)	140 (90.9)	14 (9.1)	.000
	Incorrect answer N=48 (23.8)	29 (60.4)	19 (39.6)	
	Can Ice pack be exchanged with loose ice during pulse polio immunization drive			
	Correct answerN= 23 (11.4)	12 (52.2)	11 (47.8)	.000
	Incorrect answer N=179 (88.6)	157 (87.7)	22 (12.3)	
	Can Ice pack be exchanged with loose ice during routine immunization drive			
	Conditions of discarding vials in conditions			
Correct answer N= 132 (65.3)	122 (92.4)	10 (7.6)	.000	
Incorrect answer N= 70 (34.7)	47 (67.1)	23 (32.9)		

Discussion

Cold chain knowledge of urban vaccinators is a key for maintaining safety and efficacy of the UIP and mass vaccination campaign (NID/SNID/new vaccine like JE/MR campaign)³.

In our study 86.1% respondent could correctly say that vaccines need to be stored at designated cold chain points and 89.6 % respondent could correctly enumerate all the cold chain equipment's. The need to check vaccine vials monitors and date of expiry before reconstitution

and use was stated by 62.4 % respondent. This figure is higher among the urban vaccinator in our study as compared to study done by Naik et al. In their study the corresponding figures were 75%, 90% and 60% respectively⁹. In another study done in cold chain points of Chirang District, Assam general knowledge regarding correctly identifying the cold chain equipment were 58.3% and enumerating all the cold chain equipment was 66.7%¹⁰.

Knowledge about the importance of VVM among the vaccinator was more during pulse polio immunization in Chandigarh¹¹. It was about 94% as observed by Thakur et al¹². Mallik et al studied cold chain knowledge of urban vaccinators before and after cold chain training using Government of India standard guidelines found significant improvement in knowledge score¹³.

In our study 183 out of 202 (90.6%) respondent could correctly tell the procedure and purpose of shake test which is significantly higher than the study finding of Naik et al in Surat city (less than 2/3 of the respondent was able to correctly regarding the shake test⁹). This was also observed by Gupta et al in rural Community Health Centers in Damoh district, Madhya Pradesh where it was 66.6%¹⁴.

WHO training manual for Middle Level Manager defines Supportive Supervision “as a process of helping staff to improve their own work performance continuously. It is carried out in a respectful and non-authoritarian way with a focus on using supervisory visits as an opportunity to improve knowledge and skills of health staff¹⁵.”

In our study we have found that supportive supervision by medical officers can increase the knowledge scores among the service providers considerably and for most of the parameters. In fact the importance of supportive supervision has been highlighted by Djbuti et al in a large scale study done in Georgia study involving 15 intervention districts and 15 control districts. The supportive supervision helped to improve district level service delivery outcome(measured by increased DPT3 coverage and decreased vaccine

wastage). The authors of this study concludes that supportive supervision within the ambit of national immunization programs should be carried out particularly by system supervisors. They concluded that supportive supervision generally have a positive outcomes¹⁶. A study done in Odisha by Som et. al. had shown similar results¹⁷. In this study there was observed improvement in ILR management practices (scoring in supportive supervision checklist) .Babu et al. in a study done in Bellary, Karnataka has shown supportive supervision helped to strengthen the cold chain of the district. and improve immunisation coverage¹⁸.

Conclusion

A key component of Universal Immunization Program is maintaining the cold chain from manufacturing point to the recipient. And vaccinators work are key component of the system. Our study indicates that there is a critical knowledge gap in all aspect of vaccine and cold chain management system (cold chain equipment, storage practices, ice pack conditioning practices, VVM knowledge, Open Vial Policy knowledge etc.), This knowledge gap can be considerable bridged by training of vaccinators & regular refresher trainings. Supervision by medical officers can also be an important factor in improving the knowledge gap. For all the overall improvement urban medical officer themselves trained and updated to improve quality training and supervision practices. Strengthening of urban health system should address these training needs of various categories of health workers.

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