Research Article

Study of cold chain management system at Urban Primary Health Centers (UPHCs) of Vadodara city in Western India

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Abstract

Background: Urban Primary Health Centers (UPHCs) have been the backbone for delivering immunization services in urban areas in India. It is thereby important that cold chain system is maintained at these UPHCs.

Objective: To assess the cold chain management system at all UPHCs of Vadodara city in western India.

Materials and Methods: A cross-sectional observational study was conducted at all 19 UPHCs of Vadodara city run by Vadodara Municipal Corporation. All 19 UPHCs of the entire Vadodara city were assessed for cold chain management system from April 2013 to May 2014. Data collection was done as a part of supportive supervision of Reproductive Maternal Newborn Child Health plus Adolescents (RMNCH+A) program by using structured checklist. Data were entered in Microsoft Office Excel and analyzed using Epi Info software. Descriptive statistics including actual numbers and proportions of the study variables are mentioned.

Result: Cold chain equipments including ice-lined refrigerator (ILR) and deep freezer (DF) were functional at all 19 UPHCs. No other vaccines/medicines were stored in ILR or DF in any center. Ice packs were correctly placed at five centers only. Frozen vaccine vial was observed at one site.

Conclusion: Cold chain was maintained quite satisfactorily at all the UPHCs of the Vadodara city. However, some logistics and training of cold chain handler needs to be focused as highlighted in the study.

KEY WORDS: Cold chain, assessment, UPHC, Vadodara, India

Introduction

Vaccines are considered to be one of the most effective weapons in reducing under-five mortality rates.[1] Immunization is one of the most important and effective disease prevention strategies to help us in achieving Millenium Development Goals 4 (reduce under-five mortality).[2] Immunization against a disease is achieved only if a potent vaccine is administered. Cold chain is defined as the system of storage and transportation of vaccine at the recommended temperature from the point of manufacture to the point of use.[3] If this cold chain is maintained, then only the vaccine remains potent. Moreover, if vaccine potency is once lost, it cannot be restored.[4] The cold chain remains a greatly vulnerable point for national immunization program. In order to achieve the complete advantages of immunization, potent vaccines should reach the beneficiaries for which cold chain maintenance is crucial.[5] Concurrent efforts have been made to strengthen cold chain system by proper supplies of cold chain equipments at all levels in India. Many studies have reported that cold chain is not maintained properly in India.[6–8] Urban Primary Health Centers (UPHCs) run by various Municipal Corporations have been the backbone for delivering immunization services in urban areas in India. It is thereby important that cold chain system is maintained at these UPHCs. So, the current study was carried out with an objective to assess the cold chain management system at all UPHCs of Vadodara city in western India.

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Materials and Methods

This was an observational cross-sectional study carried out in Vadodara city which is the third most populous city in Gujarat and situated in the central part of the state. Vadodara city has been divided into four zones by Vadodara Municipal Corporation to provide health services in slum and semi-slum areas of the city. There were five UPHCs in each of the North, South, and West zones, while East zone had four UPHCs. So, there were a total of 19 UPHCs in the entire city in the year 2013–2014 as shown in the map of Vadodara city in Figure 1. Each of these centers caters to the varying number of population in their assigned geographic area. The major beneficiaries of the services provided by these centers are the people residing in slum and semi-slum areas within jurisdiction of respective UPHC. These UPHCs provide all the basic health services including outpatient services, antenatal care, child health services, adolescent health services, postnatal care, and all other services pertaining to various national health programs. These UPHCs have been the crucial cold chain points and the main center for storage of vaccines. Then the vaccines were carried in vaccine carrier by auxillary nurse midwife/female health worker to their respective outreach session sites at Anganwadis to provide immunization services on urban health and nutrition day.

Thus, we had visited a total of 19 UPHCs in this study to assess their cold chain system from April 2013 to May 2014. The visits were conducted as a part of regional monitoring team work for monitoring of the Reproductive Maternal Newborn Child Health plus Adolescents (RMNCH+A) supportive supervision program. Data collection was done by single observer to avoid any interobserver bias. The checklist was based on the facility level assessment for cold chain as part of Mamta Abhiyan guidelines prepared by the Department of Health and Family welfare, Government of Gujarat.[9] It was ensured that the data collection does not interfere with the ongoing services. The staff members were briefed about the nature and purpose of the exercise beforehand. Permission was taken from the higher authorities before visiting centers and explained about the purpose of the visit.

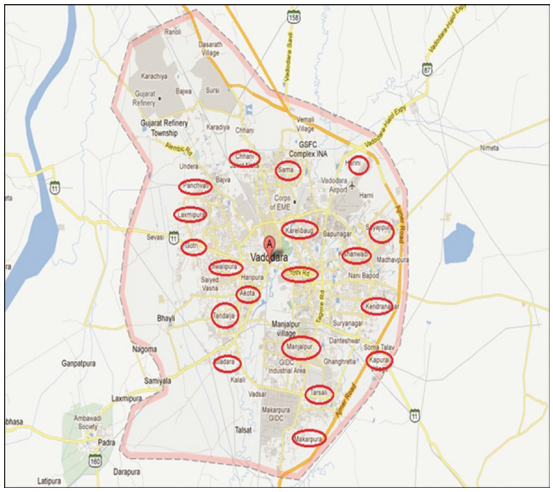

Figure 1: Distribution of Urban Primary Health Centers (UPHCs) in Vadodara city.

Data were entered in Microsoft Office Excel and analyzed using Epi Info software, version 3.5.1. This was a descriptive study, so we have reported actual numbers and proportions of the study variables.

Result

As shown in Figure 1, this study was done at all 19 UPHCs covering the entire city of Vadodara which includes all four zones. Ice-lined refrigerator (ILR) and deep freezer (DF) were functional at all 19 UPHCs as shown in Table 1. Working

Table 1: Cold chain maintenance (n = 19)

Cold chain components	*N*	%
ILR in working condition	19	100.0
Working thermometer in ILR	18	94.7
ILR connected to power through stabilizer	14	73.6
ILR kept on wooden stand	11	57.8
DF in working condition	19	100.0
Working thermometer in DF	19	100.0
DF connected to power through stabilizer	14	73.6
DF kept on wooden stand	12	63.1
Temperature inside ILR between 2 and 8°C	18	94.7
Temperature inside DF between –15 and –25°C	19	100.0
Frozen vaccine vial present inside ILR	1	5.2
Expired vaccine vial present inside ILR	0	0
Icepacks correctly placed in DF	5	26.3
Temperature log books for ILR/DFmaintained with twice record of temperature	18	94.7
Any other medicines/vaccine other than UIP vaccine stored in ILR	0	0

thermometer was found inside ILR at 18 centers and inside DF at all 19 centers. ILR and DF were connected to separate power stabilizers at 14 centers. ILR and DF were kept on wooden stand at 11 centers only. Appropriate temperature inside ILR was maintained at 18 centers. No other vaccines/medicines were stored in ILR or DF in any center. Ice packs were correctly placed in crisscross pattern at five centers only. Frozen vaccine vial was obtained at one site. Temperature log books were maintained and updated with twice daily record of temperature at 18 centers.

Discussion

Presence of ILR and DF is the basic requirement in the UPHC for the cold chain maintenance. Although domestic refrigerator can maintain temperature at +2 to +8°C, they are not recommended for use in universal immunization program since their holding time is 4 h only.[3] In our study, ILR and DFs were present and functional at all 19 (100%) UPHCs. Similar finding was also observed by Krishnappa et al.[10] in Karnataka and by Goel et al.[6] in Chandigarh. There should be a separate voltage stabilizer attached each to ILR and DF so as to monitor the range of fluctuations in the main voltage of 90–280 V and maintain voltage in a required range of 220–10 V. Stabilizer protects the cold chain equipment against voltage fluctuations and is an essential prerequisite.[3] In this study, a separate voltage stabilizer was attached each to DF and ILR in only 14 (73.6%) of the health centers. Several studies have reported shortage of voltage stabilizers.[10,11] Medical officer of the UPHCs should ensure adequate supply of voltage stabilizer and maintenance of the same at regular intervals.

If vaccines are not stored at an appropriate recommended temperature of +2 to +8°C in ILR, then it can lose its potency and become ineffective when given to the beneficiaries. As per the guidelines, temperature should also be maintained from −15 to −25°C inside the DFs. So, the temperature inside ILR and DF has to be measured and recorded twice in a day.[3] In our study, in almost all the centers, ILR and DF maintained the temperature in the recommended range, and temperature recording was also done twice in a day. Whereas, in a study by Krishnappa et al.,[10] nearly one fourth of the cold chain equipments did not maintain temperature in the recommended range. But, the record of power failure or defrosting was not maintained properly at any of the center visited in this study. This is quite important because, as per the guidelines, if there has been deposition of more than 5 mm thick ice in the side/bottom of freezer, there is a need to defrost it. This clearly indicates that there is a need to improve the practice of defrosting by cold chain handlers/pharmacists which has to be monitored on regular basis by the Medical officer of the UPHC.

DFs should be used to prepare and store ice packs only, and no other vaccines should be stored in it at PHC level. Ice packs should be stacked on the floor of the DF horizontally (not flat) on its edge by keeping 1–2 mm space from each other for air circulation, in a crisscross manner[3] Ice packs were placed correctly at 5 (26.3%) centers only. Similarly, in a study by Krishnappa et al.,[10] only 23% of the DF showed the correct crisscross placement of ice packs. This suggests that there is need to provide appropriate hands on skill-based training to the cold chain handler staff for proper arrangement of ice packs. Formal training has already been conducted for them, but if we are not demonstrating them correct crisscross arrangement of ice packs practically, it seems very difficult for them to implement such practice.

As per the guidelines, OPV and measles vaccines should be kept at bottom of the basket while BCG, DPT, pentavalent, and TT vaccines should be kept in upper part of the baskets in ILR. All T-series vaccines are freeze sensitive; hence, they should never be kept at the bottom of ILR. Diluents need to be kept in ILR for at least 24 h before vaccination because vaccine and diluents should be of similar temperature during reconstitution; otherwise, again vaccine may lose its potency if the temperature of the diluent is above 8°C.[3] Such proper arrangement of vaccines was observed at almost all centers visited in this study which was a very good practice observed. No other drug/vaccine was stored in the ILRs at any center. Contrary to this, Krishnappa et al.[10] and Sachdeva and Datta[11] observed correct practice of vaccine storage in ILR at around 60% centers only. Vaccinators need to understand the importance of this arrangement of vaccines in ILR, as if vaccine becomes impotent, it would give a false sense of security against diseases, while a child may contract the disease later on despite the vaccination. Because in such case, although the child is vaccinated but he is not immunized. Cold chain handlers and health supervisors of the centers should also take this responsibility to explain this arrangement to the other staff also. If any other drug or some agent is stored in ILR, and if it has been injected by mistake by the health worker to the child, then there are chances of serious adverse events following immunization (AEFI). So, proper labeling of all vaccine vials is very important to prevent such AEFI.

Conclusion

Cold chain was maintained quite satisfactorily at all the UPHCs of the Vadodara city. Logistics such as power stabilizer for ILR and DF, wooden stand, and working thermometer in ILR/DF needs to be procured at some UPHCs for the proper cold chain maintenance. Training of cold chain handler is required for proper arrangement of ice packs in DF and to strengthen the record keeping of power failure and defrosting of the DF at regular intervals.

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