Introduction

The Infant Mortality Rate (IMR) of Chhattisgarh state was 79 per 1000 live births in 2000, has dropped to 54 as per National Family Health Survey (NFHS-4 (2015-16)) report.[1] At the present rate of decline, it is unlikely that the State will achieve the required target of reducing IMR to 28 per 1000 live births by 2019 as per National Health Policy 2017. Immunization is one of the most important and effective interventions among various interventions for reducing infant mortality that prevents death due to Vaccine Preventable Diseases (VPDs). Immunization coverage in Chhattisgarh has never been abysmal but the improvement is rather insignificant over the years. Fully Immunized Children (FIC) coverage rate as per NFHS-3 (2005-06) - 48.7%, DLHS-3 (2007-08) - 59.3% and further improves to 76.4% NFHS-4 (2015-16).[1,2] As per Government of India directives, the year 2012 was declared as the Year of Intensification of Routine Immunization and ‘Immunization Weeks’ were organized in selected low coverage areas throughout Chhattisgarh State and continued in 2013 too.[3] It has been observed that besides these measures, some more strategic interventions are essential to

Abstract

Background: Cold chain and vaccine logistic is a key driver of immunization program. It has been observed that besides intensification of routine immunization, more strategic interventions are essential to strengthen the different aspects of immunization services like cold–chain management and monitoring/supportive supervision. The present study was considered as a part of ongoing UNICEF funded Project on Supportive Supervision of Routine Immunization in Rajnandgaon and Bilaspur districts undertaken by the Department of Community Medicine, Government Medical College, and Rajnandgaon with the objectives to assess the background information about cold chain points (CCPs), to observe the vaccine storage and handling practices, and to study the knowledge and practices of VCCH. Materials and Methods: A cross-sectional facility based study was conducted from August 2017 to February 2018. Among 60 CCPs, 48 from Rajnandgaon and 12 from Bilaspur district were considered for analysis. Structured questionnaires as a part of standard tool prescribed by Government of India was used for the collection of required data. Result: In 92% CCPs, the temperature of cold chain equipment (CCE) was recorded twice a day. In 93% CCPs, vaccines were correctly stored in ILR. In 75% CCPs, icepacks were correctly stored in DF, 90% vaccine cold chain handler (VCCH) could correctly demonstrate temperature reading from thermometer, 91% could tell about stages of VVM correctly. Conclusion: Most CCPs in both districts are doing good enough, and there is a scope of improvement in all the parameters by means of ongoing project of Strengthening of Supportive Supervision of Routine Immunization in both districts. It was evident that Rajnandgaon district scored more than Bilaspur in some parameters related to vaccine storage and handling practices.

Keywords: Cold chain equipment, cold chain points, deep freezer, ice lined refrigerator, vaccine cold chain handler

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strengthen the different aspects of immunization services like micro-planning, cold-chain & logistics management, and monitoring/supportive supervision and community mobilization. Cold chain and vaccine logistic is a key driver of immunization program. Success of national immunization program is highly dependent on supply chain system for delivery of vaccines and CCE with a functional system that meets six rights of supply chain—the right vaccine in the right quantity at right place at the right time in the right condition and at right cost. The cold chain system is necessary because vaccine may be ineffective due to failure of cold chain system. The most prominent constraints identified were as follows: coverage not uniform, deficient micro-plan, poor implementation of program, poor monitoring and supervision, high dropout rate, over reporting, injection safety, inadequate AEFI monitoring, lack of re-orientation of staff, poor stock management, inadequate cold chain replacement plan, vacancy of staff at field level, inadequate surveillance of VPDs, vaccine logistic issues, and poor maintenance of equipments.

The study findings concluded that cold chain and logistic management components were not up to the mark in study area. Supervision of such system was also compromised due to various manpower resource issues. The issues observed in the form of various components of cold chain system range from infrastructure, availability of vaccine and Cold Chain handlers’ awareness and practice to tackle issues. A study at all the Urban PHCs of the Vadodara city concluded that cold chain was maintained quite satisfactorily but logistics such as power stabilizer for ILR and DF, wooden stand and working thermometer in ILR/DF needs to be procured at some UPCs for the proper Cold Chain maintenance. There is a need to improve the methods of ILR and DF maintenance in terms of installation, temperature, regular defrosting and record keeping. The correct placement of vaccines in ILR and exclusive use of ILR for storage of vaccine is vital factor for successful immunization program.

Materials and Methods

Study area and study setting

A cross-sectional facility based study was conducted from August 2017 to February 2018 in the Rajnandgaon and Bilaspur districts of Chhattisgarh [Figure 1]. The State Vaccine Store located at Raipur caters to the entire Chhattisgarh State, through Regional and District Vaccine Stores. These DVSs supply vaccines to the cold chain points located at CHCs and PHCs. The CCPs further cater to the session sites in respective Sub-centre and Anganwadi center etc. The State has one State Vaccine Store, three Regional Vaccine Stores, 27 District Vaccine Stores, 523 Cold Chain Points and 14,400 session sites. The cold chain system in Chhattisgarh consists of 1,391 working cold chain equipments which includes 1 walk in freezer, 4 walk in coolers, 678 ice lined refrigerators, 698 deep freezers, 10 solar equipments. The human resource network to manage vaccine logistics in Chhattisgarh consists of 31 vaccine store keepers’ and 523 cold chain handlers. They work under the guidance of the State Immunization Officer, District Immunization Officers and Medical Officers in-Charge of CHC and PHC.

This study was a part of the project of Strengthening Routine Immunization program done by the Department of Community Medicine, Government Medical College, and Rajnandaon. Only PHC, CHC level and CCP were included in the study. In Rajnandgaon district, total 49 CCPs were working, out of these, District Hospital Raajnandgaon CCP was excluded from the study so total 48 CCPs were included in the study. In Bilaspur district, out of total 21 CCP, District Hospital, Bilaspur CCP, CIMS Bilaspur and seven other CCPs were excluded from the study because of time constraint, far distant location and changes in policy. So, total 12 CCPs were included in the study from Bilaspur district. Total 60 CCPs were considered for analysis in the project. Faculty from Medical College and external monitors were involved in data collection as team members. For Rajnandgaon district, one medical college team including two faculty of the rank of Assistant Professor and one external monitor was appointed as a supervisor. For Bilaspur district, one medical college team including two faculty of the same rank were appointed to collect the data. All the supervisors, team leader and project coordinator had undergone training at Raipur headquarters by UNICEF experts to assess cold chain equipment status, practices of cold chain handlers to maintain uniformity of data and to avoid bias. The permission from CMHO, Rajnandgaon and Bilaspur was sought out before the start of the project. Visits were scheduled on the day of immunization session. Structured questionnaires as a part of standard tool prescribed by Govt. of India was used to collect required relevant data. Out of 98 questions in the proforma, those questions with their answers which were of relevance to the study aims and objectives were clubbed together under different titles. Supervisor collected information by observing health-facility environment, listening to VCCH, reviewing the records using a checklist.

Statistical analysis

The relevant data was collected, checked for completeness and correctness, compiled using MS Excel and analyzed using IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp. Statistical tools applied were percentages, proportions, Fisher Exact test. P value of less than 0.05 was considered as statistically significant.

Result

In all the 60 CCPs, background information, vaccine storage and handling practices and practices of cold chain handlers were tabulated separately and compared between CCPs of Rajnandgaon and Bilaspur districts [Tables 1-3].
In the present study, 77% CCP had dedicated thermometers provided for each functional cold chain equipment and in 92% CCP, the temperature of CCE was recorded twice a day. A study conducted by Naik A et al., found that in all 20 Urban Health Centre of Municipal Corporation of Surat, temperature was being recorded twice a day for both deep freezer and ILR.[12] Temperature chart with two entries per day was maintained in 72% Government Urban Dispensaries in Delhi.[13] Ninety eight percent Temperature chart was up to date in all the CCE of Chandigarh in 2006.[14] In the present study,
logbook had record of defrosting, power-cut and PPM in 65% of CCP. A study by Goel NK et al., 80% CCE in Chandigarh reported documentation of breakdown of CCE. In the present study, 95% DF and ILR were found to maintain cabinet temperature. In another study done by Samant S, 73% of DF, ILR and refrigerators maintained the required temperature. In current study, it was found that in 93% CCP, vaccines were correctly stored in ILR. In other study, vaccines were arranged according to temperature sensitivity in ILR in 70% Health centers. Freeze sensitive vaccine were stored correctly in 62.5% health facility only. In the present study, in 75% CCP, icepacks were correctly stored in DF. In a study by Mallik S, it was found that half of CCP icepacks were correctly placed. Only in 35% centers, icepacks were stored in criss-cross manner. In the current study, vaccine vial beyond usable VVM as well as vaccine vial beyond expiry date found only in 5% CCP. A study by Naik et al. found that in 5% UHC/CCP at Surat Municipal Corporation, expired vaccine vial found in ILR and vaccine in the unusable stages of VVM found in 15% CCP. In the current study, in 58% CCP, ILR and DF were placed as per specified guidelines. In a study by Mallik S, it was found that in half of CCP, ILR and DF were placed 10 cm away from the wall and in 25% CCP, ILR and DF were kept on wooden platform.

In 98% CCP, VCCH were trained in latest VCCH module. At 95% CCP, VCCH knew about freeze sensitive and heat sensitive vaccines. But practically, only 90% VCCH could correctly demonstrate temperature reading from thermometer, 91% could tell about stages of VVM correctly, at 93% centre, vaccine correctly stored in ILR. At only 68% centers, VCCH correctly demonstrated Shake test. These findings were indicative of knowledge practice gap which needs to be addressed on priority basis. A study by Naik et al. found that 90% vaccinator knew stages of VVM correctly, 96% vaccinator knew correct arrangement of vaccine in ILR and only 60% vaccinator knew exactly about shake test. In a study done by Thakur JS et al. revealed that out of the 79 staff members interviewed, only 53 (67%) had ever heard of the VVM and were further interviewed. Fifty (94.4%) staff members were aware that VVM is present on vaccine itself and majority (79.2%) told that it is the inner square with outer circle. Only half were aware of its function and 71.7% knew how to read it. In a study done by Rao et al. found that only 22.4% medical officer knew about shake test.

As far as, inter-district comparison is concerned, it was evident from study findings that Rajnandgaon district scored more than Bilaspur district in some of the parameters [Figure 2]. The parameters which showed statistically significant results in vaccine storage and handling practices were correct storage of icepacks in DF, correct storage of vaccine in ILR, frost accumulation in walls of DF, record of PPM, defrosting and power-cut in logbook and twice daily recording of temperature of CCE. Similar findings were observed in the final report of Cold Chain Assessment Chhattisgarh where also Rajnandgaon took over Bilaspur in those parameters like knowledge of cold chain, handling of vaccine, maintenance of equipment, awareness of vaccine temperature norms, temperature recording, interpretation of thermometer temperature and awareness of shake test. Limitation of the study was that only 12 CCPs at Bilaspur district were compared with 48 CCCs at Rajnandgaon district because of less number of CCPs at Bilaspur district, time constraint, distant location and policy changes.
Conclusion

The study findings suggest that most CCPs scored very good in parameters like available updated micro-plan at CCP, adequate space for icepack conditioning and disposal of immunization waste properly indicating that the CCPs were keeping pace with the recent updates and good practices. The temperature maintenance along with record keeping and proper vaccine storage, that happens to be the single most important factor as far as vaccine potency is concerned, was seen to be present in most of the CCPs and we could be confident enough that only potent vaccine is being given to the beneficiaries. The availability of trained and skilled manpower was reflected from the findings such as VCCH trained in latest VCCH module, they knew what to do in case the CCP break down and they also knew about icepack conditioning. The overall impression comes out that most CCPs in both districts are doing good enough, though in some of the parameters the CCPs are lagging behind the expected quality, there is scope of further improvement in all the parameters by means of ongoing project of strengthening of Supportive Supervision of Routine Immunization in both the districts. As far as, inter-district comparison is concerned, it was evident from study findings that Rajnandgaon district scored more than Bilaspur district in some of the parameters related to vaccine storage and handling practices.

The primary care physicians being the first level of contact of health care delivery system with the community and in-charge of the PHCs, have the responsibility of having complete and up to date knowledge and possessing the supervisory and managerial skills to keep track of the activities and execute proper implementation of the national immunization program. The study and its findings exactly focus on the same issues which would prove very helpful for the primary care physicians to effectively manage the immunization program. As the study suggests, primary care physicians should follow the Standard Operating Procedures (SOPs) of cold chain maintenance at their level, which will help to maintain the vaccine effective and potent, reduce wastage rate, as well as Adverse Effects Following Immunization (AEFI).

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Conflicts of interest

There are no conflicts of interest.

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