आरोग्यम् सुखसम्पदा

सत्यमेव जयते

NATIONAL HEALTH MISSION
राष्ट्रीय स्वास्थ्य मिशन

National Cold Chain Assessment
India, September 2014

National Cold Chain and Vaccine Management Resource Centre (NCCVMRC)
National Institute of Health & Family Welfare (NIHFW)

unicef
unite for children

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सचिव
B.P. SHARMA
Secretary
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सत्यमेव जयते

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स्वास्थ्य एवं परिवार कल्याण विभाग
स्वास्थ्य एवं परिवार कल्याण मंत्रालय
Government of India
Ministry of Health and Family Welfare

Dated: 17th March, 2015

MESSAGE

I am happy to know that the National Institute of Health and Family Welfare (NIHFW) is bringing out the National Cold Chain Assessment (NCCA) 2014, which furnishes a comprehensive representative picture of the cold chain situation in the country. The National Cold Chain and Vaccine Management Resource Centre (NCCVMRC) situated at NIHFW, New Delhi provides key technical support for the Immunization Division, Ministry of Health and Family Welfare, Government of India, and has been vital in bringing this effort to fruition. There has been a need for a reference document that provides status of cold chain across the country. The assessment report will serve as a ready reference for national and State level policy makers in planning for an efficient immunization supply chain and enhancing its capacity and readiness to meet future opportunities and challenges in the routine immunization programme.

The NCCA, 2014 brings adequate focus on priority areas in the immunization and cold chain system and sharply identifies issues that need to be addressed. Features like current cold chain requirement under the existing immunization schedule along with future projections of cold chain need, keeping in mind the addition of newer vaccines, have been included in this document.

The NCCA, 2014 is the first step of our efforts towards a rational and data driven immunization supply chain management system, which will eventually lead us to our cherished goal of universal immunization coverage against vaccine preventable diseases.

I heartily congratulate the contributors for their hard work in making the document a reality.

17/3/15

(B.P. Sharma)

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GOVERNMENT OF INDIA
MINISTRY OF HEALTH & FAMILY WELFARE
NIRMAN BHAWAN, NEW DELHI - 110011

Dated: 17th March, 2015

MESSAGE

It is most gratifying to note that the National Cold Chain Assessment, 2014 is seeing the light of the day through the efforts of the National Cold Chain and Vaccine Management Resource Center (NCCVMRC) at the National Institute of Health & Family Welfare, New Delhi. With this document, NIHFW has stepped up its efforts in strengthening the immunization program in the country, extending from training of key program managers to management of the immunization supply chain.

Moving forward with our strong focus on capacity development of vaccinators and medical officers involved in the immunization program, this document brings to the fore issues and challenges faced by our immunization supply chain across the country. It is a key document in terms of strategizing the process of planning and monitoring of the cold chain system in India.

The assessment report sheds light on critical components of the cold chain system, specifically its distribution, current and future requirements, cold chain point information, key infrastructure and manpower indicators, training need and accessory cold chain information like spare parts etc. This should enable all stakeholders to assess the gaps and take corrective measures.

I hope that all our key stakeholders in the immunization program use this document to good effect in their future endeavors and together, we can reach our goal of reducing child mortality through prevention of vaccine preventable diseases.

I congratulate all those who have been a part of this commendable effort.

(C.K. Mishra)

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Ministry of Health & Family Welfare
Nirman Bhawan, New Delhi - 110011

Dated: 26th March, 2015

Message

I am very happy to know that National Cold Chain and Vaccine Management Resource Centre (NCCVMRC) situated at National Institute of Health and Family Welfare (NIHFW), New Delhi is coming out with the National Cold Chain Assessment (NCCA) 2014. This report is the outcome of collaborative effort of NCCVMRC-NIHFW and UNICEF. The periodic assessment of cold chain is critical in immunization and this document will go a long way in shedding light on this critical component of the immunization program.

Apart from the comprehensive nature of the report encompassing all aspects of the cold chain system, it also takes a granular look at the cold chain data in the country, at all levels.

The assessment report will serve as an excellent starting point for cold chain related planning and decision-making and also furnish authentic reference material for all stakeholders in the cold chain and vaccine logistics management. I sincerely wish that it is made an integral component of the immunization program to drive policy and planning which translates into better outcomes for the beneficiaries.

I heartily commend the painstaking efforts of all those associated with the document.

(Dr. Rakesh Kumar)

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Government of India
Ministry of Health & Family Welfare
Nirman Bhawan, New Delhi - 110011

Dated: 26th March, 2015

Foreword

It is praiseworthy to note that India has a comprehensive document detailing out all aspects of the cold chain system at all levels – the National Cold Chain Assessment, 2014. The National Cold Chain & Vaccine Management Resource Center at National Institute of Health and Family Welfare has played crucial role in bringing out the document.

The sheer amount of usable data and information in this report makes it an invaluable planning tool for Immunization Program. The report has not only focused on overall country level summary statistics but also at individual State and district level disaggregated data to highlight differences which are masked in the overall picture.

This report is a ready reckoner for our cold chain status with available references for future requirements in light of additions of newer vaccines to the Immunization Program. It is a must have for policy makers at national and State level to understand the issues and requirements of the cold chain system.

I can visualize a very effective use of this report by all relevant stakeholders in the routine Immunization Program for effective planning, monitoring and evaluating the cold chain system so as to strengthen immunization supply chain management at par with international standards.

(Dr. Mahesh Kumar Aggarwal)

प्रो. जयन्त दास, एमडी
निदेशक
Prof. Jayanta K. Das, MD
Director

आरोग्यम् सुखसम्पदा

राष्ट्रीय स्वास्थ्य एवं परिवार कल्याण संस्थान
National Institute of Health & Family Welfare

Preface

It is my privilege to present the "National Cold Chain Assessment – 2014" which crystallizes our vision of the immunization cold chain in India and enables us to plan far reaching decisions which will have a significant impact on the routine immunization program – ultimately benefitting our mothers and infants.

NCCVMRC, situated at NIHFW, is a national level nodal center for ensuring an effective, efficient and high quality immunization supply chain in the country. It has been envisaged to give technical support to immunization division of the MoHFW in managing and coordinating all cold chain and vaccine management related activities in India. The role of NCCVMRC is highly appreciated in bringing out the document.

Worldwide, the importance of supply chain management for health services delivery is increasingly coming to the fore in terms of enhancing process efficiencies, reducing costs and enhancing impacts of health programs. As we know, immunization is a supply driven program which relies on an efficient and reliable immunization supply chain to meet the demand for immunization. One of the basic components of this supply chain is the cold chain system across the country responsible for ensuring vaccine efficacy and effectiveness from the manufacturer to the point of use.

This document gives us a clear snapshot of the current cold chain status in our country. In addition, it goes an extra mile in projecting our cold chain requirement in the face of newer vaccines which are proposed to be added to the immunization schedule. It also provides us with a roadmap for addressing the most pressing issues faced by us in cold chain system management at all levels. A vital component of this document is the inclusion of supplementary cold chain information like infrastructure, cold chain point status including electricity availability, staffing and training status for cold chain and availability of spare parts.

We intend this document to be used by policy makers at national and State level to plan for their cold chain space requirement in various scenarios and also to ensure that proactive steps are being taken to enhance the availability and quality of cold chain equipment. We also encourage all stakeholders in immunization supply chain management to use this document extensively for planning and evaluating cold chain based initiatives/programs across the country.

I take this opportunity to dedicate this document to the invisible multitude of vaccinators and cold chain handlers who form the backbone of our immunization program along with all district, State and national level stakeholders who have done a remarkable job of ensuring that our immunization program stays on the right course.

(Jayanta K. Das)

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Foreword

In recent years, the partnership between the Government of India (GoI) and UNICEF has materialized in several important stepping stones towards building a stronger supply chain system not only to achieve better immunization coverage, but also to improve the health system as a whole. The Ministry of Health and Family Welfare (MoHFW), with UNICEF's technical assistance, established the National Cold Chain and Vaccine Management Resource Center (NCCVMRC) and the National Cold Chain Training Center, set up the National Cold Chain Management Information System, developed the National Cold Chain Vaccine Logistics Action Plan, facilitated the establishment of a WHO Performance Quality and Safety (PQS) certified cold chain equipment testing lab and the capacity building of manufacturers in India for producing PQS standard Cold Chain Equipment. The MoHFW with UNICEF support has also undertaken several studies: the Effective Vaccine Management assessment, cold chain assessment at several levels of the immunization supply chain, the hybrid solar system and temperature monitoring studies to generate evidence for policy guidance.

The strength of the current report lies in the emphasis on the infrastructure, the processes, the policies, and the practices of the cold chain system beyond the mere analysis of the cold chain equipment. I am confident that the findings of this assessment will be part of the evidence necessary to frame the policies required at the national and State level for a robust immunization supply chain system. These evidence-driven policies will lead to better quality immunization services, and allow for scaling up and/or introduction of new vaccines.

I appreciate the Government's initiative in carrying out these periodic assessments and thank the MoHFW for giving the opportunity to UNICEF to facilitate this endeavour. I am glad that the NCCVMRC took the lead in executing the assessment and prepare the National Cold Chain Assessment Report-2014 to provide a holistic view of the cold chain system in the country.

LOUIS-GEROGES ARSENAULT
REPRESENTATIVE

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Acknowledgements

The National Cold Chain Assessment was possible through the continuous guidance and generous support of the Immunization Division, Ministry of Health & Family Welfare, Government of India.

We are grateful to UNICEF for the high quality technical support and leadership necessary to bring out this report. We further acknowledge the pivotal role played by development partners including WHO, ITSU, UNDP, BMGF and management of all Medical Colleges associated with this assessment.

A special mention needs to be made of all SEPIOs and CCOs of all States who have taken the effort to provide us the required information in a fixed timeline and also facilitated our field visit to the sample sites for assessment.

Our greatest praise is reserved for the Cold Chain Technicians and Cold Chain Handlers associated with the immunization programme who continue to be the backbone of the immunization supply chain. Generous financial support from GAVI-HSS India has been instrumental in carrying out this assessment and producing this document.

List of Abbreviations

ACCO	Assistant Cold Chain Officer
AD	Auto Disable
AEFI	Adverse Event Following Immunization
AHS	Annual Health Survey
AMC	Annual Maintenance Contract
ANM	Auxiliary Nurse Midwife
BCG	Bacillus Calmette Guerin
CBR	Crude Birth Rate
CC	Cold Chain
CCE	Cold Chain Equipment
CCH	Cold Chain Handler
CCO	Cold Chain Officer
CCT	Cold Chain Technician
CCVLM	Cold Chain and Vaccine Logistics Management
CES	Coverage Evaluation Survey
CFC	Chloro Fluoro Carbon (refrigerant)
CHC	Community Health Centre
CIC	Coverage Improvement Plan
CMC	Comprehensive Maintenance Contract
CMYP	Comprehensive Multi-Year Plan
DF	Deep Freezer
DIO	District Immunization Officer
DLHS	District Level Household Survey
DPHN	District Public Health Nurse
DPM	District Programme Manager
DPT	Diphtheria, Pertussis, Tetanus
DT	Diphtheria, Tetanus
DVS	District Vaccine Store
EEFO	Early Expiry First Out
EVSM	Effective Vaccine Store Management
FIC	Fully Immunized Child
FW	Family Welfare
GAVI	Global Alliance for Vaccine and Immunization
GMSD	Government Medical Stores Depot
GoI	Government of India
HSS	Health System Strengthening

ILR	Ice Lined Refrigerator
INR	Indian Rupees
IPV	Inactivated Polio Vaccine
ITSU	Immunization Technical Support Unit
JE	Japanese Encephalitis
KVA	Kilo Volt Ampere
LHV	Lady Health Visitor
MIS	Management Information System
MoHFW	Ministry of Health & Family Welfare
MPW	Multi-Purpose Worker
MYSP	Multi Year Strategic Plan
NCCA	National Cold Chain Assessment
NCCMIS	National Cold Chain Management Information System
NCCTC	National Cold Chain Training Centre
NCCVMRC	National Cold Chain & Vaccine Management Resource Centre
NIHFW	National Institute of Health & Family Welfare
NPSP	National Polio Surveillance Project
NTAGI	National Technical Advisory Group on Immunization
NUVI	New and Under Utilized Vaccine Implementation
OPV	Oral Polio Vaccine
PHC	Primary Health Centre
PIP	Programme Implementation Plan
PPC	Post-Partum Centre
RCH	Reproductive and Child Health
SEPIO	State Expanded Programme of Immunization Officer
SIO	State Immunization Officer
TT	Tetanus Toxoid
UIP	Universal Immunization Programme
UNICEF	United Nations Children's Fund
V&LM	Vaccine and Logistics Management
VHND	Village Health and Nutrition Day
VMAT	Vaccine Management Assessment Tool
VPD	Vaccine Preventable Diseases
VVM	Vaccine Vial Monitor
WHO	World Health Organization
WIC	Walk in Cooler
WIF	Walk in Freezer

Credentials

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Executive Summary

Background

India has one of the largest Universal Immunization Programme (UIP) in the world for immunizing children against vaccine preventable diseases. The country is advancing new strategies to increase immunization coverage and reach more children with quality vaccines. Cold Chain is one of the most important components to ensure that each child receives quality vaccines.

The total budget for Routine Immunization strengthening was 4142 million INR in 2009-10 which increased by 93 per cent to 8000 million INR by 2013-14. Of this, the allocation for Cold Chain system was 12.6 per cent in 2009-10 which increased to 27.3 per cent in 2013-14.

In order to strengthen the Cold Chain system, MoHFW, with UNICEF support, had conducted the first National Cold Chain Assessment in 2008. Based on the NCCA 2008, MoHFW has taken several initiatives to strengthen the Cold Chain system across the country. In comparison to the NCCA-2008, the current report's emphasis has been given on the infrastructure, the processes, the policies, and the practices of the Cold Chain system beyond the mere analysis of Cold Chain equipment.

In light of the future initiatives, for expanding the scope of the Universal Immunization Programme (UIP) with introduction of several Newer and Under-Utilized Vaccines Implementation (NUVI), there was a felt need to conduct the subsequent NCCA in 2014.

Accordingly, the Ministry of Health & Family Welfare, Government of India, in collaboration with NCCVMRC-NIHFW and UNICEF, along with partner agencies, conducted a comprehensive assessment of Cold Chain system in the country involving all five levels of the supply chain system with the following objectives:

Primary Objective

1. To assess the comprehensive adequacy of the existing Cold Chain space in the country.

Secondary Objectives

1. To project future Cold Chain equipment requirements in view of newer vaccine introduction.
2. To update the status of Cold Chain points across the country, including electricity supply.
3. To assess the Cold Chain related staff and training status.
4. To provide information on dry storage space requirements at various levels.
5. To update the status of spare parts availability and requirement.
6. To assess the readiness of States for cold room installation.
7. To recommend solutions to develop improvement plan by States.
8. To validate the NCCMIS data through the NCCA field visit.

Methodology

The methodology was comprised of desk review of secondary data received from all the States and UTs along with NCCMIS data. This was followed by field visits to 10 sample States selected on the basis of geographical distribution, EVM assessment not undertaken within last two years and quality of NCCMIS data score of less than 3. A total of 141 sites were covered by 47 teams consisting of 14 State Vaccine Stores, 33 Regional Vaccine Stores, 47 District Vaccine Stores and 47 Health Facilities.

Current Cold Chain system in India

- India's Immunization programme aims to provide complete immunization to an annual birth cohort of 27 million children against the vaccine preventable diseases which are part of the national immunization schedule. This starts with immunizing during antenatal services to a corresponding number of pregnant women.
- The vaccine delivery network in India operates through 4 GMSDs, 53 SVS (State vaccine Stores), 110 RVS (Regional Vaccine Stores), 666 DVS (District Vaccine Stores) and 25,555 sub-district stores involving 81,87,544 session sites through 2,59,283 HWs.
- Immunization services are provided through 60 per cent outreach and 40 per cent fixed site sessions.
- Out of a total of 71,919 equipment, there were 64,493 operational refrigeration units of ILRs and deep freezers along with 294 WICs and WIFs.
- There were 8 WICs (40 m^3), 19 WICs (32 m^3), 204 small WICs (16.5 m^3), 9 large WIFs (32m^3) and 54 small WIFs (20 m^3, 16.5 m3) in the National UIP stores at GMSDs and in the States in the entire country.
- Out of total 71,625[1] refrigerators and freezers, (ILR and DF) 68,683 (96 per cent) were placed in 21 larger States and rest of 4 per cent equipment was installed in remaining 15 States and Union Territories.
- India has a total of 18,267 CFC units including WIC, WIF, refrigerators and freezers.
- There were total 32,628 large cold boxes with 20 lit of storage capacity and 26,452 small cold boxes of five litres of storage capacity. There are a total of 11,28,413 vaccine carriers in the country.
- One large ILR used primarily at district level is typically sufficient to cover 0.5 million population. The small ILRs are normally sufficient to cover 0.3 million population and are primarily installed at sub district level.
- The additional requirement of Cold Chain equipment for the current UIP including pentavalent vaccine in all States along with introduction of IPV and Rotavirus[2] are given below:

Table 1: Additional requirement of Cold Chain equipment

Type of equipment	Additional equipment required for current UIP	Additional equipment required for current UIP + MR	Additional requirement for current UIP + MR + IPV	Additional equipment required for current UIP + MR + Rotavirus	Additional equipment required for current UIP + MR + Pentavalent + IPV + Rotavirus
WIC 32 m^3	39	39	48	39	48
WIF 32 m^3	23	23	23	38	38
ILR large	2,124	2,124	2,601	2,742	3,506
ILR small	11,641	11,641	11,641	11,641	11,641
DF large	54	54	54	54	54
DF small	10,327	10,327	10,327	10,327	10,327

[1] Total number of ILR and DF

[2] As per NTAGI recommendation, 116e rotavirus vaccine will be introduced in the UIP

- Andhra Pradesh, Tamil Nadu, Uttar Pradesh and Gujarat have the maximum need for all types of freezers/refrigerators.
- There is an additional need of 16,858 large cold boxes and 6,846 small cold boxes.

Accessory Cold Chain information

- Of the 163 SVS, RVS locations, 85 locations have the infrastructure related to civil work available for the installation of new WIC/WIF. None of the sites are ready with the electrical works required for installation of new equipment like WIC/WIF.
- In view of the New and Underutilized Vaccine Implementation (NUVI), the districts having 30 lakh or more population should have one WIC of 40m^3 capacity.
- 26.5 per cent of the SVS/RVS do not have adequate dry storage space.
- India runs its routine immunization programme through 26,384 Cold Chain points across all States and union territories with an average population of 45,868 per Cold Chain point. However, the population per Cold Chain point is higher than 150,000 in Uttar Pradesh, Bihar and Jharkhand.
- Currently, nine States (Haryana, Assam, Arunachal Pradesh, Jammu & Kashmir, Bihar, Uttar Pradesh, Manipur, Mizoram and Jharkhand) have more than 10 per cent of their Cold Chain points which receive less than eight hours of electricity, of which the proportion is more than 20 per cent in Jharkhand, Mizoram, Manipur and Uttar Pradesh.
- There is a significant shortage of spare parts with only four out of the 25 identified fast moving spare parts available in adequate quantities in most of the districts and States.
- The human resource requirement for Cold Chain maintenance is found to be inadequate as per details given below:

Table 2: Human resource status

Designation	Total positions needed	In position	Additional required
Cold Chain Officer	36	22	14
Vaccine and Logistics Manager	36	5	31
Asst. Cold Chain Officer	15	Nil	15
Technical Assistant	36	8	28
Cold Chain Technicians[3]	647*	504	143
Cold Chain Handlers[4]	28,882	39,303	0

*19 districts of WB have been excluded as the State has CMC/AMC for maintaining Cold Chain system

- On an average, each Cold Chain technician manages 129 Cold Chain equipment.
- Only 22 per cent of the Cold Chain handlers have received the standard two day Cold Chain handlers training in the last two years.

Key findings of NCCA 2014

Equipment and performance

- The proportion of the CFC equipment accounts for 25 per cent of the total equipment. As per the guidelines on CFC equipment, this equipment should not be repaired and replaced with non-CFC equipment when deemed irreparable (i.e. internal leakage) as per the guidelines. This supports our aspiration for India to be CFC free.
- About 10 per cent of the equipment in the State and regional stores were CFC based while in DVS, this was about five per cent.
- Three out of four sites with solar equipment had average electricity supply of more than eight hours per day and one site in Uttar Pradesh did not use the equipment for storing vaccines. None of the sites prepared ice packs in the solar equipment.
- The overall sickness rate of ILRs is higher than DFs.

[3] Assuming one Cold Chain technician per district India should have 666 CCTs equal to number of districts

[4] There is no designated post of Cold Chain handler currently. Whoever looks after the Cold Chain point and equipment is termed as a Cold Chain handler

- The sickness rate of equipment more than 10 years old is higher than newer equipment.
- The sickness rate for ILRs more than 10 years old was 28 per cent in the sampled States while newer equipment had a sickness rate of 23 per cent.
- The sickness rate for DFs more than 10 years old was 16 per cent while newer equipment had a sickness rate of 14 per cent in the sampled States.
- The maximum sickness rates for newer ILRs (average age of 4.7 years) was seen in West Bengal, Uttar Pradesh and Bihar while for ILRs more than 10 years old, it was Maharashtra, Bihar and Gujarat.
- The maximum sickness rates for newer DFs (average age of 5.2 years) was observed in Uttar Pradesh and Bihar while the same was observed in Uttarakhand and Gujarat for DFs more than 10 years old.

Human resource and capacity building

- In the UIP guidelines, there is a requirement for a Cold Chain officer in every State and currently there are 14 States without Cold Chain officer. In many States, either there is no sanctioned post or the post is vacant. This presents a significant risk to the leadership and management of Cold Chain across the number of States.
- Under the NHM, there is a provision for deployment of vaccine and logistics manager for each State. Currently, 10 States have taken initiative to propose and appoint a VLM through the NHM PIP. VLMs provide a good opportunity to enhance the quality of vaccine and logistics management.
- Under UIP, there should be one CCT per district. Currently there is 143 number of vacancies (excluding West Bengal as the State adopted the AMC/CMC model). The number of equipment that one CCT is responsible for, varies from eight to 315 with an average of one CCT per 129 equipment.
- Out of the 40,000 Cold Chain handlers only 16,000 have been trained in the last two years. To comply with the guidelines, the remaining VCCH should be trained and should receive training every two years.

Data & NCCMIS findings

- Among the sample sites, Arunachal Pradesh and Uttarakhand have less than one-thirds of their immunization session sites within one hour distance from the supplying Cold Chain point. Similarly, only 3/5ths of the session sites in Bihar and Uttar Pradesh had access to supplying Cold Chain points within one hour distance.
- The overall accuracy between NCCMIS data with selected data collected through NCCA was 93.7 per cent. District store level data had the maximum matching (96.7 per cent) between NCCMIS and NCCA, while, the lowest matching (89.7 per cent) was seen for data from health facilities. The quality of the data among the sample sites shows that we have high quality data and we should continue to strive for data quality to be improved across all States.
- Equipment level data was uniformly high across all levels and the lowest matching between NCCMIS and NCCA was observed for Cold Chain Point population data and refrigerant status records. Population data accuracy at health facilities level was only 65 per cent. This data underpins vaccine demand and supply chain forecasting. The improvement in the quality of this data should be a key focus.

Key Recommendations

Replacement of CFC equipment

India still has over 18,000 CFC Cold Chain equipment which requires immediate replacement within a fixed time frame. The process of condemnation and replacement of freezers/refrigerators older than 10 years requiring frequent repair needs to be expedited.

Procurement of additional CCE

The need for additional CCE (identified in the table no. 1) for the existing UIP requirement must be fulfilled as a priority. In addition, the readiness for new vaccine introduction, the procurement process for additional Cold Chain equipment should be hastened.

Improve performance of CCE

The target sickness rate is less than two per cent. The findings of the NCCA highlight the need for work to be done to improve the quality of equipment maintenance.

In addition, the similarity of sickness rate of old and new equipment may indicate that the newer equipment is less reliable and this needs to be considered while developing specifications for future procurement.

Time to care approach

The proportion of session sites within a distance of more than one hour from a CCP varies from 16 per cent (Maharashtra) to 76 per cent (Arunachal Pradesh). It is recommended that a study be carried out to rationalize and redistribute CCPs so that vaccine potency and safety is ensured. The allocation of CCE should be appropriate in terms of population coverage and geographical location served by the facility. There needs to be adequate, equitable, terrain specific Cold Chain point presence across the country so that inaccessible areas are also catered.

Use of solar power/alternate power supply

Areas with frequent power cuts and lack of electricity need solar equipment or hybrid solar systems. It was found during the assessment that some solar equipment are present in the area with more than eight hours of electricity supply. The States may be advised to re-appropriate the equipment as per the need.

Adequate duration of electricity supply

Our findings show that 1,332 number of sites are without minimum of eight hours electricity supply in a 24 hours[5] period. We recommend the necessary steps to ensure the power availability for the Cold Chain equipment.

Adequate infrastructure availability and preparedness

Vaccine stores need to be developed based on uniform and standard prototypes.

Across India, there is lack of preparedness in terms of physical infrastructure and electricity for the installation of WIC/WIF at State and regional stores. If this preparation is not completed by the time of delivery there will be additional lead time for the installation of equipment and risk of inappropriate storage of that equipment. Upon procurement of the equipment, the specification including dimension should be disseminated to the States for necessary preparatory activities.

To prevent unnecessary delay, WIC/WIF installation checklists developed by NCCTC, Pune should be used during pre-installation to assess the site readiness of all SVS and RVS to accept new equipment in tandem with the procurement process. There should be regular follow-up on the progress towards site readiness and release of equipment should be after the site is ready for installation.

Adequate spare parts availability

There is no sufficient stock of spare and consumables and the process of identifying demand for the same is not defined with States making periodic unsubstantiated requests. The recommendation is that the MoHFW needs to create a process to adequately forecast demand of spares and consumables, procure adequate number of spare parts (all types and brands) and ensure proper storage and distribution with real time visibility of the stock through NCCMIS. The arrangements for service maintenance, spare parts and consumable should be included as part of the equipment procurement and to consider the whole life costs of equipment.

Ensure adequate human resource for CCVLM

Considering the introduction of newer vaccines, increase in cold chain points and increase in cold chain equipment, additional human resource like Vaccine and Logistics Managers, Cold Chain technicians at appropriate level need to be recruited in line with the UIP and NHM guidelines. The present workload of Cold Chain technician varies from eight to 315 CCE per technician with an average of 129

[5] As per the data in NCCMIS

CCE. Guidelines should be developed for an ideal ratio of CCE per CCT.

Capacity building of human resource for CCVLM

All Cold Chain handlers need to be trained every two years. Any new Cold Chain handler joining the system assuming responsibilities needs to be oriented and provided induction training. Such induction trainings can be organized in small batches at district level based on need. Necessary flexibility needs to be given in the NHM PIP to conduct the same.

Strengthening of NCCMIS

NCCMIS data needs to be updated regularly and should be used for planning and monitoring. MoHFW should link State funding for Cold Chain in the PIP based on the NCCMIS report to encourage the use of NCCMIS and improve the data quality.

To improve the performance of National Cold Chain and Logistics Management across India, the scope of NCCMIS should be augmented to include temperature monitoring and vaccine logistics management. An observation is that the system should also monitor supportive supervision and EVM assessments. All bulk vaccine storage sites should have real-time temperature monitoring through NCCMIS.

Development of resource pool

Resource pool of technical persons from among Cold Chain technicians of different States should be created and utilized by the respective States under the guidance of NCCVMRC and NCCTC.

Resource pool of master Cold Chain technicians, who act as a technical leader within their respective States, should be developed by NCCVMRC and NCCTC to ensure that the training and professional development of the Cold Chain technician is monitored and carried out to an adequate standard and to provide technical leadership within the cadre of Cold Chain technicians.

SECTION 1

BACKGROUND

1.1 Introduction

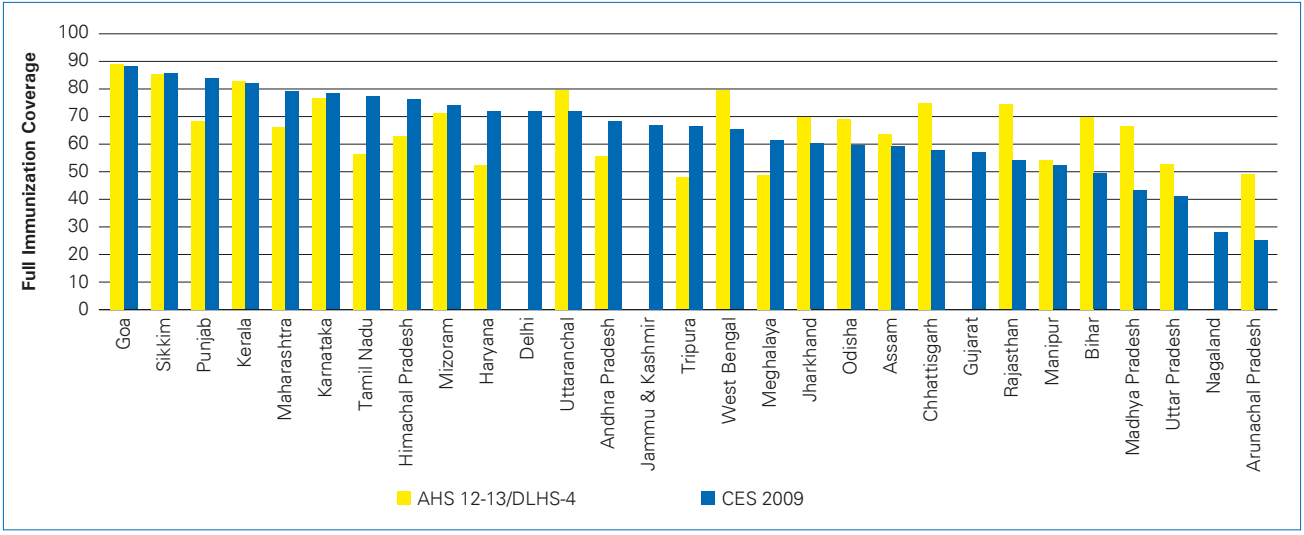
To support an effective routine immunization programme reaching all eligible target beneficiaries (27 million children and 30 million pregnant women), MoHFW has made concerted efforts to increase the number of health facilities offering immunization services many times over the last few years (28882[6] health facilities i.e. PHC/CHCs servicing 1,48,366 sub-Centres).[7] These health facilities *(also known as Cold Chain points when equipped with a set of ice-lined refrigerator and deep freezer)* store vaccines, matching diluents and logistics for outreach sessions, including those organized regularly at the facility, sub-centres/ VHNDs. The primary purpose of all the above facilities and logistics is to ensure full immunization coverage of all target beneficiaries.

The full immunization coverage assumes a greater significance in light of its contribution to overall reduction in infant and under-5 child mortality. Full immunization refers to children having received all the required doses of vaccines given in the first year of life. The FIC rates across the years reveal that only 13 States have increased their FIC during 2012-13 as compared to 2009 (the CES 2009 was carried out in 29 States and the AHS 2013 was conducted in nine States). This points towards the need for effective immunization programme planning including supply chain management for Cold Chain.

The most prominent constraints identified by 14 detailed assessments on Cold Chain vaccine logistics were:

- Coverage not uniform
- Deficient microplan
- Poor implementation of programme
- Poor monitoring and supervision
- High dropout rates
- Declining coverage in some major States
- Over reporting
- Injection safety
- Inadequate AEFI monitoring
- Lack of re-orientation of staff
- Poor stock management

Figure 1: Trends in full immunization coverage across States[8]



[6] All CHCs and PHCs in the country are not Cold Chain point.

[7] http://mohfw.nic.in/WriteReadData/l892s/492794502RHS%202012.pdf

[8] AHS 2012-13 for Uttar Pradesh, Uttarakhand, Madhya Pradesh, Rajasthan, Assam, Odisha, Chhattisgarh, Bihar & Jharkhand.

- Inadequate Cold Chain replacement plan
- Vacancy of the staff at the field level
- Inadequate surveillance of vaccine preventable diseases
- Vaccine logistics issues and poor maintenance of equipment

This NCCA aims to present the picture of India's Cold Chain system which will be used by the MoHFW and partners to address these constraints.

1.2 Cold Chain Network in the Country

To manage the Cold Chain supply, since the inception of UIP, a wide network of Cold Chain stores have been created consisting of Government Medical Store Depots (GMSD), State, Regional/Divisional Vaccine stores, District and PHC/CHC vaccine storage points. Cold Chain Network in the country is the backbone to ensure that right quantity and right quality of vaccine reaches the target population.

The Cold Chain system spans all 36 States and UTs, 666 districts, 28882 CHCs and PHCs[9], along with Cold Chain points at Defence/Railway/ESI hospitals and such associated health facilities, and even up to sub-centres and immunization sites level in certain places. In India, there are five levels of immunization supply chain:

1. Primary Stores

Any facility that receives vaccines from the manufacturer is a Primary Store. There are 4 GMSDs (Karnal, Chennai, Mumbai and Kolkata) in the country having Cold Chain storage facility.

Any facility in a State that receives vaccine directly from the manufacturer or from the GMSD is also a Primary store. All the State Vaccine Stores fall under this category. There may be more than one such State store in a State. The State Vaccine Stores supply vaccine to the Regional Vaccine Stores and in some places to the District Vaccine Stores.

2. Regional Vaccine Stores

Any facility that receives vaccines from a primary vaccine store (SVS) and distributes it to districts is a Regional Vaccine Store. The existing Divisional Vaccine Stores (wherever applicable) which receives vaccine from the primary store (SVS) will fall under this category and should be considered as Regional Vaccine Stores.

3. District Vaccine Stores

These are facilities at District Headquarter level which receive vaccines from State/Regional Vaccine Stores and distribute vaccines to CHC/PHC/UHC/last Cold Chain point etc.

4. Sub-District Vaccine Stores

These are facilities which receive vaccines from district vaccine stores and distribute to the last Cold Chain points. Any intermediary store between the district vaccine store and the last Cold Chain point fall in this category.

5. Last Cold Chain Point (Service Delivery Point)

These are facilities which receive vaccines from District/Sub-District Vaccine stores and distribute vaccines to the session sites on a session day using Alternate Vaccine Delivery System (AVDS). In the immunization supply chain network, this is the last point having vaccines storage facility

Table 3: Number of vaccine stores in India[10]

Store level	Numbers
GMSD (National UIP Store) – Primary Store Level 1	4
State Vaccine Stores – Primary Store Level 2	53
Regional Vaccine Stores (other equivalent terminology) – Intermediate Level 1	110
District Vaccine Stores – Intermediate Level 2	666
CHC/PHC/UHC/Other hospitals - Lowest Vaccine Storage Site*	25,555
Total**	26,384

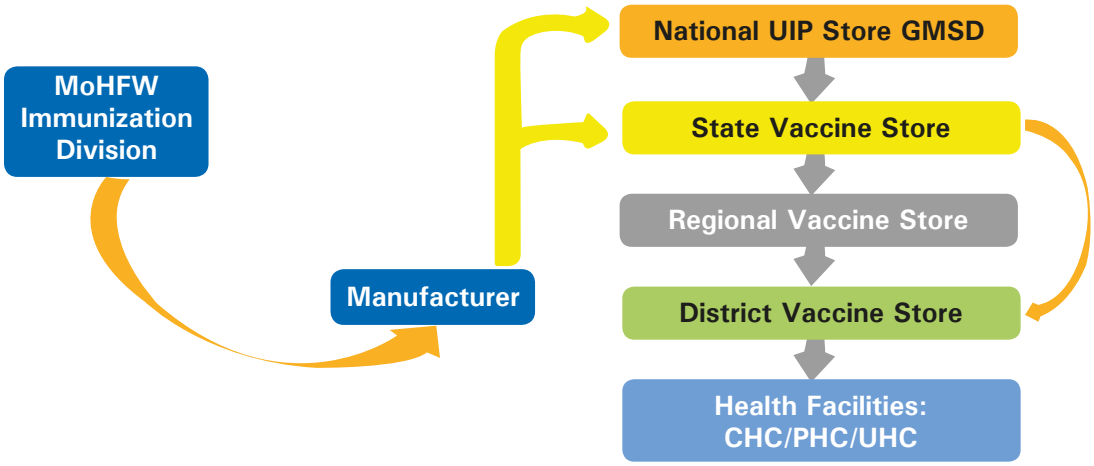
*No. of CHCs and PHCs having Cold Chain points.

**Total Cold Chain Point/Site Excluding GMSDs

[9] Total number CHC and PHC is 28882 and 18712 are termed as Cold Chain points

[10] NCCMIS data September 2014

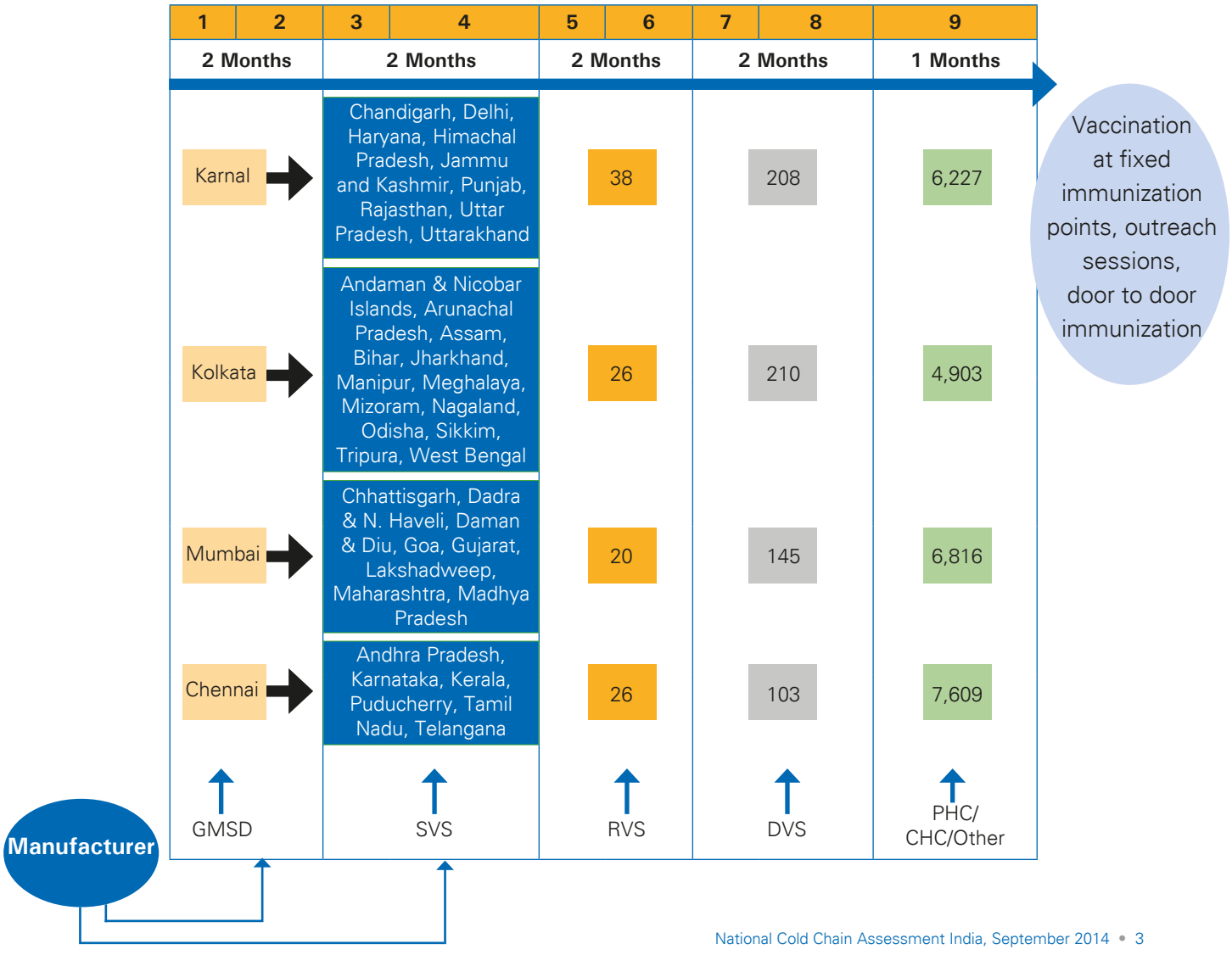
Figure 2: Schematic representation of vaccine supply chain in India



and doesn't issue vaccines to any other vaccine store but for the immunization sessions. In some States, certain sub-centres also function as last Cold Chain point because of strategic location and fulfilling the requisite criteria of Cold Chain point.

The logistics is managed through storing and transporting vaccine in a pre-defined network. The vaccine typically arrives at the primary stores and then are transported to regional vaccine stores and through district vaccine store, it reaches the service delivery point.

Figure 3: The flow of vaccine through the network with approximate duration of storage



To maintain vaccine quality throughout its shelf life, it is essential that vaccines are transported and stored within WHO/UNICEF recommended temperature range. This means that Cold Chain equipment should remain functional, be at close distance to beneficiaries and have human resources trained with systems and procedures to ensure stock availability for all planned sessions (vaccine, diluents and stocks), maintained within recommended temperature range.

Each vaccine has its own storage temperature norm recommended by WHO, as given in the Table 4.

The Cold Chain network is supported through the establishment of two nodal centres by the MoHFW; the National Cold Chain & Vaccine Management Resource Centre (NCCVMRC) at NIHFW, New Delhi and the National Cold Chain Training Centre (NCCTC) at SHTO, Pune. The NCCVMRC and NCCTC serve as technical resource centres for the MoHFW for implementation support related to CC&VLM interventions and for generating the evidence base for further innovations in Cold Chain technologies.

The monitoring of the Cold Chain system in India takes place through the National Cold Chain Management Information System (NCCMIS) which was initially developed and piloted by UNICEF and later taken over by the MoHFW through the NCCVMRC. Currently the NCCMIS is operational across all States and UTs. The NCCMIS has the provisions for providing the mandated proforma based reports as required to be submitted by the district and State to the MoHFW. The NCCMIS provides more than 60 detailed reports on Cold

Table 4: WHO norms of storing vaccines[11]

<table>
<tr><th rowspan="2">Name of the vaccine</th><th rowspan="2">Primary vaccine store*</th><th colspan="2">Intermediate vaccine store</th><th rowspan="2">Health centre</th><th rowspan="2">Health post</th></tr>
<tr><th>Region</th><th>District</th></tr>
<tr><td>OPV</td><td colspan="2">-15^{0}C to -25^{0}C</td><td colspan="2" rowspan="19">All vaccines are recommended to be stored at +2^{0}C to +8^{0}C.</td></tr>
<tr><td>BCG</td><td colspan="2" rowspan="8">WHO no longer recommends that freeze-dried vaccines be stored at -20^{0}C. Storing them at -20^{0}C is not harmful but is unnecessary. Instead, these vaccines should be kept in refrigeration and transported at +2^{0}C to +8^{0}C.</td></tr>
<tr><td>Measles</td></tr>
<tr><td>MMR</td></tr>
<tr><td>MR</td></tr>
<tr><td>YF</td></tr>
<tr><td>Hib freeze dried</td></tr>
<tr><td>JE</td></tr>
<tr><td>Meningococcal A&C</td></tr>
<tr><td>Hep B</td><td colspan="2" rowspan="10">+2^{0}C to +8^{0}C
These vaccines are freeze sensitive and must never be frozen.</td></tr>
<tr><td>IPV</td></tr>
<tr><td>DT</td></tr>
<tr><td>DTP</td></tr>
<tr><td>DTP-HepB</td></tr>
<tr><td>Hib liquid</td></tr>
<tr><td>Td</td></tr>
<tr><td>TT</td></tr>
<tr><td colspan="6">Diluents vials must NEVER be frozen. If the manufacturer supplies a freeze-dried vaccine packed with its Diluent, ALWAYS store the product at between +2^{0}C and +8^{0}C. If space permits, diluents supplied separately from vaccine may safely be stored in the Cold Chain between +2^{0}C and +8^{0}C.</td></tr>
</table>

*Stores receiving vaccines directly from the manufacturers like GMSDs and State Vaccine Stores.

[11] Temperature sensitivity of vaccine; WHO/IVB/06.10

Chain inventory, Cold Chain point information, equipment related information and performance indicators at all levels of the immunization supply chain.

Various recent studies like National Effective Vaccine Management (NEVM 2013), Vaccine Wastage Study (UNICEF 2008), ITSU Deep Dive Study, KPMG vaccine logistics study (2013), ICMR Freezing Study (2012) etc. have pointed out issues related to Cold Chain space, quality of storage and management of Cold Chain system at all levels of the supply chain.

Taking cognizance of these and other related observations, the MoHFW has formulated Multi year Strategic Plan for immunization. The current Multi-Year Strategic Plan (2013–17) has evolved from its first iteration (cMYP 2005–10) and is underpinned by the Government of India RMNCH+A 2013 strategy and the National Vaccine Policy of 2011. India's comprehensive Multi Year Strategic Plan (2013-2017) for Universal Immunization Programme has been prepared with the goal of reaching every child and to reduce mortality and morbidity due to vaccine-preventable diseases through high quality immunization services. RI interventions will be targeted at reaching out to all eligible children and pregnant women as per the National Immunization schedule. The Multi Year Strategic Plan 2013-2017 also addresses this vital component of the immunization programme through specific priority actions, as listed below. To address the challenges in Cold Chain MoHFW has taken initiatives through evidence based solutions and this has led to various studies like NCCA, Solar Hybrid Assessment etc. Necessary funding and mechanisms has been ensured through MYSP 2013-17.

Table 5: India comprehensive Multi Year Plan 2013-2017

MYSP objective	Multi Year Plan priority actions
KO 1: Improve programme service delivery for equitable and efficient immunization services by all districts.	Expected Result 1.1: Strengthen the National Cold Chain Management System 1. Develop National Cold Chain Management action plan. 2. Enhance the capacity of the National Cold Chain Vaccine Management Resource Centre (NCCVMRC) and the National Cold Chain Training Centre (NCCTC) to better manage the Cold Chain and Vaccine Logistics Management (VLM) system. 3. Conduct a nationwide rollout of Cold Chain (NCCMIS). 4. Increase the number of Cold Chain points closer to vaccination sites in selected States and take up repairs and maintenance work of the existing equipment. 5. Facilitate installation and/or replacement of Cold Chain equipment of vaccine stores at different levels. 6. Enhance management capacity and numbers of Cold Chain and vaccine logistics staff at all levels with the district being responsible for stock distribution planning, management and repair. 7. Promote mentoring and supportive supervision to ensure that vaccines are stored within the correct temperature range. 8. Scale up a system for SMS-enabled real-time temperature monitoring for Cold Chain as part of electronic Vaccine Intelligence Network (eVIN). 9. Enhance capability of Cold Chain handlers and mechanics across the country. Expected Result 1.2: Strengthen vaccine and syringe logistics management across the country including forecasting and procurement at central level 1. Develop a vaccine and syringe logistics management system in the country with real-time stock visibility. 2. Strengthen HR capacity at all levels for vaccine management, including effective vaccine store management and forecasting. 3. Pilot new technology for improving vaccine logistics and Cold Chain management with an overall objective to develop an electronic Vaccine Intelligence Network (eVIN). 4. Implement Effective Vaccine Management (EVM) improvement plans.

1.3 Current Immunization Schedule

India's vaccine and Cold Chain requirement is based on the current National Immunization Schedule which lays down the recommended vaccines for a fully immunized child.

The National Immunization Schedule is a commitment to deliver the recommended and appropriate vaccines to every child in the country. This mandates the requirement and availability of adequate Cold Chain space at all levels for proper storage of the vaccines under ideal temperature conditions to maintain their potency and effectiveness.

Table 6: Current National Immunization Schedule

Vaccine	When to give	Dose
For pregnant women		
TT-1	Early in pregnancy	0.5 ml
TT-2	4 weeks after TT-1	0.5 ml
TT- Booster	If pregnancy occurs within three yrs. of last pregnancy and two TT doses were received	0.5 ml
For infants		
BCG	At birth or along with DPT-1	0.1 ml (0.05 ml in infants)
Hep-B	At Birth in institutional Deliveries	0.5 ml
OPV-0	At birth or within 15 days after birth	2 drops
OPV1.2 & 3	At 6 weeks, 10 weeks & 14 weeks	2 drops
DPT1.2 & 3	At 6 weeks 10 weeks & 14 weeks	0.5 ml
Pentavalent (DPT, Hep B & HiB)	At 6 weeks 10 weeks & 14 weeks*	0.5 ml
HepB 1, 2 & 3	6 weeks 10 weeks & 14 weeks	0.5 ml
Measles/MR 1st Dose	9-12 months	0.5 ml
JE 1st Dose	9-12 months #	0.5 ml
For children		
DPT booster	16-24 months, 5-6 years*#	0.5 ml
Measles/MR 2nd Dose	16-24 months with DPT/OPV booster	0.5 ml
JE 2nd Dose	16-24 months with DPT/OPV booster #	0.5 ml
OPV Booster	16-24 months	2 drops
TT	10 years & 16 years	0.5 ml

** Pentavalent vaccine (DPT + Hep B + Hib) is given in the selected States in place of DPT and Hep-B vaccines*

 # JE Vaccine is given in JE endemic districts

**# DPT booster doses are administered at 16 to 24 months and at 5 to 6 years of age*

Vaccine Storage Requirement

The subsequent three tables detail the vaccine storage requirement under different UIP scenario including new vaccine introduction for various level of stores. This information has been used throughout the national Cold Chain assessment to forecast Cold Chain capacity by extrapolating the storage volume requirement against population.

Table 7a: Cold Chain space requirement for target beneficiary (according to UIP schedule) – present UIP vaccines

Vaccine	Number of doses per vial	Storage volume per dose (ml)	Wastage rate	3Net storage volume per dose[12]	Number of doses per target	Storage volume required per target (ml)
Vaccine to be stored at +2^{0}C to +8^{0}C at SVS, RVS & DVS						
BCG	10	2.6	50%	3.9	1.0	3.9
DPT	10	1.8	10%	2.0	5.0	9.9
TT	10	3.9	10%	4.3	3.5	15.0
Measles/MR	5	5.2	25%	6.5	2.0	13.0
Hep B	10	4.4	10%	4.8	4.0	19.4
Total Cold Chain volume required per target beneficiary						61.2
Vaccine to be stored at -15^{0}C to – 25^{0}C at intermediate stores						
OPV	20	0.9	10%	1.0	5	5.0
Diluent to be stored at +2^0 C to +8^{0}C at Primary Health Centres						
BCG	10	0.7	50%	1.1	1	1.1
Measles/MR	5	4	25%	5.0	2	10.0
Net storage volume required for +2^{0}C to +8^{0}C at State, Regional and District Vaccine Stores per target beneficiary						61.2
Net storage volume required for -15^{0}C to -25^{0}C at State, Regional and District Vaccine Stores per target beneficiary						5.0
Net storage volume required for +2^{0}C to +8^{0}C at Primary Health Centres without Diluents per target beneficiary						66.1
Net storage volume required for +2^{0}C to +8^{0}C at Primary Health Centres with Diluents per target beneficiary						77.2

[12] http://www.who.int/immunization_standards/vaccine_quality/PQ_vaccine_list_en/en/

Table 7b: Cold Chain space requirement for target beneficiary (according to UIP schedule) – with Pentavalent vaccine

Vaccine	Number of doses per vial	Storage volume per dose (ml)	Wastage rate	4Net storage volume per dose[13]	Number of doses per target	Storage volume required per target (ml^3)
Vaccine to be stored at +2^{0}C to +8^{0}C at intermediate stores						
BCG	10	2.6	50%	3.9	1	3.9
Pentavalent	10	3.0	10%	3.3	3	9.9
DPT	10	1.8	10%	2.0	2	4.0
TT	10	3.9	10%	4.3	3.5	15.0
Measles/MR	5	5.2	25%	6.5	2	13.0
Hep B	10	4.4	10%	4.8	1	4.8
Total Cold Chain volume required per target beneficiary						50.6
Vaccine to be stored at -15^{0}C to – 25^{0}C at intermediate stores						
OPV	20	0.9	10%	1.0	5	5.0
Diluent to be stored at +2 to +8 Deg at Primary Health Centres						
BCG	10	0.7	50%	1.1	1	1.1
Measles/MR	5	4	25%	5.0	2	10.0
Net storage volume required for +2^{0}C to +8^{0}C at State, Regional and District Vaccine Stores per target beneficiary						50.6
Net storage volume required for -15^{0}C to -25^{0}C at State, Regional and District Vaccine Stores per target beneficiary						5.0
Net storage volume required for +2^{0}C to +8^{0}C at Primary Health Centres without Diluents per target beneficiary						55.6
Net storage volume required for +2^{0}C to +8^{0}C at Primary Health Centres with Diluents per target beneficiary						66.6

[13] http://www.who.int/immunization_standards/vaccine_quality/PQ_vaccine_list_en/en/

Table 7c: Cold Chain space requirement for target beneficiary (according to UIP schedule) – with IPV and Rotavirus vaccine

Vaccine	Number of doses per vial	Storage volume per dose (ml)	Wastage rate	5Net storage volume per dose[14]	Number of doses per target	Storage volume required per target (ml)
Vaccine to be stored at +2^{0}C to +8^{0}C at intermediate stores						
BCG	10	2.6	50%	3.9	1	3.9
Pentavalent	10	3	10%	3.3	3	9.9
IPV	10	2.5	10%	2.8	1	2.8
DPT	10	1.8	10%	2.0	2	4.0
TT	10	3.9	10%	4.3	3.5	15.0
Measles/MR	5	5.2	25%	6.5	2	13.0
Hep B	10	4.4	10%	4.8	1	4.8
JE	5	4.2	25%	5.3	2	10.5
Total Cold Chain volume required per target beneficiary						63.9
Vaccine to be stored at -15^{0}C to – 25^{0}C at intermediate stores						
OPV	20	0.9	10%	1.0	5	5.0
Rotavirus	10	3.3	10%	3.6	3	10.9
Diluent to be stored at +2^0 to +8^0 at Primary Health Centres						
BCG	10	0.7	50%	1.1	1	1.1
Measles/MR	5	4	25%	5.0	2	10.0
Net storage volume required for +2^{0}C to +8^{0}C at State, Regional and District Vaccine Stores per target beneficiary						63.9
Net storage volume required for -15^{0}C to -25^{0}C at State, Regional and District Vaccine Stores per target beneficiary						15.8
Net storage volume required for +2^{0}C to +8^{0}C at Primary Health Centres without Diluents per target beneficiary						79.7
Net storage volume required for +2^{0}C to +8^{0}C at Primary Health Centres with Diluents per target beneficiary						90.8

[14] http://www.who.int/immunization_standards/vaccine_quality/PQ_vaccine_list_en/en/

1.4 Rationale of Current Assessment

The last National Cold Chain Assessment conducted in 2008 provided a comprehensive picture of the Cold Chain status in India and underpinned the need for upgradation of the Cold Chain system.

During the intervening six years, many Cold Chain equipment have been condemned with the aging of equipment and need for replacement, causing changes in the equipment inventory status. Moreover, the GoI has undertaken measles catch up campaigns and plans for the introduction of the MR, IPV and Rota vaccines in the near future. This requires additional Cold Chain space, and replenishment of Cold Chain equipment which requires structured assessment and planning. This makes it necessary to have a comprehensive assessment which addresses the future challenges.

Previously, the focus of the Cold Chain assessment was only equipment. However, buildings, infrastructure, transport and dry storage are equally important in Cold Chain system planning. These need to be assessed for future Cold Chain planning.

1.5 Objectives of the Assessment

Primary Objective

1. To assess the adequacy of the existing Cold Chain space in the country.

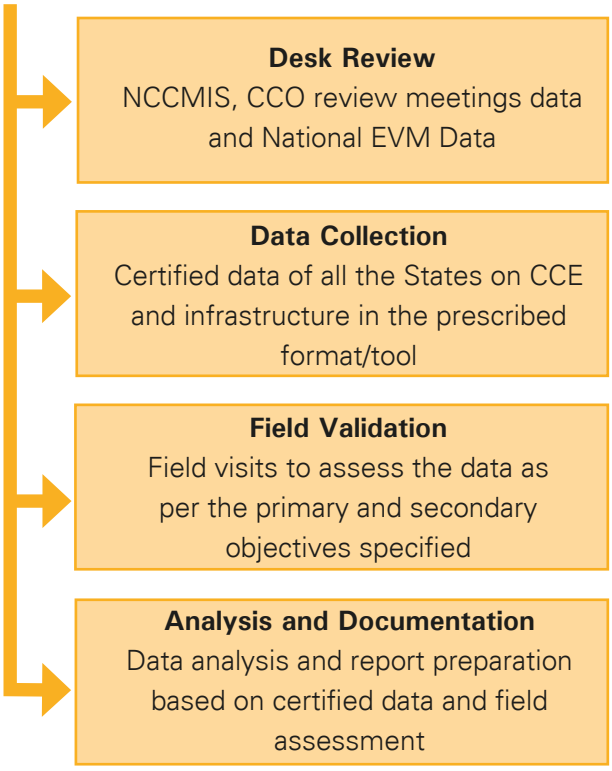
Secondary Objectives

1. To project future Cold Chain requirements in view of newer vaccine introduction.
2. To update the status of Cold Chain points across the country, including electricity supply.
3. To assess the Cold Chain related staff and training status.
4. To provide information on dry storage space requirements at various levels.
5. To update the status of spare parts availability and requirement.
6. To assess the readiness of States for cold room installation.
7. To recommend solutions to develop improvement plan by States.
8. To validate the NCCMIS data through the NCCA field assessment.

SECTION 2

METHODOLOGY

The NCCA, 2014 started off with formation of a core group for NCCA design and implementation drawn from the MoHFW and development partners. The core group undertook several meetings and the study tool was developed in consultation with partners and MoHFW. The developed tools were piloted and subsequently refined. The investigation team assessors were from partner agencies, medical college faculty, SEPIOs and CCOs. The assessors' orientation was conducted in NIHFW and Lucknow Medical College with NCCVMRC being the secretariat for NCCA development. The National Cold Chain Assessment, 2014 was conducted using the following approach.



2.1 Sampling

The sample States were selected based on the following criteria:

- Geographical representation (North, South, East, West, Hilly, Tribal and Coastal).
- State EVM/NEVM not done in last two years.
- NCCMIS data quality; States scoring less than equal to three out of five (coding based on the completeness and access of NCCMIS).

Table 8: List of selected States based on selection criteria

S.No.	State	Geographic location	State EVM/NEVM conducted	Other features	NCCMIS data quality score
1	Uttarakhand	North	No	Hilly Area	2
2	Uttar Pradesh	North	Yes (NEVM)	-	1
3	Andhra Pradesh	South	No	-	1
4	Karnataka	South	Yes (NEVM)	-	2
5	Gujarat	West	No	-	4***
6	Maharashtra	West	No	-	3
7	Odisha*	East	Yes	Coastal	3
8	West Bengal	East	No	-	2
9	Assam	North East	No	-	1
10	Arunachal Pradesh	North East	No	-	1
11	Chhattisgarh**	Central	Yes (NEVM)	Tribal	1
12	Bihar	East	Yes (NEVM)	-	2

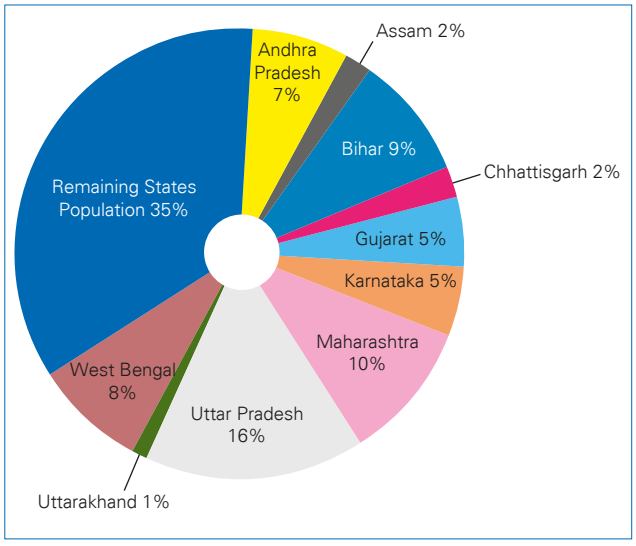
*Odisha has not been included among the sample States as the State had planned for EVM in 2014.

**Chhattisgarh could not be assessed due to security reasons

***For geographical representation

Figure 4(a): Map of selected States for NCCA-2014

Figure 4(b): Proportion of population of the selected States



Information was collected from the selected stores using a structured information format and the collected data was compiled and analysed using standard techniques. The sample States contribute to 65 per cent of the Indian population.

Total 141 sites were covered by 47 teams in the assessment consisting of 14 State Vaccine Stores, 33 Regional Vaccine Stores, 47 District Vaccine Stores and 47 health facilities.

2.2 Desk Review

The data sources for NCCA 2014 included the:

- National Cold Chain Management Information System.
- Certified copies of Cold Chain equipment availability based on a structured format.
- Data from CCO reviews (2013).
- Various assessments like National EVM and various State EVMs (from 2011).

The initial data required for the assessment was obtained from the NCCMIS and corroborated through the certified copies of structured information from all States. The data sets were checked for any inconsistencies and if found, the inconsistencies were followed up and resolved through personal interactions with State level stakeholders.

The final data sets thus prepared were incorporated in a compilation format for analysis.

SECTION 3

FINDINGS

3.1 Cold Chain Capacity

Present status

In this section, the situation of the present Cold Chain storage capacity at various levels is presented followed by the assessment of required vaccine storage capacity based on the UIP programme and the target population for each vaccine storage level. Benchmark norms and assumptions were created and used for analysis and forecasting of Cold Chain infrastructure in terms of capacity and manpower development for future UIP need.

Summary - the big picture

With the given 5-tier vaccine store network, out of 71,625 equipment, there were 64,493 operational refrigeration units of ILRs and deep freezers. In addition, India also had a total of 294 WICs and WIFs. Table 9 lists out the summary of Cold Chain equipment in the entire country.

Table 9: Summary of Cold Chain equipment in the country[15]

Equipment type	Number (CFC)	Numbers (CFC-Free)	Items stored
WIC 40 m^3	NIL	8	BCG, Measles, MR, Pentavalent, TT, DPT, HepB, JE
WIC 32 m^3	5	14	BCG, Measles, MR, Pentavalent, TT, DPT, HepB, JE
WIC 16.5 m^3	69	135	BCG, Measles, MR, Pentavalent, TT, DPT, HepB, JE
WIF 32 m^3	NIL	9	OPV, Ice packs
WIF 20 m^3	NIL	21	OPV, Ice packs
WIF 16.5 m^3	1	32	OPV, Ice packs
ILR Large	1,017	4,325	BCG, Measles, MR, Pentavalent, TT, DPT, HepB, JE
ILR Small	9,295	22,569	BCG, Measles, MR, Pentavalent, TT, DPT, HepB, JE, OPV, Diluent (BCG & Measles/ MR, JE)
DF Large	791	5,499	OPV, ice packs
DF Small	7,089	21,040	OPV, Ice packs
Cold box (20 litres)	41,933		Mixed antigens
Cold box (5 litres)	24,049		Mixed antigens
Vaccine carrier	1,128,413		Mixed antigens

[15] Includes all the equipment i.e. functional and non-functional

Walk in Coolers & Walk in Freezers

There are 8 number of WICs of 40 m^3, 19 number of WICs of 32 m^3, 204 number of small WICs (16.5 m^3), 9 number of large WIFs (32 m^3) and 54 number of small WIFs (20 m^3 and 16.5 m^3) in the country. WICs and WIFs were installed at GMSD, State and regional vaccine stores. Table 10 lists out the details of installed cold rooms and freezer rooms in the country. The location details of the WIC and WIF along with their size and refrigerant is in the annexure.

Table 10: Distribution of WICs and WIFs State wise

States	WIC				WIF					
	16.5m^3		32m^3		16.5m^3		20m^3		32m^3	
	CFC	NCFC	CFC	NCFC	CFC	NCFC	CFC	NCFC	CFC	NCFC
Andaman & Nicobar Islands		1								
Andhra Pradesh	4	4		1		1				1
Arunachal Pradesh	1	1								
Assam	2	4				1				
Bihar	4	10		1		3				
Chandigarh		1								
Chhattisgarh	1	3		1		1		1		
Dadra & Nagar Haveli										
Daman & Diu										
Delhi	1	1								
Goa		1								
Gujarat	5	5			1	1				
Haryana	2	3				1				
Himachal Pradesh	2	2				1				
Jammu & Kashmir	2	3				1				
Jharkhand	1	4		1		1		1		1
Karnataka	4	5		1		2				1
Kerala		6				1				
Lakshadweep										
Madhya Pradesh	4	7	1	1		4				
Maharashtra	6	8		1		4		1		
Manipur	1	1								
Meghalaya	1	2								
Mizoram		1								
Nagaland		1								
Odisha	4	6	1	1				1		
Puducherry										
Punjab		5				2				
Rajasthan	7	8		1		1				1
Sikkim										
Tamil Nadu	7	6		2		1				1
Telangana	2	2								
Tripura	1	1				1				
Uttar Pradesh	5	15	3	1		3		4		
Uttarakhand	2	3				1				
West Bengal		14		2		1				1
Total	**69**	**134**	**5**	**14**	**1**	**32**	**0**	**8**	**0**	**6**

Table 11: Distribution of WICs and WIFs in GMSDs

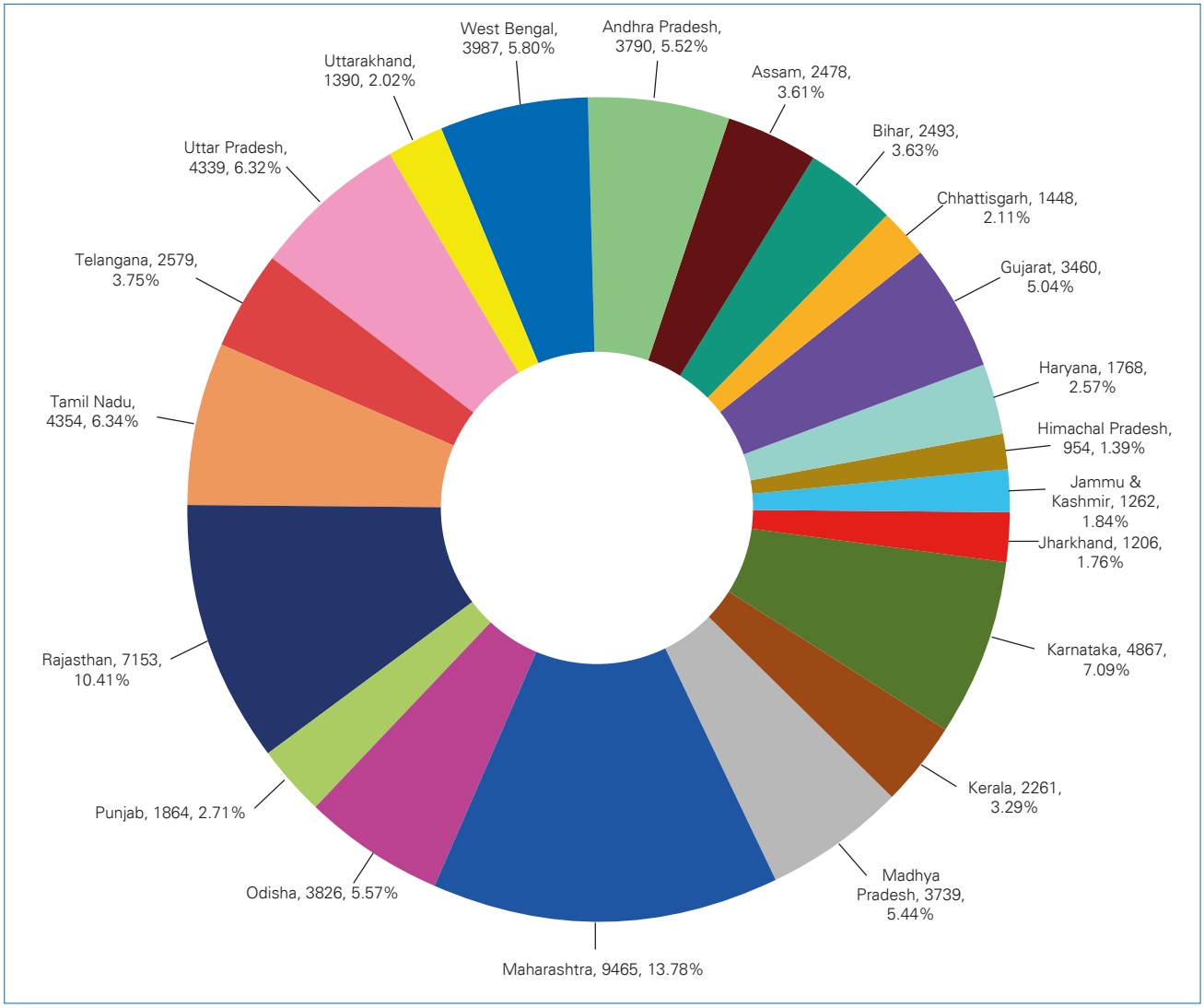
Name of the GMSDs	Type of equipment available							
	WIC 40 m^3		WIC 16.5 m^3		WIF 32 m^3		WIF 20 m^3	
	CFC	Non CFC	CFC	Non CFC	CFC	Non CFC	CFC	Non CFC
Chennai		2						3
Karnal*				1		1		2
Kolkata		4				1		4
Mumbai		2				1		4
Total		8		1		3		13

** The GMSD Karnal has got 566336 litres of hired space and the vaccines are stored in the hired cold room.*

Refrigerators and Freezers (ILR and DF)

There were 71,625 refrigerators and freezers available in the country. Out of total 71,625 equipment, 68,683 (96 per cent) are placed in 21 larger States and rest of 4 per cent equipment are placed in smaller States and Union Territories. Figure 5 shows the proportion of Cold Chain equipment installed in the 21 States of the country.

Figure 5: Share of Cold Chain equipment available per State*



*As per data received from States

Table 12: ILRs and DFs summarized by State (Operational Equipment)

State	Dist.	PHC	CHC	ILR large	ILR small	DF large	DF Small
Andaman & Nicobar Islands	3	22	4	6	31	3	34
Andhra Pradesh & Telangana[16]	23	1,624	281	168	1,472	195	1,349
Arunachal Pradesh	17	97	48	44	158	50	139
Assam	27	975	109	334	712	373	694
Bihar	38	1,863	70	157	962	365	567
Chandigarh	1	0	2	4	0	3	0
Chhattisgarh	27	755	149	126	734	159	314
Dadra & Nagar Haveli	1	6	1	3	13	1	14
Daman & Diu	2	3	2	3	13	1	14
Delhi	11	5	0	62	181	21	307
Goa	2	19	5	11	43	2	48
Gujarat	26	1,158	318	346	1,345	409	1,290
Haryana	21	447	109	101	833	56	700
Himachal Pradesh	12	472	76	53	407	29	452
Jammu & Kashmir	22	396	84	42	557	8	500
Jharkhand	24	330	188	129	267	125	312
Karnataka	30	2,310	180	258	2,185	224	1,130
Kerala	14	809	217	38	1,171	49	1,003
Lakshadweep	1	4	3	1	4	2	3
Madhya Pradesh	51	1,156	333	428	1,445	631	1,235
Maharashtra	35	1,811	363	807	4,118	840	3,651
Manipur	9	80	16	11	78	9	66
Meghalaya	11	109	29	12	170	28	167
Mizoram	8	57	9	21	67	19	64
Nagaland	11	126	21	17	87	24	65
Odisha	30	1,226	377	128	1,342	193	1,356
Puducherry	4	24	4	3	30	4	50
Punjab	20	449	132	132	853	96	661
Rajasthan	33	1,528	382	100	3,316	142	3,368
Sikkim	4	24	2	22	53	16	98
Tamil Nadu	32	1,227	385	137	1,925	399	1,721
Tripura	8	79	12	22	92	21	120
Uttar Pradesh	76	3,692	515	549	2,018	884	2,067
Uttarakhand	13	257	59	135	290	213	195
West Bengal	19	909	348	362	1,879	63	1,459
Total	**666**	**24,049**	**4,833**	**4,772**	**28,851**	**5,657**	**25,213**

[16] Equipment of Andhra Pradesh and Telangana has been clubbed together due to lack of information on the segregated number of CHC and PHC in these two States.

The following table gives State wise summary of Cold Chain equipment per lakh population and average Cold Chain equipment per Cold Chain point:

Table 13: Summary of Cold Chain equipment per lakh population

Name of the State	Total population	Total number of CCE*	Total number of CCP	CCE per lakh population	CCE per CCP
Andaman & Nicobar Islands	379,944	75	44	19	2
Andhra Pradesh and Telangana	84,665,563	3,199	2,234	4	1
Arunachal Pradesh	1,382,611	393	164	28	2
Assam	31,169,272	2,120	801	7	3
Bihar	103,804,637	2,069	586	2	4
Chandigarh	1,054,686	8	59	1	0
Chhattisgarh	25,540,196	1,340	513	5	3
Dadra & Nagar Haveli	342,853	31	13	9	2
Daman & Diu	242,911	31	9	13	3
Delhi	16,753,235	573	400	3	1
Goa	1,457,723	105	37	7	3
Gujarat	60,383,628	3,402	1,585	6	2
Haryana	25,353,081	1,696	586	7	3
Himachal Pradesh	6,856,509	946	452	14	2
Jammu & Kashmir	12,548,926	1,113	579	9	2
Jharkhand	32,966,238	842	220	3	4
Karnataka	61,130,704	3,810	2,364	6	2
Kerala	33,387,677	2,268	1,206	7	2
Lakshadweep	64,429	10	3	16	3
Madhya Pradesh	72,597,565	3,756	1,193	5	3
Maharashtra	112,372,972	9,436	3,643	8	3
Manipur	2,721,756	166	87	6	2
Meghalaya	2,964,007	380	141	13	3
Mizoram	1,091,014	172	80	16	2
Nagaland	1,980,602	194	131	10	1
Odisha	41,947,358	3,032	1,178	7	3
Puducherry	1,244,464	87	51	7	2
Punjab	27,704,236	1,749	740	6	2
Rajasthan	68,621,012	6,944	2,189	10	3
Sikkim	607,688	189	34	31	6
Tamil Nadu	72,138,958	4,199	1,891	6	2
Tripura	3,671,032	258	119	7	2
Uttar Pradesh	199,581,477	5,549	1,162	3	5
Uttarakhand	10,116,752	839	324	8	3
West Bengal	91,347,736	3,781	1,566	4	2

*Equipment including WIC, WIF, ILR & DF

CFC equipment

In addition to upgrading the Cold Chain capacity, MoHFW is required to plan the replacement of refrigeration units that have potential of depleting the ozone layer (CFC equipment). Our country had total of 18,267 CFC units including WIC, WIF, refrigerators and freezers. As per the Montreal Protocol, the production and use of CFC substances should be reduced to zero by year 2010, however the equipment running on CFC can continue to operate beyond 2010 with no scope of repair and maintenance. With the exception of refrigerant leak free equipment, it has become impractical to operate CFC based equipment ever since beginning of 2001. Most of the States however, have already received part replacement of CFC equipment.

Figure 6: Share of CFC and CFC-Free equipment in the country

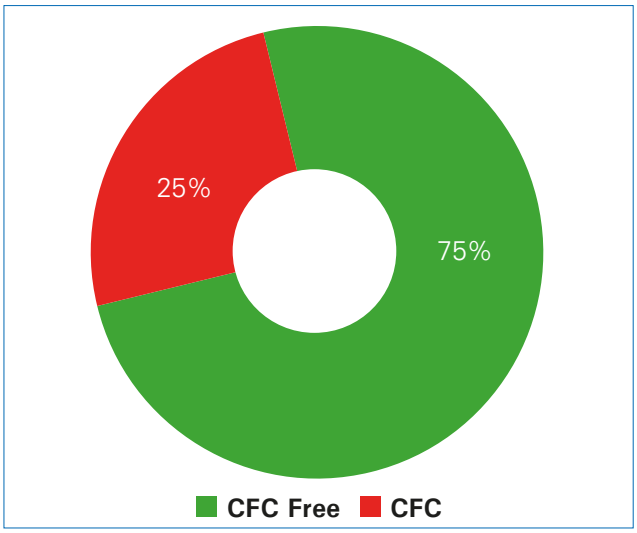
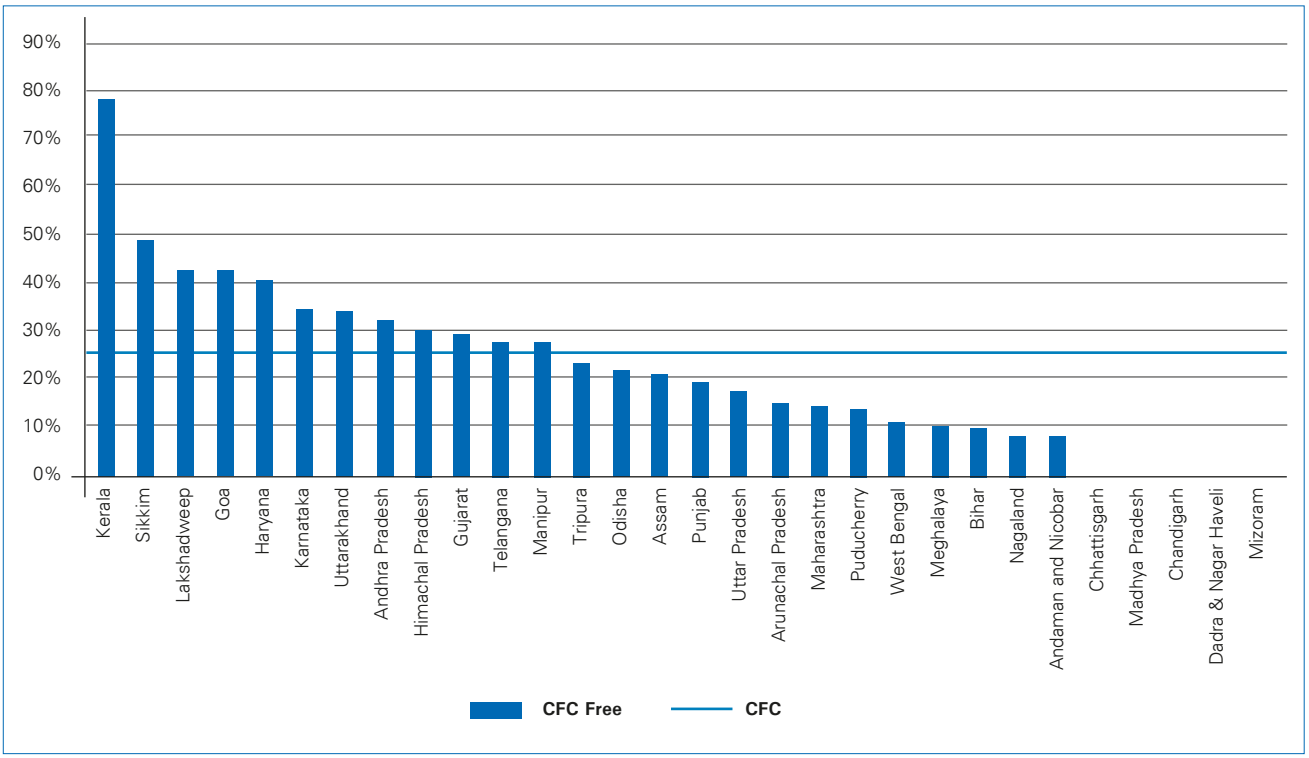


Table 14: CFC equipment in the country

Equipment type	Number (CFC)
WIC 32 m^3	5
WIC 16.5 m^3	69
WIF 32 m^3	NIL
WIF 20 m^3	NIL
WIF 16.5 m^3	1
ILR large	1,017
ILR small	9,295
DF large	791
DF small	7,089
Total	**18,267**

Figure 7: State wise share of CFC equipment*



*As per data received from States in September-October 2014.

Packing of a Cold box in a health facility

Cold Boxes and Vaccine Carriers

The cold boxes are required to transport vaccine between regional, district vaccine stores, CHCs and PHCs. There were total 32,628 large cold boxes with 20 litres of storage capacity and 26,452 small cold boxes of 5 litres of storage capacity. large cold boxes are typically needed at intermediate stores and small cold boxes at PHCs.

Cold boxes are required for transportation of vaccine at all levels of Cold Chain points except from GMSD to regional vaccine stores. The appropriate number of cold boxes was calculated based on the criteria shown in Table 15.

Based on the above criteria, the country needs a total of 41,933 20 litres sized cold boxes and 24,049 five litres cold boxes. As can be seen in the calculation in table 16, there is a need of additional 16,858 large cold boxes and 6,846 small cold boxes. The disproportionate requirement emerges due to some States having more than the requirement as per the criteria mentioned to calculate the requirement of cold boxes.

Table 15: Requirement of cold box at different levels

Store	20 Litres	5 Litres
District vaccine store	5[17]	
CHC	3[18]	
PHC	1[19]	1

[17] Considering the capacity of the vaccine van which can optimally be utilized to hold 5 cold box (L) along with logistics

[18] To supply vaccine from the CHC to the last Cold Chain point and a contingency measure for storing vaccine upon the failure of the ILR

[19] To meet the contingency requirement of storing vaccine upon the failure

Table 16: The requirement of cold boxes summarized by State

State	No. of districts	PHC	CHC	Appropriate number of cold boxes						Total available		Cold box additional requirement	
				PHC		CHC	District	Total					
				Large	Small	Large	Large	Large	Small	Large	Small	Large	Small
Andaman & Nicobar Islands	3	22	4	22	22	12	15	49	22	5	5	44	17
Andhra Pradesh	23	1,624	281	1,624	1624	843	115	2,582	1,624	2,055	2,049	527	
Arunachal Pradesh	17	97	48	97	97	144	85	326	97	12	34	314	63
Assam	27	975	109	975	975	327	135	1437	975	1,403	646	34	329
Bihar	38	1,863	70	1,863	1,863	210	200	2,273	1,863	6,186	5,126		
Chandigarh	1	0	2	0	0	6	5	11	0	15	2		
Chhattisgarh	27	755	149	755	755	447	135	1337	755	429	266	908	489
Dadra & Nagar Haveli	1	6	1	6	6	3	5	14	6	12	9	2	
Daman & Diu	2	3	2	3	3	6	5	14	3			14	3
Delhi	11	5	0	5	5	0	55	60	5			60	5
Goa	2	19	5	19	19	15	10	44	19	9	12	35	7
Gujarat	26	1,158	318	1,158	1,158	954	165	2,277	1,158	1,492	1,164	785	
Haryana	21	447	109	447	447	327	105	879	447	646	337	233	110
Himachal Pradesh	12	472	76	472	472	228	60	760	472	149	151	611	321
Jammu & Kashmir	22	396	84	396	396	252	110	758	396			758	396
Jharkhand	24	330	188	330	330	564	120	1014	330			1014	330
Karnataka	30	2310	180	2310	2310	540	150	3,000	2,310	1,831	833	1,169	1,477
Kerala	14	809	217	809	809	651	70	1530	809	680	293	850	516
Lakshadweep	1	4	3	4	4	9	5	18	4	2	5	16	
Madhya Pradesh	51	1,156	333	1,156	1,156	999	255	2,410	1,156	2,510	1,534		
Maharashtra	35	1811	363	1,811	1,811	1,089	180	3,080	1,811	6,554	3,859		
Manipur	9	80	16	80	80	48	45	173	80	35	95	138	
Meghalaya	11	109	29	109	109	87	55	251	109	131	278	120	
Mizoram	9	57	9	57	57	27	40	124	57	29	84	95	
Nagaland	11	126	21	126	126	63	55	244	126	132	98	112	28
Odisha	30	1,226	377	1,226	1,226	1,131	150	2,507	1,226	1,814	1,396	693	
Puducherry	4	24	4	24	24	12	20	56	24	118	167		
Punjab	20	449	132	449	449	396	110	955	449	629	473	326	
Rajasthan	33	1,528	382	1,528	1,528	1,146	165	2,839	1,528			2,839	1,528
Sikkim	4	24	2	24	24	6	20	50	24	16	73	34	
Tamil Nadu	32	1,227	385	1,227	1,227	1,155	160	2,542	1,227			2,542	1,227
Tripura	8	79	12	79	79	36	40	155	79	125	250	30	
Uttar Pradesh	75	3,692	5,15	3,692	3,692	1,545	375	5,612	3,692	4,338	5,602	1,274	
Uttarakhand	13	257	59	257	257	177	65	499	257	416	338	83	
West Bengal	19	909	348	909	909	1044	100	2053	909	855	1273	1198	
Total	**666**	**24,049**	**4,833**	**24,049**	**24,049**	**14,499**	**3,385**	**41,933**	**24,049**	**32,628**	**26,452**	**16,858**	**6,846**

Vaccine carriers are required for outreach immunization sessions and immunization campaigns. Vaccination in India has normally been carried out by ANMs and vaccinators during campaigns. There are 11,28,413 vaccine carriers as against 167,642 positions of ANMs. The number of vaccine carriers required is based on the number of polio booths as this presents the greatest need. In the event of decrease in the number of polio booths the minimum requirement should be based on the number of sub-centres. The numbers of vaccine carriers available are sufficient in quantity except in few States. However, the effective age of vaccine carrier is about five years, there is a need of replacing 20 per cent of vaccine carriers every year.

Table 17: The stock position of vaccine carriers in the country summarized by States

S. No.	Name of the State/UTs	CHC	PHC	Total PHC and CHC	Presence of CCP in CHC and PHC	Sub centre	Planned sessions[20]	No. of Polio booth	Vaccine carrier available	Vaccine carrier require-ment
1	Andaman & Nicobar Islands	4	22	26	23	119	1801	633	330	303
2	Andhra Pradesh & Telangana	281	1,624	1,905	1,644	1,2522	180,930	5,9057	83,032	
3	Arunachal Pradesh	48	97	145	128	286	6,825	2,427	15	2,412
4	Assam	109	975	1,084	403	4,604	298,396	26,952	49,053	
5	Bihar	70	1,863	1,933	523	9,696	681,656	80,334	85,408	
6	Chandigarh	2	0	2	1	16	9,310	529	1,500	
7	Chhattisgarh	149	755	904	474	5,111	228,019	14,393	19,587	
8	Dadra & Nagar Haveli	1	6	7	7	50	1,764	171	331	
9	Daman & Diu	2	3	5	3	26	1,123	111	122	
10	Delhi	0	5	5	5	41	72,765	9,654	834	8,820
11	Goa	5	19	24	19	205	5,576	524	873	
12	Gujarat	318	1,158	1,476	1,356	7,274	201,596	33,956	51,392	
13	Haryana	109	447	556	446	2,520	229,702	16,535	32,884	
14	Himachal Pradesh	76	472	548	453	2,065	56,210	5,575	7,226	
15	Jammu & Kashmir	84	396	480	480	1,907	99,148	11,142	13,852	
16	Jharkhand	188	330	518	184	3,958	430,809	23,809	48,240	
17	Karnataka	180	2,310	2,490	2,052	8,871	381,015	30,218	33,233	
18	Kerala	217	809	1,026	947	4,575	197,079	10,506	9,965	541
19	Lakshadweep	3	4	7	7	14	442	107	12	95
20	Madhya Pradesh	333	1,156	1,489	918	8,869	698,502	45,641	97,575	
21	Maharashtra	363	1,811	2,174	2,006	10,580	755,508	73,977	104,061	
22	Manipur	16	80	96	59	420	25,117	3,612	504	3,108
23	Meghalaya	29	109	138	106	397	70,924	5,061	6,176	
24	Mizoram	9	57	66	58	370	7,629	1,306	987	319
25	Nagaland	21	126	147	75	396	21,609	2,317	4,034	
26	Odisha	377	1,226	1,603	947	6,688	246,956	17,909	42,387	
27	Puducherry	4	24	28	28	51	2,814	401	1,244	
28	Punjab	132	449	581	427	2,951	160,720	14,554	24,823	

[20] Session planned for the year 2014-15 as per HMIS

S. No.	Name of the State/UTs	CHC	PHC	Total PHC and CHC	Presence of CCP in CHC and PHC	Sub centre	Planned sessions[20]	No. of Polio booth	Vaccine carrier available	Vaccine carrier require-ment
29	Rajasthan	382	1,528	1,910	1,910	11,487	419,074	45,376	60,525	
30	Sikkim	2	24	26	26	147	1,285	511	1,936	
31	Tamil Nadu	385	1,227	1,612	1,533	8,706	526,991	28,472	58,040	
32	Tripura	12	79	91	87	719	33,604	4,083	1,454	2,629
33	Uttar Pradesh	515	3,692	4,207	739	20,521	165,3742	139,762	218,519	
34	Uttarakhand	59	257	316	215	1,848	129,969	12,759	21,425	
35	West Bengal	348	909	1,257	423	10,356	348,934	55,310	46,834	8,476
All India		**4,833**	**24,049**	**28,882**	**18,712**	**148,366**	**8,187,544**	**777,684**	**1,128,413**	**26,703**

3.2 Estimation of Cold Chain Space

The vaccine storage Cold Chain space requirement was calculated based on storage volume required per target beneficiary. The annual volume required was estimated as 66.6ml for +2°C to +8°C storage and 5 ml for -15°C to -25°C storage per beneficiary. Refer to Table 7(b) for details of storage calculations per FIC.

Annual volume of vaccine storage requirement was then factored to the frequency of vaccine arrival at vaccine stores. Normally, if there is higher number of shipments per year, then the storage space required is lower.

The net storage requirement per shipment cycle was translated into population covered by each equipment. Table 18 shows the population coverage by each typical type of equipment installed in the country.

The estimated requirement of Cold Chain equipment has been assumed by considering target population and volume of space required per beneficiary. Tables 18 and 19 below show the quantity of each recommended equipment type alongside population data requirements.

A well maintained cold chain room in a health facility

Table 18: Potential population coverage by different Cold Chain equipment

Particulars	Cold Chain equipment						
	WIC		WIF		ILR (Large)	Deep freezer (Large)	ILR (Small)
	16.5 m3	32 m3	16.5 m3	32 m3			
Net vaccine storage volume per equipment (in litres)	4,500	9,000	4,500	9,000	105	220	45
Number of months of storage	3	3	3	3	2	2	1
Total vaccine storage capacity (net volume x frequency) in litres	18,000	36,000	18,000	36,000	630	1320	540
Volume required per fully immunized child (in ml)	50.6	50.6	5	5	50.6	5	66.6
Safety stock (25%)	12.65	12.65	1.25	1.25	12.65	1.25	16.68
Target population (infant) covered/equipment	284,585	569,170	2,880,000	5,760,000	9,960	211,200	6,477
Total population covered/ equipment (assuming CBR 20/1000) in million	14.2	28.5	144	288	0.50	10.56	0.3

Table 19: Requirement of CCE based on population

Population (in million)	Requirement of Cold Chain equipment						
	WIC		WIF		ILR (Large)	Deep Freezer (Large)	ILR (Small)
	16.5 m^3	32 m^3	16.5 m^3	32 m^3			
0.02						1	1
0.05						1	1
0.10						1	1
0.50					2	1	
1.0					3	1	
2.0					6	1	
3.0	1					1	
5.0	1					1	
10.0		1				2	
50.0		3	1				
100.0		6	1				

The large ILRs used primarily at district level are typically sufficient to cover 0.5 million population. The small ILRs are normally sufficient to cover 0.3 million population and are primarily installed at PHC or sub-district level.

The projected requirement of equipment providing -15 to -25ºC storage space has been calculated for the storage of OPV vaccine only. This has been assumed that any store requiring more than 6 large ILR should go for a WIC as the WIC are more reliable than the ILRs and in terms of maintenance of equipment it is easier to maintain one WIC than maintaining 6 ILRs. The WIC has also more life span as compared to the ILR.

Based on the above assumptions, the following graphs indicate the additional Cold Chain requirements by equipment type considering the following scenarios:

- Equipment required for RI based on the target population of beneficiaries and number of Cold Chain points/vaccine stores.
- Requirement for newer vaccines in the UIP.
- Operational CFC equipment requiring replacement.
- Non-CFC equipment more than 10 years.

Figure 8: Present inventory status and requirement analysis of large Ice-Lined Refrigerator

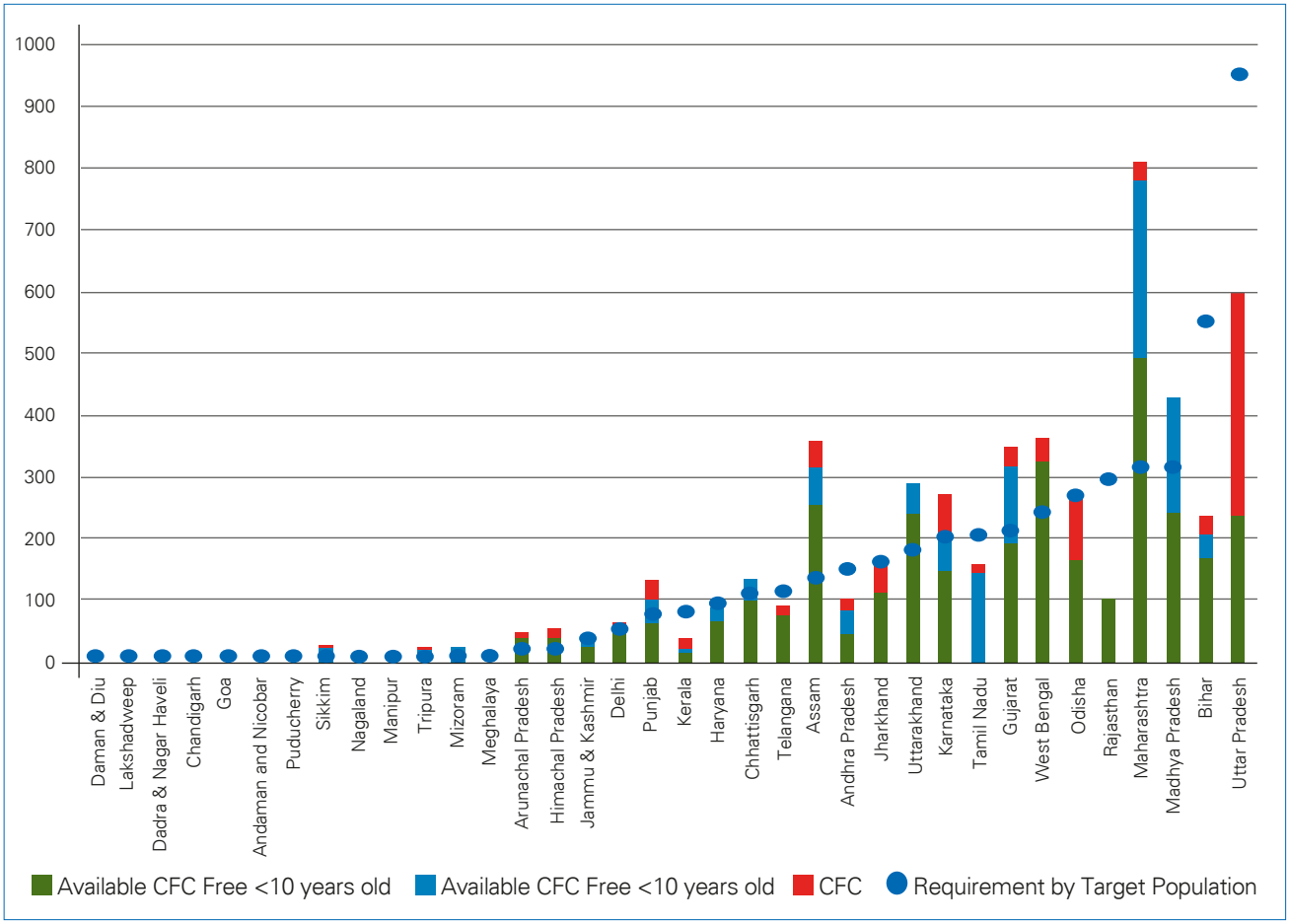


Figure 9: Present inventory status and requirement analysis of small Ice-Lined Refrigerator for stores

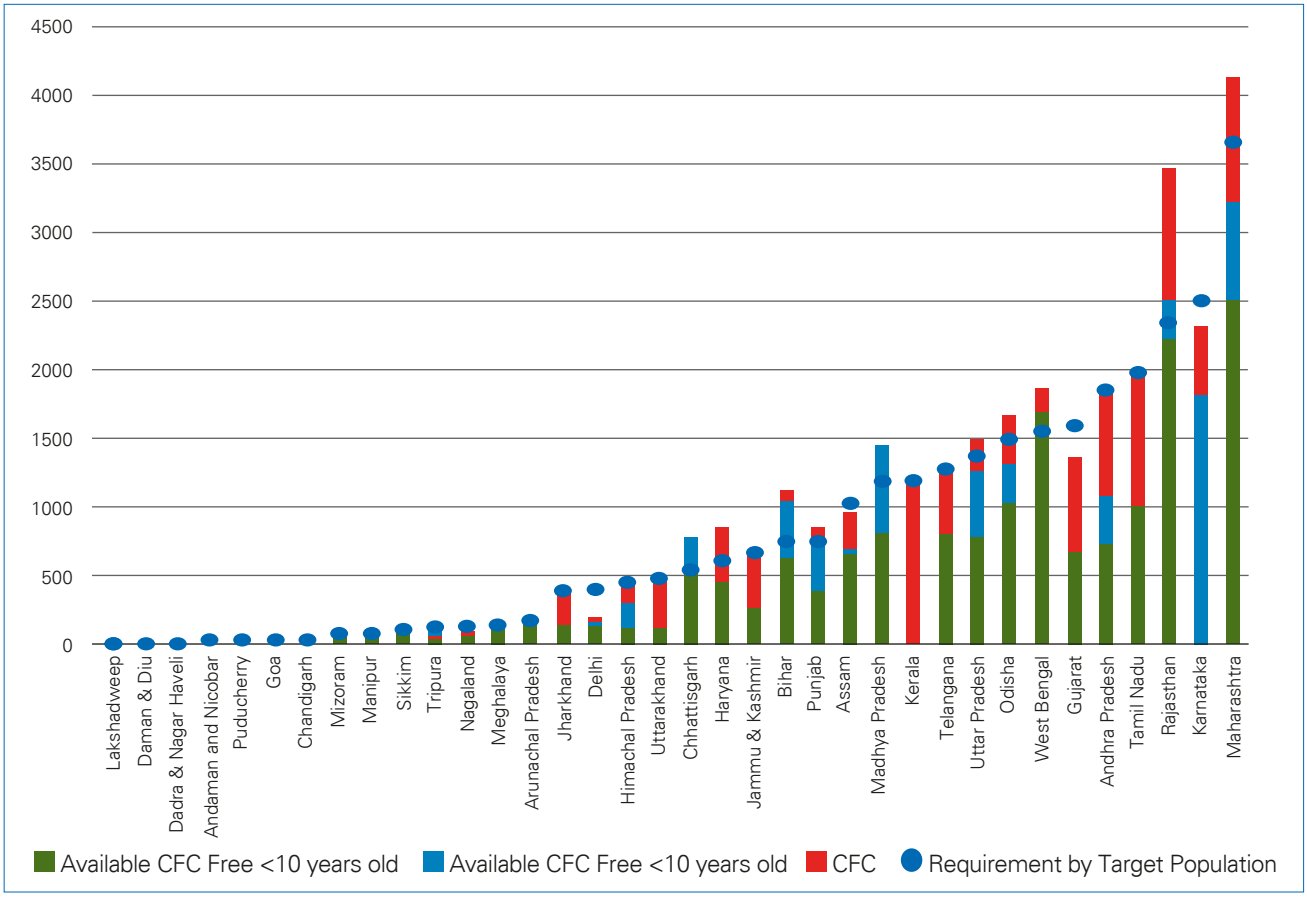


Figure 10: Present inventory status and requirement analysis of Large Deep Freezers for stores

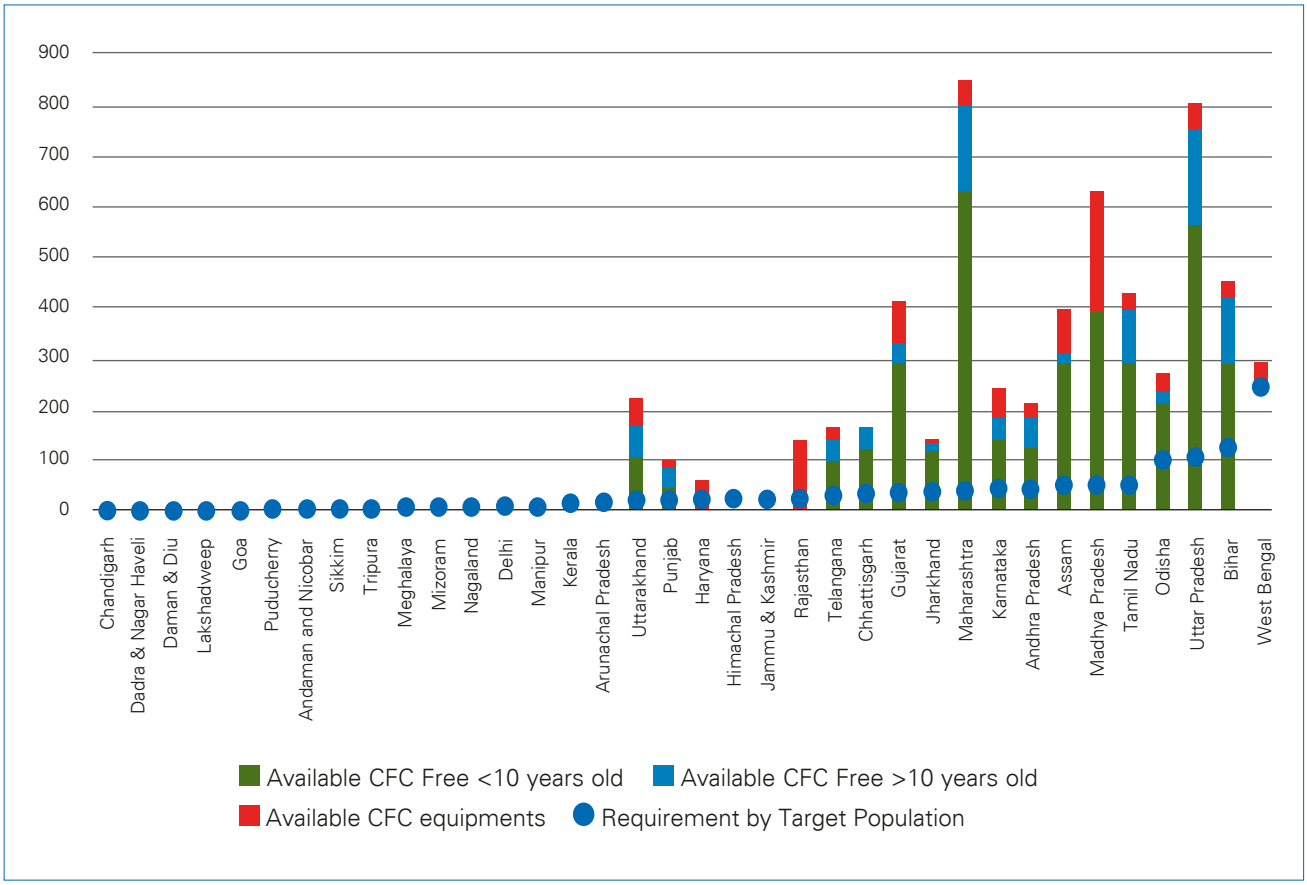
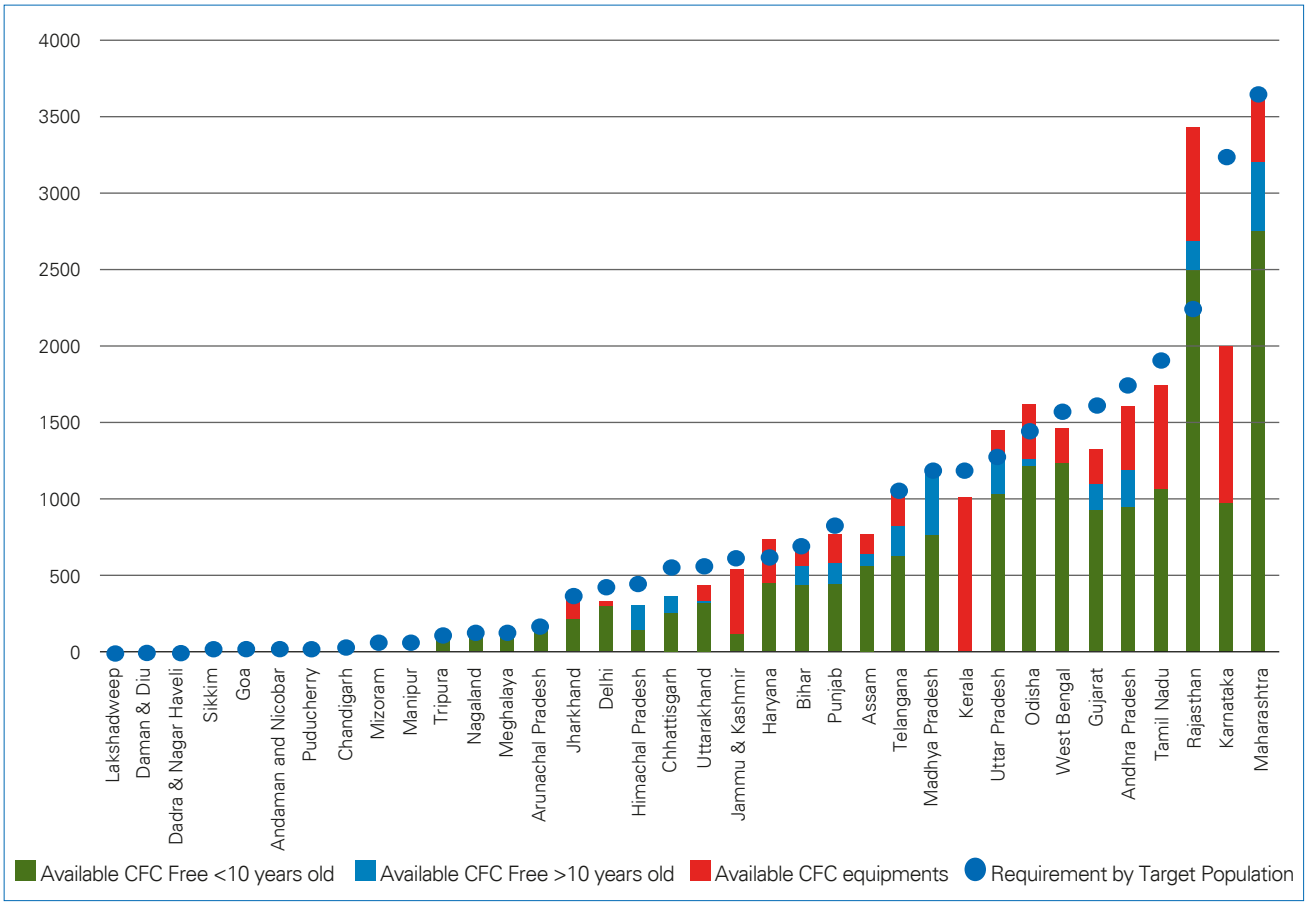
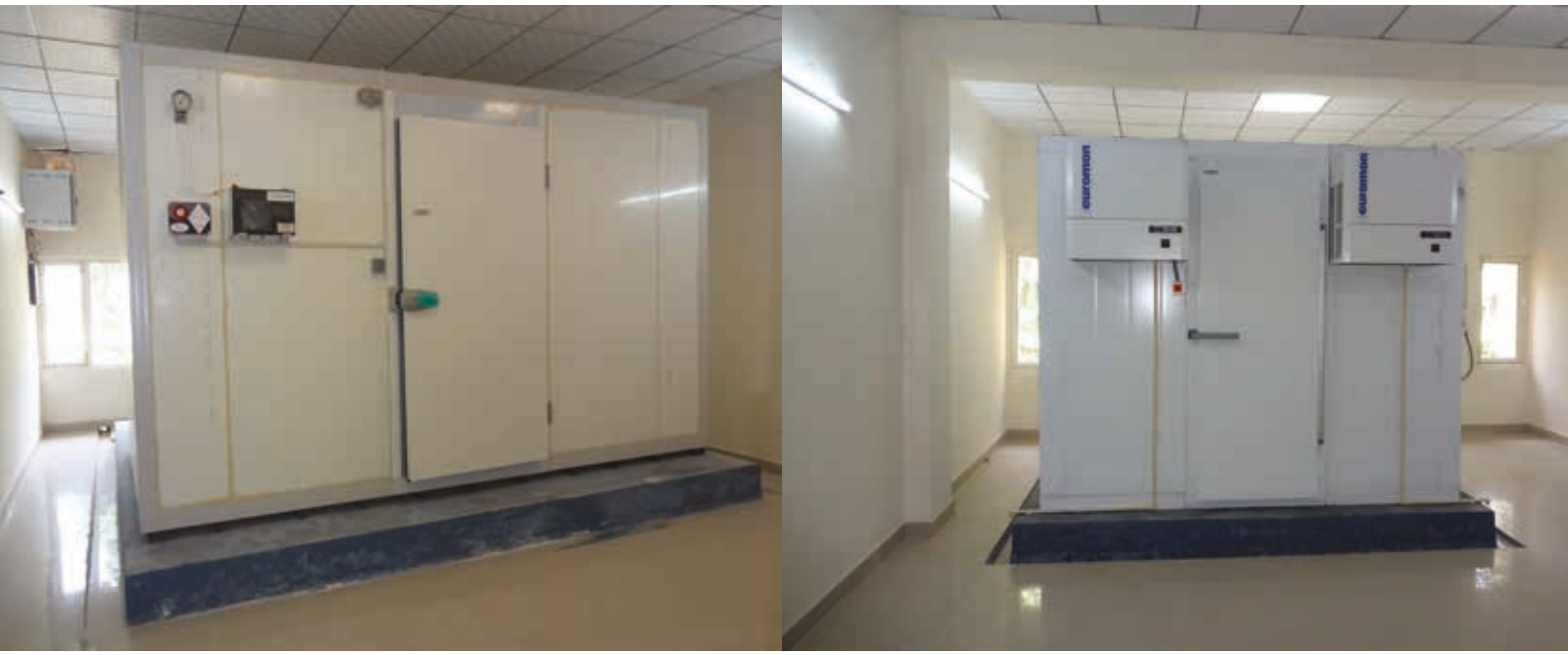


Figure 11: Present inventory status and requirement analysis of Small Deep Freezers for stores





Model WIC / WIF installation at NCCVMRC

3.3 Storage Capacity Enhancement for Current UIP Schedule

The vaccine storage capacity at various store levels needs enhancement as there are equipment that need replacement and there is a critical shortage of vaccine storage space at various levels. The following section lists out the total additional Cold Chain equipment requirement considering following factors:

- *Replacement of CFC equipment wherever needed.*
- *Replacement of CFC-Free equipment which are more than 10 years of age.*
- Additional equipment to address shortage of cold storage space.

The Cold Chain storage space requirements were computed based on standard equipment space assumptions as detailed below:

Table 20: Space assumptions for analysis

Equipment	Net storage space assumed
WIC 40 m^3*	12,000 litres
WIC 32 m^3	9,000 litres
WIC 16.5 m^3	4,500 litres
WIF 32 m^3	9,000 litres
WIF 20 m^3	6,000 litres
WIF 16.5 m^3	4,500 litres
ILR (large)	105 litres
DF (large)	220 litres
ILR (small)	45 litres
DF (small)	80 litres

*Presently only the GMSDs have the WIC of 40 cubic metre.

Table 21: Summary of Cold Chain equipment required

Type of equipment	Additional equipment required for current UIP	Additional equipment requirement for current UIP + IPV	Additional equipment required for current UIP + Rotavirus	Additional equipment required for current UIP + Pentavalent + IPV + Rotavirus
WIC 32 m^3	39	48	39	48
WIF 32 m^3	23	23	38	38
ILR large	2,124	2,601	2,742	3,506
ILR small	11,641	11,641	11,641	11,641
DF large	54	54	54	54
DF small	10,327	10,327	10,327	10,327

Walk in Cooler & Walk in Freezer Requirements

All the CFC WIC/WIF are required to be replaced with CFC-Free equipment. Furthermore, there is a requirement of bulk storage units to meet the requirement under the current UIP.

Table 22 lists out the summary of required WIC/ WIF in the country.

Table 22: Additional requirement of WIC and WIF in the country

State	Requirement*	
	WIC (32 m^3)	WIF (32 m^3)
Andaman and Nicobar		
Andhra Pradesh	2	1
Arunachal Pradesh		
Assam	1	1
Bihar	3	2
Chandigarh		
Chhattisgarh	1	
Dadra & Nagar Haveli		
Daman & Diu		
Delhi	1	1
Goa		
Gujarat	2	1
Haryana	2	1
Himachal Pradesh		
Jammu & Kashmir		
Jharkhand	1	
Karnataka	1	1
Kerala	1	1
Lakshadweep		
Madhya Pradesh	3	1
Maharashtra	2	2
Manipur		
Meghalaya		
Mizoram		
Nagaland		
Odisha	2	1
Puducherry		
Punjab	1	1
Rajasthan	1	2
Sikkim		
Tamil Nadu	2	1
Telangana	1	1
Tripura	0	0
Uttar Pradesh	8	3
Uttarakhand	1	1
West Bengal	3	2
INDIA	39	23

*All requirements were assumed on the basis of 32 m3 equipment

There is an additional requirement of 39 WIC and 23 WIF of 32 m^3 capacity for the States in the entire country to meet the present requirement for the existing UIP.

Requirement of ILR and DF

The storage equipment type dependent on the target beneficiary of the area is covered by the store. As per the storage capacity, the ILR and DF are classified in two types, small and large. Based on the requirement of the target beneficiary, commonly, the large ILR and DF are placed in the DVS and the small ILR and DF are used at the sub-district level store. Ideally, any Cold Chain point should, as a minimum, have the combination of one ILR and one DF. The requirement of ILR and DF has been calculated based on the following:

- Replacement of CFC equipment.
- Replacement of obsolete and ageing equipment.
- Requirement based on the target beneficiary and current UIP.
- Ensuring minimum one ILR and DF for every Cold Chain point.

There was a net requirement of 24,146 additional refrigerators/freezers in the country. The detailed requirement is listed below through Table 23 to Table 26.

Table 23: Large ILR requirement

State	Available CFC Free <10 years old	Net additional requirement
Andaman and Nicobar	3	1
Andhra Pradesh	75	105
Arunachal Pradesh	37	0
Assam	255	0
Bihar	134	385
Chandigarh	2	1
Chhattisgarh	98	14
Dadra & Nagar Haveli	1	1
Daman & Diu	1	0
Delhi	46	8
Goa	6	0
Gujarat	193	21
Haryana	66	28
Himachal Pradesh	17	2
Jammu & Kashmir	25	13
Jharkhand	111	50
Karnataka	148	53
Kerala	13	70
Lakshadweep	0	1
Madhya Pradesh	242	75
Maharashtra	491	0
Manipur	9	2
Meghalaya	7	7
Mizoram	19	0
Nagaland	13	0
Odisha	98	171
Puducherry	3	3
Punjab	61	14
Rajasthan	5	291
Sikkim	14	0
Tamil Nadu	89	117
Telangana	45	41
Tripura	14	0
Uttar Pradesh	236	650
Uttarakhand	112	0
West Bengal	325	0
INDIA	3,014	2,124

The requirement of ILR (large) is especially pronounced in Andhra Pradesh, Bihar, Odisha, Rajasthan, Tamil Nadu and Uttar Pradesh which accounts for more than 80 per cent of the entire requirement.

Table 24: Small ILR requirement

State	Available CFC Free <10 years old	Net additional requirement
Andaman and Nicobar	29	15
Andhra Pradesh	735	1,132
Arunachal Pradesh	145	38
Assam	664	377
Bihar	638	109
Chandigarh	0	59
Chhattisgarh	552	9
Dadra & Nagar Haveli	7	6
Daman & Diu	8	1
Delhi	144	275
Goa	36	22
Gujarat	675	936
Haryana	455	161
Himachal Pradesh	133	319
Jammu & Kashmir	271	411
Jharkhand	151	248
Karnataka	1,218	1,294
Kerala	231	975
Lakshadweep	4	2
Madhya Pradesh	820	373
Maharashtra	2,510	1,157
Manipur	56	36
Meghalaya	86	59
Mizoram	67	18
Nagaland	68	63
Odisha	1,035	474
Puducherry	14	38
Punjab	394	358
Rajasthan	2,232	112
Sikkim	55	56
Tamil Nadu	1,012	975
Telangana	804	486
Tripura	37	84
Uttar Pradesh	784	601
Uttarakhand	120	362
West Bengal	1,691	0
INDIA	17,881	11,641

Andhra Pradesh, Gujarat, Karnataka, Kerala, Maharashtra, Tamil Nadu and Uttar Pradesh need more than 60 per cent of the entire requirement of ILR (Small) for the country.

Assuming the use of DF (large) only at the district level, there is no substantial requirement of DF (large) across the country.

Table 25: Requirement of large DF

State	Available CFC Free <10 years old	Net additional requirement
Andaman and Nicobar	3	3
Andhra Pradesh	118	0
Arunachal Pradesh	31	0
Assam	288	0
Bihar	293	0
Chandigarh	2	0
Chhattisgarh	121	0
Dadra & Nagar Haveli	0	1
Daman & Diu	0	1
Delhi	17	0
Goa	0	2
Gujarat	289	0
Haryana	39	0
Himachal Pradesh	22	3
Jammu & Kashmir	7	18
Jharkhand	111	0
Karnataka	142	0
Kerala	16	0
Lakshadweep	1	0
Madhya Pradesh	394	0
Maharashtra	633	0
Manipur	8	5
Meghalaya	15	0
Mizoram	20	0
Nagaland	15	0
Odisha	208	0
Puducherry	2	2
Punjab	47	0
Rajasthan	14	19
Sikkim	8	0
Tamil Nadu	292	0
Telangana	95	0
Tripura	16	0
Uttar Pradesh	561	0
Uttarakhand	98	0
West Bengal	260	0
INDIA	4,186	54

Table 26: Requirement of small DF

State	Available CFC Free <10 years old	Net additional requirement
Andaman and Nicobar	30	14
Andhra Pradesh	957	792
Arunachal Pradesh	118	58
Assam	573	308
Bihar	438	265
Chandigarh	0	59
Chhattisgarh	265	295
Dadra & Nagar Haveli	8	5
Daman & Diu	10	0
Delhi	303	119
Goa	22	21
Gujarat	934	687
Haryana	453	176
Himachal Pradesh	151	301
Jammu & Kashmir	118	509
Jharkhand	216	157
Karnataka	1,130	1,234
Kerala	203	1,003
Lakshadweep	1	3
Madhya Pradesh	771	422
Maharashtra	2,751	910
Manipur	49	50
Meghalaya	98	46
Mizoram	65	20
Nagaland	54	77
Odisha	1,219	227
Puducherry	31	21
Punjab	432	417
Rajasthan	2,506	0
Sikkim	32	6
Tamil Nadu	1,067	853
Telangana	630	436
Tripura	100	21
Uttar Pradesh	1,026	253
Uttarakhand	323	241
West Bengal	1,245	321
INDIA	18,329	10,327

Andhra Pradesh, Gujarat, Jammu & Kashmir, Karnataka, Kerala, Maharashtra and Tamil Nadu need to constitute more than 60 per cent of the DF (Small) requirement countrywide.

3.4 Future Scenarios

The immunization programme of India is expanding with the addition of newer vaccines and additional Cold Chain points closer to the community in order to deliver vaccines safely to the immunization session site and follow open vial policy. This requires expansion of Cold Chain points from the existing sites with additional Cold Chain equipment and infrastructure. India's immunization programme has recently witnessed the addition of the second dose of measles in a phased manner country wide. Similar initiatives are also on the cards and the Immunization Division of the Ministry of Health & Family Welfare is progressing towards introduction of newer vaccines in the immunization schedule. Notable among these newer vaccines are the pentavalent vaccine affording protection against five vaccine preventable diseases (Diphtheria, Pertussis, Tetanus, Hemophilus influenzae B and Hepatitis B). Although the introduction of pentavalent requires less Cold Chain space, it needs to be more reliable keeping in mind the sensitivity of the vaccine to low temperatures. This requires institution of continuous temperature monitoring system at all levels into the present Cold Chain system. Following on the success of the Polio eradication efforts with OPV, the next logical step is the introduction of IPV. Similarly, Rotavirus diarrhoea is another common ailment targeted by the rotavirus vaccine aimed at limiting infant morbidity and mortality.

3.4.1 Storage Space Requirement With IPV

The injectable IPV is the logical addition to the routine immunization programme following the success of Polio eradication efforts with OPV. However, the IPV introduction requires additional Cold Chain space at $+2^0$C to $+8^0$C at all levels of storage and this needs to be factored in subsequent Cold Chain planning. The storage requirement of IPV vaccine has been assumed on the basis of single dose per beneficiary. The equipment requirement in view of IPV introduction is given in the subsequent tables.

Table 27: Requirement of WIC with IPV introduction at SVS/RVS

State	Available CFC Free < 10 years old (32 m^3 + 16 m^3)	Net additional requirement for IPV (32 m^3)
Andaman and Nicobar	0	1
Andhra Pradesh	6	3
Arunachal Pradesh	1	0
Assam	4	1
Bihar	7	5
Chandigarh	1	0
Chhattisgarh	4	1
Dadra & Nagar Haveli	0	0
Daman & Diu	0	0
Delhi	1	1
Goa	1	0
Gujarat	5	2
Haryana	2	2
Himachal Pradesh	2	0
Jammu & Kashmir	3	0
Jharkhand	5	1
Karnataka	6	1
Kerala	2	1
Lakshadweep	0	0
Madhya Pradesh	8	3
Maharashtra	11	3
Manipur	1	0
Meghalaya	2	0
Mizoram	1	0
Nagaland	1	0
Odisha	7	2
Puducherry	0	1
Punjab	4	1
Rajasthan	9	1
Sikkim	0	1
Tamil Nadu	8	2
Telangana	2	1
Tripura	1	0
Uttar Pradesh	15	10
Uttarakhand	3	1
West Bengal	16	3
Total	**139**	**48**

The introduction of IPV will require total 48 WIC in different States. There is a total requirement of 32 equipment in Andhra Pradesh, Bihar, Gujarat, Madhya Pradesh, Maharashtra, Odisha, Tamil Nadu, Uttar Pradesh and West Bengal which accounts 66 per cent of the total requirement of the country.

Table 28: Requirement of large DF with IPV introduction

State	Available CFC Free <10 years old	Net additional requirement
Andaman and Nicobar	3	3
Andhra Pradesh	118	0
Arunachal Pradesh	31	0
Assam	288	0
Bihar	293	0
Chandigarh	2	0
Chhattisgarh	121	0
Dadra & Nagar Haveli	0	1
Daman & Diu	0	1
Delhi	17	0
Goa	0	2
Gujarat	289	0
Haryana	39	0
Himachal Pradesh	22	3
Jammu & Kashmir	7	18
Jharkhand	111	0
Karnataka	142	0
Kerala	16	0
Lakshadweep	1	0
Madhya Pradesh	394	0
Maharashtra	633	0
Manipur	8	5
Meghalaya	15	0
Mizoram	20	0
Nagaland	15	0
Odisha	208	0
Puducherry	2	2
Punjab	47	0
Rajasthan	14	19
Sikkim	8	0
Tamil Nadu	292	0
Telangana	95	0
Tripura	16	0
Uttar Pradesh	561	0
Uttarakhand	98	0
West Bengal	260	0
Total	**4,312**	**54**

The introduction of IPV will not have any impact on the requirement of large DF in the country. As from the vaccine storage perspective, the large DF are only used for the storage of OPV.

Table 29: Requirement of small DF with IPV introduction

State	Available CFC Free <10 years old	Net additional requirement
Andaman and Nicobar	30	14
Andhra Pradesh	957	792
Arunachal Pradesh	118	58
Assam	573	308
Bihar	438	265
Chandigarh	0	59
Chhattisgarh	265	295
Dadra & Nagar Haveli	8	5
Daman & Diu	10	0
Delhi	303	119
Goa	22	21
Gujarat	934	687
Haryana	453	176
Himachal Pradesh	151	301
Jammu & Kashmir	118	509
Jharkhand	216	157
Karnataka	1,130	1,234
Kerala	203	1,003
Lakshadweep	1	3
Madhya Pradesh	771	422
Maharashtra	2,751	910
Manipur	49	50
Meghalaya	98	46
Mizoram	65	20
Nagaland	54	77
Odisha	1,219	227
Puducherry	31	21
Punjab	432	417
Rajasthan	2,506	0
Sikkim	32	6
Tamil Nadu	1,067	853
Telangana	630	436
Tripura	100	21
Uttar Pradesh	1,026	253
Uttarakhand	323	241
West Bengal	1,245	321
Total	**19,550**	**10,327**

As in the DF large, the DF small requirement is not affected by the introduction of IPV. The small DF are used at the sub district level only for the preparation of ice packs used for vaccine transportation to the outreach session sites.

Table 30: Requirement of large ILR with IPV introduction

State	Available CFC Free <10 years old	Net additional requirement
Andaman and Nicobar	3	1
Andhra Pradesh	75	127
Arunachal Pradesh	37	0
Assam	255	0
Bihar	134	461
Chandigarh	2	2
Chhattisgarh	98	30
Dadra & Nagar Haveli	1	1
Daman & Diu	1	0
Delhi	46	16
Goa	6	0
Gujarat	193	55
Haryana	66	42
Himachal Pradesh	17	5
Jammu & Kashmir	25	19
Jharkhand	111	69
Karnataka	148	82
Kerala	13	83
Lakshadweep	0	1
Madhya Pradesh	242	125
Maharashtra	491	0
Manipur	9	2
Meghalaya	7	9
Mizoram	19	0
Nagaland	13	0
Odisha	98	171
Puducherry	3	4
Punjab	61	25
Rajasthan	5	330
Sikkim	14	0
Tamil Nadu	89	147
Telangana	45	55
Tripura	14	0
Uttar Pradesh	236	739
Uttarakhand	112	0
West Bengal	325	0
Total	**3,014**	**2,601**

As the IPV requires a storage space of +2^{0}C to +8^{0}C it will create the demand of large ILR. The country needs 2,601 large ILR due to the inclusion of IPV in the immunization schedule. Out of the total requirement, States like Uttar Pradesh, Tamil Nadu, Rajasthan, Odisha, Madhya Pradesh, Bihar Andhra Pradesh require 2,100 numbers of large ILR which is 80 per cent of the total requirement.

Table 31: Requirement of small ILR with IPV introduction

State	Available CFC Free <10 years old	Net additional requirement
Andaman and Nicobar	29	15
Andhra Pradesh	735	1,132
Arunachal Pradesh	145	38
Assam	664	377
Bihar	638	109
Chandigarh	0	59
Chhattisgarh	552	9
Dadra & Nagar Haveli	7	6
Daman & Diu	8	1
Delhi	144	275
Goa	36	22
Gujarat	675	936
Haryana	455	161
Himachal Pradesh	133	319
Jammu & Kashmir	271	411
Jharkhand	151	248
Karnataka	1,218	1,294
Kerala	231	975
Lakshadweep	4	2
Madhya Pradesh	820	373
Maharashtra	2,510	1,157
Manipur	56	36
Meghalaya	86	59
Mizoram	67	18
Nagaland	68	63
Odisha	1,035	474
Puducherry	14	38
Punjab	394	358
Rajasthan	2,232	112
Sikkim	55	56
Tamil Nadu	1,012	975
Telangana	804	486
Tripura	37	84
Uttar Pradesh	784	601
Uttarakhand	120	362
West Bengal	1,691	0
Total	**19,151**	**11,641**

The country requires a total of 11,641 number of small ILRs. States like Uttarakhand, Uttar Pradesh, Telangana, Tamil Nadu, Punjab, Odisha, Maharashtra, Kerala, and Karnataka are major contributors in the total requirement.

3.4.2 Storage Space Requirement with Rotavirus Vaccine

An important cause of infant and childhood morbidity and mortality due to rotavirus diarrhoea is proposed to be addressed through the introduction of the Rotavirus vaccine (116 e) in the routine immunization programme. The storage for this vaccine is at -15^{0}C to -25^{0}C at State and regional levels and at +2^{0}C to +8^{0}C at district and health facility levels. The oral form of this vaccine has a significant impact on space requirements for storage. The storage space projection has been arrived on the basis of three doses of Rotavirus vaccine per target beneficiary.

Table 32: Requirement of WIF with Rotavirus introduction

State	Available CFC Free <10 years old	Net additional requirement
Andaman and Nicobar	0	0
Andhra Pradesh	1	2
Arunachal Pradesh	0	1
Assam	1	1
Bihar	2	4
Chandigarh	0	0
Chhattisgarh	2	1
Dadra & Nagar Haveli	0	0
Daman & Diu	0	0
Delhi	0	1
Goa	0	1
Gujarat	1	2
Haryana	1	1
Himachal Pradesh	1	1
Jammu & Kashmir	1	1
Jharkhand	3	1
Karnataka	2	1
Kerala	1	1
Lakshadweep	0	0
Madhya Pradesh	4	1
Maharashtra	4	1
Manipur	0	1
Meghalaya	0	1
Mizoram	0	1
Nagaland	0	1
Odisha	1	1
Puducherry	0	0
Punjab	2	1
Rajasthan	2	3
Sikkim	0	0
Tamil Nadu	2	1
Telangana	0	2
Tripura	1	0
Uttar Pradesh	7	3
Uttarakhand	1	0
West Bengal	2	2
Total	**42**	**38**

The largest requirement of WIF will be in Bihar, Rajasthan and Uttar Pradesh with introduction of Rota vaccine.

Table 33: Requirement of large DF with Rotavirus introduction

State	Available CFC Free <10 years old	Net additional requirement
Andaman and Nicobar	3	3
Andhra Pradesh	118	0
Arunachal Pradesh	31	0
Assam	288	0
Bihar	293	0
Chandigarh	2	0
Chhattisgarh	121	0
Dadra & Nagar Haveli	0	1
Daman & Diu	0	1
Delhi	17	0
Goa	0	2
Gujarat	289	0
Haryana	39	0
Himachal Pradesh	22	3
Jammu & Kashmir	7	18
Jharkhand	111	0
Karnataka	142	0

State	Available CFC Free <10 years old	Net additional requirement
Kerala	16	0
Lakshadweep	1	0
Madhya Pradesh	394	0
Maharashtra	633	0
Manipur	8	5
Meghalaya	15	0
Mizoram	20	0
Nagaland	15	0
Odisha	208	0
Puducherry	2	2
Punjab	47	0
Rajasthan	14	19
Sikkim	8	0
Tamil Nadu	292	0
Telangana	95	0
Tripura	16	0
Uttar Pradesh	561	0
Uttarakhand	98	0
West Bengal	260	0
Total	**4,312**	**54**

There is no impact of Rota vaccine on large DF requirement.

Table 34: Requirement of small DF with Rotavirus introduction

State	Available CFC Free <10 years old	Net additional requirement
Andaman and Nicobar	30	14
Andhra Pradesh	957	792
Arunachal Pradesh	118	58
Assam	573	308
Bihar	438	265
Chandigarh	0	59
Chhattisgarh	265	295
Dadra & Nagar Haveli	8	5
Daman & Diu	10	0
Delhi	303	119
Goa	22	21
Gujarat	934	687
Haryana	453	176
Himachal Pradesh	151	301
Jammu & Kashmir	118	509
Jharkhand	216	157
Karnataka	1,130	1,234
Kerala	203	1003
Lakshadweep	1	3
Madhya Pradesh	771	422
Maharashtra	2,751	910
Manipur	49	50
Meghalaya	98	46
Mizoram	65	20
Nagaland	54	77
Odisha	1,219	227
Puducherry	31	21
Punjab	432	417
Rajasthan	2,506	0
Sikkim	32	6
Tamil Nadu	1,067	853
Telangana	630	436
Tripura	100	21
Uttar Pradesh	1,026	253
Uttarakhand	323	241
West Bengal	1,245	321
Total	**19,550**	**10,327**

There is a total requirement of 10,327 numbers of DF small in the country. States like West Bengal, Uttar Pradesh, Telangana, Tamil Nadu, Madhya Pradesh, Kerala and Andhra Pradesh account for more than 50 per cent of the total requirement.

Table 35: Requirement of large ILR with Rotavirus introduction

State	Available CFC Free <10 years old	Net additional requirement
Andaman and Nicobar	3	1
Andhra Pradesh	75	131
Arunachal Pradesh	37	
Assam	255	
Bihar	134	475
Chandigarh	2	2
Chhattisgarh	98	33
Dadra & Nagar Haveli	1	1
Daman & Diu	1	
Delhi	46	18

State	Available CFC Free <10 years old	Net additional requirement
Goa	6	
Gujarat	193	61
Haryana	66	45
Himachal Pradesh	17	5
Jammu & Kashmir	25	20
Jharkhand	111	73
Karnataka	148	88
Kerala	13	86
Lakshadweep	0	1
Madhya Pradesh	242	134
Maharashtra	491	
Manipur	9	2
Meghalaya	7	9
Mizoram	19	
Nagaland	13	
Odisha	98	170
Puducherry	3	4
Punjab	61	27
Rajasthan	5	360
Sikkim	14	
Tamil Nadu	89	153
Telangana	45	57
Tripura	14	
Uttar Pradesh	236	714
Uttarakhand	112	72
West Bengal	325	
Total	**3,014**	**2,742**

An additional 2,742 large ILRs would be required in Rota vaccine introduction of which the maximum requirement is in Uttar Pradesh, Bihar and Rajasthan.

Table 36: Requirement of small ILR with Rotavirus introduction

State	Available CFC Free <10 years old	Net additional requirement
Andaman and Nicobar	29	15
Andhra Pradesh	735	1132
Arunachal Pradesh	145	38
Assam	664	377
Bihar	638	109
Chandigarh	0	59
Chhattisgarh	552	9
Dadra & Nagar Haveli	7	6
Daman & Diu	8	1
Delhi	144	275
Goa	36	22
Gujarat	675	936
Haryana	455	161
Himachal Pradesh	133	319
Jammu & Kashmir	271	411
Jharkhand	151	248
Karnataka	1,218	1,294
Kerala	231	975
Lakshadweep	4	2
Madhya Pradesh	820	373
Maharashtra	2,510	1,157
Manipur	56	36
Meghalaya	86	59
Mizoram	67	18
Nagaland	68	63
Odisha	1,035	474
Puducherry	14	38
Punjab	394	358
Rajasthan	2,232	112
Sikkim	55	56
Tamil Nadu	1,012	975
Telangana	804	486
Tripura	37	84
Uttar Pradesh	784	601
Uttarakhand	120	362
West Bengal	1,691	0
Total	**19,151**	**11,641**

The Rota vaccine introduction will require 11,641 small ILR in the country. The States like Uttarakhand, Uttar Pradesh, Punjab, Odisha, Andhra Pradesh accounts for the majority of the requirement.

Table 37: Cold Chain equipment requirement with current UIP vaccines along with Pentavalent, IPV and Rotavirus vaccines combined

State	WIC	WIF	ILR(L)	DF(L)	ILR(S)	DF(S)
Andaman and Nicobar	0	1	2	3	15	14
Andhra Pradesh	1	0	158	0	1,132	792
Arunachal Pradesh	0	1	4	0	38	58
Assam	0	1	21	0	377	308
Bihar	3	2	570	0	109	265
Chandigarh	0	1	3	0	59	59
Chhattisgarh	0	0	40	0	9	295
Dadra & Nagar Haveli	1	1	2	1	6	5
Daman & Diu	0	1	1	1	1	0
Delhi	2	1	22	0	275	119
Goa	1	2	2	2	22	21
Gujarat	0	0	74	0	936	687
Haryana	2	1	54	0	161	176
Himachal Pradesh	0	1	6	3	319	301
Jammu & Kashmir	1	1	24	18	411	509
Jharkhand	2	1	88	0	248	157
Karnataka	0	0	106	0	1,294	1,234
Kerala	2	1	104	0	975	1,003
Lakshadweep	1	3	2	0	2	3
Madhya Pradesh	9	1	161	0	373	422
Maharashtra	1	0	65	0	1,157	910
Manipur	0	1	3	5	36	50
Meghalaya	1	1	11	0	59	46
Mizoram	1	1	8	0	18	20
Nagaland	1	1	5	0	63	77
Odisha	1	1	204	0	474	227
Puducherry	1	1	5	2	38	21
Punjab	0	1	33	0	358	417
Rajasthan	0	2	432	19	112	0
Sikkim	1	1	6	0	56	6
Tamil Nadu	0	1	184	0	975	853
Telangana	1	1	69	0	486	436
Tripura	0	1	8	0	84	21
Uttar Pradesh	10	3	920	0	601	253
Uttarakhand	0	1	72	0	362	241
West Bengal	5	1	37	0	0	321
Total	**48**	**38**	**3,506**	**54**	**11,641**	**10,327**

The above table is a summary of various types of active Cold Chain equipment requirement that resulted after the newer vaccines like IPV, Rota, Pentavalent were included in the current UIP. The MR vaccine under the UIP will have no impact in the requirement of cold space as the vial volume of current Measles vaccines are same as that of MR vaccine. While calculating the space projection, this has been assumed that one sub-district Cold Chain point requires minimum one small ILR and one small DF, irrespective of the population served by the store. However, if the store requires more than one small ILR or DF then instead of going for more small ILR and DF the store should be provided with large ILR or large DF as per the requirement.

3.5 Proposed Augmentation of Cold Chain Space

The Immunization Division of the Ministry of Health & Family Welfare, Government of India, has been actively involved in planning for the procurement of additional Cold Chain equipment to address the increased number of beneficiaries, replacement of ageing equipment and introduction of newer and underutilized vaccines. The current procurement of equipment is being processed under GAVI-HSS and KFW assistance and the immunization division of MoHFW has drawn up a tentative distribution list for the same. Based on the distribution list, this section attempts to highlight the impact of this additional augmentation on the available Cold Chain space.

Table 38: Summary of proposed augmentation*

Equipment	Existing	Additional requirement	Proposed augmentation under GAVI-HSS, KFW assistance
WIC 40	8	0	7
WIC 32	19	48	30
WIC 16.5	213	0	23
WIF 32	10	38	8
WIF 20	7	0	2
WIF 16.5	32	0	0
DF large**	5,657	54	3,683
ILR large**	4,772	3,50	3,850
DF small**	25,213	10,327	7,957
ILR small**	28,851	11,641	9,355

*This includes equipment under GAVI-HSS/KFW support

**Space assumptions: ILR(L) – 140 litres; ILR(S) – 95 litres; DF(L) – 220 litres; DF(S) – 80 litres as per the revised specification of MoHFW

This proposed augmentation goes a long way in fulfilling the Cold Chain space requirements with all types of equipment except DF Small and ILR Small which have a shortfall even after the proposed augmentation by around 3,000 units and 2,500 units respectively.

Storage space analysis of GMSDs

A well maintained ware house

A poorly maintained ware house

Government Medical Store Depots form the first point of storage for vaccines entering the country. They are the national level stores and each of these four stores have a defined catchment area for vaccines provision. Karnal and Chennai have a deficiency in the -15°C to -25°C while Mumbai has a deficiency in the +2°C to +8°C storage capacity.

Table 39: Cold Chain space in GMSDs for the current UIP schedule

S.No.	Name of the States	States fully supplied by the GMSDs	States with buffer supply from GMSDs	Beneficiary	Cold space requirement for a three month cycle (+2 to +8) °C	Available (+2 to +8) °C	Cold space requirement for a three month cycle (-15 to -25) °C	Available (-15 to -25) °C
GMSD Karnal								
1	Chandigarh	√	X	18,000	35,569	570,836 (of which 566,336 is hired space, and 4,500 is owned space	26,101	21,000
2	Himachal Pradesh	√	X	111,000				
3	Jammu & Kashmir	√	X	221,000				
4	Uttarakhand	√	X	189,000				
5	NCT of Delhi	X	√	313,000				
6	Haryana	X	√	555,000				
7	Punjab	X	√	445,000				
8	Rajasthan	X	√	1,779,000				
9	Uttar Pradesh	X	√	5,499,000				
GMSD Mumbai								
10	Dadra & Nagar Haveli	√	X	10,000	26,421	24,000	18,071	29,294
11	Daman & Diu	√	X	5,000				
12	Lakshadweep	√	X	1,000				
13	Goa	√	X	21,000				
14	Chhattisgarh	X	√	624,000				
15	Gujarat	X	√	1,282,000				
16	Madhya Pradesh	X	√	1,924,000				
17	Maharashtra	X	√	1,904,000				
GMSD Chennai								
18	Puducherry	√	X	2,3000	22,990	24,000	15,520	9,524
19	Karnataka	X	√	1,133,000				
20	Kerala	X	√	503,000				
21	Tamil Nadu	X	√	1,132,000				
22	Andhra Pradesh	X	√	852,670				
23	Telangana	X	√	609,330				
GMSD Kolkata								
24	Andaman & Nicobar Islands	√	X	6,000	32,493	48,000	22,789	37,894
25	Arunachal Pradesh	√	X	27,000				
26	Manipur	√	X	43,000				
27	Meghalaya	√	X	70,000				
28	Mizoram	√	X	18,000				
29	Nagaland	√	X	31,000				
30	Tripura	√	X	52,000				
31	Sikkim	√	X	11,000				
32	Assam	X	√	692,000				
33	Bihar	X	√	2,884,000				
34	Jharkhand	X	√	822,000				
35	Odisha	X	√	814,000				
36	West Bengal	X	√	1,467,000				
Total				**26,091,000**				

Table 40: Additional requirement of Cold Chain space in GMSDs for the current UIP schedule

Additional Requirement of equipment at GMSDs for the current UIP							
		Storage Space for +2°C to +8°C			Storage space for -15°C to -25°C		
S. No.	Name of the GMSDs	Cold Space requirement for a three month cycle	Available	Additional equipment required 40 m^3	Cold Space requirement for a three month cycle (-15 to -25) °C	Available (-15 to -25) °C	Additional equipment required 40 m^3
1	GMSD Karnal	35,569	4,500	3	26,101	21,000	1
2	GMSD Mumbai	26,421	24,000	1	18,071	29,294	0
3	GMSD Chennai	22,990	24,000	0	15,520	9,524	1
4	GMSD Kolkata	32,493	48,000	0	22,789	37,894	0
Total		**117,473**	**100,500**	**4**	**82,481**	**97,712**	**2**

There is a requirement of storage space in GMSD Karnal and GMSD Mumbai. GMSD Kolkata and Chennai are having sufficient space for storing the current UIP vaccine. To meet the present space requirement, the GMSD Karnal primarily depends on the hired cold space. The following table depicts GMSD wise requirement of equipment for the current UIP. The equipment requirement in the GMSDs has been projected in terms of 40 m^3 of WIC and WIF which is coming to 4 WICs and 2 WIFs.

3.6 Cold Chain Infrastructure (Building)

This section attempts to provide a perspective on the status of buildings and other infrastructure related to the Cold Chain system, especially in terms of availability and adequacy. Standards exist for all levels of Cold Chain storage which are internationally accepted. This section also makes an effort to analyse India's readiness in terms of infrastructure to ensure efficient and high quality storage of vaccines and logistics.

The findings are expressed in terms of space available for expansion of Cold Chain (WIC/WIF installation, dry storage space and electrical fitting status)

At present there is no national standard for Cold Chain infrastructure. NCCVLAP is expected to provide the necessary guidelines on the standards for Cold Chain infrastructure.

Site Readiness for the installation of new equipment

The expansion of Cold Chain capability demands that buildings/stores at all levels have the required space to meet the expansion requirements. This usually translates into new construction to prepare for future expected needs. Installation of any WIC/WIF requires certain procedures to be followed like site assessment, 3-phase electricity connectivity, drainage system, etc. All these components require adequate physical space and hence, before supply of any WIC/WIF, these have to be ensured.

There are 171 SVS and RVS in the country which store vaccines in bulk quantity. These either have WIC/WIF or would require bulk storage equipment to meet the demand for the increased population and newer vaccines under the UIP. Of these 171 locations, 85 locations have the infrastructure related to civil work available for the installation of new equipment, 70 locations are not ready with the requisite civil work for the installation and they require on an average one year for the readiness in terms of civil work. Respondents from seven sites could not provide any information. None of the sites are ready with the electrical works required for the installation of new equipment. The electricity works will take place after the civil works are completed and as per the respondents it would require on an average four months to get ready with the electricity work after the civil works are completed.

The State site preparedness is placed in Annexure 4.

A modern ware house with use of fork-lift for dry goods handling

Adequacy of Dry Space

Dry storage space is required for the proper and safe storage of immunization supplies other than the vaccines, i.e. diluents and syringes. Diluent and syringes should have equal importance in storage as vaccines as they are also affected by higher temperature and humidity (should be less than 60 per cent). Although, it does not require strict temperature conditions, it is affected by extreme temperature conditions. In order to maintain the hygiene, it is recommended that the dry store should be non-humid, protected from direct sunlight, rain, pests etc.

Dry space was assessed on the basis of space required for diluents, droppers and syringes and reflected in terms of square feet of space assuming seven feet of storage space vertically in the present infrastructure. There is a need to modernize GMSDs and SVS by introducing fork lifts and other mechanical devices to reduce manual labour and optimize space requirements. Presently, 26.5 per cent of the SVS and RVS don't have adequate dry storage space to meet the required need.

The State dry space adequacy is placed at the Annexure 5.

3.7 Last Cold Chain Point Status

Last Cold Chain points are the lowest level facilities for vaccine storage before distribution to be fixed on outreach session sites. They are the final and key link in the immunization supply chain as far as storage is concerned. Last Cold Chain point planning and operations are a key component of ensuring that the full immunization coverage targets are achieved.

India runs its routine immunization programme through 26,384 Cold Chain points across all States and Union Territories. The average population served by each Cold Chain point in India is 45,868. However, there is a wide variation between States like Uttar Pradesh and Bihar having more than 1,50,000 population per Cold Chain point and conversely, States like Arunachal Pradesh and Andaman and Nicobar Islands with less than 10,000 population per Cold Chain point (Figure-12). Majority of the bigger States have an average population covered by each Cold Chain point from 25,000 to 50,000.

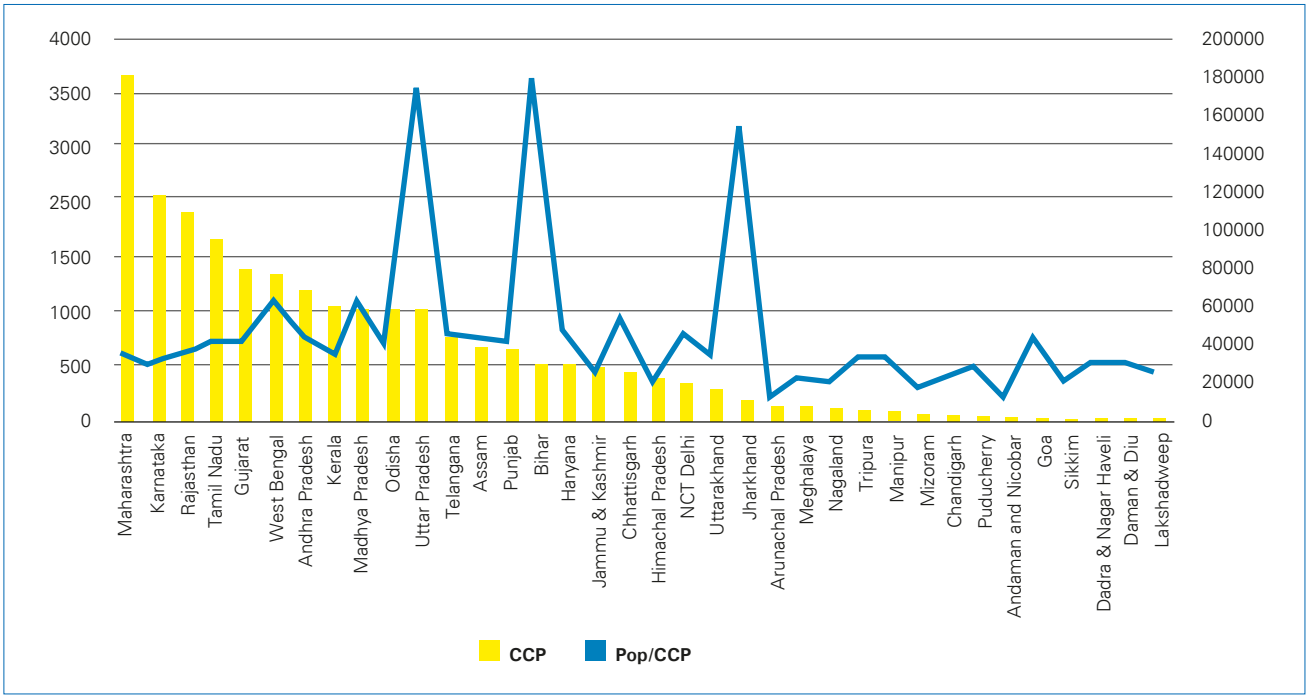
The population has been considered as a proxy indicator for the distance to immunization session sites.

Table 41: Cold Chain Point No. by State

Name of the States	Population	No. of Cold Chain Points	Population/CCP
Andaman & Nicobar Islands	379,944	44	8,635
Andhra Pradesh	49,378,806	1,369	36,069
Arunachal Pradesh	1,382,611	164	8,431
Assam	31,169,272	801	38,913
Bihar	103,804,637	586	177,141
Chandigarh	1,054,686	59	17,876
Chhattisgarh	25,540,196	513	49,786
Dadra & Nagar Haveli	342,853	13	26,373
Daman & Diu	242,911	9	26,990
NCT Delhi	16,753,235	400	41,883
Goa	1,457,723	37	39,398
Gujarat	60,383,628	1,585	38,097
Haryana	25,353,081	586	43,265
Himachal Pradesh	6,856,509	452	15,169
Jammu & Kashmir	12,548,926	579	21,673
Jharkhand	32,966,238	220	149,847
Karnataka	61130704	2,364	25,859
Kerala	33,387,677	1,206	27,685
Lakshadweep	64,429	3	21,476
Madhya Pradesh	72,597,565	1,193	60,853
Maharashtra	112,372,972	3,643	30,846
Manipur	2,721,756	87	31,285
Meghalaya	2,964,007	141	21,021
Mizoram	1,091,014	80	13,638
Nagaland	1,980,602	131	15,119
Odisha	41,947,358	1,178	35,609
Puducherry	1,244,464	51	24,401
Punjab	27,704,236	740	37,438
Rajasthan	68,621,012	2,189	31,348
Sikkim	607,688	34	17,873
Tamil Nadu	72,138,958	1,891	38,149
Telangana	35,286,757	865	40,794
Tripura	3,671,032	119	30,849
Uttar Pradesh	199,581,477	1,162	171,757
Uttarakhand	10,116,752	324	31,225
West Bengal	9,1347,736	1,566	58,332
INDIA	1,210,193,452	26,384	45,868

Bihar (1,77,141), Uttar Pradesh (1,71,757) and Jharkhand (1,49,847) are the biggest priority as far as the creation and redistribution of Cold Chain points are concerned.

Figure 12: Cold Chain point distribution across States

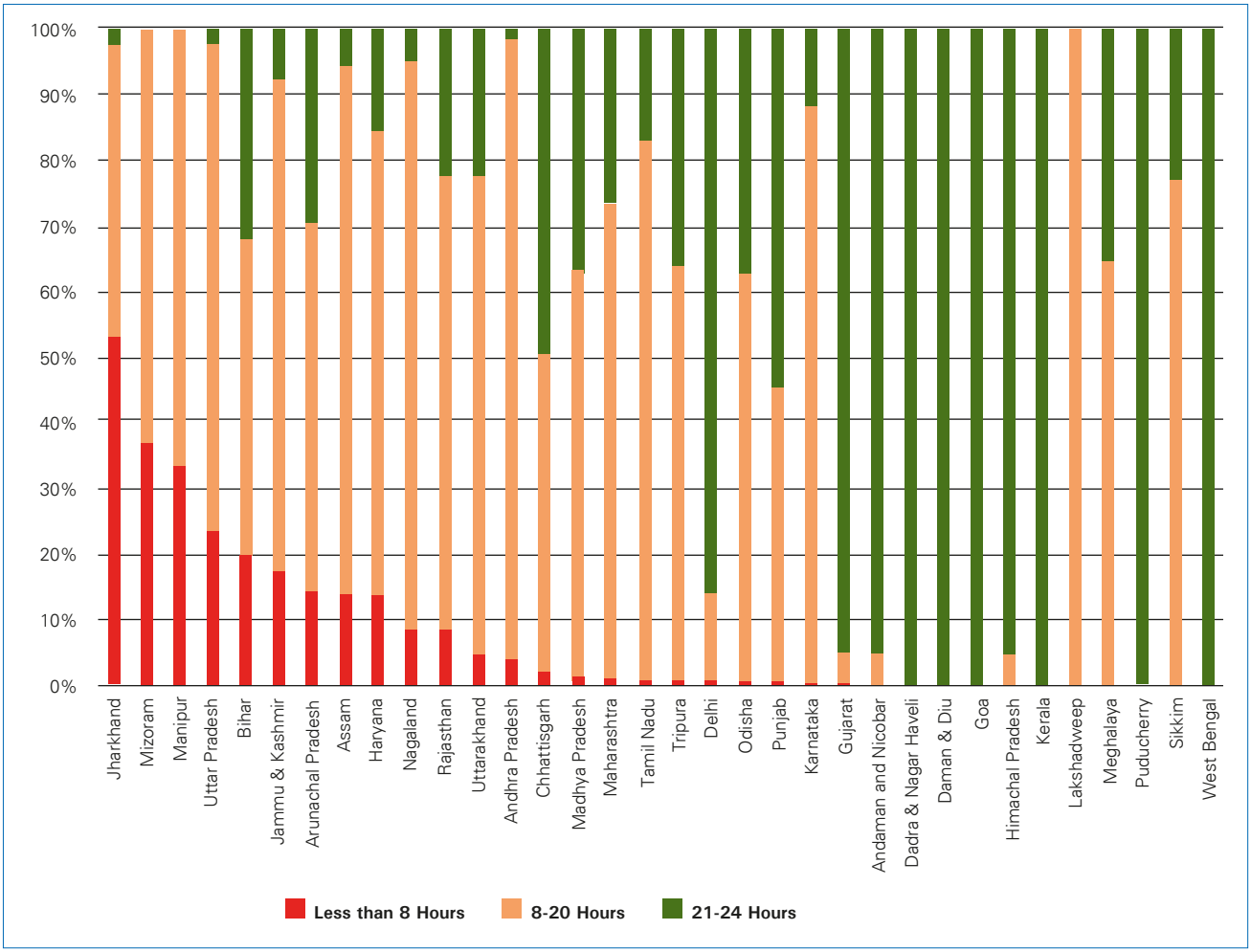


3.8 Electricity Availability at Cold Chain Points

Apart from programmatic issues, the biggest impact on Cold Chain operation and efficiency is decided by the duration and quality of electricity supply at the Cold Chain points. The basic assumptions in setting up Cold Chain points include availability of a steady source of power for functioning of the Cold Chain equipment. At a minimum, it is imperative that a Cold Chain point has regular grid power for a minimum duration of eight hours in a 24 hours cycle for temperature maintenance in the Cold Chain equipment.

Model solar panel installation at a PHC in Maharashtra

Figure 13: Distribution of electricity availability at Cold Chain points



Currently, nine States (Haryana, Assam, Arunachal Pradesh, Jammu & Kashmir, Bihar, Uttar Pradesh, Manipur, Mizoram and Jharkhand) have more than 10 per cent of their Cold Chain points which receive less than eight hours of electricity in a 24 hour cycle. This highlights the need to assess the specific Cold Chain points involved in these States which have to be provided power support for the Cold Chain in terms of solar equipment or the use of hybrid solar installations for uninterrupted power supply which will help the overall health programme beyond immunization. Details of the electricity availability can be found at Annexure 6.

3.9 Spare Parts Availability and Requirement

One of the most critical components of Cold Chain maintenance is the adequate availability of spare parts for CCE. In fact, the entire Cold Chain system is threatened in the absence of spare parts for repair and maintenance.

Out of the numerous spare parts required, a total of 25 fast moving spare parts have been selected for analysis at the GMSD level. Overall, there is a significant shortage of spare parts with only four out of the 25 identified fast moving spare parts available in adequate quantities. This reflects an immediate need to streamline the spare parts procurement planning and supply.

Table 42: Spare parts status at GMSDs as on 28-10-2015

Spare Part	Code No.	Annual requirement	Availability
Starting device	1	210	108
Starting device for FR805B compressor	2	60	51
Thermostat freezer	248	150	0
Starting device for TFS-5-AT compressor	249	210	0
Thermostat ILR	258	150	0
Starting device for 4AT compressor	259	360	25
Compressor 7.5 CFC Free	262	120	0
Starting device 7.5B	264	195	247
Starting device for FR6B compressor	456	330	1,322
Compressor FR10G complete for MF-304	801	1,710	84
Compressor FR8G complete for MK-304	802	1,380	91
Compressor FR6G complete for MF-144	803	2,445	82
Compressor TL5G HST for MK-144	804	2,685	216
Starting device for FR10G & FR6G compressors	805	2,805	811
Starting device for FR8.5G compressor	806	2,370	130
Starting device for TL5G HST compressor	807	2,160	967
Thermostat (Freezer)	808	1,770	448
Thermostat (ILR)	809	1,980	664
Thermostat for ice pack	810	150	1,414
Thermostat suspension	811	135	327
Thermostat knob	812	360	115
Thermostat (Digital)	813	1,725	650
Thermostat stem	814	6,600	0
Control panel (Freezer)	817	825	3
Control panel (ILR)	818	750	2

	Fast moving spare parts
	Medium moving spare parts
	Slow moving spare parts

3.10 Human Resource

3.10.1 Rationale for HR positions in Cold Chain System

Presently, management of entire Cold Chain infrastructure and logistics suffers from acute shortage of trained manpower. Over the year UIP has expanded and requires specialized staff to manage Cold Chain and logistics at all levels. Many of the much needed HR positions have not been officially sanctioned. It has been proposed to expand the manpower and logistics to effectively manage the UIP across the country. The details are given below.

Cold Chain Officer (CCO)

The Cold Chain officer should be an engineering graduate, having adequate experience of maintenance in refrigeration and air conditioning, required IT Skills and management experience since majority of the issues in Cold Chain are managerial in nature.[21]

[21] As per National EVM Assessment Recommendation

The CCO should be responsible to maintain Cold Chain equipment within prescribed response time and break down time, carrying out preventive maintenance, inventory control of spare parts updating of NCCMIS at all levels and training to Medical officers, refrigerator mechanics and Cold Chain handlers.

The requirement of CCO is:

National level (With MoHFW)	One
GMSD level	One each
State level (With DFW)	One for each State

Vaccine and Logistics Manager

The vaccine and logistics manager (V&LM) is required at national and State levels. The vaccine and logistics manager should be specialist in supply chain management, preferably a logistician, pharmacist or an IT person with good knowledge of MIS. Good computer knowledge is an essential requirement.

The V&LM will be responsible to manage stock of vaccine and other logistics as per WHO guidelines at all the levels of vaccine store.

The requirement of V&LM is:

National level (With MoHFW)	One
GMSD level	One each
State level (With DFW)	One for each State

Assistant Cold Chain Officer

In larger States like Uttar Pradesh, Bihar, Rajasthan, Madhya Pradesh, Maharashtra, one assistant Cold Chain officer may be deployed at selected regional level. The officer will be responsible to maintain Cold Chain of one or more region of the State. The assistant Cold Chain officer should be a diploma engineer in refrigeration and air conditioning with IT skills and worthwhile experience of maintenance of Cold Chain.

The responsibility of the assistant Cold Chain officer will be same as of Cold Chain officer.

Store Keeper

Every store up to the level of district, should have a dedicated store keeper to handle the vaccine, Cold Chain and other logistics. Store keeper could be either pharmacist or science graduate. Good computer knowledge is essential requirement. Before deployment, adequate training should be provided on vaccine management and storing in Cold Chain as per the national/WHO guidelines.

Technical Assistant Cold Chain

To assist Cold Chain officer at State level one Technical Assistant is recommended by Government of India at State level, however, very few States had posted a technical person on this post. The technical assistant should be competent enough to support and contribute toward efficient management of Cold Chain and vaccine logistics.

Cold Chain Technician

It is proposed that all Cold Chain stores from GMSD up to the district store level should have one or more Cold Chain technicians to maintain the Cold Chain equipment. The technician is responsible to maintain equipment available at specified level.

At GMSD, State and regional/divisional level, the technician will be responsible for the maintenance of Cold Chain equipment and in districts he will be responsible for the major and minor repairs at districts sub-district level. The technician should have ITI in refrigeration and air conditioning and five years' experience of repairs of CFC-free refrigerators and air conditioner along with basic IT skills in order to operate and manage NCCMIS at district, region and State level.

Table 43: Present status of CCO, CCT and CCH by State

Name of the State	Total number of districts in the State	CCO		Total number of technician		No. of districts without any technician	Total CCH	No. of trained CCH in last two years
		Regular	Contractual	Regular	Contractual			
A&N Islands	3	NA	NA	2	0	1	NA	NA
Andhra Pradesh	13	1	0	8	4	1	4,119	0
Arunachal Pradesh	17	1	0	12	3	1	166	0
Assam	27	1	0	13	1	13	2,178	920
Bihar	38	0	0	3	19	16	589	589
Chandigarh	1	0	0	1	0	0	NA	NA
Chhattisgarh	27	0	0	14	0	13	540	375
D&N Haveli	1	0	0	1	0	0	NA	NA
Daman & Diu	2	0	0	2	0	0	NA	NA
Delhi	11	0	1	2	0	9	500	181
Goa	2	0	0	1	0	1	32	20
Gujarat	26	0	0	20	8	2	1,539	1,319
Haryana	21	0	1	10	10	1	586	586
Himachal Pradesh	12	1	0	3	0	9	585	286
J & K	22	0	0	7	0	15	NA	NA
Jharkhand	24	0	1	1	18	5	218	450
Karnataka	30	1	0	1	10	19	5,228	60
Kerala	14	1	0	14	0	0	2,600	1,460
Lakshadweep	1	0	0	1	0	0	NA	NA
Madhya Pradesh	51	1	0	32	13	6	1,193	1,193
Maharashtra	35	1	0	25	13	2	3,643	2,714
Manipur	9	1	0	5	0	4	NA	NA
Meghalaya	11	1	0	NA	NA	11	NA	NA
Mizoram	8	1	0	3	1	4	80	0
Nagaland	11	1	0	NA	NA	11	NA	NA
Odisha	30	0	0	8	21	1	2,398	832
Puducherry	4	0	0	NA	NA	4	NA	NA
Punjab	20	1	0	12	8	0	2,936	2,902
Rajasthan	33	1	0	21	11	1	2,247	1,386
Sikkim	4	0	1	1	1	2	114	114
Tamil Nadu	32	0	0	14	0	18	12,600	0
Telangana	10	0	0	7	3	0	2,601	0
Tripura	8	1	0	1	7	0	650	246
Uttar Pradesh	76	0	1	57	18	1	NA	NA
Uttarakhand	13	0	1	3	10	0	622	622
West Bengal	19	1	0	0	0	19*	2,679	600
Total	**666**	**16**	**6**	**319**	**185**	**190**	**39,303**	**16,855**

NA- No information received from the States

*The State adopts CMC/AMC model for repair and maintenance through third party

Table 44: Electrical Cold Chain equipment Vs availability of Cold Chain technicians

S. No.	Name of the States	No. of districts	Total no. of electrical CCE[22]	No. of CCT	No. of CCE per CCT (Target 1:100)
1	Andaman & Nicobar Islands	3	75	2	37
2	Andhra Pradesh	13	1,966	12	164
3	Arunachal Pradesh	17	393	15	26
4	Assam	27	2,120	14	151
5	Bihar	38	2,069	22	94
6	Chandigarh	1	8	1	8
7	Chhattisgarh	27	1,340	14	96
8	Dadra & Nagar Haveli	1	31	1	31
9	Daman & Diu	2	31	2	16
10	Delhi	11	573	2	287
11	Goa	2	105	1	105
12	Gujarat	26	3,402	28	122
13	Haryana	21	1,696	20	85
14	Himachal Pradesh	12	946	3	315
15	Jammu & Kashmir	22	1,113	7	159
16	Jharkhand	24	842	19	44
17	Karnataka	30	3,810	11	346
18	Kerala	14	2,268	14	162
19	Lakshadweep	1	10	1	10
20	Madhya Pradesh	51	3,756	45	83
21	Maharashtra	35	9,436	38	248
22	Manipur	9	166	5	28
23	Meghalaya	11	380	7	54
24	Mizoram	8	172	4	43
25	Nagaland	11	194	12	24
26	Odisha	30	3,032	29	105
27	Puducherry	4	87	1	87
28	Punjab	20	1,749	20	87
29	Rajasthan	33	6,944	32	217
30	Sikkim	4	189	2	95
31	Tamil Nadu	32	4,199	14	300
32	Telangana	10	1,233	10	123
33	Tripura	8	258	8	233
34	Uttar Pradesh	76	5,549	75	52
35	Uttarakhand	13	839	13	65
36	West Bengal	19	3,781	0	NA
Total		**666**	**64,762**	**504**	**129**

[22] State-wise total number of electrical equipment including WIC/WIF.

Cold Chain Handler

The Cold Chain handler is responsible for the movement of the vaccines in State, Region, District and PHCs stores. At present there is no separate cadre of staff as Cold Chain handlers. At present, CCH are designated from existing HR like PHN/BPHN/LHV/ANM/MPW available in the PHC in addition to their routine duties. There is no system to provide induction training to CCH.

The person given the responsibility of cold chain should be given adequate training and refresher trainings at least once in two years. In case of any change, the new person should be provided induction training before taking over the responsibilities. Given the vaccine and logistics load, two dedicated Cold Chain handlers are recommended at each GMSDs, State, regional and district level and one each at PHC level.

3.10.2 Post Requirements

Table 45: Post requirements

Designation	Total positions needed	In position	Additional required
Cold Chain officer	36	22	14
Vaccine and logistics manager	36	5	31
Asst. Cold Chain officer	15	Nil	15
Technical assistant	36	8	28
Store keepers	749	NA*	NA*
Cold Chain technicians	647**	504	143
Semi-skilled helpers	NA	NA	NA
Cold Chain handlers	28,882	39,303	0

*This is assumed that the Cold Chain handler is the in charge of the store keeping

**19 districts of WB have been excluded as the State has CMC/AMC way of maintaining Cold Chain system

With exception to the store keeper and Cold Chain handler all the other critical posts have significant vacancy level across the country. The 15 large States are also required to have Asst. Cold Chain officer for the smooth management of CCVLM.

Table 46: Approved posts in CCVLM by MoHFW in State Programme Implementation Plans (2014-15)

S. No.	Posts / Name of the State	Immunization consultant	State VLM	Ref mechanic/ Cold Chain technicians	Field monitors
1	Andaman & Nicobar Islands				
2	Andhra Pradesh		1		
3	Arunachal Pradesh	1			
4	Assam		1	13	
5	Bihar				
6	Chandigarh				
7	Chhattisgarh		1		
8	D&N Haveli		1		
9	Daman & Diu				
10	Delhi				
11	Goa				
12	Gujarat				
13	Haryana				
14	Himachal Pradesh				

S. No.	Posts / Name of the State	Immunization consultant	State VLM	Ref mechanic/ Cold Chain technicians	Field monitors
15	Jammu & Kashmir		2		
16	Jharkhand	1			
17	Karnataka				
18	Kerala				
19	Lakshadweep				
20	Madhya Pradesh				
21	Maharashtra				
22	Manipur		1	4	
23	Meghalaya		1	2	
24	Mizoram				
25	Nagaland				
26	Odisha				
27	Puducherry				
28	Punjab				
29	Rajasthan		1		10
30	Sikkim				
31	Tamil Nadu			3	
32	Telangana				
33	Tripura		1		
34	Uttar Pradesh				
35	Uttarakhand		1		
36	West Bengal	1			
Total		**3**	**11**	**22**	**10**

In order to strengthen the immunization programme, the MoHFW has taken initiative to support the States by approving new posts in CCVLM component. That includes approval of Vaccine Logistics Manager post in the NHM-PIP.

Table 47: Training status in the repair and maintenance of various Cold Chain equipment and Cold Chain handlers

State	Solar refrigerator (10 Days)	WIC & WIC (7 Days)	DF & ILR (6 Days)	% CCH trained
Andhra Pradesh	0	0	6	0%
Andaman & Nicobar Islands	0	0	5	0%
Arunachal Pradesh	0	9	0	100%
Assam	0	0	0	42%
Bihar	0	13	25	100%
Chandigarh	0	4	0	0%
Chhattisgarh	0	1	0	69%
Dadra & Nagar Haveli	0	0	0	0%
Daman & Diu	0	0	0	0%
Delhi	0	0	0	0%
Goa	0	0	0	63%
Gujarat	0	1	0	86%
Haryana	0	4	5	100%
Himachal Pradesh	0	0	12	49%
Jammu & Kashmir	2	0	0	0%
Jharkhand	0	0	4	217%
Karnataka	0	5	0	0%
Kerala	0	0	0	56%
Lakshadweep	0	0	0	0%
Madhya Pradesh	0	10	5	100%
Maharashtra	0	8	2	74%
Manipur	0	0	0	0%
Meghalaya	0	0	0	0%
Mizoram	0	0	0	0%
Nagaland	0	0	0	0%
Odisha	0	0	3	35%
Puducherry	0	0	0	0%
Punjab	0	2	6	99%
Rajasthan	0	9	5	62%
Sikkim	0	0	0	100%
Tamil Nadu	0	1	0	0%
Telangana	0	2	0	0%
Tripura	0	5	27	38%
Uttar Pradesh	0	0	8	0%
Uttarakhand	0	0	0	100%
INDIA	2	74	113	22%


Training of Cold Chain Technicians on WIC/WIF

- The NCCVMRC and NCCTC conduct the training of CCT on the repair and maintenance of ILR, DF, WIC and WIF.
- During the year 2014-15, 74 CCO and CCTs have been trained at both the institutes in ILR and DF and 113 CCO and CCT have been trained on the repair and maintenance of WIC and WIF.
- Across the country, 22 per cent CCH have been trained on the standard two days Cold Chain handler training module in the last two years.

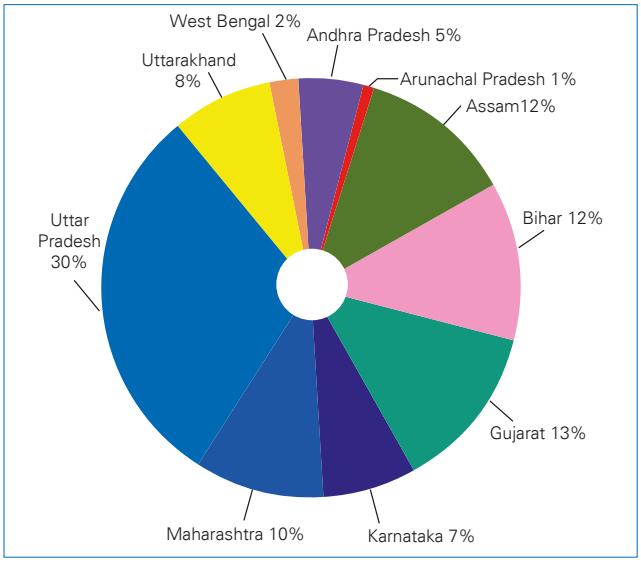
SECTION 4

FIELD ASSESSMENT FINDINGS

The sample survey for a rapid Cold Chain assessment and data validation was undertaken in 10 States covering every level of storage. Some of the key findings are presented below:

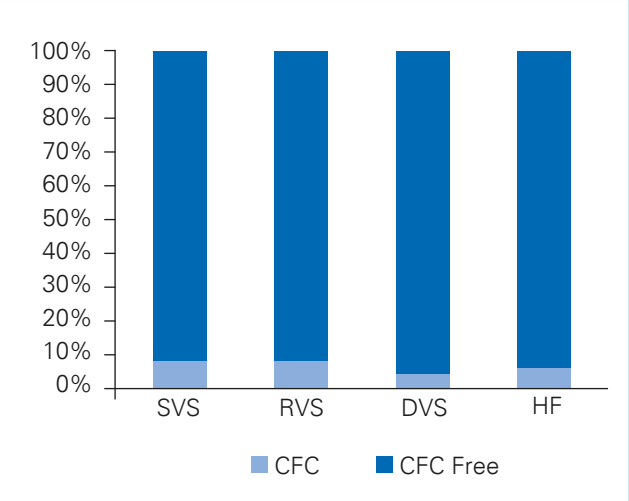
- A total of 141 sites were covered containing 1,017 Cold Chain equipment. The largest proportion of Cold Chain equipment covered was from Uttar Pradesh.

Figure 14: Distribution of Cold Chain equipment in sample sites



- About 10 per cent of the equipment in the State and regional stores were CFC based while in DVS, this was about 5 per cent.

Figure 15: Share of CFC and CFC free equipment in sample sites



Section on solar equipment

Three out of four sites with solar equipment had average electricity supply of more than eight hours per day and one site in Uttar Pradesh did not use the equipment for storing vaccines, while, none of the sites prepared ice packs in the solar equipment. The findings suggest a revalidation of the sites where solar equipment has been distributed so that their optimum use and benefit can be obtained.

Table 48: Status and use of solar equipment in the sample sites

Name of the States	No. of sites assessed having solar equipment	Total no. of solar equipment available	Hrs. of electricity supply in 24 hrs. at the site		Used for storing vaccine		Used for preparation of ice packs	
			Site 1	Site 2	Site 1	Site 2	Site 1	Site 2
Assam	1	1	24		Y		N	
UP	1	1	14		N		N	
Maharashtra	2	2	24	8	Y	N	N	N

Staffing Status for Cold Chain in the Sample States

There is no sanctioned Cold Chain officer in Uttarakhand while the regular post is not filled up in Bihar and Gujarat. The position of district Cold Chain technician is almost universal in the sampled States except West Bengal which does not have any district level CCTs, as it follows a CMC model of Cold Chain maintenance. Vaccine managers are not sanctioned in any sampled State which reflects the need to introduce this important position in all these States. The sanctioned posts reflected in table 49 are those staff in other designations who are in-charge of the vaccine management activity.

Table 49: Staffing status for Cold Chain in the sample States

State	Total No. of District	Cold Chain officer			Vaccine manager			Cold Chain technician		
		Sanction	Regular	Contractual	Sanction	Regular	Contractual	Sanction	Regular	Contractual
Andhra Pradesh and Telangana[23]	23	1	1	0	0	0	0	22	15	7
Arunachal Pradesh	17	1	1	0	0	0	0	12	12	3
Assam	27	1	1	0	0	0	1	14	13	1
Bihar	38	1	0	0	0	0	1	6	3	19
Gujarat	26	1	0	0	0	0	0	21	20	8
Karnataka	30	1	1	0	0	1	0	1	1	10
Maharashtra	35	1	1	0	0	6	1	25	25	13
Uttar Pradesh	75	1	0	1	0	0	0	69	63	21
Uttarakhand	13	0	0	1	0	0	0	6	3	10
West Bengal	19	1	1	0	0	0	0	0	0	0

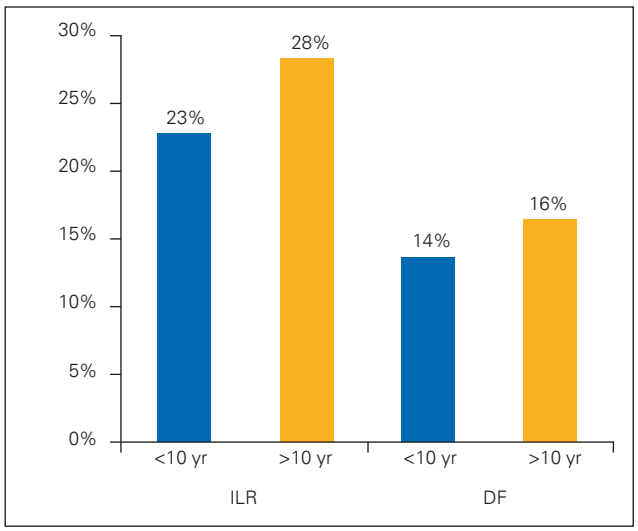
Cold Chain Equipment Sickness Rates

Overall sickness rates across the sample assessment are much higher than the target sickness rate of <2 per cent.

It was found that the overall sickness rate of ILRs is higher than DFs.

As expected, the sickness rate of equipment more than 10 years old is higher than newer equipment.

Figure 16: Overall sickness rate of ILRs and DFs in sample States



[23] At the time of assessment they were one State and the State has been bifurcated after the assessment

Figure 17: Sample state-wise break up of sickness rate

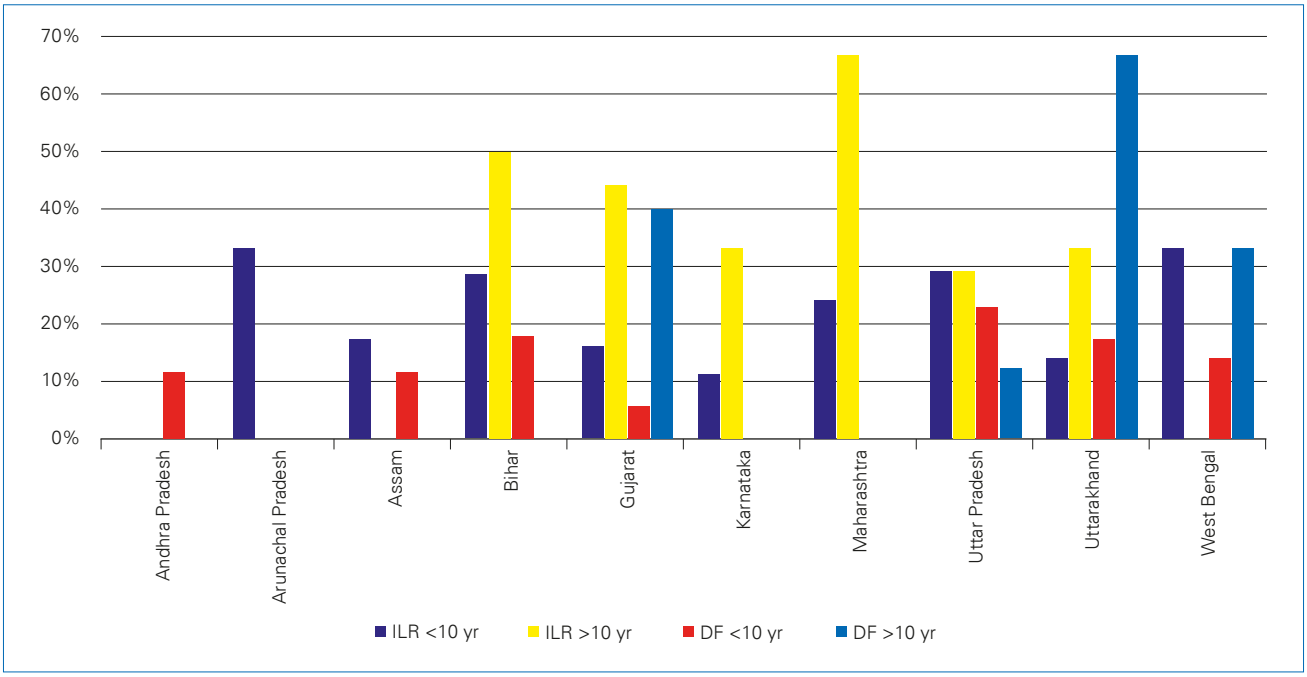


Figure 18: Sample state-wise distribution of immunization sessions within one hour of the CCP

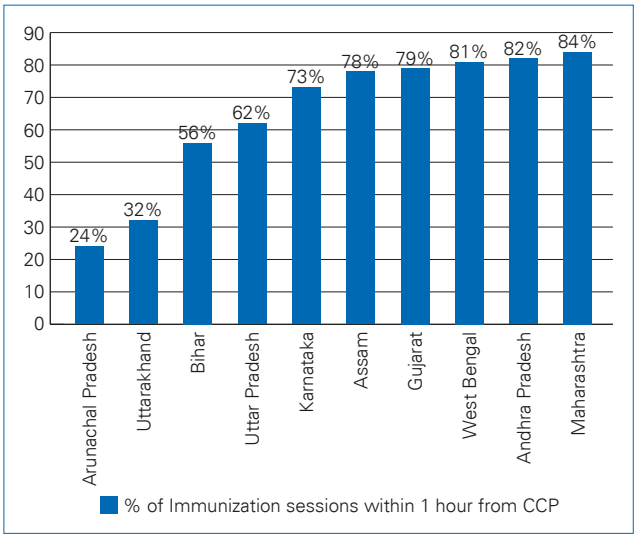


Table 50: Storage level-wise validation

	Proportion of data points matched (in %)				
Validation data points	**SVS**	**RVS**	**DVS**	**HF**	**Total**
No. of Equipment	99	99	99	99	99
Serial number	99	98	99	97	98.25
Type of equipment	98	98	97	98	97.75
Working status	97	95	95	91	94.5
CFC/NCFC	89	90	91	88	89.5
Population	89	80	99	65	83.25
Overall average	95.2	93.3	96.7	89.7	93.7

State Distribution of Cold Chain Points

States with difficult terrain and those with larger populations per Cold Chain point have increased proportion of immunization sites more than one hour away from the Cold Chain point. This would suggest the need to rationalize the distribution of Cold Chain points through realignment or expansion, as applicable.

Validation of NCCMIS with NCCA Data

This sample assessment also looked at validating the existing NCCMIS data with the actual field observations from the NCCA. The data points captured in the NCCA data collection instrument were validated by accessing the same data points from the NCCMIS for the same facilities visited. District store level data had the maximum matching

(96.7 per cent) between NCCMIS and NCCA while the lowest matching (89.7 per cent) was seen for data from health facilities. The lowest matching was observed for Cold Chain point population data which highlights the issues concerning forecasting demand for UIP.

- Matching for the same data points was done across the surveyed States taking into consideration different storage levels. Gujarat had the maximum level of matching while Karnataka had the least.

Table 51: State-wise validation

	Proportion of data points matched (in %)				
State	**SVS**	**RVS**	**DVS**	**HF**	**Overall average**
Assam	95	93	97	95	95
Gujarat	98	-	99	97	98
Arunachal Pradesh	96	-	97	91	94.7
Bihar	97	95	97	93	95.5
Maharashtra	97	94	98	91	95
Andhra Pradesh	97	96	96	93	95.5
Uttar Pradesh	98	96	98	80	93
West Bengal	91	-	95	83	89.7
Uttarakhand	97	95	97	92	95.25
Karnataka	85	82	86	80	83.25
Overall average	95.2	93.3	96.7	89.7	93.7

SECTION 5

RECOMMENDATIONS

Cold Chain Equipment

- India still has over 18,000 CFC Cold Chain equipment which requires immediate replacement within a fixed timeline. In line with the Montreal Protocol, the replacement of this equipment should be expedited. A process needs to be developed to accelerate the condemnation and replacement of CFC equipment which are beyond economic repair or have internal leakage.
- This has been found that a significant number of equipment beyond economic repair are awaiting condemnation. In line with the Government of India guidelines, the States should expedite condemnation processes to release space in stores at all levels of the supply chain.
- Replacement of freezers/refrigerators older than 10 years, beyond economic repair and suffering frequent breakdown should also be expedited.
- The allocation of CCE should be appropriate in terms of population coverage by any equipment and the expected population catered by the Cold Chain point or bulk vaccine store.
  - WIC of capacity 32 m^3 or more is recommended for population coverage exceeding 10 million.
  - Large ILRs are recommended for use in population coverage more than 0.5 million upto 2 million.
  - Small ILRs are similarly recommended for population coverage below 0.1 million.
- The need for approximately 24,000 additional CCE for the existing UIP vaccines must be fulfilled immediately. This figure has been calculated based on the following assumptions;
  - There should be at least one ILR and DF at every Cold Chain point
  - Equipment which is more than 10 years old need to be replaced
  - CFC equipment replacement
  - Aiming for complete immunization coverage with quality of all target beneficiaries.
- Andhra Pradesh, Tamil Nadu, Uttar Pradesh and Gujarat must be prioritized because they have the maximum need for all types of freezers/ refrigerators.
- To properly implement the addition of newer vaccines to the UIP, the Cold Chain procurement process should be hastened and coordinated with new vaccine introduction. In addition to the 24,000 CCE required for the existing UIP, a further 1,600 CCE (total of 25,600) are required to be procured to accommodate the introduction of MR, IPV and Rotavirus vaccine in the UIP.
- GMSDs should have an additional supply of four WICs and two WIFs to adequately provide space for the current UIP vaccines.
- A planned preventive maintenance programme should be prepared and followed by the States to maintain the breakdown rate within the GoI guideline of less than 2 per cent. States should be encouraged and supported to conduct assessment and repair drives for backlog maintenance of Cold Chain equipment to keep the sickness rate within established GoI norms.

Cold Chain Infrastructure

- It has been found during the field assessment that Cold Chain infrastructure in many places is not sufficient. India should have a national standard for all Cold Chain infrastructure including building and transport to meet the operational and quality requirements of the UIP.
  - Standard building norms with provision of dry storage space should be circulated to States in order to meet this important requirement.
  - States should be guided towards establishing standard norms for Cold Chain point expansion to optimize the functioning

of the Cold Chain points and to ensure quality vaccine, within one hour reach to immunization session sites.

- Pre-installation check lists should be designed to assess the site readiness of all SVS and RVS to accept new equipment, in tandem with the procurement process. There should be regular follow-up on the progress towards site readiness and release of equipment should be after the site is ready for installation.
- States or regions experiencing lack of stable grid electricity supply should be encouraged to adopt newer technologies to ensure continuous power supply. It is estimated that 1332 number of Cold Chain points are having electricity supply of less than eight hours in a 24 hours period. Procurement of Cold Chain equipment should take into account the requirement of solar equipment based on State level feedback on power availability. Also, the sites for solar equipment installation should be revalidated with States before supply and installation.
- The management of fast moving spare parts at the GMSD level should be streamlined and adequate stocks of spares should be maintained to ensure smooth Cold Chain maintenance in all States. Particular attention should be given to expedite the rectification of backlog maintenance.

Human Resource for Cold Chain

- There are significantly high vacancy levels for Cold Chain technicians, with currently 164 vacant posts. These vacancy levels should be reduced immediately by expediting the regular recruitment process or through the appointment of contractual posts through the NHM PIP. The root causes of poor retention and staff engagement need to be analysed.
- The numbers of CCE that a CCT is responsible for varies between eight and 315. The distribution of Cold Chain technicians should be such that no CCT manages more than 100 CCE each and in future the number of CCTs should be calculated based on an individual's workload considering geographic area and number of CCE.
- There are currently 22,448 CCHs that have not received the standard two days CCHs training. The trainings need to be completed by all States by the end of 2015-16 so that another round of refresher training can start off.
- The person given the responsibility of Cold Chain should be given adequate training and refresher trainings at least once in two years. In case of any change, the new person should be provided induction training before taking over the responsibilities.
- In line with the NHM guidelines, Vaccine Logistics Managers should be appointed in all States to improve the management and quality of vaccine logistics. States that have been provided with the funding through NHM should commence the recruitment of these positions immediately.

Other Recommendations

- All Cold Chain management should be done through the NCCMIS so that a central MIS for Cold Chain is available with reliable and accurate data for evidence based planning and management of the Cold Chain system in the country. The NCCMIS should be extended to the sub district levels and funds allotment to States for Cold Chain maintenance through the NHM PIP should be based on NCCMIS data. Based on the field assessment currently 88 per cent of NCCMIS data is accurate. We should continue to strive for high data quality across all States.

Annex 1

Sites covered through assessment

Details of sample						
Name of the State	**State vaccine store**	**Regional vaccine store**	**District vaccine store**	**Health facilities**	Supplying GMSDs*	
Andhra Pradesh & Telangana	Hyderabad	X	Rangareddy	Balapur		GMSD Chennai
		Vishakapatnam	East Godavari	Angara		
		Guntur	West Godavari (Elluru)	Che Brolu		
		Kadpa	Nellore	Mypadu		
		Nizamabad	Adilabad	PHJC, Ankoli		
Karnataka	Belgaun		Dharwad	Alnavar		
	x	Gulbarga	Raichur	Koppar		
	x	Chitradurga	Bellary	Kamalapura		
	x	Mangalore	Chikmangalur	Kadur		
	x	Mysore	Hassan	Ramanathapura		
Arunachal Pradesh	Naharlagun	X	East kameng	Seppa		GMSD Kolkata
Assam	Guwahati	X	Nagaon	Lanka		
		Cachar	Karimganj	Shrigaouri		
		Golpara	Bongaigaon	Abhaypori		
		Dibrugarh	Golaghat	Kamarbandhali		
		Tezpur	Dhemaji	SiSSI Borgaon		
Bihar	Patna	X	Gaya	Tekari		
		Muzzaferpur	Sitamarhi	Sursand		
		Saran	Gopalganj	Barauli		
		Aurangabad	Arwal	Karpi		
		Bhagalpur	Jamui	Gidhaur		
		Darbhanga	Madhubani	Pandaul		
West Bengal	Kolkata	X	South 24 Paraganas	Kuchitala		
Maharashtra	Pune		Aundh Pune 27	PHC Loni Kalbhor Tal Havelli		GMSD Mumbai
		Latur	Beed	Naugaun		
		Nasik	Ahmadnagar	Ladgaon		
		Thane	Pimpri Chinchvad	Jijamata Hospital		
		Kolhapur	Buldana	Padali		
		Nagpur	Gadhchiroli	Bodli		
Gujarat	Bhavnagar		Amreli	Mota Ankadiya		
	Ahmedabad		Kheda	Salon		
	Vadodara		Narmada	Lachhras		
	Surat		Navsari	Sagara		
	Rajkot		Kutch	Kukma		
	X	Gandhinagar	Banaskanta	Jalotra		

* GMSDs were not covered during this assessment.

Details of sample						
Name of the State	**State vaccine store**	**Regional vaccine store**	**District vaccine store**	**Health facilities**		
Uttar Pradesh	Faizabad	X	Barabanki	Fatehpur		GMSD Karnal
	X	Gonda	Balrampur	Sriiduttganj		
	X	Aligarh	Etah	Aliganj		
	X	Chitrakoot	Banda	Narayani		
	X	Bareli	Pilbhit	Pooranpur		
	X	Saharanpur	Samli	Kirana		
	X	Gorakhpur	Khushinagar	Kuberstan		
	X	Mirzapur	Sonbhadra	Muirpur		
	X	Janshi	Lalitpur	Jakhaura		
Uttarakhand	Dehradun	X	Haridwar	Bahadrabad		
		Almora	Pithoragarh	Egyardevi		
		U S Nagar	Nainital	Motahaldo		

Annex 2

Team composition and sites visited during the assessment

Team No.	Assessors	Organization	Designation	State vaccine store	Regional vaccine store	District vaccine store	Health facilities (sub-district vaccine store)
Andhra Pradesh							
1	Mr. Ram Ratan	SHSB, Govt. of Bihar	Programme Officer Polio and RI	Hyderabad		Rangareddy	Balapur
	Mr. Amlesh Bishwas	Govt. of WB	CCO				
2	Mr. Somshekhar	Govt. of Karnataka	CCO		Vishakapatnam	East Godavari	Angara
	Dr. Nandani	NIHFW	Associate Prof.				
3	Dr. S. Haider	RIMS, Jharkhand	Prof. & HOD		Guntur	West Godavari (Elluru)	Chebrolu
	Mr. Shashikant Ray	NCCVMRC-NIHFW	Software Developer				
4	Mr. R.K. Sharma	Govt .HP	CCO		Kadpa	Nellore	Mypadu
	Mr. Shashank Savita	NCCVMRC-NIHFW	Jr. tech.				
Arunachal Pradesh							
5	Mr. J.R. Samaddar	Govt. of Assam	Joint Director	Nahar lagun		East Kameng	Seppa
	Mr. B.K. Choudhary	Govt. of Assam	CCO				
6	Mr. Shashank Pathak	UNICEF	Consultant UP		Nizamabad	Adilabad	Ankoli
	Dr. R Murli	Govt. Kerala	CCO				
Asaam							
7	Dr. S. Ahmed	NEIGRIHMS Shillong	Prof. & HOD	Guwahati		Nagaon	Lanka
	Ms. Dipti Singhal	NCCVMRC-NIHFW	Programme Assistant				
8	Dr. N.P. Jani	Govt. of Gujarat	SEPIO		Cachar	Karimganj	Shrigaouri
	Mr. Shashank Savita	NCCVMRC-NIHFW	Jr. Tech.				
9	Dr. Kamlesh Parmar	Govt. of Gujarat	CCO		Golpara	Bongaigaon	Abhaypori
	Dr. Tulika	Govt. of Assam	Associate. Prof.				
10	Dr. Prem Singh	ITSU	Manager, M&E		Dibrugarh	Golaghat	Kamarbandhali
	Dr. Manisha Ruikar	AIIMS, Raipur	Prof. & HOD				
11	Dr. Jenita	Govt. of Assam	Associate. Prof.		Tezpur	Dhemaji	Borgaon
	Dr. G B Singh	Govt. of Punjab	SEPIO				
Bihar							
12	Dr. S.K. Jha	Govt. of UK	Associate. Prof.	Patna		Gaya	Tekari
	Mr. Harkesh Singh	NCCVMRC-NIHFW	Jr. Tech.				
13	Mr. Abhimanyu Kumar	UNICEF	Consultant		Muzzaferpur	Sitamarhi	Sursand
	Dr. F. Akbar	Govt. of WB	Professor				

Team No.	Assessors	Organization	Designation	State vaccine store	Regional vaccine store	District vaccine store	Health facilities (sub-district vaccine store)
14	Mr. Asjad Iqbal Sagar	UNICEF	Consultant		Saran	Gopalganj	Barauli
	Mr. Shashikant Ray	NCCVMRC-NIHFW	Software Developer				
15	Mr. Naushad Ali	UNICEF	Consultant		Aurangabad	Arwal	Karpi
	Mr. Kumud Ranjan Mishra	UNICEF	Consultant				
16	Mr. Kumud Ranjan Mishra	UNICEF	Consultant		Bhagalpur	Jamui	Gidhaur
	Mr. Omnkar Singh	UNICEF	Consultant				
17	Dr. Arup Deb Rai	ITSU	State Manager		Darbhanga	Madhubani	Pandaul
	Mr. Arvind Kumar Mishra	UNICEF	Consultant				
Karnataka							
18	Mr. Paritosh Panigrahi	ITSU	Manager, Cold Chain	Belgaun		Dharwad	Alnavar
	Dr. Suraliraman	Govt. of Tamil Nadu	Asst. Prof.				
19	Mr. Amlesh Biswas	Govt. of WB	CCO		Gulbarga	Raichur	Koppar
	Dr. Vinay Garg	Sharda University, Greater Noida	Professor				
20	Dr. K.A. Gopichand	Govt. of AP	SEPIO		Chitradurga	Bellary	Kamalapura
	Dr. Safikul Islam	Govt. of Assam	Professor				
21	Dr. Anil Patnayak	UNICEF	Consultant		Mangalore	Chikmagalur	Kadur
	Ms. Dipti Singhal	NCCVMRC-NIHFW	Programme Assistant				
22	Prof. M Bhattacharya	NIHFW	HOD (CHA)		Mysore	Hassan	Ramanathapura
	Mr. G. Devanandam	Govt. of AP	CCO				
Maharashtra							
23	Dr. Sourabh Saxena	UNICEF	Consultant	Pune		Aundh Pune 27	Loni Kalbhor Tal Havelli
	Dr. Sanjay Dixit	Govt. of MP	Prof. & HOD				
24	Dr. Raj Kumar Dutta	Govt. of Assam	Professor		Latur	Beed	Naugaun
	Mr. Harkesh Singh	NCCVMRC-NIHFW	Jr. Tech.				
25	Ms. Manjari Sharma	UNICEF	Consultant		Nasik	Ahmadnagar	Ladgaon
	Dr. Sonali Kar	KIMS Medical College, Odisha	Asst. Prof.				
26	Mr. R.K. Sharma	Govt. of HP	CCO		Thane	Pimpri Chinchvad	Jijamata Hospital
	Dr. Deepak Raut	SFDJ, Delhi	Dir. & Prof.				
27	Mr. Devanandam	Govt. of AP	CCO		Kolhapur	Buldhana	Padali
	Dr. S. Haider	RIMS, Jharkhand	Prof. & HOD				
28	Dr. Pankaja	AIIMS, Jodhpur	HOD		Nagpur	Gadchirouli	Bodli
	Dr. Prafful Bharadwaj	ITSU	Technical Officer				

Team No.	Assessors	Organization	Designation	State vaccine store	Regional vaccine store	District vaccine store	Health facilities (sub-district vaccine store)
Gujarat							
29	Mr. Vipin Srivastava	Govt. of MP	CCO	Ahmedabad		Kheda	Salon
	Dr. Abhiruchi Galhotra	AIIMS, Jaipur	Asst. Prof.				
30	Mr. Ram Ratan	SHSB, Govt. of Bihar	Programme Officer Polio and RI	Vadodara		Narmada	Lachhras
	Dr. Irfan Momin	Govt. of Gujarat	Asst. Prof.				
31	Dr. S. Mukherjee	Sharda University, Greater Noida	Professor	Bhavnagar		Amreli	Mota Ankadiya
	Dr. Chandresh Pandya	Govt. of Gujarat	Associate. Prof.				
32	Dr. Hussain Qazi	Govt. of Karnataka	DD(Immn.), SEPIO	Surat		Navsari	Sagara
	Dr. Mamta Rani Verma	Govt. of Gujarat	Asst. Professor				
33	Dr. R.G. Mahajan	Govt. of Gujarat	Associate. Prof.	Rajkot		Kutch	Kukma
	Mr. Shashank Savita	NCCVMRC-NIHFW	Jr. Tech.				
34	Dr. Santosh Shukla	Govt. of MP	SEPIO		Gandhinagar	Banaskanta	Jalotra
	Dr. Rashmi Sharma	Govt. of Gujarat	Professor				
Uttar Pradesh							
35	Ms. Manjari Sharma	UNICEF	Consultant	Faizabad		Barabanki	Fatehpur
	Mr Gagan Shrivastava	MoHFW	Sr. Statistical Officer				
	Mr. Subhash	UNICEF	Consultant				
	Mr. Shamshuddin	WHO	Consultant				
36	Mr. Shailesh Pandey	UNICEF	Consultant		Gonda	Balrampur	Sriiduttganj
	Mr. Anurag Dixit	UNICEF	Consultant				
37	Mr. Shashank Savita	NIHFW	Jr. Tech.		Aligarh	Etah	Aliganj
	Dr.Rakesh Vishwakarma	WHO	OSD				
38	Dr. Santosh Gupta	WHO	OSD		Chitrakoot	Banda	Narayani
	Mr. Paritosh Panigrahi	ITSU	Manager, Cold Chain				
	Mr. Naveen Chandra Tripathi	UNICEF	Consultant				
	Mr. Saurabh Sinha	UNICEF	Consultant				
39	Mr. Naushad Ali	UNICEF	Consultant		Bareli	Pilbhit	Pooranpur
	Mr. Saket	UNICEF	Consultant				
	Mr. Tariq	UNICEF	Consultant				
40	Er. Shashank Pathak	UNICEF	Consultant		Saharanpur	Shamli	Kirana
	Mr. Arif Hassan	UNICEF	Consultant				
	Mr. Farooq Aziz	UNICEF	Consultant				
41	Mr. Jasvinder Singh	Govt. of Punjab	CCO		Gorakhpur	Khushinagar	Kuberstan
	Mr. Manoj Srivastava	UNICEF	Consultant				
	Mr. Abdul Sami Khan	UNICEF	Consultant				
	Dr. Faizaan	UNICEF	Consultant				

Team No.	Assessors	Organization	Designation	State vaccine store	Regional vaccine store	District vaccine store	Health facilities (sub-district vaccine store)
42	Mr. Pravesh Kumar Mishra	UNICEF	Consultant		Mirzapur	Sonbhadara	Muripur
	Mr. Arif Ali	UNICEF	Consultant				
43	Mr. Arvind Kumar Mishra	UNICEF	Consultant		Janshi	Lalitpur	Jakhaura
	Mr. Aushotosh Bajpai	UNICEF	Consultant				
	Mr. Saurabh Agarwal	UNICEF	Consultant				
Uttarakhand							
44	Mr. Surendra Vyas	Govt. of Rajasthan	CCO	Dehradun		Haridwar	Bahadrabad
	Dr. Sanket V. Kulkarni	US, AID	State Team Leader				
45	Dr. S.D. Kandpal	Govt. of UK	Professor		Almora	Pithoragarh	Egyardevi
	Mr. Harkesh Singh	NCCVMRC-NIHFW	Jr. Tech.				
46	Ms. Dipti Singhal	NCCVMRC-NIHFW	Programme Assistant		Udham Singh Nagar	Nainital	Motahaldu
	Dr. S.K. Jha	Govt of UK	Associate Prof.				
West Bengal							
47	Mr. Abhimanyu Saxena	NCCVMRC-NIHFW	Training Coordinator	Kolkata		South 24 Paraganas	Kuchilahat
	Dr. Ranabir Pal	AIIMS Jodhpur	Additional Prof.				
	Dr. Tanushree	Govt. of WB	Associate Prof.				

Annex 3

Specific location of WICs/ WIFs distributed as per store and refrigerant

State	Location			WIC 40 m^3	WIC 32 m^3	WIC 16.5 m^3		WIF 32 m^3	WIF 20 m^3	WIF 16.5 m^3
Legends	State vaccine store	CFC	CFC Free							
Govt. Medical Store Depot (GMSD)										
Tamil Nadu	Chennai		2					3		
Haryana	Karnal				1		1	2		
West Bengal	Kolkata		4				1	4		
Maharashtra	Mumbai		2				1	4		
State, divisional and regional vaccine store										
Andaman & Nicobar Islands	SVS Port Blair				1					
Andhra Pradesh	SVS Hyderabad			1			1			
	RVS Kurnool				1	1				
	RVS Cuddapah				1	1				
	RVS Vishakapatnam				1	1				1
	RVS Guntur				1	1				
Arunachal Pradesh	SVS Itanagar				1	1				
Assam	SVS Guwahati				1					1
	RVS Kamrup (M)				1					
	RVS Dibrugarh				1					
	RVS Silcghar				1					
	RVS Tejpur				1					
	RVS Goalpara				1					
Bihar	SVS Patna				2					1
	RVS Purnia				1					1
	RVS Aurangabad				2					1
	RVS Bhagalpur				1	1				
	RVS Patna				1					
	RVS Nalanda				1					
	RVS Darbhanga				1					
	RVS Saran				1	1				
	RVS Muzaffarpur				1					
	RVS Motihari				1					
	RVS Saharsa			1						

State	Location	WIC 40 m^3	WIC 32 m^3	WIC 16.5 m^3	WIF 32 m^3	WIF 20 m^3	WIF 16.5 m^3
Chandigarh	SVS Chandigarh			1			
Chhattisgarh	SVS Raipur		1			1	
	RVS Bastar			1			
	RVS Bilashpur			1			
	RVS Raighar			1			
	RVS Raipur			1			
	RVS Surguja						1
Goa	SVS Panjim			1			
Delhi	SVS Delhi			1 1			
Gujarat	SVS Ahmedabad			1			
	SVS Bhavnagar			1			
	RVS Gandhinagar			1 1			1
	SVS Vadodara			1 1			1
	SVS Rajkot			1 1			
	SVS Surat			1 1			
Haryana	SVS Panchkula			1			1
	RVS Kurukshetra			1			
	RVS Rohtak			1			
	RVS Gurgaon			1			
	RVS Hisar			1			
Himachal Pradesh	SVS Shimla			1			1
	RVS Mandi			1			
	RVS Shimla			1			
	RVS Dharamshala			1			
Jammu & Kashmir	SVS Jammu			1 1			1
	SVS Srinagar			1 2			
Jharkhand	SVS Ranchi			1 2	1		1
	RVS Ranchi			2			
	RVS Deogarh		1			1	
Karnataka	RVS Bagalkot			1			
	SVS Bengaluru			1	1		
	RVS Bengaluru			1			
	SVS Belgaum		1				
	RVS Belgaum						1
	RVS Chitradurga			1 1			
	RVS Gulbarga			1			1
	RVS Mysore			1 1			
	RVS Mangalore			1			
Kerala	SVS Trivandrum			1			1
	RVS Trivandrum			1			
	RVS Ernakulam			2			
	RVS Kozhikode			2			

State	Location	WIC 40 m^3	WIC 32 m^3	WIC 16.5 m^3	WIF 32 m^3	WIF 20 m^3	WIF 16.5 m^3
Madhya Pradesh	SVS Bhopal		1	1			1
	SVS Gwalior			1			1
	SVS Indore			1			1
	SVS Jabalpur		1				1
	Betul DVS			1			
	RVS Indore			1			
	RVS Rewa			1			
	RVS Bhopal			1			
	RVS Sagar			1			
	RVS Ujjain			1			
	RVS Ratlam			1 1			
Maharashtra	SVS Pune		1	1		1	1
	RVS Nashik			1 1			
	RVS Akola			1 1			
	RVS Aurangabad			1			1
	RVS Nagpur			1			1
	DVS Chandarpur			1			
	RVS Latur			1			
	DVS Parbhani			1			
	RVS Thane			1			1
	RVS Kolhapur			1 1			
	RVS Pune			1			
Manipur	SVS Imphal			1 1			
Meghalaya	SVS Shillong			1 1			
	RVS West Garo Hills			1			
Mizoram	SVS Aizawal			1			
Nagaland	SVS Kohima			1			
Odisha	SVS Bhubaneswar		1			1	
	RVS Bhubaneswar			1			
	RVS Balangir		1				
	RVS Baleswar			1 1			
	RVS Sambalpur			1			
	RVS Kandhamal			1 1			
	RVS Ganjam			1 1			
	RVS Sundargarh			1			
	RVS Koraput			1			
Punjab	SVS Chandigarh			1			2
	RVS Amritsar			1			
	RVS Chandigarh			1			
	RVS Firozpur			1			
	RVS Hoshiarpur			1			

State	Location	WIC 40 m^3	WIC 32 m^3	WIC 16.5 m^3		WIF 32 m^3	WIF 20 m^3	WIF 16.5 m^3
Rajasthan	SVS Jaipur			1	1	1		
	SVS Udaipur			1				
	RVS Ajmer			1	1			
	RVS Jaipur			1	1			
	RVS Udaipur			1	1			
	RVS Kota			1	1			
	RVS Jodhpur			1	1			1
	RVS Bharatpur			1				
	RVS Bikaner		1	1				
Tamil Nadu	SVS Chennai			1		1		
	RVS Chennai			1				
	RVS Coimbatore			1	1			
	RVS Cuddalore		1					
	RVS Salem			1				
	RVS Madurai		1	1				1
	RVS Tirunelveli			1	1			
	RVS Thanjavur			1				
	RVS Trichy			1	1			
	RVS Vellore			1				
	RVS Sivaganga			1				
Telangana	SVS Hyderabad			1				
	RVS Nizamabad			1	1			
	RVS Warangal			1				
Tripura	SVS Agartala			1	1			1
Uttar Pradesh	SVS Lucknow		1				1	
	SVS Kanpur							1
	SVS Faizabad			1				
	SVS Bareily			1				1
	SVS Agra			1			1	
	SVS Meerut			1			1	
	SVS Varanasi		1				1	
	SVS Gorakhpur			1				1
	RVS Agra			1				
	RVS Aligarh			1				
	RVS Allahabad		1					
	RVS Faizabad			1				
	RVS Kanpur			1				
	RVS Azamgarh			1				
	RVS Gonda			1				
	RVS Chitrakoot (Banda)			1				
	RVS Moradabad			1				
	RVS Basti			1				
	RVS Varanasi		1					
	RVS Gorakhpur			1				
	RVS Lucknow			1				
	RVS Jhansi			1	1			
	RVS Mirzapur			1				
	RVS Saharanpur			1				

State	Location	WIC 40 m^3	WIC 32 m^3	WIC 16.5 m^3	WIF 32 m^3	WIF 20 m^3	WIF 16.5 m^3
Uttarakhand	SVS Dehradun			1			1
	RVS Almora			1			
	RVS Pauri Garhwal			1			
	RVS U S Nagar			1			
	RVS Dehradun			1			
West Bengal	SVS Kolkata		2	2	1		1
	DVS Coochbehar			1			
	DVS Siliguri			1			
	DVS Uttar Dinajpur			1			
	DVS Balurghat			1			
	DVS Purulia			1			
	DVS West Medinapur			1			
	DVS Mursidabad			1			
	DVS N24 Parganas			1			
	DVS Bardhaman			1			
	DVS Birbhum			1			
	DVS Bankura			1			
	DVS Hoogli			1			

Annex 4

Status of building construction and electrical work at State and regional level

Name of the State	State and regional vaccine store	Civil work complete (Y/N)*	If not estimated time for completion*	Electrical work completed (Y/N)*	If not estimate time for completion*
Andaman & Nicobar Islands	SVS Port Blair	*		*	*
Andhra Pradesh	SVS Hyderabad	YES		No	3 months
	RVS Kurnool	YES		No	3 months
	RVS Cuddapah	YES		No	3 months
	RVS Vizag	YES		No	3 months
	RVS Guntur	YES		No	3 months
Arunachal Pradesh	SVS Itanagar	NO	12 months	No	1 Year
Assam	SVS Guwahati	YES		No	3 Months
	RVS Guwahati	NO	12 months	No	1 Year
	RVS Goalpara	NO	12 months	No	1 Year
	RVS Cachar	NO	12 months	No	1 Year
	RVS Tejpur	NO	12 months	No	1 Year
	RVS Dibrugarh	NO	6 months	No	six months
Bihar	SVS Patna	NO	12 months	No	1 Year
	RVS Purnia	NO	12 months	No	1 Year
	RVS Aurangabad	NO	12 months	No	1 Year
	RVS Bhagalpur	NO	12 months	No	1 Year
	RVS Patna	NO	12 months	No	1 Year
	RVS Darbhanga	NO	12 months	No	1 Year
	RVS Saran	NO	12 months	No	1 Year
	RVS Muzaffarpur	NO	12 months	No	1 Year
Chandigarh	SVS Chandigarh	*	*	*	*
Chhattisgarh	SVS Raipur	NO	12 months	No	1 Year
	RVS Bastar	NO	12 months	No	1 Year
	RVS Raipur	NO	12 months	No	1 Year
	RVS Surguja	NO	12 months	No	1 Year
Dadra & Nagar Haveli	SVS Silvasa	*	*	*	*
Daman & Diu	SVS Daman	*	*	*	*
Goa	SVS Panjim	NO	*	No	*
Gujarat	SVS Ahmedabad	NO	*	No	*
	SVS Bhavnagar	YES		No	*
	RVS Gandhinagar	YES		No	*
	SVS Vadodara	NO	*	No	*
	SVS Rajkot	NO	*	No	*
	SVS Surat	YES		No	*

Name of the State	State and regional vaccine store	Civil work complete (Y/N)*	If not estimated time for completion*	Electrical work completed (Y/N)*	If not estimate time for completion*
Haryana	**SVS Panchkula**	YES		No	*
	RVS Kurukshetra	YES		No	*
	RVS Rohtak	YES		No	*
	RVS Gurgaon	YES		No	*
	RVS Hisar	YES		No	*
Himachal Pradesh	**SVS Shimla**	YES		No	*
	RVS Mandi	YES		No	*
	RVS Shimla	YES		No	*
	RVS Dharamshala	YES		No	*
Jammu & Kashmir	SVS Jammu	NO	*	No	*
	RVS Srinagar	NO	*	No	*
Jharkhand	**SVS Ranchi**	YES		No	3 months
	RVS Ranchi	YES		No	3 months
	RVS Deogarh	NO	12 months	No	1 year
Karnataka	SVS Bengaluru	NO	*	No	*
	RVS Bagalkot	NO	*	No	*
	RVS Bengaluru	NO	*	No	*
	RVS Belgaum	NO	*	No	*
	RVS Chitradurga	NO	*	No	*
	RVS Gulbarga	NO	*	No	*
	RVS Mysore	NO	*	No	*
	RVS Mangalore	NO	*	No	*
Kerala	**SVS Trivandrum**	YES		No	*
	RVS Trivandrum	YES		No	*
	RVS Ernakulam	YES		No	*
	RVS Kozhikode	YES		No	*
Lakshadweep	SVS Kavaratti	*	*	*	*
Madhya Pradesh	**SVS Bhopal**	YES		No	*
	SVS Gwalior	YES		No	*
	SVS Indore	NO	6 months	No	*
	SVS Jabalpur	YES		No	*
	RVS Indore	NO	6 months	No	*
	RVS Rewa	YES		No	*
	RVS Gwalior	YES		No	*
	RVS Jabalpur	YES		No	*
	RVS Bhopal	YES		No	*
	RVS Sagar	YES		No	*
	RVS Ujjain	YES		No	*
	RVS Ratlam	YES		No	*

Name of the State	State and regional vaccine store	Civil work complete (Y/N)*	If not estimated time for completion*	Electrical work completed (Y/N)*	If not estimate time for completion*
Maharashtra	SVS Pune	YES		No	*
	RVS Nashik	YES		No	*
	RVS Akola	YES		No	*
	RVS Aurangabad	YES		No	*
	RVS Nagpur	YES		No	*
	RVS Latur	YES		No	*
	RVS Thane	YES		No	*
	RVS Kolhapur	YES		No	*
	RVS Mumbai	YES		No	*
	RVS Pune	YES		No	*
Manipur	SVS Imphal	YES		No	*
Meghalaya	SVS Shillong	NO	12 months	No	*
	RVS West Garo Hills	NO	12 months	No	*
Mizoram	SVS Aizawal	YES		No	*
Nagaland	SVS Kohima	NO	12 months	No	*
NCT of Delhi	SVS Delhi	NO	12 months	No	*
Odisha	**SVS Bhubaneswar**	YES		No	*
	RVS Bhubaneswar	YES		No	*
	RVS Balangir	YES		No	*
	RVS Baleswar	YES		No	*
	RVS Sambalpur	YES		No	*
	RVS Kandhamal	YES		No	*
	RVS Ganjam	YES		No	*
	RVS Sundargarh	YES		No	*
	RVS Koraput	YES		No	*
Puducherry	**Puducherry**	NO	12 months	No	*
Punjab	**SVS Chandigarh**	YES		No	*
	RVS Amritsar	YES		No	*
	RVS Chandigarh	YES		No	*
	RVS Firozpur	YES		No	*
	RVS Hoshiarpur	YES		No	*
Rajasthan	**SVS Jaipur**	YES		No	*
	SVS Udaipur	YES		No	*
	RVS Ajmer	YES		No	*
	RVS Jaipur	YES		No	*
	RVS Udaipur	YES		No	*
	RVS Kota	YES		No	*
	RVS Jodhpur	YES		No	*
	RVS Bharatpur	YES		No	*
	RVS Bikaner	YES		No	*
Sikkim	SVS Gangtok	*	*	*	*

Name of the State	State and regional vaccine store	Civil work complete (Y/N)*	If not estimated time for completion*	Electrical work completed (Y/N)*	If not estimate time for completion*
Tamil Nadu	SVS Chennai	YES		No	*
	RVS Trichy	YES		No	*
	RVS Chennai	YES		No	*
	RVS Coimbatore	YES		No	*
	RVS Cuddalore	YES		No	*
	RVS Salem	YES		No	*
	RVS Madurai	YES		No	*
	RVS Tirunelveli	YES		No	*
	RVS Thanjavur	YES		No	*
	RVS Sivaganga	YES		No	*
Telangana	SVS Hyderabad	YES		No	3 months
	RVS Nizamabad	NO	12 months	No	1 year
	RVS Hyderabad	YES		No	3 months
	RVS Warangal	NO	12 months	No	1 year
Tripura	SVS Agartala	*	*	*	*
Uttar Pradesh	**SVS Lucknow**	NO	12 months	No	1 year
	SVS Kanpur	NO	12 months	No	1 year
	SVS Faizabad	NO	12 months	No	1 year
	SVS Bareily	NO	12 months	No	1 year
	SVS Agra	NO	12 months	No	1 year
	SVS Meerut	NO	12 months	No	1 year
	SVS Varanasi	NO	12 months	No	1 year
	SVS Gorakhpur	NO	12 months	No	1 year
	RVS Agra	NO	12 months	No	1 year
	RVS Aligarh	NO	12 months	No	1 year
	RVS Allahabad	NO	12 months	No	1 year
	RVS Faizabad	NO	12 months	No	1 year
	RVS Kanpur	NO	12 months	No	1 year
	RVS Azamgarh	NO	12 months	No	1 year
	RVS Meerut	NO	12 months	No	1 year
	RVS Devipatan	NO	12 months	No	1 year
	RVS Chitrakoot	NO	12 months	No	1 year
	RVS Bareilly	NO	12 months	No	1 year
	RVS Moradabad	NO	12 months	No	1 year
	RVS Basti	NO	12 months	No	1 year
	RVS Varanasi	NO	12 months	No	1 year
	RVS Gorakhpur	NO	12 months	No	1 year
	RVS Lucknow	NO	12 months	No	1 year
	RVS Jhansi	NO	12 months	No	1 year
	RVS Vindhyachal	NO	12 months	No	1 year
	RVS Saharanpur	NO	12 months	No	1 year

Name of the State	State and regional vaccine store	Civil work complete (Y/N)*	If not estimated time for completion*	Electrical work completed (Y/N)*	If not estimate time for completion*
Uttarakhand	**SVS Dehradun**	YES		No	*
	RVS Almora	NO	12 months	No	1 Year
	RVS Pauri Garhwal	NO	12 months	No	1 Year
	RVS U S Nagar	YES		No	3 months
	RVS Dehradun	YES		No	3 months
West Bengal	**SVS Kolkata**	YES		No	3 months

* Blank/ null entries in the civil work completion column is due to the inability of the respondents to provide a confirmed answer while those on the time of completion column are from those respondents who said that any construction would only begin after confirmation of supply from the MoHFW

Annex 5

Dry space adequacy across State and regional stores

State	Region	Total population	Target population	Required dry space (ft^2)*	Adequacy of available dry space	Dedicated store in the same building	Outside the premises
Andaman & Nicobar Islands		**379,944**	**6,000**	**8**		**n**	**n**
Andhra Pradesh		49,378,776	852,670	1,075	YES	YES	NO
	RVS Kurnool	8,129,916	140,387	177	YES	YES	NO
	RVS Cuddapah	10,021,074	173,043	218	YES	YES	NO
	RVS Vizag	14,482,001	250,074	315	YES	YES	NO
	RVS Guntur	16,745,785	289,165	365	YES	YES	NO
Arunachal Pradesh		31,169,272	692,000	873	NO	NO	NO
Assam		26,681,807	692,000	873	NO	NO	NO
	RVS Guwahati	10,804,842	234,181	295	NO	NO	NO
	RVS Goalpara	5,059,047	112,318	142	NO	NO	NO
	RVS Cachar	4,873,000	113,888	144	NO	NO	NO
	RVS Tejpur	4,487,465	99,628	126	NO	NO	NO
	RVS Dibrugarh	5,944,918	131,985	166	NO	NO	NO
Bihar		103,804,637	2,884,000	3,637			
	RVS Purnia	16,958,541	471,158	594	NO	NO	NO
	RVS Aurangabad	7,800,299	216715	273	NO	NO	NO
	RVS Bhagalpur	9,177,414	254,976	322	NO	NO	NO
	RVS Patna	29,535,479	820,583	1,035	NO	NO	NO
	RVS Darbhanga	21,658,445	601,736	759	NO	NO	NO
	RVS Saran	9,819,311	272,810	344	NO	NO	NO
	RVS Muzaffarpur	8,855,148	246,022	310	NO	NO	NO
Chhattisgarh		25,540,196	624,000	787	NO	NO	NO
	RVS Bastar	2,339,821	57,167	72			
	RVS Raipur	19,327,964	472,222	596	YES	YES	NO
	RVS Surguja	3,872,411	94,611	119			
Dadra & Nagar Haveli		342,853	10,000	13			
Daman & Diu		242,911	5,000	6			
Goa		1,457,723	21,000	26	YES	YES	YES
Gujarat		60,383,628	128,2001	1,617	YES	YES	NO
	RVS Ahmedabad	13,353,283	283,502	358			
	RVS Bhavnagar	7,133,866	151,459	191			
	RVS Gandhinagar	10,301,342	218,707	276			
	RVS Vadodara	10,813,594	229,583	290			
	RVS Rajkot	8,635,275	183,335	231			
	RVS Surat	10,146,268	215,415	272			

State	Region	Total population	Target population	Required dry space (ft^2)*	Adequacy of available dry space	Dedicated store in the same building	Outside the premises
Haryana		25,353,081	555,000	700			
	RVS Kurukshetra	645,3251	141,267	178	YES	YES	NO
	RVS Rohtak	7,249,270	158,693	200	YES	YES	NO
	RVS Gurgaon	6,339,067	138,767	175	YES	YES	NO
	RVS Hisar	5,311,493	116,273	147	YES	YES	NO
Himachal Pradesh		6,856,509	111,000	140			
	RVS Mandi	1,819,048	29,449	37	YES	NO	NO
	RVS Shimla	2,036,044	32,962	42	YES	NO	NO
	RVS Dharamshala	3,001,417	48,590	61	YES	NO	NO
Jammu & Kashmir		12,548,926	221,000	279			
	RVS Jammu	5,350,811	95,876	121			
	RVS Srinagar	7,198,115	125,124	158			
Jharkhand		32,966,238	822,000	1037			
	RVS Ranchi	23,557,233	587,390	741	YES	YES	NO
	RVS Deogarh	9,409,005	234,610	296	YES	NO	NO
Karnataka		61,130,704	1,133,000	1429			
	RVS Bagalkot	6,522,455	120,888	152			
	RVS Bangalore	17,134,963	317,580	401			
	RVS Belgaum	8,223,938	152,423	192			
	RVS Chitradurga	7,895,178	146,330	185			
	RVS Gulbarga	7,362,668	136,460	172			
	RVS Mysore	9,037,454	167,501	211			
	RVS Mangalore	4,954,048	91,819	116			
Kerala		33,387,677	503,000	634			
	RVS Trivandrum	9,254,467	119,429	151	YES	YES	NO
	RVS Ernakulam	12,287,916	194,920	246	YES	YES	NO
	RVS Kozhikode	11,845,294	188,651	238	YES	YES	NO
Lakshadweep		64,429	1,000	1			
Madhya Pradesh		72,597,565	1,924,000	2427			
	RVS Indore	12,534,283	332,187	419	NO	NO	NO
	RVS Rewa	9,355,099	247,931	313	NO	NO	NO
	RVS Gwalior	10,985,304	291,135	367	NO	NO	NO
	RVS Jabalpur	11,772,617	312,001	394	NO	NO	NO
	RVS Bhopal	11,402,129	302,182	381	NO	NO	NO
	RVS Sagar	7,865,803	208,462	263	NO	NO	NO
	RVS Ujjain	5,062,057	134,156	169	NO	NO	NO
	RVS Ratlam	3,620,273	95,945	121	NO	NO	NO

State	Region	Total population	Target population	Required dry space (ft^2)*	Adequacy of available dry space	Dedicated store in the same building	Outside the premises
Maharashtra		112,372,972	1,904,000	2,401			
	RVS Nashik	18,571,535	314,668	397	YES	YES	NO
	RVS Akola	11,266,653	190,897	241	YES	YES	NO
	RVS Aurangabad	8,669,366	146,890	185	YES	YES	NO
	RVS Nagpur	11,736,526	198,859	251	YES	YES	NO
	RVS Latur	12,693,776	215,078	271	YES	YES	NO
	RVS Thane	20,386,612	345,422	436	YES	YES	NO
	RVS Kolhapur	9,156,130	155,138	196	YES	YES	NO
	RVS Mumbai	3,145,966	53,304	67	YES	YES	NO
	RVS Pune	16,746,408	283,744	358	YES	YES	NO
Manipur		2,721,756	43,000	54	NO	YES	NO
Meghalaya		2,964,007	70,000	88			
	RVS WGH	1,103,115	26,052	33			
	RVS Shillong	1,860,892	43,948	55	YES	YES	NO
Mizoram		1,091,014	18,000	23	NO	YES	NO
Nagaland		1,980,602	31,000	39	YES	NO	NO
NCT of Delhi		16,753,235	313,000	395	NO	NO	NO
Odisha		41,947,358	814,000	1,027			
	RVS Bhubaneswar	14,392,668	279,294	352	NO	YES	NO
	RVS Balangir	4,480,225	86,940	110	NO	NO	YES
	RVS Sambalpur	2,835,407	55,022	69	NO	NO	YES
	RVS Kandhamal	1,171,869	22,740	29	NO	NO	YES
	RVS Ganjam	4,096,031	79,485	100	NO	NO	YES
	RVS Sundargarh	2,660,163	51,621	65	NO	NO	YES
	RVS Koraput	4,170,382	80,927	102	NO	NO	YES
Puducherry		1,244,464	23,000	29			
Punjab		27,704,236	445,000	561			
	RVS Amritsar	5,909,987	94,929	120	YES		NO
	RVS Chandigarh	11,283,346	181,239	229	YES		NO
	RVS Firozpur	5,928,689	95,230	120	YES	NO	NO
	RVS Hoshiarpur	4,582,214	73,602	93	YES	YES	NO
Rajasthan		68,621,012	1,779,000	2,244			
	RVS Ajmer	9,726,317	252,155	318	YES	YES	NO
	RVS Jaipur	16,790,591	435,296	549	YES	YES	NO
	RVS Udaipur	9,825,555	254,728	321	YES	YES	NO
	RVS Kota	5,699,464	147,759	186	YES	YES	YES
	RVS Jodhpur	11,868,011	307,678	388	YES	YES	NO
	RVS Bharatpur	6,552,987	169,886	214	YES	YES	NO
	RVS Bikaner	8,158,087	211,498	267	YES	YES	NO
Sikkim		607,688	11,000	14	YES	YES	NO

State	Region	Total population	Target population	Required dry space (ft^2)*	Adequacy of available dry space	Dedicated store in the same building	Outside the premises
Tamil Nadu		72,138,958	1,132,000	1,428	YES	YES	NO
	RVS Trichy	6,726,163	105,547	133	YES	YES	NO
	RVS Chennai	12,397,681	194,544	245	YES	YES	NO
	RVS Coimbatore	8,938,479	140,262	177	YES	YES	NO
	RVS Cuddalore	12,461,235	195,541	247	YES	YES	NO
	RVS Salem	8,587,818	134,760	170	YES	YES	NO
	RVS Madurai	8,389,398	131,646	166	YES	YES	NO
	RVS Tirunelveli	6,674,430	104,735	132	YES	YES	NO
	RVS Thanjavur	5,284,944	82,931	105	YES	YES	NO
	RVS Sivaganga	2,678,810	42,036	53	YES	YES	NO
Telangana		35,286,757	609,330	769	YES	YES	NO
	RVS Nizamabad	5,289,811	91,344	115	YES	YES	NO
	RVS Hyderabad	19,864,350	343,017	433	NO	YES	NO
	RVS Warangal	10,132,596	174,969	221	YES	YES	NO
Tripura		3,671,032	52,000	66	YES	YES	NO
Uttar Pradesh		199,581,477	5,499,000	6,936	YES	YES	NO
	RVS Agra	11,266,642	310,426	392	YES	YES	NO
	RVS Aligarh	8,256,843	227,498	287	YES	YES	NO
	RVS Allahabad	8,256,843	227,498	287	YES	NO	NO
	RVS Faizabad	11,915,985	328,317	414	YES	YES	NO
	RVS Kanpur	13,047,064	359,481	453	YES	YES	NO
	RVS Azamgarh	10,045,321	276,775	349	YES	YES	NO
	RVS Meerut	14,584,234	401,834	507	YES	YES	NO
	RVS Devipatan	10,173,324	280,302	354	YES	YES	NO
	RVS Chitrakoot	4,770,243	131,433	166	YES	YES	NO
	RVS Bareilly	13,217,683	364,182	459	YES	YES	NO
	RVS Moradabad	12,631,203	348,023	439	YES	YES	NO
	RVS Basti	6,728,882	185,399	234	YES	YES	NO
	RVS Varanasi	13,733,706	378,400	477	YES	YES	NO
	RVS Gorakhpur	13,761,034	391,629	494	YES	YES	NO
	RVS Lucknow	23,682,514	640,040	807	YES	YES	NO
	RVS Jhansi	4,889,475	134,718	170	YES	YES	NO
	RVS Vindhyachal	5,911,348	162,873	205	YES	YES	NO
	RVS Saharanpur	7,602,833	209,478	244	YES	YES	NO
Uttarakhand		10,116,752	189,000	238	YES	YES	NO
	RVS Almora	1,367,760	25,552	32	YES	NO	NO
	RVS Pauri Garhwal	1,314,498	24,557	31	YES	NO	NO
	RVS U S Nagar	2,862,810	53,483	67	YES	NO	NO
	RVS Dehradun	4,571,684	85,408	108	YES	NO	NO
West Bengal		91,347,736	1,467,000	1,850	YES	YES	NO

*Dry space requirement have been calculated assuming that the syringes and diluents are stacked upto a height of 8ft and the required floor area is in square feet.

Note: Blank fields show non availability of information from states

Annex 6

State wise electricity availability at Cold Chain points*

State	Total CCP	Less than 8 hours	8-20 hours	21-24 hours
Andaman & Nicobar Islands	44	0	2	42
Andhra Pradesh & Telangana	2,592	100	2,450	43
Arunachal Pradesh	166	23	94	49
Assam	805	112	647	47
Bihar	597	118	289	190
Chandigarh	53	0	12	38
Chhattisgarh	563	12	273	278
Dadra & Nagar Haveli	13	0	0	13
Daman & Diu	3	0	0	3
Delhi	274	2	36	236
Goa	39	0	0	39
Gujarat	1,675	4	77	1,593
Haryana	640	87	453	100
Himachal Pradesh	643	0	31	612
Jammu and Kashmir	579	99	436	44
Jharkhand	241	128	107	6
Karnataka	2,774	11	2,432	331
Kerala	1,181	0	3	1,177
Lakshadweep	2	0	2	0
Madhya Pradesh	1,199	16	745	438
Maharashtra	3,250	33	2,358	859
Manipur	82	27	55	0
Meghalaya	176	0	114	62
Mizoram	81	30	51	0
Nagaland	121	10	105	6
Odisha	1,193	8	737	448
Puducherry	56	0	0	56
Punjab	757	3	339	414
Rajasthan	2,308	197	1,596	516
Sikkim	35	0	27	8
Tamil Nadu	2,564	23	2,103	437
Tripura	119	1	75	43
Uttar Pradesh	1162	272	865	25
Uttarakhand	330	16	192	121
West Bengal	1,434	0	3	1,431

* At the time of assessment the NCCMIS data was not bifuricated between Andhra Pradesh and Telangana

Note: The difference between no. of total CCP and electricity availability is due to the no. of sites without electricity data entered on NCCMIS

Annex 7

Forms for data collection during field visit

National Cold Chain Assessment 2014

State HQ/State Vaccine Store

Tool-1

Assessment team number			
Name of team members	**Designation**	**Contact number**	**Email-id**
1			
2			
3			
Site location			
State			
Date			

Section A

(To be filled up at State Headquarters only)

National Cold Chain Assessment Tool 2014

Section A1: Background

Officials met

Name	Designation	Email-ID	Mobile number
	SEPIO/SIO		
	SCCO/ACCO		
	Vaccine manager		
	Other- Please specify		

To be collected at State HQ

Section A1.1.1 Total Population catered by State

Section A.1.1.2 Birth Rate of State:

Section A1.2 No. of State vaccine stores/Regional vaccines stores

(Refer to vaccine distribution network provided in file State VDN to fill this information)

(Where vaccine and Cold-Chain equipment received directly from Manufactures/GMSD)

S. No.	Location of SVS/RVSw
1	
2	
3	
4	

Section A1.3

Divisional vaccine stores under SVS/RVS mentioned under Section 1.2

To be collected at State HQ

SVS/RVS name	SVS/RVS name	SVS/RVS name	SVS/RVS name	SVS/RVS name	SVS/RVS name	SVS/RVS name	SVS/RVS name
Divisional vaccine stores under SVS/RVS	Divisional vaccine stores under SVS/RVS	Divisional vaccine stores under SVS/RVS	Divisional vaccine stores under SVS/RVS	Divisional vaccine stores under SVS/RVS	Divisional vaccine stores under SVS/RVS	Divisional vaccine stores under SVS/RVS	Divisional vaccine stores under SVS/RVS
	1	1	1	1	1	1	1
	2	2	2	2	2	2	2
	3	3	3	3	3	3	3
	6	6	6	6	6	6	6

Section A1.4

District Vaccine stores under Divisional Vaccine Stores mentioned under Section 1.3

To be collected at State HQ

Divisional vaccine store (Div VS)	Divisional vaccine store (Div VS)	Divisional vaccine store (Div VS)	Divisional vaccine store (Div VS)	Divisional vaccine store (Div VS)	Divisional vaccine store (Div VS)	Divisional vaccine store (Div VS)
Name of districts	Name of districts	Name of districts	Name of districts	Name of districts	Name of districts	Name of districts
1	1	1	1	1	1	1
2	2	2	2	2	2	2
3	3	3	3	3	3	3
4	4	4	4	4	4	4

Total number of Cold-Chain Points in State:_____

Section A1.5 State HQ/SVS/RVS

Status of Human Resource					
Designation	**Sanctioned (regular) in number**	**In position in number**		**Vacant**	**Regular post-vacant since (Month/Year)**
		Regular	**Contractual**		
1.5.A Cold Chain Officer					
1.5.B Cold Chain Consultant (State, Region & Distt)					
1.5.C Asst. Cold Chain Officer					
1.5. D Vaccine and Logistic Manager					
1.5. E Technical Assistant					
1.5. F Cold Chain Technicians					
1.5. G Semi Skilled Helper					
1.5. H Vaccine Store Keeper					
1.5. I Others – specify					

Section A1.6

Training status of CCT & CC handlers in last three years (2011/2012/2013):

To be collected at State HQ

1.6.1 A) Total Ref technicians in position (Both- Regular + contractual)	
1.6. B) Trained on WIC/WIF (Year) (Six days training)	
1.6. C) Trained on Non-CFC Cold Chain equip (Six days training)	
1.6. D)Trained on Solar refrigerators	
1.6. E) Trained in Gensets/Servo/stabilizers	
1.6. F) Trained in NCCMIS	
1.6. G) Total number of Cold-Chain handlers	
1.6. H) No. of Cold-Chain handlers trained	

Section A2) Financial Analysis of CCE Maintenance – Department mechanic vs. AMC/CMC

Section A2.1

Type of maintenance (Tick what is applicable)		**Total amount for one financial year**
Departmental (By Cold-Chain Tech)		
AMC (Without spares)		
CMC (With spares and accessories)		
Mixed		

Section A2.2

Cold Chain technician in the State	**Number of Cold Chain technicians (A)**	**Monthly salary Rs. (B)**	**Daily allowance per day during travel Rs. (C)**	**Average monthly cost for travel per CCT Rs. (D)**	**Total for all districts per month Rs. (F) = (B + C + D)**
Permanent					
Contractual					

Section A2.3

Cold Chain equipment	Number of equipment available	Approx breakdown cases attended by AMC/ CMC per month	Approx breakdown cases attended by CCT per month
WIC			
WIF			
ILR			
DF			
Genset			
Stabilizer			

Section A2.4

Total AMC value (Rs.)	# of districts	# of equipment under AMC	AMC value per district (Rs.)

Section A2.5

Cost of spares/consumables in last one year (Rs.)

# of districts maintaining essential stock of spares	List of spares and quantities consumed by one district per month (Average of those received from GMSD)	List of spares, numbers and costs of spares bought locally (Average for one district per month)	Average cost of transporting spares to district (Average for one district)

Section A2.6

NRHM funds utilization for Cold Chain (Rs.)

NRHM PIP Part-C- CC maintenance fund available	
NRHM fund per district available	
Fund utilized	

Provide the status of present year or last year

Section B

(To be filled up at State/Regional Vaccine Stores only)

[Only those stores which receive vaccines directly from manufacturers]

Officials met

Name	Designation	Email-ID	Mobile number
	Store Keeper		
	Cold-Chain Handler		
	Other- Please Specify		

To be collected at State HQ

Section B1 Total population catered by vaccine store visited

Section B2 Target population catered by vaccine store visited

Section B3: Cold Chain Refrigeration Equipment Inventory

To be collected at vaccine store

Section B3.1 (Form-A): WIC/WIF

Data	Type of equipment (Concrete Cold Room, WIC/ WIF	Make & model (Huurre Euromon Year-2009/ Bluestar -10000 Year-2010)	Serial No.	Size (HxLxW in cms) (16.5 cum or 32 cum)*	Functional stabilizer attached (Yes/ No)	Stabilizer rated capacity (KVA)	Number of equipment attached to the stabiliser	Refrigerant (CFC - Non CFC)	Accessories status (In case of WIC-WIF) (W-Working, NW-Non-working, NA-Not available)				Functional genset available (Yes/No)
									Graphic chart recorder	Alarm/ hooter	WiFi data-logger	Internet connection	
NCCMIS													
Actual													
NCCMIS													
Actual													
NCCMIS													
Actual													

Section B3.2 Form-B: ILR

Data	SN	Please mention number of ILRs as per categories mentioned below									
		CFC Free: Less than 10 years old				CFC Free: Over 10 years old				CFC (Only Working)	
		ILRs				ILRs				ILRs	
		Model	Serial number	Working	Repairable	Model	Serial number	Working	Repairable	Model	Serial number
NCCMIS											
Actual											
NCCMIS											
Actual											
NCCMIS											
Actual											

Section B3.3 Form-C: Deep Freezer

Data	SN	Please mention number of DFs as per categories mentioned below									
		CFC Free: Less than 10 years old				CFC Free: Over 10 years old				CFC (Only working)	
		Deep freezers				Deep freezers				Deep freezers	
		Model	Serial number	Working	Repairable	Model	Serial number	Working	Repairable	Model	Serial number
NCCMIS											
Actual											
NCCMIS											
Actual											
NCCMIS											
Actual											

Section B3.4 Form D: Tool Kit

Sr.No	Tool kit Type (large/ small/non standard)	Number of units	Available since	In use (Yes/no)
1				
2				

Section B3.5 Form E: Spare Parts (Availability vs. Need)

Sr.No	Type of CCE	Name of first five spares	GoI code	Quantity	Spares available since (Month/Year)	Schedule of distribution [Monthly/ Quarterly/ When required]	Requirement of spares/ year (based on earlier requirement)
1	ILR	1.					
		2					
		3.					
		4.					
		5.					
2	DF	1.					
		2					
		3.					
		4.					
		5.					
3	Voltage stabiliser	1.					
		2					
		3.					
		4.					
		5.					
4	WIC	1.					
		2					
		3.					
		4.					
		5.					
5	WIF	1.					
		2					
		3.					
		4.					
		5.					
6	AMF Panel/ Genset/ Servo	1.					
		2					
		3.					
		4.					
		5.					

Section B3.6 Status of Cold Chain space available at the facility

Net Cold-Chain space available 2 to 8^{0}C (ltr.)	
Net Cold-Chain space required 2 to 8^{0}C (ltr.)	
Net Cold-Chain space available -15 to -25^{0}C (ltr.)	
Net Cold-Chain space required-15 to -25^{0}C (ltr.)	
No of WIC of capacity 16.5/32/40 cubic metre required for deficient space	

Refer Tool A for assessment of required and available Net Cold-Chain space

Section B4: Store Infrastructure Questionnaire

Section B4.1 Electricity/generator/fuel

1. Electricity availability	2. Generator usage: Of available	3. Fuel availability
1.1 Number of hours available per day	Use immediately after power cut	Always in stock
1.2 Dedicated genset available: if yes, size	Use whenever temperature rises	No fund for fuel
1.3 Genset usage per month (Hrs)	Use only during pulse polio	Inadequate stock
1.4 Electric connections are properly connected with ISI mark plug sockets? (Yes/No)	Never used because no fuel	Fuel not available
1.5 Proper earthing done? (Yes/No)	Not working	Register/record available – Yes/No
	Register/record available – Yes/No	

Section B4.2 Dry storage space available – Syringes and Diluents

Dry storage area: (in cubic metres: (WxLxH):
Available (Measure):
Required:

Please clearly mention metres/centimetres or feet and inches.

Section 4.2.1 Does the store has dedicated dry store for syringes and diluents: (Y/N)

If yes, Section 4.2.2 (Skip this section in case no dedicated dry store available)

Refer Tool A for the assessment of required dry space

Section B4.3 Feasibility of expansion of the Cold Chain infrastructure

Feasibility of expansion of the Cold Chain infrastructure (Building and equipment)	
If additional space required for installation of WIC/WIF/ILR/DF, please mention space available at facility for expansion	
4.3.1. How much physical space is available for additional ILR/DF? (metres x metres)	
4.3.2. How much physical space is available for additional WIC/WIFs (16.5/32/40 cubic metre)	Room sizes for different size of WIC-WIFs: 16.5/20 cubic metres – 3.2 metres x 6 metres 30 cubic metres – 4 metres x 8 metres 40 cubic metres – 5 metres x 10 metres
4.3.3. How much physical space is available for additional Dry space (metres x metres)	

Section B5: Vaccine Stock Management

Section B5.1

What type of inventory management system the vaccine store has?	
Vaccine stock register	Yes/No
Vaccine issue register	Yes/No
Issue voucher	Yes/No
Indent voucher	Yes/No
Online MIS	Yes/No

Section B5.2

Vaccine stock management register adequacy				
Sr. no	**VACCINE**	**Status (Yes/No)**	**Diluent [Are diluent details mentioned next to vaccine stock details]**	**Status (Yes/No)**
1	Vaccine type		Diluent type	
2	Presentation		Presentation	
3	Vaccine manufacturer		Diluent manufacturer	
4	Quantity received or distributed		Quantity received or distributed	
5	Batch/lot number		Batch/lot number	
6	Expiry date		Expiry date	
7	VVM status (All vaccines in India)		Location in store (in larger stores)	
8	Location in store (in larger stores)		NA	

Refer to Additional Tool 1A for the vaccine stock position

Vaccines arrival reports for Pentavalent vaccines – [For supplies from 1 April 2013 to 31 March 2014]

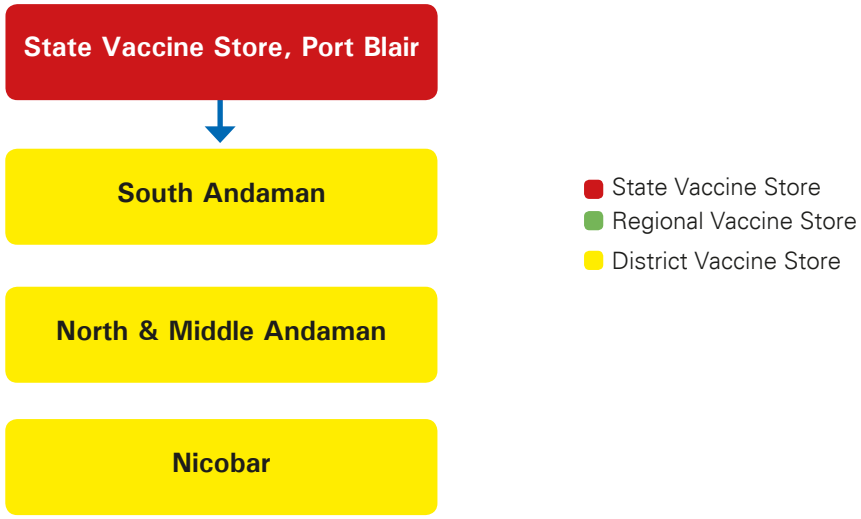
Number of reports filled ---------- /Total consignments of Pentavalent vaccines----------

Comments:

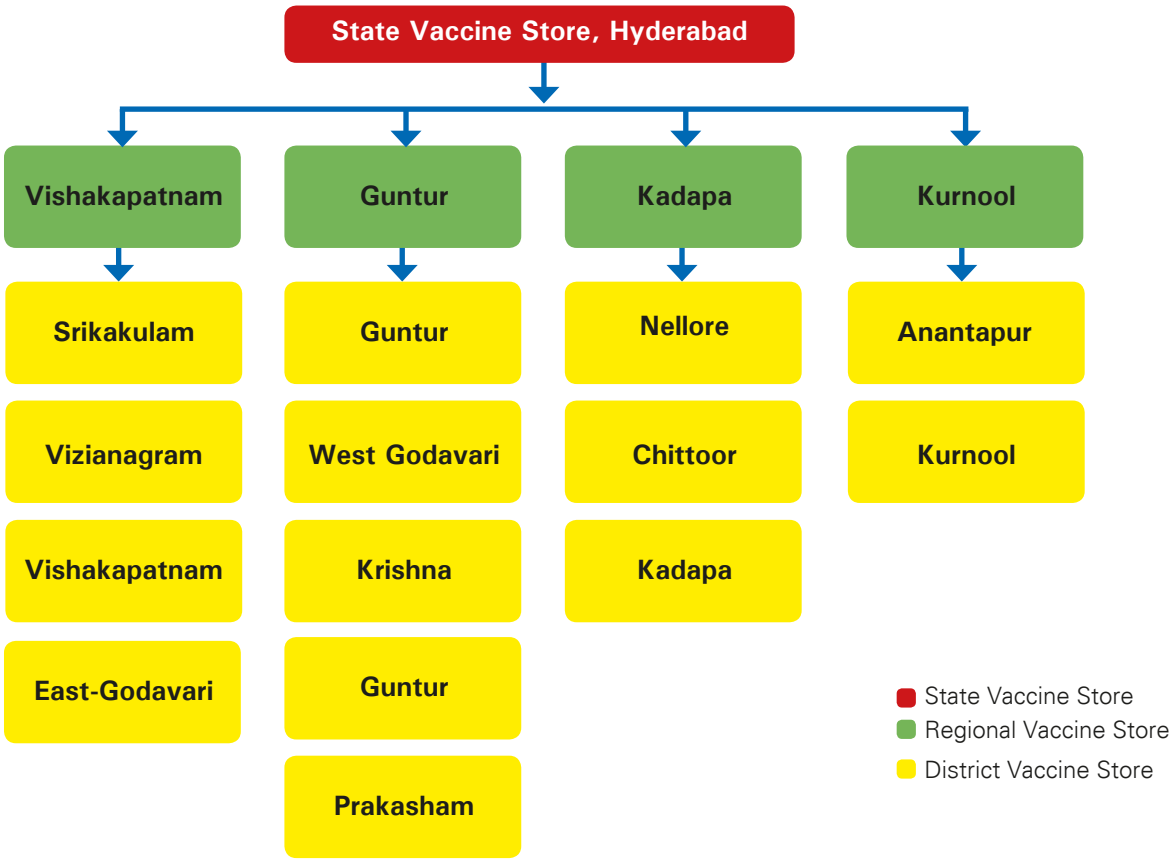
Annex 8

Vaccine distribution network

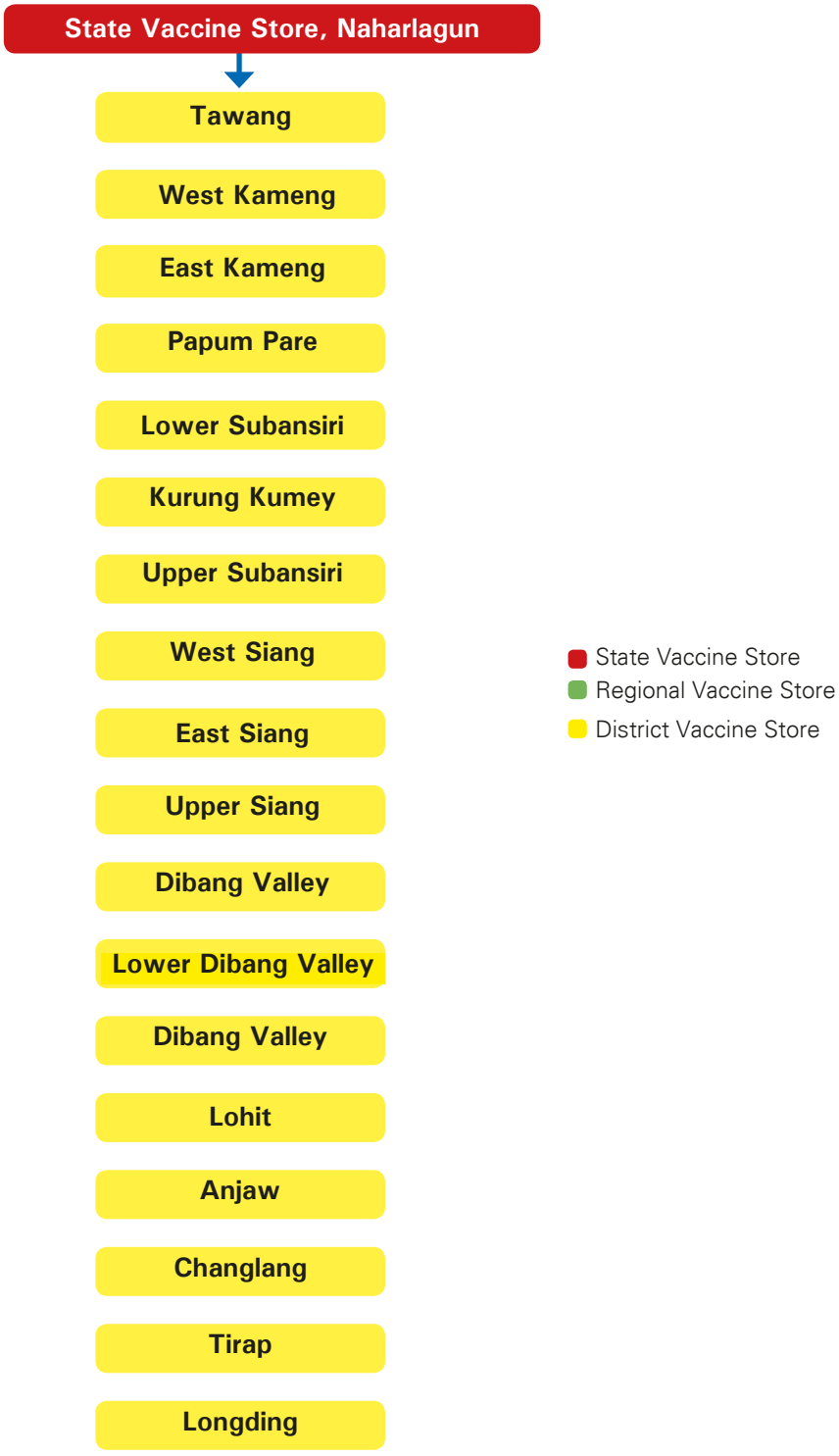
Andaman & Nicobar Islands: Vaccine Distribution Network



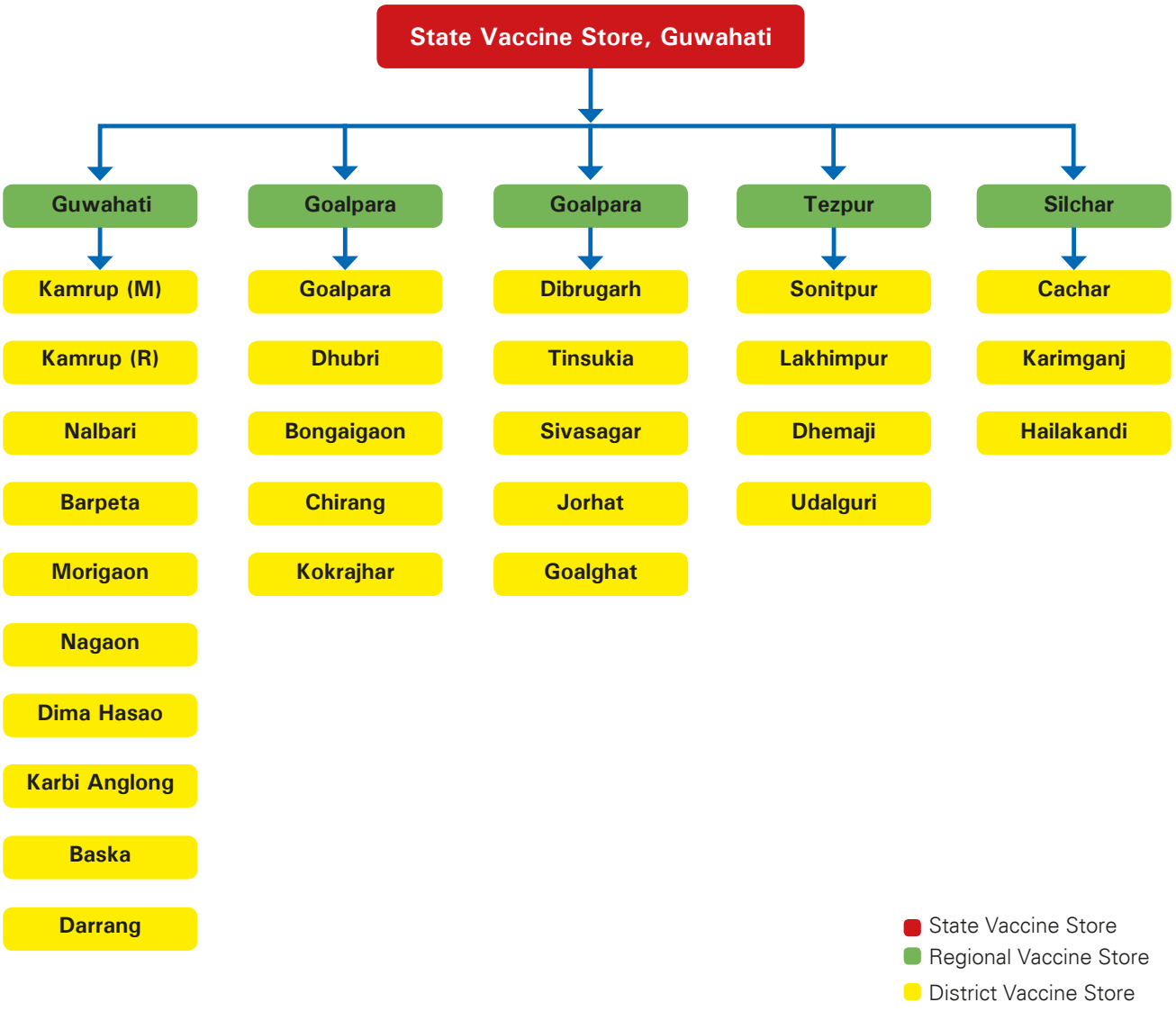
Andhra Pradesh: Vaccine Distribution Network



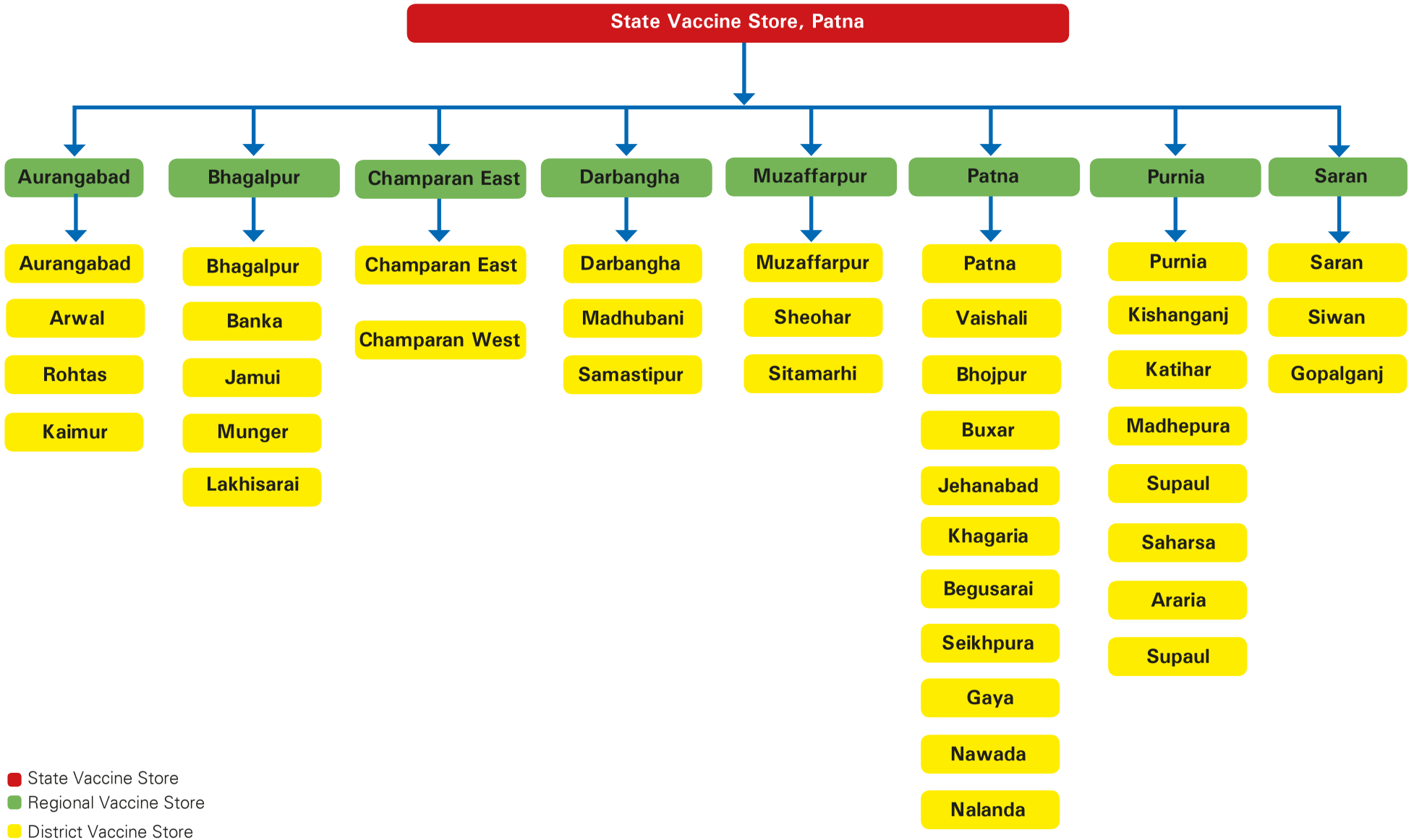
Arunachal Pradesh: Vaccine Distribution Network



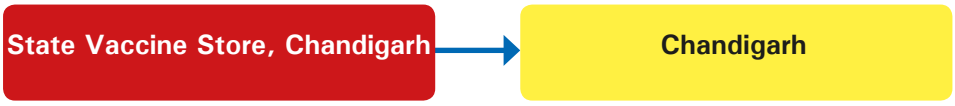
Assam: Vaccine Distribution Network



Bihar: Vaccine Distribution Network

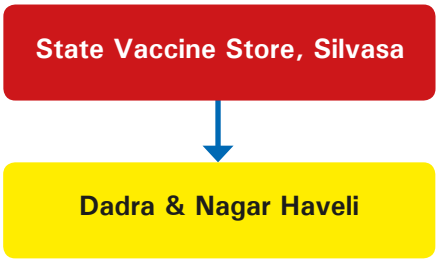


Chandigarh: Vaccine Distribution Network

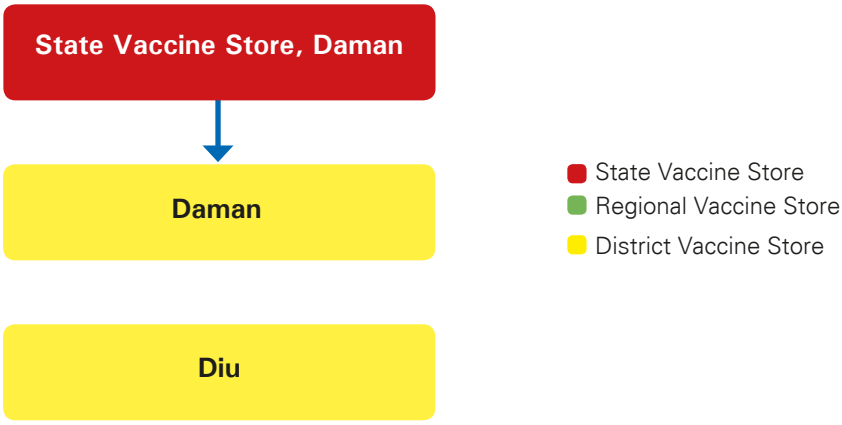


Chhattisgarh: Vaccine Distribution Network

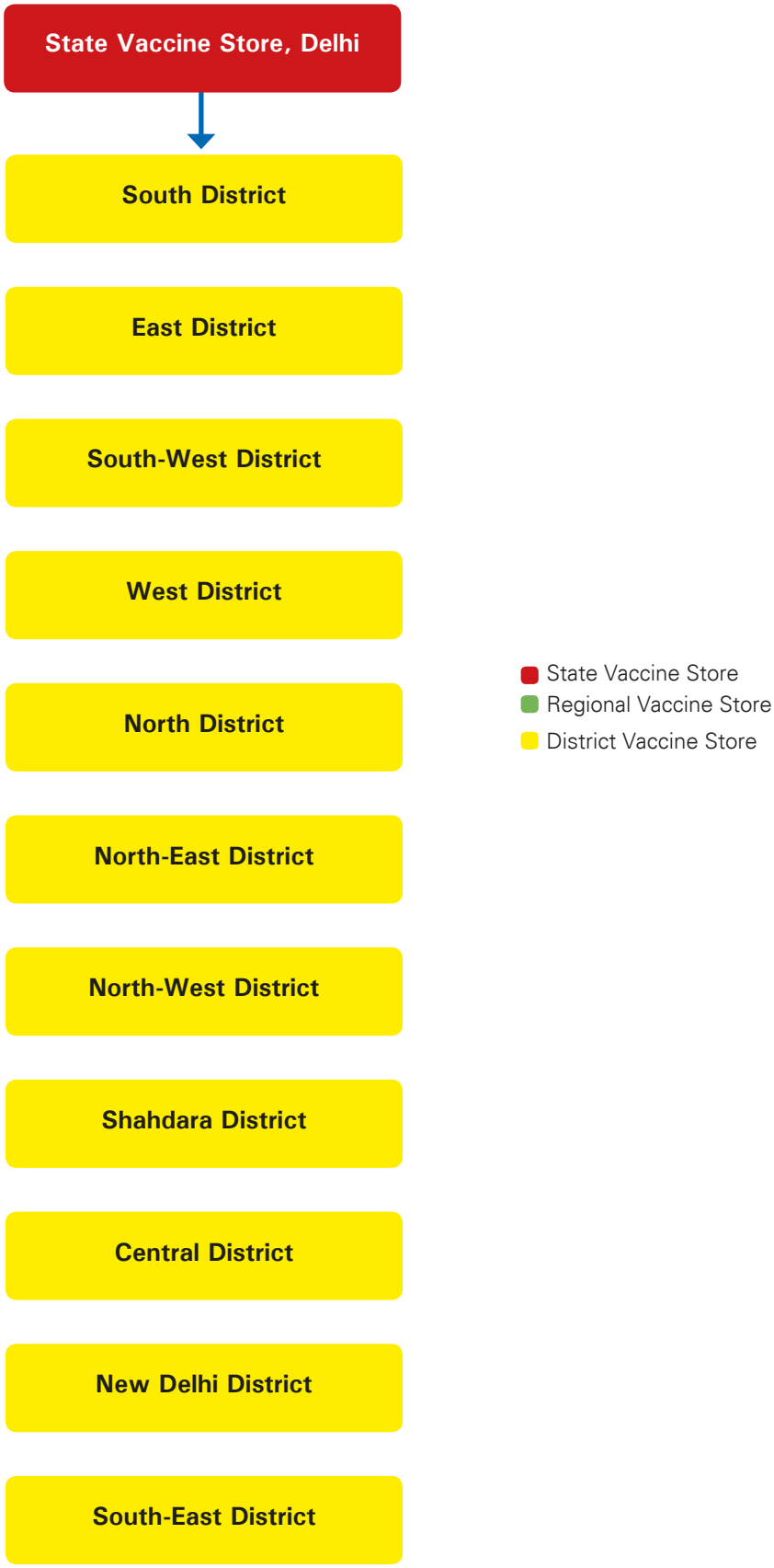
Dadra & Nagar Haveli: Vaccine Distribution Network



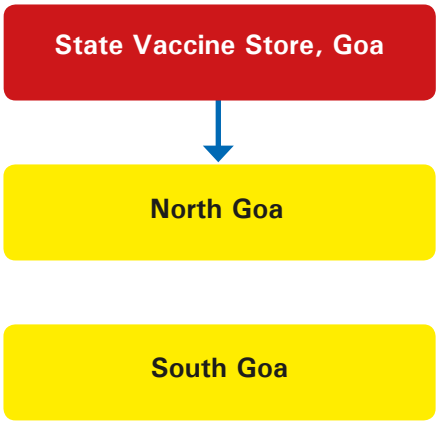
Daman & Diu: Vaccine Distribution Network



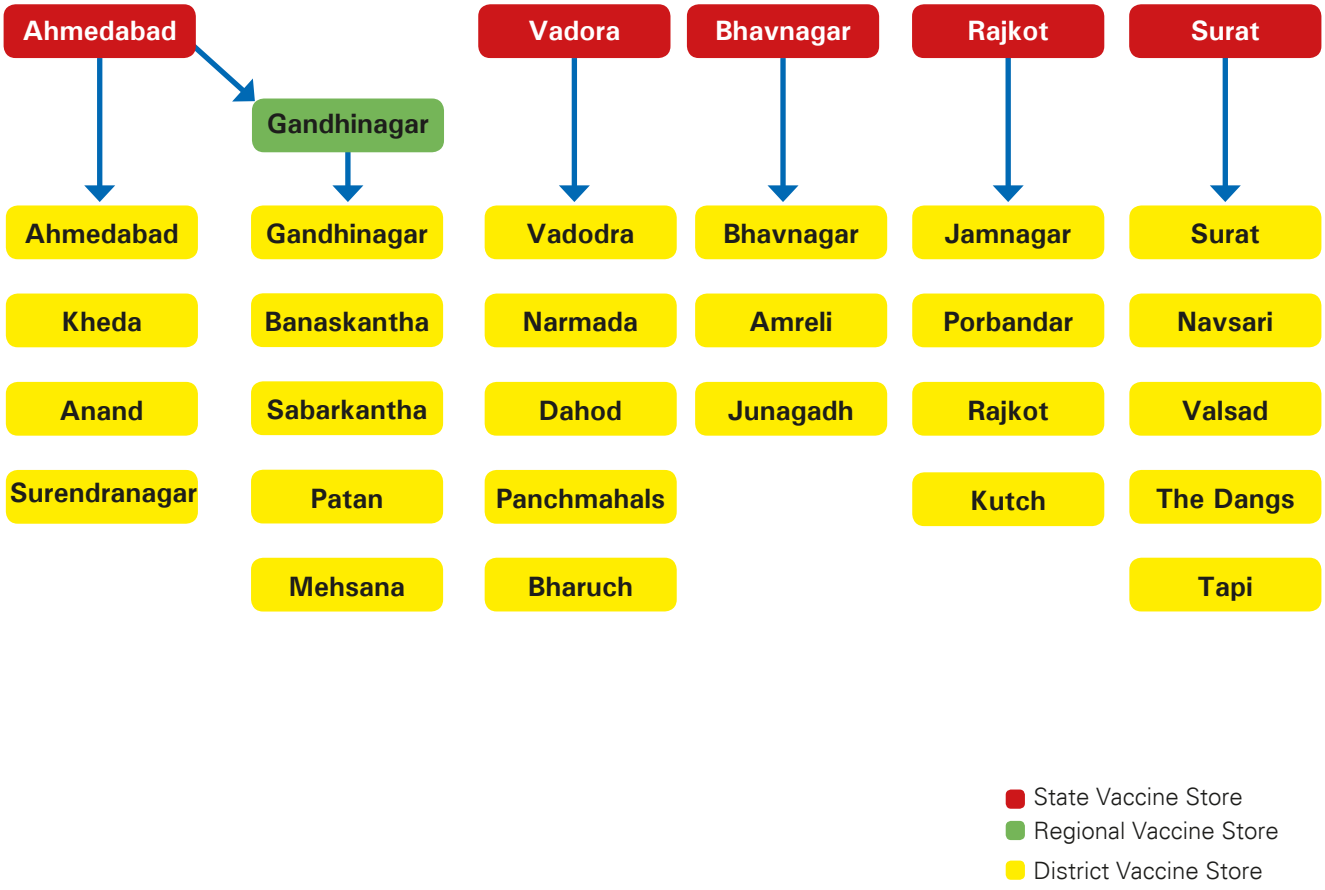
Delhi: Vaccine Distribution Network



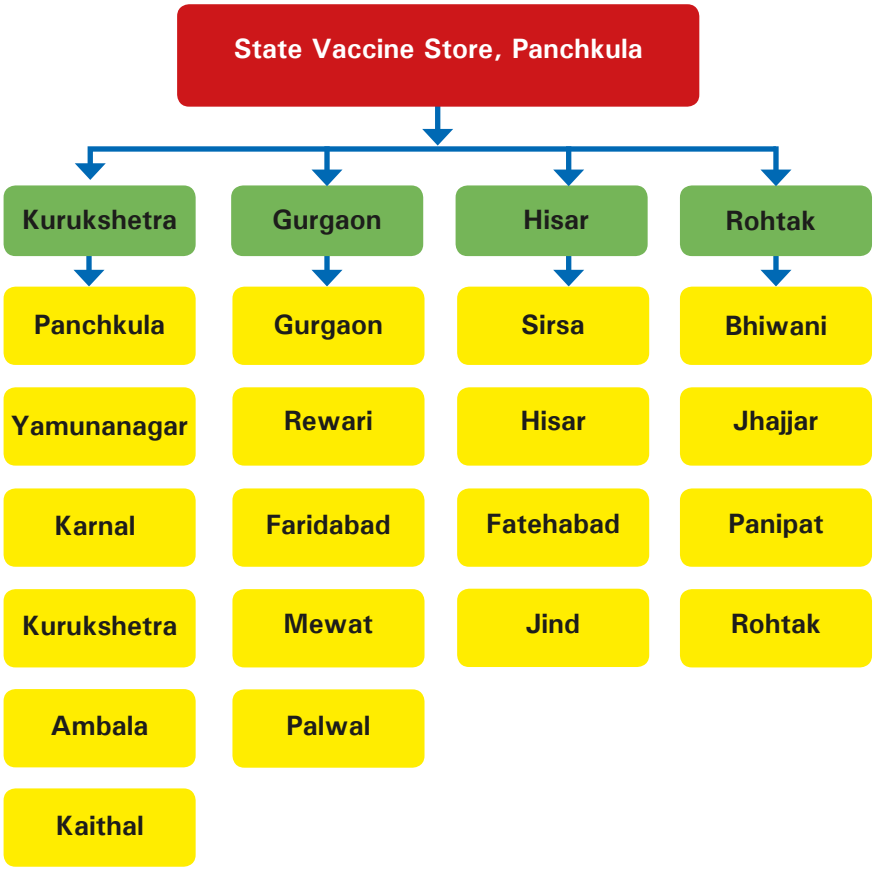
Goa: Vaccine Distribution Network



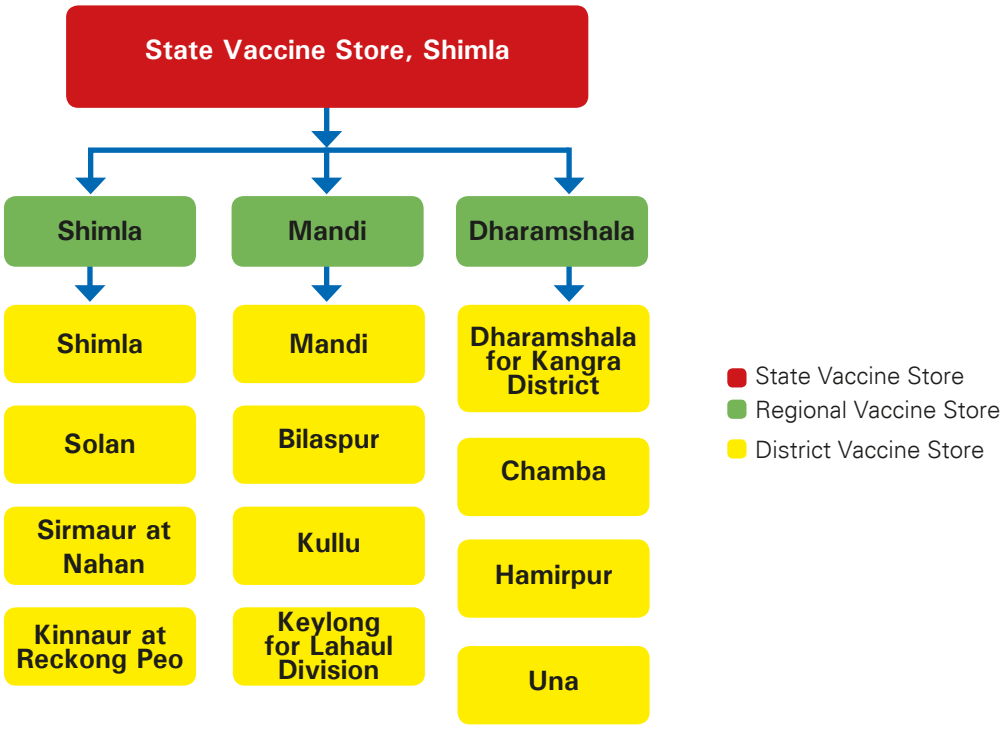
Gujarat: Vaccine Distribution Network



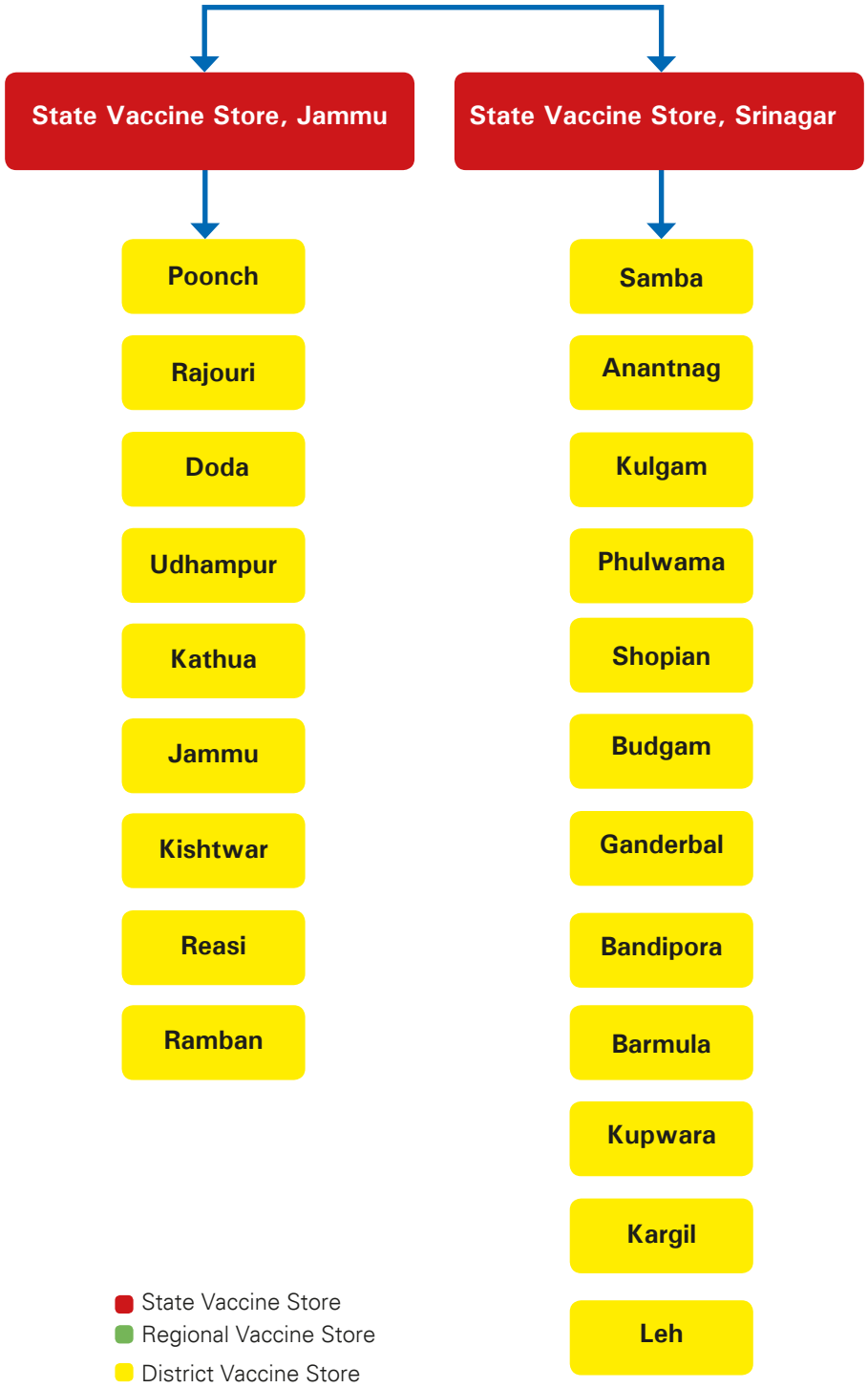
Haryana: Vaccine Distribution Network



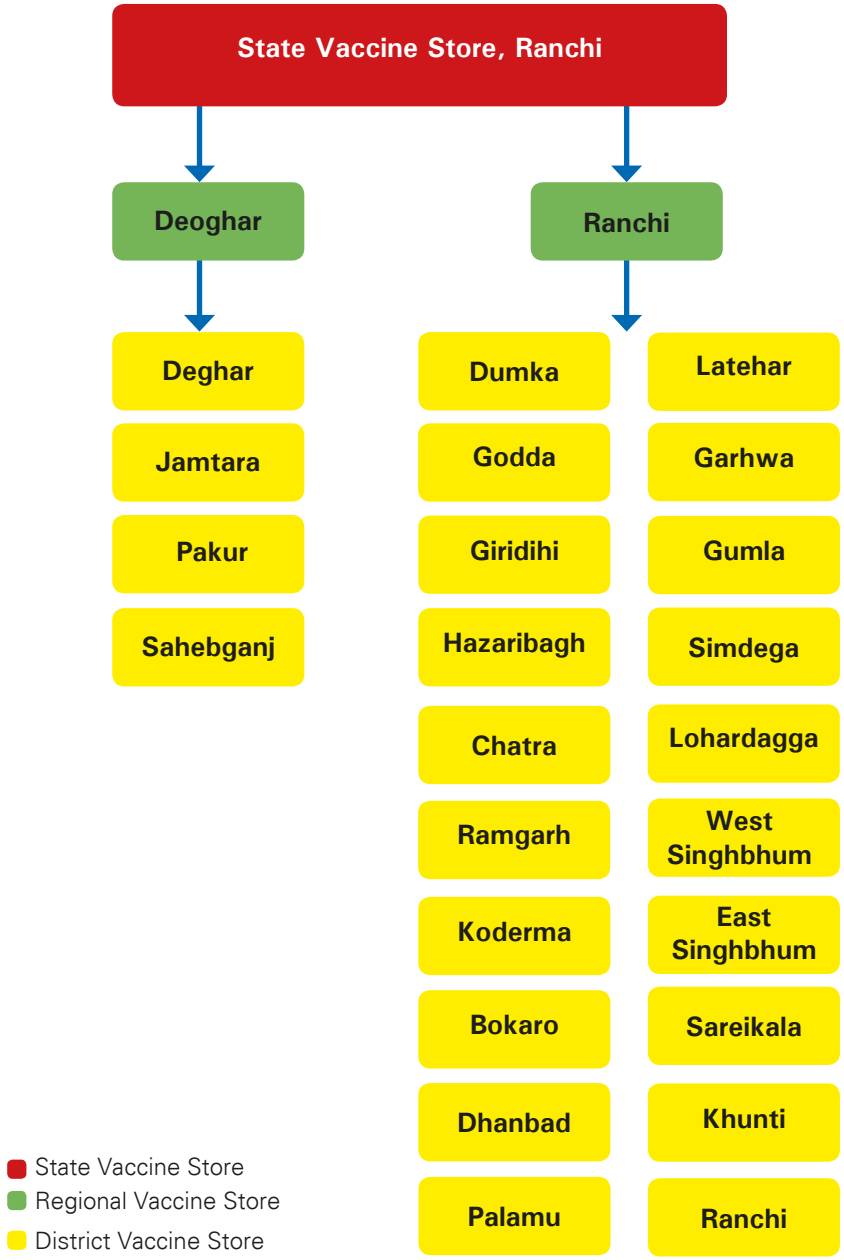
Himachal Pradesh: Vaccine Distribution Network



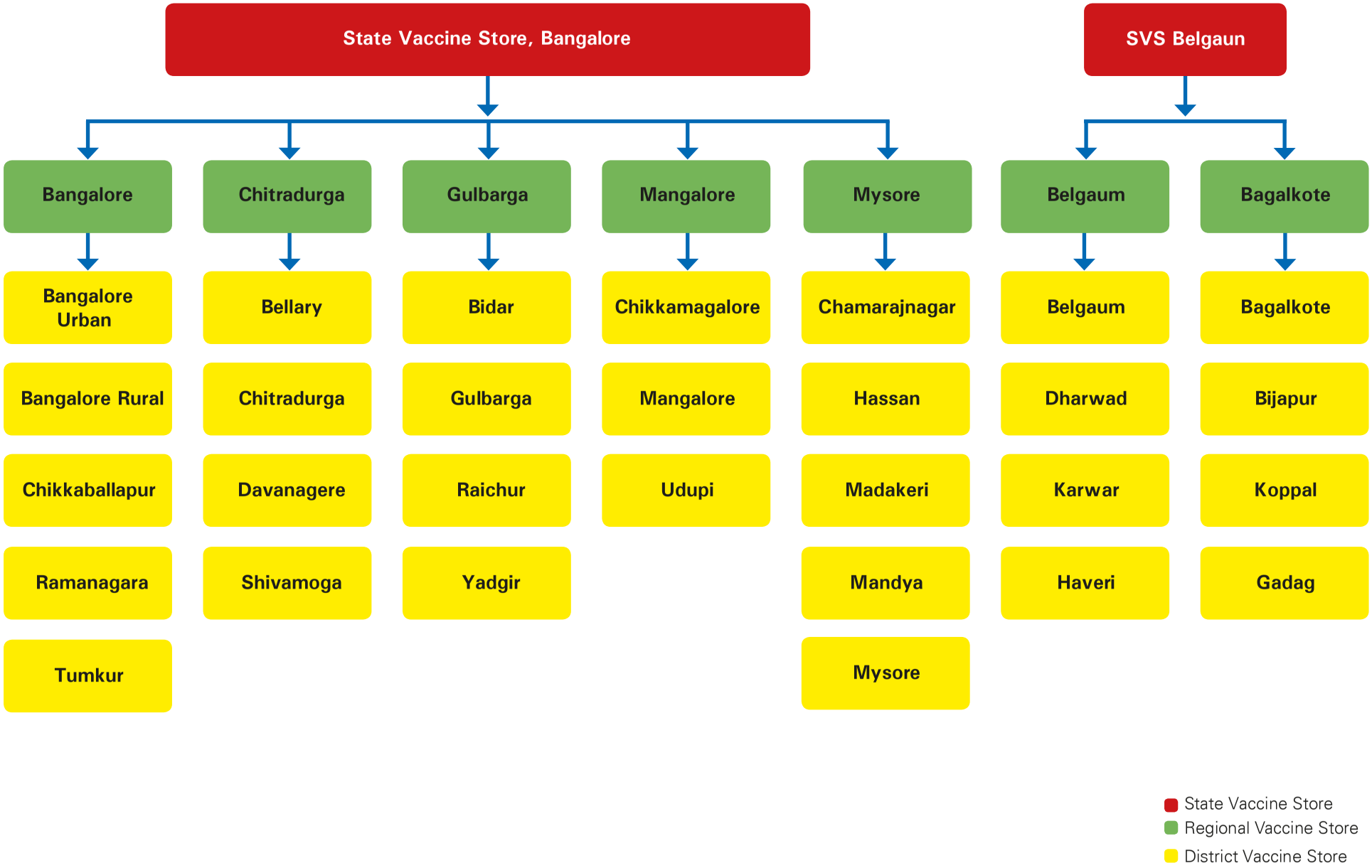
Jammu & Kashmir: Vaccine Distribution Network



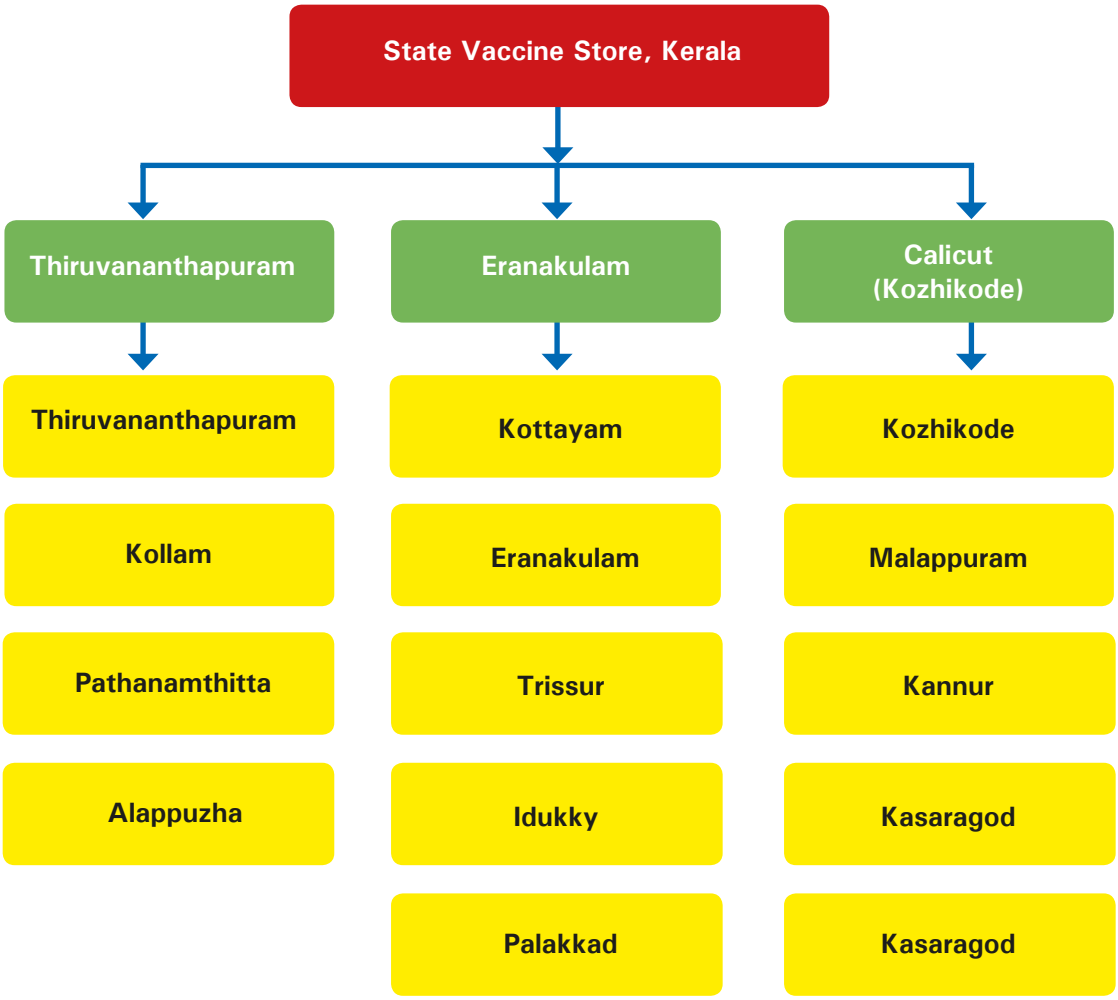
Jharkhand: Vaccine Distribution Network



Karnataka: Vaccine Distribution Network

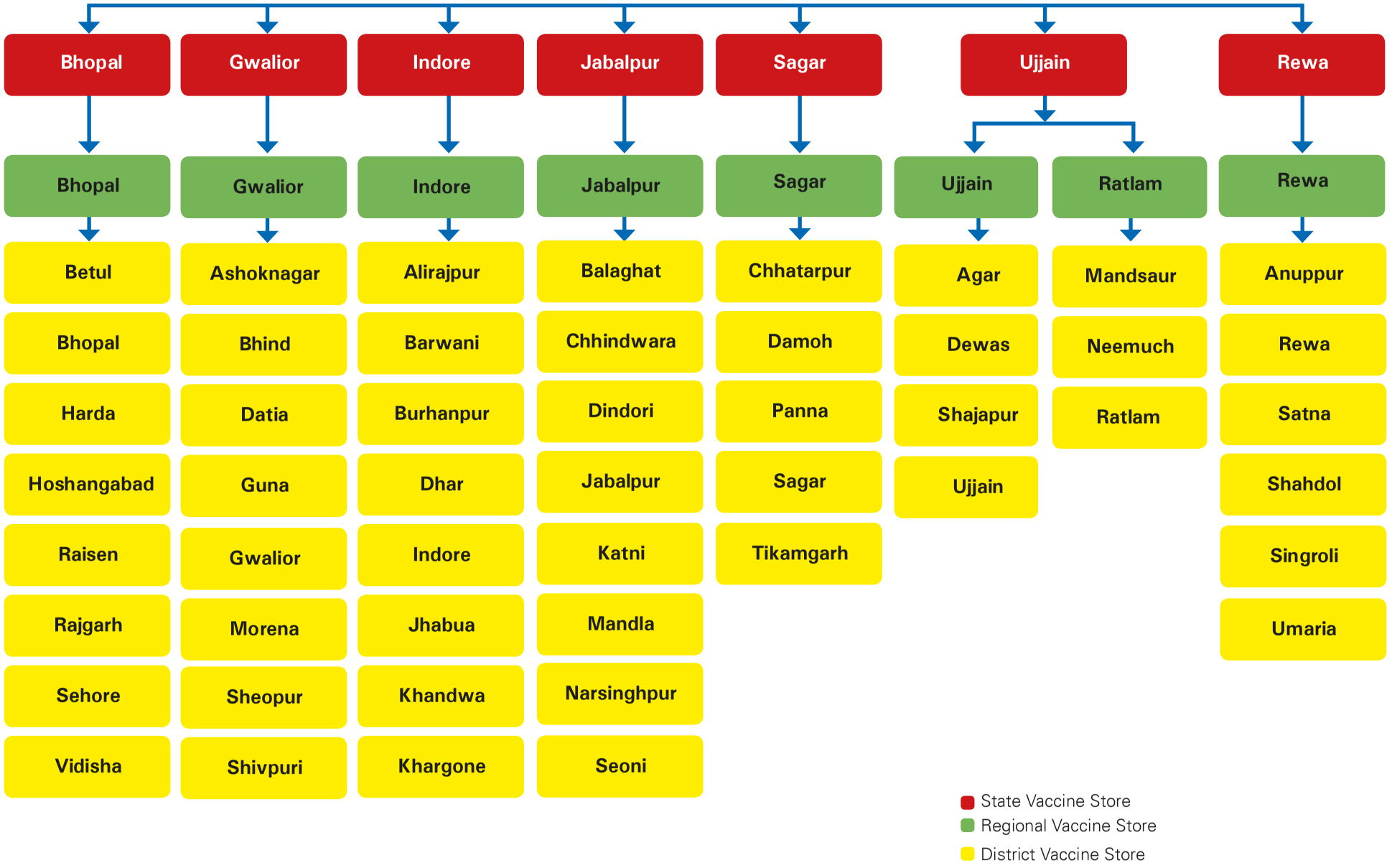


Kerala: Vaccine Distribution Network

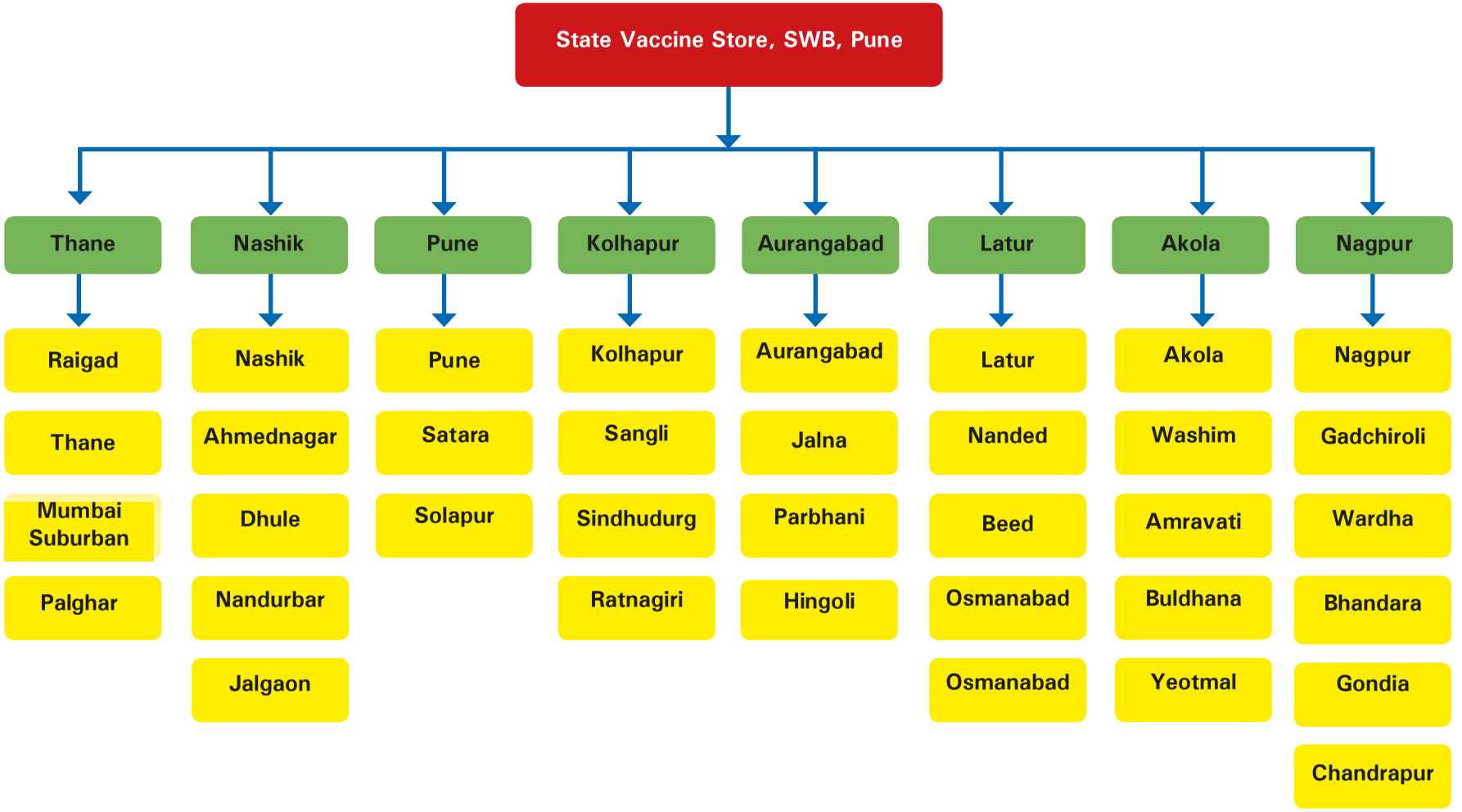


Lakshadweep: Vaccine Distribution Network

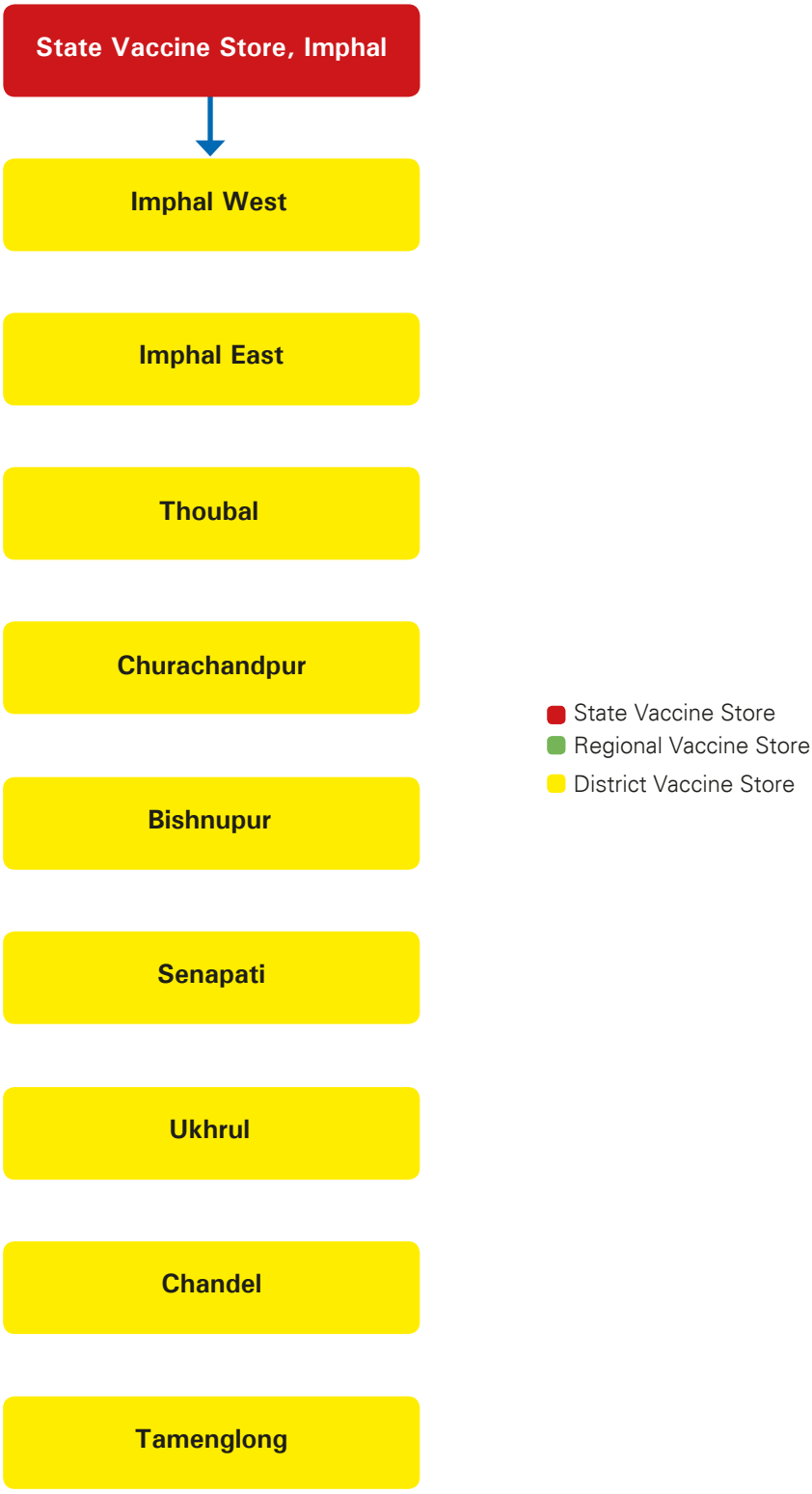
Madhya Pradesh: Vaccine Distribution Network



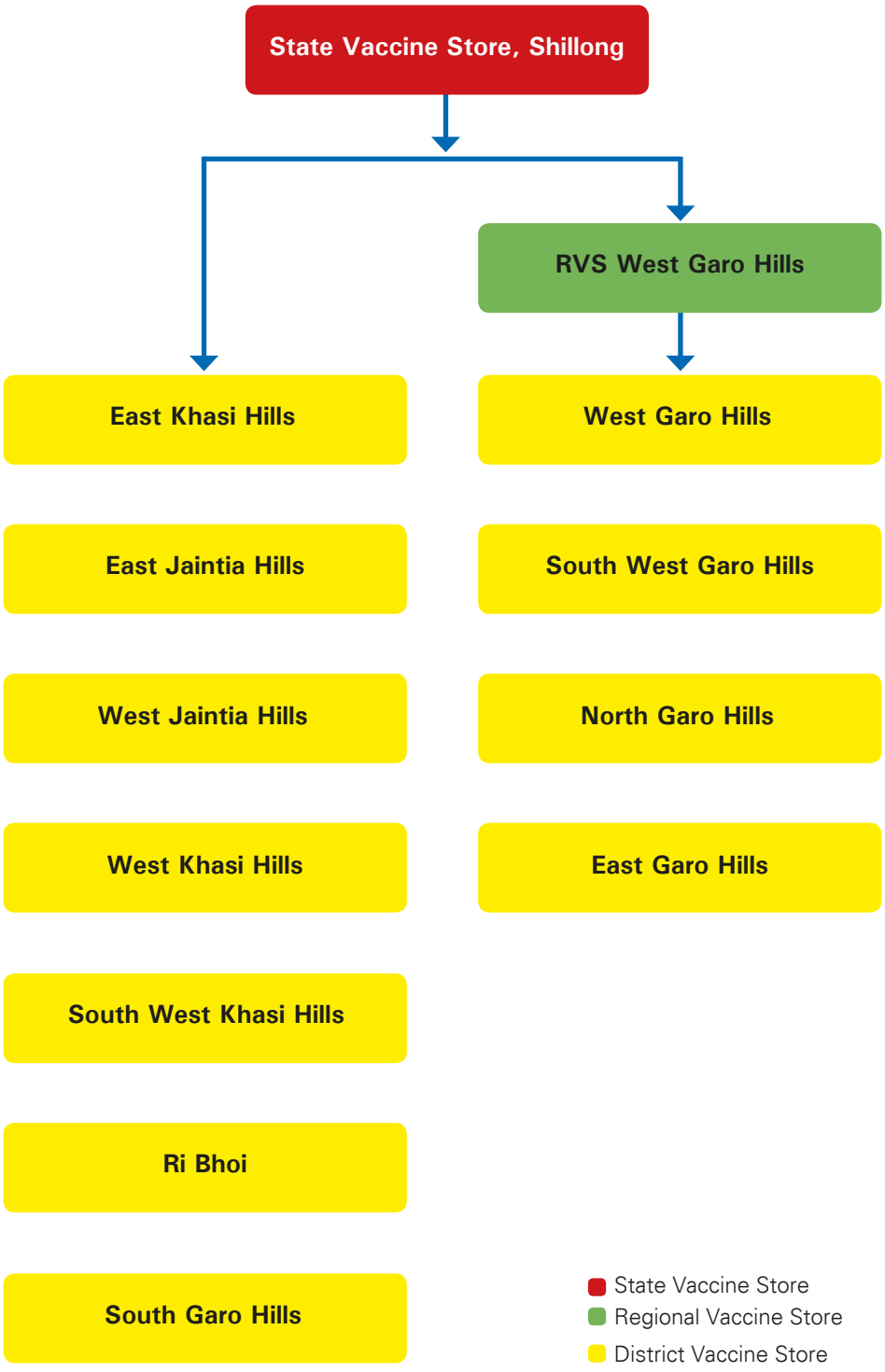
Maharashtra: Vaccine Distribution Network



Manipur: Vaccine Distribution Network

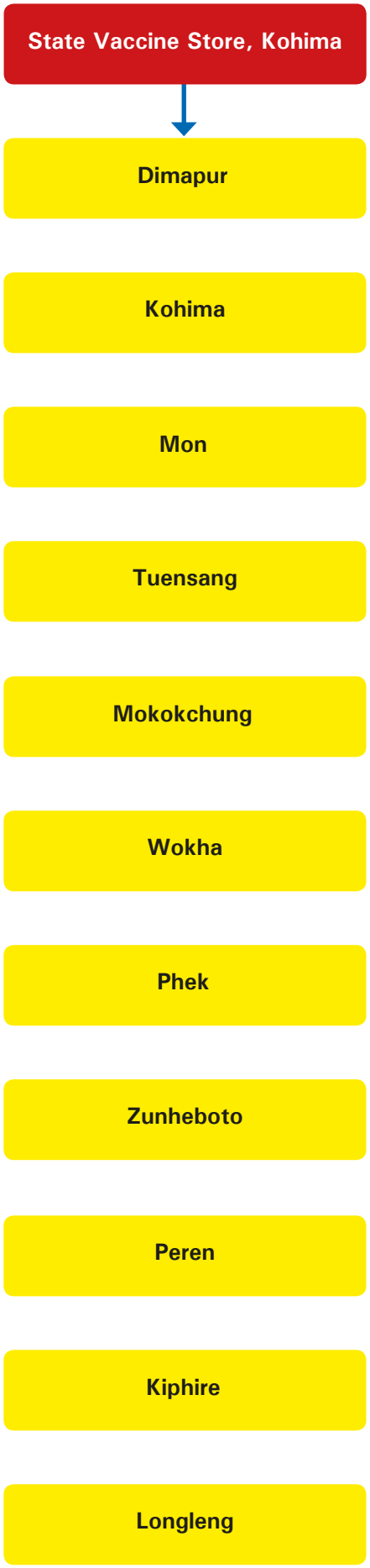


Meghalaya: Vaccine Distribution Network

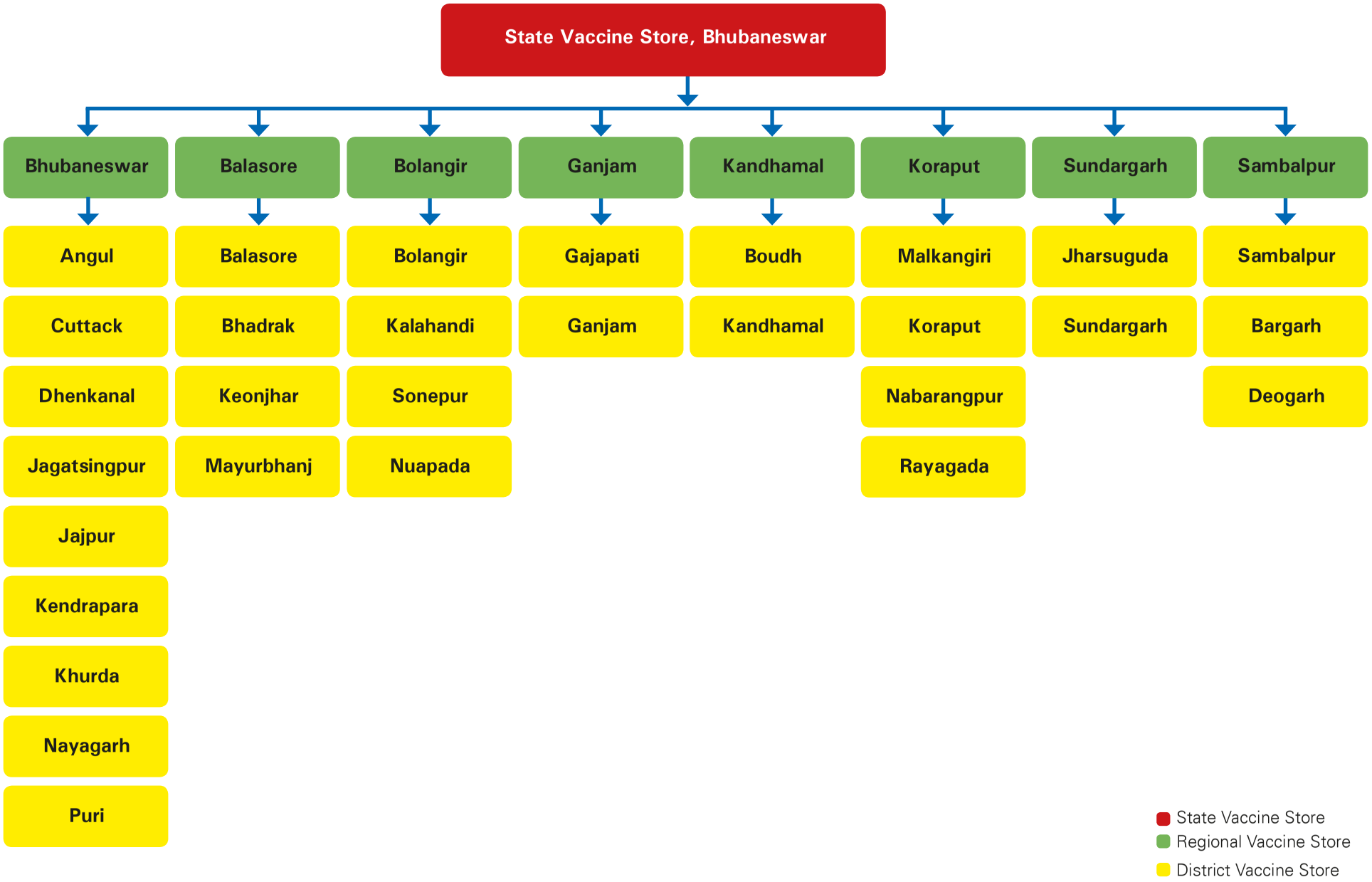


Mizoram: Vaccine Distribution Network

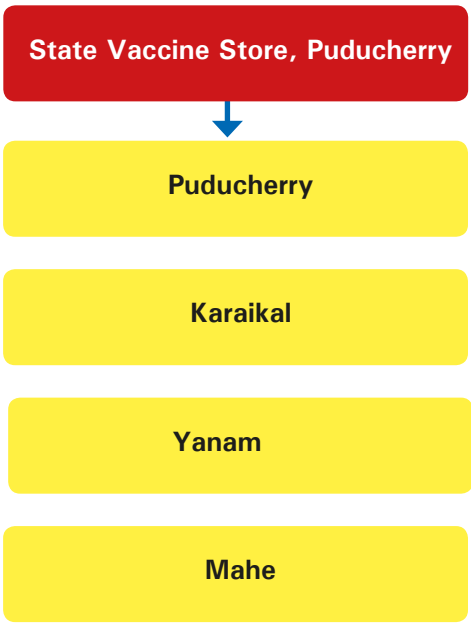
Nagaland: Vaccine Distribution Network



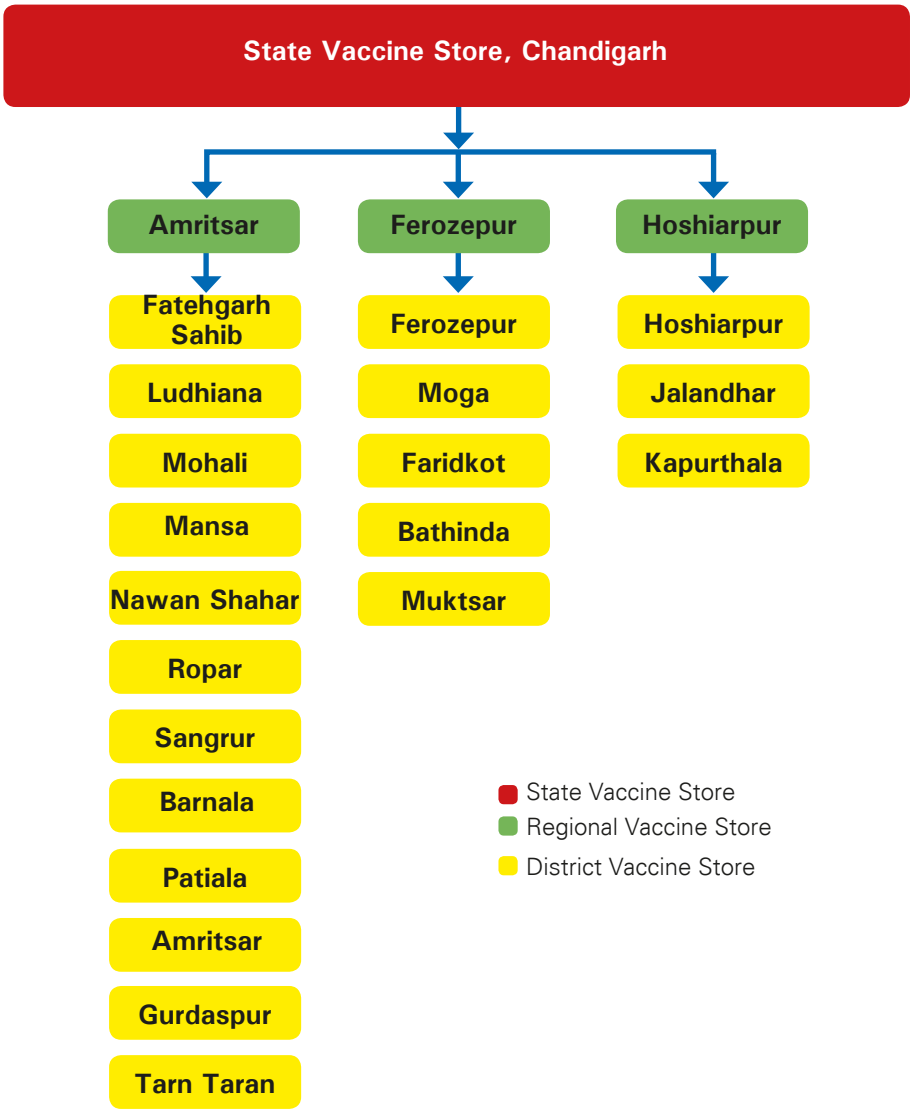
Odisha: Vaccine Distribution Network



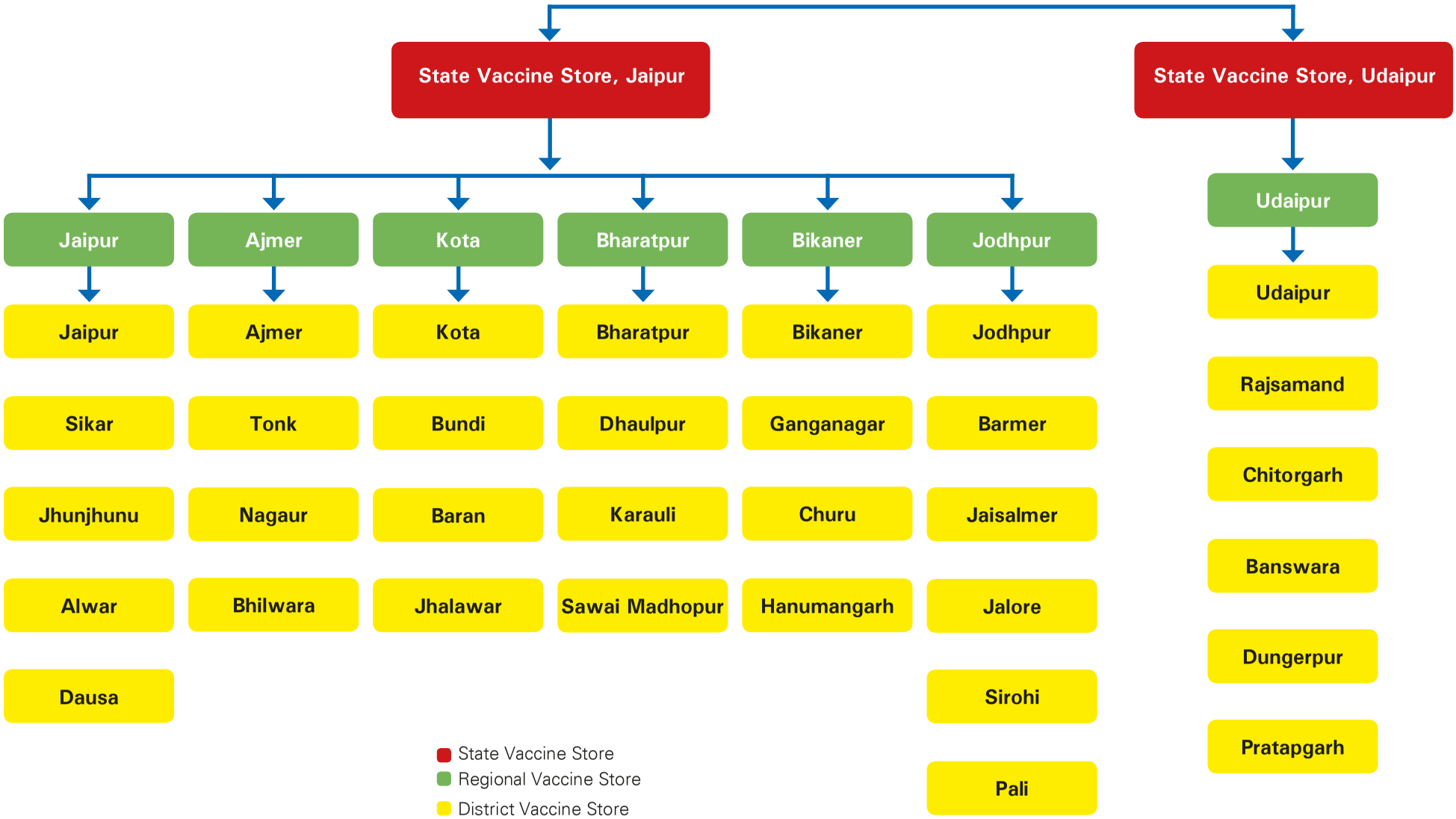
Puducherry: Vaccine Distribution Network



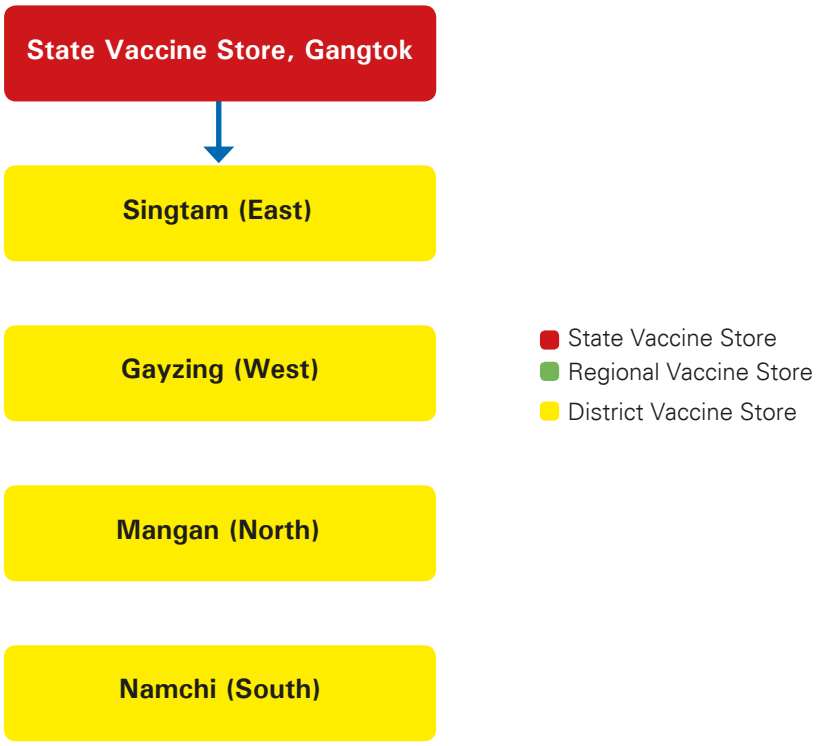
Punjab: Vaccine Distribution Network



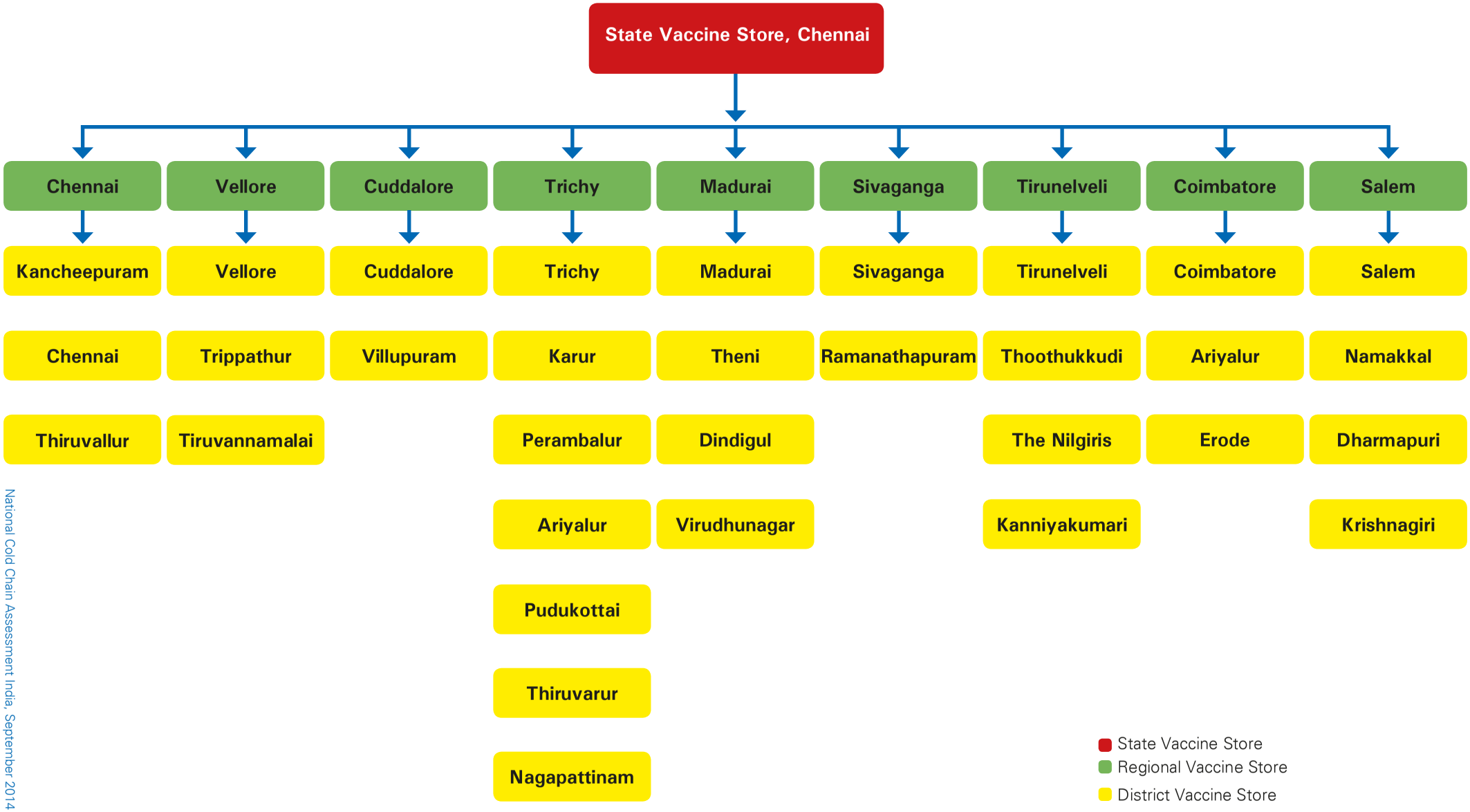
Rajasthan: Vaccine Distribution Network



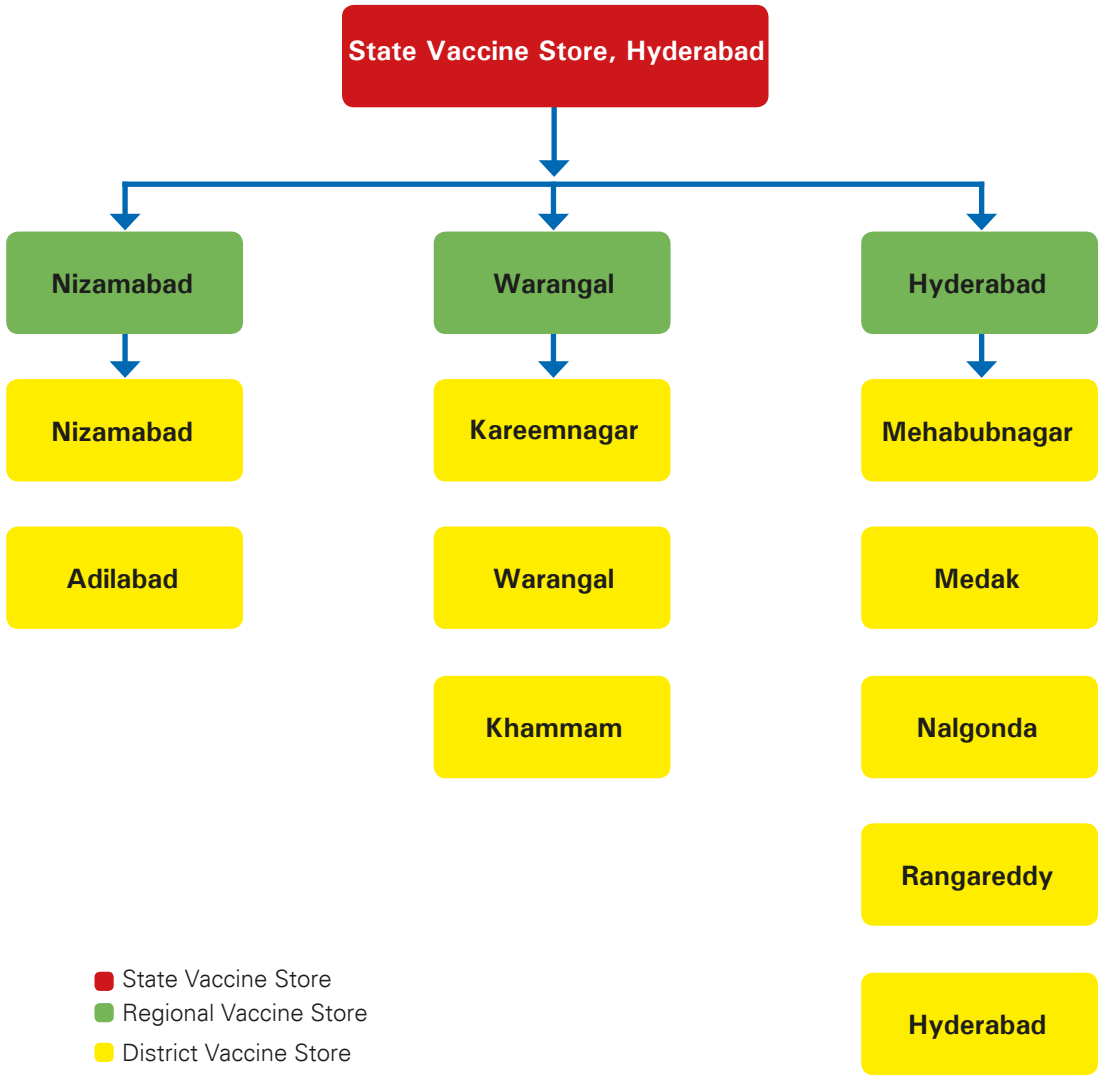
Sikkim: Vaccine Distribution Network



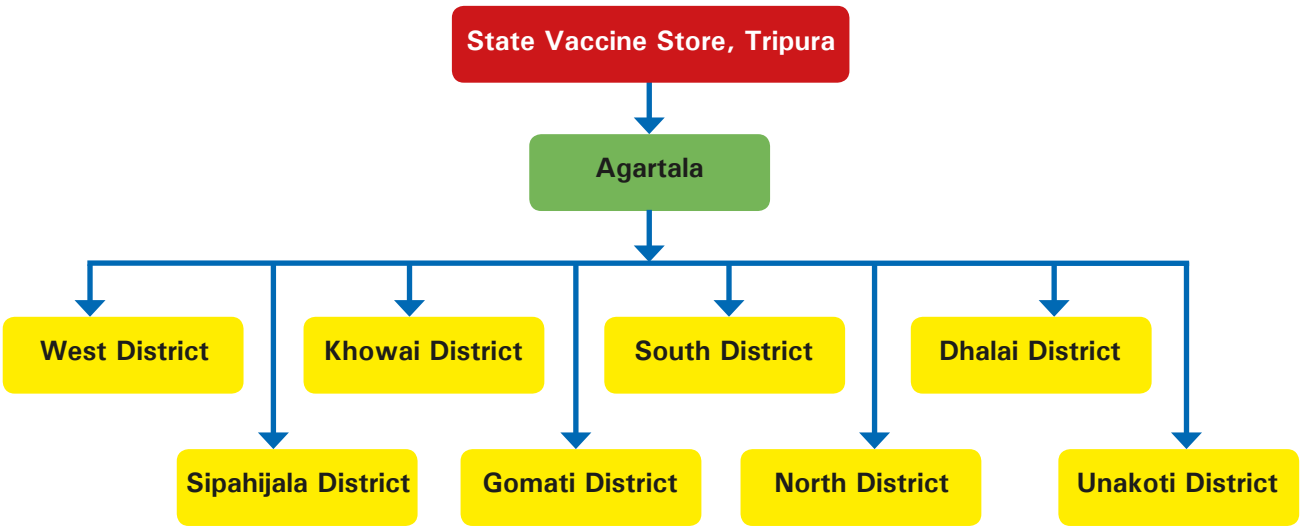
Tamil Nadu: Vaccine Distribution Network



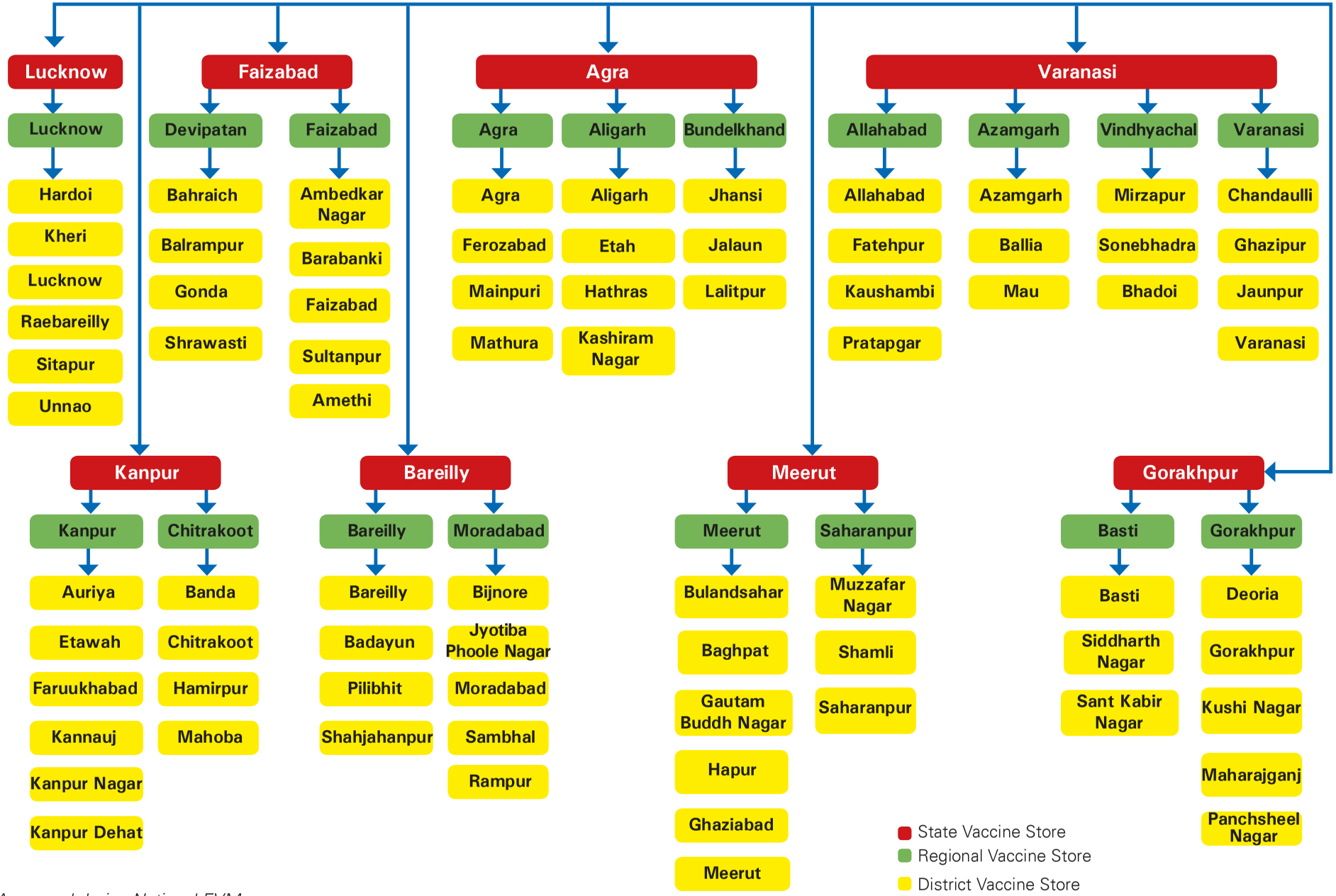
Telangana: Vaccine Distribution Network



Tripura: Vaccine Distribution Network

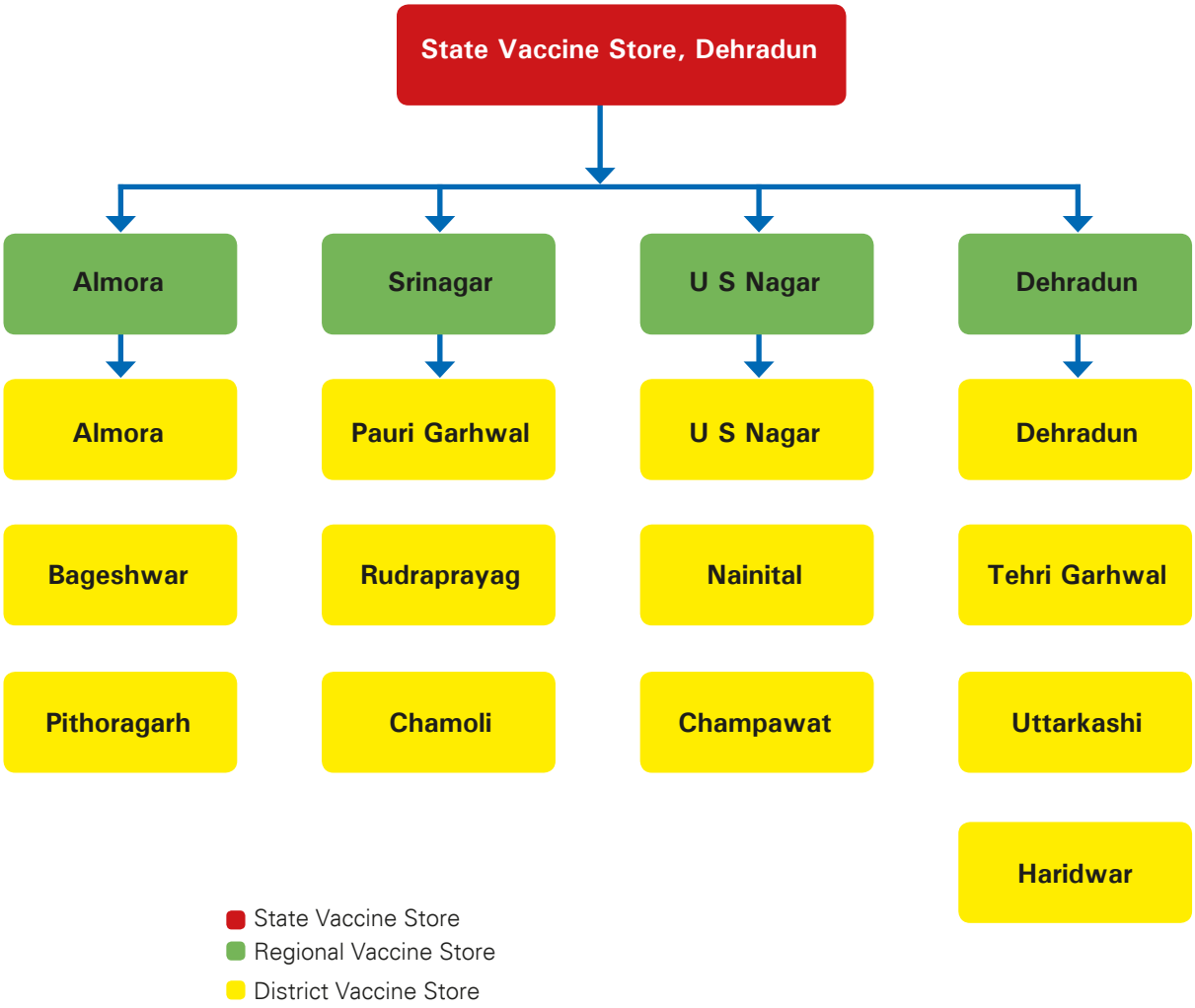


Uttar Pradesh : Vaccine Distribution Network



Assessed during National EVM

Uttarakhand: Vaccine Distribution Network



West Bengal: Vaccine Distribution Network

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Telephone: +91 11 24690401
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Munirka
New Delhi 110067
Telephone: +91 11 2616 5959
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