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INTEGRATED CHILD HEALTH AND IMMUNIZATION SURVEY (INCHIS)

Report - Rounds 1 & 2

July 2016

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Immunization Technical Support Unit, Ministry of Health and Family Welfare, Government of India

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MESSAGE

India's Universal Immunisation Program (UIP), launched in 1985, is the largest immunisation program in the world catering to 27 million newborns, with over 9 million immunisation sessions planned per year. It is the Government's constant endeavour to not only improve access, coverage and quality of immunisation services but also to reach the under-reached and ensure full immunisation coverage to all children under the UIP programme.

Accomplishment of the target of full immunisation coverage requires an understanding of the immunisation program and identifying factors which influence the achievement of the target. The past few yeas have seen rapid changes in the immunisation program with introduction of auto-disable syringes (2005) and new antigens for immunization (Penta 2011-15, IPV 2015, Rotavirus vaccine 2016). The combination vaccines (Pentavalent) have decreased the number of pricks required per child and a thrust to reach the most unreached children through Mission Indradhanush. In order to have a reliable data on immunization coverage to monitor the progress of these initiatives being implemented under UIP, the Government of India initiated the Integrated Child Health and Immunization Survey (INCHIS).

Initiated in 2015, INCHIS aims to provide high quality – accurate, reliable and timely – data on status of immunization coverage and related indicators to inform priorities for UIP and monitor impact of interventions being undertaken by the MoHFW towards improving immunization coverage, including Mission Indradhanush (MI). So far, INCHIS has completed two rounds of survey.

The first two rounds of INCHIS survey shows that MI has provided a significant jump in immunization estimates – meeting the objectives planned by the MoHFW, I hope that subsequent rounds of INCHIS would continue to provide information on immunization coverage that will help in further strengthening India's health and immunization goals for its children.

The efforts of Ministry of Health and Family Welfare (MoHFW), Immunization Technical Support Unit (ITSU) and United Nations Development Programme (UNDP), who have tirelessly worked and supported this project, are acknowledged with appreciation.

(B.P. Sharma)

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FOREWORD

Hundreds of millions of children have been immunized since the Universal Immunization Programme (UIP) was launched in 1985 in the country. The objective of UIP was to reduce mortality and morbidity due to six major vaccine preventable diseases with six basic vaccines. However, today the UIP provides 13 vaccines protecting from a total of nine vaccine-preventable diseases. Since the inception of UIP, constant efforts have been undertaken to strengthen its functioning and reach by incorporating UIP into the Child Survival and Safe Motherhood Programme in 1992 and a more holistic programme of Reproductive and Child Health (RCH) in 1997. In 2005, routine immunization was integrated into the overall umbrella health programme, National Rural Health Mission (NRHM) and subsequently the National Health Mission (NHM) after 2012.

Intensive ongoing efforts focus on strengthening the immunization programme, both in terms of coverage as well as quality of immunization services, in order to provide full immunization to every child in the country. In order to achieve effective and timely assessment of existing as well as new programme initiative, there is a need for rapid, accurate and reliable evidence to capture the change in the ground realities of the immunization programme.

The Integrated Child Health and Immunization Survey (INCHIS) has been initiated in 2015 by MoHFW, with GAVI-Heatlh Systems Strengthening (HSS) support, as a rapid, bi-annual chid health survey to obtain timely data on immunization coverage and a snapshot of the status of health system infrastructure. Regular, timely data is crucial for evaluating programme interventions and inform decision making and prioritization of future interventions. In this regard, the information provided in this INICHIS report on the impact of Mission Indradhanush is appreciable.

I envision that the information compiled in this report will provide helpful insights into the progress being made in the country related to immunization coverage of children and provide up-to-date estimates on indicators that can be used to further improve the immunization programme. I thank the GAVI support, staff at the Ministry of Health and Family Welfare, Immunization Technical Support Unit (ITSU) and United Nations Development Programme (UNDP) for their diligent efforts towards this survey.

(C.K.Mishra)

New Delhi
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PREFACE

Immunization is one of the most cost-effective public health interventions to prevent a series of vaccine-preventable diseases. The Government of India launched the Universal Immunization Program (UIP) in 1985 to provide immunization cover against six major vaccine preventable diseases. Since being operational for over 30 years, the UIP has achieved full-immunization coverage among 65% children in the first year of their life nationally. To further strengthen and invigorate the program and attain full immunization coverage for all children at a rapid pace, the Ministry of Health and Family Welfare launched Mission Indradhanush (MI) in December 2014. A total of 201 districts were covered under phase-I of MI, vaccinating over 76,00,000 children between April and July 2015.

Better planning of the UIP and monitoring of MI to accomplish the target of full immunization coverage requires an understanding of coverage at the population level and identification of appropriate determinants that influence the achievement of the target. Such information is key towards effective prioritization and direct course corrections in existing programmes. Hence, to obtain regular, timely data on child health and immunization coverage as well as determinants including immunization delivery infrastructure, a new survey – Integrated Child Health and Immunization Survey (INCHIS) – was planned by the Ministry of Health and Family Welfare.

This report presents data from the first (March-April 2015) and second (September-October 2015) rounds of the INCHIS survey conducted before and after the first phase of Mission Indradhanush programme, respectively in the year 2015. The report provides nationally representative immunization coverage estimates, functional state of health facilities in selected states and evaluation of the impact of Mission Indradhanush n improving immunization coverage.

I hope that the database provided in this round of INCHIS would help us to evaluate the successes of our program and strengthen the monitoring and implementation of the program. I would like to thank the teams at the Ministry of Health and Family Welfare (MoHFW), Immunization Technical Support Unit (ITSU), and United Nations Development Programme (UNDP) for their efforts in completing this study. I especially appreciate the efforts of the leadership at immunization division of MoHFW, ITSU and UNDP in implementing the study.

Ms. Vandana Gurnani

Joint Secretary

Table of Contents

List of Tables

List of Figures

Acknowledgements

Integrated Child Health and Immunization Survey (INCHIS) was conceptualized and designed by the INCHIS Core team at Immunization Technical Support Unit (ITSU) who analysed the data and compiled the report. The INCHIS core team deserves special mention for their immense dedication and hard work in making this survey a success. We are thankful to all members, past and present, of ITSU and PHFI who provided invaluable technical guidance towards improving the survey and spent valuable time during the training of investigators and monitoring of data collection.

Funding and strategic support of Gavi – The Vaccine Alliance as part of the Health Systems Strengthening (HSS) project was instrumental in the successful completion of the survey. We also appreciate the steadfast operational support from members of United Nations Development Programme (UNDP) for smooth conduct of both rounds of INCHIS as well as for ensuring data quality.

Data collection for this survey was done by Nielsen India Pvt. Ltd. (Nielsen). We acknowledge the contribution of a thoroughly professional core team of Nielsen, including all state coordinators, zonal coordinators, supervisors, field investigators and listers involved in the two rounds of INCHIS.

The data collection for this study would not have been possible without the support of State Health and Family Welfare departments and district officials. We are thankful to all the participants of the survey for their time and patience in providing information to the field survey staff.

Last and most important, the survey would not have been possible without the guidance, leadership and support of the Immunization Division at the Ministry of Health & Family Welfare (MoHFW), Government of India, at all stages of this project.

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Abbreviations

AD	Auto-Disabled
AEFI	Adverse Events Following Immunization
AHS	Annual Health Survey
ANC	Antenatal Check-up
ANM	Auxiliary Nurse Midwife
ARI	Acute Respiratory Infection
ASHA	Accredited Social Health Activist
AVD	Alternate Vaccine Delivery
AWW	Anganwadi Worker
BCG	Bacillus Calmette–Guérin
BPL	Below Poverty Line
CEB	Census Enumeration Block
CES	Coverage Evaluation Survey
CHC	Community Health Centre
CI	Confidence Interval
DHS	Demographic Health Survey
DLHS	District-Level Household and Facility Survey
DoB	Date of Birth
DPT	Diphtheria, Pertussis and Tetanus
EAG	Empowered Action Group
EPI	Expanded Program on Immunization
FI	Field Investigator
FIC	Full Immunization Coverage
FIR	First Information Report
FTP	File Transfer Protocol
GAPPD	Global Action Plan for the Prevention and Control of Pneumonia and Diarrhea
GoI	Government of India
HBNC	Home-Based Newborn Care
HEP-B0	Hepatitis-B Birth Dose
HH	Household
HMIS	Health Management Information System

HoH	Head of Household
ICC	Intra-Cluster Correlation Coefficient
IEC	Information, Education and Communication
IMNCI	Integrated Management of Neonatal and Childhood Illness
IMR	Infant Mortality Rate
INCHIS	Integrated Child Health and Immunization Survey
IPHS	Indian Public Health Standards
IQR	Inter-Quartile Range
ILR	Ice-Lined Refrigerators
ITSU	Immunization Technical Support Unit
IUD	Intra-Uterine Device
IUCD	Intra-Uterine Contraceptive Device
JE	Japanese Encephalitis
J & K	Jammu & Kashmir
LPG	Liquefied Petroleum Gas
MCP	Mother and Child Protection
MCTS	Mother and Child Tracking System
MDG	Millennium Development Goal
MHW	Male Health Worker
MI	Mission Indradhanush
MIS	Management Information System
MNP	Minimum Needs Program
MoHFW	Ministry of Health and Family Welfare
MO	Medical Officer
MP	Madhya Pradesh
MSTA	Mukhyamantri Saghan Tikakaran Abhiyan
NE	North-East
NFHS	National Family Health Survey
NHM	National Health Mission
NI	No Immunization
NRHM	National Rural Health Mission
NW	North-West
OBC	Other Backward Caste
OPD	Outpatient Department

OPV	Oral Polio Vaccine
OPV0	Oral Polio Vaccine Birth Dose
ORS	Oral Rehydration Solution
OVP	Open Vial Policy
PAPI	Pen and Paper Interviewing
PCA	Principal Component Analysis
PHC	Primary Health Centre
PHFI	Public Health Foundation of India
PI	Partial Immunization
PU	Planning Unit
RCH	Reproductive and Child Health
RI	Routine Immunization
RKS	Rogi Kalyan Samiti
RSOC	Rapid Survey On Children
SAGE	Study on global AGEing and adult health
SC	Scheduled Caste/ Sub-Centre
SE	South-East/ Standard Error
SEPIO	State EPI Officer or State Immunization Officer
SLT	State-Level Training
SRS	Sample Registration System
ST	Scheduled Tribe
SW	South-West
ToT	Training of Trainers
U5MR	Under-five Mortality Rate
UHC	Urban Health Centre
UHP	Urban Health Post
UIP	Universal Immunization Program
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Emergency Fund
UP	Uttar Pradesh
VHND	Village Health Nutrition Day
VPD	Vaccine-Preventable Diseases
VVM	Vaccine Vial Monitor
WB	West Bengal
WHO	World Health Organization

Executive Summary

Child Health, Immunization, and INCHIS Survey

Despite substantial improvements in health and health system over the last two decades, a large number of children in India, especially in the age group of 0-5 years, continue to suffer from vaccine-preventable diseases, early childhood illnesses, lack of access to improved sanitation and safe drinking water, and under-nutrition. Reducing child mortality was a key target of the Millennium Development Goal (MDG)-4 set for India with an aim to reduce infant mortality rate (IMR) and under-five mortality rate (U5MR) in the country by two-thirds between 1990 and 2015. The resulting target was to achieve an IMR of 26 and U5MR of 39 per 1000 live births by 2015. As per Sample Registration System 2013 estimates of IMR and U5MR are 40 and 49 respectively.

Immunization is a globally accepted public health intervention to prevent vaccine-preventable diseases. Incomplete immunization increases the risk of illness and death among children, with implications for their growth potential and the risk of morbidity and mortality in later years. India's Universal Immunization Program (UIP), launched in 1985, is among the largest immunization programs in the world in terms of the quantity of vaccines used, number of beneficiaries covered, geographical spread and human resources involved. Under the UIP, all beneficiaries (pregnant women and children) are eligible to receive vaccination at the nearest public health facility or at an immunization post (Anganwadi centers/ other identified session sites) near their village or urban locality, as per the National Immunization Schedule.

Accomplishment of the target of coverage goals requires an understanding of the immunization coverage at the population level. In India, population-level child immunization indicators are derived from many health surveys, which vary in frequency, scope and detail, limiting their use in regular monitoring of coverage and planning and evaluation of immunization interventions. To overcome these drawbacks, a new survey – Integrated Child Health and Immunization Survey (INCHIS) – was planned by the Ministry of Health and Family Welfare (MoHFW) in consultation with the Immunization Technical Support Unit (ITSU) based at Public Health Foundation of India (PHFI). For regular monitoring of immunization coverage, INCHIS aims to collect representative data for India and selected states on a bi-annual basis. Another key objective of INCHIS is to evaluate the impact of Mission Indradhanush (MI) in improving full immunization coverage (FIC). Since its inception, INCHIS has completed three rounds of data collection in 25 states by April 2016. This report presents the findings from the first two rounds of INCHIS. The first round of data collection took place during March-April 2015 (INCHIS-1) and the second round was implemented in September-October 2015 (INCHIS-2).

In each round of INCHIS, 12 states were selected for inclusion in the sample– six fixed states and six other states on a rotational basis. Six fixed states which were repeated in both rounds of INCHIS were the following:

- Bihar
- Maharashtra
- Madhya Pradesh (MP)
- Rajasthan
- Telangana
- Uttar Pradesh (UP),

In INCHIS-1, in addition to these six fixed states, the six rotational states were the following:

- Tamil Nadu
- Manipur
- Uttarakhand
- Haryana
- Odisha
- Andhra Pradesh

In INCHIS-2, in addition to the six fixed states, the six rotational states were the following:

- Himachal Pradesh
- Jammu & Kashmir
- Goa
- Mizoram
- West Bengal
- Kerala.

The state selection method was designed to ensure that at least one state from each geographical region as well as from each level of development category was selected. Within a selected state, a three-stage stratified sampling design was adopted with district, cluster (village/urban ward) and households being selected at three different stages.

Status of National-level Immunization Coverage and Mission Indradhanush

Despite a long standing national program for universal immunization in India, only 64.1% (95% CI 60.7-67.5) of 12-23 months old children were found to be fully immunized according to the first round of INCHIS data (INCHIS-1, Mar-Apr 2015). Full Immunization Coverage (FIC) is defined as receipt of one dose of Bacillus Calmette-Guerin (BCG), three doses of oral polio vaccine (OPV) and three doses of diphtheria, pertussis, tetanus (DPT) or Pentavalent, and one dose of measles containing vaccine. Although, recent coverage estimates indicate that the urban-rural coverage inequality has decreased in many states, at the national level there still exists statistically significant difference in FIC between urban (72.8%, 95% CI 66.1-78.6) and rural (61.0%, 95% CI 56.9-64.8) areas, according to INCHIS-1 data.

In order to achieve full immunization coverage of 90% before 2020 at the national level and reduce inequity in coverage, the Ministry of Health and Family Welfare (MoHFW) launched Mission Indradhanush (MI) in December 2014. Indradhanush depicts seven colors of the rainbow, representing seven vaccine-preventable diseases, namely tuberculosis, diphtheria, pertussis, tetanus, polio, hepatitis B and measles. One of the key objectives of MI was to ensure that the partially immunized and unimmunized children are fully immunized in selected high focus districts (MI districts) through special immunization drives. Between INCHIS-1 (Mar-April 2015) and INCHIS-2 (Sep-Oct 2015), the first phase of MI was implemented, one week per month for each of the four intervening months (April to July 2015). Hence, INCHIS-1 and INCHIS-2 was used to evaluate the first phase of MI intervention (MI phase 1), considering the data from the two rounds as baseline and endline.

Impact of Mission Indradhanush at the National-level and for Fixed States

Full Immunization Coverage: Estimated full immunization coverage increased from 64.1% (95% CI 60.7-67.5) in INCHIS-1 to 73.5% (95% CI 70.3-76.4) in INCHIS-2, an increase of approximately 9% in FIC within a span of six months, potentially attributable to Mission Indradhanush. Urban-rural coverage gap in FIC decreased from 11.9% in INCHIS-1 (72.8% in urban vs. 61.0% in rural areas) to 5.3% in INCHIS-2 (77.3% in urban vs. 72.0% in rural areas). According to INCHIS-2 data, urban (95% CI 71.3-82.4) and rural (95% CI 68.2-75.6) coverage gap is not statistically significant, potentially because of the targeted implementation of MI.

Data from five states (Bihar, Madhya Pradesh, Rajasthan, Telangana and Uttar Pradesh), included in both rounds of INCHIS, was used to assess the impact of MI. Among these states, significant

increase in FIC was observed in three states, namely Bihar, Madhya Pradesh and Rajasthan, at endline (INCHIS-2) relative to baseline (INCHIS-1). The percentage of children aged 12-23 months who were fully immunized increased from 62.9% to 86.5% in Bihar (24% increase), from 54.7 % to 70.6 % in Rajasthan (16% increase) and from 67.9% to 74% in Madhya Pradesh (6% increase). The increase in FIC in Bihar and Rajasthan is statistically significant, whereas in MP it is not. In contrast to the high FIC attainments in Bihar, Rajasthan and Madhya Pradesh, the full immunization coverage increased only marginally from 48.0% to 51.0% in Uttar Pradesh. With already high levels of immunization coverage in Telangana, the full immunization coverage in the state remained almost at the same level between INCHIS-1 (90.7%) and INCHIS-2 (90.4%).

Though the levels of partial immunization (PI) reduced significantly between the two rounds, rates for no immunization (NI) remained stagnant between baseline and endline. Partial Immunization is defined as a case when the child receives at least one dose of at least one of the following vaccines (but not all): BCG, OPV, DPT/Penta, Measles. No Immunization (NI) is defined as a case when the child does not receive any of the above mentioned vaccines.

At the national level, there is a statistically significant decline of 10% in PI (from 31.9% to 22.2%), but NI rate remained stagnant at the level of 4%. The highest decline in partial immunization levels was noted in Bihar (by 24 percentage points; from 36.0% to 12.4%) and Rajasthan (by 14.5 percentage points; from 38.7 % to 24.2%) - both are statistically significant. NI rates were higher in Uttar Pradesh (9.9%) and Rajasthan (6.6%) according to INCHIS-1. Although, Rajasthan went through a decline of 1.4 percentage point in NI rate, it increased slightly in UP according to INCHIS-2 data.

Vaccine-specific Coverage and Drop-out Rates: In the context of individual vaccines, there exists a clear pattern with a gradual decrease in coverage rate starting with BCG up to three doses of OPV and DPT/Penta and then an increase for measles. For example, according to INCHIS-1 data, the coverage rates for India are:

- 91.9% for BCG
- 90.8% (86.2%) for one dose of OPV (DPT)
- 83.2% (80.6%) for two doses of OPV (DPT)
- 68.6% (67.5%) for three doses of OPV (DPT)
- 80.2% for measles.

Numbers in the parenthesis along with OPV represent corresponding DPT dose coverage. In INCHIS-2, no significant improvement was noted for BCG, one dose of OPV (OPV1), one dose of DPT (DPT1), two doses of OPV (OPV2), two doses of DPT (DPT2), and one dose of measles coverage in India. However, for three doses of OPV (OPV3) and three doses of DPT (DPT3), the increase in coverage (approximately 8% for both) was statistically significant subsequent to Mission Indradhanush phase 1.

According to INCHIS-1 data, national-level measles coverage in India was 80.2% which increased to 84.9% in INCHIS-2. Higher coverage rate for measles relative to coverage rate of three doses of OPV and DPT/Pentavalent observed in INCHIS is consistent with the findings from other health and demographic surveys, although measles is scheduled much later than the three doses of OPV and DPT/Pentavalent in the national immunization schedule. Completion of vaccine schedule for vaccines that require multiple doses (e.g., OPV/Pentavalent) remains a major challenge.

According to INCHIS-1 data, at the national level, highest drop-out rates were observed between OPV1 and OPV3 and also between DPT1/Penta1 and DPT3/Penta3. The national level drop-out rate between OPV1 and OPV3 was remarkably high (23.7%, 95% CI 21.5-26) and from DPT1/Penta1 to DPT3/Penta3 the drop-out rate was 20.6% (95% CI 18.6-22.7). Both of these drop-out rates get reduced to 14% according to INCHIS-2 data. This reduction is statistically significant and can potentially be attributed to targeted supplementary immunization activities under MI.

Relatively low drop-out rates between three doses of OPV/DPT/ Penta and measles (7% at baseline and 4% at endline) suggest that completion of three doses of oral polio vaccine and DPT/Penta remains a key factor in achieving high levels of full immunization coverage.

This is also suggested by the increased FIC observed in Bihar, Rajasthan and Madhya Pradesh between INCHIS-1 and INCHIS-2 being associated with increased coverage of three doses of OPV and three doses of DPT/Penta. All the three states witnessed 14-26 % increase for three doses of OPV and 11-25 % increase for three doses of DPT/Penta. As evidenced by the data, Uttar Pradesh did not reveal a similar impact of Mission Indradhanush.

Pre and Post-Comparison of MI districts: Among the districts selected for INCHIS, 36 districts where MI was operational in phase 1 were included in both rounds. While comparing immunization coverage by vaccine across two rounds of INCHIS for these MI districts, no significant improvement was noted for BCG, OPV1, DPT1/Penta1, and one dose of measles. However, for OPV3 and DPT3/Penta3, the increase in coverage (approximately 10%) was statistically significant and seems to translate into a similar increase in full immunization coverage for these districts, subsequent to Mission Indradhanush phase 1. Furthermore, there was a statistically significant reduction in the partially immunized children (from 36.2% to 24.5%) between INCHIS-1 and INCHIS-2 but no change in the unimmunized children, indicating that MI may have been successful in specifically targeting children who were partially immunized but did not have much impact on left-out children.

State-level Coverage Estimates across INCHIS States

While reporting state-level coverage rates for INCHIS, INCHIS-2 data for fixed states (most recent available data) was considered, and for rotational states, data from respective round of INCHIS in which these states were covered was used. As per the latest estimates, full immunization coverage rate among children in the age group of 12-23 months was close to 50% in Uttar Pradesh and Manipur, and was slightly above 50% in Mizoram (54.4%). Telangana, West Bengal, Kerala, Bihar, Goa, and Maharashtra achieved FIC rates of more than 84%. Historically poor performing state Bihar's high FIC can potentially be explained by intensive supplementary immunization activities through Mission Indradhanush.

UP and Mizoram, the two states with the lowest FIC rate, also had the highest proportion of left-out children with a no immunization (NI) rate of 23.2% in Mizoram and 12.2 % in UP. Haryana (7.6%) and Rajasthan (5.2%) had significant number of left-out children as well. Interestingly, in Haryana a high FIC rate (78.5%) as well as a relatively high NI rate (7.6%) was observed. This suggests that benefits of routine immunization may not be reaching specific areas and sections of the population, despite overall satisfactory performance of the program. On the contrary, Goa, Himachal Pradesh, Kerala, Andhra Pradesh, Tamil Nadu, and West Bengal had hardly any left-out children in the age group of 12-23 months as the NI rate was close to 0%.

Many states have achieved the MDG-4 target of 90% measles coverage with Himachal Pradesh, West Bengal, Goa, and Telangana having 95% or above measles coverage rate among children in the age group of 12-23 months. The populous state of Uttar Pradesh (69.5%, 95% CI 62.1-76.0) had one of the lowest measles coverage rate among all INCHIS states, possibly contributing to the national measles coverage lagging behind the MDG-4 target.

Status of Immunization Services

In addition to assessing immunization coverage, INCHIS survey also evaluated the functioning of key components of health system that are crucial for immunization. In this context, sub-centres, the first point of contact between primary health care system and the community, and planning units, the cold chain storage points that oversee activities related to planning and delivery of immunization related services, were surveyed.

Sub-Centres

A total of 402 sub-centres in INCHIS-1 and 436 sub-centres in INCHIS-2 were surveyed.

Infrastructure and service delivery: Nationally, 71% of the sub-centres were housed in a government building and 65% of sub-centre buildings were reported to be in good physical condition. However, less than 50% had a clean premises and access to piped water, regular power supply and telephone facility. Sub-centers in Bihar, Madhya Pradesh, Rajasthan, Telangana, Uttar Pradesh, West Bengal, Manipur and Odisha lagged behind the rest of the country in most aspects related to infrastructure.

An estimated 83% of sub-centres in the country and most states reported a regular auxiliary nurse midwife (ANM) in position, except in states of Bihar and Haryana where this percentage was close to 60%. In Bihar 40% of sub-centres were without a regular ANM and male health worker (MHW) and in Haryana the figure was 28%. In 68% of sub-centres in the country, ANMs/ MHWs received training related to immunization in the last three years, however, in Maharashtra, Telangana, Kerala, and Mizoram less than 50% did so. An average of 12 immunization sessions were conducted by a sub-centre in the quarter prior to the survey period across India with 65% of sub-centres organizing at least one session in hard-to-reach areas. However, only 10% of sub-centres reported adverse events following immunization (AEFI) cases in the previous quarter.

Although the recommended practice of disposing a used syringe was followed in around 79% of sub-centres in the country, only 26% sub-centres in Andhra Pradesh and 31% in Manipur reported doing this. The recommended practice is to cut the syringe at the hub using hub cutter immediately after administering the injection at the session site.

Availability of equipment and medicines: Among the sub-centres surveyed, at an all-India level, only 42% had a functional instrument sterilizer available. Availability of functional hub-cutter was on the higher side (90%) at the national level. More than or equal to 95% of the sub-centres in Haryana, Himachal Pradesh, Madhya Pradesh, Maharashtra, and Tamil Nadu had a functional hub cutter available. Only half of the sub-centres in the country had all the recommended medicines (Cotrimoxazole, Paracetamol-tablet or syrup, IFA Tablets, Vitamin-A Solution, Oral Rehydration Salt Packets and Zinc tablet) available on the day of survey and there existed huge variation across states. For example, the percentages were less than 10% in Kerala, Mizoram and Uttarakhand.

Monitoring, supervision and logistics: Although more than 80% of sub-centres in the country had routine immunization (RI) micro-plan prepared for the survey year, less than half of sub-centres in Telangana and Jammu & Kashmir had the microplan available. In most states, almost all sub-centres had immunization card available in sufficient quantity for a month. However, in Odisha (50%), Uttarakhand (76%) and Madhya Pradesh (78%) this percentage was relatively low.

The mode of delivery of vaccines from the cold chain point to the session site varied across states, with either the planning unit (PU) staff, Alternate Vaccine Delivery (AVD)/courier, or ANM being the main medium of delivery. In Maharashtra, Kerala, Haryana and Odisha, the planning unit staff delivered vaccines from cold chain point to the session site. AVD/courier was the main medium of delivery in Bihar, Madhya Pradesh and West Bengal. For other states, mostly ANM collected vaccines from the cold chain point. Supply of vaccines from the cold chain point to the session site on the session day was a widespread practice nationally and in most states, except for Andhra Pradesh (26%), Manipur (52%) and Mizoram (58%).

Planning Units (PUs)

A total of 439 planning units were interviewed during INCHIS-1 and 478 during INCHIS-2.

Infrastructure and service delivery: Most of the clusters in the survey were served by planning units

that were either a primary health centre (PHC) or a community health centre (CHC). Nationally, an average of 15 sub-centres was served by a planning unit with a median catchment area population of 67,000 which varied by state and type of planning unit (PHC/CHC). The average number of sub-centres served by planning units ranged from a high of 27 in Uttar Pradesh to a low of 7 in Telangana and Haryana. The average distance of the farthest sub-centre served by the planning unit was approximately 23 km at the national level and it varied with the terrain of the state, from 11 km in Kerala to 54 km in Uttarakhand.

Nationally, 82% of the planning units were reported to be housed in buildings with good physical condition, however, only 63% were reported to have clean premises. Among all the PUs surveyed, 88% had access to regular piped water, 83% had power back up and 88% had an official computer. Only 55% had regular power supply at the national level, with some states having as low as 7% (UP), 24% (Haryana) and 32% (Manipur).

On an average three medical officers (MOs) and one pharmacist were in place as regular commissioned staff, along with an average of 13 ANMs/staff nurses per planning unit. Nationally, more than 75% of MOs and ANMs/staff nurses at planning units received training on immunization and around 83% of cold chain in-charges received training on cold chain. However, the percentage of MOs who received training on integrated management of neonatal and childhood illness (IMNCI)/ home-based newborn care (HBNC) and data entry officers who received training on mother and child tracking system (MCTS)/ health management information system (HMIS) was relatively low at around 60%.

More than 75% of the PUs in the country reported a functional waste disposable pit and 91% disposed used syringes using hub cutters.

Monitoring & supervision and logistics: 70% of PUs nationally had an RI Microplan available, with 29% of PUs in West Bengal and 35% of PUs in Uttarakhand having the microplan. Updated stock registers, vaccine distribution registers, due cum tally sheets and immunization monitoring forms were reported in more than 80% of the PUs surveyed across India. Nationally, 88% PUs reported immunization sessions planned at least once a week with the mode of distribution of vaccines from PU to the session site varying across states, with PU staff, Alternate Vaccine Delivery (AVD)/courier, or ANM collecting vaccines from PU.

Over 90% of PUs reported receipt of vaccines at least once a month. Though a rare event overall, stock-outs of five or more vaccines at least once in the past six months was reported in Rajasthan, Kerala, West Bengal, Andhra Pradesh, Madhya Pradesh, Telangana, and Mizoram. Though the occurrence of stock-outs is a rare event, in Andhra Pradesh almost all PUs reported occurrence of stock-out in the past six months for most of the vaccines. This data gets supported with a similar pattern in the neighbouring state of Telangana (though lesser in severity), indicating the problem of stock-out to be common in these two states.

Over 90% of facilities nationally reported availability of functional cold chain equipment at planning units, including that of ILRs, deep freezers, cold box and vaccine carriers. Temperature of ILRs was in recommended range (+2°C to +8°C) in around 90% of facilities but only 12% PUs in Mizoram had their ILRs in that range.

AEFI management kit was available in more than 70% facilities in the country and 86% of PUs reported systems in place for reporting and monitoring AEFIs. Overall, 12% of facilities in the country reported a serious or a non-serious AEFI in last six months.

1. INTRODUCTION

Introduction

1.1 Background

High Child Mortality in India

Despite improvements in population health and health system over the last two decades, children in India continue to lose their lives to vaccine-preventable diseases, early childhood illnesses, lack of access to improved sanitation and safe drinking water, and under-nutrition. Reducing child mortality was one of the key goals of Millennium Development Goal (MDG)-4 set for India with an aim to reduce infant mortality rate (IMR) and under-five mortality rate (U5MR) in the country by two-thirds between 1990 and 2015. The resulting target was to achieve an IMR of 26 and U5MR of 39 per 1,000 live births by 2015 [1]. In the past two decades, there has been a consistent decline in IMR and U5MR in India. However, according to recent reports from United Nations [2] and Ministry of Statistics and Programme Implementation [3], India is unlikely to meet the targets of IMR and U5MR, despite recent trends indicating an acceleration towards achieving this goal with a narrowing in the gap between the likely achievement (as per 2015 estimates) and the target rates. As per Sample Registration System, 2013 estimates of IMR and U5MR are 40 and 49 respectively.

Leading Causes of Child Mortality and Morbidity in India

According to the latest estimates of child mortality issued by United Nations Children's Emergency Fund (UNICEF), pneumonia and diarrhea continue to be the leading killers of children under the age of five worldwide. Pneumonia and diarrhea are responsible for 15% and 9% of global child deaths, and together claimed the lives of more than 1.5 million under-five children in 2013 [4]. These diseases predominantly affect developing countries and are highly concentrated in just a few countries, India being one of them [4, 5].

In 2013, the Global Action Plan for the Prevention and Control of Pneumonia and Diarrhea (GAPPD) was developed and issued by the World Health Organization (WHO) and UNICEF, outlining key interventions that should be universally adopted, with the goal of ending preventable pneumonia and diarrhea mortality in children by 2025 [6]. GAPPD set forth coverage targets of 90% for vaccinations (pertussis, measles, *Haemophilus influenzae* type B- Hib, pneumococcal, and rotavirus vaccines), 90% for access to pneumonia and diarrhea treatments, and 50% for exclusive breastfeeding of children during their first six months of life. India and Nigeria, the two countries with the largest pneumonia and diarrhea disease burdens, continue to have the lowest GAPPD scores, which are calculated averages of countries' coverage levels across key GAPPD interventions for which data is available [5].

In addition to infectious diseases, under-nutrition jeopardizes children's survival, health, growth and development, and slows national progress towards achieving development goals. According to Rapid Survey on Children (RSOC) (2013-14) [7], 29.4% of under-five children in India are underweight and 38.7% are stunted due to chronic under-nutrition. In absolute terms this indicates 43.6 million stunted children in India (calculated based on Census 2011 estimates of under-five children). Malnutrition in early childhood has serious, long-term consequences because it impedes motor, sensory, cognitive, social and emotional development. Malnourished children are less likely to perform well in school and more likely to grow into malnourished adults, and are at a greater risk of disease and early death.

Immunization Program in India

Immunization is one of the most cost-effective public health interventions to prevent a series of vaccine-preventable diseases. India's Universal Immunization Program (UIP), launched in 1985, is one of the largest immunization programs in the world in terms of the quantity of vaccines used, number of beneficiaries covered, geographical spread and human resources involved. Under the UIP, all vaccines are given free of cost to the beneficiaries as per the National Immunization Schedule. All beneficiaries (pregnant women and children) can get vaccinated at the nearest public health facility or at an immunization post (Anganwadi centres/ other identified session sites) near their village or urban locality.

Evolution of India's Universal Immunization Program

The success of smallpox eradication in the 1970s brought attention to the immunization program globally as well as in India. In 1978, the Expanded Program on Immunization (EPI) was launched in India for immunizing children during the first year of life with DPT, OPV, BCG and typhoid-paratyphoid fever vaccines [8]. However, the program had a limited reach and was mostly confined to urban areas. In 1985, the name of EPI was changed to the Universal Immunization Program (UIP). Measles vaccine was included at this point. Subsequently, the typhoid- paratyphoid vaccine was removed from the schedule. Tetanus toxoid vaccination for pregnant women was part of EPI and was retained in UIP [9].

The objective of UIP was to reduce mortality and morbidity due to six vaccine-preventable diseases (VPDs) - childhood tuberculosis, diphtheria, pertussis, tetanus, poliomyelitis, and measles. The UIP was taken up in 1986 as National Technology Mission and became operational in all districts in the country by 1990-91 [8, 10]. Emphasis was given on enhancing indigenous vaccine production capacity, establishing cold chains, and implementing monitoring and evaluation systems. The National Technology Mission on immunization helped in modernization and upgradation of vaccine facilities and by 1990-1991, the country became self-sufficient for all vaccines except for OPV. Till March 1991, maintenance of cold chains was under contract between UNICEF and commercial agencies. From April 1991 onwards, states and union territories took responsibility of the maintenance of cold chains [8].

UIP became a part of Child Survival and Safe Motherhood Program in 1992 and a more holistic program of Reproductive and Child Health (RCH) in 1997. In 2005, routine immunization was integrated into the overall umbrella health program, National Rural Health Mission (NRHM), and subsequently the National Health Mission (NHM) after 2012.

After going through multiple changes since its launch in 1985, the UIP in India provides free vaccines against following 12 vaccine-preventable diseases:

- Diphtheria,
- Pertussis
- Tetanus
- Poliomyelitis
- Tuberculosis (childhood TB)
- Measles
- Hepatitis B
- Japanese Encephalitis
- Pneumonia
- Meningitis
- Diarrhea
- Rubella

Challenge of Full Immunization Coverage

Incomplete immunization increases the risk of illness and death among children, with severe implications for their growth potential and the risk

of morbidity and mortality in later years. Despite a long-standing national program for universal immunization in India (UIP, since 1985), only 65.3% of 12-23 months old children are fully immunized (RSOC, 2013-14) [7]. According to RSOC (2013-14), national-level measles coverage in India was 79%, portending that India is likely to be below the MDG-4 target of 90% by 2015.

Completion of vaccination schedule, particularly for vaccines that require multiple doses (e.g., Diphtheria, Pertussis, and Tetanus - DPT/ Pentavalent and Oral Polio Vaccine - OPV), remains a major challenge. For example, coverage rate of three doses of DPT is consistently lower than measles coverage across health and demographic surveys although measles appears later in the vaccination schedule. Drop-out rates for DPT 2 to 3 and OPV 2 to 3 are 11.1% and 11.9%, respectively (RSOC, 2013-14) [7]. This poses a major challenge in achieving the target of Full Immunization Coverage (FIC) defined as receipt of one dose of BCG, three doses of OPV and DPT/Pentavalent, and one dose of measles vaccine.

Mission Indradhanush – An Initiative to Expand Full Immunization Coverage

In order to ensure full immunization coverage at the national level, the Ministry of Health and Family Welfare (MoHFW) launched a new initiative in December 2014, termed Mission Indradhanush depicting seven colors of the rainbow, representing seven key vaccine preventable diseases, namely, Tuberculosis, Diphtheria, Tetanus, Pertussis, Polio, Hepatitis B and Measles. Mission Indradhanush (MI) aims to reach all unimmunized and partially immunized before their first birthday, in high focus districts of the country. MI aims to achieve this by introducing a multi-pronged communication campaign for improving demand generation and strengthening program operations to ensure a more focused implementation. Under this initiative, 201 high-focus districts across the country that have the highest number of partially vaccinated or unvaccinated children were identified. These districts were then targeted to improve routine immunization coverage through intensive efforts with an aim of expanding full immunization coverage.

Lack of Sources to Assess Immunization Coverage, Child Health, and Nutrition

Accomplishment of the target of full immunization coverage requires an understanding of the immunization coverage at the population level and identification of appropriate determinants that influence the achievement of the target. In addition to immunization, although a key indicator related to child health is nutritional status, up-to-date indicators of nutritional status among children are not available at a regular interval.

Population-level child immunization and other health indicators in India are derived from many health surveys, which vary in frequency, scope and detail. For example, the Coverage Evaluation Survey (CES) includes only immunization related indicators. The more comprehensive nation-wide National Family Health Surveys (NFHS) are conducted at a much longer interval than the ideal frequency recommended for monitoring immunization programs. First three rounds of NFHS happened at an interval of 5-6 years whereas the most recent one (NFHS-4) happened at an interval of 10 years (2015-16). Annual Health Surveys (AHS), although conducted more frequently on an annual basis, are confined only to nine high focus states and thereby does not inform national level estimates. District Level Household and Facility Survey (DLHS), provides information at a much needed disaggregated level of districts, but is confined by a long interval of 3-5 years between consecutive survey rounds. Moreover, the latest round of DLHS (DLHS-4, 2012-13) covered non-high focus states only, again restricting its use for national level estimation.

INCHIS – A Nationally-Representative Survey

To overcome the drawbacks of the existing data sources used to assess child health status, including immunization coverage in the country, a new survey – Integrated Child Health and Immunization Survey (INCHIS) – was planned by the Ministry of Health and Family Welfare (MoHFW) in consultation with the Immunization Technical Support Unit (ITSU) based at Public Health Foundation of India (PHFI).

Within the ambit of INCHIS, there are following components:

- Regular monitoring of immunization coverage
- Evaluation of targeted immunization campaigns in high focus districts implemented under Mission Indradhanush
- Nationally representative repeated cross-sectional survey on different aspects of immunization, including immunization services at the facility level
- Longitudinal cohort study involving different aspects of child health and serology survey

1.2 Objectives of this Report

This report presents the findings from the first two rounds of INCHIS survey. The first round of data collection took place during March-April 2015 (INCHIS-1) and the second round was implemented in September-October 2015 (INCHIS-2). The first two rounds of the INCHIS survey aimed to:

- Conduct household surveys to obtain representative data on immunization coverage and its determinants for India and selected states
- Conduct health facility surveys to assess the availability, functionality and quality of immunization services in selected states and identify program gaps
- Evaluate the impact of Mission Indradhanush (MI) in improving coverage of vaccines that require multiple doses and full immunization coverage (FIC)

2. SURVEY DESIGN AND METHODOLOGY

Survey Design and Methodology

2.1 Selection of States

One of the main objectives of INCHIS is to produce reliable national-level estimates on immunization coverage. To achieve the goal of national representativeness in a resource-effective way, a limited number of states were included in each round, selected through an appropriately stratified sampling design. Following the WHO Study on global AGEing and adult health (SAGE) [11], all 29 states were stratified into six levels of development (I to VI, I means the most developed as far as the selected indicators are concerned) and six geographic locations (north, central, east, north-east, west and south). To construct the composite development index, the following state-level indicators related to child health and its determinants were used:

i. Infant mortality rate (SRS bulletin, 2014)[1]
ii. Female literacy rate (Census 2011, Primary Census Abstract)
iii. Proportion of stunted children (NFHS-3, 2005-06)[2]
iv. Full immunization coverage rate (most recent available estimates before the survey)[3]
v. Per capita net state domestic product (2012-13, Planning Commission)[4]

The indicators were chosen in accordance with the study objectives; either directly related to the outcome or determinants of the outcome. Principal component analysis (PCA) technique was used to construct the composite index. The PCA method is particularly suitable for developing composite indices because this statistical method creates non-correlated linear combinations of variables by explaining maximum variability present in the original variables. Each variable is assigned a weight (loading) generated through PCA and the standardized variables are multiplied by the loadings and summed to produce the index. Use of PCA technique to create household or neighborhood socioeconomic index is abundant in the literature exploring inequalities in health or education [12-15].

Table 2.1 displays the cross-classification of states into six regions and levels of development as per the indicators available during the planning of the survey. Given that the state of Telangana was newly formed out of Andhra Pradesh in 2014, it was not considered while calculating the index as separate state-level indicators were not available for Telangana at the time of planning of this study. After the stratification, Telangana was included in the same development stratum as Andhra Pradesh. By selecting at least one state from each region as well as from each level of development (at least six states, in total), we sought to ensure representativeness of the sample at the national level [11].

Different highlight colours in Table 2.1 indicate different categories of the states; green indicating fixed states, yellow rotational states in INCHIS-1, and orange representing rotational states in INCHIS-2. Similar colour coding is used in the map in Figure 2.1.

In each round of INCHIS, 12 states were selected for inclusion in the sample – six fixed states and six other states on a rotational basis in order to cover all 30 states (29 plus Telangana) across all rounds of INCHIS. Six fixed states selected were Bihar, Maharashtra, Madhya Pradesh (MP), Rajasthan, Telangana, and Uttar Pradesh (UP) (Table 2.2 and Figure 2.1). These fixed states were repeated in first round (INCHIS-1) and second round of INCHIS (INCHIS-2). Relatively less developed and populous states like Bihar, MP, Rajasthan, and UP are supposed to play a crucial role in determining the national-level estimates of child

[1]Available at http://censusindia.gov.in/vital_statistics/SRS_Bulletins/SRS%20Bulletin%20-Sepetember%202014.pdf
[2] For nutritional indicators, no other recent data sources were available since NFHS-3 (2005-06).
[3] For EAG states, AHS-3 (2012-13) estimates were used. For non-EAG states, DLHS-4 (2012-13) estimates were considered. States (Delhi, Gujarat, Jammu & Kashmir) for which none of the two sources were available, we used Coverage Evaluation Survey 2009 estimates.
[4] Per capita Net State Domestic Product (NSDP) at current prices, available at http://planningcommission.nic.in/data/datatable/data_2312/DatabookDec2014%20160.pdf

Table 2.1: Distribution of States Based on the Composite Level-of-Development Index and Geographic Region

Region	I (most developed)	II	III	IV	V	VI (least developed)
North	Delhi	Punjab	Himachal Pradesh, Uttarakhand	Jammu & Kashmir, Haryana		
Central					Rajasthan	Madhya Pradesh, Chhattisgarh, Uttar Pradesh
East			West Bengal		Odisha, Jharkhand	Bihar
Northeast	Sikkim	Manipur, Mizoram, Tripura	Nagaland	Arunachal Pradesh	Meghalaya	Assam
West	Goa	Maharashtra		Gujarat		
South	Kerala, Tamil Nadu		Karnataka		Andhra Pradesh, Telangana	

Table 2.2: List of Selected States for INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015)

INCHIS-1			INCHIS-2		
State	Region	Development category	State	Region	Development category
Tamil Nadu	South	I	Kerala	South	I
Maharashtra*	West	II	Goa	West	I
Manipur	Northeast	II	Maharashtra*	West	II
Uttarakhand	North	III	Mizoram	Northeast	II
Haryana	North	IV	Himachal Pradesh	North	III
Rajasthan*	Central	V	West Bengal	East	III
Telangana*	South	V	Jammu & Kashmir	North	IV
Odisha	East	V	Rajasthan*	Central	V
Andhra Pradesh	South	V	Telangana*	South	V
Bihar*	East	VI	Bihar*	East	VI
Madhya Pradesh*	Central	VI	Madhya Pradesh*	Central	VI
Uttar Pradesh*	Central	VI	Uttar Pradesh*	Central	VI

* Fixed states included in both rounds of INCHIS

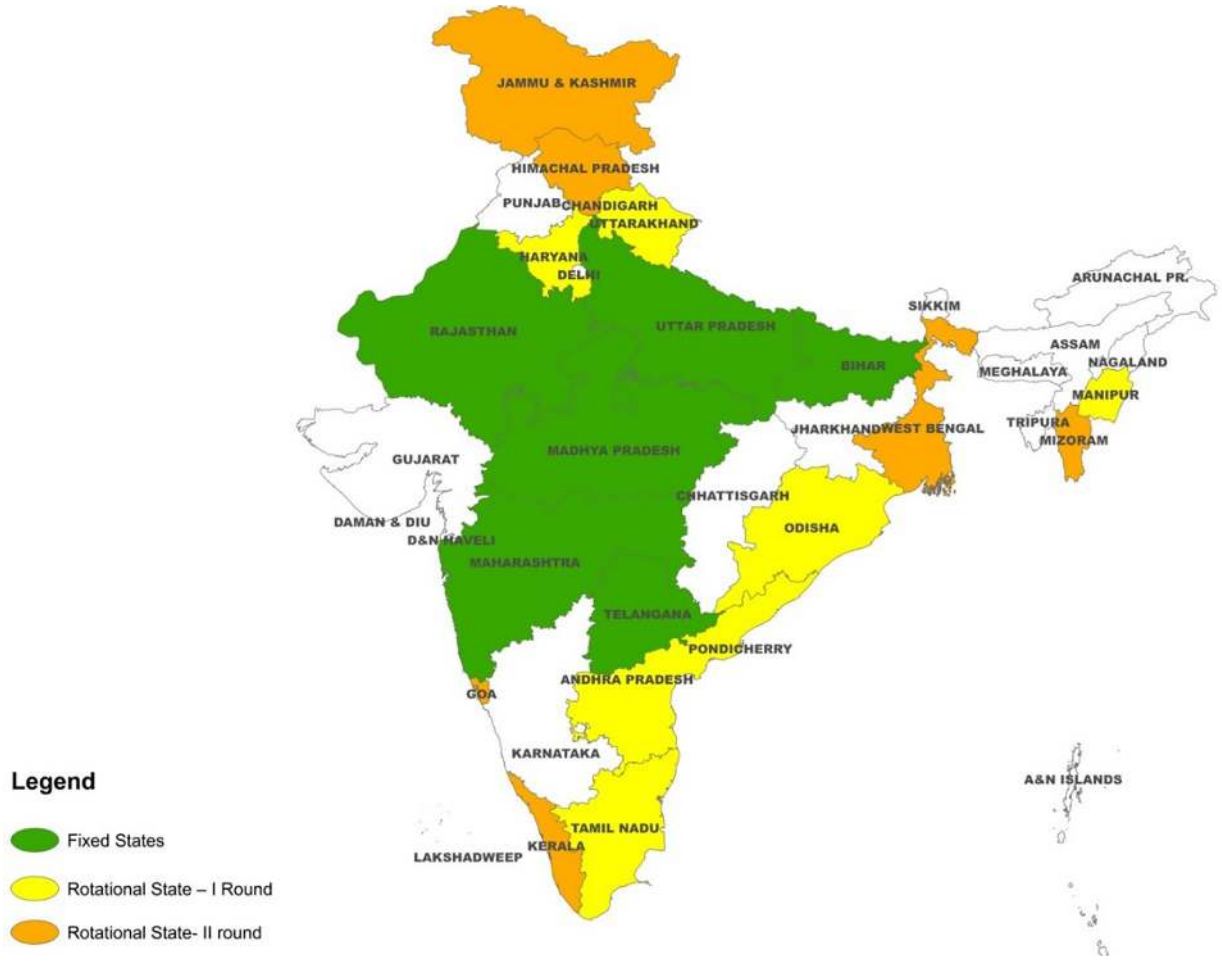


Figure 2.1: States Covered by Integrated Child Health and Immunization Survey: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015)

health indicators, and hence, in order to achieve required regular monitoring, these states were sampled in all rounds. Telangana being the newly formed state carved out from Andhra Pradesh also requires frequent monitoring and program evaluation. Maharashtra is a relatively progressive state, and hence, included as a control state for the evaluation of Mission Indradhanush, along with the non-MI districts in other five states.

In addition to these six fixed states, six other rotational states (Tamil Nadu, Manipur, Uttarakhand, Haryana, Odisha, and Andhra Pradesh) were included in INCHIS-1. In INCHIS-2, which was conducted after the completion of the first phase of Mission Indradhanush (MI-1), the survey covered the six fixed states and six rotational states – Himachal Pradesh, Jammu & Kashmir, Goa, Mizoram, West Bengal and Kerala. The state selection method was designed to ensure that at least one state from each geographical region as well as from each level of development category was selected as per the grid in Table 2.1.

2.2 Sampling Design

Within a selected state, a three-stage stratified sampling design was adopted. At each stage, the sampling design was chosen to select a representative random sample.

Stage 1: Selection of Districts

For the selection of districts, district-level data

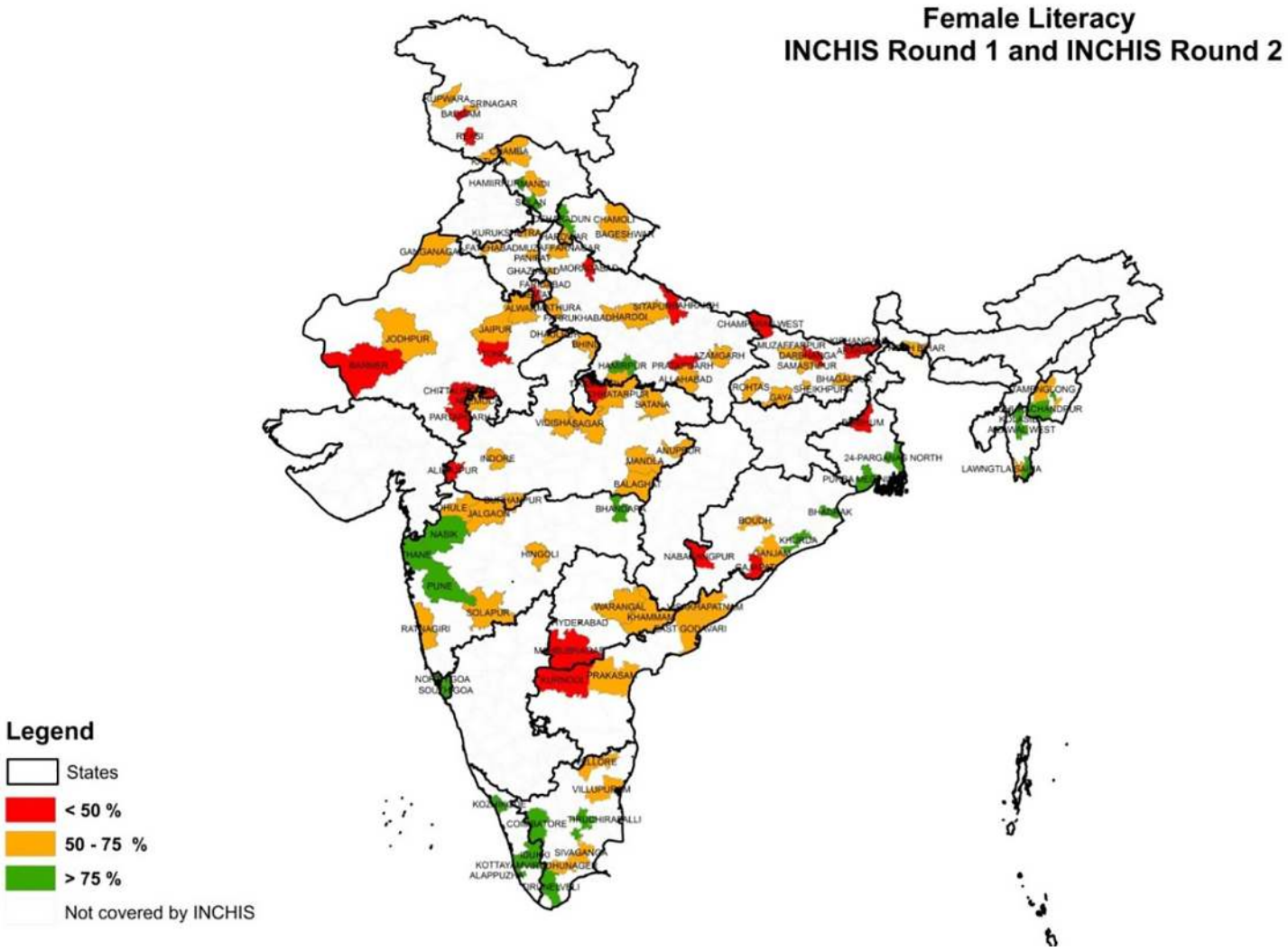


Figure 2.2: Female Literacy Rate (Census 2011) Across Districts Surveyed in INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015)

from Census 2011 was considered as the sampling frame. First, districts were stratified into one of the specified strata (3 or 4 strata, depending on the state). Strata were created based on a composite index constructed using the following district-level indicators:

- proportion of urban households (HHs)
- percentage of SC/ST population (either of the categories, depending on the context of the state)
- literacy rate
- proportion of HHs with latrine facility
- HHs availing banking facility.

All the district-level indicators were available from Census 2011. Then, from within each stratum, 1-3 districts were selected, depending on the number of districts in the state. For example, three districts were chosen from each of the four strata in large states like UP and MP, while only one district was chosen per stratum in smaller states like Manipur and Mizoram.

Such a stratification strategy guaranteed the

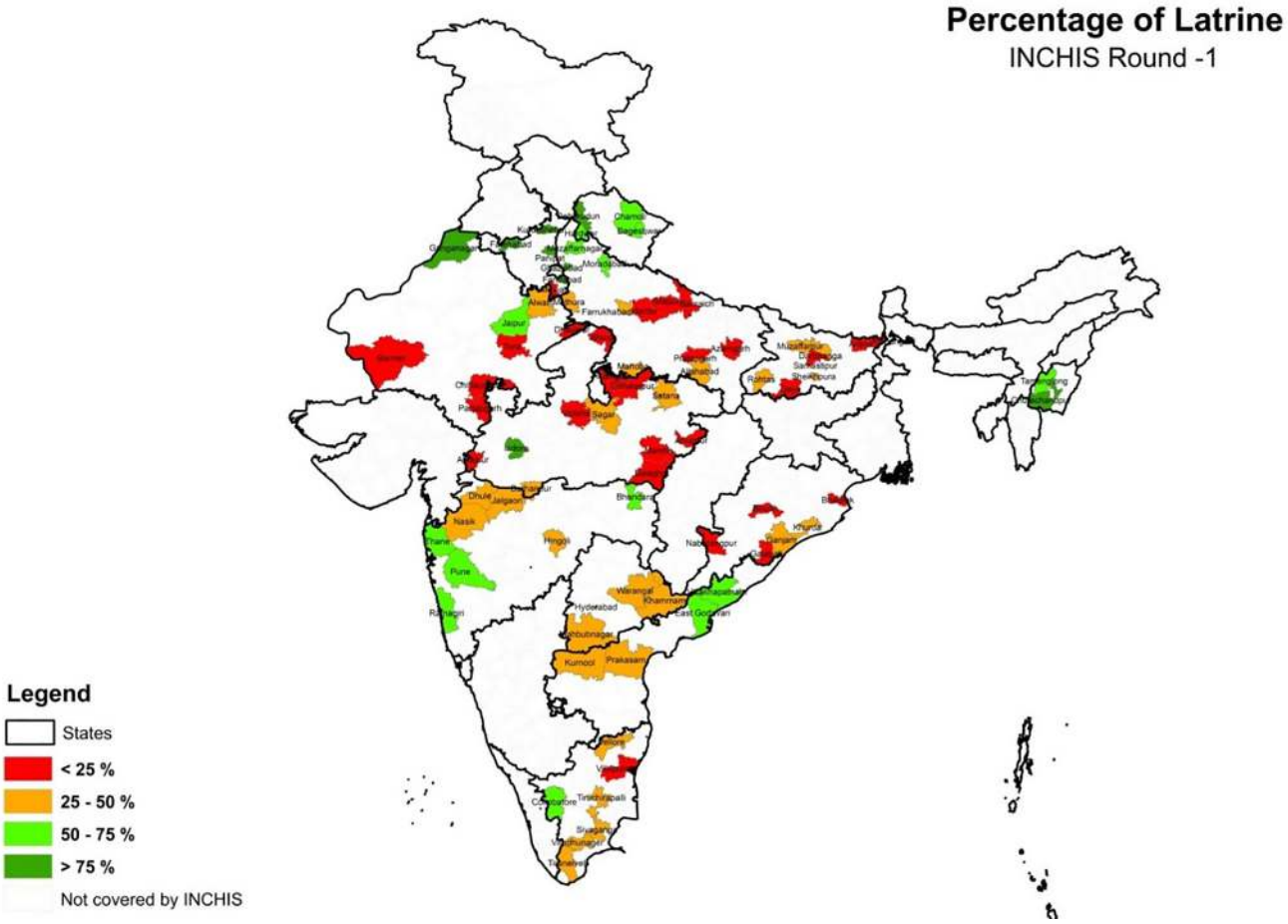


Figure 2.3: Percentage of Households with Access to Latrine Facilities (Census 2011) Across Districts Surveyed in INCHIS-1 (Mar-Apr 2015)

inclusion of districts with varied socio-economic characteristics and infrastructure access, resulting in a more representative sample as opposed to a simple random sampling. Moreover, stratification leads to gain in efficiency while estimating outcome indicators as long as strata are different in terms of outcome indicators.

The final selection of districts in INCHIS was constrained by another INCHIS objective which was to evaluate the impact of Mission Indradhanush on immunization coverage in high-focus districts (MI districts). Therefore, it was sought to ensure that enough number of MI districts and non-MI districts (controls) were included across India.

Figure 2.2, Figure 2.3, Figure 2.4 display the wide variation across sampled districts in terms of three selected indicators: percentage of urban population, percentage of households with access to latrine facilities, and female literacy rate.

For fixed states, the same districts were surveyed in INCHIS-1 and INCHIS-2 to enable evaluation of the impact of Mission Indradhanush in these states. In INCHIS-2, one additional district was sampled from the states of Rajasthan, UP, MP and Maharashtra each, and two additional districts were sampled from Bihar. These additional districts were added in INCHIS-2 to accomplish geographical representativeness, in addition to the representativeness with respect to the key indicators related to immunization coverage achieved in INCHIS-1. The final list of districts included in the two rounds of INCHIS is given in Appendix A.

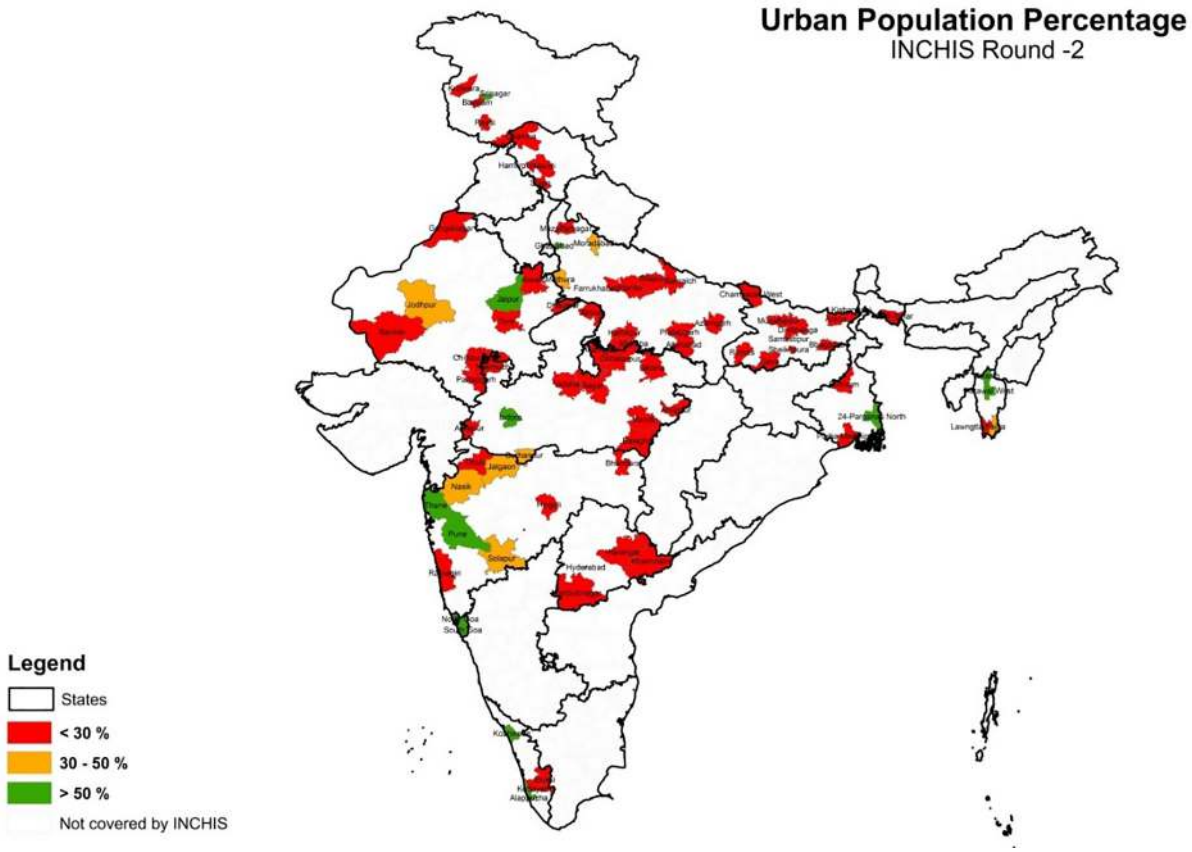


Figure 2.4: Percentage of Urban Population (Census 2011) Across Districts Covered in INCHIS-2 (Sep- Oct 2015)

Stage 2: Selection of Clusters

Clusters were defined as villages in rural areas and wards in urban areas. For the selection of clusters, cluster-level 2011 Census data was considered as sampling frame. Within a selected district, sampling frame of clusters (villages/wards) was arranged by female literacy rate and clusters were drawn using systematic sampling. This ensured that the sample included clusters covering the whole range of female literacy rate within a district. This type of systematic sampling strategy is also referred to as implicit stratification. The number of clusters required within a state was determined based on the sample size calculation as discussed in Section 2.3.

In INCHIS-2, the clusters selected in round 1 were excluded from the sampling frame before selection. Since the two rounds of INCHIS were being conducted within an interval of 5-6 months, selecting the same clusters would have led to selection of same households which, in turn, could result in various biases in the responses, in addition to the risk of a higher nonresponse rate.

Stage 3: Household and Health Facility Selection

For the purpose of selecting households (HHs), no readily available sampling frame of HHs exists in India, unlike in other developed countries (e.g., master address file in USA). Hence, a separate houselisting exercise (Section 2.5.1) was crucial for implementing a probability sampling for HH selection. Complete listing of all eligible households in the selected clusters (villages/wards) was used as the sampling frame for selection of households.

Households with at least one child in the age group 0-23 months were eligible for selection. In

INCHIS, children in the 0-23 months age group were considered as opposed to the 12-23 months age group included in other immunization related surveys. The goal was to consider different age groups for age-specific vaccines as per the national immunization schedule of India.

In INCHIS-1, 20 eligible households (HHs) were randomly selected from each sampled cluster using stratified sampling technique. In INCHIS-2, number of sampled HHs was increased to 25. This increment in the HHs was exclusively applied for the age group 12-23 months old children. The objective of this increase was to compare INCHIS estimates with existing immunization coverage rates from other surveys which traditionally use the age group 12-23 months. The number of HHs considered was equal in all the clusters in order to manage the interviewer workload efficiently.

Stratification of HHs was based on the presence of 0-11 months old child, 12-23 months old child, and children from both age groups. In a selected HH, all mothers/primary care givers with children in the age group of 0-23 months were eligible for interview. Mother interview questionnaires recorded information pertaining only to her youngest child.

Selection of health facilities was linked to the sampled clusters. In a sampled village, the sub-centre (SC) catering to the basic health needs of the people living in the village and the planning unit serving the SC were included in the health facility survey. In a selected urban ward, only the planning unit catering to the basic health needs of the people living in the ward was included in the health facility survey as SC is usually not present in urban areas. A planning unit (PU) is usually a primary health centre (PHC) in rural areas and an urban health centre (UHC) or urban health post (UHP) in urban areas with a cold chain point where vaccines are stored and the microplanning for immunization is carried out. However, in some districts, PU could be a different type health facility, such as community health centre (CHC) or even district hospitals (in urban areas). The two key defining criteria of a PU used were storage of vaccines and immunization microplanning.

2.3 Sample Size

The ultimate sampling unit was the household. The number of households to be selected from each cluster (village/ward) was assumed to be 20 in INCHIS-1 (and it was increased to 25 in INCHIS-2, as described above). Under this assumption, sample size calculation was equivalent to determining the number of clusters in each of the 12 states.

Sample size for this survey was calculated to allow an estimation of population level child health indicators within a pre-specified margin of error (say, ± 5%) with high confidence probability (say 95%). To calculate the sample size, proportion of fully immunized children was considered as the outcome indicator. Estimated proportions of fully vaccinated children were obtained from the most recent available data source. For high focus states (eight Empowered Action Group[5] states and Assam), Annual Health Survey (AHS-3, 2012-13) full immunization coverage (FIC) estimates were used. For non-high focus states, DLHS-4 (2012-13) estimates were considered. To account for the correlation that possibly exists among children belonging to the same village or ward, sample size was multiplied by the variance inflation factor, which is a function of cluster size and intra-cluster correlation coefficient (ICC). To calculate the sample size (number of clusters) a value of 0.10 was assumed for ICC. ICC measures the degree of within-cluster homogeneity in the outcome. The assumption of ICC is based on a calculation done using DLHS-3 data [16].

Total number of clusters within a state was equally allocated to the number of selected districts. For example, 40 clusters required in Andhra Pradesh were equally allocated to four districts with 10 clusters in each district. Within a district, clusters were allocated proportionally to the urban and rural areas (in proportion to the urban and rural households as per Census 2011). Table 2.3 and

[5]Eight economically backward states- Bihar, Chhattisgarh, Jarkhand, Madhya Pradesh, Odisha, Rajasthan, Uttarakhand and Uttar Pradesh.

Table 2.3: Number of Districts, Clusters (villages/urban wards), and Health Facilities Surveyed: INCHIS-1 (Mar-Apr 2015)

State	Districts	Clusters	Villages	Wards	Households	Sub-centres	Planning Units
Bihar*	8	50	44	6	972	31	31
Madhya Pradesh*	12	54	40	14	1,079	33	47
Maharashtra*	8	56	34	22	1,105	34	49
Rajasthan*	8	47	36	11	936	28	46
Telangana*	4	40	24	16	776	29	27
Uttar Pradesh*	12	56	42	14	1,071	41	51
Andhra Pradesh	4	40	27	13	793	31	23
Haryana	5	55	35	20	1,096	32	29
Manipur	4	48	32	16	959	29	22
Odisha	6	52	42	10	1,039	50	45
Tamil Nadu	8	55	31	24	1,100	39	46
Uttarakhand	4	38	27	11	757	25	23
India	**83**	**591**	**414**	**177**	**11,683**	**402**	**439**

* Fixed states included in both rounds of INCHIS

Table 2.4: Number of Districts, Clusters (villages/urban wards), and Health Facilities Surveyed: INCHIS-2 (Sep-Oct 2015)

State	Districts	Clusters	Villages	Wards	Households	Sub-centres	Planning Units
Bihar*	10	58	49	9	1,358	48	47
Madhya Pradesh*	13	74	51	23	1,632	51	56
Maharashtra*	9	60	33	27	1,408	31	54
Rajasthan*	9	58	43	15	1,451	41	56
Telangana*	4	40	22	18	927	22	37
Uttar Pradesh*	13	74	55	19	1,799	52	61
Goa	2	24	9	15	552	15	16
Himachal Pradesh	4	56	48	8	1,270	43	31
Jammu & Kashmir	5	55	38	17	1,359	30	36
Kerala	4	40	21	19	958	25	32
Mizoram	4	48	23	25	1,196	36	17
West Bengal	4	48	32	16	1,129	42	35
India	**81**	**635**	**424**	**211**	**15,039**	**436**	**478**

* Fixed states included in both rounds of INCHIS

Table 2.4 present the total number of districts, clusters, villages and wards, households, sub-centres, and planning units selected within each state for each round of INCHIS.

2.4 Questionnaires

Data from target households and health facilities were collected using five structured questionnaires:

- household
- mother/primary caregiver
- Accredited Social Health Activist (ASHA)
- sub-centre (SC)
- planning unit (PU).

In INCHIS-1, questions pertaining to the ASHA worker were part of the SC questionnaire. However, feedback from the field suggested that interviewing ASHAs during the SC interview was not feasible as most of the time the ASHAs resided in the designated villages and were unavailable for interview at the SC. In INCHIS-2, a separate questionnaire was designed based on the ASHA questions from INCHIS-1. This ASHA questionnaire was then used for interviewing ASHAs in the sampled village. The content of INCHIS-1 and INCHIS-2 questionnaires remained more or less the same. Some changes in INCHIS-2 questionnaires were essential based on the feedback received from the field during INCHIS-1 implementation.

The questionnaires for each state were bilingual, with questions in English and the principal language of the state. Initial versions of Hindi questionnaires were pilot-tested in Faridabad district of Haryana and subsequently revised based on feedback from the pilot study. The revised questionnaires were translated by the field agency in six different languages (Hindi, Marathi, Tamil, Telugu, Oriya, and Manipuri) for INCHIS-1. Translated versions of the questionnaires were field-tested and revised, leading to the final bilingual questionnaires. Similarly, for INCHIS-2, questionnaires were translated, field-tested and revised in seven different languages (Hindi, Konkani, Malayalam, Marathi, Mizo, Telugu and Bengali) as per the principal language of the selected states.

The contents of each of the five questionnaires used in both rounds of INCHIS are described below:

Household Questionnaire

The respondent for this questionnaire was the head of household (HoH) or any knowledgeable adult in the HH. The household questionnaire starts with a roster which lists all usual residents in each sampled household. For all residents aged five years and above, information was collected on the following: age (in completed years), sex, relationship to the head of the HH, marital status, and whether the resident is a mother/primary caregiver of 0-23 month old child or not. For each child below five years of age, information was collected on age (in completed months), sex, relationship to the head of the HH, and whether the child belonged to the age group of 0-23 months. Information was also collected on socio-demographic characteristics, infrastructure access and asset possession of the household.

Mother/Primary Caregiver Questionnaire

The respondent for this questionnaire was the mother with children in the age group 0-23 months or any other primary caregiver looking after the wellbeing of a child in the age group 0-23 months, residing in the household. Primary caregiver of a child was interviewed only if mother was deceased or had been away from the child for an extended period. In a household, all mothers/primary caregivers with children in the age group of 0-23 months were interviewed.

Details about mother's age, age at marriage, number of children, educational attainment, occupation, empowerment and decision making power were collected. For the youngest child, immunization status was collected either from the vaccination card or by maternal recall (if card was unavailable), reasons behind partial and non-vaccination were recorded and details on childhood illness were

collected. Utilization of health system during pregnancy and place of delivery (corresponding to the youngest child) and access to immunization related communication messages were also recorded.

Sub-centre (SC) Questionnaire

Sub-centre questionnaire was administered to Auxiliary Nurse Midwife (ANM) posted at the sub-centre. This questionnaire sought to collect data on manpower at the SC, workload of the sub-centre, training received by ANM, infrastructure of the sub-centre, availability of equipment, drugs and other essential items, services provided, vaccine logistics at the sub-centre, monitoring and supervision activities and knowledge and immunization practices followed by the ANM.

Planning unit (PU) Questionnaire

Key respondent for the planning unit questionnaire was the medical officer in charge of routine immunization. However, pertinent sections of the PU questionnaire were answered by cold chain handler, data entry operator, pharmacist, and person in charge of IEC materials. Detailed information was collected about the infrastructure of the PU, child health and immunization related trainings received by health staff, availability of human resources, lab and cold chain equipment, drugs and other essential items at the PU, immunization waste disposal practices, services provided, surveillance, monitoring and supervision activities, immunization microplanning, data reporting practices, and vaccine and cold chain management. Some of the questions were observation and record based.

ASHA Questionnaire

This questionnaire was administered to ASHA worker serving in the sampled village. The aim was to ascertain the basic demographic details of ASHA, services provided by them, their knowledge about the incentive structure, incentives received, and trainings received by the ASHA.

2.5 Survey Implementation

Data collection for INCHIS was conducted by the reputed field agency Nielsen India Pvt. Ltd. (Nielsen) on behalf of ITSU and UNDP. The Public Development & Sustainability unit of Nielsen collected data from households and health facilities across 12 states in each round of INCHIS. Pen and paper interviewing (PAPI) method was used to collect data. Data collection involved two key components:

- houselisting of selected clusters
- administering the household and health facility survey questionnaires to selected household and health facilities.

2.5.1 Houselisting

For the purpose of selecting households from each selected cluster, all the households in each cluster were listed and numbered systematically. Segmentation was allowed in large clusters (as per 2011 Census data or data obtained from other sources such as village panchayat office) and only one segment was randomly selected and listed. In rural areas, large villages were divided into multiple segments, taking natural boundaries as far as possible, such that each segment had approximately equal number of HHs.

Urban wards are usually much bigger than that of villages in terms of number of HHs. For the purpose of conducting decennial Census in India, wards are divided into census enumeration blocks (CEBs). CEB level data were obtained from the Registrar General & Census Commissioner office. However, in the absence of CEB maps, similar segmentation strategy was used for urban wards. In wards with more than 500 HHs, each ward was first divided into nine geographical segments starting from the North-East direction (NE, East, SE, South, SW, West, NW, North and Central). Then one segment was selected randomly. Within the selected segment, a cluster of approximately 150 households was listed.

Based on prior experience, it was known that in small clusters (fewer than 100 HHs as per 2011 census), it would be difficult to find required number of eligible HHs. Hence small villages were merged with a nearby village and the listing happened for the merged area. Selection of the adjacent village happened on the basis of the criteria that the nearby village should belong to the same sub-centre coverage area as the original village.

From the houselisting data, the list of eligible HHs was used as the sampling frame for HH selection. Upon completion of houselisting, data was entered into electronic format by Nielsen and shared with ITSU. ITSU did the selection of the required number of HHs and shared the same with Nielsen for conducting the main survey.

2.5.2 Recruitment, Training, Fieldwork

The survey agency Nielsen was responsible for recruitment and training of survey staff, and conducting fieldwork for the survey.

Training of Trainers

A core team from Nielsen Gurgaon office, all state coordinators from sampled states, and some zonal coordinators were trained through two workshops. These training workshops are formally known as Training of Trainers (ToT). Members from INCHIS core team provided the training with technical support from other ITSU colleagues. UNDP representatives were also present during the training and provided inputs.

The objective of the first workshop was to provide training on houselisting methodology. It was conducted telephonically on 10 March 2015 (INCHIS-1) and on 4 September 2015 (INCHIS-2). This was a three-hour training where steps involved in houselisting exercise and definitions of different terminologies such as structure, dwelling unit, household, head of household, eligible household were discussed.

The second ToT workshop was organized by Nielsen in their Gurgaon office on 16-17 March 2015 (INCHIS-1) and 10-11 September 2105 (INCHIS-2). The objective of this ToT was to provide training on the background and objectives of the survey, survey methodology, basic interview techniques, and key immunization related concepts which include national immunization schedule, vaccine logistics, cold chain management, open vial policy, guidelines for safe disposal of the vaccine, waste management, and more generally, Government of India guidelines for sub-centres and planning units. Each and every question from all five questionnaires was discussed in detail along with skip rules, specific instructions and coding structure.

In order to further ensure uniformity in survey procedures throughout the survey, a training manual was prepared by the INCHIS core team and circulated to the participants at these workshops. The manual contained a questionnaire-wise breakdown of methods for asking questions and recording answers, guidelines on appropriate interviewing techniques and detailed illustration of key immunization related concepts. Images, pictures, charts and tables were used in the manual to enable better understanding of the concepts.

Recruitment of Field Staff

For the listing exercise, field staff comprised of listers, mappers and listing supervisors, and for main survey it included field investigators and supervisors. State coordinators were in charge of both teams. Recruitment of field staff was done by lead state coordinators from an existing panel of field supervisors and investigators in the respective states. The candidates had at least a bachelor's degree in any social science field or relevant technical qualification degree / diploma. Candidates having prior experience of conducting women and child health related surveys were preferred.

A listing team comprised of four listers and one supervisor. The main survey team for household, mother and ASHA interviews consisted of one supervisor and four female investigators. Teams conducting health facility surveys consisted of one supervisor and four investigators. Additional investigators (15-20%) were recruited to account

for potential attrition after training and potential dismissal of the candidates with unsatisfactory performance.

State-Level Trainings

Five-day State-Level Trainings (SLTs) were conducted in each selected state by the lead state coordinators who participated in the main survey ToT workshop in Gurgaon. The training of interviewers was conducted in local language using translated bilingual questionnaires; and it included detailed discussion of questionnaires, interviewing techniques, rapport building with respondents, following specific instructions, cross-checking of responses, observing certain responses before recording, effective probing techniques to elicit accurate response without introducing biases. More time was spent on each and every question relative to ToT. Special emphasis was given on how to fill in the immunization section from the card. Actual Immunization/Mother and Child Protection (MCP) cards used in the state were used for illustration purpose.

SLTs included both classroom and field practice sessions. Mock/practice sessions were conducted in the classroom prior to field practices of the survey questionnaires. During SLTs, field practice of household and mother questionnaires were conducted in a cluster which was not part of INCHIS sample. A key component of health facility survey training was visiting sub-centres and planning units so that the investigators become familiar with vaccine storage area, different equipment, registers, and reporting formats. During this visit mock interviews of ANM and medical officers were also conducted. The last day of the SLTs was scheduled for debriefing sessions where the state coordinators brought up for discussion the wrong practices that were noticed during field visits and discussed solutions to those, emphasized on important aspects of the questionnaires, and clarified doubts and confusions the investigators might have. Field plans were also discussed on the last day.

Members from ITSU and Nielsen core teams also attended last two-three days of SLTs across INCHIS states to monitor training sessions and provide technical support to the state coordinators.

Fieldwork Duration and Timeline

Table 2.5 presents field work duration and data entry timeline for the two rounds of INCHIS. In INCHIS-1, data collection was completed in MI districts on or before 7 April, the official launch date of MI phase 1. However, the household and facility survey continued for non-MI districts until 14 April in all states except Manipur. In Manipur, data collection took longer and got completed by 29 April.

In INCHIS- 2, data collection was completed in MI districts on or before 7 October, the official launch date of MI phase 2. However, the household and facility survey continued for non-MI districts until 15 October in all states except Mizoram. In Mizoram, data collection continued even further and got completed by 24 October.

Table 2.5: Fieldwork Duration and Timeline: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015)

Survey	Houselisting	Main survey	Data entry and submission of final dataset post ITSU validation	
			Household/Mother	Health facility
INCHIS-1	17 Mar-11 Apr	25 Mar-15 Apr (all states except Manipur)	23 Apr- 18 May	5 May- 30 May
INCHIS-2	10 Sept- 5 Oct	20 Sept-15 Oct (all states except Mizoram)	26 Oct- 24 Nov	Nov- 3 Dec

2.6 Data Processing

Data processing for INCHIS involved data entry, data cleaning, cross-checking of related responses, and tabulation of geographical codes and other key variables. As mentioned earlier, pen and paper interviewing (PAPI) method was used to collect data in both rounds of the survey. After completion of the interview, all filled questionnaires were couriered to the nearest data entry centre of Nielsen for data entry and processing. Data entry happened at four centres: Lucknow, Baroda, Kolkata and Jaipur. The data recorded on hard copy were transcribed into electronic format using CSPro software.

In order to ensure good quality, double data entry of all the responses was done and a comparison of the two datasets was made. In case of inconsistencies, the entries were verified against the hard copy of the questionnaire. After the completion of data entry, state-wise data files were made available to designated ITSU data analysts at the secured FTP site for validation. This constituted the initial submission of the datasets. Quality control tables were generated to check the completeness and consistency within the dataset by the INCHIS team. A random check of the hardcopy questionnaires and comparison with the final data was also done at ITSU after the final data submission.

2.7 Quality Assurance Mechanism

Besides conducting two levels of training as discussed in the earlier section, INCHIS adopted multiple quality control measures in order to ensure that data collected was unbiased, accurate, complete, relevant and valid. Following measures are worth mentioning:

Houselisting and Household Selection

In the absence of readily available sampling frame of HHs, a separate houselisting exercise was carried out for implementing a probability sampling for HH selection. Complete listing of all eligible households in the selected clusters (villages/wards) was used as the sampling frame for selection of households. This procedure guaranteed that each HH had a positive probability of being selected and reduced the coverage bias that could have arisen from an incomplete sampling frame.

After the houselisting was complete, Nielsen entered the data into electronic format and shared it with ITSU. ITSU selected the required number of HHs, which was shared with Nielsen for conducting the main survey. This back and forth between Nielsen and ITSU, although required additional effort as compared to the standard practice of letting the field investigators (FIs) to do the selection, has certain methodological advantages. It minimizes selection bias, ensures that the FIs visit the selected HH, and prevents the FIs from adopting convenient sampling in the field.

Internal Monitoring by Nielsen

In each state, a state coordinator was in charge of overall coordination of field activities including listing, household and facility survey. During the survey, the state coordinator was responsible for planning and maintaining logistics for the field teams and effective communication between Nielsen core team members and INCHIS core team. Timely sharing of field issues, MIS, and field updates were crucial for the smooth and timely progress of the survey.

Field supervisors made back-checks in at least five households (one from each investigator) completed by the interviewers in their respective teams and revised questionnaires based on back-check outcome. Supervisors debriefed their teams on the problems found on a daily basis.

Supervisors and state coordinators were engaged in verification/back-check of the facility survey as well. They were able to cover more than 80% of the facilities across states through these efforts. There were a few facilities which were covered only by interviewers. To verify such facilities, supervisors/ state coordinators did random verification over

a call. Overall, verification/back-check exercise ensured the accuracy of the data collected.

Supportive supervision and monitoring visits were also made by Nielsen's national core team, research professionals and zonal coordinators on a regular basis.

External Monitoring by ITSU

The training of trainers, state-level training and the actual survey were all monitored by INCHIS monitoring team with the objective of reducing errors, ensuring quality of data and trouble-shooting any discrepancies in conducting fieldwork by the field staff. Real-time feedback was provided to agency field staff as well as to the agency supervisors/ITSU/UNDP regarding any systemic errors identified during fieldwork by the monitoring team.

Overall, ITSU staff monitored the survey in 12 of the 18 selected states. In each of the clusters visited, the team observed and validated data collected for at least 10 households and one health facility. Observations from the monitoring exercise were recorded in standardized monitoring forms comprising of both an observation and a validation component. Feedback received was also shared with the survey agency to ensure immediate correction of any grave inadequacies identified during the monitoring.

2.8 Survey Weights

If individuals in certain subgroups of the population (e.g., some villages or particular demographic groups) are sampled at a lower rate than individuals in other subgroups, then their data can be thought to represent more individuals in the population [17]. Otherwise, any estimation based on the sample may be biased, more so if the selection probabilities are correlated with the outcome of interest. For example, in INCHIS-1, the number of households (HHs) selected from each cluster (village/urban ward) was fixed at 20 irrespective of cluster size. This equal allocation of ultimate sampling units (HHs) in a multi-stage sampling is useful in managing interviewer workload in the field. However, this strategy leads to differential sampling rates for HHs belonging to different clusters. Survey weights incorporate these differential sampling rates as well as adjustments for non-response and adjustments for incomplete sampling frame and/or mismatch between sampling and population distributions through post-stratification. The survey weight of a sampled unit (e.g., household, individual) is the (estimated) number of units in the population which the sampled unit represents.

A weighted mean or proportion (e.g., vaccination coverage rate) with the weights being the survey weights can estimate the true population mean or proportion in an approximately unbiased manner, whereas ignoring the survey weights in an analysis can lead to substantial bias. There is a price one potentially pays for using weighted estimation. If weighted estimation is used when actually unnecessary for bias reduction, then the analysis could be inefficient as compared to unweighted analysis. The extent of inefficiency actually depends on the variability present in the survey weights. A small proportion of units with large weights can make the inefficiency large. However, for descriptive analysis, it is usually recommended to consider weighted analysis, as the weighted estimator with its confidence interval does offer a valid description of the population and the estimator [18].

2.8.1 Components of Survey Weights

Design weight: The design weight (or base weight) is the component of the survey weight that accounts for the differential probabilities of selection, as follows from the sampling design. It is defined as the inverse of the inclusion probability of the ultimate sampling unit. In INCHIS, the ultimate sampling unit was a household. Within a selected HH, all mothers with children in the age group 0-23 months were included in the sample. Immunization related information was obtained regarding the youngest child of a mother. Hence,

the design weight corresponding to the child was the same as the design weight of the household as the household selection was the last stage of sample selection.

For a three-stage sampling design as in INCHIS, the inclusion probability of a household is the product of the inclusion probability of the first stage of sampling units and the conditional inclusion probabilities from the latter stages of sampling. Detailed calculations of design weights are given in Appendix B.

Non-response: Design weight was adjusted to account for non-response at the household level. In INCHIS, non-response occurred only at the third stage of sampling (household selection) as 100% coverage of districts (first stage) and clusters (second stage) was achieved as per the sampling plan. For most clusters, the response rate was 100%, with a negligible non-response rate across clusters. In the clusters with non-response, the design weights were divided by the cluster-specific response rates to obtain the non-response-adjusted weights.

Post-stratification: The sample selected for INCHIS may differ somewhat from that of the target population in terms of key demographic characteristics. To bring the two distributions into closer agreement and hence to reduce the bias in estimating immunization coverage rates due to differential coverage, post-stratification adjustment of weights was performed to known population totals. Assuming that the Census 2011 figures are the gold standard, the (provisional) survey weights were multiplied by a constant factor (within a post-stratum) so that the sum of weights exactly matches census figures. Besides adjusting for sampling distributions, post-stratification also can improve the accuracy of estimators by reducing their variability.

2.8.2 Adjustment of Oversampling of MI Districts

Selection probability of a HH depends on three components:

- Selection probability of the district,
- Selection probability of the cluster (village/ urban ward) given that it belongs to a particular district and
- Selection probability of the HH given that it belongs to a particular cluster.

For MI evaluation, we oversampled poor performing MI districts from four big states (Bihar, MP, Rajasthan and UP) which might lead to bias in state-level and national-level estimates. To overcome this, we made an adjustment in the calculation of survey weight, more specifically, the calculation of district selection probability. The adjustment can be viewed as a post-stratification adjustment with post-strata being MI and non-MI districts. The inverses of district selection probabilities were adjusted to force the estimated number of districts in post-strata equal to total number of MI and non-MI districts in a particular state or at India level.

2.8.3 Two Sets of Survey Weights

In INCHIS, two sets of survey weights are of interest. One set of weights was used for generating national-level indicators and another set for producing state-level indicators. Each set again had the following different types of weights:

Household weight: Post-stratification adjustment to the household weights was applied separately at the state level as well as at the national level. Post-strata were formed by area of residence (urban/ rural). In other words, the adjustment was made in such a way that sum of state-level weights corresponding to rural households for a particular state matched with the census counts of the number of rural HHs in that state; similarly for urban areas. National-level weights were obtained by matching the sum of (provisional) weights to national-level census figures within post-strata. Household weights were used to produce indicators at the household level such as proportion of Muslim and tribal households, percentage of households having access to toilet facilities, and percentage of HHs living in the lowest wealth quintile in each of the selected states.

Child weight: As a separate exercise, post-stratification adjustment was applied to the child weights separately at the state level as well as at the national level. Post-strata were formed by gender (boy/girl) and area of residence (urban/rural). In other words, the adjustment was made in such a way that sum of state-level weights corresponding to rural boys for a particular state added up to the census counts of the number of rural boys in the age group 0-23 months in that state; similarly for rural girls and urban boys and girls. National-level weights were obtained by matching the sum of (provisional) weights to national-level census figures within post-strata. Child weights were used to produce indicators such as vaccination coverage rate, prevalence of childhood illness such as different types of fever, acute respiratory infection (ARI), and diarrhea.

The mother of the corresponding child was assigned the survey weight of her child. This weight can be used to obtain indicators for women such as proportion of women having first child before the age of 20 and having educational qualification higher secondary or more. Note that estimation of mother indicators corresponds to the target population of mothers having child in the age group 0-23 months. This survey does not specifically focus on including all mothers in the reproductive age group.

2.8.4 Weight Trimming

The precision of a survey estimate depends on the sampling design and the variation in survey weights. In some cases, the variation in survey weights is dominated by a few extreme weights. Trimming or truncating these extreme weights can substantially reduce the overall variation in weights and can considerably improve the precision of the estimates [19]. In most large-scale surveys, after doing necessary adjustments to design weights, the distribution of weights is routinely examined for outliers or extreme values [19, 20].

To control the variation in weights due to extreme values, the weighting procedure includes detection and trimming of extreme weights and redistribution of the trimmed portion of weights to maintain consistency with the external control totals such as census data [19]. Following the National Immunization Survey in US, the median and inter-quartile range (IQR) of weights were computed within a state and then all weights greater than the cutoff value 6IQR (median+6*IQR) were truncated. The weights were readjusted after trimming to ensure the sum of weights remained the same as before within each post-stratification cell. The procedure of trimming and adjusting was repeated several times so that no more weight remained greater than the cutoff value.

3. HOUSEHOLD POPULATION AND HOUSING CHARACTERISTICS

Household Population and Housing Characteristics

This chapter provides socio-economic and demographic profile of the sampled households in INCHIS. INCHIS collected basic demographic information on the usual members of the survey households. Data was also collected on key housing characteristics and asset possession to understand the economic status of the household, and the relationship between these characteristics and immunization and child health related outcomes.

As discussed in the previous chapter, INCHIS sample included only HHs with children below two years of age (target population). So the socio-economic and demographic profile based on INCHIS sample may not necessarily be generalizable for India. This is particularly true for demographic characteristics such as age and sex distribution, marital status of the population, sex ratio, household size distribution. However, our sample is representative of the target population under consideration at the national level as well as for the selected states. As both the rounds of INCHIS are representative of India, the household characteristics from the latest round (INCHIS-2) are being presented here. For state-wise presentation of some key findings, rotational states of INCHIS-1 have also been shown. All analysis in this chapter are survey-weighted, national-level and state-level household weights are used, as applicable.

3.1 Demographic Composition of Household Population

3.1.1 Age and Sex Distribution

Table 3.1 presents the distribution of household population in five year age groups by sex and place of residence. This analysis is based on household roster data. INCHIS-2 covered a sample of 15,039 households, in which 88,613 usual members were enumerated. Of the 88,613 usual members, males constituted 49% of the population and females were enumerated at 51%. The sex ratio, in total population, was enumerated at 1,023 females per 1,000 males. The sex ratio in urban and rural areas was 1,010 and 1,030 females per 1,000 males, respectively. The child sex ratio (0-6 years) in enumerated population was 981 girls per 1,000 boys, which is less skewed as compared to Census of India 2011 estimates of 919 girls per 1,000 boys. The urban child sex ratio (942 girls per 1,000 boys) was lower compared to rural child sex ratio (999 girls per 1,000 boys).

The age-sex structure of the enumerated population from INCHIS-2 is shown in Table 3.1 and a population pyramid is presented in Figure 3.1. The pyramid shown in the graph is not similar to that of a typical developing country (wide base gradually narrowing towards the top) due to restricted eligibility criteria of our study. INCHIS recorded the highest percentage of population (35%) concentrated in the age group of 0-9 years. Of this 35 percent, approximately half (17%) consists of children in the age group of 0-1 years (data not shown separately). The second largest percentage (34%) of population is contributed by the age group of 20-34 years, indicating the dominant presence of young couples in our sample which matches the eligibility criteria. Approximately six percent of the total population was aged 60 years or more. Population pyramids in urban and rural areas follow similar pattern. Population in the age group of 0-24 years in rural areas (57%) is four percentage points higher than the urban areas (53%), indicating sustained higher fertility in rural areas.

Table 3.1: Household Population by Age, Sex, and Residence: INCHIS-2 (Sep-Oct 2015) Data

Age in years	Urban			Rural			Total		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
0-4	25.4	23.6	24.5	26.9	24.6	25.8	26.4	24.3	25.3
5-9	8.0	8.6	8.3	9.1	11.5	10.4	8.8	10.6	9.7
10-14	3.0	4.7	3.8	4.3	5.5	4.9	3.9	5.3	4.6
15-19	3.4	4.7	4.1	4.2	5.3	4.8	4.0	5.1	4.5
20-24	7.8	15.9	11.8	7.0	15.4	11.3	7.3	15.6	11.5
25-29	14.8	15.0	14.9	14.6	13.1	13.8	14.7	13.7	14.2
30-34	12.7	6.3	9.5	10.3	5.4	7.8	11.1	5.7	8.4
35-39	7.3	3.0	5.2	6.0	2.4	4.2	6.5	2.6	4.5
40-44	2.7	1.8	2.3	2.4	2.0	2.2	2.5	1.9	2.2
45-49	1.8	3.9	2.9	2.3	3.0	2.7	2.2	3.3	2.8
50-54	3.1	4.0	3.5	2.7	3.4	3.1	2.8	3.6	3.2
55-59	3.2	3.4	3.3	2.9	3.0	3.0	3.0	3.1	3.1
60-64	2.9	2.4	2.6	3.2	2.5	2.8	3.1	2.5	2.8
65-69	1.8	1.4	1.6	2.1	1.3	1.7	2.0	1.3	1.7
70-74	1.4	0.7	1.0	1.1	0.7	0.9	1.2	0.7	0.9
75-79	0.4	0.3	0.3	0.5	0.3	0.4	0.4	0.3	0.4
80+	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5
Number	14,575	14,948	29,523	29,233	29,825	59,058	43,808	44,773	88,581
Sex ratio*	na	na	1,010	na	na	1,030	na	na	1,023
Child sex ratio	na	na	942	na	na	999	na	na	981

Note: The household roster identified 32 household members as of 'other' sex, which is not shown in the table.
* Sex ratio (all ages): Females per 1,000 males. Child sex ratio (0-6 years): Girls per 1,000 boys.

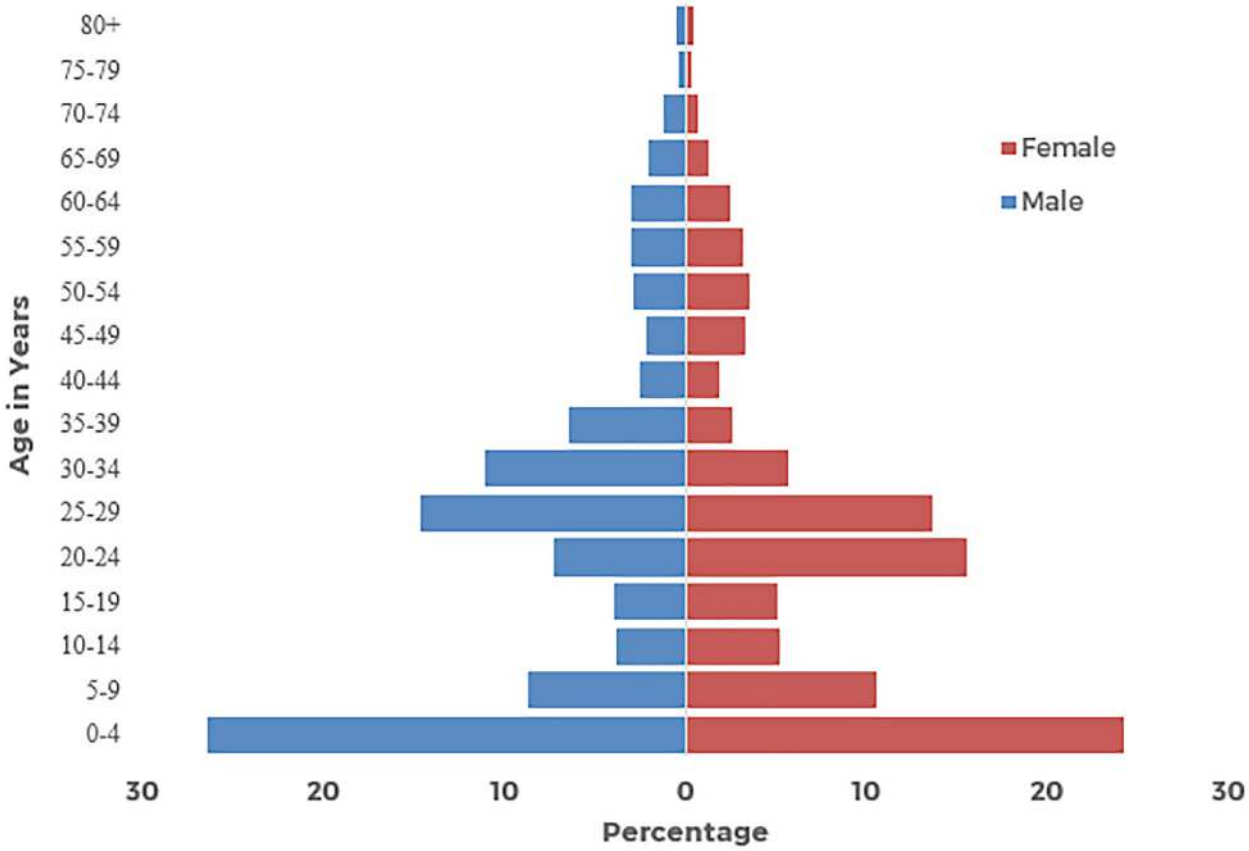


Figure 3.1: Population Pyramid Based on Sampled Individuals: INCHIS-2 (Sep-Oct 2015) Data

3.1.2 Marital Status

The marital status of household population aged 10 years or above by age groups and sex is presented in Table 3.2. As expected, 78% of the total enumerated population was married, four percent were widow/widower and 0.3% was divorced or separated. Seventeen percent (17%) population was never married. Though the percentage of married population was same among male (78%) and female (78%), widow/widower percentages was slightly higher among female (6%) compared to male (2%). Percentage of respondents identified as never married were higher among male (20%) than female (15%).

In the age group of 10-19 years, 20% of females were married compared to 3% of male population (data not shown separately). In the age group of 50 years and above, percentage of widow/widower population was higher among female (29%) population relative to male (10%).

Table 3.2: Marital Status of the Household Population by Age and Sex: INCHIS-2 (Sep-Oct 2015) Data

Age in years	Marital status				Sum
	Never married	Married	Widow/ Widower	Divorced/ Separated	
Male					
10-14	98.5	1.3	0.2	0.1	100.0
15-19	96.3	3.7	0.0	0.0	100.0
20-29	19.8	80.0	0.2	0.1	100.0
30-39	2.7	96.6	0.4	0.3	100.0
40-49	2.6	94.3	3.1	0.1	100.0
50-59	1.0	92.2	6.6	0.3	100.0
60+	0.5	87.2	12.3	0.1	100.0
Total (%)	**19.5**	**78.0**	**2.3**	**0.2**	**100.0**
Number	5,293	22,701	591	40	28,625
Female					
10-14	98.5	1.5	0.1	0.0	100.0
15-19	60.3	39.3	0.1	0.3	100.0
20-29	4.5	94.8	0.4	0.3	100.0
30-39	1.4	96.7	1.0	0.9	100.0
40-49	0.6	89.5	9.6	0.3	100.0
50-59	0.4	82.7	16.8	0.1	100.0
60+	0.6	54.8	44.0	0.6	100.0
Total (%)	**15.0**	**78.3**	**6.4**	**0.3**	**100.0**
Number	4,193	23,499	1,775	109	29,576
Total					
10-14	98.5	1.4	0.1	0.0	100.0
15-19	75.9	23.9	0.0	0.2	100.0
20-29	11.0	88.5	0.3	0.2	100.0
30-39	2.3	96.6	0.6	0.5	100.0
40-49	1.5	91.7	6.6	0.2	100.0
50-59	0.7	87.0	12.2	0.2	100.0
60+	0.5	73.3	25.9	0.3	100.0
Total (%)	**17.2**	**78.1**	**4.4**	**0.3**	**100.0**
Number	9,486	46,200	2,366	149	58,201

3.2 Household Composition

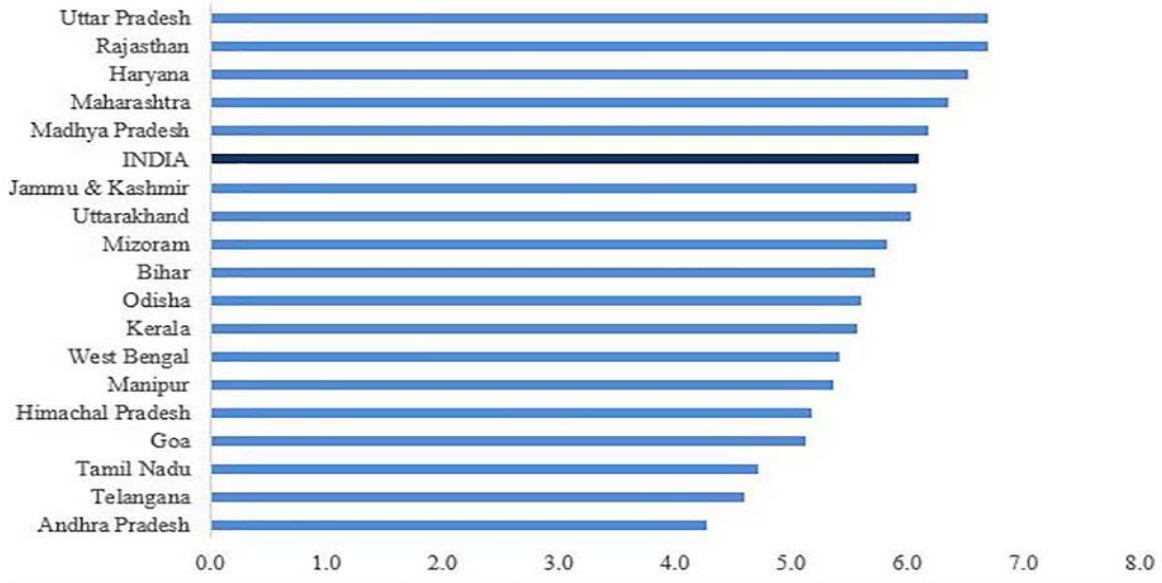
3.2.1 Household Size

Household size is defined as the number of usual residents of the household as obtained from the household roster. The distribution of household size and mean household size by place of residence is shown in Table 3.3. The mean household size was 6.1 among the sampled households. Interestingly, both urban and rural areas had the same mean household size. The state-wise distribution of number of usual members revealed that 14% households in Rajasthan and 13% in Uttar Pradesh were of size 10 or more members (data not shown).

Table 3.3: Percent Distribution of Households by Household Size and Average Household Size: INCHIS-2 (Sep-Oct 2015) Data

Number of usual members	Urban	Rural	Total
3	12.7	10.8	11.4
4	17.6	17.8	17.8
5	19.8	21.4	20.9
6	16.0	17.6	17.1
7	11.0	11.1	11.1
8	6.7	7.5	7.3
9	5.2	5.1	5.1
10+	11.0	8.5	9.3
Number	4,970	10,069	15,039
Mean household size	6.1	6.1	6.1

Note: None of the households had one or two members as the target population was households with a child in the age group of 0-23 months.



Note: For India and fixed states, data from INCHIS-2 was used. For rotational states, respective round of INCHIS data was considered.

Figure 3.2: Average Household Size across States and India: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

3.2.2 Religion

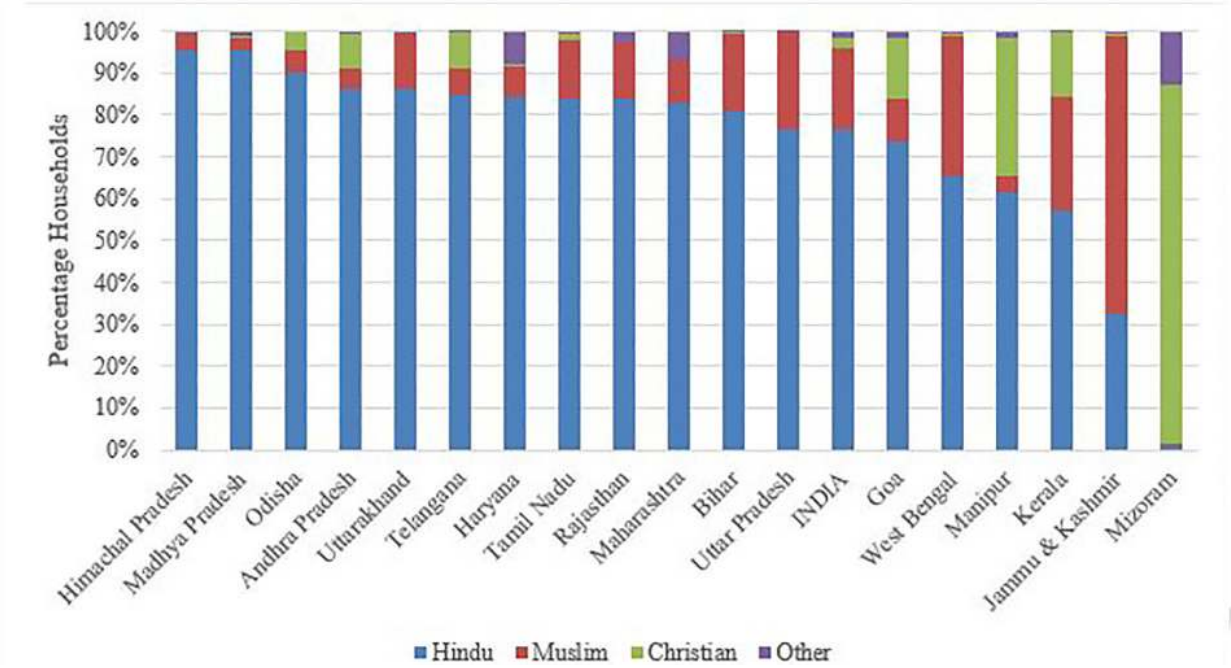
The distribution of households by religion of the respondent of the household questionnaire for India and states is shown in Figure 3.3. At the India level, 76.4% respondents identified themselves as Hindu, 19.4% as Muslim, 2.6% as Christian and 1.6% belonged to other religions. The rural areas had a slightly higher percentage of households belonging to Hindu religion (79.5%) compared to that of urban areas (69.9%). Consequently, urban India reported higher Muslim households (23.9%) in comparison to rural India (17.3%). Data for urban and rural India is not shown separately.

While most of the households in selected states belonged to Hindu religion, 86% of households in Mizoram were Christian and 66% belonged to Islam religion in Jammu & Kashmir (J&K). Besides J&K, states having higher percentage of Muslim population relative to India are Uttar Pradesh (23%), Kerala (27%), and West Bengal (34%). Besides Mizoram, states having higher percentage of Christian population relative to India are Odisha (5%), Andhra Pradesh and Telangana (9% each), Goa (15%), Kerala (16%), and Manipur (33%).

3.2.3 Caste

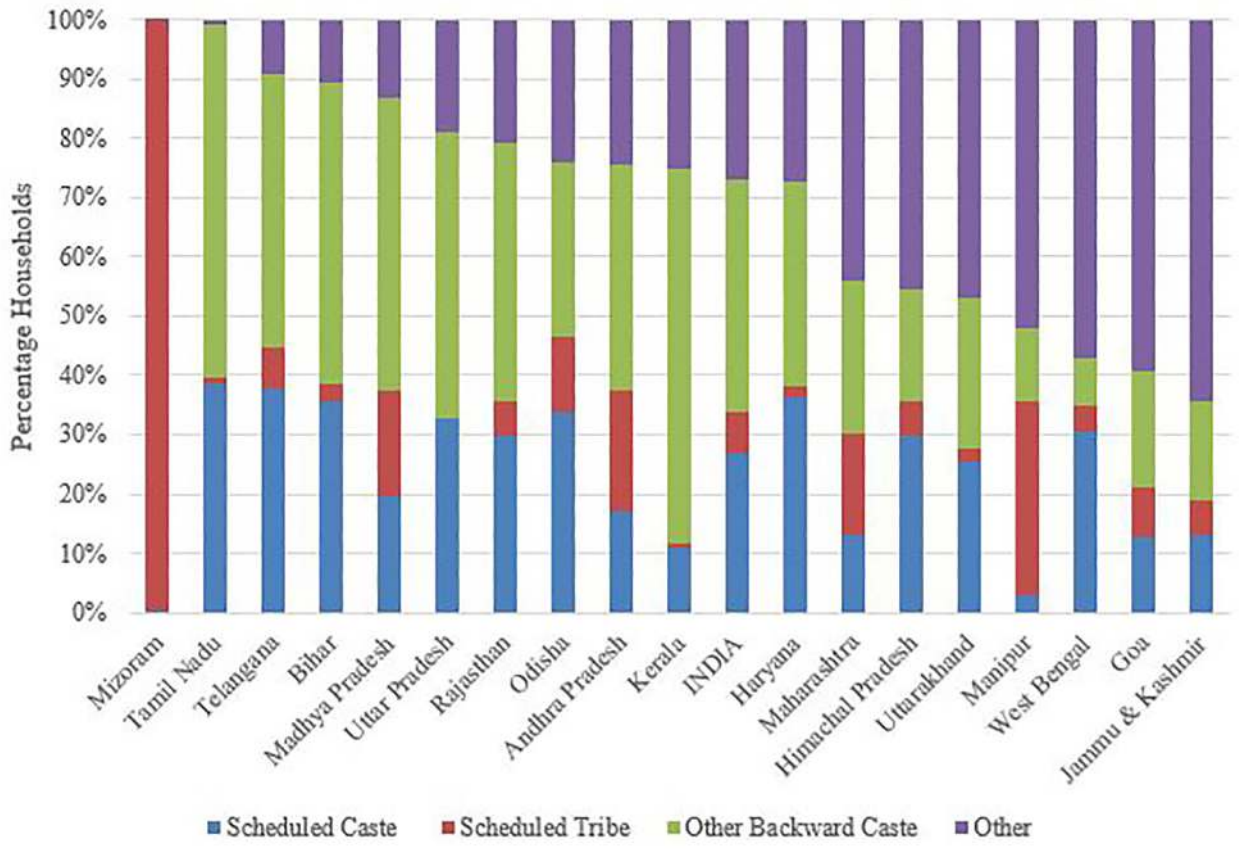
The distribution of households by caste of the respondent for India and states is shown in Figure 3.4. Among the surveyed households, 27% identified themselves as scheduled caste (SC), 7% as scheduled tribe (ST), 39% as other backward caste (OBC) and 27% belonged to 'Other' caste. 'Other' caste includes either general caste or not aware of their caste (1.7%). Rural areas reported a slightly higher percentage of scheduled caste households (30%) compared to urban areas (21%). Other caste households were lower in rural areas (23%) than urban areas (36%). Data for urban and rural India is not shown separately.

Scheduled castes constituted more than 30% of the total population in West Bengal (31%), Uttar Pradesh (33%), Odisha (34%), Bihar (36%), Haryana (37%), Telangana and Tamil Nadu (38% each). Almost all the respondents in Mizoram and 33% in Manipur identified themselves as



Note: For India and fixed states, data from INCHIS-2 was used. For rotational states, respective round of INCHIS data was considered.

Figure 3.3: Percent Distribution of Households across Major Religions for India and Selected States: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data



Note: The Other caste includes HHs who did not identify themselves as Scheduled Caste, Scheduled Tribe or Other Backward Castes. The Other caste also includes HHs (approximately 2%) whose heads reported that they do not know their caste.

Figure 3.4: Percent Distribution of Households across Different Castes in India and Selected States: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

scheduled tribe. Percentage of OBC households was high in the following states: Rajasthan (43%), Telangana (46%), Uttar Pradesh 48%), Madhya Pradesh (49%), Bihar (51%), Tamil Nadu (60%) and Kerala (63%). Other castes constituted more than one-half of the enumerated population in Manipur (52%), West Bengal (57%), Goa (59%) and Jammu & Kashmir (65%).

3.3 Household Characteristics and Assets

The household characteristics and possession of assets are an important measure of the socio-economic status of the household and are known to be associated with health outcomes. These are presented in Table 3.4.

INCHIS collected information on type of residential structure by observing the construction of the house. At the national level, 40.4% of the households were found residing in *pucca* houses, 37.2% houses were *semi-pucca*, and 22.5% were *kachcha*. In urban areas, 65% residential structures were observed as *pucca* compared to 26% in rural areas.

To understand household crowding, INCHIS asked questions on the number of rooms used for sleeping. To compute the household crowding variable, household size (number of usual residents as obtained from the household roster) was divided by the number of rooms used for sleeping. The estimates suggest that in a remarkably high percentage (83%) of HHs, more than two persons

Table 3.4: Percent Distribution of Household Characteristics and Possession of Assets by Place of Residence: INCHIS-2 (Sep-Oct 2015) Data

Housing characteristics	Urban	Rural	Total
Type of household structure			
Pucca	64.9	28.6	40.4
Semi-pucca	26.1	42.5	37.2
Kachcha	8.9	29.0	22.5
Number of persons share a room for sleeping			
Less than or equal to 2	16.9	16.5	16.6
Greater than 2 but less than or equal to 4	62.5	57.1	58.9
More than 4	20.5	26.4	24.5
Main source of cooking fuel			
Solid fuel[1]	23.4	80.3	61.9
Liquefied petroleum gas (LPG)	66.9	16.8	33.0
Other refined sources[2]	6.9	2.7	4.1
Other (Kerosene, no food cooked etc.)	2.8	0.3	1.1
Main source of lighting			
Electricity	94.6	64.3	74.1
Kerosene	4.2	33.8	24.2
Other (solar, other oils, no lighting)	1.2	1.9	1.7
Main source of drinking water			
Improved source[3]	96.3	92.8	93.9
Unimproved source[4]	1.8	6.9	5.3
Other	1.9	0.3	0.8
Households having toilet facility			
Yes	84.1	37.7	52.7
No	15.9	62.4	47.3
Type of toilet facility			
Flush or pour flush toilet	56.1	18.6	30.7
Other type of toilet facilities[5]	30.5	19.9	23.3
No facility/uses open field	10.5	61.4	44.9
Have Bank or post-office account			
Yes	89.6	84.0	85.8
No	10.4	16.0	14.2

[1]Solid fuel includes coal, lignite, charcoal, wood, straw, shrubs, grass, agricultural crop waste, and dung cakes
[2]Other refined sources include electricity, natural gas and biogas
[3]Improved source includes piped into dwelling/yard/plot, public tap/standpipe, tubewell or borehole, hand pump, protected well, protected spring, rainwater and bottled water
[4]Unimproved source includes unprotected well, unprotected spring, tanker truck, surface water (river/dam/lake/pond/stream/canal/irrigation canal)
[5]Other type of toilet facilities include ventilated improved pit/biogas latrine, pit latrine with slab, pit latrine without slab/open pit, twin pit/composting toilet, bucket toilet

Housing characteristics	Urban	Rural	Total
Have Aadhaar card			
Yes	92.8	91.7	92.1
No	7.2	8.3	7.9
Have BPL or Antyodaya card			
Yes	29.1	44.1	39.2
No	71.0	55.9	60.8
Possession of household assets			
Watch or clock	90.5	66.5	74.3
Radio/transistor/music system	18.4	10.0	12.7
Television	84.3	44.7	57.5
Telephone/mobile phone	94.1	86.8	89.2
Computer/laptop	10.7	3.1	5.6
Internet	13.6	3.6	6.9
Refrigerator	44.8	12.7	23.1
Washing machine	16.8	4.5	8.5
Air Cooler	28.2	9.7	15.7
Air conditioner	2.6	0.6	1.2
Motorcycle/scooter	44.1	26.0	31.9
Car/jeep/van/tractor	6.0	4.7	5.1
Number of households	**4,970**	**10,069**	**15,039**

share a room for sleeping (Table 3.4). In 25% households, more than four persons shared a room for sleeping. These data indicate the presence of extreme household crowding in the households selected for INCHIS-2. Evidence identifies household crowding as a potential risk factor for infectious diseases, particularly those with respiratory spread [21].

In response to the question on the main type of fuel used for cooking, 62% households reported use of solid cooking fuel and 33% reported use of Liquefied Petroleum Gas (LPG). Solid cooking fuel is defined as use of either of the following fuels as the main source of cooking: coal, lignite, charcoal, wood, straw, shrubs, grass, agricultural crop waste, and dung cakes. In rural areas, a remarkably high percentage of households (80%) use solid fuel for cooking while 67% households in urban areas use LPG as cooking fuel (Table 3.4).

In India, 74% of households used electricity as main source for lighting, 24% used kerosene. Though electricity was the main source of lighting in urban as well as rural areas, 34% of rural households were still dependent on kerosene for lighting.

In the context of source of drinking water, 96% of urban households and 93% of rural households in the country have access to improved source of drinking water. Improved source includes piped into dwelling/yard/plot, public tap/standpipe, tubewell or borehole, hand pump, protected well, protected spring, rainwater and bottled water.

INCHIS asked about the availability of toilet

facility in the household and the type of toilet being used by household members. In India, 53% households reported availability of a toilet in the household, while 47% households did not have any toilet facility. In urban India, 84% of the households reported availability of toilet facilities in the house while this number was only 38% among rural households.

In response to the type of toilet facility used by household members, 45% of Indian households reported practicing open defecation, 31% reported use of flush or pour flush toilet, and 23% used other types of toilet including ventilated improved pit/biogas latrine, pit latrine with slab, pit latrine without slab/open pit, twin pit/composting toilet, bucket toilet or any other type of toilet. Notably, in rural India, 61% households reported practicing open defecation.

INCHIS also collected information on ownership of bank or post-office account, enrolment in Aadhaar card, BPL card and possession of various types of household assets. In India, 86% of the households had at least one member who owned a bank account or a post-office account. Likewise 92% of the households had at least one member enrolled and in possession of Aadhaar card. Among the sampled households, 39% reported possession of BPL or Antyodaya card.

Among different types of assets, less than 10% of Indian households owned computer/laptop, internet, washing machine, air conditioner and car/jeep/van/tractor. Notably, ownership of these assets was predominantly attributed to urban area households. See Table 3.4 for further details. Assets which were owned by the majority of households included watch or clock (74%), television (58%), telephone or mobile phone (89%).

3.4 Wealth Index

Wealth index is a composite measure of the economic status of households. The wealth index has been developed and tested in a large number of countries in relation to inequalities in household income, use of health services, and health outcomes [22]. It reflects the household's long term economic status and is used as a proxy for the economic well-being of households [15]. To construct the wealth index, we considered variables related to housing characteristics, sanitation facility of the HH, asset possession. Each variable is assigned a weight (loading) generated through principal component analysis (PCA) and the standardized variables are multiplied by the loadings and summed to produce the wealth index.

The variables used to create the wealth index were:

- type of household structure,
- number of persons sharing a room for sleeping,
- availability of a separate room used as a kitchen,
- type of fuel used for cooking,
- electricity as a source of lighting,
- type of toilet facility,
- ownership of the following assets: clock, television, laptop, internet, refrigerator, washing machine, air cooler/air conditioner, motorcycle/scooter and car/jeep/van/tractor.

After calculating the principal components using these variables, it was found that the first principal component explained 32.5% of the total variability present in the data (INCHIS-2). The first principal component was considered as the wealth index. Based on the wealth index the households were divided into quintiles: poorest, poorer, middle, richer, and richest.

In Figure 3.5 different household characteristics are plotted against the wealth quintiles. Among the richest quintile of households, 92% resided in a pucca house. However, in 67% of the richest households more than two persons, on an average shared a room for sleeping. Only 32% of the poorest households used electricity as main source of lighting. A remarkably high percentage (87%) of the poorest households practiced open defecation. Almost all of the poorest households used solid cooking fuel (98%). Only 5% of the poorest households owned a television.

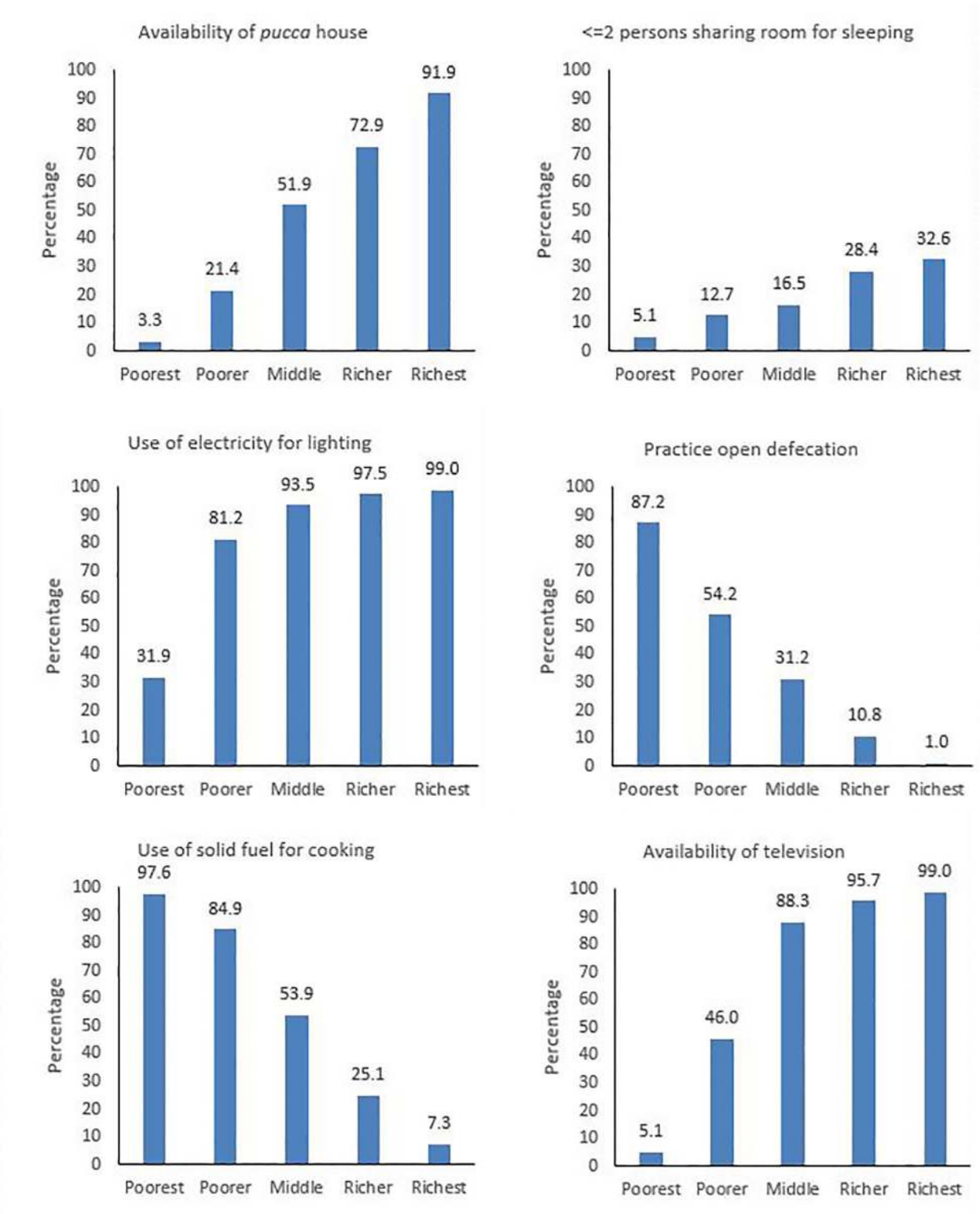


Figure 3.5: Distribution of Various Household Characteristics (percent households) by Wealth Quintile in India: INCHIS-2 (Sep-Oct 2015) Data

Table 3.5: Percent Distribution of Households Having BPL/ Antyodaya Card by Wealth Quintile: INCHIS-2 (Sep-Oct 2015) Data

Wealth Quintile	Yes	No	Number of households
Poorest	44.6	55.4	3,031
Poorer	44.1	55.9	2,986
Middle	42.3	57.8	3,010
Richer	33.4	66.6	3,005
Richest	23.9	76.1	3,007
Total	**39.2**	**60.8**	**15,039**

Table 3.6: Distribution of Households (percentage) Across Wealth Quintiles for India and Selected States: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

India/state	Poorest	Poorer	Middle	Richer	Richest
India (INCHIS-2)	29.6	21.1	18.5	16.0	14.8
Urban	6.4	14.1	23.0	25.6	30.9
Rural	40.8	24.4	16.3	11.4	7.1
Bihar	67.5	20.0	6.9	3.4	2.4
Madhya Pradesh	20.2	28.2	23.7	16.7	11.3
Maharashtra	6.9	16.3	24.6	27.6	24.7
Rajasthan	14.5	24.9	21.3	18.8	20.5
Telangana	7.2	22.4	42.7	19.6	8.2
Uttar Pradesh	49.2	20.2	11.7	8.7	10.3
Goa	4.0	7.8	21.1	26.6	40.5
Himachal Pradesh	0.3	3.7	10.9	37.9	47.2
Jammu & Kashmir	13.2	20.1	24.9	18.2	23.6
Kerala	0.3	2.8	18.4	43.0	35.6
Mizoram	14.0	21.3	17.3	22.0	25.5
West Bengal	20.9	38.1	26.2	11.2	3.7
Andhra Pradesh*	1.6	10.1	16.3	51.4	20.6
Haryana*	5.3	12.0	19.1	17.6	46.0
Manipur*	15.4	19.4	27.5	13.1	24.6
Odisha*	20.4	30.1	27.9	14.0	7.7
Tamil Nadu*	0.2	7.9	29.0	29.9	32.9
Uttarakhand*	6.9	13.0	21.9	24.3	33.8

* For rotational states from INCHIS-1, wealth index was calculated using INCHIS-1 data at the national level and then the state specific distributions were obtained relative to that.

The percent distribution of households having BPL/ Antyodaya card by wealth quintile are shown in Table 3.5. Interestingly, households with a BPL card were distributed across wealth quintiles. In the richest quintile, 24% HHs owned a BPL card relative to 45% in the poorest quintile.

Table 3.6 presents percentage of households belonging to each of wealth quintiles by place of residence (urban and rural) and by state.

Thirty one percent (31%) of the urban households in India were in the highest wealth quintile relative to 7.1% in rural India. The distribution of the households across wealth quintiles shows a huge variation across states, with Kerala (36%), Goa (41%), Haryana (46%) and Himachal Pradesh (47%) reporting over one-third of their households in the richest wealth quintile. On the other hand, Bihar (2%), West Bengal (4%), Odisha and Telangana (8% each) had less than 10% of their households in the highest wealth quintile.

4. IMMUNIZATION COVERAGE

Immunization Coverage

4.1 Need for Evaluation of Universal Immunization Program

Despite a long-standing national program for universal immunization in India, only 65.3% of 12-23 months old children in the country are fully immunized (RSOC, 2013-14) [7]. Full immunization coverage (FIC) is defined as children receiving 1 dose of BCG, 3 doses of OPV, 3 doses of DPT or Pentavalent, 1 dose of measles vaccine. Completion of vaccine schedule for antigens that require multiple doses (e.g., DPT/Pentavalent and OPV) remains a major challenge. For example, coverage rate of three doses of DPT is consistently lower than measles coverage across health and demographic surveys although measles appears later in the national immunization schedule. Drop-out rates for DPT 2 to 3 and OPV 2 to 3 are 11.1% and 11.9%, respectively (RSOC, 2013-14).

Although the coverage of three doses of OPV and DPT and one dose of measles is sub-optimal and there still exists huge inequality in coverage across states, UIP also achieved many successes. One of the achievements of UIP worth mentioning is India was certified as a polio-free nation by the WHO in 2014. The last case of polio in the country was reported on 13 January 2011 from West Bengal. This is a remarkable achievement, particularly considering the fact that in 2009 India accounted for nearly half of the total number of polio cases globally [10].

Recent year coverage estimates indicate that the urban-rural coverage inequality has decreased significantly in many states [7, 23]. The NRHM, initiated in 2005 by the Government of India, sought to provide effective healthcare to the rural population through architectural corrections of the health system and through the promotion of policies that strengthen public health management and service delivery across India [24]. The NRHM has had both supply side and demand side effects on the immunization program in rural India through various interventions, such as hiring of additional Auxiliary Nurse Midwives (ANMs), introduction of the Alternate Vaccine Delivery (AVD) system and establishing effective links between the local community and healthcare providers through ASHA workers [23]. The above mentioned interventions may have contributed significantly to the improvement in immunization coverage in rural areas.

Regular monitoring and evaluation of any universal immunization program and related interventions is possible only upon availability of updated information. Hence, one of the objectives of INCHIS survey was to produce reliable national and state-level estimates on immunization coverage on a bi-annual basis and evaluate the targeted immunization campaigns conducted in high focus districts under Mission Indradhanush.

4.2 National and State-level Coverage Estimates from INCHIS

In this section we present national-level and state-level estimates of vaccination coverage rates using two rounds of INCHIS data. All estimates in this section are survey-weighted, with weights being national-level child weight or state-level child weight depending on the geographical level of estimation. Standard errors used to define the 95% confidence intervals (CIs) incorporate sampling design features (e.g., clustering, unequal selection probability) and were calculated using 'svy' package of STATA [25]. Ignoring the sampling design features while calculating SEs can

severely underestimate the measure of uncertainty associated with the estimates and lead to wrong inferences.

4.2.1 Source of Immunization Related Information

In both rounds of INCHIS, vaccination details of children in the age group of 0-23 months were obtained from vaccination card as well as from mother's recall.

In INCHIS-1, an interviewer was asked to administer mother's recall section if either the card was unavailable or incomplete. The sequence of questions followed other immunization related surveys in India, vaccination details from card followed by mother's recall. However, letting the interviewer decide whether the card was complete or not resulted in missing cases (neither available from card nor from recall) in some states and for specific vaccines. In some cases, interviewers did not ask for recall even if the dates were unavailable in the card.

Taking lessons from the first round, in INCHIS-2 all mothers were asked about their child's vaccination status, irrespective of availability of immunization card, completeness status of card, and child's age. This was applicable for all vaccines except for booster dose of OPV and DPT and 2nd dose of measles and JE. In the mother's recall section, questions regarding these four vaccines were applicable only for children of age 16 months or older. Additionally, in INCHIS-2 mother's recall section was administered before asking for vaccination card.

If immunization/MCP card was available and seen, the interviewer was instructed to copy date, month, and year for each of the vaccines received. In case the card showed that vaccine was given but no date was mentioned, the interviewer was trained to record '44' in the field of day and month and '4444' in the year field. During pilot testing of questionnaire, this situation was observed for vaccines which are given at the same time. For example, DPT, Hepatitis-B, and OPV are scheduled to be administered together when the child is of age 6, 10, and 14 weeks. In some instances, date was recorded for one of the vaccines and kept blank for other two along with a tick mark beside the vaccine.

If only part of date was written on the card, the interviewer was instructed to record '99' if day or month is missing and '9999' if year was not available.

Vaccination coverage rate is very sensitive to the type of source as vaccination status of a child may change with the source of information. We performed a sensitivity analysis to demonstrate the severity of the issue.

4.2.2 Method to Calculate Coverage Rates

The general methodology used for calculating vaccination coverage rates can be summarized in the following steps. For further details, see Appendix C.

Step1: Define child's age (in completed months)

In an ideal scenario, a child's age was calculated in completed months by subtracting child's date of birth (DOB) from the survey date. However, if the survey date was wrong (e.g., beyond the date of actual field work) or child's DOB is missing (whole or part) or appeared to be wrong (e.g., DOB is during field work), then child's age in months as reported by mother was considered.

Step2: Create a binary variable whether specific vaccine received or not

- To create this variable, first preference was given to information obtained from vaccination card, if available.
  - For a specific vaccine, if there was a valid full date (DD/MM/YYYY) in the card, it was treated as vaccine received.
  - If the child was given a vaccine but no date was recorded in the vaccination card (coded as '44'), it was considered as vaccine received.
  - If part of date was available in the card (coded as '99' in the missing field), it was considered as vaccine received.
- If there was no record of vaccination in the card (coded as '0' or all date fields are coded as '99') or no card was shown to the

interviewer (coded as '.' or 'NA'), information on vaccination status was obtained from mother's recall section.

- If mother responded as 'Yes', it was treated as vaccination received.
- If mother responded as 'No' or 'Don't know', we considered it as vaccination not received.
- If mother's recall is missing (coded as '.' or 'NA') then
  - If record in the card says '0', it was treated as vaccination not received.
  - If record in the card says '.' or 'NA', it was considered missing.

For some vaccines (e.g., DPT and Pentavalent), defining immunization status based on mother's recall is slightly complicated (depends on the combination of two-three questions).

Please see Appendix C for further details.

Step3: Subset the data by child's age

Different age groups were considered to estimate coverage rates for different vaccines. For all vaccines, upper limit of child's age was considered as 23 months. The lower limit varies depending on the national immunization schedule. For example, third dose of OPV or DPT is supposed to be given at 14 weeks which is slightly more than 3 months. Hence, for this vaccine, age group was considered as 4-23 months. In other words, denominator for the coverage rate of three doses of OPV or DPT is all children in the age group of 4-23 months. For vaccine specific age groups and sample size, see Table 4.3 and Table 4.4.

Step4: Calculate the survey-weighted proportion of children in that particular age group who received specific vaccine.

To calculate the weighted proportion, we used national-level child weight or state-level child weight depending on the geographical level of estimation. Survey-weighted proportions were multiplied by 100 to obtain coverage rates (percentages).

4.2.3 Notations and Definitions

The definitions for different terms used while assessing immunization coverage are presented in Table 4.1.

Table 4.1: Definition of Different Terms Used in the Coverage Rate Tables

Terms	Definitions
Card	Vaccination card was available and seen by the interviewer
BCG	Child received BCG vaccine
OPV0	Child received birth dose of oral polio vaccine
Hep-B0	Child received birth dose of Hepatitis-B vaccine
OPV1	Child received one dose of oral polio vaccine
OPV2	Child received two doses of oral polio vaccine
OPV3	Child received three doses of oral polio vaccine
DPT1/Penta1*	Child received either one dose of DPT or Pentavalent vaccine
DPT2/Penta2*	Child received either two doses of DPT or Pentavalent vaccine
DPT3/Penta3*	Child received either three doses of DPT or Pentavalent vaccine
Measles	Child received first dose of measles vaccine
FIC	Full Immunization Coverage: Child received BCG, OPV3, DPT3/Penta3, Measles
NI	No Immunization: Child did not receive any of the vaccines BCG, OPV1, DPT1/Penta1, Measles
PI	Partial Immunization: Child received at least one dose of at least of the vaccines BCG, OPV, DPT/Penta but not all (for all practical purposes, PI is defined as 100-FIC-NI)

* In this report we did not attempt to provide coverage rates separately for Pentavalent. The reference period of the survey coincided with the national rollout of Pentavalent vaccine, and in almost all states DPT and Pentavalent both were in use. There was a lot of confusion in the vaccination card entries and in the understanding of the mother about the specific vaccine administered to the child (DPT or Pentavalent). For similar reasons separate coverage rates for Hepatitis B (which is integrated in the Pentavalent vaccine) were not calculated.

4.2.4 Availability of Immunization Card

In both rounds of INCHIS, mothers were asked about the availability of child's vaccination card. If the card was available, mother was asked to show the card. Evidence suggests that availability of immunization card is an important precondition for a child to be fully vaccinated [26, 27]. Table 4.2 presents the estimated percentages of children (0-23 months) across three response options – 'Card available and seen', 'Card available but not seen', and 'No card' - regarding card availability for India and selected states. India estimates based on INCHIS-2 data include all 12 states (six fixed and six rotational). India INCHIS-1 estimates are based on 11 states (five fixed states excluding Maharashtra and six rotational states). For any analysis in this report, data from Maharashtra was excluded from INCHIS-1 because of data quality concerns.

Table 4.2: Percent Distribution of Immunization Card Availability for India and Selected States: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	Card available and seen	Card available but not seen	No card	Number of children (0-23 months)
India (INCHIS-2)	**65.0**	**19.4**	**15.6**	**15,132**
Bihar	67.5	18.4	14.2	1,369
Madhya Pradesh	69.4	21.2	9.4	1,659
Maharashtra	71.9	18.5	9.6	1,402
Rajasthan	42.0	41.5	16.5	1,471
Telangana	70.8	21.1	8.2	930
Uttar Pradesh	53.5	14.6	32.0	1,839
Goa	75.6	20.0	4.4	550
Himachal Pradesh	65.9	27.3	6.8	1,278
Jammu & Kashmir	50.0	34.9	15.1	1,378
Kerala	89.2	9.4	1.4	969
Mizoram	50.2	18.1	31.7	1,199
West Bengal	88.1	10.8	1.1	1,088
India (INCHIS-1)	**58.6**	**22.4**	**19.0**	**10,623**
Andhra Pradesh	70.6	11.0	18.4	779
Haryana	64.8	19.0	16.2	1,115
Manipur	64.1	25.5	10.4	947
Odisha	66.8	29.1	4.1	1,043
Tamil Nadu	85.9	11.7	2.4	1,082
Uttarakhand	59.2	29.1	11.8	763

Note: For fixed states, data from INCHIS-2 was used. For rotational states, respective round of INCHIS data was considered.

Card Available and Seen

Figure 4.1 presents the percentages of children for whom immunization card was available and seen during mothers' interview. For fixed states, latest available data, from INCHIS-2 is shown. For rotational states, data from the respective round of INCHIS in which the state was sampled is shown.

At the national level, availability of immunization cards during mother interview increased significantly between INCHIS-1 (58.6%, 95% CI 55.5-61.7) and INCHIS-2 (65%, 95% CI 62.3-67.6). Percentage of card availability during interview was lower in Rajasthan (42%), Jammu & Kashmir (50%), Mizoram (50.2%) and Uttar Pradesh (53.5%). On the other hand, in Kerala, West Bengal and Tamil Nadu, for more than 85% of the children in the age group 0-23 months, immunization card was reported to be available during interview.

Card Available but not Seen

As per INCHIS-1, for 22.4% of children in 0-23 months age group across India, immunization card was issued by a care provider, but was not available during the interview. This percentage was approximately the same for INCHIS-2 (19.4%). The main reasons behind the non-availability of immunization card during interview were "card with husband or other family members" and "ASHA/ANM/AWW has the card". For

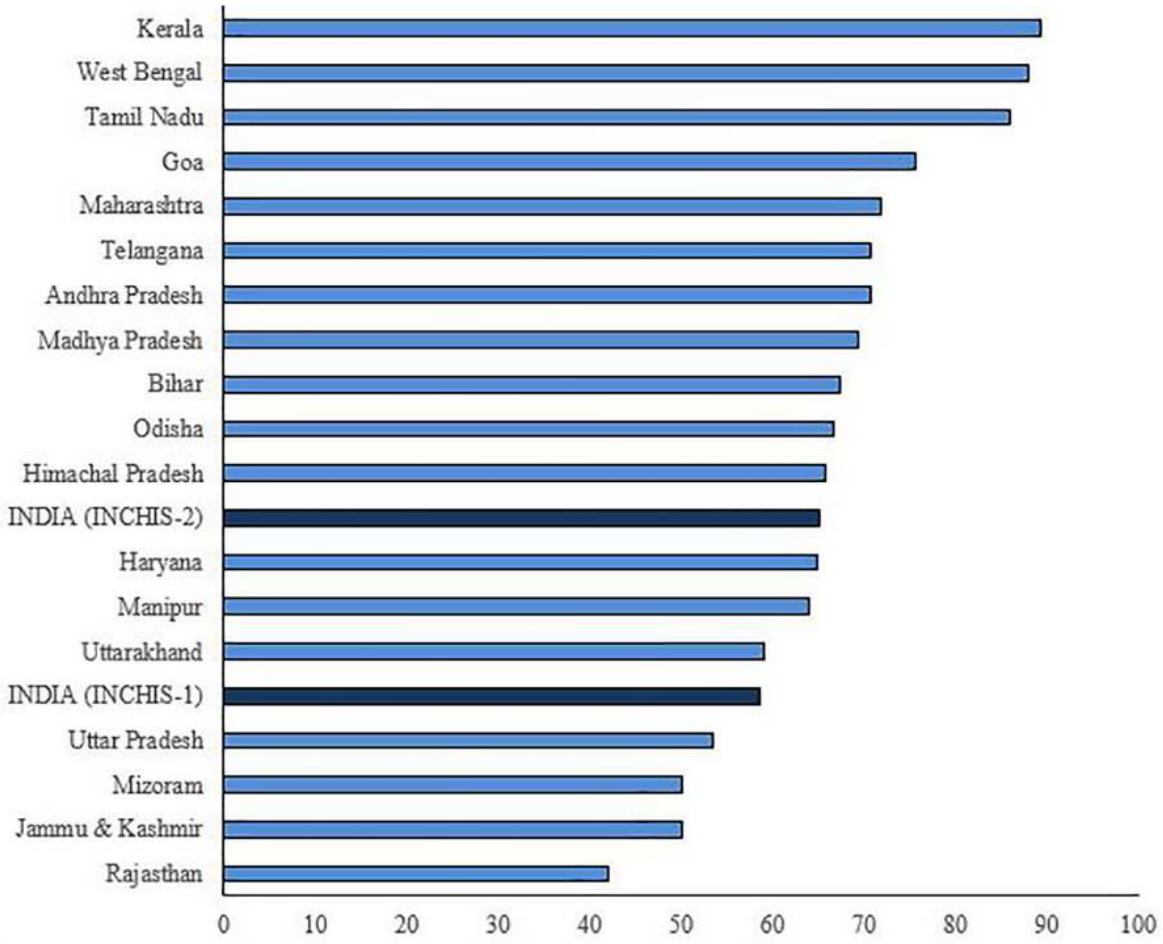


Figure 4.1: Percent Distribution of Children (0-23 months) with Immunization Card Available and Seen in India and Selected States: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

INCHIS-1, these two reasons accounted for 53% and 40% of cards not seen whereas the respective percentages for INCHIS-2 were 57% and 33%. At the state-level, Rajasthan (41%) and Jammu & Kashmir (35%) reported the highest percentage of children for whom card was issued but not available during the interview (Table 4.2).

No Card

For the remaining children, the immunization card did not exist, meaning, either card was never issued or was lost. Estimated percentage of children without card at the national level was 19% from INCHIS-1 and 17% from INCHIS-2. At the state-level, Mizoram (32%) and Uttar Pradesh (32%) had the highest percentage of children without immunization card. Out of these children in Uttar Pradesh, for 63% children card was not issued by the care provider.

4.2.5 Immunization Coverage Rates

Sample Size (Number of Children)

In this section, sample sizes for different age groups of children included in the analysis for estimating coverage rates for different vaccines are described. The upper end of the age group was considered to be equal (23 months) for all vaccines but the lower end varied depending on the national immunization schedule guidelines for the age. Table 4.3 and Table 4.4 show the number of children in the sample for India and by place of residence for selected states from INCHIS-1 (Mar-

Table 4.3: Sample Size for India and by Place of Residence and Selected States: INCHIS-1 (Mar-Apr 2015)

Vaccine	OPV0/ Hep-B0/ BCG	OPV1/ DPT1/ Penta1	OPV2/ DPT2/ Penta2	OPV3/ DPT3/ Penta3	Measles/ FIC/ NI
Age group (in months)	0-23	2-23	3-23	4-23	12-23
India*	10,623	9,983	9,530	9,080	5,313
Urban	3,070	2,896	2,768	2,654	1,526
Rural	7,553	7,087	6,762	6,426	3,787
Bihar	976	918	864	820	445
Madhya Pradesh	1,082	1,022	984	949	609
Rajasthan	953	891	843	808	463
Telangana	769	722	686	656	389
Uttar Pradesh	1,114	1,026	966	921	505
Andhra Pradesh	779	740	702	665	382
Haryana	1,115	1,036	998	952	556
Manipur	947	911	871	832	500
Odisha	1,043	983	948	898	559
Tamil Nadu	1,082	1,033	996	943	516
Uttarakhand	763	701	672	636	389

*For India and India by rural/urban, 11 states from INCHIS-1 (except Maharashtra) were considered; 11 states include five fixed states and six rotational states. Maharashtra was excluded from INCHIS-1, because of data quality concerns.

Table 4.4: Sample Size for India and by Place of Residence and Selected States: INCHIS-2 (Sep-Oct 2015)

Vaccine	OPV0/ Hep-B0/ BCG	OPV1/ DPT1/ Penta1	OPV2/ DPT2/ Penta2	OPV3/ DPT3/ Penta3	Measles/ FIC/ NI
Age group (in months)	0-23	2-23	3-23	4-23	12-23
India*	15,132	14,227	13,638	13,112	8,268
Urban	5,025	4,727	4,525	4,357	2,745
Rural	10,107	9,500	9,113	8,755	5,523
Bihar	1,369	1,270	1,220	1,173	746
Madhya Pradesh	1,659	1,539	1,462	1,398	908
Maharashtra	1,402	1,322	1,276	1,230	740
Rajasthan	1,471	1,372	1,306	1,268	824
Telangana	930	855	818	776	480
Uttar Pradesh	1,839	1,710	1,646	1,593	1,021
Goa	550	529	507	487	284
Himachal Pradesh	1,278	1,240	1,189	1,136	728
Jammu & Kashmir	1,378	1,321	1,266	1,208	802
Kerala	969	890	848	810	450
Mizoram	1,199	1,158	1,115	1,080	678
West Bengal	1,088	1,021	985	953	607

*For India and India by rural/urban areas, 12 states from INCHIS-2 were considered. Six fixed states and six rotational states are presented in the table.

Apr 2015) and INCHIS-2 (Sep-Oct 2015).

The reasons behind the higher sample size in INCHIS-2 relative to INCHIS-1 are as follows:

- In INCHIS-1, 20 eligible households (HHs) were randomly selected from each sampled cluster using stratified sampling technique. In INCHIS-2, the number of sampled HHs was increased to 25. The increment was applied to the age group of 12-23 months old children. This was done to allow comparability of INCHIS estimates with existing immunization coverage rates from other surveys which traditionally use the age group 12-23 months.
- For fixed states, same districts were surveyed in INCHIS-1 and INCHIS-2 for the purpose of evaluating the impact of Mission Indhradhanush. However, in INCHIS-2, one additional district was sampled from the states of Rajasthan, UP, MP and Maharashtra and two additional districts were sampled in Bihar. The purpose of considering additional districts in INCHIS-2 was to accomplish geographical representativeness, in addition to the representativeness achieved with respect to the key indicators related to immunization coverage in INCHIS-1.

National-level Coverage rate

Birth Doses

In Figure 4.2 the vaccination coverage rate for birth doses of oral polio vaccine (OPV0) and Hepatitis-B (Hep-B0) for India and by area of residence are displayed using INCHIS-1 and INCHIS-2 data. For institutional deliveries, birth doses are supposed to be given at birth. With increasing trend of institutional deliveries in India, coverage rates are quite high for OPV0 (88%), which remained unchanged across the two rounds of INCHIS. However, for Hep-B0 the coverage rate was relatively lower (close to 80%) at the national level. The birth dose of Hepatitis B vaccine is effective in preventing peri-natal transmission of Hepatitis B if given within the first 24 hours after birth. On the other hand, OPV0 can be administered within two weeks of birth. This possibly explains the difference in the coverage rate of OPV0 and Hep-B0 as children who were not born at health facilities probably received OPV0 at a later date (within 2 weeks), but not Hep-B0. Although BCG is also given at birth (or as early as possible till one year of age), since it is a vaccine included in estimating FIC, the coverage rates for the same are elaborated in the next section.

Vaccines under FIC

Table 4.5 presents antigen-wise coverage rate for vaccines considered under FIC in India and by place of residence (urban/rural) from INCHIS-1 and INCHIS-2. From INCHIS-1, FIC, i.e. percentage of children in the age group of 12-23 months who received one dose of BCG, three doses of OPV, three doses of DPT or Pentavalent vaccine, and one dose of measles in India was 64.1% (95% CI 60.7-67.5). FIC increased to 73.5% (95% CI 70.3-76.4) according to INCHIS-2. An increase of approximately 9% in FIC within a span of six months may potentially be attributed to Mission Indradhanush. Urban-rural coverage gap in FIC decreased to 5.3% in INCHIS-2 (77.3% in urban vs. 72.0% in rural areas) from 11.9% in INCHIS-1 (72.8% in urban vs. 61.0% in rural areas). According to INCHIS-2 data, urban (95% CI 71.3-82.4) and rural (95% CI 68.2-75.6) coverage gap is not statistically significant, potentially because of targeted implementation of MI. However, further analysis on the comparison

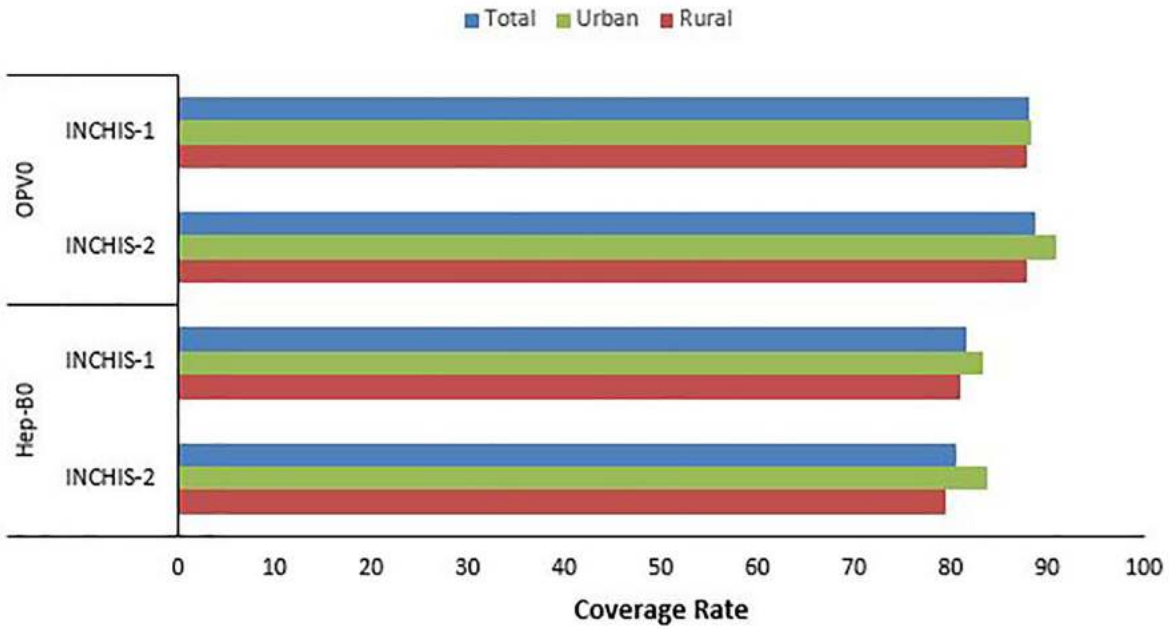


Figure 4.2: Coverage Rate of Birth Doses of OPV0 and Hep-B0 Among 0-23 Months Old Children for India and by Place of Residence: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

Table 4.5: Vaccine-Wise Vaccination Coverage Rate for India: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

Vaccine	BCG	OPV1	OPV2	OPV3	DPT1/ Penta1	DPT2/ Penta2	DPT3/ Penta3	Measles	FIC	NI
Age group (in months)	0-23	2-23	3-23	4-23	2-23	3-23	4-23	12-23	12-23	12-23
INCHIS-1 (Based on 11 states except Maharashtra*)										
India	91.9	90.8	83.2	68.6	86.2	80.6	67.5	80.2	64.1	4.1
Urban	92.6	91.8	85.7	73.2	87.7	82.4	70.8	84.4	72.8	3.4
Rural	91.7	90.4	82.2	66.9	85.7	80.0	66.2	78.7	61.0	4.3
INCHIS-2 (Based on all 12 states)										
India	93.1	90.6	85.9	77.1	88.0	83.4	75.3	84.9	73.5	4.4
Urban	94.5	92.8	89.6	82.2	91.0	87.5	80.5	87.2	77.3	3.6
Rural	92.5	89.7	84.5	75.2	86.9	81.8	73.4	84.1	72.0	4.7

* Maharashtra was excluded because of data quality concern

of fixed states across rounds would be crucial to understand the impact of MI (see Section 4.6).

In the context of individual vaccines, there exists a clear pattern with gradual decrease in coverage rate starting with BCG up to three doses of OPV and DPT/Penta and then an increase for measles. For example, according to INCHIS-1 data, the coverage rates in India for vaccines are given below (numbers in the parenthesis along with OPV represent corresponding DPT dose coverage):

- BCG: 91.9%,
- one dose of OPV (DPT): 90.8% (86.2%),
- two doses of OPV (DPT): 83.2% (80.6%),
- three doses of OPV (DPT): 68.6% (67.5%),
- measles: 80.2%

In INCHIS-2, no significant improvement was noted for BCG, OPV1, DPT1, OPV2, DPT2, and one dose of measles coverage in India. However, for OPV3 and DPT3, the increase in coverage (approximately 8% for both) was statistically significant subsequent to Mission Indradhanush phase 1.

According to INCHIS-1 data, national-level measles coverage in India was 80.2% which increased to 84.9% in INCHIS-2. Although measles appears later in the vaccination schedule, higher coverage rate for measles observed in INCHIS as compared to coverage rate of three doses of OPV and DPT/Pentavalent is consistent with the findings from other health and demographic surveys [7, 28].

State-level Coverage rates

In Table 4.6 antigen-wise coverage rate for states selected in INCHIS-1 and INCHIS-2 are presented. While reporting state-level coverage rates for INCHIS, INCHIS-2 data for fixed states (most recent available data) was considered, and for rotational states, data from respective round of INCHIS in which these states were covered was used. As per the latest estimates, full immunization coverage rate among children in the age group of 12-23 months was only close to 50% in Uttar Pradesh and Manipur, and was slightly above 50% in Mizoram (54.4%). Telangana, WB, Kerala, Bihar, Goa, and Maharashtra achieved FIC rates of more than 84%. Historically poor performing state

Table 4.6: Vaccine-Wise Vaccination Coverage Rate for Selected States: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

Vaccine	BCG	OPV1	OPV2	OPV3	DPT1/ Penta1	DPT2/ Penta2	DPT3/ Penta3	Measles	FIC	NI
Age group (in months)	0-23	2-23	3-23	4-23	2-23	3-23	4-23	12-23	12-23	12-23
INCHIS-2 (Sep-Oct 2015)										
India	93.1	90.6	85.9	77.1	88.0	83.4	75.3	84.9	73.5	4.4
Bihar	95.7	95.3	91.7	88.2	93.5	90.0	86.3	90.9	86.5	1.1
Madhya Pradesh	97.3	96.0	92.3	80.7	93.4	89.5	77.7	88.6	74.0	0.5
Maharashtra	97.0	96.9	95.4	90.0	95.9	91.7	86.2	92.7	84.2	1.4
Rajasthan	91.6	87.7	81.4	73.4	83.4	78.6	72.6	79.2	70.6	5.2
Telangana	99.2	99.1	96.8	94.0	98.0	96.1	92.1	94.5	90.4	0.8
Uttar Pradesh	83.1	77.0	67.5	52.4	73.8	65.6	52.0	69.5	51.0	12.2
Goa	98.5	99.5	95.6	87.1	97.1	92.5	85.3	95.1	85.6	0.0
Himachal Pradesh	99.5	99.6	98.8	90.2	86.3	85.2	77.0	98.4	76.9	0.0
Jammu & Kashmir	96.5	95.7	91.6	82.8	90.2	85.9	77.3	93.7	75.8	2.4
Kerala	100.0	97.3	94.0	90.1	98.0	94.9	91.8	93.2	86.1	0.0
Mizoram	76.2	75.1	69.1	59.4	72.1	67.7	61.2	69.4	54.4	23.2
West Bengal	99.5	98.9	97.5	92.0	97.6	95.1	89.8	97.6	90.7	0.0
INCHIS-1 (Mar-Apr 2015)										
India	91.9	90.8	83.2	68.6	86.2	80.6	67.5	80.2	64.1	4.1
Andhra Pradesh	99.2	97.9	95.1	69.4	91.9	86.0	65.5	87.4	61.1	0.0
Haryana	92.2	89.3	84.8	78.9	86.4	83.1	78.5	83.3	78.5	7.6
Manipur	88.2	96.8	89.4	70.0	88.9	83.3	66.0	78.8	49.1	1.3
Odisha	97.3	97.5	94.6	85.9	94.7	90.8	83.8	94.1	83.8	1.5
Tamil Nadu	98.4	98.4	97.0	87.0	96.4	93.6	86.0	73.0	62.8	0.0
Uttarakhand	93.4	91.3	82.3	65.2	88.0	81.3	67.1	80.5	64.1	2.7

Note: For fixed states, data from INCHIS-2 was used. For rotational states, respective round of INCHIS data was considered.

Bihar's high FIC can potentially be explained by intensive supplementary immunization activities through Mission Indradhanush.

UP and Mizoram, the two states with the lowest FIC rate, also had the highest proportion of left-out children with a no immunization (NI) rate of 23.2% in Mizoram and 12.2 % in UP. Haryana (7.6%) and Rajasthan (5.2%) had significant number of left-out children as well. Interestingly, in Haryana a high FIC rate (78.5%) as well as a relatively high NI rate (7.6%) was observed. This suggests that benefits of routine immunization may not be reaching specific areas and sections of the population, despite overall satisfactory performance of the program. On the contrary, Goa, Himachal Pradesh, Kerala, Andhra Pradesh, Tamil Nadu, and West Bengal had hardly any left-out children in the age group of 12-23 months as the NI rate was close to 0%.

The results show that many states have achieved the MDG-4 target of 90% measles coverage with Himachal Pradesh, West Bengal, Goa, and Telangana having 95% or above measles coverage rate among children in the age group of 12-23 months. The populous state of Uttar Pradesh (69.5%, 95% CI 62.1-76.0) had one of the lowest measles coverage rate among all INCHIS states, possibly contributing to the national measles coverage lagging behind the MDG-4 target.

4.3 Mothers perception on Partial/No Immunization

We explored the reasons behind partial or no immunization of children. In both rounds of INCHIS, this information was collected from mothers who perceived that their children did not receive all required vaccines as per their age, irrespective of the information recorded in the vaccination card. Mothers were asked about the reasons behind partial/no immunization using a multiple-response question and interviewers were instructed not to prompt responses. Table 4.7 and Table 4.8 present the primary reasons behind partial or no immunization using INCHIS-1 and INCHIS-2 data.

As per INCHIS-1, an estimated 19.4% mothers cited "Do not know the benefit of vaccination" as the reason behind partial or no immunization. Interestingly, 26% mothers in urban India cited lack of time as one of the main reasons behind child's partial or no immunization status. This percentage was high for the whole country as well (23%). Table 4.7 also presents the primary reasons

Table 4.7: Reasons for Partial or No Immunization: INCHIS-1 (Mar-Apr 2015) Data

Reasons for partial/no vaccination	India	Urban	Rural	Manipur	Uttar Pradesh
Do not know the benefit of vaccination	19.4	19.2	19.4	57.3	13.3
Do not know the vaccination schedule	24.9	21.3	26.0	45.8	21.3
Do not know the vaccination site	6.8	9.0	6.2	34.9	2.7
Do not know about vaccination session	24.4	19.6	25.9	75.0	22.9
Do not have time to take child for immunization	22.8	26.4	21.7	19.5	16.5
No one to take the child to vaccination site	13.6	9.9	14.8	23.4	10.1
Fear of side effects	18.4	16.6	18.9	12.9	22.3
Vaccination site too far	6.1	2.2	7.3	29.7	4.6
Vaccine not available	11.1	10.7	11.3	21.6	5.4
ANM absent during visit	10.1	7.0	11.1	8.0	4.0
Number of children	**3,799**	**885**	**2,914**	**581**	**574**

Table 4.8: Reasons for Partial or No Immunization: INCHIS-2 (Sep-Oct 2015) Data

Reasons for partial/no vaccination	India	Urban	Rural	Mizoram	Uttar Pradesh
Do not know the benefit of vaccination	23.2	16.9	24.8	50.8	16.3
Do not know the vaccination schedule	26.6	25.5	26.9	27.0	23.5
Do not know the vaccination site	11.8	12.3	11.7	11.0	9.6
Do not know about vaccination session	21.4	18.8	22.1	16.6	22.9
Do not have time to take child for immunization	20.3	19.6	20.5	12.5	19.4
No one to take the child to vaccination site	13.2	11.1	13.8	8.3	10.2
Fear of side effects	22.6	20.9	23.1	10.0	30.0
Uncomfortable/Painful for the child	16.4	13.4	17.2	9.2	20.3
Vaccine not available	11.7	7.5	12.8	19.5	5.7
Number of children	**2,774**	**690**	**2,084**	**325**	**629**

in two states where the FIC is the lowest. In Manipur, 75% mothers of incompletely immunized children (as per their perception) were not aware of vaccination session and 35% did not know the vaccination site. In UP, fear of side effects turned out to be an important factor (22%) along with lack of awareness about vaccination session (23%).

In INCHIS-2, the list of primary reasons as reported by mothers remained more or less the same. Lack of awareness about the vaccination schedule (27%) once again turned out to be the most important reason for India. Table 4.8 also presents the primary reasons in the two states where the FIC is the lowest. In Mizoram, 51% mothers (as per their perception) of incompletely immunized children did not know about the benefits of vaccination, hence, did not adhere to the completion of vaccination schedule. In UP, the same reasons turned out to be important again in INCHIS-2; fear of side effects (30%) along with lack of awareness about vaccination session (23%).

4.4 Drop-out Rates

While it is important to study the coverage rates for different vaccines, it is equally important to understand the drop-out rates (Table 4.9) in order to target specific vaccines for achieving higher level of FIC.

According to INCHIS-1 data, at the national level, highest drop-out rates were observed between one dose of OPV (OPV1) and three doses of OPV (OPV3) and also between one dose of DPT/Penta (DPT1/Penta1) and three doses of DPT/Penta (DPT3/Penta3). The national level drop-out rate between OPV1 and OPV3 was remarkably high (23.7%, 95% CI 21.5-26) and from DPT1/Penta1 to DPT3/Penta3 the drop-out rate was 20.6% (95% CI 18.6-22.7). Both of these drop-out rates get reduced to 14% according to INCHIS-2 data. This reduction is statistically significant and can potentially be attributed to targeted supplementary immunization activities under MI. Relatively low drop-out rates between three doses of OPV/DPT/ Penta and measles (7% at baseline and 4% at endline) suggest that completion of three doses of oral polio vaccine and DPT/Penta remains a key factor in achieving high levels of full immunization coverage.

The last two columns of Table 4.9 (Measles to DPT3 and Measles to OPV3) indicate that a significant percentage of 12-23 months old children received measles but failed to get three doses of DPT/Penta (13% as per INCHIS-1) and three doses of OPV (12% as per INCHIS-1). These percentages decrease during INCHIS-2.

Table 4.9: Drop-Out Rates for Specific Vaccines for India and by Place of Residence and States: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

Vaccine	BCG to DPT1	DPT1 to DPT3	DPT2 to DPT3	BCG to OPV1	OPV1 to OPV3	OPV2 to OPV3	DPT3 to Measles	OPV3 to Measles	Measles to DPT3	Measles to OPV3
Age group	2-23	4-23	4-23	2-23	4-23	4-23	12-23	12-23	12-23	12-23
INCHIS-1 (All 11 states except Maharashtra*)										
India	8.3	20.6	14.4	3.9	23.7	15.7	6.8	7.0	12.9	12.1
Urban	6.9	18.0	12.5	3.0	19.3	13.4	5.9	6.2	9.6	8.0
Rural	8.8	21.5	15.2	4.2	25.3	16.6	7.1	7.2	14.0	13.6
INCHIS-2 (All 12 states)										
India	6.9	14.2	9.3	4.5	14.8	9.9	4.0	4.3	9.2	7.6
Urban	4.7	11.3	7.8	3.0	11.3	7.8	3.6	3.8	7.6	6.0
Rural	7.8	15.3	9.9	5.1	16.1	10.7	4.2	4.5	9.8	8.2

Note: As discussed earlier, by DPT we mean DPT or Pentavalent. It is presented as DPT to save space.
* Maharashtra was excluded because of data quality concern

4.5 Determinants of Immunization Coverage

Several factors are known to be associated with vaccination coverage across antigens [23]. Previous analysis based on three rounds of NFHS undertaken between 1992 and 2006 shows considerable variations in child immunization coverage across six geographical regions in India [29]. Despite a decline in urban-rural and gender differences over time, children residing in rural areas and girls were found to have significantly lower coverage [29-32]. Moreover, birth order of child, mother's education, caste, religion and wealth index of the household also influence vaccination coverage [33].

Evidence suggests that availability of immunization card is an important precondition for a child to be fully vaccinated [26, 27]. Children of mothers who received sufficient antenatal care are also significantly more likely to be fully immunized relative to children of mothers who received insufficient or no antenatal care [34, 35]. In addition to the above mentioned demand-side determinants [36-39], supply-side factors such as access to health care facilities and other infrastructure also affect vaccination coverage [37, 38, 40].

Based on this existing literature, different factors were identified and coverage rates were calculated across different categories of the determining factors. Table 4.10 presents coverage rates for one dose of DPT/Penta and 3 doses of DPT/Penta.

As discussed in the vaccination coverage and drop-out rate sections, completion of vaccine schedule for vaccines that require multiple doses (e.g., DPT/Pentavalent and OPV) remains a major challenge behind sub-optimal FIC. For comparison purpose, coverage rates for one dose of DPT/Penta and 3 doses of DPT/Penta are presented for different determinants. Similar results hold true for one and three doses of OPV (results not shown here).

Table 4.10: Inequality in Immunization Coverage by Socio-Economic and Demographic Characteristics: INCHIS-2 (Sep-Oct 2015) Data

Background characteristics	One dose of DPT/Penta (2-23 months)	Three doses of DPT/Penta (4-23 months)
Vaccination card availability		
Yes, card seen	97.4	86.1
Yes, card not seen	85.0	68.4
No card	50.3	36.1
Place of residence		
Urban	91.0	80.5
Rural	86.9	73.4
Mother's age at marriage (excluding primary caregiver)		
≤ 18 years	85.1	71.4
19-25 years	91.4	79.4
25-29 years	94.9	88.7
30+ years	92.6	91.4
Education status of mother/primary caregiver		
No schooling	79.9	64.4
Less than or equal to Primary	87.9	74.2
More than Primary but less than or equal to Secondary	93.1	81.5
More than Secondary but less than or equal to Graduation	93.8	85.3
More than Graduation	96.9	85.7
Education status of father (includes only currently married and divorced)		
No schooling	77.0	59.7
Less than or equal to Primary	86.7	71.7
More than Primary but less than or equal to Secondary	90.4	79.8
More than Secondary but less than or equal to Graduation	93.0	81.3
More than Graduation	95.6	86.4
Birth order of the child		
First	92.1	80.5
Second	89.5	77.3
Third	85.8	72.2
Fourth or more	77.6	62.5

Background characteristics	One dose of DPT/Penta (2-23 months)	Three doses of DPT/Penta (4-23 months)
Sex of the child		
Boy	88.8	75.1
Girl	87.2	75.6
Caste		
Scheduled Caste	89.0	74.8
Scheduled Tribe	88.2	75.9
Other Backward Castes	86.5	72.9
Others	89.2	79.3
Religion		
Hindu	89.5	77.3
Muslim	81.0	66.0
Christian	94.0	85.2
Place of delivery		
Institutional	91.2	79.5
At home or parent's home	74.6	57.3
Number of Antenatal Check-ups (mother only)		
No ANC	60.8	40.0
One ANC	81.9	66.2
Two ANCs	86.4	71.5
Three or more ANCs	93.9	83.7
Advised by health worker on when to come next for immunization		
Yes	95.7	84.1
No	69.1	53.1
Wealth quintile		
Poorest	80.6	65.4
Poorer	88.0	73.8
Middle	91.3	79.9
Richer	93.2	82.9
Richest	94.9	85.6

Background characteristics	One dose of DPT/Penta (2-23 months)	Three doses of DPT/Penta (4-23 months)
Distance between vaccination site and child's house		
< 1 km	89.3	75.8
1-5 km	89.3	78.4
> 5 km	76.5	67.4
Time taken to travel to the vaccination site		
< 30 minutes	90.1	76.8
30-60 minutes	85.5	75.0
> 60 minutes	82.6	64.9
Have seen/heard/read of any immunization message		
Yes	92.1	79.4
No	83.9	71.2

4.6 Impact of Mission Indradhanush

The Government of India launched Mission Indradhanush (MI) in December 2014 to achieve a full immunization coverage of 90% before 2020 at the national level and reduce inequity in coverage. One of the key objectives of MI was to ensure that the partially immunized and unimmunized children are fully immunized in selected high-focus districts (MI districts) through special immunization drives [41, 42].

Between INCHIS-1 and INCHIS-2, the first phase of MI was implemented (from April to July 2015), for one week of every month for four consecutive months. Hence, INCHIS-1 can be considered as baseline and INCHIS-2 as endline for this first round of MI intervention (MI phase 1).

The first phase of Mission Indradhanush was introduced in 201 high focus districts spread over 28 states of the country. The selection of districts was based on the highest number of partial and not immunized children identified by the government [42]. However, the districts where Mission Indradhanush was operational differed from the original list of 201 districts. Some states took decision to expand the program beyond the originally-planned districts based on low immunization coverage or the expansion was done by the Government of India (GoI) in consultation with state authorities during the first phase of Mission Indradhanush. In addition, the state of Bihar also conducted a parallel state-run initiative – Mukhyamantri Saghan Tikakaran Abhiyan (MSTA) along the lines of MI, in districts where MI was not conducted.

The districts where Mission Indradhanush was actually operational can be identified from the coverage report prepared by State Immunization Officers (SEPIOs) of each state. For monitoring and evaluation purposes, these reports were sent to 'Mission Indradhanush Control Room' at ITSU every day while Mission Indradhanush was operational. These reports briefly describe numbers of sessions held, children vaccinated, antigen-wise vaccines administered, children fully immunized, booster doses administered, complete immunizations, Oral Rehydration Solution packets distributed and Zinc tablets distributed as well as number of tetanus toxoid doses administered to pregnant women. These reports were useful in identifying districts where Mission Indradhanush was actually operational and formed the basis for identifying MI districts in this report.

4.6.1 National-Level Comparison of Coverage Rates between MI and Non-MI districts

Comparison Based on All States

Among the districts sampled in INCHIS-1, 57 were identified for MI intervention and 18 districts continued to receive routine immunization services alone (non-MI) (Table 4.11). Similarly, among the districts sampled in INCHIS-2, 52 districts received MI intervention and 29 districts were non-MI districts. In INCHIS-1, the 57 districts selected for MI intervention (MI districts) had considerably poorer coverage estimates for all vaccines as compared to the non-MI districts, validating their selection (Table 4.12).

Table 4.11: Number of MI and Non-MI districts Across States: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	INCHIS-1 (11 states)			INCHIS-2 (12 states)		
	MI#	Non-MI	Total	MI#	Non-MI	Total
Fixed States: INCHIS-1 and 2						
Bihar	8	0	8	10	0	10
Madhya Pradesh	8	4	12	8	5	13
Maharashtra*	-	-	-	5	4	9
Rajasthan	8	0	8	9	0	9
Telangana	1	3	4	1	3	4
Uttar Pradesh	11	1	12	12	1	13
INCHIS-1 Rotational States						
Andhra Pradesh	3	1	4	-	-	-
Haryana	5	0	5	-	-	-
Manipur	2	2	4	-	-	-
Odisha	5	1	6	-	-	-
Tamil Nadu	5	3	8	-	-	-
Uttarakhand	1	3	4	-	-	-
INCHIS-2 Rotational States						
Goa	-	-	-	0	2	2
Himachal Pradesh	-	-	-	4	0	4
Jammu & Kashmir	-	-	-	0	5	5
Kerala	-	-	-	0	4	4
Mizoram	-	-	-	2	2	4
West Bengal	-	-	-	2	2	4
Total	**57**	**18**	**75**	**53**	**28**	**81**

#Based on actual MI Phase-1 implementation
*Excluded from INCHIS-1 analysis because of data quality concerns

Table 4.12: Comparison of Coverage Rates by Vaccine between MI and Non-MI Districts: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	INCHIS-1 (11 states)		INCHIS-2 (12 states)		Absolute percent change between 1 & 2	
	MI	Non-MI	MI	Non-MI	MI	Non-MI
BCG (0-23)	89.7	97.8	91.2	98.8	1.4	1.0
OPV1 (2-23)	88.3	97.1	88.0	98.1	-0.3	1.0
OPV3 (4-23)	62.9	83.3	73.1	88.9	10.2	5.6
DPT1/Penta1 (2-23)	82.9	95.0	85.2	96.4	2.3	1.4
DPT3/Penta3 (4-23)	61.2	83.5	71.5	86.6	10.3	3.1
Measles (12-23)	77.7	86.4	81.7	94.7	4.0	8.3
FIC (12-23)	58.5	78.0	69.8	84.6	11.4	6.6

According to INCHIS-2 data, coverage rates for MI-districts increased by 10.2% for OPV3 (from 62.9%, 95% CI 59.4-66.4 to 73.1%, 95% CI 69.3-76.6). This increase is statistically significant as evident from the non-overlapping 95% CIs. Similar phenomenon was observed for DPT3/PENTA3 (statistically significant increase of 10.3% relative to INCHIS-1).

However, coverage rates remained more or less unchanged or improved marginally (overlapping CIs across INCHIS rounds, not shown here) for other vaccines (Figure 4.3 and Table 4.12). The increase in OPV3 and DPT3 resulted in an increase of 11.4% in FIC after MI intervention. On the other hand, the coverage rates for all vaccines, except measles, remained relatively unchanged in the non-MI districts (overlapping CIs, not shown here) across INCHIS rounds. Overall, there was an increase of 6.6% in FIC in the non-MI districts. This increase is not statistically significant as the 95% CIs are overlapping (INCHIS-1: 71.6-83.2 and INCHIS-2: 81.8-87.0).

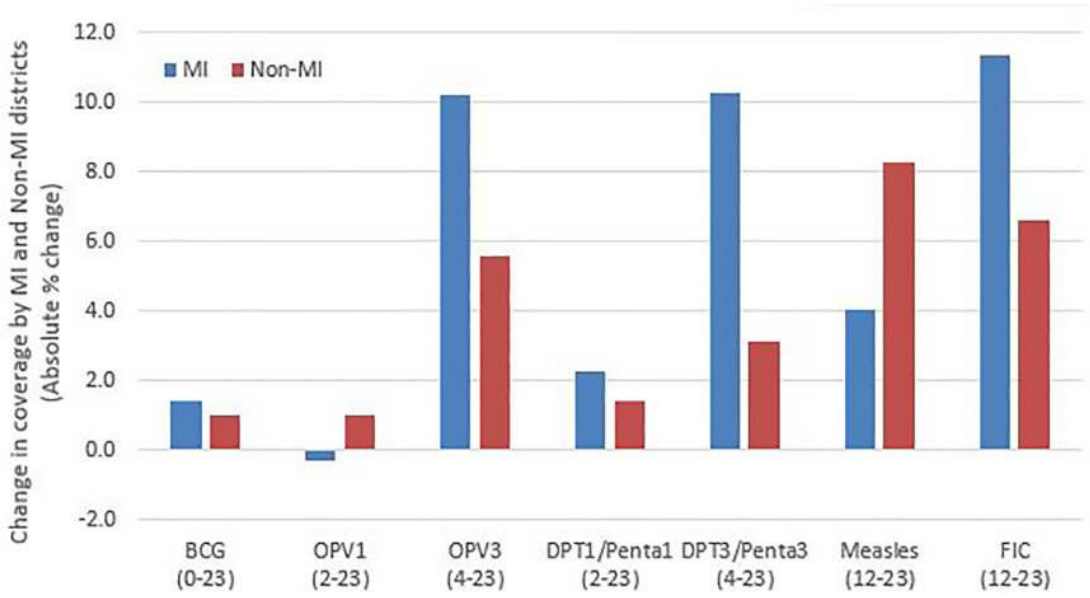


Figure 4.3: Change in Coverage Rates between INCHIS rounds by MI and Non-MI Districts: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

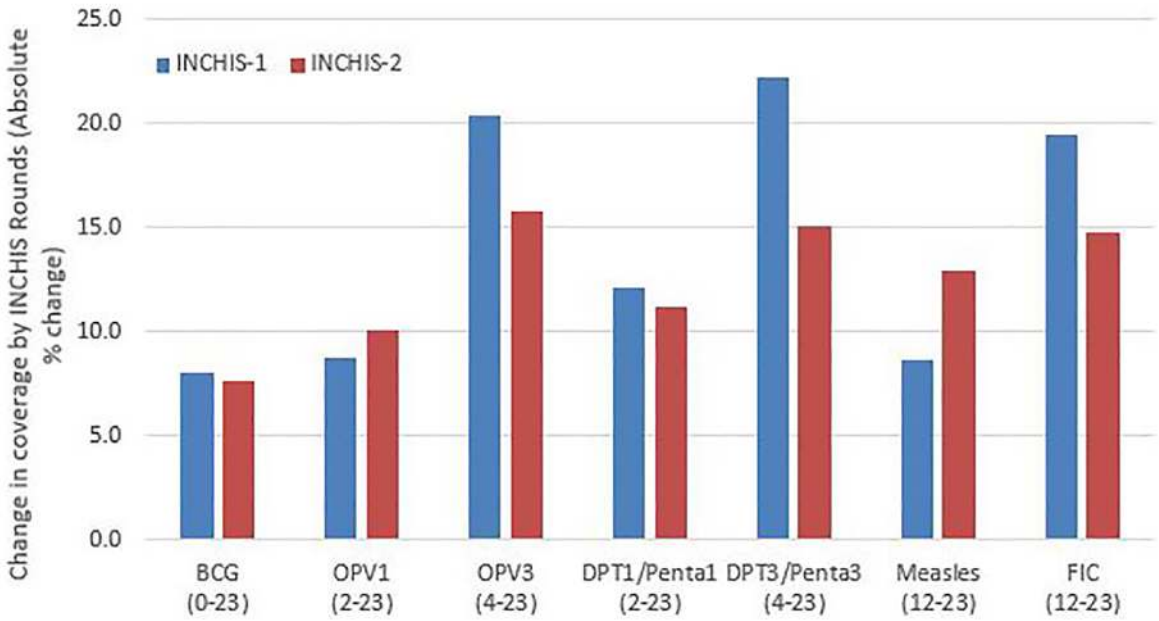


Figure 4.4: Change in Coverage Rates between MI and non-MI districts by INCHIS rounds: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) data

In addition to comparison of change in coverage across INCHIS-1 and 2 for MI and non-MI districts, it was also of interest to assess if the gap in coverage between MI and non-MI districts changed between the two rounds. For example, although the coverage for OPV3 increased at a much higher rate for MI districts compared to the non-MI districts but with the given increase, how close did MI districts come to non-MI districts in terms of their FIC. Figure 4.4 shows that the gap between coverage of MI and non-MI districts for BCG, OPV1, and DPT1/Penta1 remained more or less the same across the two rounds of INCHIS. However, the gap between coverage reduced during INCHIS-2 relative to INCHIS-1 for OPV3 and DPT3/Penta3 and also the overall FIC. These results may indicate improvement in coverage for poor-performing districts due to implementation of MI.

Comparison Based on Five Fixed States

A caveat in the all-state analysis is that all states were not sampled in both rounds of INCHIS. Six states were included in both rounds of INCHIS and were considered for evaluating the impact of MI. Although six states (Bihar, Madhya Pradesh, Maharashtra, Rajasthan, Telangana and Utter Pradesh) were repeated in INCHIS-1 and INCHIS-2, data from the five fixed states was eventually used for the impact evaluation analysis. The state of Maharashtra was excluded from this analysis because of data quality concerns at baseline (INCHIS-1). Data from 36 overlapping MI districts and 8 non-MI districts of the five fixed states that participated in both rounds of INCHIS was used for analysis (Table 4.13).

Table 4.14 shows a comparison of immunization coverage by antigen across two rounds of INCHIS (baseline and endline) for 36 districts where MI was operational in MI phase 1. Although the results are presented here for non-MI districts in INCHIS-1 and INCHIS-2, but due to small sample size (8 districts), interpretation of this analysis is not discussed here.

The comparison in coverage of MI districts suggests that no significant improvement occurred between INCHIS-1 and INCHIS-2 for vaccines

Table 4.13: Number of MI and Non-MI Districts Across Five Fixed States and INCHIS Rounds

State	INCHIS-1 (Mar-Apr 2015)			INCHIS-2 (Sep-Oct 2015)		
	MI#	Non-MI	Total	MI#	Non-MI	Total
Bihar	8	0	8	8	0	8
Madhya Pradesh	8	4	12	8	4	12
Rajasthan	8	0	8	8	0	8
Telangana	1	3	4	1	3	4
Uttar Pradesh	11	1	12	11	1	12
Total	**36**	**8**	**44**	**36**	**8**	**44**

#Based on actual MI Phase-1 implementation

Table 4.14: Comparison of Coverage Rates for MI Districts$ Among Children: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	INCHIS-1 (5 fixed states)		INCHIS-2 (5 fixed states)	
	MI	Non-MI	MI	Non-MI
BCG (0-23)	88.0	96.5	89.5	98.5
OPV1 (2-23)	86.2	95.6	85.7	98.9
OPV3 (4-23)	58.6	76.8	68.4	84.7
DPT1/Penta1 (2-23)	80.5	91.9	82.8	97.3
DPT3/Penta3 (4-23)	57.0	78.2	67.3	81.9
Measles (12-23)	75.4	87.2	79.0	92.6
FIC (12-23)	54.9	76.0	66.1	79.9

$only from five fixed states

BCG, one dose of OPV, one dose of DPT/Penta, and one dose of measles. For all these vaccines, coverage rate estimates have overlapping 95% confidence intervals (not shown here). However, for three doses of OPV and three doses of DPT/Penta, the increase in coverage is statistically significant which may be due to supplementary immunization drives as happened during Mission Indradhanush phase 1. The significant increase in OPV3 and DPT3/Penta3 also led to statistically significant increase (11.2%) in full immunization coverage for these 36 MI districts.

4.6.2 State-Level Comparison of Coverage Rates

In Table 4.15, coverage rates by vaccine for all districts of five fixed states (MI and non-MI) are presented along with full immunization coverage (FIC), partial immunization (PI) and no immunization (NI). For each state, the first row indicates INCHIS-1 estimates and the second row in bold font represents INCHIS-2 estimates. The FIC rates from INCHIS-1 data are similar to estimates from other large scale surveys (RSOC,

Table 4.15: Comparison of Coverage Rates Among Children for Fixed States: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

Vaccine	BCG	OPV1	OPV3	DPT/ Penta1	DPT/ Penta3	Measles	FIC	PI	NI
Age group (Months)	(0-23)	(2-23)	(4-23)	(2-23)	(4-23)	(12-23)			
Bihar	95.5	94.2	66.2	83.9	65.3	84.8	62.9	36.0	1.1
Bihar*	**95.7**	**95.3**	**88.2**	**93.5**	**86.3**	**90.9**	**86.5**	**12.4**	**1.1**
Madhya Pradesh	96.4	95.3	71.0	91.6	73.0	89.9	67.9	30.7	1.4
Madhya Pradesh*	**97.3**	**96.0**	**80.7**	**93.4**	**77.7**	**88.6**	**74.0**	**25.5**	**0.5**
Rajasthan	90.2	89.8	59.9	80.0	57.5	75.6	54.7	38.7	6.6
Rajasthan*	**91.6**	**87.7**	**73.4**	**83.4**	**72.6**	**79.2**	**70.6**	**24.2**	**5.2**
Telangana	99.0	98.5	90.0	97.5	88.5	97.0	90.7	9.3	0.0
Telangana*	**99.2**	**99.1**	**94.0**	**98.0**	**92.1**	**94.5**	**90.4**	**8.9**	**0.8**
Uttar Pradesh	82.5	79.2	52.0	76.7	50.5	64.7	48.0	42.2	9.9
Uttar Pradesh*	**83.1**	**77.0**	**52.4**	**73.8**	**52.0**	**69.5**	**51.0**	**36.9**	**12.2**

* Bold fonts indicate INCHIS-2 estimates

2014; CES, 2009). However, significant increase in FIC was observed in three states, namely Bihar, Madhya Pradesh and Rajasthan in INCHIS-2 relative to INCHIS-1.

The percentage of children aged 12-23 months who were fully immunized increased from 62.9% to 86.5% in Bihar (24% increase), from 54.7% to 70.6% in Rajasthan (16% increase), and from 67.9% to 74% in Madhya Pradesh (6% increase). The increase in FIC in Bihar and Rajasthan is statistically significant, whereas in MP it is not. In contrast to the high FIC attainments in Bihar, Rajasthan, and Madhya Pradesh, the full immunization coverage increased marginally from 48% to 51% in Uttar Pradesh. With already high levels of immunization coverage in Telangana, the full immunization coverage remained almost at the same level between INCHIS-1 (90.7%) and INCHIS-2 (90.4%).

The increase in FIC in Bihar, Rajasthan, and Madhya Pradesh was possible because of the significant increase in the coverage of three doses of OPV and three doses of DPT/Penta (Table 4.15). Interestingly, all the surveyed districts in Bihar and Rajasthan were under the MI intervention and majority of districts in Madhya Pradesh (8 out of 12 or 13) and Uttar Pradesh (11 out of 12 or 13) were part of MI. This significant increase in OPV3 and DPT3/Penta3 in all the states may be attributed to the special immunization drive of MI.

Though the levels of partial immunization reduced significantly between the two rounds, NI rates remained stagnant between INCHIS-1 and INCHIS-2. The highest decline in partial immunization levels was noted in Bihar (by 24 percentage points; from 36% to 12.4%) and Rajasthan (by 14.5 percentage points; from 38.7% to 24.2%). This suggests that MI was perhaps

more successful in targeting children who were partially immunized and transformed them into full immunization category but did not have much impact on left-out children.

4.7 Sensitivity Analysis of Vaccination Coverage Rates

Throughout the report, we used the definition of vaccination coverage rate that combines information from vaccination card (if available) and mother's recall in order to reduce the instances of misclassification. In the absence of vaccination card, we relied solely on mother's recall. Depending on the age of child and complexity of vaccination schedule, authenticity of mother's recall data is questionable. On the other hand, vaccination card of a child may also be incomplete. Even if the child received a vaccine, it may not be recorded in the card for several reasons such as mother forgot to bring the card with her on the day of vaccination, ANM did not have time to record date in the card because of her workload, child might have received some vaccines from the public health facilities and some from private practitioners (which may not be recorded in the card), among others. Hence, for comparison purpose, we present a sensitivity analysis of vaccination coverage rate with respect to its definition.

Table 4.16 presents the sample sizes for two mutually exclusive populations: children having vaccination card which was seen during the survey (card population) and children for whom card was not available during the interview (no card population).

In Table 4.17 we present vaccination coverage rates under different scenarios across vaccines and INCHIS rounds. For the card population, vaccination coverage rates are always higher if we combine two sources of information to define coverage rate as opposed to relying only on card (ignoring mother's recall). This holds true across all antigens and two rounds of INCHIS. Coverage rates are particularly higher for measles vaccine (12.8% higher in INCHIS-1 and 14.3% higher in INCHIS-2) which leads to two potential hypotheses:

- Amount of incomplete information is much higher for measles relative to other vaccines may be because mothers' lose the habit of carrying card to the vaccination site (but

Table 4.16: Number of Children (Sample Size) at the National Level by Vaccination Card Status: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015)

	OPV0/Hep-B0/ BCG (0-23)	OPV1/DPT1/ Penta1 (2-23)	OPV2/DPT2/ Penta2 (3-23)	OPV3/DPT3/ Penta3 (4-23)	Measles/FIC/ NI (12-23)
Different scenarios	**INCHIS-1 (excluding Maharashtra)**				
Vaccination card available	6,375	6,013	5,719	5,408	3,012
No vaccination card	4,248	3,970	3,811	3,672	2,301
All children	10,623	9,983	9,530	9,080	5,313
Different scenarios	**INCHIS-2**				
Vaccination card available	9,823	9,282	8,892	8,522	5,103
No vaccination card	5,309	4,945	4,746	4,590	3,165
All children	15,132	14,227	13,638	13,112	8,268

Table 4.17: Vaccination Coverage Rates for Different Populations and Different Definitions across Vaccines at the National Level: INCHIS-1 (Mar- Apr 2015) and INCHIS-2 (Sep-Oct 2015) data

	BCG (0-23)	OPV1 (2-23)	OPV3 (4-23)	DPT/Penta1 (2-23)	DPT/Penta3 (4-23)	Measles (12-23)	FIC (12-23)
Different scenarios	**INCHIS-1 (excluding Maharashtra)**						
Vaccination card available (coverage definition based on card only)	93.7	92.0	74.4	93.4	77.3	72.4	63.9
Vaccination card available (coverage definition based on card and recall*)	98.1	96.9	81.9	96.2	81.4	85.2	77.6
No vaccination card (using mother's recall only)	83.2	81.8	49.6	71.7	47.4	73.6	46.4
All children (coverage definition based on card and recall*)	91.9	90.8	68.6	86.2	67.5	80.2	64.1
Different scenarios	**INCHIS-2**						
Vaccination card available (coverage definition based on card only)	93.5	92.2	76.5	93.5	79.0	77.9	68.4
Vaccination card available (coverage definition based on card and recall*)	98.6	97.9	86.7	97.4	86.1	92.2	85.3
No vaccination card (using mother's recall only)	82.8	76.5	58.8	70.0	54.6	72.5	53.1
All children (coverage definition based on card and recall*)	93.1	90.6	77.1	88.0	75.3	84.9	73.5

* Definition outlined in Section 4.2.2

vaccine is not denied) as measles appears five months after the last recommended dose of vaccine that precedes measles and

- Relative to OPV and DPT/Penta, the recall question on measles vaccination status is a simple one ("yes/no") and, hence, it is more likely for mothers to respond "yes" (overreport) without thinking much. On the other hand, for vaccines with multiple doses, the mother is required to recall number of doses the child received and, hence, there is less of a chance of overreporting. The condition of simple "yes/no" question is also

applicable to BCG. However, for a relatively high level of BCG coverage across different scenarios, these nuances are not manifested.

For the recall population (no card), vaccination coverage rates are always lower than that of card population irrespective of the definition used for the coverage rate for the card population. This holds true across all antigens and two rounds of INCHIS (except for one instance, INCHIS-1 measles, where it is marginally the opposite).

5. SUB-CENTRE: FUNCTIONING and QUALITY of IMMUNIZATION SERVICES

Sub-Centre: Functioning and Quality of Immunization Services

In the public sector, a health sub-centre is the first point of contact between the primary health care system and the community. In an ideal scenario, it is the first step of the referral pyramid of health facilities consisting of the sub-centres, primary health centres, community health centres, sub-divisional/sub-district hospitals and district hospitals [43].

The purpose of the sub-centre is largely preventive and promotive, but it also provides a basic level of curative care. The focus is to provide essential maternal and child health services (both preventive and curative), including home visits for neonatal care and outreach services such as Village Health and Nutrition Day (VHND). The sub-centre is also responsible for promoting family planning, counselling and appropriate referral for safe abortion, school health services, surveillance of VPDs, annual house-to-house surveys, and smooth implementation of different national health programs. The personnel at the sub-centre, Auxillary Nurse Midwife (ANM) and Male Health Worker (MHW), are tasked with coordinating these services with community health workers, such as Anganwadi Worker (AWW) and Accredited Social Health Activist (ASHA).

As sub-centre is the first contact point with the community, the success of any health system would depend largely on the well-functioning sub-centre providing services of acceptable standard to the people. The current level of functioning of the sub-centres is much below the expectations [43]. In this chapter, we evaluate the functioning of the sub-centre and quality of services provided by the sub-centre, particularly in the context of immunization. The most recent round of INCHIS (INCHIS-2) was used for India-level estimates and fixed state estimates, and respective rounds of data (INCHIS-1 or 2) were used for estimates of rotational states. All estimates based on health facility data (sub-centre and planning unit) are unweighted.

5.1 Information Collected from Sub-Centres in INCHIS

In both rounds of INCHIS, selection of sub-centres was linked to the sampled clusters. This criteria served two purposes:

- Sampled clusters being representative at the national and state level, selected sub-centres would produce reliable indicators of sub-centre characteristics at the national and state level.
- This linking would help explore the association between sub-centre characteristics with the immunization coverage rate as obtained from household surveys.

In a sampled village, the sub-centre (SC) catering to the basic health needs of the people living in the village was included in the health facility survey. In a selected urban ward, only the planning unit catering to the basic health needs of the people living in the ward was included in the health facility survey as SC is usually not present in urban areas.

The sub-centre questionnaire was administered to ANM posted at the sub-centre to collect data on human resources at the SC; workload of the sub-centre; training received by ANM; infrastructure of the sub-centre; availability of equipment, drugs and other essential items; services provided; vaccine logistics at the sub-centre; monitoring and supervision activities and knowledge and immunization practices of ANM.

5.2 Sub-centre Catchment Area and Population Coverage

As per the Minimum Needs Program (MNP) introduced in the Fifth Five-Year Plan (1974–78), there should be one sub-centre for a population of 5,000 in the plains and for 3,000 in tribal and hilly areas, one Primary Health Centre (PHC) for a population of 30,000 in plains and 20,000 in tribal and hilly areas, and one Community Health Centre (CHC/Rural Hospital) for a population of one lakh [43]. However, as the population density in the country is not uniform, the criteria also depends on the case load of the facility and distance of the villages which fall in the catchment area of the sub-centre.

In Table 5.1, the number of sub-centres surveyed,

Table 5.1: Sample Size and Background Information of Sub-Centres (SC): INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	Villages sampled	Sub-centres surveyed	Median population covered by SC	Median number of villages covered by SC	Median distance (in km) between SC and cold chain
India	424	436	5,471	4	8.0
Bihar	49	48	7,960	5	7.5
Madhya Pradesh	51	51	5,887	6	10.0
Maharashtra	33	31	5,487	5	10.0
Rajasthan	43	41	3,563	4	10.0
Telangana	22	22	5,336	4	11.0
Uttar Pradesh	55	52	7,539	4	11.0
Goa	9	15	5,773	3	10.0
Himachal Pradesh	48	43	3,000	4	14.0
Jammu & Kashmir	38	30	3,130	3	7.0
Kerala	21	25	5,315	3	5.0
Mizoram	23	36	2,715	1	1.5
West Bengal	32	42	7,206	5	8.0
Andhra Pradesh	27	31	5,458	4	10.0
Haryana	35	32	8,219	3	7.5
Manipur	32	29	4,560	6	9.0
Odisha	42	50	6,996	8	7.0
Tamil Nadu	31	39	6,218	5	5.0
Uttarakhand	27	25	4,380	6	15.0

Note: For India and fixed states, data from INCHIS-2 was used. For rotational states, respective round of INCHIS data was considered

average population covered by a sub-centre and average (median) distance between a sub-centre and the nearest cold chain point for India and INCHIS states are presented. As mentioned earlier, selection of sub-centres was linked to selection of villages/wards for the survey. As sub-centres are commonly found in the rural areas, one would expect to have more or less equal number of sub-centres in the INCHIS sample as the number of villages. Although it holds true for many states, there were some discrepancies in both directions, particularly for Goa, Jammu & Kashmir, Mizoram, West Bengal, Odisha and Tamil Nadu

In general, the reason for lower number of sub-centres relative to number of villages could be attributed to the absence or refusal of ANMs for interview, no sub-centre in the village as the village was directly served by a different health facility (e.g. PHC) other than sub-centre, or one sub-centre catered to two sampled villages. For example, seven villages in J&K were served directly by primary health centres which were covered under planning units in the survey. In Mizoram, eight sub-centres could not be covered because of a Bandh (strike) that was going on during INCHIS-2 survey.

On the other hand, where the number of sub-centres is higher relative to the number of villages (e.g., in Goa, Mizoram, West Bengal, Odisha and Tamil Nadu), it was mainly because sub-centres were found within sampled urban wards. In Goa, sub-centres provided services to six sampled urban wards. Many wards in Mizoram were also catered to by sub-centres, leading to 14 additional sub-centres being covered relative to the number of villages. In West Bengal some of the wards receive services from Health Administrative Units which are usually considered as sub-centres.

In the context of rural health, as per norms one sub-centre covers a population of 5,000 people in the plains. However, Table 5.1 shows that in Bihar, Uttar Pradesh, West Bengal, and Haryana the average (median) population per sub-centre stood at more than 7,000. In hilly states such as Himachal Pradesh, Jammu & Kashmir and Mizoram, the average population covered by the sub-centre was closer to the norm of 3,000, although this was higher in Manipur and Uttarakhand. For India, the median population covered by sub-centre was 5,471. Median number of villages covered by sub-centers was estimated to be 4 for India varying from 1 village in Mizoram to 8 in Odisha.

Average distance between the sub-centre and the nearest cold chain point is higher in states having difficult terrain such as Himachal Pradesh, Manipur and Uttarakhand (highest, 15 km). For immunization sessions at the sub-centre or other outreach sessions organized by sub-centres, vaccines and other logistics are supplied from the cold chain point.

5.3 Human Resources

Minimum manpower requirement for delivery of services at the sub-centre depends on the expected number of beneficiaries for maternal and child health care, immunization, family planning and other services. The Indian Public Health Standards (IPHS) [43] guidelines for sub-centres recommends at least one regular ANM and one regular Male Health Worker (MHW) to be available at the sub-centre. Table 5.2 presents the manpower situation of sub-centres across states in India and the training received by ANM or MHW in the last three years. Questions were asked about two specific trainings: basic health worker's training on immunization and Integrated Management of Neonatal and Childhood Illness (IMNCI) training.

In most states, more than 80% of the sub-centres had a regular ANM in position. These percentages were higher in the southern states of India: Andhra Pradesh (100%), Tamil Nadu (97%), and Kerala (96%), and the northern state of J&K (97%). Although this appears counter-intuitive given that J&K is a conflict-prone state, validation with NRHM data suggests accuracy of these estimates. In Bihar and Haryana, percentage of sub-centres with regular ANM was close to 60%.

Table 5.2: Availability of Human Resource and Training Status of Health Workers at Sub-Centers (percent facilities): INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	Availability of a regular ANM	Availability of a regular MHW	Unavailability of regular ANM and MHW	Any ANM/ MHW received training in the last 3 years on	
				Basic health worker's training on immunization	IMNCI
India	82.8	41.3	11.7	68.1	60.3
Bihar	60.4	10.4	39.6	97.9	89.6
Madhya Pradesh	96.1	51.0	2.0	78.4	66.7
Maharashtra	83.9	87.1	0.0	16.1	25.8
Rajasthan	80.5	12.2	12.2	73.2	65.9
Telangana	81.8	50.0	18.2	27.3	40.9
Uttar Pradesh	84.6	5.8	13.5	92.3	80.8
Goa	86.7	86.7	0.0	66.7	66.7
Himachal Pradesh	86.1	55.8	4.7	79.1	48.8
Jammu & Kashmir	96.7	16.7	3.3	73.3	83.3
Kerala	96.0	84.0	4.0	44.0	24.0
Mizoram	75.0	80.6	5.6	30.6	27.8
West Bengal	76.2	26.2	21.4	78.6	66.7
Andhra Pradesh	100.0	51.6	0.0	100.0	100.0
Haryana	62.5	37.5	28.1	96.9	84.4
Manipur	75.9	37.9	20.7	93.1	93.1
Odisha	90.0	42.0	8.0	88.0	76.0
Tamil Nadu	97.4	43.6	2.6	74.4	76.9
Uttarakhand	88.0	8.0	12.0	92.0	76.0

Note: For India and fixed states, data from INCHIS-2 was used. For rotational states, respective round of INCHIS data was considered

Another Indian Public Health Standard guidelines recommendation is the need of MHW, in addition to at least one regular ANM in a sub-centre [43]. Estimated percentage of sub-centres where regular male health worker was available varied by state with Bihar (10%), Rajasthan (12%), UP (6%), J&K (17%), West Bengal (26%), and Uttarakhand (8%) reporting low numbers. Additionally, in Bihar, 40% of the sub-centres did not have any of the regular health workers (neither ANM nor MHW) in position. Absence of both recommended personnel in sub-centres is observed in some other states as well, including Telangana (18%), West Bengal (21%), Haryana (28%), and Manipur (21%).

In Andhra Pradesh, in almost all sub-centres, the respondent (either ANM or MHW) received basic health worker's training on immunization and training on IMNCI in the last three years. In Bihar, in most sub-centres (98%) the respondent (staff-in-charge, either regular or contractual ANM or MHW) had received training on immunization in the last three years. In Maharashtra, Telangana, Mizoram, and Kerala the percentage of sub-centres reporting receiving immunization training stood at less than 50%, with most of the trainings received three years prior to the survey date.

5.4 Physical Infrastructure

To ensure smooth and uninterrupted functioning of sub-centre, government-owned buildings are recommended as per Indian Public Health Standard guidelines [43]. Moreover, wherever health facilities exist, uninterrupted power supply is to be ensured, and in the absence of regular electricity, inverter facility or solar power facility is to be provided. Generator facility ideally should be available at sub-centres that conduct deliveries and provide newborn care.

Potable water for patients and staff and water for other use should be available in sufficient quantity. Towards this end, adequate water supply and water storage facility (overhead tank) with piped water should be made available, especially where labor room is attached to the sub-centre. Landline telephone or mobile facility should be provided to sub-centres where deliveries are conducted to facilitate referral services in cases of complications during delivery. Toilet facility for use of patients, attendants and sub-centre staff are also recommended for all sub-centres.

As per the above-mentioned guidelines related to sub-centre infrastructure, condition of the sub-centres across India and selected states was evaluated using INCHIS-1 and INCHIS-2 data. The results are presented in Table 5.3. About three-quarters of the facilities in the country were seen to function from a government building. In Bihar, 40% of sub-centres owned designated government building with remaining sub-centres either functioning from a rented building or from a rent-free panchayat or voluntary society building. Among all the sub-centres in Haryana, Telangana, and Goa, less than 50% had their own building. On the other hand, in Maharashtra (84%), Uttar Pradesh (81%), Himachal Pradesh (91%), Mizoram (83%), West Bengal (86%), Manipur (83%) and Uttarakhand (84%) percentage of sub-centres with designated government building was quite high.

Cleanliness of both building and premises was good in less than half of the facilities in the country. Also, availability of piped water, power supply, and phone facility remained low. The status of physical infrastructure varies across states as presented in Table 5.3.

In the typical layout of the sub-centre, as given in the IPHS guidelines, residential facility for ANM should be included, or some rented premises should be available in the sub-centre village for accommodating the ANM. This ensures proximity of ANM to the sub-centre to facilitate efficient health care delivery.

In an estimated 40% of the sub-centres in India, ANM quarters were attached to the sub-centre building (Table 5.4). In Madhya Pradesh (65%), Maharashtra (68%), Himachal Pradesh (60%), Mizoram (56%), Odisha (52%) and Uttarakhand (60%), estimated percentage of sub-centres with attached ANM quarter was higher than the national

Table 5.3: Percentage of Sub-Centres having Characteristics related to Physical Infrastructure: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	Govt bldg	Building condition good	Building cleanliness good	Premises cleanliness good	Piped water	Regular power supply	Toilet facility	Govt phone facility
India	71.3	64.7	50.0	46.3	33.5	41.5	72.3	36.0
Bihar	39.6	72.9	43.8	35.4	2.1	16.7	37.5	18.8
Madhya Pradesh	74.5	54.9	41.2	33.3	2.0	27.5	74.5	49.0
Maharashtra	83.9	87.1	83.9	74.2	54.8	22.6	83.9	16.1
Rajasthan	70.7	65.9	41.5	48.8	22.0	24.4	75.6	17.1
Telangana	31.8	59.1	36.4	9.1	22.7	40.9	36.4	22.7
Uttar Pradesh	80.8	26.9	11.5	9.6	1.9	0.0	61.5	61.5
Goa	46.7	93.3	73.3	60.0	86.7	73.3	80.0	26.7
Himachal Pradesh	90.7	90.7	62.8	65.1	88.4	93.0	95.4	97.7
Jammu & Kashmir	66.7	90.0	73.3	80.0	60.0	43.3	80.0	46.7
Kerala	72.0	68.0	56.0	64.0	52.0	40.0	80.0	16.0
Mizoram	83.3	58.3	75.0	69.4	58.3	75.0	86.1	11.1
West Bengal	85.7	47.6	42.9	38.1	21.4	76.2	81.0	14.3
Andhra Pradesh	71.0	67.7	74.2	25.8	45.2	38.7	45.2	29.0
Haryana	43.8	68.8	40.6	37.5	56.3	28.1	78.1	87.5
Manipur	82.8	44.8	44.8	41.4	20.7	17.2	69.0	3.5
Odisha	58.0	48.0	46.0	44.0	14.0	42.0	68.0	86.0
Tamil Nadu	59.0	74.4	71.8	66.7	51.3	76.9	61.5	87.2
Uttarakhand	84.0	72.0	56.0	28.0	40.0	32.0	92.0	40.0

Note: For India and fixed states, data from INCHIS-2 was used. For rotational states, respective round of INCHIS data was considered.

average. However, no sub-center in Goa, only 5% in West Bengal, 7% in Manipur, 8% in Bihar, and 14% in Telangana reported residential quarter of ANM as part of the sub-centre compound. As per INCHIS-1 data, 66% of ANMs in Manipur resided outside the sub-centre village. The median distance between ANM residence and sub-centre was more than 5 km for states like Telangana, UP, Goa, J&K, Kerala, WB, Haryana and Manipur, in comparison to IPHS guidelines recommending a travel of no more than 3 km to reach sub-centre [43].

Table 5.4: ANM Residence Facility and Proximity to the Sub-Centre (SC): INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	% of sub-centres having ANM quarter attached to the SC	% of sub-centres where ANM resides within SC village*	Median distance from ANM residence to SC**
India	39.7	42.7	2.0
Bihar	8.3	25.0	3.0
Madhya Pradesh	64.7	51.0	1.0
Maharashtra	67.7	74.2	0.0
Rajasthan	46.3	46.3	0.0
Telangana	13.6	45.5	5.5
Uttar Pradesh	48.1	28.9	6.0
Goa	0.0	6.7	12.0
Himachal Pradesh	60.5	53.5	0.0
Jammu & Kashmir	26.7	26.7	5.0
Kerala	48.0	48.0	7.0
Mizoram	55.6	83.3	0.0
West Bengal	4.8	16.7	6.5
Andhra Pradesh	12.9	35.5	3.0
Haryana	25.0	28.1	7.0
Manipur	6.9	34.5	7.0
Odisha	52.0	78.0	0.0
Tamil Nadu	43.6	35.9	4.0
Uttarakhand	60.0	44.0	3.0

* Includes ANM staying in the quarter attached to the SC
** If ANM is staying in the quarter attached to the SC, distance was considered to be 0

5.5 Availability of Equipment and Medicines

As per guidelines, the equipment provided to the sub-centres should be adequate to provide all the assured services in the sub-centres, including all the equipment necessary for conducting safe deliveries at sub-centre (if deliveries are conducted at the sub-centres), home deliveries, immunization, contraceptive services like IUD insertion, etc. In addition, equipment for first aid and emergency care, water quality testing, and blood smear collection should also be available. Maintenance of the equipment should be ensured either through preventive maintenance or prompt

repair of non-functional equipment so as to ensure uninterrupted delivery of services. Proper sterilization of all equipment and compliance of all universal precautions are to be ensured.

INCHIS collected information on availability and functionality of equipment (such as instrument sterilizer, hub cutter, B.P. instrument, stethoscope, weighing machine for adults and infants, test kit for measuring haemoglobin and IUCD kit) and medicines (Albendazole, Cotrimoxazole, Paracetamol tablet or syrup, Iron Folic Acid tablets, Vitamin-A solution, Oral Rehydration Salt packets and Zinc tablets) at the sub-centre. Percentage of sub-centers with functional availability of selected instruments and a recommended list of basic medicines are presented in Table 5.5.

Around 40% of sub-centers had a functional instrument sterilizer available at India level. However, state-wise percentages of functional availability of instrument sterilizer varied from 15% in Tamil Nadu to 90% in Andhra Pradesh. Availability of functional hub-cutter was almost

Table 5.5: Availability of Selected Functional Equipment and Medicines at Sub-Centres (% of facilities): INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	Instrument sterilizer	Hub cutter	Test kit for measuring haemoglobin	IUCD kit	All selected medicines[1]
India	42.2	89.5	76.6	70.0	49.5
Bihar	31.3	87.5	52.1	45.8	18.8
Madhya Pradesh	27.5	100.0	100.0	90.2	66.7
Maharashtra	48.4	96.8	90.3	80.7	64.5
Rajasthan	36.6	90.2	87.8	68.3	70.7
Telangana	54.6	90.9	63.6	50.0	77.3
Uttar Pradesh	26.9	78.9	80.8	71.2	30.8
Goa	33.3	86.7	40.0	46.7	93.3
Himachal Pradesh	79.1	100.0	88.4	88.4	69.8
Jammu & Kashmir	60.0	93.3	63.3	50.0	53.3
Kerala	16.0	88.0	40.0	52.0	4.0
Mizoram	55.6	72.2	83.3	75.0	8.3
West Bengal	42.9	88.1	83.3	85.7	64.3
Andhra Pradesh	90.3	90.3	77.4	67.7	64.5
Haryana	53.1	100.0	100.0	87.5	53.1
Manipur	31.0	48.3	31.0	31.0	41.4
Odisha	36.0	90.0	88.0	72.0	86.0
Tamil Nadu	15.4	94.9	51.3	87.2	69.2
Uttarakhand	52.0	72.0	76.0	88.0	8.0

Note: For India and fixed states, data from INCHIS-2 was used. For rotational states, respective round of INCHIS data was considered
[1]Selected medicines include Cotrimoxazole, Paracetamol (tablet or syrup), IFA tablets, Vitamin-A solution, Oral Rehydration Salt packets and Zinc tablet.

universal in India (90%). Almost all of the sub-centres in Madhya Pradesh, Himachal Pradesh and Haryana had a functional hub cutter available.

A low number of the sub-centres in the country had all the recommended medicines available on the day of survey. For example, 4% sub-centres in Kerala and 8% each in Uttarakhand and Mizoram had all recommended medicines available.

5.6 Immunization and Other Related Services

In the context of immunization services, key responsibilities of ANM include the following [43]:

- Full immunization of all infants and children against vaccine-preventable diseases as per guidelines of Government of India

Table 5.6: Status of Immunization Sessions and Related Services Conducted by Sub-Centers in Last Quarter Prior to the Survey: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	Average number of sessions	Average number of sessions per 1,000 population	% of SCs organizing at least one session in hard-to-reach areas	% of SCs reporting AEFI cases
India	12.0	2.5	64.5	10.1
Bihar	15.1	2.1	60.0	0.0
Madhya Pradesh	22.8	4.2	66.7	23.5
Maharashtra	9.0	1.5	39.3	0.0
Rajasthan	8.5	2.3	72.7	2.4
Telangana	16.1	3.3	63.6	18.2
Uttar Pradesh	20.9	4.3	75.9	11.5
Goa	4.5	1.4	83.3	20.0
Himachal Pradesh	6.4	2.0	75.0	0.0
Jammu & Kashmir	6.0	2.6	73.7	0.0
Kerala	6.0	1.1	65.0	16
Mizoram	4.3	1.6	41.7	2.8
West Bengal	10.2	1.5	76.9	31.0
Andhra Pradesh	5.5	2.1	76.0	48.4
Haryana	20.5	2.6	100.0	15.6
Manipur	9.1	2.1	72.4	0.0
Odisha	10.8	1.7	45.5	20.0
Tamil Nadu	11.5	2.3	100.0	33.3
Uttarakhand	17.0	4.5	52.9	0.0

Note: For India and fixed states, data from INCHIS-2 was used. For rotational states, respective round of INCHIS data was considered.

- Prevention and control of childhood diseases like malnutrition, infections, ARI, Diarrhea, Fever, Anemia including IMNCI strategy
- Name-based tracking of all infants and children to ensure full immunization coverage
- Identification and follow up, referral and reporting of Adverse Events Following Immunization (AEFI)

Many of the services may not be delivered in the sub-centre building itself and the site of service delivery may be at the following places: 1) during Village Health and Nutrition Day/Immunization session in the village, 2) during house visits, 3) during house to house surveys, 4) during meetings and events with the community.

In Table 5.6 indicators related to immunization services are presented using INCHIS-1 and INCHIS-2 data. On an average, 12 immunization sessions were conducted in the last quarter prior to the survey across India. However, the number of sessions conducted in the last quarter was much higher in Madhya Pradesh (23), Uttar Pradesh (21), Haryana (21), Uttarakhand (17), Telangana (16) and Bihar (15) in comparison to Andhra Pradesh (6), Kerala (6), J&K (6), Himachal Pradesh (6), Goa (4.5) and Mizoram (4.3, the lowest). In the last quarter, on an average, 2.5 sessions per 1,000 population were conducted in the country. Sub-centres in Kerala conducted approximately one session per 1,000 population compared to 4.5 sessions per 1,000 population in Uttarakhand.

The immunization guidelines specify conduct of at least one session per quarter in hard-to-reach areas. Sixty five percent (64.5%) of sub-centres in the country followed this guideline. Another key responsibility of the ANM is to report AEFI cases; either serious or non-serious. However, only 10% of sub-centres in the country reported AEFI cases, while none of the sub-centres in Bihar, Maharashtra, Himachal Pradesh, Jammu & Kashmir, Manipur and Uttarakhand reported AEFI cases in the last quarter prior to the survey.

5.7 Planning, Monitoring and Supervision Activities at the Sub-Centre

A Routine Immunization (RI) micro-plan is an important tool for the ANM in ensuring that the universal program of immunization reaches every corner of the country. At the national-level, more than 80% of the sub-centres reported preparing sub-centre plan (RI Micro-plan/ANM work plan) (Table 5.7). However, in only 52% of the sub-centres RI micro-plan was present and displayed.

There exists large variation in the reporting of sub-centre plan (RI Micro-plan) availability. Less than 50% of sub-centres in Telangana and Jammu & Kashmir had sub-centre plan prepared for the year relative to much higher percentages in Bihar (94%), Maharashtra (100%), Rajasthan (98%), Uttar Pradesh (98%), Goa (100%), West Bengal (95%) and Tamil Nadu (97%). In Uttar Pradesh, although almost all the sub-centres reported preparing RI micro-plan, however, only 15% had RI Micro-plan/ANM roster for immunization present and displayed.

Percentage of sub-centres having immunization cards (93%) and tally sheets (88%) available in sufficient quantity for one month is on the higher side, whereas only 63% of them had health worker module available. All the sub-centres in Kerala, Maharashtra, Himachal Pradesh and Telangana had immunization cards in sufficient quantity for a month. Tally sheets were available in sufficient quantity for a month in all the sub-centres of Haryana, Goa and Telangana. Approximately 70% of the sub-centres reported that PHC medical officer visited the sub-centre during last month, which falls under his/her supervisory activities. This percentage is the highest in Telangana (100%) and Andhra Pradesh (100%) and the lowest in West Bengal (24%).

Table 5.7: Planning, Monitoring and Supervision Activities at Sub-Centres (% of facilities): INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	SC RI Micro-plan prepared	RI Micro-plan present and displayed	Available in sufficient quantity for one month			Submission of MCTS reports at data entry point		PHC MO visited SC during last one month
			Card	Tally sheet	Health worker module	Recorded in register	Summary sheet	
India	83.5	51.8	93.4	87.8	63.1	67.2	31.9	68.8
Bihar	93.8	45.8	93.8	93.8	45.8	66.7	33.3	58.3
Madhya Pradesh	86.3	51.0	78.4	78.4	54.9	64.7	35.3	70.6
Maharashtra	100.0	71.0	100.0	74.2	80.7	93.6	6.5	80.7
Rajasthan	97.6	70.7	92.7	97.6	85.4	39.0	61.0	68.3
Telangana	40.9	81.8	100.0	100.0	95.5	95.5	0.0	100.0
Uttar Pradesh	98.1	15.4	96.2	88.5	50.0	88.5	11.5	73.1
Goa	100.0	53.3	93.3	100.0	73.3	80.0	13.3	93.3
Himachal Pradesh	74.4	69.8	100.0	95.4	62.8	30.2	69.8	83.7
Jammu & Kashmir	46.7	53.3	96.7	83.3	46.7	46.7	53.3	76.7
Kerala	84.0	92.0	100.0	96.0	76.0	96.0	4.0	88.0
Mizoram	61.1	41.7	91.7	69.4	77.8	91.7	8.3	50.0
West Bengal	95.2	21.4	88.1	88.1	45.2	47.6	47.6	23.8
Andhra Pradesh	77.4	77.4	96.8	93.6	87.1	87.1	12.9	100.0
Haryana	53.1	75.0	90.6	100.0	71.9	31.3	68.8	65.6
Manipur	65.5	31.0	93.1	89.7	65.5	44.8	55.2	65.5
Odisha	86.0	78.0	50.0	92.0	52.0	66.0	24.0	62.0
Tamil Nadu	97.4	51.3	97.4	61.5	61.5	84.6	0.0	89.7
Uttarakhand	72.0	48.0	76.0	88.0	72.0	68.0	28.0	68.0

Note: For India and fixed states, data from INCHIS-2 was used. For rotational states, respective round of INCHIS data was considered

5.8 Immunization Waste Disposal

The guidelines on disposal of AD syringes recommends cutting of the syringe at the hub immediately after administering the injection at the session site using a hub cutter [44]. The used sharps (needles) must be collected in a hub cutter before being transported to the PHC for safe disposal. The recommended practice of disposing a used syringe was followed in around 80% of sub-centres in the country (Table 5.8). This percentage is even higher (more than 90% of sub-centres) for Odisha, Jammu & Kashmir, Tamil Nadu, Telangana and Himachal Pradesh, whereas only 26% sub-centres in Andhra Pradesh and 31% in Manipur followed this practice. Discarded needles were observed on the ground in around 8% of sub-centres in the country and between 12-18% of sub-centres in Madhya Pradesh, Himachal

Table 5.8: Immunization Waste Disposal Practices at the Sub-Centre (% of facilities): INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	Biomedical Waste		Destruction of used syringes by hub cutter before disposal	Discarded needles observed on the ground outside facility
	Sent to PHC	Buried in pit		
India	38.7	46.8	79.1	7.8
Bihar	62.5	27.1	75.0	8.3
Madhya Pradesh	43.1	31.4	66.7	17.7
Maharashtra	38.7	61.3	74.2	3.2
Rajasthan	31.7	65.8	85.4	7.3
Telangana	54.6	40.9	95.5	0.0
Uttar Pradesh	32.7	51.9	78.9	1.9
Goa	93.3	6.7	53.3	0.0
Himachal Pradesh	39.5	60.5	97.7	11.6
Jammu & Kashmir	20.0	76.7	93.3	16.7
Kerala	60.0	32.0	80.0	0.0
Mizoram	0.0	52.8	55.6	0.0
West Bengal	19.1	38.1	88.1	14.3
Andhra Pradesh	6.5	48.4	25.8	0.0
Haryana	90.6	6.3	84.4	6.3
Manipur	10.3	58.6	31.0	6.9
Odisha	36.0	36.0	92.0	8.0
Tamil Nadu	76.9	20.5	94.9	2.6
Uttarakhand	0.0	96.0	76.0	16.0

Note: For India and fixed states, data from INCHIS-2 was used. For rotational states, respective round of INCHIS data was considered.

Pradesh, Jammu & Kashmir, West Bengal and Uttarakhand.

With regards to the practices related to immunization waste disposal, 46.8% of sub-centres reported burying biomedical waste in pit and 38.7% sent it to PHC for disposal (Table 5.8). None of the facilities in Mizoram reported sending biomedical waste to the PHC, instead it was commonly disposed in open pits (47%)

5.9 Vaccine Logistics at the Sub-Centre

Table 5.9 presents the percentage of different methods used to deliver vaccines to the sub-centre. The main medium of delivery of vaccines from the cold chain point to the session site varied across states and was either of the following:

- Planning unit staff

Table 5.9: Vaccine Logistics Between Cold Chain Point and the Sub-Centre (% of facilities): INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	Vaccine delivery from cold chain point to session site by:					Vaccine supplied on the session day	Receive open vials
	PU staff delivers	AVD/ courier	Collected by ANM	Collected by ASHA	Others		
India	22.9	35.3	37.4	3.0	1.4	89.7	82.8
Bihar	2.1	97.9	0.0	0.0	0.0	93.7	85.4
Madhya Pradesh	2.0	92.2	5.9	0.0	0.0	98.0	96.1
Maharashtra	90.3	3.2	6.5	0.0	0.0	96.8	83.9
Rajasthan	26.8	41.5	26.8	4.9	0.0	97.6	78.1
Telangana	22.7	0.0	72.7	4.6	0.0	95.5	77.3
Uttar Pradesh	38.5	7.7	48.1	5.8	0.0	100.0	88.5
Goa	40.0	0.0	53.3	0.0	6.7	100.0	86.7
Himachal Pradesh	4.7	2.3	88.4	2.3	2.3	62.8	86.1
Jammu & Kashmir	0.0	3.3	80.0	10.0	6.7	90.0	70.0
Kerala	52.0	4.0	40.0	4.0	0.0	92.0	84.0
Mizoram	25.0	0.0	69.4	5.6	0.0	58.3	66.7
West Bengal	9.5	83.3	2.4	0.0	4.8	95.2	81.0
Andhra Pradesh	41.9	0.0	58.1	0.0	0.0	25.8	61.3
Haryana	59.4	3.1	25.0	9.4	3.1	93.8	96.9
Manipur	10.3	0.0	82.8	6.9	0.0	51.7	17.2
Odisha	50.0	6.0	16.0	6.0	22.0	86.0	60.0
Tamil Nadu	18.0	0.0	59.0	2.6	20.5	100.0	87.2
Uttarakhand	12.0	0.0	80.0	8.0	0.0	68.0	76.0

Note: For India and fixed states, data from INCHIS-2 was used. For rotational states, respective round of INCHIS data was considered

- Alternative Vaccine Delivery (AVD)/courier
- ANM.

In Maharashtra, Kerala, Haryana and Odisha, planning unit staff delivered vaccines from cold chain point to the session site. AVD/courier was the main medium of delivery in Bihar, Madhya Pradesh and West Bengal. For other states, mostly ANM collected vaccines from the cold chain point. Supply of vaccines from cold chain point to the session site on the session day was a widespread practice nationally and in most states, except for Andhra Pradesh (26%), Manipur (52%) and Mizoram (58%). In Andhra Pradesh 74% sub-centres reported receiving vaccines from cold chain point a day before the session day.

5.10 Knowledge and Practices of ANM

Knowledge and practices of ANM on immunization are presented in Table 5.10. Most of the ANMs (95%) were aware of the age group (16-

Table 5.10: Knowledge and Practices of ANMs on Immunization (% of ANMs): INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	Aware of age for 2nd dose of measles	Aware of all four key messages#	Prepares due list
India	95.2	42.7	52.8
Bihar	100.0	37.5	16.7
Madhya Pradesh	100.0	5.9	72.6
Maharashtra	93.6	83.9	67.7
Rajasthan	92.7	46.3	29.3
Telangana	100.0	72.7	50.0
Uttar Pradesh	98.1	36.5	34.6
Goa	86.7	6.7	73.3
Himachal Pradesh	90.7	32.6	60.5
Jammu & Kashmir	100.0	20.0	90.0
Kerala	96.0	68.0	44.0
Mizoram	80.6	94.4	77.7
West Bengal	97.6	31.0	47.6
Andhra Pradesh	100.0	nr	83.9
Haryana	96.9	nr	56.3
Manipur	93.0	nr	51.7
Odisha	100.0	nr	86.0
Tamil Nadu	100.0	nr	0.0
Uttarakhand	72.0	nr	48.0

nr=not reported; In INCHIS-1, the question regarding the four key messages was asked as a "read-out" question which led to over-reporting of awareness. This question was revised in round-2 and the estimates are presented only from INCHIS-2.
#Four key messages include vaccines given on that day and diseases it prevents, place and time of next vaccination, side effects which could occur and how to deal with it, and to keep vaccination card safe and to bring it during next visit

24 months) when a child should be administered the second dose of measles vaccine. There was not much variation across states. According to the immunization handbook for health workers [44], on the vaccination day ANMs should remind parents of four key messages:

1. what vaccine was given and what disease it prevents,
2. when and where to come for the next visit,
3. what are the side effects and how to deal with them,
4. to keep the immunization card safe and to bring it along for the next visit.

At the national level 43% of ANMs were aware of all four key messages. Awareness of four key messages varied across the states, ranging from 6% in Madhya Pradesh to 94% in Mizoram.

Approximately 50% ANMs at the national level reported to prepare the list of due beneficiaries (due list) and share the due list with ASHA and AWW to mobilize them for the session. This percentage varied from 16% in Bihar to 90% in Jammu and Kashmir.

5.11 ASHA: A Link between Health System and Community

The National Rural Health Mission, initiated in 2005 by the Government of India, sought to provide effective health care to the rural population through architectural corrections of the health system. In order to address the demand-side barriers to immunization, it introduced a cadre of health workers, known as ASHA (Accredited Social Health Activist; a female community worker) in every village of the country to establish the link between community and health care providers. One of the key roles of ASHA is mobilizing the community for utilization of existing health services in their village. Her responsibilities vary from being a promoter of good health practices, to make referrals, to counsel women on birth preparedness, safe delivery, breast-feeding and complimentary feeding, immunization, contraception and prevention of common infection.

In the context of UIP, ASHA is supposed to enumerate and record immunization status of all the children in her community, to help ANM in identifying hard-to-reach or underserved population, in planning for session site, day and time of session. This section provides basic information and services provided by ASHA in her community and trainings received in the last three years.

Table 5.11 presents the number of ASHAs interviewed in INCHIS-1 and INCHIS-2. The ASHA scheme was absent in Goa and was not yet universal in Tamil Nadu. As a result, no ASHAs were interviewed from Goa and only one ASHA from Tamil Nadu was included in the INCHIS survey. In Telangana only two ASHAs were interviewed during INCHIS-2 due to strike of ASHAs in the state, hence, data from INCHIS-1 for Telangana are being presented. The national-level estimates are based on data from 11 states included in INCHIS-2 (excluding Goa).

ASHA: Basic information

The NRHM guidelines suggest that ASHA should be a resident of the village where she serves. In India 90% of ASHAs were residents of the village where they were interviewed and served (see Table 5.11). Almost all the ASHAs in Andhra Pradesh, Haryana, Mizoram and Kerala resided in the same village. In Bihar, Uttar Pradesh, West Bengal and Manipur, 15-24% ASHAs resided in a neighbouring village.

The educational qualifications of ASHAs have been kept simple and realistic, to include literate women preferably qualified up to 10th standard, with flexibility in case of unavailability of candidates. An estimated 83% of ASHAs were found to be educated up to standard 8th or more in the country (see Table 5.11). Percentage of ASHAs having qualification less than 8th standard varied across states with Mizoram (60%), Andhra

Table 5.11: Place of Residence and Educational Qualification of ASHAs: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State[1]	Number of ASHAs interviewed	Place of residence (% of ASHAs)		Educational qualification (% of ASHAs)	
		Same village	Other village	Less than 8th standard	Standard 8th or more
India	419	90.0	10.0	17.2	82.8
Bihar	46	84.8	15.2	6.5	93.5
Madhya Pradesh	45	95.6	4.4	24.4	75.6
Maharashtra	33	97.0	3.0	3.0	97.0
Rajasthan	46	87.0	13.0	10.9	89.1
Uttar Pradesh	56	78.6	21.4	16.1	83.9
Himachal Pradesh	48	93.8	6.3	16.7	83.3
Jammu & Kashmir	31	93.6	6.5	22.6	77.4
Kerala	32	100.0	0.0	0.0	100.0
Mizoram	42	100.0	0.0	59.5	40.5
West Bengal	40	77.5	22.5	7.5	92.5
Andhra Pradesh	31	100.0	0.0	71.0	29.0
Haryana	28	100.0	0.0	17.9	82.1
Manipur	29	75.9	24.1	44.8	55.2
Odisha	50	90.0	10.0	52.0	48.0
Telangana[2]	29	96.6	3.5	51.7	48.3
Uttarakhand	24	87.5	12.5	25.0	75.0

[1]Goa and Tamil Nadu reportedly do not have ASHA.
[2]Unlike in other tables, Telangana estimates are presented using INCHIS-1 data. During INCHIS-2, there was strike of ASHAs in the state.

Pradesh (71%), Manipur (45%), Odisha (52%), and Telangana (52%) having higher percentages.

Immunization Services Provided by ASHA

One of the major duties of ASHAs is to promote services under universal immunization program. The key roles are:

- Prepare the due list of beneficiaries in her community and visit the houses of due beneficiaries to inform them about the session's day and site
- Ensure that the due beneficiaries are present at the session site
- Provide assistance to ANM in conducting the immunization session smoothly
- Report to ANM of any case of high fever, any allergic reaction or convulsions after immunization
- Counsel the mothers of drop-outs for immunization

In an estimated 62% of the villages in India, ASHAs usually prepared the immunization due list (see Table 5.12). In majority of villages of Bihar, UP and West Bengal ASHAs prepared the due list, whereas in Maharashtra, Goa, Jammu & Kashmir,

Table 5.12: Immunization Services provided by ASHA: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	Due list prepared by ASHA	Due list shared between ANM and ASHA on the session day or one day before	Attended monthly review meeting at PU	Average number of times ASHA met ANM in the last month
India	61.8	93.3	91.7	5.0
Bihar	84.8	86.9	97.8	3.7
Madhya Pradesh	51.1	88.9	95.6	2.7
Maharashtra	33.3	94.0	97.0	5.0
Rajasthan	47.8	95.7	97.8	7.4
Uttar Pradesh	80.4	98.2	91.1	2.6
Himachal Pradesh	62.5	93.8	89.6	6.2
Jammu & Kashmir	54.8	96.8	87.1	3.4
Kerala	31.3	100.0	100.0	7.2
Mizoram	66.7	83.3	76.2	4.2
West Bengal	85.0	97.5	85.0	8.5
Andhra Pradesh	16.1	67.7	100.0	7.35
Haryana	35.7	96.5	100.0	8.25
Manipur	48.3	93.1	82.76	4.55
Odisha	14.0	98.0	94.00	4.6
Telangana	10.3	100.0	96.55	4.20
Uttarakhand	50.0	79.1	95.83	3.41

Andhra Pradesh and Odisha ANMs preparing the due list is a more common scenario as discussed in the previous sub-section.

At the national level, in an estimated 93% of the villages the due list is shared between the ASHA and ANM on the session day or one day before the session. In 32% of the villages of Andhra Pradesh, 21% of Uttarakhand and 17% of Mizoram, the due list was never shared between ANM and the ASHA. Most of the ASHAs in the country reported attending monthly review meeting at the health facility/PU and, on average, ASHAs met ANMs five times in the last month (Table 5.12).

Incentives received, delay in receiving incentives and the reasons of delay

ASHAs receive performance-based incentives for promoting universal immunization, referral and escort services for RCH and other healthcare programs. In India 80% of the ASHAs reported having received incentives for immunization (see Table 5.13). The receipt of incentives varied from 6% in Himachal Pradesh to 100% in Kerala, Rajasthan, Uttar Pradesh and Uttarakhand. Many of the ASHAs reported never to have received incentives in Himachal Pradesh (94 percent), Mizoram (57 percent) and Andhra Pradesh (45 percent). In Telangana, on an average, ASHAs

Table 5.13: Incentives and Payments Received by ASHA: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	Received incentive (% of ASHAs)	Number of times (median) incentive received in last 6 months*	Received incentive and faced delay in Payment	Among ASHAs who reported to face delay in payment$:			
				Not Approved by ANM	Payment Held at PHC for long	No Funds (as per PHC official)	Others
India	79.7	2	55.1	9.2	47.8	49.5	11.4
Bihar	95.7	1	90.9	7.5	72.5	72.5	2.5
Madhya Pradesh	95.6	4	34.9	0.0	60.0	6.7	20.0
Maharashtra	87.9	1	62.1	44.4	50.0	55.6	5.6
Rajasthan	100.0	5	15.2	14.3	57.1	42.9	0.0
Uttar Pradesh	100.0	1	50.0	7.1	71.4	39.3	3.6
Himachal Pradesh	6.3	1	0.0	0.0	0.0	0.0	0.0
Jammu & Kashmir	96.8	1	70.0	4.8	47.6	66.7	0.0
Kerala	100.0	2	53.1	5.9	11.8	58.8	5.9
Mizoram	42.9	2	72.2	0.0	23.1	69.2	0.0
West Bengal	82.5	4	75.8	4.0	8.0	16.0	56.0
Andhra Pradesh	54.8	5	5.9	na	na	na	na
Haryana	92.9	2	50.0	na	na	na	na
Manipur	86.2	1	76.0	na	na	na	na
Odisha	98.0	4	34.7	na	na	na	na
Telangana	89.7	6	42.3	na	na	na	na
Uttarakhand	100.0	2	70.8	na	na	na	na

*Questions on receipt of immunization-related incentives were asked differently in INCHIS-1 and INCHIS-2. INCHIS-1 asked "Do you receive immunization-related incentives?" while INCHIS-2 asked "Have you ever received immunization-related incentives?"
na = not available; the reasons for delay in incentive has been asked differently, therefore not shown here.
$ More than one option was available

received immunization-related incentives six times in the last six months.

Fifty-five percent (55%) of the ASHAs reported delays in receiving payment in the country. There were considerable interstate variations with regard to delays in receiving payments, ranging from 91% in Bihar to no delay in Himachal Pradesh. More than two-thirds of the ASHAs from Bihar, Manipur, West Bengal, Mizoram, Uttarakhand and Jammu and Kashmir faced delays in receiving payments.

Among the ASHAs who faced delay in payment, the reasons of delay were reported as no funds as per PHC official (50%), payment held at PHC for long (48%), not approved by ANM (9%) and others (11%). Not approved by ANM was reported as a major reason of delay in Maharashtra (44%). In Bihar (73%), Uttar Pradesh (71%), Madhya Pradesh (60%), Rajasthan (57%) and Maharashtra (50%), more than two in one ASHAs, who faced delay in payment, reported that payment was held up at PHC.

Training received by ASHA

An estimated 75% of the ASHAs received training on immunization in the last three years, however, 10% ASHAs never received any training (Table 5.14). While more than 80% of ASHAs in Odisha, Telangana, Bihar, Uttar Pradesh, Rajasthan, Haryana, Manipur, West Bengal, Kerala, Uttarakhand, Jammu & Kashmir and Andhra Pradesh received training in the last three years, 33% in Mizoram, 52% in Himachal Pradesh reported receiving training on immunization

Table 5.14: Training Status of ASHAs in Last Three Years (% of ASHAs): INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	Immunization		Communication and Social mobilization		Child Health	
	Last three years	Never	Last three years	Never	Last three years	Never
India	74.5	10.3	68.0	17.0	69.9	15.0
Bihar	84.8	2.2	80.4	8.7	82.6	6.5
Madhya Pradesh	62.2	15.6	51.1	33.3	57.8	26.7
Maharashtra	69.7	9.1	69.7	15.2	78.8	9.1
Rajasthan	89.1	2.2	80.4	10.9	71.7	6.5
Uttar Pradesh	85.7	8.9	60.7	23.2	78.6	14.3
Himachal Pradesh	52.1	43.8	50.0	47.9	45.8	52.1
Jammu & Kashmir	93.6	0.0	90.3	3.2	80.7	19.4
Kerala	90.6	6.3	93.8	0.0	93.8	3.1
Mizoram	33.3	2.4	31.0	11.9	31.0	2.4
West Bengal	90.0	5.0	90.0	0.0	90.0	2.5
Andhra Pradesh	100.0	0.0	74.2	25.8	93.6	6.5
Haryana	89.3	0.0	60.7	10.7	75.0	0.0
Manipur	89.7	3.5	86.2	3.5	86.2	3.5
Odisha	82.0	10.0	84.0	8.0	96.0	2.0
Telangana	89.7	3.5	51.7	6.9	86.2	0.0
Uttarakhand	91.7	4.2	70.8	8.3	91.7	0.0

in that time period. A large percentage (44%) of ASHAs in Himachal Pradesh reported never receiving training on immunization

Sixty eight percent (68%) of the ASHAs reported being trained on communication and mobilization in the last three years in the country and 17% reported that they never received any training on this topic. State-wise estimates suggested that in Bihar, Rajasthan, Odisha, Manipur, West Bengal, Jammu & Kashmir and Kerala 80% or more of the ASHAs had received training on communication and mobilization in the last three years. Similar to the trend on immunization related training, 48% ASHAs in Himachal Pradesh reported that they had never been trained on communication and social mobilization.

Awareness on Mission Indradhanush

Table 5.15 presents the percentage of ASHAs who worked for MI in their area. In India, 53% of ASHAs reported having ever worked for MI in their area, 21% did not work on MI and 26% said that they did not know about MI or MI was not operational in their area. Reporting of ever working in MI varied from 19% in Mizoram to 100% in Kerala. A little more than 40% of the ASHAs were aware of the incentives for MI rounds in the country. The awareness on incentives for MI rounds varied from 21% in Mizoram to 62% in Madhya Pradesh. Twenty one percent ASHAs reported receiving incentives for MI rounds in India

Table 5.15: Involvement of ASHA in Mission Indradhanush: INCHIS-2 (Sep-Oct 2015) Data

State	Ever worked for MI in her area			Aware of incentives for MI	Received incentives for MI	Received Union Health Minister's letter during MI
	Yes	No	Don't know about MI/ No MI in her area			
India	53.2	20.8	26.0	44.8	21.3	15.8
Bihar	41.3	17.4	41.3	55.6	14.8	0.0
Madhya Pradesh	75.6	6.7	17.8	62.2	40.5	32.4
Maharashtra	45.5	21.2	33.3	40.9	27.3	45.5
Rajasthan	73.9	17.4	8.7	50.0	14.3	9.5
Uttar Pradesh	78.6	10.7	10.7	54.0	36.0	8.0
Himachal Pradesh	29.2	50.0	20.8	29.0	7.9	10.5
Jammu & Kashmir	25.8	19.4	54.8	35.7	7.1	7.1
Kerala	100.0	0.0	0.0	40.6	15.6	21.9
Mizoram	19.1	38.1	42.9	20.8	4.2	25.0
West Bengal	37.5	22.5	40.0	41.7	29.2	4.2

6. PLANNING UNITS

Planning Units

The term planning unit (PU) in INCHIS survey is used to refer to a health facility with a cold chain point, where vaccines are stored and the micro-planning for immunizations is carried out. Depending on the context (rural or urban) and the state, a planning unit may be either of the following: Primary Health Centre (PHC), Urban Health Centre (UHC), Community Health Centre (CHC), another type of health facility.

Planning units catering to the sampled clusters were evaluated. In most settings, planning units are the first point of contact between the community and the Medical Officer, who is the key respondent for most of the information presented herein. However, pertinent questions of the PU questionnaire were answered by the cold chain handler, the data entry operator, the pharmacist and the person in-charge of IEC materials. This section on evaluation of planning units presents indicators on the availability, accessibility, functioning and quality of immunization services.

6.1 Type of Health Facility Functioning as Planning Unit

Description of clusters and resultant planning units interviewed for INCHIS-1 and INCHIS-2 are described in Table 6.1. As part of INCHIS, a total of 439 planning units in INCHIS-1 and 478 planning units in INCHIS-2 were surveyed. Across states, the numbers ranged from a minimum of 16 PUs in Goa to 61 in Uttar Pradesh. The surveyed PUs covered a total of 628 clusters that compares to 635 clusters sampled in the household survey of INCHIS-2. Similarly, in INCHIS-1, 439 sampled PUs covered 542 sampled clusters relative to a total of 591 clusters in the household survey. Sampled planning units covered all the sampled clusters in most states, except in Maharashtra, Mizoram, Manipur, Haryana, Tamil Nadu and Andhra Pradesh where some of the planning unit surveys could not be conducted mainly due to non-participation by medical officer, Bandh, unavailability of medical officer.

Usually one planning unit was found to serve one sampled cluster in Bihar, Madhya Pradesh, Rajasthan, Uttar Pradesh, Telangana, Kerala and West Bengal, while one planning unit served on an average, two sampled clusters in Goa, Himachal Pradesh, Jammu & Kashmir and Uttarakhand.

Most of the planning units were either a PHC or CHC, except in some states where planning units were reported to be other types of health facilities. Among the other types of health facilities reported in Madhya Pradesh, Maharashtra, Himachal Pradesh, Kerala and Jammu & Kashmir, majority were District or Sub-district hospital. Majority of the facilities reported as others in Mizoram were Health Centres, and Municipality Health Administrative unit in West Bengal.

6.2 Coverage Area and Workload of Planning Units

As mentioned earlier, in most states, PHC or CHC served as the planning unit. According to the Minimum Needs Program (MNP) criteria, each PHC should cater to 30,000 population in plains and 20,000 population in tribal and hilly area, and each CHC/Rural Hospital should cater to a population of 100,000 [43]. However, depending on geographical location and population density, there was considerable variation in the number

Table 6.1: Sample Covered and the Type of Health Facility: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	PUs	Number of clusters covered		Type of Planning unit (%)			
		in INCHIS HH survey	by interviewed PUs	PHC	CHC	UHC	Other
India	478	635	628	45.4	31.2	5.0	18.4
Bihar	47	58	58	87.2	6.4	0.0	6.39
Madhya Pradesh	56	74	74	28.6	46.4	0.0	25.0
Maharashtra*	54	60	58	61.1	9.3	9.3	20.4
Rajasthan	56	58	58	41.1	48.2	8.9	1.8
Telangana	37	40	40	54.1	2.7	24.3	18.9
Uttar Pradesh	61	74	74	14.8	77.1	0.0	8.2
Goa	16	24	24	56.3	18.8	18.8	6.3
Himachal Pradesh	31	56	55	29.0	45.2	0.0	25.8
Jammu & Kashmir	36	55	54	55.6	16.7	0.0	27.8
Kerala	32	40	40	34.4	34.4	6.3	25.0
Mizoram$	17	48	45	47.1	11.8	0.0	41.2
West Bengal	35	48	48	51.4	11.4	0.0	37.2
Andhra Pradesh#	23	40	30	91.3	4.4	4.4	0.0
Haryana	29	55	54	69.0	13.8	10.3	6.9
Manipur**	22	48	41	63.6	22.7	0.0	13.6
Odisha	45	52	52	40.0	53.3	4.4	2.2
Tamil Nadu	46	55	52	87.0	2.2	8.7	2.2
Uttarakhand	23	38	38	26.1	34.8	0.0	39.1

*Two planning units in Maharashtra refused to be interviewed.
$Three planning units in Mizoram could not be interviewed due to Bandh in the respective areas.
#Nine planning units in Andhra Pradesh could not be covered due to unavailability of planning unit staff, or due to demand of a specific letter from state officials.
**Four planning units in Manipur could not be covered due to unavailability of transportation facilities or Medical officer was unavailable (even after multiple attempts).

of sub-centres served by the planning units, population covered by PU, distance between the PU and the farthest sub-centre, and time taken to reach the farthest sub-centre. State-wise averages are presented in Table 6.2.

The average number of sub-centres served by planning units ranged from a high of 27 in Uttar Pradesh to a low of 7 in Telangana and Haryana. The average number of sub-centres served by each of the planning unit was much higher in

Table 6.2: Catchment Area of Planning Units Participating in Survey: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	Average number of SCs/ Wards served	Median population covered by different types of PUs					Average distance (in km) between PU and farthest SC*	Average time (in min) to farthest SC
		All PUs together	PHC	CHC	UHC	Other health facilities		
India	15	67,123	49,030	130,000	46,050	81,662	23.1	84.6
Bihar	25	251,910	243,331	289,648	na	68,758	24.5	118.0
Madhya Pradesh	17	100,000	39,345	145,335	na	117,876	29.0	84.6
Maharashtra	9	43,286	38,400	37,731	57,838	46,640	20.2	55.5
Rajasthan	8	30,673	28,450	30,360	31,140	175,000	19.3	49.8
Telangana	7	50,639	60,736	na	47,529	45,000	11.6	65.4
Uttar Pradesh	27	234,567	223,478	234,567	na	372,962	26.0	90.2
Goa	10	50,439	49,030	50,268	59,066	90,000	19.4	73.3
Himachal Pradesh	13	29,101	17,717	45,562	na	53,780	29.5	119.7
Jammu & Kashmir	10	34,277	18,867	84,467	na	54,637	27.2	101.5
Kerala	12	31,181	27,206	38,816	52,408	62,928	11.3	43.9
Mizoram	12	9,934	6,897	6,698	na	61,677	19.5	175.6
West Bengal	23	161,000	185,965	224,449	na	86,000	27.1	101.2
Andhra Pradesh	9	40,756	40,610	56,786	72,000	na	17.9	NA
Haryana	7	57,021	42,152	103,348	100,000	51,174	16.1	NA
Manipur	8	28,688	17,400	30,000	na	56,000	42.2	NA
Odisha	13	70,600	30,862	140,813	85,262	115,893	30.0	NA
Tamil Nadu	9	41,377	40,525	30,895	48,271	126,597	13.7	NA
Uttarakhand	15	60,977	50,142	73,338	na	34,000	53.5	NA

*Excluding urban areas
na: Not applicable since no such facility was sampled.
NA: Not asked in INCHIS-1

Uttar Pradesh, Bihar, and West Bengal compared to Manipur, Mizoram and Rajasthan. Median population catered by each of the planning units was high in Bihar (2,51,910), Uttar Pradesh (2,34,567), and West Bengal (1,61,000) compared to Mizoram (9,934) and Manipur (28,688).

The average distance between the planning unit and the farthest sub-centre varied, with the terrain of the state, from 11 km in Kerala to 54 km in Uttarakhand. Similarly, average time taken to reach the farthest sub-

centre ranged from 44 minutes in Kerala to 176 minutes in Mizoram.

6.3 Human Resources at Planning Units

The average number of in position-regular and in position-total (regular and contractual together) staff by state is presented in Table 6.3.

There was considerable inter-state variation for availability of each type of health staff, with states that had high population coverage per planning unit reporting higher overall number of staff in place. In most states there was an even distribution of staff in regular and contractual positions. The average number of in position-regular medical officers ranged from one per planning unit in Odisha and Andhra Pradesh to five

Table 6.3: Staff Position at the Planning Units: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	Average number of regular, in position staff				Average number of total (regular and contractual combined) in position staff			
	MO/ specialist	Pharmacist	Data Entry Operator	Any nurse[1]	MO/ specialist	Pharmacist	Data Entry Operator	Any nurse1
India	3	1	0	13	4	2	1	17
Bihar	2	1	0	15	5	1	1	26
Madhya Pradesh	5	1	0	17	6	1	1	22
Maharashtra	3	1	0	9	4	1	0	12
Rajasthan	2	1	1	5	3	1	2	7
Telangana	2	1	0	9	2	1	0	14
Uttar Pradesh	4	2	0	16	6	3	2	21
Goa	3	1	0	13	4	1	1	16
Himachal Pradesh	6	2	0	10	6	3	1	11
Jammu & Kashmir	4	2	1	6	5	2	1	7
Kerala	5	2	0	17	5	2	1	19
Mizoram	2	1	0	9	4	2	1	16
West Bengal	3	1	0	25	3	1	2	33
Andhra Pradesh	1	1	1	8	1	1	0	14
Haryana	2	1	1	4	2	1	1	9
Manipur	4	1	1	6	6	1	0	12
Odisha	1	1	1	7	1	1	1	9
Tamil Nadu	2	1	1	3	2	1	0	4
Uttarakhand	4	3	1	9	6	3	1	13

[1]Any nurse includes staff nurse, Auxiliary Nurse Midwife, public health nurse, health assistant, male or female and lady health visitor, multipurpose health worker, junior health inspector or health inspector, junior public health nurse, nursing assistant, and general nursing and midwife, nursing sister, male nurse.

and six in Madhya Pradesh and Himachal Pradesh, respectively. Himachal Pradesh, Madhya Pradesh, Manipur, Jammu & Kashmir, Uttarakhand, Uttar Pradesh, Maharashtra, Kerala, Goa and West Bengal reported three or more medical officers/ specialists in position as regular staff at each of the planning units.

The average number of medical officers/specialists was considerably higher in Rajasthan, Mizoram, Bihar, Goa, Kerala, Maharashtra, Jammu & Kashmir, Uttar Pradesh, Uttarakhand, Manipur and Madhya Pradesh when accounting for both regular and contractual staff, reflecting a high number of contractual positions in these states. As per IPHS norms, at least five staff nurses per PHC, and an additional two contractual staff nurses and 19 staff nurses per CHC are expected to be in position.

6.4 Training Status of Health Staff

The INCHIS survey included questions to discern the training status of the health staff on matters related to their respective roles in the planning unit. Table 6.4 presents percentage of planning units where health staff has received training specific to their roles within the last three years.

Table 6.4: Training Status of Planning Unit Health Staff: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	MOs training on Immunization	MOs training on IMNCI/ HBNC	Cold Chain In-charge's training on Cold Chain	Data entry Officer's Training either on MCTS or HMIS	ANM/ Staff Nurse Training on Immunization
India	74.5	62.1	82.6	62.3	78.5
Bihar	97.9	89.4	95.7	95.7	100.0
Madhya Pradesh	67.3	60.0	87.5	64.3	89.3
Maharashtra	66.7	63.0	70.4	25.9	64.8
Rajasthan	85.7	73.2	94.6	80.4	78.2
Telangana	55.6	47.2	56.8	8.1	61.1
Uttar Pradesh	100.0	88.1	98.4	100.0	98.3
Goa	80.0	80.0	100.0	93.8	93.8
Himachal Pradesh	86.7	43.3	80.7	64.5	71.0
Jammu & Kashmir	51.4	51.4	86.1	41.7	79.4
Kerala	65.6	43.8	65.6	40.6	65.6
Mizoram	33.3	33.3	35.3	41.2	37.5
West Bengal	60.6	27.3	85.7	68.6	65.6
Andhra Pradesh	91.3	73.9	95.7	91.3	100.0
Haryana	86.2	79.3	100.0	96.6	100.0
Manipur	77.3	54.6	54.6	22.7	41.2
Odisha	82.2	75.6	88.9	71.1	90.6
Tamil Nadu	90.9	79.6	67.4	41.3	69.7
Uttarakhand	82.6	65.2	78.3	56.5	91.3

MO = Medical Officer; IMNCI = Integrated Management of Neonatal and Childhood Illnesses; HBNC = Home-Based Neonatal Care; MCTS= Mother and Child Tracking System; HMIS = Health Management Information System;

Nationally, 75% of medical officers and 78.5% of ANMs/staff nurses at planning units received training on immunization and around 83% of cold chain in-charges received training on cold chain handling. However, the percentage of MOs receiving training on Integrated Management of Neonatal and Childhood Illnesses or Home-Based Newborn Care (IMNCI or HBNC) and data entry officers receiving training on MCTS or HMIS was close to 60%.

Compared to the national numbers, the training status of health staff showed large variations across states, with no consistent trend with regard to trainings received. For example, across all training programs, while some states showed that a high proportion of cold chain in-charges had received training (Rajasthan, Goa, West Bengal), in other states the highest proportion of training completion was observed for ANMs/staff nurses having received training on immunization (Bihar, M.P., Andhra Pradesh, Odisha, Uttarakhand) or MOs having received training on immunization (Himachal Pradesh, Manipur, Tamil Nadu).

The percentages of Medical Officers having received training on immunization ranged from 33% in Mizoram to as high as 100% in Uttar Pradesh, while in Bihar, Andhra Pradesh, Uttarakhand, Tamil Nadu, Himachal Pradesh, Haryana, Rajasthan, Odisha, Goa, and Manipur more than 75% of medical officers had received such training.

Medical Officer training on IMNCI or HBNC varied considerably across states with West Bengal reporting 27.3% trained MOs to 89.4% of MOs having been trained in Bihar. Similarly, MOs receiving cold chain training varied from 35.3% in Mizoram to 100% in Goa and Haryana. Data entry officer training on MCTS or HMIS ranged from 8.1% in Telangana to 100% in Uttar Pradesh; and ANM/staff nurse training from 37.5% in Mizoram to 100% in Bihar, Andhra Pradesh, and Haryana.

In some states less than 75% of the facilities reported receiving training across all types of training programs – Mizoram (all below 40%), Telangana (all below 60%), Manipur (4 out of 5 below 55%), and Jammu & Kashmir (3 out of 5 below 55%). Other states reported deficiencies in one or two training domains, such as Maharashtra (data entry officer training on MCTS or HMIS); Telangana and Kerala (MO training on IMNCI or HBNC and data entry officer training); Himachal Pradesh (MO training on IMNCI or HBNC); West Bengal (MO training on IMNCI or HBNC); and Tamil Nadu (data entry officer training).

6.5 Planning Unit Infrastructure

Table 6.5 presents the state of infrastructure at the planning units in India and by states. Nationally, 82% of the facilities reported being housed in a building in good condition. However, only around 50% planning units' buildings in West Bengal were in good condition compared to 100 % in Goa. In other states, the percent of PUs housed in buildings in good condition varied from 65 to 95%. In terms of cleanliness, around 60% of facilities in the country had clean premises, wards and Out-Patient Departments (OPDs). States of Madhya Pradesh, Maharashtra, Uttar Pradesh, and West Bengal had less than 55% facilities reporting clean premises, wards, and OPDs, with West Bengal and Uttar Pradesh reporting less than 35% clean premises. However, states of Rajasthan, Telangana, Jammu & Kashmir, Kerala, Haryana, and Tamil Nadu reported consistently high (>75% facilities) clean premises, wards and OPD at the planning unit.

Twenty-four-hour water supply was commonly available across the nation, except in Mizoram and Manipur. Nationally, 55% of facilities in the country reported regular power supply, but 82.6% had a functional generator or invertor. Less than seven percent of planning units in Uttar Pradesh reported regular power supply; however, almost all the PUs in the state reported availability of a working generator or invertor. Access to electricity supply was also a problem in states of Bihar, Maharashtra, Rajasthan, Jammu & Kashmir, Haryana, and Manipur where less than 50% of

Table 6.5: State of Infrastructure at the Planning Units: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	Buildings in good condition	Cleanliness good			Availability/Access to							
		Premises	Wards	OPDs	24-Hr Water supply	Regular power supply	Functional generator / invertor	Functional telephone	Functional official computer	Internet	Vehicle for regular use	Vehicle for patients
India	82.0	63.0	57.5	60.5	87.9	55.0	82.6	69.5	88.1	78.2	58.6	69.0
Bihar	76.6	61.7	59.6	61.7	97.9	44.7	100.0	91.5	95.7	85.1	68.1	89.4
Madhya Pradesh	89.3	50.0	53.6	51.8	91.1	75.0	89.3	60.7	82.1	78.6	44.6	85.7
Maharashtra	90.7	53.7	44.4	55.6	77.8	37.0	90.7	70.4	96.3	81.5	92.6	96.3
Rajasthan	87.5	82.1	76.8	78.6	87.5	50.0	73.2	67.9	87.5	85.7	37.5	57.1
Telangana	70.3	70.3	70.3	70.3	73.0	91.9	54.1	24.3	73.0	24.3	13.5	29.7
Uttar Pradesh	80.3	34.4	27.9	34.4	93.4	6.6	100.0	63.9	98.4	98.4	65.6	50.8
Goa	100.0	93.8	62.5	75.0	87.5	68.8	56.3	100.0	100.0	100.0	87.5	87.5
Himachal Pradesh	83.9	77.4	74.2	67.7	100.0	93.6	67.7	96.8	100.0	96.8	61.3	64.5
Jammu & Kashmir	94.4	86.1	86.1	83.3	83.3	41.7	86.1	50.0	75.0	58.3	75.0	77.8
Kerala	87.5	90.6	81.3	87.5	90.6	68.8	75.0	96.9	93.8	93.8	62.5	50.0
Mizoram	64.7	70.6	64.7	64.7	64.7	76.5	82.4	64.7	58.8	29.4	64.7	70.6
West Bengal	51.4	31.4	17.1	22.9	94.3	68.6	80.0	71.4	80.0	77.1	45.7	68.6
Andhra Pradesh	73.9	52.2	52.2	60.9	82.6	56.5	82.6	60.9	78.3	82.6	30.4	73.9
Haryana	79.3	86.2	82.8	86.2	75.9	24.1	82.8	79.3	100.0	93.1	27.6	82.8
Manipur	68.2	81.8	68.2	77.3	55.0	31.8	86.4	9.1	63.6	13.6	45.5	40.9
Odisha	75.6	75.6	60.0	60.0	88.4	68.9	75.6	68.9	57.8	46.7	55.6	68.9
Tamil Nadu	87.0	84.8	89.1	89.1	97.7	95.7	82.6	82.6	93.5	87.0	34.8	73.9
Uttarakhand	87.0	69.6	56.5	65.2	95.7	87.0	87.0	78.3	87.0	73.9	60.9	65.2

facilities reported regular power supply. However the lack of power supply seems to be compensated by availability of functional generators and/or invertors at the facilities in all states.

Functional telephone, official computer, and internet availability were reported by 70%, 88%, and 78% of facilities in the country. Availability of office computers was the norm in most of the states, except Mizoram and Odisha where less than 60% facilities reported availability of a functional official computer. However, fewer facilities (≤ 50%) in Telangana, Jammu & Kashmir, Mizoram, Manipur, and Odisha reported access to functional telephone and/or access to internet.

Vehicle for regular use was available only in 58.6% of facilities in the country and vehicle availability for use by patients stood at 69% across facilities. Less than 50% of facilities in 7 out of 18 states (Madhya Pradesh, Rajasthan, Telangana, Andhra Pradesh, Haryana, Manipur, and Tamil Nadu) in the sample reported availability of vehicle for regular use by the facility and three states (Telangana, Kerala, and Manipur) reported the same for vehicle availability for use by patients.

These findings highlight that each state faces various sets of challenges with regard to availability of physical infrastructure and facilities, therefore interventions need to be tailored to address these in a state specific manner.

6.6 Immunization Waste Disposal at Planning Unit

The percentage of planning units with a functional waste disposal pit in the country stood at 77.2% and the number varied from 61% in Andhra Pradesh to almost universal in Odisha (Table 6.6). In the states of Bihar, West Bengal, Andhra Pradesh, and

Table 6.6: Immunization Waste Disposal at the planning Units: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	Waste disposal pit functional	Disposal of used syringes using hub cutter and then disposed of	Discarded needles seen on the floor
India	77.2	91.4	6.5
Bihar	66.0	91.5	14.9
Madhya Pradesh	83.9	94.6	3.6
Maharashtra	75.9	92.6	5.6
Rajasthan	76.8	94.6	10.7
Telangana	81.1	89.2	2.7
Uttar Pradesh	70.5	90.2	6.6
Goa	81.3	100.0	0.0
Himachal Pradesh	74.2	100.0	0.0
Jammu & Kashmir	88.9	97.2	2.8
Kerala	90.6	90.6	12.5
Mizoram	82.4	64.7	0.0
West Bengal	65.7	80.0	8.6
Andhra Pradesh	60.9	73.9	4.4
Haryana	79.3	89.7	27.6
Manipur	90.9	81.8	4.6
Odisha	97.8	91.1	24.4
Tamil Nadu	82.6	97.8	6.5
Uttarakhand	73.9	82.6	0.0

Uttar Pradesh the percent of facilities reporting functional waste disposal pit was 70% or less.

A large proportion of the country's facilities (91.4%) reported disposal of used syringes using hub cutter and safe disposal. However, only 65% planning units in Mizoram and 74% in Andhra Pradesh reported practicing this procedure, compared to 80% or more facilities in other sampled states. In Goa, Mizoram, Himachal Pradesh and Uttarakhand, none of the planning units were observed to have discarded needles on the floor compared to 28% of facilities in Haryana, 24% in Odisha, 15% in Bihar, 13% in Kerala, and 11% in Rajasthan reported discarded needles being seen on the floor.

6.7 Service Delivery at Planning Unit

This section examines the service delivery at planning units to understand the frequency of immunization sessions held at PU, mode of delivery of vaccines to session site, and the display of Information, Education and Communication (IEC) related materials by PU. Both national and state-wise percentages are calculated and presented in Table 6.7.

The results show that nationally 89.1% of facilities held an immunization session at least once a week and 2.3% had no fixed day for such sessions. Between 90% to 100% of planning units in Telangana, Kerala, Andhra Pradesh, Rajasthan, Bihar, Tamil Nadu, Uttar Pradesh, Uttarakhand, Jammu & Kashmir, Haryana, Madhya Pradesh and Himachal Pradesh conducted sessions at least once a week compared to only 24% in Mizoram and 67% in Maharashtra. Forty one percent of planning units in Mizoram had no fixed day for immunization sessions.

Maximum number of facilities (41.6%) in the country were seen to be utilizing alternative vaccine delivery/courier to distribute vaccines to session site, while in 34.5% facilities ANMs collected vaccines from PUs and in 26.4% PU staff delivered the vaccine to session site (the number do not sum to 100% because facilities were allowed to choose one or more option). Some facilities also utilized other health staff (such as ASHA, Aarogya Sevika, block health worker, female health worker, multipurpose health worker, health supervisor, tikakaran express gaadi) for vaccine distribution.

In Haryana (86%), Maharashtra (74%) and Kerala (66%), vaccines were primarily delivered to the sub-centre by the PU staff, while alternative vaccine delivery/ courier was the dominant mode of vaccine delivery in Bihar (96%), Madhya Pradesh (89%) and West Bengal (80%). In Himachal Pradesh (77%), Jammu & Kashmir (75%) and Telangana (73%) mostly ANMs collected vaccines from the planning unit on their own.

Planning units across the country displayed IEC materials within the PU (63.8%), within cold chain room (43.7%), near gate of PU (46.4%), and outside the PU (36%) (the numbers do not add up to 100% because facilities were allowed to choose one or more option). However, 5.4% of health facilities also reported not displaying the materials anywhere (Table 6.7). Further analysis (not presented here), showed that 38.7% of facilities displayed their IEC material only at one of the given places (within PU, within cold chain room, near gate of facility, or outside PU); 25.3% displayed at two places, 20.5% at three places, and 9.6% at all four places. The percentages varied across states, with Maharashtra and Mizoram reporting 15% and 18% facilities, respectively, where IEC material were not displayed anywhere.

Table 6.7: Service Delivery at the Planning Units: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	Frequency of Immunization Sessions		Vaccines distributed to session site by[1]:				IEC related material display site[2]:				
	At least once a week	No fixed day	PU staff	Alternative Vaccine Delivery/	ANM collect vaccines from PU	Any other	Within PU	Cold chain room	Near gate of PU	Outside PU	Nowhere
India	89.1	2.3	27.8	41.6	34.5	2.7	63.8	43.7	46.4	36	5.44
Bihar	100	0	0.0	95.7	4.3	0.0	25.5	12.8	59.6	44.7	6.4
Madhya Pradesh	96.4	0	3.6	89.3	8.9	0.0	69.6	82.1	69.6	50	1.8
Maharashtra	66.7	0	74.1	5.6	14.8	9.3	57.4	40.7	50	25.9	14.8
Telangana	100	0	27.0	8.1	73.0	0.0	86.5	54.1	40.5	51.4	0
Uttar Pradesh	96.7	0	34.4	54.1	42.6	0.0	57.4	63.9	55.7	45.9	4.9
Rajasthan	98.2	0	16.1	53.6	25.0	5.4	55.4	50	39.3	35.7	3.6
Goa	87.5	0	56.3	0.0	56.3	0.0	50	37.5	43.8	18.8	0
Himachal Pradesh	90.3	0	16.1	6.5	77.4	3.2	80.7	38.7	35.5	45.2	0
Jammu & Kashmir	94.4	5.6	13.9	8.3	75.0	8.3	88.9	38.9	27.8	19.4	2.8
Kerala	100	0	68.8	0.0	31.3	3.1	87.5	15.6	43.8	21.9	3.1
Mizoram	23.5	41.2	29.4	11.8	64.7	0.0	58.8	5.9	17.7	0	17.7
West Bengal	74.2	5.7	14.3	80.0	5.7	0.0	62.9	28.6	34.3	31.4	11.4
Andhra Pradesh	100	0	65.2	0.0	39.1	0.0	NA	NA	NA	NA	NA
Haryana	93.1	0	86.2	3.5	3.5	6.9	NA	NA	NA	NA	NA
Manipur	86.4	0	40.9	0.0	36.4	22.7	NA	NA	NA	NA	NA
Odisha	84.4	4.4	51.1	11.1	15.6	24.4	NA	NA	NA	NA	NA
Tamil Nadu	97.8	0	39.1	2.2	26.1	34.8	NA	NA	NA	NA	NA
Uttarakhand	95.7	0	39.1	0.0	65.2	17.4	NA	NA	NA	NA	NA

[1] Vaccines distributed to session site had multiple possible options, therefore may not add up to 100.
[2] IEC materials (related to immunization) displayed at the PU had multiple possible options, therefore may not add up to 100.
NA: not applicable; INCHIS-1 did not ask questions on IEC.

6.8 Monitoring and Supervision at Planning Unit

The Medical Officer or any supervisory staff from the planning unit is responsible for routine monitoring visits to the sub-centres. This section presents an assessment of monitoring and supervision activities undertaken at planning units. Out of a total of 478 facilities interviewed, 332 planning units were located in rural areas. Sub-centres are usually located in rural areas only.

The findings show that in more than 90% PUs across the country a supervisory officer visited a sub-centre in the month preceding the survey date, with mean number of sub-centres supervised by each facility during previous month being 8. In almost all states, more than 75% PUs reported undertaking a supervisory visit of a sub-centre in the previous month. Supervisory staff supervised on an average 16 sub-centres in Uttar Pradesh and 11 in Bihar compared to four in Manipur in the month prior to survey (Figure 6.1).

Citizen's charter in local language is to be displayed at the planning unit and according to INCHIS data, 78.2% of PUs in the country were seen to follow this norm. However, only 49% of planning units in West Bengal displayed the charter. Rogi Kalyan Samiti (RKS) is a registered society of a group of trustees to manage affairs of the hospital. According to INCHIS, 78% of PUs across the country have constituted RKS and 68.4% were receiving funds for RKS. Across states, only 27% of planning units in Goa reported constitution of Rogi Kalyan Samiti, followed by 30% in Telangana, 37.5% in Rajasthan, 56.5% in Tamil Nadu, 65% each in Mizoram and Uttarakhand, and 74% in West Bengal. In some states, PUs reported not receiving funds for RKS with only 6% PUs receiving funds in Goa, 11% in Telangana, 30% in Rajasthan, and around 50% each in West Bengal and Odisha.

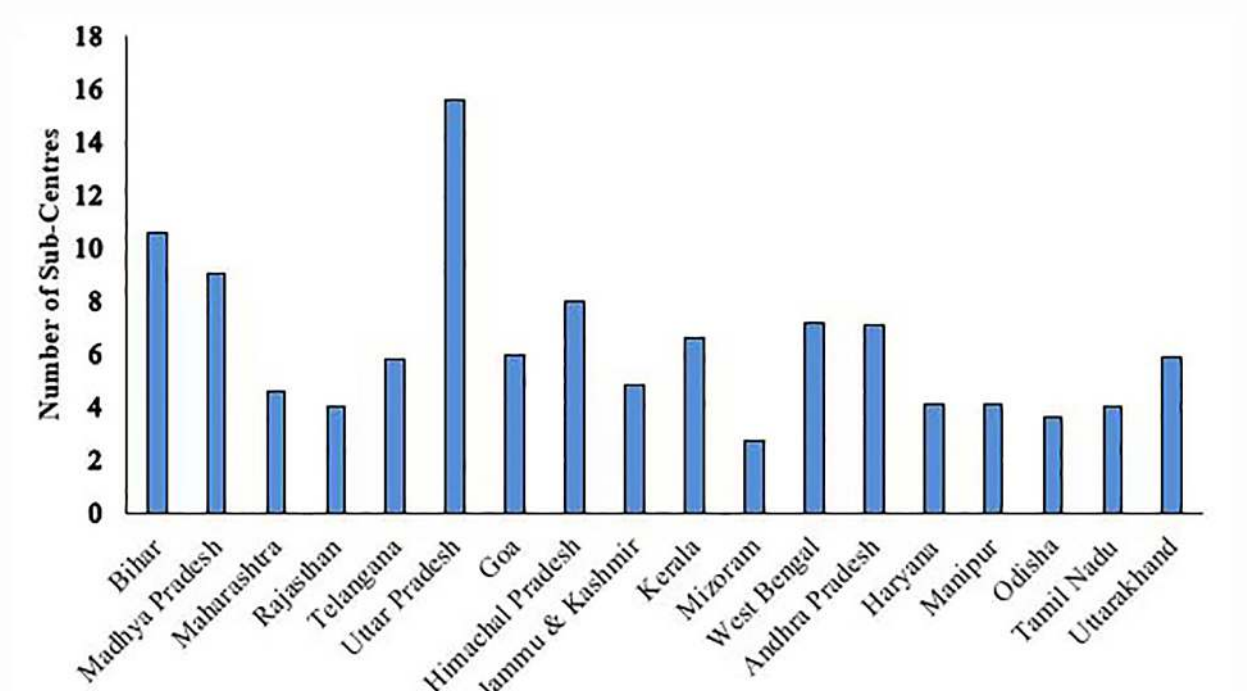


Figure 6.1: Mean Number of Sub-Centers Supervised in Last Month by States: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

Table 6.8: Status of Monitoring and Supervision Activities at Planning Units: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	Number of PUs*	Supervisory officer visited SC in last month	Mean number of SCs supervised last month	Citizen's charter displayed	*Rogi Kalyan Samiti* constituted	Received funds for *Rogi Kalyan Samiti* **
India	330	92.4	8.0	78.2	78.0	68.4
Bihar	40	95.0	10.6	74.5	97.9	97.9
Madhya Pradesh	37	94.6	9.0	78.6	96.4	78.6
Maharashtra	32	90.6	4.6	81.5	96.2	0.74
Rajasthan	43	93.0	4.0	85.7	37.5	28.6
Telangana	22	95.5	5.8	91.9	29.7	10.8
Uttar Pradesh	49	95.9	15.6	67.2	91.8	91.8
Goa	5	100.0	6.0	68.8	27.3	6.25
Himachal Pradesh	27	92.6	8.0	93.6	100.0	87.1
Jammu & Kashmir	26	76.9	4.8	75.0	88.9	86.1
Kerala	20	100.0	6.6	90.6	81.3	68.8
Mizoram	7	85.7	2.7	88.2	64.7	82.4
West Bengal	22	86.4	7.2	48.6	74.3	48.6
Andhra Pradesh	18	83.3	7.1	91.3	69.6	91.3
Haryana	22	100.0	4.1	89.7	93.1	86.2
Manipur	14	92.9	4.1	72.7	86.4	86.4
Odisha	36	86.1	3.6	62.2	93.3	51.1
Tamil Nadu	23	100.0	4	60.9	56.5	89.1
Uttarakhand	15	100.0	5.9	87.0	65.2	78.3

*Out of total 332 PUs located in rural areas, 2 did not respond to these questions as the questions were not applicable to them.
**Question on *Rogi Kalyaan Samiti* funds was asked in INCHIS-2 but in INCHIS-1 it was asked as untied funds.

6.9 Documentation and Micro-Planning

A Routine Immunization Micro-plan is precise and effective management and planning of where, when, who and how of delivering the immunization services. INCHIS-1 and INCHIS-2 included questions on various components related to documentation and planning relevant to day-to-day working of planning units, including components of RI Micro-plan and stock registers. Some of the important documents that comprise the RI Micro-plan are the following:

- ANM roster
- Alternative vaccine delivery plan
- Updated vaccine distribution register
- Sample child health card or immunization card
- Monitoring form
- Updated stock register
- Due cum tally sheet
- MO handbook
- Cold chain handler module
- Health worker module

Table 6.9 summarizes the most important constituents of Micro-plan - ANM roster and alternative vaccine delivery plan examined in the survey, both nationally and by states. Similarly, key constituents of stock registers were identified and summarized to understand the status of documentation and micro-planning at planning units.

Despite its strategic importance in deciding the immunization levels, less than 75% of PUs in the country (69.5%) had both an ANM roster and an alternative vaccine delivery plan in place ("exist and seen at the time of survey"). Comparison across states shows that 29% of planning units in West Bengal and 35% in Uttarakhand had an ANM roster and alternative vaccine delivery plan documents in place. Many other states had less than 75% facilities maintaining the two documents, except Madhya Pradesh, Rajasthan, Telangana, Uttar Pradesh, Kerala, and Haryana where more than 75% PUs had the two documents in place and available at the time of the survey.

Likewise, availability of an updated stock register is another important indicator of smooth management and functioning of health facility and in 82% of the PUs nationally an updated stock register existed and was seen at the time of survey. Compared to RI-Microplan, most states were seen to report maintenance of stock registers. With the exception of five states – Telangana, Mizoram, West Bengal, Andhra Pradesh, and Uttarakhand – in all states more than 75% of PUs had updated stock registers at the time of the survey.

Nationally, in more than 90% of the PUs both an updated vaccine distribution register and a sample child health card or immunization card were seen at the time of the survey. With the exception of Odisha and Uttarakhand, in all states more than 75% of PUs had these documents in place. Immunization monitoring forms and immunization due-cum-tally sheets existed and were seen at more than 80% PUs, but a few states had less than three-quarter of PUs reporting having these forms or sheets.

Availability of immunization hand book for MOs and health worker module was around 60% across the country. Less than 50% PUs in Uttar Pradesh and West Bengal reported having immunization MO handbooks and health worker modules. In Andhra Pradesh no information was provided on the availability of health worker modules but fewer than half of PUs reported availability of MO handbooks on immunization. In many other states, availability of these immunization modules along with cold chain handler modules was reported in less than 75% of planning units.

Table 6.9: Status of Documentation and Micro-planning at Planning Units (% of facilities): INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	Useful RI micro-plan[1]	Updated stock register[2]	Updated vaccine distribution register	Sample immunization card	Monitoring form	Due cum tally sheets	Medical Officer handbook	Cold chain handler module	Health Worker Module
India	69.5	82.0	90.8	91.2	83.4	81.4	61.5	78.2	65.5
Bihar	70.2	91.5	97.9	95.7	93.6	87.2	78.7	93.6	78.7
Madhya Pradesh	78.6	82.1	94.6	87.5	75.0	73.2	46.4	83.9	57.1
Maharashtra	50.0	83.3	77.8	85.2	75.9	66.7	59.3	81.5	64.8
Rajasthan	80.4	83.9	94.6	83.9	83.9	89.3	78.6	82.1	75.0
Telangana	81.1	73.0	91.9	97.3	91.9	89.2	70.3	89.2	75.7
Uttar Pradesh	78.7	82.0	86.9	93.4	78.7	72.1	27.9	72.1	45.9
Goa	68.8	87.5	93.8	100.0	93.8	93.8	62.5	93.8	75.0
Himachal Pradesh	74.2	93.6	96.8	96.8	83.9	93.6	71.0	64.5	64.5
Jammu & Kashmir	66.7	83.3	83.3	94.4	94.4	91.7	69.4	55.6	55.6
Kerala	84.4	84.4	100.0	100.0	87.5	93.8	84.4	78.1	84.4
Mizoram	58.8	70.6	94.1	100.0	82.4	88.2	94.1	82.4	88.2
West Bengal	28.6	62.9	85.7	77.1	60.0	62.9	34.3	62.9	48.6
Andhra Pradesh	69.6	73.9	100.0	100.0	91.3	100.0	47.8	91.3	N/A
Haryana	82.8	86.2	86.2	93.1	96.6	96.6	82.8	79.3	69.0
Manipur	72.7	86.4	81.8	90.9	90.9	81.8	86.4	77.3	72.7
Odisha	64.4	77.8	68.9	68.9	84.4	86.7	71.1	71.1	66.7
Tamil Nadu	58.7	91.3	95.7	93.5	87.0	78.3	80.4	78.3	71.7
Uttarakhand	34.8	73.9	78.3	60.9	56.5	56.5	39.1	78.3	52.2

[1] Micro-plan with ANM roster and alternative vaccine delivery plan in it (these are two of the 11 components of RI micro-plan).
[2] Updated stock register on stocks of vaccine, diluents and other materials related to immunization like syringes, red and black bags were seen

6.10 Vaccine and Cold Chain Management

Vaccine and cold chain management deals with the system of storing and transporting vaccines at recommended temperatures from the point of manufacture to the point of use and regular supply of vaccine logistics to the health facility without any occurrence of stock-outs. Four aspects of vaccine and cold chain management are presented here

- supply of vaccines
- vaccine stock-out
- availability of other vaccine logistics at the planning unit
- awareness and compliance with open vial policy.

Vaccine Supply

Table 6.10 presents information on percentage of planning units that received vaccine supply at least once a month and proportion of PUs receiving stock of each specific vaccine at least six times over the past six months. Nationally, 94% PUs reported receiving supply of vaccines at least once a month; and 18% planning units in Manipur, 17% each in Andhra Pradesh and West Bengal and 11% in Telangana did not receive the supply at least once a month.

Study of stock received at least six times in the past six months for specific vaccines revealed that in half of the states less than 50% of PUs received stocks for Hep-B and OPV at least six times in past six months. Less than half of PUs in states of Rajasthan, Kerala, West Bengal, and Andhra Pradesh reported receiving stocks of almost all vaccines/diluents at least six times in past six months. PUs in states of Madhya Pradesh, Telangana, and Mizoram also showed that less than 75% of PUs were receiving stocks of five or more vaccines.

Question related to number of preventive maintenance visits made by a mechanic in last six months was also asked (data not shown). An average of three preventive visits were made by a mechanic across all PUs. In Madhya Pradesh, the usual number of preventive maintenance visits by mechanic was five compared to only two in Manipur.

Vaccine Stock-Out

Percentage of planning units facing a stock-out at least once in last six months and average longest duration of stock-out (in days) in last six months for specific vaccines based on INCHIS-1 and INCHIS-2 data are presented in Table 6.11 (Part A and Part B). An overview of the table reveals that though the occurrence of stock-outs is a rare event, in Andhra Pradesh almost all PUs reported occurrence of stock-out in the past six months for most of the vaccines. Additionally, average longest duration of stock-out varied from 20-28 days for many vaccines in Andhra Pradesh. This data gets supported with a similar pattern in the sister state of Telangana (though lesser in severity), indicating the problem of stock-out to be common in these two states.

Availability of Other Logistics

Table 6.13 presents state-wise availability of standard logistics at the planning unit in percentages. Availability of Auto-Disabled (AD) syringes, both 0.1 ml and 0.5 ml, was almost universal in all the planning units, except in Manipur where 18% PUs reported non-availability of these. Availability of 5 ml reconstitution syringes was around 98% in the country and across states this number varied from 56% in Uttar Pradesh to 100% in Haryana, Bihar, Tamil Nadu, Telangana, Andhra Pradesh, Goa, Andhra Pradesh and Himachal Pradesh.

Blank RI/mother child protection cards were also available at most PUs except in states of Manipur, Odisha, and Uttarakhand. Vitamin A solution was available in less than half of PUs in Bihar, Mizoram, and Uttarakhand. ORS packets availability was lowest in Mizoram (59%) and low in Kerala (69%). Only 13% of planning units in Kerala reported the availability of Zinc tablet or syrup; and less than

Table 6.10: Vaccine and Cold Chain Management (Vaccine Supply) at Planning Units: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	Vaccine supply at least once a month	Stock received at least 6 times over the past 6 months										
		BCG	Hep-B	OPV	DPT	Measles	TT	Penta*	JE	BCG Diluent	Measles Diluent	JE Diluent
India	94.1	65.7	49.6	69.7	58.2	70.5	63.6	33.1	25.7	65.9	69.7	25.9
Bihar	97.9	78.7	27.7	74.5	42.6	85.1	63.8	68.1	70.2	78.7	85.1	70.2
Madhya Pradesh	94.6	58.9	23.2	69.6	39.3	73.2	58.9	58.9	3.6	64.3	69.6	1.8
Maharashtra	94.5	96.3	100.0	100.0	100.0	98.2	100.0	7.4	11.1	96.3	96.3	13.0
Rajasthan	92.9	41.1	17.9	58.8	26.8	44.6	35.7	30.4	8.9	41.1	42.9	8.9
Telangana	89.2	51.4	43.2	59.5	51.4	51.4	54.1	13.5	40.5	48.7	51.4	37.8
Uttar Pradesh	98.4	88.5	91.8	88.5	86.9	90.2	90.2	N/A	59.0	90.2	88.5	62.3
Goa	93.8	43.8	18.8	68.8	62.5	62.5	31.3	62.5	75.0	50.0	62.5	68.8
Himachal Pradesh	100.0	93.6	93.6	90.3	93.6	93.6	96.8	N/A	6.5	90.3	93.6	22.6
Jammu & Kashmir	97.2	69.4	72.2	80.6	75.0	75.0	80.6	80.6	11.1	69.4	75.0	2.8
Kerala	90.6	40.6	21.9	43.8	40.6	43.8	37.5	40.6	6.3	37.5	43.8	6.3
Mizoram	94.1	70.6	47.1	58.8	58.8	64.7	47.1	41.2	23.5	58.8	70.6	17.7
West Bengal	82.9	28.6	5.7	37.1	17.1	37.1	22.9	22.9	5.7	31.4	37.1	5.7
Andhra Pradesh	82.6	26.1	26.1	26.1	26.1	26.1	26.1	N/A	17.4	21.7	26.1	17.4
Haryana	100.0	96.6	79.3	93.1	89.7	93.1	93.1	96.6	58.6	96.6	93.1	72.4
Manipur	81.8	59.1	68.2	63.6	63.6	63.6	54.6	N/A	31.8	50.0	54.6	27.3
Odisha	100.0	91.1	88.9	93.3	86.7	84.4	93.3	24.4	11.1	84.4	88.9	13.3
Tamil Nadu	93.5	65.2	60.9	78.3	58.7	82.6	58.7	82.6	34.8	65.2	80.4	37.0
Uttarakhand	100.0	56.5	56.5	56.5	47.8	52.2	52.2	4.4	N/A	56.5	52.2	N/A

*Penta vaccine was not launched in states with status "N/A" at the time of INCHIS survey

three-quarter of PUs in Bihar, Kerala, Mizoram, and Uttarakhand had IFA tablets available in the facility. Overall, except for the availability of syringes of all types, PUs in Mizoram reported difficulties in availability of other logistics related to vaccine and cold chain management.

Open Vial Policy

Open Vial Policy (OVP) is the use of open multi-dose vaccine vial in subsequent immunization session for upto four weeks after a vial is opened, provided that the expiry date has not passed, vaccine stored is under correct

Table 6.11: Vaccine and Cold Chain Management (Stock-Outs of Vaccines/Diluents - Part A): INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	BCG		Hep-B		OPV		DPT		Measles	
	Faced*	Avg. duration#	Faced*	Avg. duration#	Faced*	Avg. duration#	Faced*	Avg. duration#	Faced*	Avg. duration#
India	7.5	15.9	5.0	16.6	7.5	15.4	2.9	25.0	6.5	14.8
Bihar	2.1	0.0	0.0	0.0	8.5	0.5	0.0	0.0	8.5	0.3
Madhya Pradesh	1.8	0.1	1.8	0.2	3.6	0.8	0.0	0.0	1.8	0.0
Maharashtra	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rajasthan	8.9	0.8	0.0	0.0	8.9	1.3	7.1	1.5	5.4	0.3
Telangana	21.6	9.4	16.2	6.2	18.9	7.4	18.9	6.8	18.9	6.2
Uttar Pradesh	23.0	1.6	18.0	1.2	21.3	1.6	1.6	0.1	9.8	0.7
Goa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Himachal Pradesh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.7
Jammu & Kashmir	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kerala	0.0	0.0	0.0	0.0	3.1	0.5	0.0	0.0	0.0	0.0
Mizoram	23.5	2.5	29.4	3.2	17.7	0.9	11.8	0.8	23.5	2.9
West Bengal	5.7	0.9	2.9	0.9	2.9	0.3	0.0	0.0	14.3	2.5
Andhra Pradesh	100.0	28.2	100.0	28.2	87.0	24.7	100.0	27.0	100.0	27.2
Haryana	6.9	1.1	0.0	0.0	3.5	0.7	0.0	0.0	0.0	0.0
Manipur	18.2	2.1	18.2	0.8	13.6	2.0	0.0	0.0	13.6	1.4
Odisha	11.1	0.0	6.7	0.0	13.3	0.1	13.3	0.0	6.7	0.4
Tamil Nadu	2.2	0.0	2.2	0.0	2.2	0.0	4.4	0.1	2.2	0.0
Uttarakhand	0.0	0.0	13.0	2.1	8.7	1.4	4.4	0.4	8.7	1.3

* Percent of planning units that faced stock out at least once in last six months
# Average of longest duration of stock-out in last six months

Table 6.12: Vaccine and Cold Chain Management (Stock-Outs by Vaccines/Diluents - Part B): INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	TT		Pentavalent		JE		BCG Diluent		Measles Diluent	
	Faced*	Avg. duration#	Faced*	Avg. duration#	Faced*	Avg. duration#	Faced*	Avg. duration#	Faced*	Avg. duration#
India	2.9	17.6	3.6	20.9	2.3	5.5	4.4	22.1	3.6	19.8
Bihar	0.0	0.0	0.0	0.0	6.4	0.1	2.1	0.0	2.1	0.1
Madhya Pradesh	0.0	0.0	3.6	0.0	0.0	0.0	1.8	0.1	1.8	0.0
Maharashtra	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rajasthan	5.4	0.0	5.4	0.6	0.0	0.0	5.4	1.3	1.8	0.3
Telangana	18.9	6.2	18.9	7.3	0.0	0.0	18.9	7.8	18.9	6.1
Uttar Pradesh	3.3	0.1	0.0	0.0	4.9	0.3	6.6	0.4	4.9	0.3
Goa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Himachal Pradesh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Jammu & Kashmir	0.0	0.0	0.0	0.0	2.8	0.3	0.0	0.0	0.0	0.0
Kerala	0.0	0.0	3.1	0.1	3.1	0.2	0.0	0.0	0.0	0.0
Mizoram	11.8	0.6	17.7	1.9	11.8	1.2	23.5	2.5	17.7	2.5
West Bengal	0.0	0.0	2.9	0.4	2.9	0.0	2.9	0.9	2.9	0.9
Andhra Pradesh	100.0	28.2	100.0	28.2	87.0	24.7	100.0	27.0	100.0	27.2
Haryana	6.9	1.1	0.0	0.0	3.5	0.7	0.0	0.0	0.0	0.0
Manipur	18.2	2.1	18.2	0.8	13.6	2.0	0.0	0.0	13.6	1.4
Odisha	11.1	0.0	6.7	0.0	13.3	0.1	13.3	0.0	6.7	0.4
Tamil Nadu	2.2	0.0	2.2	0.0	2.2	0.0	4.4	0.1	2.2	0.0
Uttarakhand	0.0	0.0	13.0	2.1	8.7	1.4	4.4	0.4	8.7	1.3

* Percent of planning units facing stock-out at least once in last six months
# Average of longest duration of stock-out in last six months

Table 6.13: Vaccine and Cold Chain Management (Availability of Other Logistics): INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	AD (0.1ml) syringes	AD (0.5ml) syringes	5ml reconstitution syringes	Blank RI/ Mother Child Protection Card	Vitamin-A solution	ORS Packet	Plastic Spoon/cap for Vit-A	Red & Black Bags	Paracetamol tablet	Zinc tablet/ syrup	IFA tablet
India	97.1	98.3	92.7	93.1	84.9	94.1	86.8	83.7	94.4	83.9	84.9
Bihar	100.0	100.0	100.0	93.6	42.6	93.6	42.6	91.5	91.5	76.6	63.8
Madhya Pradesh	100.0	100.0	96.4	85.7	92.9	96.4	96.4	92.9	98.2	94.6	98.2
Maharashtra	96.3	98.2	98.2	94.4	96.3	100.0	100.0	92.6	98.2	94.4	94.4
Rajasthan	98.2	100.0	100.0	94.6	85.7	92.9	92.9	92.9	100.0	94.6	94.6
Telangana	100.0	100.0	100.0	100.0	97.3	100.0	97.3	67.6	91.9	97.3	97.3
Uttar Pradesh	96.7	98.4	55.7	95.1	98.4	100.0	96.7	98.4	95.1	90.2	86.9
Goa	100.0	100.0	100.0	100.0	100.0	100.0	100.0	87.5	100.0	87.5	100.0
Himachal Pradesh	100.0	100.0	100.0	100.0	100.0	100.0	100.0	80.7	100.0	96.8	100.0
Jammu & Kashmir	94.4	100.0	100.0	100.0	80.6	100.0	88.9	86.1	83.3	75.0	75.0
Kerala	96.9	96.9	96.9	96.9	96.9	68.8	93.8	62.5	100.0	12.5	50.0
Mizoram	88.2	88.2	88.2	76.5	41.2	58.8	23.5	35.3	64.7	58.8	52.9
West Bengal	88.6	91.4	94.3	77.1	68.6	94.3	77.1	62.9	91.4	91.4	82.9
Andhra Pradesh	100.0	100.0	100.0	100.0	100.0	100.0	100.0	47.8	100.0	100.0	100.0
Haryana	100.0	100.0	100.0	93.1	100.0	93.1	100.0	100.0	100.0	100.0	100.0
Manipur	81.8	81.8	77.3	68.2	77.3	81.8	59.1	63.6	77.3	81.8	77.3
Odisha	97.8	100.0	91.1	60.0	95.6	95.6	91.1	95.6	97.8	95.6	95.6
Tamil Nadu	100.0	100.0	100.0	95.7	97.8	100.0	97.8	95.7	100.0	91.3	100.0
Uttarakhand	91.3	95.7	87.0	69.6	47.8	78.3	60.9	82.6	69.6	73.9	56.5

cold chain condition, vaccine vial septum not submerged in water, vaccine vial monitor not reached discard point, and aseptic techniques are used to withdraw all doses (not for BCG, JE and measles). Based on INCHIS-1 and INCHIS-2 data, percentage of planning units in the country and by state where at least one health staff is aware of open vial policy, PU received guidelines for open vial policy from state/ district and open vial policy is followed by state are presented in Table 6.14.

More than four-fifth of the planning units in all the sampled states were aware of OVP. Knowledge of OVP was universal in Bihar, Uttar Pradesh, Goa, Himachal Pradesh, Madhya Pradesh and Kerala. Almost all the planning units in Maharashtra, Bihar, Rajasthan, Uttar Pradesh, Goa, Himachal Pradesh and Kerala received guidelines for the OVP. An observation of opened vials at the planning unit confirmed that almost all the PUs in Madhya Pradesh, Bihar, Rajasthan, Uttar Pradesh,

Table 6.14: Vaccine and Cold Chain Management (Open Vial Policy): INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	Know about Open Vial Policy	Received guidelines for the Open Vial Policy from state/district	Open Vial Policy followed[1]
India	98.3	96.9	97.7
Bihar	100.0	100.0	100.0
Madhya Pradesh	100.0	98.2	100.0
Maharashtra	98.2	100.0	98.2
Rajasthan	98.2	100.0	100.0
Telangana	97.3	83.8	94.6
Uttar Pradesh	100.0	100.0	100.0
Goa	100.0	100.0	100.0
Himachal Pradesh	100.0	100.0	100.0
Jammu & Kashmir	97.2	91.7	86.1
Kerala	100.0	100.0	100.0
Mizoram	82.4	82.4	82.4
West Bengal	97.1	94.3	100.0
Andhra Pradesh	100.0	78.3	95.7
Haryana	96.6	96.6	96.6
Manipur	86.4	81.8	90.9
Odisha	93.3	86.7	86.7
Tamil Nadu	82.6	80.4	82.6
Uttarakhand	95.7	95.7	91.3

[1]Open vial policy followed was decided by observing for open vials at cold storage point.

Goa, Himachal Pradesh and Kerala followed OVP.

6.11 Cold Chain Equipment

INCHIS asked planning units about the availability and functional status of some essential equipment required for the storage and transportation of vaccine vials. Percentage of planning units with availability of ice-lined refrigerator (ILR), deep freezer, cold box, vaccine carrier and temperature log book by state, based on INCHIS-1 and INCHIS-2 data, are presented in Table 6.15. ILR availability and functionality was around 97% nationally, but among states, Mizoram and Manipur, each reported 77% of planning units with functional ILRs compared to Bihar, Madhya Pradesh, Uttar Pradesh, Goa, Himachal Pradesh, Kerala and Uttarakhand where all the planning units reported presence of a functional ILR.

Deep freezer availability and functionality was also high nationally (97%) and common in Madhya Pradesh, Goa, Himachal Pradesh, Kerala, West Bengal and Uttarakhand, with all facilities reporting their presence. Availability of functional cold box ranged from 81% in Jammu & Kashmir to 100% in Bihar, Rajasthan, Uttar Pradesh, Telangana, Maharashtra, Goa, Kerala, West Bengal, and Andhra Pradesh. Vaccine carriers were available and functional in more than 95% of facilities across all states and nationally. Availability of functional temperature log books was reported by more than 90% facilities in the country and almost all states, except in Mizoram and Manipur where 59% and 77% of facilities reported availability of these.

To check whether equipment at the health facility is functioning properly, interviewers were asked to observe the vaccine storage area and to record functionality of ILR/deep freezer, thermometer inside refrigerator, temperature inside refrigerator, how and often temperatures are recorded in the log book, etc. Table 6.16 presents percentage of planning units where temperature of ILR and/or deep freezer was found to be maintained at the normal range on the day of survey. The normal temperature for ILR is recommended to be between +2° Celsius to +8° Celsius and for Deep freezer between -15° Celsius to -25° Celsius.

The percentage of planning units where ILR's recorded temperatures in normal range varied from 12% in Mizoram to 59-89% in Manipur, Telangana, Andhra Pradesh, Odisha, Haryana, Uttarakhand, Bihar, Jammu & Kashmir and Tamil Nadu, and between 90 to 97% in Himachal Pradesh, West Bengal, Goa, Maharashtra, Uttar Pradesh, Madhya Pradesh, Rajasthan and Kerala. Similarly, percentage of planning units with deep freezers maintained within recommended temperature range varied from 32% in Manipur to 100% in Uttarakhand.

6.12 AEFI Reporting and Monitoring

An Adverse Event Following Immunization (AEFI) is any untoward medical occurrence which follows immunization and which does not necessarily have a causal relationship with the usage of the vaccine. Incidence of such events may prevent many children from getting immunized; however, a prompt detection, reporting and response to such events can significantly minimize its negative impact on public health. Table 6.17 illustrates INCHIS-collected information pertaining to AEFIs on the availability of AEFI management kit, system for AEFI, reporting of serious/non-serious AEFI, total cases of serious/non-serious AEFI, and blank First Information Report (FIR).

AEFI management kit was available in 73% of facilities across the country but its availability varied from 24% in Mizoram to being universal in Haryana. In addition to Mizoram, less than 50% of facilities in Maharashtra, Jammu & Kashmir, West Bengal, and Uttarakhand had AEFI management kits. Eighty six percent of planning units in the country reported a system in place for reporting and monitoring AEFIs; however, only around 50% planning units in Jammu and Kashmir and Odisha, 65% in Andhra Pradesh, and 74% in Maharashtra confirmed having such a system in place. All

Table 6.15: Cold Chain Equipment Availability and Functional Status at Planning Units: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	Ice-Lined Refrigerator[1]		Deep Freezer[2]		Cold Box		Vaccine Carrier		Temperature Log Book	
	Available	Available and Functional	Available	Available and Functional	Available	Available and Functional	Available	Available and Functional	Available	Available and Functional
India	98.5	96.9	97.7	96.7	97.9	97.5	99.4	99.2	97.3	96.9
Bihar	100.0	100.0	97.9	95.7	100.0	100.0	100.0	100.0	100.0	100.0
Madhya Pradesh	100.0	100.0	100.0	100.0	98.2	98.2	100.0	100.0	100.0	100.0
Maharashtra	98.2	98.2	98.2	96.3	100.0	100.0	100.0	100.0	100.0	100.0
Rajasthan	98.2	98.2	96.4	96.4	100.0	100.0	98.2	98.2	98.2	98.2
Telangana	94.6	94.6	91.9	91.9	100.0	100.0	97.3	97.3	94.6	91.9
Uttar Pradesh	100.0	100.0	100.0	98.4	100.0	100.0	100.0	100.0	98.4	98.4
Goa	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Himachal Pradesh	100.0	100.0	100.0	100.0	93.6	93.6	100.0	100.0	100.0	100.0
Jammu & Kashmir	100.0	86.1	88.9	86.1	83.3	80.6	100.0	97.2	94.4	91.7
Kerala	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mizoram	82.4	76.5	100.0	94.1	94.1	88.2	94.1	94.1	58.8	58.8
West Bengal	100.0	94.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Andhra Pradesh	100.0	95.7	95.7	95.7	100.0	100.0	100.0	100.0	100.0	100.0
Haryana	93.1	93.1	93.1	93.1	96.6	96.6	96.6	96.6	96.6	96.6
Manipur	90.9	77.3	86.4	81.8	90.9	90.9	95.5	95.5	77.3	77.3
Odisha	95.6	93.3	97.8	93.3	95.6	93.3	97.8	95.6	97.8	95.6
Tamil Nadu	91.3	91.3	91.3	91.3	95.7	93.5	97.8	95.7	95.7	93.5
Uttarakhand	100.0	100.0	100.0	100.0	100.0	95.7	100.0	100.0	100.0	100.0

1 Ice-Lined Refrigerator (ILR) availability, and availability and functionality represents either large or small ILR
2 Deep freezer availability, and availability and functionality represent either large or small deep freezer

Table 6.16: Vaccine Storage Area Temperature: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	Temperature of ILR in normal range (+2˚C to +8˚C)	Temperature of deep freezer in normal range (-15˚C to -25˚C)
India	87.9	74.9
Bihar	85.1	68.1
Madhya Pradesh	96.4	94.6
Maharashtra	94.4	77.8
Rajasthan	96.4	71.4
Telangana	64.9	83.8
Uttar Pradesh	95.1	55.7
Goa	93.8	87.5
Himachal Pradesh	90.3	83.9
Jammu & Kashmir	86.1	63.9
Kerala	96.9	93.8
Mizoram	11.8	64.7
West Bengal	91.4	62.9
Andhra Pradesh	65.2	73.9
Haryana	79.3	79.3
Manipur	59.1	31.8
Odisha	66.7	42.2
Tamil Nadu	89.1	95.7
Uttarakhand	82.6	100.0

Table 6.17: AEFI Reporting and Monitoring at Planning Units: INCHIS-1 (Mar-Apr 2015) and INCHIS-2 (Sep-Oct 2015) Data

State	AEFI Mgmt. kit available	System for monitoring AEFI	Reported any AEFI in last 6 months	Cases of serious AEFI	Cases of non-serious AEFI	MO trained on AEFI guidelines	Blank FIR available
India	72.8	86.2	12.1	48	131	77.0	68.4
Bihar	85.1	95.7	0.0	0	0	97.1	87.2
Madhya Pradesh	80.4	91.1	17.9	10	87	87.5	69.6
Maharashtra	40.7	74.1	5.6	1	2	87.0	57.4
Rajasthan	94.6	89.3	8.9	6	12	60.7	78.6
Telangana	89.2	83.8	10.8	17	4	78.4	67.6
Uttar Pradesh	91.8	96.7	8.2	3	13	93.4	57.4
Goa	87.5	100.0	50.0	1	1	81.3	100.0
Himachal Pradesh	71.0	87.1	3.2	0	1	61.3	93.6
Jammu & Kashmir	47.2	50.0	8.3	2	1	55.6	36.1
Kerala	84.4	100.0	15.6	0	7	78.1	96.9
Mizoram	23.5	88.2	5.9	1	1	70.6	35.3
West Bengal	42.9	80.0	37.1	7	2	48.6	48.6
Andhra Pradesh	82.6	65.2	13.0	6	53	39.1	47.8
Haryana	100.0	89.7	6.9	0	2	75.9	96.6
Manipur	63.6	86.4	13.6	0	0	77.3	63.6
Odisha	77.8	48.9	4.4	3	0	42.2	26.7
Tamil Nadu	91.3	89.1	10.9	2	0	80.4	69.6
Uttarakhand	47.8	78.3	0.0	0	0	87.0	65.2

planning units in Goa and Kerala reported systems in place for monitoring and reporting AEFIs for all vaccines.

Reporting of any serious/non-serious AEFI varied from no health facility reporting AEFIs in last six months in Bihar and Uttarakhand to almost 50% health facilities in Goa reporting either a serious or a non-serious event. Overall, 12% of facilities in the country reported a serious or a non-serious AEFI in last six months. Total cases of serious AEFI was highest in Telangana (17), followed by Madhya Pradesh (10), West Bengal (7), Andhra Pradesh (6), Rajasthan (6), Odisha (3), Uttar Pradesh (3), Tamil Nadu (2), Jammu & Kashmir (2), Mizoram (1), Goa (1) and Maharashtra (1), making it a total of 48 cases across the country. No case of serious AEFI was reported in Bihar, Himachal Pradesh, Kerala, Manipur, Haryana and Uttarakhand.

In Andhra Pradesh, Odisha, and West Bengal, less than half of the facilities reported that their MO received training on AEFI guidelines, although the national average was 77%. Less than three-fourth of facilities in Rajasthan, Himachal Pradesh, Jammu & Kashmir and Mizoram reported receiving MO training on AEFI guidelines. In very few states, more than 75% facilities reported availability of blank FIR form.

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APPENDIX

Appendix A: List of Sampled Districts in INCHIS

Table A.1: List of sampled districts for INCHIS states across INCHIS rounds and their Mission Indhradhannush status

State	District	INCHIS-round	MI phase 1 operational status
Andhra Pradesh	East Godavari	INCHIS-1 only	MI
Andhra Pradesh	Kurnool	INCHIS-1 only	MI
Andhra Pradesh	Prakasam	INCHIS-1 only	Non-MI
Andhra Pradesh	Visakhapatnam	INCHIS-1 only	MI
Bihar	Bhagalpur	INCHIS-2 only	MI
Bihar	Pashchimchmaparan	INCHIS-2 only	MI
Bihar	Araria	INCHIS-1 and INCHIS-2 both	MI
Bihar	Darbhanga	INCHIS-1 and INCHIS-2 both	MI
Bihar	Gaya	INCHIS-1 and INCHIS-2 both	MI
Bihar	Kishanganj	INCHIS-1 and INCHIS-2 both	MI
Bihar	Muzaffarpur	INCHIS-1 and INCHIS-2 both	MI
Bihar	Rohtas	INCHIS-1 and INCHIS-2 both	MI
Bihar	Samastipur	INCHIS-1 and INCHIS-2 both	MI
Bihar	Sheikhpura	INCHIS-1 and INCHIS-2 both	MI
Goa	North Goa	INCHIS-2 only	Non-MI
Goa	South Goa	INCHIS-2 only	Non-MI
Himachal Pradesh	Chamba	INCHIS-2 only	MI
Himachal Pradesh	Hamirpur	INCHIS-2 only	MI
Himachal Pradesh	Mandi	INCHIS-2 only	MI
Himachal Pradesh	Solan	INCHIS-2 only	MI
Haryana	Faridabad	INCHIS-1 only	MI
Haryana	Fatehabad	INCHIS-1 only	MI
Haryana	Kurukshetra	INCHIS-1 only	MI

State	District	INCHIS-round	MI phase 1 operational status
Haryana	Mewat	INCHIS-1 only	MI
Haryana	Panipat	INCHIS-1 only	MI
Jammu & Kashmir	Badgam	INCHIS-2 only	Non-MI
Jammu & Kashmir	Kathua	INCHIS-2 only	Non-MI
Jammu & Kashmir	Kupwara	INCHIS-2 only	Non-MI
Jammu & Kashmir	Reasi	INCHIS-2 only	Non-MI
Jammu & Kashmir	Srinagar	INCHIS-2 only	Non-MI
Kerala	Alappuzha	INCHIS-2 only	Non-MI
Kerala	Idukki	INCHIS-2 only	Non-MI
Kerala	Kottayam	INCHIS-2 only	Non-MI
Kerala	Kozhikode	INCHIS-2 only	Non-MI
Madhya Pradesh	Neemuch	INCHIS-2 only	Non-MI
Maharashtra	Solapur	INCHIS-2 only	Non-MI
Mizoram	Aizwal	INCHIS-2 only	Non-MI
Mizoram	Kolasib	INCHIS-2 only	Non-MI
Mizoram	Lawngtlai	INCHIS-2 only	MI
Mizoram	Saiha	INCHIS-2 only	MI
Madhya Pradesh	Alirajpur	INCHIS-1 and INCHIS-2 both	MI
Madhya Pradesh	Anuppur	INCHIS-1 and INCHIS-2 both	MI
Madhya Pradesh	Balaghat	INCHIS-1 and INCHIS-2 both	Non-MI
Madhya Pradesh	Bhind	INCHIS-1 and INCHIS-2 both	Non-MI
Madhya Pradesh	Burhanpur	INCHIS-1 and INCHIS-2 both	Non-MI
Madhya Pradesh	Chhatarpur	INCHIS-1 and INCHIS-2 both	MI
Madhya Pradesh	Indore	INCHIS-1 and INCHIS-2 both	Non-MI
Madhya Pradesh	Mandla	INCHIS-1 and INCHIS-2 both	MI
Madhya Pradesh	Sagar	INCHIS-1 and INCHIS-2 both	MI
Madhya Pradesh	Satna	INCHIS-1 and INCHIS-2 both	MI
Madhya Pradesh	Tikamgarh	INCHIS-1 and INCHIS-2 both	MI

State	District	INCHIS-round	MI phase 1 operational status
Madhya Pradesh	Vidisha	INCHIS-1 and INCHIS-2 both	MI
Maharashtra	Bhandara	INCHIS-1 and INCHIS-2 both	Non-MI
Maharashtra	Dhule	INCHIS-1 and INCHIS-2 both	MI
Maharashtra	Hingoli	INCHIS-1 and INCHIS-2 both	MI
Maharashtra	Jalgaon	INCHIS-1 and INCHIS-2 both	MI
Maharashtra	Nashik	INCHIS-1 and INCHIS-2 both	MI
Maharashtra	Pune	INCHIS-1 and INCHIS-2 both	Non-MI
Maharashtra	Ratnagiri	INCHIS-1 and INCHIS-2 both	Non-MI
Maharashtra	Thane	INCHIS-1 and INCHIS-2 both	MI
Manipur	Churachandpur	INCHIS-1 only	MI
Manipur	Imphal West	INCHIS-1 only	Non-MI
Manipur	Tamenglong	INCHIS-1 only	MI
Manipur	Thoubal	INCHIS-1 only	Non-MI
Odisha	Baudh	INCHIS-1 only	MI
Odisha	Bhadrak	INCHIS-1 only	Non-MI
Odisha	Gajapati	INCHIS-1 only	MI
Odisha	Ganjam	INCHIS-1 only	MI
Odisha	Khordha	INCHIS-1 only	MI
Odisha	Nabarangapur	INCHIS-1 only	MI
Rajasthan	Jodhpur	INCHIS-2 only	MI
Rajasthan	Alwar	INCHIS-1 and INCHIS-2 both	MI
Rajasthan	Barmer	INCHIS-1 and INCHIS-2 both	MI
Rajasthan	Chittaurgarh	INCHIS-1 and INCHIS-2 both	MI
Rajasthan	Dhaulpur	INCHIS-1 and INCHIS-2 both	MI
Rajasthan	Ganganagar	INCHIS-1 and INCHIS-2 both	MI
Rajasthan	Jaipur	INCHIS-1 and INCHIS-2 both	MI
Rajasthan	Pratapgarh	INCHIS-1 and INCHIS-2 both	MI
Rajasthan	Tonk	INCHIS-1 and INCHIS-2 both	MI

State	District	INCHIS-round	MI phase 1 operational status
Tamil Nadu	Ariyalur	INCHIS-1 only	Non-MI
Tamil Nadu	Coimbatore	INCHIS-1 only	MI
Tamil Nadu	Sivaganga	INCHIS-1 only	Non-MI
Tamil Nadu	Tiruchirappalli	INCHIS-1 only	MI
Tamil Nadu	Tirunelveli	INCHIS-1 only	MI
Tamil Nadu	Vellore	INCHIS-1 only	MI
Tamil Nadu	Viluppuram	INCHIS-1 only	Non-MI
Tamil Nadu	Virudhunagar	INCHIS-1 only	MI
Telangana	Hyderabad	INCHIS-1 and INCHIS-2 both	Non-MI
Telangana	Khammam	INCHIS-1 and INCHIS-2 both	Non-MI
Telangana	Mahbubnagar	INCHIS-1 and INCHIS-2 both	MI
Telangana	Warangal	INCHIS-1 and INCHIS-2 both	Non-MI
Uttar Pradesh	Raebareli	INCHIS-2 only	MI
Uttar Pradesh	Allahabad	INCHIS-1 and INCHIS-2 both	MI
Uttar Pradesh	Azamgarh	INCHIS-1 and INCHIS-2 both	MI
Uttar Pradesh	Bahraich	INCHIS-1 and INCHIS-2 both	MI
Uttar Pradesh	Farrukhabad	INCHIS-1 and INCHIS-2 both	MI
Uttar Pradesh	Ghaziabad	INCHIS-1 and INCHIS-2 both	MI
Uttar Pradesh	Hardoi	INCHIS-1 and INCHIS-2 both	MI
Uttar Pradesh	Mahoba	INCHIS-1 and INCHIS-2 both	Non-MI
Uttar Pradesh	Mathura	INCHIS-1 and INCHIS-2 both	MI
Uttar Pradesh	Moradabad	INCHIS-1 and INCHIS-2 both	MI
Uttar Pradesh	Muzaffarnagar	INCHIS-1 and INCHIS-2 both	MI
Uttar Pradesh	Sant Ravidas Nagar (Bhadohi)	INCHIS-1 and INCHIS-2 both	MI
Uttar Pradesh	Sitapur	INCHIS-1 and INCHIS-2 both	MI
Uttarakhand	Bageshwar	INCHIS-1 only	Non-MI
Uttarakhand	Chamoli	INCHIS-1 only	Non-MI

State	District	INCHIS-round	MI phase 1 operational status
Uttarakhand	Dehradun	INCHIS-1 only	Non-MI
Uttarakhand	Hardwar	INCHIS-1 only	MI
West Bengal	Birbhum	INCHIS-2 only	MI
West Bengal	Kochbihar	INCHIS-2 only	Non-MI
West Bengal	North24parganas	INCHIS-2 only	MI
West Bengal	Purbamedinipur	INCHIS-2 only	Non-MI

Appendix B: Detailed Calculations of Design Weights

Let's define π_{ka} as the probability of selecting the kth household (HH) in the ath state; $a = 1, \ldots, 12$. Design weight is the inverse of the selection probability, which takes care of unequal selection probability. Design weight is the key component of survey weight, which incorporates nonresponse adjustment, and post stratification adjustment by key demographics.

The quantity π_{ka} can be calculated as follows:

$$\begin{aligned}\pi_{ka} &= Prob.(selecting\ the\ kth\ HH\ in\ the\ ath\ state)\\ &= Prob.(selecting\ the\ kth\ HH \mid kth\ HH \in jth\ cluster)\\ &\times Prob.(selecting\ the\ jth\ cluster \mid jth\ cluster \in ith\ district)\\ &\times Prob.(selecting\ the\ ith\ district)\\ &= P_1 \times P_2 \times P_3\end{aligned}$$

Now,

$$P_1 = Prob.(selecting\ the\ kth\ HH \mid kth\ HH \in jth\ cluster)$$

$$= \begin{cases} \frac{n_j}{N_j}; if\ jth\ cluster\ was\ not\ segmented. n_j = number\ of\ responding\ HHs\ and \\ N_j = total\ number\ of\ eligible\ HHs\ in\ the\ jth\ cluster. \\ \frac{n_{sj}}{N_{sj}} \times \frac{1}{S_j}; if\ cluster\ j\ was\ segmented\ into\ S_j\ segments\ and \\ the\ quantities\ n_{sj}\ and\ N_{sj}\ are\ the\ orresponding\ numbers\ in\ the\ sth\ segment\ of\ the\ jth\ cluster. \end{cases}$$

Note that P_1 automatically takes care of nonresponse rate at the household selection level as number of responding units were considered in the numerator (not sample size).

$$P_2 = Prob.(selecting\ the\ jth\ cluster \mid jth\ cluster \in ith\ district)$$

$$= \frac{c_i}{C_i};\ c_i = number\ of\ sampled\ clusters\ from\ the\ ith\ district\ and\ C_i = total\ number\ of\ clusters\ in\ the\ ith\ district.$$

Note that P_2 was calculated separately for villages and urban wards.

$$P_3 = Prob.(selecting\ the\ ith\ district) = \frac{d_a}{D_a};\ d_a = number\ of\ sampled\ districts\ from\ the\ ath\ state\ and\ D_a = total\ number\ of\ districts\ in\ the\ ath\ state.$$

As discussed in section 2.8.2, for four large (Bihar, MP, Rajasthan and UP) states and India, P_3 was adjusted to account for oversampling of MI districts.

Appendix C: Coverage Rate Definition for Each Vaccine

Coverage rates for BCG, OPV0, Hep-B0, and measles have been calculated as per the definition given in Section 4.2.2. Coverage rates for different doses of OPV and DPT/Penta are discussed below.

OPV1 (One dose of Polio): As in the case of other vaccines, to create this variable first preference was given to information obtained from vaccination card, if available.

- A child was defined to receive one dose of OPV:
  - If there was a valid full date (DD/MM/YYYY) corresponding to at least one of three doses of OPV.
  - If no valid full dates were available in the card (for any of the three doses of OPV), but the card indicated that at least one dose of OPV was given (recorded as '44' corresponding to at least one of three doses of OPV).
  - If no valid full dates were available in the card, but part of the date was available (coded as '99' in the missing field) corresponding to at least one of three doses of OPV.

If there was no record of vaccination in the card corresponding to all three doses of OPV (coded as '0' or all date fields are coded as '99') or no card was shown to the interviewer (coded as '.' or 'NA'), information on vaccination status was obtained from mother's recall section:

- If mother responded ≥ 1 to the question "How many times was the polio drop given till date (excluding birth dose)?", it was treated as vaccination received.
- If mother responded 0, it was treated as vaccination not received.
- If mother's recall was missing (coded as '.' or 'NA') then
  - If record in the card says '0' corresponding to all three doses of OPV, it was treated as vaccination not received.
  - If record in the card says '.' or 'NA' corresponding to all three doses of OPV, it was considered missing.

OPV2 (Two doses of Polio):

- A child was defined to receive two doses of OPV:
  - If there was a valid full date (DD/MM/YYYY) corresponding to at least two of three doses of OPV.
  - If '44' was recorded corresponding to at least two of three doses of OPV.
  - If part of the date was available (coded as '99' in the missing field) corresponding to at least two of three doses of OPV.
  - If any combination of the above three scenarios holds true for at least two of three doses of OPV.

If there was no record of vaccination in the card corresponding to at least two doses of OPV (coded as '0' or all date fields are coded as '99') or no card was shown to the interviewer (coded as '.' or 'NA'), information on vaccination status was obtained from mother's recall section:

- If mother responded ≥ 2 to the question "How many times was the polio drop given till date (excluding birth dose)?", it was treated as vaccination received.
- If mother responded 0 or 1, it was treated as vaccination not received.
- If mother's recall was missing (coded as '.' or 'NA') then
  - If record in the card says '0' corresponding to at least two doses of OPV, it was treated as vaccination not received.
  - If record in the card says '.' or 'NA'

corresponding to at least two doses of OPV, it was considered missing.

OPV3 (Three doses of Polio):

- A child was defined to receive three doses of OPV:
  - If there was a valid full date (DD/MM/YYYY) corresponding to all three doses of OPV.
  - If '44' was recorded corresponding to all three doses of OPV.
  - If part of the date was available (coded as '99' in the missing field) corresponding to all three doses of OPV.
  - If any combination of the above three scenarios holds true for three doses of OPV.

If there was no record of vaccination in the card corresponding to at least one dose of OPV (coded as '0' or all date fields are coded as '99') or no card was shown to the interviewer (coded as '.' or 'NA'), information on vaccination status was obtained from mother's recall section:

- If mother responded ≥ 3 to the question "How many times was the polio drop given till date (excluding birth dose)?", it was treated as vaccination received.
- If mother responded < 3, it was treated as vaccination not received.
- If mother's recall was missing (coded as '.' or 'NA') then
  - If record in the card says '0' corresponding to at least one dose of OPV, it was treated as vaccination not received.
  - If record in the card says '.' or 'NA' corresponding to at least one dose of OPV, it was considered missing.

DPT/Pentavalent vaccine: In this report we did not differentiate between DPT and Penta vaccine (as Penta includes DPT) and reported coverage of different doses of DPT or Penta (DPT/Penta). In order to define different doses of DPT/Penta, first we define the variable from mother's recall. There are two relevant questions in the mother's recall section:

Q1. Was a Pentavalent (5-in-1) or DPT injection given in the thigh at the same time as the polio drops?

Q2. How many times was the Pentavalent (5-in-1) or DPT vaccine given?

Based on the above two questions, we define different doses of DPT/Penta from mother's recall (MR_DPT/Penta_dose) as follows:

- If mother responded 'Yes' to Q1 and Q2 was recorded 0, then MR_DPT/Penta_dose = 0.
- If mother responded 'No' or 'Don't know' to Q1 and Q2 was missing, then MR_DPT/Penta_dose = 0.
- If mother responded 'Yes' to Q1 and Q2 was recorded any positive number (≥1), then MR_DPT/Penta_dose = 1.
- If mother responded 'Yes' to Q1 and Q2 was recorded missing, then MR_DPT/Penta_dose = 1.
- If mother responded 'Yes' to Q1 and Q2 was recorded ≥2, then MR_DPT/Penta_dose = 2.
- If mother responded 'Yes' to Q1 and Q2 was recorded ≥3, then MR_DPT/Penta_dose = 3.
- If mother's response to Q1 is missing, then MR_DPT/Penta_dose was also considered as missing.

DPT1/Penta1 (One dose of DPT/Penta): To create this variable, first preference was given to information obtained from vaccination card, if available.

- A child was defined to receive one dose of DPT/Penta:
  - If there was a valid full date (DD/MM/YYYY) corresponding to at least one of three doses of DPT or Penta.
  - If no valid full dates were available in the card (for any of the three doses of DPT or Penta), but the card indicated that at least one dose of DPT or Penta was given (recorded as '44' corresponding to at least one of three doses of DPT or Penta).
  - If no valid full dates were available in the

card, but part of the date was available (coded as '99' in the missing field) corresponding to at least one of three doses of DPT or Penta.

If there was no record of vaccination in the card corresponding to all three doses of DPT or Penta (coded as '0' or all date fields are coded as '99') or no card was shown to the interviewer (coded as '.' or 'NA'), information on vaccination status was obtained from mother's recall section:

- If MR_DPT/Penta_dose ≥1, it was treated as vaccination received.
- If MR_DPT/Penta_dose = 0, it was treated as vaccination not received.
- If MR_DPT/Penta_dose is missing then
  - If record in the card says '0' corresponding to all three doses of DPT or Penta, it was treated as vaccination not received.
  - If record in the card says '.' or 'NA' corresponding to all three doses of DPT or Penta, it was considered missing.

DPT2/Penta2 (Two doses of DPT/Penta):

- A child was defined to receive two doses of DPT/Penta:
  - If there was a valid full date (DD/MM/YYYY) corresponding to at least two of three doses of DPT or Penta.
  - If '44' was recorded corresponding to at least two of three doses of DPT or Penta.
  - If part of the date was available (coded as '99' in the missing field) corresponding to at least two of three doses of DPT or Penta.
  - If any combination of the above three scenarios holds true for at least two of three doses of DPT or Penta.

If there was no record of vaccination in the card corresponding to least two doses of DPT or Penta (coded as '0' or all date fields are coded as '99') or no card was shown to the interviewer (coded as '.' or 'NA'), information on vaccination status was obtained from mother's recall section:

- If MR_DPT/Penta_dose ≥2, it was treated as vaccination received.
- If MR_DPT/Penta_dose = 0 or 1, it was treated as vaccination not received.
- If MR_DPT/Penta_dose is missing then
  - If record in the card says '0' corresponding to at least two doses of DPT or Penta, it was treated as vaccination not received.
  - If record in the card says '.' or 'NA' corresponding to at least two doses of DPT or Penta, it was considered missing.

DPT3/Penta3 (Three doses of DPT/Penta):

- A child was defined to receive three doses of DPT/Penta:
  - If there was a valid full date (DD/MM/YYYY) corresponding to all three doses of DPT or Penta.
  - If '44' was recorded corresponding to all three doses of DPT or Penta.
  - If part of the date was available (coded as '99' in the missing field) corresponding to all three doses of DPT or Penta.
  - If any combination of the above three scenarios holds true for three doses of DPT or Penta.

If there was no record of vaccination in the card corresponding to at least one dose of DPT or Penta (coded as '0' or all date fields are coded as '99') or no card was shown to the interviewer (coded as '.' or 'NA'), information on vaccination status was obtained from mother's recall section:

- If MR_DPT/Penta_dose = 3, it was treated as vaccination received.
- If MR_DPT/Penta_dose < 3, it was treated as vaccination not received.
- If MR_DPT/Penta_dose is missing then
  - If record in the card says '0' corresponding to at least one dose of DPT or Penta, it was treated as vaccination not received.
  - If record in the card says '.' or 'NA' corresponding to at least one dose of DPT or Penta, it was considered missing.

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