Evaluation of Routine Immunisation Services in a Community Development Block of Jodhpur: A mixed method study

Thesis

Submitted to

All India Institute of Medical Sciences, Jodhpur

In partial fulfilment of the requirement for the degree of

DOCTOR OF MEDICINE (MD)

(COMMUNITY MEDICINE)

July 2020 **DR. BHARAT VAISHNAV**

AIIMS, JODHPUR

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CERTIFICATE

This is to certify that this thesis entitled **"Evaluation of Routine Immunisation Services in a Community Development Block of Jodhpur: A mixed method study"** is an original work of **Dr. Bharat Vaishnav** carried out under our direct supervision and guidance at Department of Community Medicine and Family Medicine, All India Institute of Medical Sciences, Jodhpur.

Guide

Dr. Naveen K. H.
Associate Professor
Department of CMFM
AIIMS Jodhpur

Forwarded by

14/01/2023

Dr. Pankaja Raghav
Professor and Head
Department of CMFM
AIIMS Jodhpur

DEPARTMENT OF COMMUNITY MEDICINE AND FAMILY MEDICINE
ALL INDIA INSTITUTE OF MEDICAL SCIENCES, JODHPUR

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Guide

Dr. Naveen K. H.
Associate Professor

Co-Guides

Dr. Pankaj Bhardwaj
Additional Professor

Dr. Manoj Kumar Gupta
Additional Professor

Dr. Akhil Dhanesh Goel
Associate Professor

Dr. Prem Prakash Sharma
Associate Professor

ALL INDIA INSTITUTE OF MEDICAL SCIENCES, JODHPUR

DECLARATION

I, hereby declare that the work reported in the thesis entitled **"Evaluation of Routine Immunisation Services in a Community Development Block of Jodhpur: A mixed method study"** embodies the result of original research work carried out by undersigned in the Department of Community Medicine and Family Medicine, All India Institute of Medical Sciences, Jodhpur.

I further state that no part of the thesis has been submitted either in part or in full for any other degree of All India Institute of Medical Sciences or any other institution/University.

Dr. Bharat Vaishnav

Junior Resident

Department of Community Medicine & Family Medicine

All India Institute of Medical Sciences, Jodhpur

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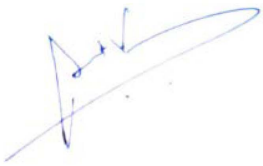

Dr. Bharat Vaishnav

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List of abbreviations

AD	Auto-Disable
AEFI	Adverse effect following Immunization
ANM	Auxiliary Nursing Midwifery
AVC	Appropriately Vaccinated Children
AVD	Alternate Vaccine Delivery
ASHA	Accredited Social Health Activist
ASER	Annual Status of Education Report
BP	Blood Pressure
BMW	Bio Medical Waste
CHO	Community Health Officer
CHC	Community Health Centre
FGD	Focus Group Discussion
IMI	Intensified Mission Indradhanush
IDI	In Depth Interview
MO	Medical Officer
NTAG	National Technical Advisory Group on Immunisation
ORS	Oral Rehydration Solution
PHC	Primary Health centre
RCH	Reproductive and child health
RI	Routine Immunisation
SIA	Supplementary Immunization Activity
SSM	Session Site Monitoring
UIP	Universal Immunisation Programme
VHND	Village Health Nutrition Day
VVM	Vaccine Vial Monitoring
WHO	World Health Organization

SUMMARY OF THESIS

Background

Immunisation is critical to a child's survival. For infants, missing Routine Immunization (RI) can be fatal. Immunisation is one of the most effective and cost-effective strategies for protecting the lives and future of children. More than half of the world's most vulnerable children remain deprived of the vaccines they require to survive and live healthy lives. If vaccinated children, 4-5 million deaths could be prevented worldwide.

Aim

To evaluate the routine immunisation services in a Community Development Block of Jodhpur.

Objectives

1. To assess the routine immunisation coverage in a community development block of Jodhpur
2. To find out the determinants of routine immunisation in a community development block of Jodhpur
3. To explore the barriers and challenges in implementing RI services in a community development block of Jodhpur

Methodology

This was an explanatory sequential mixed method study, including a cross-sectional study followed by a qualitative study. This was conducted in a Luni community development block of Jodhpur, which was selected by convenient sampling. A cross-sectional study was conducted by the WHO 30x7 cluster sampling method using a validated semi-structured questionnaire that included socio-demographic data, antenatal data, place and type of delivery, details of vaccination, and reasons for not vaccinating/partial vaccination. In the first stage, clusters (each village represented a mutually exclusive cluster) were selected systematically, and in the second stage, houses were selected by a simple random sampling method. Seven youngest children aged 12-23 months in the seven households were selected per village (cluster). Finally, a total of 210 children were selected from 30 villages.

A qualitative study was conducted by non-participatory observation of vaccination sessions (session site monitoring-SSM) using the WHO supportive supervision checklist, Focused Group Discussion (FGDs) with parents of children and In-depth interviews (IDI) with Health Care Workers (MO, ASHA, ANM) using an interview guide. We conducted session site monitoring mostly in the Anganwadi centre as per PHC or CHC. In-depth interviews of medical officers, ANMs and ASHAs, were done until saturation. For the Quantitative part, SPSS 23 version was used for data analysis and deductive thematic analysis was done for the qualitative data.

Results

In the study, out of 210 children, 119 (56.7%) were male, 91 (43.3%) were female, 47 (22.4%) were from nuclear families, and 163 (77.6%) were from joint families. The majority of mothers had a lower level of education than fathers. Most of the mothers were homemakers 199 (94.8), and the fathers were unskilled workers 108 (51.4%). According to the Modified B G Prasad scale, the maximum number of children belonged to the middle class (46.2%)**.** Out of 210 mothers, 209 (99.5%) were registered for ANC, while one (0.5%) was not**,** and 49 (23.3%) reported having less than four antenatal care visits**.** The majority of pregnant women, 171 (81.4%), delivered in a government hospital, while 21 (10%) delivered at home. A total of 190 (90.6%) deliveries were conducted by a doctor or an ANM, or nursing staff.

In the study, 61.9% of children aged 12-23 months were fully immunised, 37.9% were partially immunised, and 45.4 % were appropriately vaccinated children (AVC) **as** per parents' recall or vaccination card. Only one person (0.5%) was not immunised. As per the vaccination card alone, 61.2% of children were fully immunised, and 42.3% were appropriately vaccinated. Maximum coverage was seen for BCG (97.5%) and minimum for Hepatitis-B birth dose (75.6) based on the vaccination card alone. The highest dropout was found between BCG-Measles (3.5%)

In univariate analysis, it was found that male children were more likely to be fully vaccinated (OR=1.83, 95% CI = 1.04-3.21) than female children. Children whose parents had two children or fewer (OR=2.09, 95% CI =1.15-3.77) were more likely to be fully vaccinated than children whose parents had more than two children**.** Children whose mothers were educated up to 10th standard (OR=1.20, 95% CI =0.59-2.0) or above 10^{th} standard (OR=2.17, 95% CI =1.01-4.64) were more likely to be fully

vaccinated than children whose mothers were illiterate. In Multivariate analysis using a stepwise forward binary regression model, male children (aOR: 1.89, 95% CI = 1.03–3.47) were more likely to be fully vaccinated than female children. Children whose parents had≤2 Children (aOR: 2.00, 95% CI = 1.05–3.83) were more likely to be fully vaccinated than parents with>2 children. Children who were delivered in an institution (aOR: 12.92, 95% CI =3.55-47.03) were more likely to be fully vaccinated than those delivered at home.

The most common reasons for partial or not immunising children were the vaccine was unavailable (46.25%), parents postponed until a later date (38.75%), and unaware of the need for immunisation (13.75%).

During the study period, nine vaccination sites were visited. Favourable practices were observed, like maximum logistics were available, and ANM was found to be trained in vaccination. Some unfavourable practices that were observed were Alternate Vaccine Delivery (AVD) was unavailable, not following the standard methods for maintaining a cold chain system and disposal of Bio-Medical waste (BMW). Some vaccines were found non-usable, a particular vaccine (fIPV) was absent at most sites and incorrect information about contraindications to vaccine administration.

In FGD, a total of twenty-five mothers and one father participated, expressing the positive perception that vaccines help prevent illness and provide immunity and long-term benefits of vaccination. Incentives provided by the government (supplementary nutrition in Anganwadi centres) were one of the motivating factors for them. Barriers included lack of information regarding adverse effects, vaccination hesitancy & delay due to cultural practices, lack of knowledge about the national immunisation schedule, especially for birth doses, accessibility issues, lack of reminder system and nonavailability of vaccines and indirect costs for vaccination. Community leaders and influencers can play a key role in improving vaccination coverage.

In IDI, HCW (MO, ANM, ASHA) shared their views on the scarcity of human resources, demand and supply issues, other essential logistic-related issues, issues with communication, skills and training and the impact of COVID-19 as possible barriers and challenges for poor vaccination. Also, they mentioned various measures taken to improve and catch-up immunisation adhering to the governmental guidelines.

Conclusion

Full immunisation coverage was around 62% by both parents' recall or vaccination card and vaccination card only. Appropriately vaccinated children were 42.0% of the fully immunised children. The gender of the child, the number of children in the family and the place of delivery were the significant predictors of full immunisation. Some favourable and unfavourable practices related to SOPs were observed during session site monitoring. In FGD, lack of information, vaccine hesitancy and delay, accessibility and indirect costs were hindering immunisation. In IDI, management and administrative-related issues, training and communication and the COVID-19 pandemic were the barriers and challenges to immunisation coverage. These barriers must be addressed by appropriate intervention community and health system level interventions.

Chapter 1: INTRODUCTION

Definition

Immunisation refers to the process of getting the vaccine and becoming immune to the disease after administering a vaccine. Immunisation is an important component of primary health care (1).

History of immunisation

The concept of immunisation came from the history of smallpox. It was seen that people who had been infected with smallpox never got reinfected. In 1796 Edward Jenner invented the first-ever vaccine for smallpox. (1) With the help of this invention, this deadly disease of the world got eradicated in the year 1980, and so far, this is the only disease that has been eradicated. This shows that vaccines can help in preventing diseases. Effective Immunisation has reduced the morbidity and mortality of children due to vaccine-preventable diseases worldwide, and vaccination prevents 4-5 million deaths yearly (2).

Vaccination programs

Vaccines are very important in the prevention and control of many infectious diseases. The World Health Organisation (WHO) launched Expanded Program on Immunization as a global effort to use vaccination in preventing various infectious diseases.

Expanded Program on Immunisation (EPI) is the name given to India's immunisation program in 1978. After the beginning of the Expanded Program on Immunization in India, a general decline in important vaccine-preventable diseases was seen, mainly among diphtheria, tetanus, pertussis and measles (3). After gaining momentum in 1985, the program was expanded into the Universal Immunization Program (UIP). The two major milestones of UIP have been the elimination of Polio in 2014 and Maternal and Neonatal tetanus elimination in 2015 (4). Under Universal Immunization Program, immunization is provided free of cost against 12 vaccine-preventable diseases, which include, Diphtheria, Pertussis, Tetanus, Polio, Measles, Rubella, severe forms of Childhood Tuberculosis, Hepatitis B and Meningitis & Pneumonia caused by Haemophilus Influenza type B, Rotavirus diarrhoea, Pneumococcal pneumonia and Japanese Encephalitis. Vaccine-preventable diseases are still a major public health problem worldwide and in India (4). Immunisation is a significant, cost-effective and

important public health intervention measure to prevent disease. Immunization acts as a shield, protecting families and communities. By vaccinating our children, we also protect our community's most vulnerable members, such as new born babies.

Burden of Vaccine-preventable disease

Every year, over nine million immunisation sessions are held across India to achieve full immunisation coverage. Despite progress, infectious diseases continue to be a major cause of child mortality and morbidity in India. In India, nearly one million children die before reaching the age of five. One in every four deaths is caused by pneumonia or diarrhoea, the two leading infectious causes of child deaths worldwide. However, many of them are preventable through interventions such as immunisation. Vaccination coverage varies across India. Large states with the highest proportions of partially immunised and unimmunized children are Bihar, Madhya Pradesh, Uttar Pradesh, and Rajasthan (5).

Immunization coverage trend: Global and in India

Due to COVID-19 19 pandemic, global vaccination coverage declined from 86% in 2019 to 81% in 2021. Around 25 million children under one year did not receive basic vaccines, the highest number since 2009. The number of completely unvaccinated children in 2021 increased by 5 million compared to 2019 (2). In 2021, 18.2 million infants were not immunised against Diphtheria, Pertussis and Tetanus indicating a lack of access to immunisation and other health services. Another 6.8 million people have only received a partial vaccination. More than 60% of the 25 million children are found in ten countries: Angola, Brazil, the Democratic Republic of the Congo, Indonesia, Ethiopia, India, Myanmar, Nigeria, Pakistan, and the Philippines (5).

Data was collected from NFHS-5 considering all basic vaccination (one dose of BCG, three doses of DPT vaccine, three doses of polio vaccine and one dose of measles vaccine. The proportion of 12-23 months of children who have received all basic vaccinations increased from 62.0% (NFHS-4) to 76.4% (NFHS-5). This percentage increased more in rural areas (from 61.0 % to 76.8%) than in urban areas (from 64.0% to 75.5%). The proportion of children who did not receive vaccinations dropped from 6% (NFHS-4) to 4%. (NFHS-5) (2). In Rajasthan, coverage rate increased from 67.6% (NFHS- 4) to 81.5% (NFHS-5), higher than the national average (76.4%). The percentage rise in rural areas is greater (from 54.8% to 79.7%) than in urban areas (from

80.4% to 83.2%), but still, coverage in rural is lower than in urban areas. In Jodhpur, immunisation coverage drastically increased from 42% to 81% in the past five years (3,4). However, during COVID-19 pandemic, vaccination coverage declined compared to pre COVID-19 levels (6).

In India, regular national health surveys obtain data on Full Vaccination Coverage (FVC). These studies show an increasing trend of this FVC in many states of India. However, high vaccination coverage does not necessarily mean age-appropriate vaccinations. Collecting information on age-appropriate immunisation coverage for measles and DPT/Pentavalent vaccine and overall prevalence will help state and district immunisation program managers improve immunisation quality (3).

Facilitators and Barriers to immunization

To reach children across the country, periodic intensification of RI is carried out through Mission Indradhanush, which started in 2014. After this campaign, full immunisation coverage increased by 18.5%. Barriers to immunisation include - weak vaccine-preventable disease surveillance system, lack of data on disease burden and diagnostic tools, limited economic evaluations to show the cost-effectiveness of vaccines over other interventions and shortage of manpower in managing UIP at the centre and state levels.

As the COVID-19 pandemic has disrupted essential immunization services due to multiple reasons, the possibility of non/partially vaccinated children being exposed to the risk of vaccine-preventable diseases is very high. As the poorly vaccinated cohort increases in an area/pocket, there is a high risk of disease outbreaks. Ministry of Health and Family Welfare (MoHFW), Government of India mandated WHO India to conduct a rapid and independent survey. It revealed that interruption of immunization services was largely due to health care workers being engaged in COVID-19 related activities, health care workers/family members affected with COVID-19. The focus shifted from RI program to overall COVID-19 pandemic management. This, coupled with other inequities in immunization based on wealth, parents' education, urban-rural setting, etc., has further contributed to the immunization gap (2).

WHO has also taken the initiative to improve immunisation in priority countries, including India, Indonesia, Myanmar and Nepal (7).

India launched Mission Indradhanush, a special catch-up vaccination drive, in December 2014. The flagship programme aims to strengthen Routine Immunization coverage by reinforcing learnings from polio eradication activities. Intensified Mission Indradhanush 4.0 has been planned to reach out to unvaccinated and partially vaccinated children to catch up on gaps that might have emerged due to the pandemic. Districts/ blocks/ villages/ urban areas having high number of children with missed vaccination were identified and prioritized. Rajasthan comes in 25th place with 19 districts, including Jodhpur (7). In spite of best efforts, there exists a segment of the population with partial coverage, which might not be captured during the time-of-service delivery. Also, various challenges and barriers exist at the community and health system levels which may hinder full vaccination coverage among children.

Need for the study

The partially vaccinated and unvaccinated children are at risk of morbidity and mortality due to vaccine-preventable diseases. Identifying and vaccinating these children, who are widely distributed across the country, is critical. Data monitoring at subnational level is critical for assisting countries in prioritising and tailoring vaccination strategies and operational plans to address immunisation gaps and reach every person with lifesaving vaccines. In spite of the measures to improve the coverage, there exist regional differences and challenges and barriers which might be unique to particular states/districts. Hence, it is important to evaluate RI services to identify the local challenges and barriers to develop feasible solutions to improve the coverage and quality of services and thereby prevent Vaccine-Preventable Diseases (VPD). With this background, the present study was planned to evaluate routine immunization services in a community development block of the Jodhpur district.

Chapter 2: AIM AND OBJECTIVES

Aim

To evaluate the routine immunisation services in a Community Development Block of Jodhpur.

Objectives

1. To assess the routine immunisation coverage in a community development block of Jodhpur
2. To find out the determinants of routine immunisation in a community development block of Jodhpur
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Chapter 3: REVIEW OF LITERATURE

The databases screened for the current study were PubMed, Scopus, National Family Health Survey and WHO Immunization data portal.(**Table 1**)

Table 1 Search strategy adopted for review of literature

Criteria	**MeSH Terms**
Populations	"Infant" [MeSH] "Rural Population" [MeSH]
Exposure	"Immunization" [MeSH]
Outcomes	"Vaccination coverage "[MeSH] OR "Risk Factors" [MeSH] OR Delay OR Hesitancy OR Barrier* OR Challenge* OR "Full immunized" OR "Completely immunized" OR "Partially immunized" OR "Drop-outs" OR "Left-outs" OR "Socioeconomic Factors" [MeSH] OR "Sociocultural factors"

3.1 Vaccination History:

Since the last 15th century, People in various parts of the world have tried to prevent illness by deliberately exposing healthy people to smallpox—a practice known as variolation.

In May 1796, English physician Edward Jenner improved on this discovery by inoculating 8-year-old James Phipps with material collected from a cowpox sore on a milkmaid's hand. Phipps recovered completely despite a local reaction and feeling ill for several days.

In July 1796, two months later, Jenner inoculated Phipps with material from human smallpox sore to test Phipps' resistance. Phipps remains healthy and is the first person to be immunised against smallpox. Later, the term "vaccine" was coined from the Latin word for cow, "Vacca".

In 1872, Louis Pasteur developed the first research lab vaccine: a fowl cholera vaccine for chickens.

In 1918-1919 the H1N1 influenza pandemic that spread across the world sometimes called "the mother of all pandemics", involved a particular virulent new strain of influenza a virus. In 1918 the first wave was mild in infection, but later on, the second wave was more deadly. The most common complication is pneumonia due to secondary bacterial infection, which is more dangerous in vulnerable populations like children, older people, and people with comorbidities (Asthma, Diabetes or heart disease). In 1942 the first inactivated flu vaccine was developed by Thomas Francis and Jonas Salk at the University of Michigan.

From 1952–1955, Jonas Salk develops the first effective polio vaccine. The following year, Salk tested the vaccine on himself and his family. In 1954, a mass considered over 1.3 million children take place, was developed by Thomas Francis and Jonas

By 1960, Albert Sabin invented the second polio vaccine approved for use. Sabin's vaccine was live-attenuated (it used a weakened virus) and could be administered orally, as drops, or on a sugar cube. The oral polio vaccine (OPV) was developed and tested first in the Soviet Union and Eastern Europe. Czechoslovakia becomes the world's first country to eradicate polio.

In 1967, the International Health Organization announced the Intensified Smallpox Eradication Programme, which will use surveillance and vaccination to eradicate smallpox in more than 30 countries. Eradication means, in a single area, more than the elimination of a particular disease, also defined as "permanent reduction to zero of a specific pathogen, as a result of deliberate efforts, with no more risk of reintroduction".

In 1969, When Dr. Baruch Blumberg discovered the hepatitis B virus, he collaborated with microbiologist Irving Millman to create the first hepatitis B vaccine. From 1981 to 1990, a plasma-derived inactivated vaccine was approved for commercial use, and a DNA recombinant vaccine developed in 1986 is still in use today.

In 1971, Dr. Maurice Hilleman managed to combine the measles vaccine (1963) with recently developed mumps and rubella vaccines (1967, 1969) into a single vaccination (MMR). In 1974, WHO established the Expanded Programme on Immunisation (EPI), now the Essential Programme on Immunisation worldwide. The EPI's priority diseases are tetanus, Polio, diphtheria, measles, whooping cough and tuberculosis. In 1978 a polysaccharide vaccine that protects against 14 different strains of pneumococcal pneumonia was licensed, and in 1983 it was expanded to protect against 23 strains.

In 1980, the World Health Assembly, acting on the recommendation from the WHO Global Commission for the Certification of Smallpox Eradication, declared smallpox eradicated.

In 1985, the first vaccine was licensed against diseases caused by Haemophilus influenza type b (Hib) after David H Smith's company produced it on a large scale.

In 1988, Following the smallpox eradication, the WHO turned its attention to poliomyelitis, launching the Global Polio Eradication Initiative. Due to this, polio was endemic in 125 countries in the late 1980s.

In 1999, the first vaccine against the rotavirus was withdrawn only a year after it was licensed, risk of intestinal problems was a major concern. In over 2006, a lower-risk version of the vaccine is introduced. It takes until 2019 to be utilised in 100 countries.

Vaccines have preserved more human lives than any other medical intervention in history. Vaccines have helped to reduce child mortality by more than half in the last 30 years. However, more needs to be done. In several parts of the world, one in every five children is still unvaccinated. To ensure that no child suffers or dies from a vaccine-preventable disease in the coming decades, global cooperation, funding, commitment, and vision will be required (8).

3.2 Vaccine and Immunisation

Millions of lives are saved thanks to vaccination, a success story in global health and development annually. We currently have vaccines to prevent more than 20 life-threatening diseases, enabling people of all ages to live healthier and longer. Vaccines interact with our body's natural defences to build protection. Currently, vaccinations avert 3.5–5 million deaths annually. Immunisation is an unquestionable human right and an essential part of primary healthcare. It's also among the finest investments in health that money can buy. Additionally, vaccinations are essential for controlling and preventing the spread of infectious diseases. However, despite significant advancements, vaccination rates have plateaued recently and have even started to decline since 2020. Health systems are stressed due to the COVID-19 pandemic and related interruptions during the previous two years. In 2021, 25 million children will not receive vaccinations, a 6 million increase from 2019 and the biggest amount since 2009. (9)

3.3 Evolution of the programme in India

Immunisation programs are one of the most important strategies for preventing preventable diseases that can kill children. It is one of the world's largest immunisation programs and an important public health initiative for the nation. Expanded Program on immunisation (EPI) is the name given to India's immunisation program in 1978. After gaining momentum in 1985, the program was expanded into the Universal Immunization Program (UIP), phased into all districts nationwide in 1989-1990. In 1992, UIP joined the Child Survival and Safe Motherhood Program. Immunisation programs have been an integral part of the National Reproductive and Child Health Program since 1997 and have been the focus of the National Rural Health Mission (NRHM) since 2005. The MoHFW has increased immunisation coverage and launched the PentavalentHiB vaccine, inactivated poliovirus vaccine, Td vaccine, measles-rubella vaccine, rotavirus vaccine, and pneumococcal conjugate vaccine.(**Table 2**)

Table 2 Evolution of Immunisation programme in India since 1978

Year	Name of Program	Key points
1978	Expanded Programme of Immunisation (EPI)	Limited reach – mostly in the urban area
1985	Universal Immunization Programme (UIP).	For morbidity and mortality reduction due to 6VPDs. Indigenous production to enhanced vaccine capacity and established cold chain
1986	Technology Mission on Immunisation	Monitoring under PMO's 20-point programme Coverage in infants monitored
1992	Child Survival and Safe Motherhood (CSSM)	Included both UIP and Safe motherhood program
1997	Reproductive Child Health	Improving maternal and child health has been one of the top health priorities of GOI
2005	National Rural Health Mission	To provide accessible, affordable and quality of health care of the rural population especially the vulnerable group.
2012	Year of Intensification of Routine Immunization	Declared by the Government of India.

3.4 New initiatives under UIP

3.4.1 Introduction of new vaccines

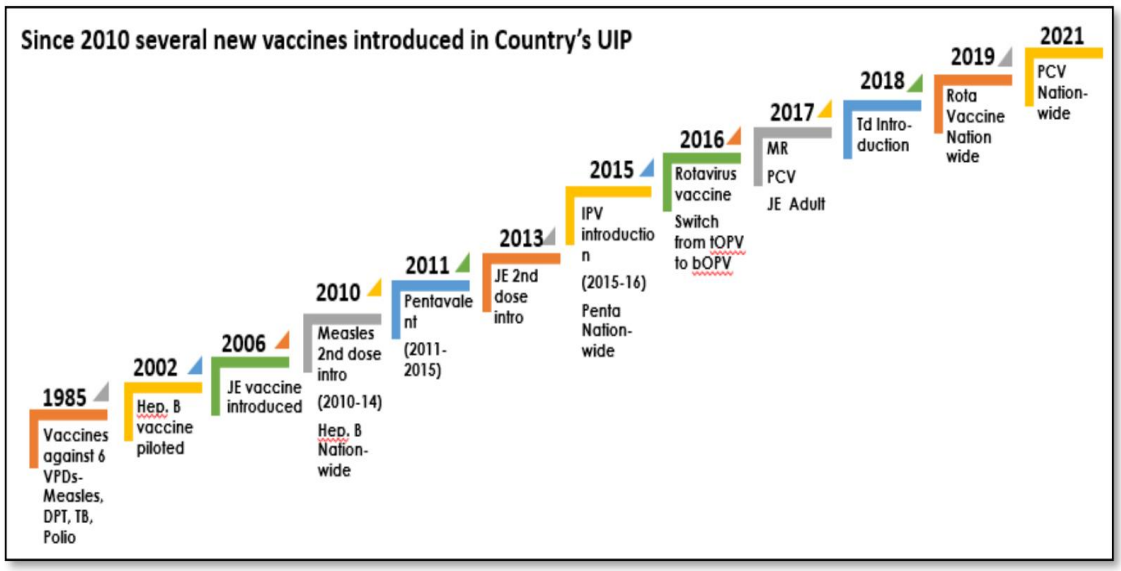


Figure 1 Introduction of New Vaccines under UIP

Rotavirus Vaccine (RVV)

Rotavirus is a major cause of severe diarrhoea and death in children under five. RVV was introduced in India in March 2016 to reduce mortality and morbidity caused by Rotavirus diarrhoea. RVV was implemented in 11 states/UTs up until 2018. However, in 2019, as per the expansion plan, all remaining 25 States/UTs introduced RVV.

Measles-Rubella (MR) Vaccine

As India is committed to the SEAR goal of Measles and Rubella elimination by 2023, Measles-Rubella (MR) vaccine was introduced through a campaign targeting approximately 41 million children aged 9 months to 15 years (covering 13 per cent of the population of the country), followed by two doses in routine immunisation at 9-12 months and 16-24 months. MR campaign was launched in 2017, and till September 2022, the same has been completed in 34 States/UTs, wherein 32.43 crore children have been vaccinated against the target of 33.07 crores with a coverage of 98.1%.

Pneumococcal Conjugate Vaccine (PCV)

In May 2017, PCV was launched in a phased manner in UIP to reduce infant morbidity and mortality caused by pneumococcal pneumonia. Till 2020-21, PCV was introduced

in 5 States viz. Bihar, Himachal Pradesh, Madhya Pradesh, Uttar Pradesh, Rajasthan, and Haryana (State initiative). In 2021-22, PCV has been expanded fully nationwide.

Tetanus and adult Diphtheria (Td) vaccine

Increase in immunisation coverage in children led to shift in age-group of diphtheria cases to school-going children and adults. As per the recommendation of NTAGI in 2016, the Td vaccine has replaced the TT vaccine & given to pregnant women and children of 10 and 16 years of age from February 2019 as per the national Immunisation schedule.

Inactivated Polio Vaccine (IPV)

To reduce the risk associated with the tOPV to bOPV switch, it was introduced in UIP as part of the Global Polio end-game strategy. Initially, in six states, IPV was introduced in November 2015 and expanded across the country by April 2016 (11).

3.4.2 **System strengthening**

Surveillance and Action for Events Following Vaccination (SAFEVAC)

As a part of the process to strengthen AEFI surveillance in India, a web portal, surveillance and Action for Events Following Vaccination (SAFEVAC) has been developed and implemented phase-wise since May 2019. Since January 2020, the portal is functional across all States/UTs. The portal is a digitalisation of manual reporting of AEFI cases and helps speed up the processes of recording & reporting and reduce the loss of data during transmission from the District to the State/national level. It supports the assessment of vaccine safety.

Surveillance for Vaccine-Preventable Disease

Surveillance for Diphtheria, Pertussis and Tetanus was initiated in 2015 and is being expanded in a phase-wise manner. Currently, it is functional in 35 States/UTs. Fever and Rash surveillance for Measles & Rubella and Acute Flaccid Paralysis (AFP) surveillance for polio is functional across India.

Electronic Vaccine Intelligence Network (eVIN)

The Government of India launched the Electronic Vaccine Intelligence Network (eVIN) Portal in 2015, which digitises vaccine stock management, logistics, and temperature tracking at all levels of vaccine storage, from national to sub-district. eVIN has been expanded nationwide and is now available in all states and territories.

Effective Vaccine Management

Effective Vaccine Management (EVM) is a globally accepted tool for safe and effective vaccine supply chains. In 2013, 1st National EVM, and 2018, the 2nd National EVM assessment was done. The country witnessed a significant increase in National EVM scores from 53% in 2013 to 68% in 2018. In August-September 2022, the 3rd National EVM assessment was done & evaluation of the score is currently ongoing.

Demand generation activities

Immunisation services and address vaccine hesitancy, dedicated Information Education Communication (IEC) strategies and packages have been developed under UIP to boost demand generation. Key IEC packages for routine immunisation include-

(a) '5 Saal 7 Baar initiative' to provide information on the vaccination schedule, importance of MCP cards, AEFI;

(b) Risk Communication Framework to create awareness about risks if a child is not vaccinated, the importance of vaccination and creating vaccine confidence;

(c) Routine Immunisation FAQs to provide comprehensive information about immunisation and dispelling myths related to it

(d) BRIDGE (Boosting Routine Immunization Demand Generation and Expansion) training for frontline workers to enhance interpersonal communication skills.

e) IEC packages for new vaccines, including the development of posters, banners, leaflets, audio-visual spots and social media creative about a specific vaccine.

3.4.3 **Capacity building**

The National Cold Chain Training Centre (NCCTE) in Pune and the National Cold Chain & Vaccine Management Resource Centre (NCCVMRC) - NIHFW in New Delhi were established to provide technical training to cold chain technicians in the repair and maintenance of cold chain equipment.

3.4.4 **Monitoring of the program**

The program monitors the coverage on a real-time basis via Health Management. Information Systems (HMIS) and Periodic surveys such as National Family Health Surveys (NFHS). Full digitisation of vaccine stocks is managed through Electronic Vaccine Intelligence Network (eVIN). The functionality of cold chain equipment is monitored through National Cold Chain. Management Information system (NCCMIS). Often during campaigns, portals are designed to capture the immunisation coverage during catch-up campaigns. The data on the surveillance of vaccine-preventable diseases are captured through the SIMS portal supported by WHO. For cold chain assessment, effective vaccine management is undertaken periodically to identify the gap and challenges in cold chain maintenance. The program is also conducting post-introduction evaluation (PIE) surveys after the introduction of new vaccines to identify the critical issues and gaps in implementation and provide mid-course correction (6).

3.4.5 **Declarations**

On 27th March 2014, the South-East Asia Region of WHO, including India, was certified Polio-free. On 14th July 2016, WHO certified India for eliminating maternal and neonatal tetanus India is currently targeting Measles and Rubella elimination by the year 2023 (12).

3.4.6 **Improving vaccine coverage**

Polio National Immunization Days (NID) and Sub National Immunization Days (SNID) are conducted every year among children in the age group of 0-5 years in order to mitigate the risk of poliovirus importation, and maintain population immunity against polio. Around 167 million and 75 million children are immunised across the country during each National Immunization Day and Sub National Immunization Day, respectively.

Table 3 The full immunisation coverage, as reported/evaluated through various sources

S. No	Source	Full Immunisation Coverage (%)		
		Urban	Rural	Total
1	National Family Health Survey-3 (2005-06)	57.6	38.6	43.5
2	Coverage Evaluation Survey (2009)	67.4	58.5	61.0
3	National Family Health Survey-4 (2015-16)	63.9	61.3	62.0
4	National Family Health Survey-5 (2019-21)	75.5	76.8	76.4
5	Integrated Child Health & Immunization Survey-INCHIS (2016)	75.9	68.9	70.8
6	Health Management Information System – HMIS (2017-18)	-	-	86.7
7	Health Management Information System – HMIS (2018-19)	-	-	87.0
8	Health Management Information System – HMIS (2019-20)	-	-	92.8
9	Health Management Information System – HMIS (2020-21)	-	-	87.8

The Global Vaccine Action Plan had a plan for a decade of vaccines (2011-2020) to meet the vaccine coverage of 90% at the national level, and 80% of every district or equivalent unit administrative unit and 19.5 million did not receive the routine lifesaving vaccines. (10)

Despite constant efforts of national health programmes towards increasing the utilisation of immunisation services, immunisation services are still low among the different segments of society. So, we want to evaluate the routine immunisation services in the community development block of Jodhpur and identify the barriers and determinates of routine immunisation services.

Mission Indradhanush (MI): A catch-up vaccination program was launched in December 2014 with the goal of increasing full immunisation coverage to 90% by focusing on unvaccinated and partially vaccinated children and pregnant women in high-risk and difficult-to-reach areas with low immunisation coverage.

A total of eleven phases of Mission Indradhanush have been completed. It was identified as one of the Flagship Scheme under Gram Swaraj Abhiyan (GSA) and Extended Gram Swaraj Abhiyan (EGSA). To date, 4.45 crores of children have been vaccinated. In addition, 1.12 crore pregnant women have been vaccinated. Recently, IMI 4.0 was conducted from February 2022 to May 2022 in 416 identified districts, including 75 Azadika Amrit Mohatsav districts across 33 States/UTs.

The term "catch-up vaccination" describes the practice of immunising someone who, for whatever reason, is deficient in or has not received the recommended number of vaccine doses for which they are qualified. Routine immunisation service delivery (fixed, outreach, mobile, school-based), periodic intensification of routine immunisation (PIRI) activities, or local creative strategies that guarantee people have the chance to receive routine immunisations for which they are eligible can all be used to carry out catch-up vaccination.

The mission has had a good effect on vaccination rates. India has achieved full vaccination coverage (12 to 23 months of age) of 76.4% in 2019–21 with strong and ongoing efforts through routine immunisation across the nation and targeted intervention in high-risk and poor coverage areas through MI/IMI (NFHS- 5). In 1992–1993 the figure was low at 35.4%. (NFHS-1) (11).

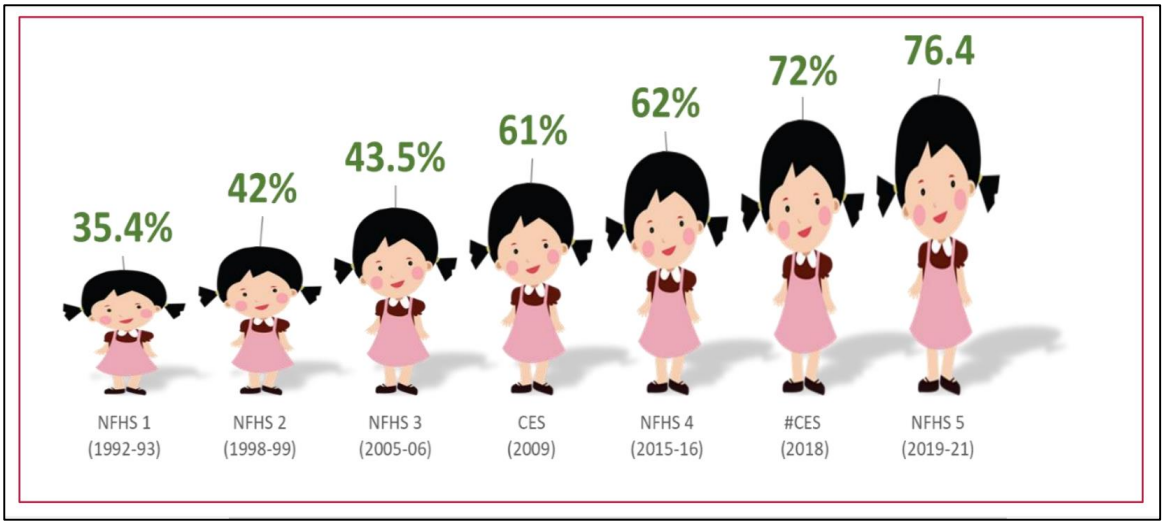


Figure 2 Progression of Immunization Coverage

3.5 Impact of COVID-19 on Vaccination Coverage:

The COVID-19 pandemic has adversely impacted immunisation coverage across the globe, with an estimated 2.3 crores children under the age of 1 year left unvaccinated with basic vaccines, and 1.7 crores have not received even their 1st dose of DTP-containing vaccine. About 62% of these missed children are in ten countries, of which India ranks first with the highest number of missed children. The COVID-19 pandemic affected RI offerings in India at some point in the direction of the ultimate years (2020 and 21), which brought about a decline in immunisation rates. The biggest decline occurred within the first quarter of 2020 (a 26% decline from 2019 - HMIS). According to a WUENIC estimate, 21 lakh children in 2019 and about 35 lakhs in 2020 didn't acquire their DPT3 doses. Due to the decline in DPT3 coverage, missed children burden increased by 14 lakh. It changed into tough to discover and immunise the migrants who had been returning to their domestic countries. The chance of ailment outbreaks will increase as the share of partially, and unvaccinated cohorts rise in a location or pocket. Even after resuming RI services in the latter part of 2020, the restricted movement was compounded by fear of exposure/contracting COVID-19 infection and limited access to services. The disruption affected the conduct of immunisation sessions and supply chain management. The migrants returning to their native places were difficult to track and vaccinate. As the partially and unvaccinated cohort increases in an area/pocket, there is a high risk of disease outbreaks. The disrupted VPD surveillance potentially

may miss or not pick up these outbreaks. Hence, it is essential to immunise these children while VPD surveillance is being strengthened rapidly. (11)

3.6 Immunisation Division at MoHFW:

This division's key roles include activities related to Routine immunisation, Campaigns (SIAs) such as Polio, Measles, and Japanese Encephalitis, Monitoring AEFI, Vaccine and Cold Chain Logistics, Strategic Communication Related to Immunization Programs, and Immunization Program Training. It enables the NTAGI to review and recommend its views on various technical and programmatic issues related to immunisation, such as introducing new vaccines. The division reviews and shares the program's learning with state and district program officers. (13)

3.7 Universal Immunization Programme

India's immunisation programme is one of the world's largest public health initiatives. Launched in 1978 as the Expanded Programme on Immunization, it was renamed the Universal Immunization Programme in 1985 when it expanded beyond urban areas.

It targets 3.04 crores pregnant women and 2.7 crores newborns annually. More than 1.2 crores immunisation sessions are conducted annually. Immunisation is provided free of charge against 12 vaccine-preventable diseases under UIP.: Nationally against 11 diseases severe forms of Childhood Tuberculosis, Hepatitis B, diphtheria, Pertussis, Tetanus, Polio, Measles, Rubella, Rotavirus diarrhoea, Meningitis & Pneumonia caused by Haemophilus Influenza type B and Pneumococcal Pneumonia and sub-nationally against one disease - Japanese Encephalitis (JE vaccine is provided only in endemic districts).

It is the most cost-effective public health intervention, largely responsible for reducing vaccine-preventable diseases and mortality by around 40.2%, thus contributing to a decrease in India's infant mortality rate from 50 per 1000 live births in 2008 to 30 per 1000 live births in 2020. (14)

The stated objectives of UIP are (3)

- To rapidly increase immunisation coverage.
- To improve the quality of services.
- To establish a reliable cold chain system at the health facility level.
- Monitoring of performance.
- To achieve self-sufficiency in vaccine production.

Table 4 National Immunization Schedule

Age	Vaccine given
Birth	Bacillus Calmette Guerin (BCG), Oral Polio Vaccine (OPV)-0 dose, Hepatitis B birth dose
6 weeks	OPV-1, Pentavalent-1, Rotavirus Vaccine (RVV)-1, Fractional dose of Inactivated Polio Vaccine (fIPV)-1, Pneumococcal Conjugate Vaccine (PCV) -1
10 weeks	OPV-2, Pentavalent-2, RVV-2
14 weeks	OPV-3, Pentavalent-3, fIPV-2, RVV-3, PCV-2
9-12 months	Measles & Rubella MR-1, JE-1**, PCV-Booster, fIPV-booster*
16-24 months	MR-2, JE-2**, Diphtheria, Pertussis & Tetanus (DPT)-Booster-1, OPV – Booster
5-6 years	DPT-Booster-2
16 years	Td

* Applicable from 2023 in NIS (16)

** JE Vaccine is introduced in selected endemic districts after the campaign.

3.8 Summary of studies from the literature

3.8.1 Routine Vaccination coverage

A cross-sectional study conducted by Murhekar et al. on vaccination among children aged 12-23 months in 32 revenue districts of Tamil Nadu 2015. They did cluster surveys to estimate the coverage of childhood vaccination in the state and identify the factors associated with low coverage. Cross-sectional surveys were conducted in 15 strata, including corporation non-slum, municipal slum, hilly, rural and urban areas. From each stratum, 30 clusters were selected using probability proportional to the population of each cluster linear systematic sampling; seven children aged 12-23 months were selected from each cluster, and their mothers/caretakers were interviewed to collect information about the vaccination status of the child. A total of 3150 children were surveyed. Of them, 2528 (80.3%) had vaccination cards.

In the state, the weighted coverage of fully vaccinated children, validated fully vaccinated children (V-FVC) (having immunisation as per vaccination card) and

appropriately vaccinated children (AVC) (vaccination card and all the doses as per the immunisation schedule) in the state was 79.9 per cent (95% CI: 78.2-81.5), 78.8 per cent (95% CI: 76.9-80.5) and 69.7 per cent (95% CI: 67.7-71.7), respectively. About 12 per cent of V-FVC were not vaccinated as per the vaccination schedule. The percentage of people who received each specific vaccine ranged from 84% (measles) to 99.8%. (BCG). The coverage of V-FVC was not found to be significantly different among different strata. They found maximum dropout from BCG to measles followed by pentavalent1 to measles and pentavalent1 to pentavalent3 (17).

A cross-sectional study was conducted by Datta et al. from November 2013 to October 2014 using the LQAS technique and 330 sample size to evaluate the full immunisation coverage among 12 to 23-month-old children of rural field practice areas under the Department of Community Medicine, Agartala, Tripura, Government Medical College. They assessed immunisation coverage and vaccine dropout rates. Around 91% fully immunised, 8.8% were partially immunised, and 0.3% were non-immunised children were found. This study also revealed dropout rate of BCG-Measles was maximum (3.9%), followed by BCG-DPT3 (2.1%) and DPT-Measles (1.8%) (18) .

A cross-sectional study by Singh CM et al. conducted in low-performing blocks in Bihar to estimate full immunisation coverage, left-out and dropouts and factors for partial immunisation between January and march 2019 in 12-23 months children (59 blocks x 30 villages x 7 households) on 12,390 children. Around 91% were fully immunised, close to 9% were partially immunised, and the rest 0.35% were non-immunised. The highest coverage was seen in the BCG vaccine (82.9%), and the minimum was PCV1 (30.6%). The maximum dropout rate was seen BCG-Measles (6.7%), and the minimum was seen in BCG-Penta1 (0.61%), while the dropout rates in Penta1-Penta3 and Penta3-Measles were 2.4% and 3.5% per cent respectively (19).

One more study was conducted in 14 community development blocks of the Bhojpur district of Bihar in 2015 by Pandey et al. on 360 children of 12-36 months. They found 65% were fully immunised, 33.9% were partially immunised, and 1.1 % were not immunised. Maximum coverage was seen with the BCG vaccine (98.1%) and minimum for measles (77.5%). The highest dropout rate was seen BCG-Measles (21.8%), and the lowest was seen in DPT1-DPT3 (5.47%), while the dropout rate OPV1-OPV3 (5.1%), DPT1-Measles (11.26), respectively (20).

A cross sectional study conducted by Singhal at al. in rural area of block Malpura, district Tonk, Rajasthan, on 12-23 months children using by WHO 30x7 cluster sampling method. They were found full vaccination child 71.0 %, partially vaccination child 23.9% and not immunized 5.2%. In the study they found BCG coverage (90.5%) was maximum and Measles 71.0% had minimum coverage. Highest dropout seen with BCG-Measles (20.0%) followed by Penta1-Measles (15.2%), Penta1-Penta3 (13.3%) (21).

A community-based cross-sectional study was conducted by Agrawal et al. in a rural area of Dhule, Maharashtra, to evaluate immunisation coverage by the WHO 30x7 cluster survey method. As a result, they found that fully immunised, partially immunised, and unimmunised were 58.6%. 37.1% and 4.3%, respectively, individual coverage of DPT1 and OPV1 (94.3% and 94.3%) were maximum, and Vitamin A was lowest (67.1%). Dropouts were seen in DPT1- Measles (22.6%), followed by BCG-Measles (21.4%) (22).

A similar study was conducted by Goyal et al. in a rural block of Rohtak district, Haryana. In their study, around three-fourths of children (73.1%) were fully immunised, and one-fourth of children (26.8%) were partially immunised. BCG coverage was highest (97.4%), and Measles vaccination coverage was lowest (83.89%). The dropout rate was highest for pentavalent-1 to measles (16.11%), whereas BCG to measles and OPV-1 to OPV-3 and Pentavalent1 to 3 were 13.88%, 10.93% and 4.07%, respectively (23).

A cross-sectional Mixed-method study by Krishnamoorthy et al. was conducted to explore factors related to vaccine hesitancy during the implementation of the Measles-Rubella campaign 2017 in rural Puducherry between 9 months to 15 years children's parents with a sample size of 484 in January and February of 2018. Researchers used the WHO SAGE Vaccine Hesitancy Survey Tool, which included a qualitative component utilising IDI and a 5-point Likert scale. In rural Puducherry, the rate of vaccination hesitancy for the MR campaign was 14.1% (95% CI: 11-17.6%), and 6 (1.3%) parents declined to provide vaccinations during the campaign (24).

A cross-sectional mixed method study by Francis et al. assessed Vaccination coverage and factors associated with routine childhood vaccination uptake in rural Vellore in primary caretakers of children aged 12–23 months during August–September 2017,

using data from vaccination cards or parental recall was 65.0%, and by card, only the coverage rate was found to be 76.5%. Maximum vaccination coverage for BCG by vaccination cards or parental recall (97.0%) and by card only (94%). Minimum vaccination coverage for measles (75.0) by vaccination cards or parental recall and OPV3 by card only. The highest dropouts were seen from BCG-OPV3 (5.9%), followed by BCG-Measles and penta1-measles, and penta1-penta3 (3.90%) (25).

3.8.2 Determinants of Routine Immunisation:

The study by Murhekar et al. discovered that children's coverage was unaffected by participants' sex, religion, or caste. In univariate analysis, they found that children whose mother (OR=3.69, 95% CI=2.42-5.61) and fathers (OR=1.96, 95% CI= 1.21-3.17) were illiterate and whose mother was a homemaker (OR 1.90, 95% CI = 1.14-3.16) and father was wage earner (OR=1.62, 95% CI= 1.34-1.96) had significantly lower coverage. Multiple logistic regression analysis revealed that children with illiterate mothers and wage-earning fathers were more likely to have incomplete vaccinations (17).

The study by Dutta et al. found no gender difference between the children in the context of full immunisation. The significant associations found in univariate analysis with the child's religion (P = 0.003), social caste (P = 0.004), father's literacy rate (P = 0.002), father's occupation (P = 0.011), place of delivery (p<0.001). In multivariate analysis, less educated fathers (primary education) (aOR= 0.187, 95% CI=0.038-0.926, P=0.040), the child who delivered at home (aOR= 0.093, 95% CI=0.034-0.252, P=<0.001) found significantly associated with partial immunisation. Subsequently, partially vaccinated children were significantly associated with general caste castes (aOR= 0.078, 95% CI=0.007-0.92, P=<0.043) (18).

One more study was conducted in 14 community development blocks of the Bhojpur district of Bihar in 2015 by Pandey et al. on 360 children of 12-36 months. They used a multivariate regression model in which they found that maternal education (adjusted OR = 2.28 (1.28-4.05), P-value = 0.005) and place of birth (adjusted OR = 29.04, 95% CI = 10.75-78 .43, P-value = 0.0001) and the availability of vaccination card (adjusted OR = 20.04, 95% CI = 15.82-916.47, P-value = 0.001) significantly associated with Immunisation status (20).

The Study by Agrawal et al. shows an association between the sex of the child, birth order, delivery location, vaccine card availability, social class of the child, the mother's level of education, and the child's immunisation record. Increased FIC was discovered in a male infant, an educated mother, the first birth orders of a child, a child born in a facility, and a vaccination record and social class other than SC and ST (22).

Goyal et al. found a significant association between children's immunisation records and mothers' literacy levels ($P < 0.05$). The relationship between family structure and immunisation status was also discovered to be a significant association ($P < 0.05$) (23).

The study by Krishnamoorthy et al. showed the relationship between sociodemographic characteristics and reluctance to vaccinate. They found that mothers over 30 were significantly more likely to hesitate to vaccinate than younger mothers under 30 years of age (aOR= 2.27, 95% CI =1.21-4.27). An unadjusted analysis shows that employed mothers were more likely to hesitate to vaccinate than unemployed mothers (OR=2.34, 95% CI =1.48-3.71). Maternal and paternal educational attainment was also found to influence vaccination resistance. Compared with fathers with a college degree, fathers with lower levels of education between primary and secondary education showed more frequent (OR=`1.83, 95% CI =1.07-3.17) hesitant to vaccines. Similarly, primary to secondary education mothers were more likely to hesitate to vaccinate than mothers with college degrees (OR=`1.79, 95% CI =1.04-3.08) (24).

The study by Rohit Francis et al. found in univariate analysis sociodemographic factors like the mother's education and occupation, father's occupation, community type, and availability of vaccination card during a survey. Non-socio-demographic factors like I am familiar with the recommended immunisation schedule for children received information about the recommended immunisation schedule during antenatal visits, and the incentive for receiving three doses of Pentavalentvaccine was significantly associated with child vaccination status. In multivariate analysis, children whose mother was wage earner o (aPOR=: 0.21, 95% CI = 0.07–0.64) and salary earner/small business owners' mothers (aPOR: 0.18, 95% CI = 0.04–0.73) significantly found less likely to be vaccinated than children whose mother was a homemaker. No non-socio-demographic determinants were found to be associated with multivariate analysis (25)

3.8.3 Barriers and Challenges in implementing RI services:

The study by Murhekar et al. described that lack of awareness about vaccination and obstacles such as a child's illness and inconvenient timing of vaccination were the main reasons for incomplete or non-vaccination (26)

The study by Datta et al. explained the main reasons for the failure of full immunisation as were, unawareness of the need to return for a second and third dose of vaccines (26.7%), illness of the child- not brought for immunisation (26.7%), followed by fear of side reactions (20%) (18)

The study by Singh CM et al. also explained reasons for partial immunisation the unavailability of the child followed by sickness and hence did not take for vaccination, going for vaccination but did not get the vaccine, lack of information about vaccination and fear of AEFI. Even some respondents cited the unavailability of vaccine and session site was either inconvenient or long waiting time (19).

Agrawal et al. mentioned reasons separately for both not completing immunisation for non-immunisation. The reasons for not completing immunisation were unaware of the need for return for subsequent doses (60.3), followed by fear of adverse effects (14.1), and reasons for non-immunisation were unaware of the need for immunisation (66.7%) and fear of adverse effects (33.3%) (22).

The study by Krishnamoorthy et al. mentioned both themes (Facilitating factors and Hindering factors) into four categories parents' level, school level, community level, and health system level. Facilitating factors they found at the parents' level were that parents felt vaccine protects their children against serious disease, their trust in doctors, and based on previous experience, they were not afraid of vaccine side effect. At the health system level, Doctors also played a major role in facilitating the campaign by spreading awareness. At the school level, awareness sessions were conducted by the school. At the community level, people used to vaccinate their children by getting influenced by neighbours and friends.

The major reason for hesitating to vaccinate the children at the community level was rumours spread about the vaccine's safety. At the parent, confusion was present regarding eligibility, lack of knowledge about the vaccine and campaign reliability. At the school level, the administration demand written consent from the parents to

vaccinate their children. From the health system perspective, HCW reported inadequate time for planning

Some suggestions and solutions were given to overcome the hindering factors for implementing any future large-scale vaccination campaign were given. One of the common suggestions at the health system level was to plan and inform about the campaign in advance, the need for frequent awareness sessions, and the role of the VHND platform for awareness. Another common suggestion at the community level was to avoid spreading rumours by social media platforms without valid evidence, and neighbours and friends also play an important role in encouraging. At the school level, parent-teacher meetings should be conducted to create awareness regarding vaccination, and at the parent level, they should not believe any rumour from unreliable sources (24).

The study by Mark Rohit Francis et al. also found the most frequent reason for missed UIP doses reported by parents was a failure of health workers to record dates despite the child being vaccinated (n = 137/192 reasons for missed doses, 71%). Other important reasons included travel out of the village on the due date of vaccination (n = 24, 12.4%), misplaced vaccination cards (n = 20, 10.4%) and a lack of awareness of the recommended schedule (n = 5, 2.6%) (25).

The study by Agrawal et al. found the main reason for not completing immunisation was unawareness of the need to return for a subsequent visit (22).

Another comparative study by Goyal et al. also found that the majority of children who were only partially immunised missed some vaccines during their first year of life because their mothers either didn't realise how important and necessary full immunisation was (44.14%), there weren't enough vaccines available in the healthcare facilities (33.79%). Children did not bring on the day of their visits due to becoming ill, even by mild sickness (10.34%). Other explanations included the health worker's rudeness (6.89%), the mother's domestic workload (4.14%), and distance from the home (0.69%) (23).

A cross-sectional survey was conducted by Sourav et al. in the Bankura district of West Bengal in 2018 to assess the quality of care and client satisfaction toward immunisation via observation of the immunisation process, in-depth interviews of ANMs and through "focus group discussions" (FGDs) of mothers. Vaccine vial monitors (VVM) were

checked, time of opening of reconstituted vials was marked and noted in all immunisation sessions. Pre-vaccination counselling was given in 88% of cases. Proper positioning of children and drawing of injectable vaccines were found to be always correct. A sterilised cotton swab was used before intramuscular (IM)/ subcutaneous (SC) vaccination, and the used swab was discarded properly in 100% of cases. The angle between the needle and the skin surface was also found to be correct during the injection. Rubbing was not used on vaccination sites in 100% of cases. Only 1.20% of children were observed for 30 min for adverse events following immunisation. Key messages were given to mothers in 98% of cases. However, using a hub cutter and disposing of syringes were found inappropriate. No needle stick injury was observed. Cold chain and tickler bag were maintained properly, and checking of vaccine vials beyond the expiry date was done in all selected subcentre. The average waiting time for vaccination was 21.82 ± 15.37 (mean ± SD) min. Sitting arrangement and cleanliness in subcentres were labelled as good by 59.30% and 82.60%. All respondent mothers ranked attendance of health workers and timing of service as good, while skill and attitude of ANMs were opined to be good by 98.80% and 100% of mothers. All of the ANMs received recent training on adverse events following immunisation. No one practices safe disposal of syringes and vials due to the unavailability of a red bag for BMW management. Vaccine supply was reported to be occasionally irregular. According to ASHAs, panchayat members were not optimally motivated to advocate for immunisation (27).

A community-based cross-sectional study by Titoria R et al. was conducted in an urbanised village in Delhi from November 2015 to April 2017 to explore the perception of clients on the quality of routine immunisation service and dissatisfaction toward the different domains, which was reported to be 3.2% for vaccine availability, 9.7% for vaccine information, 3.2% for staff behaviour, 6.1% for doctor behaviour, and 7.5% for infrastructure (28).

A community-based cross-sectional study conducted by Dhaliwal et al. investigated community perceptions of vaccination among influential stakeholders: qualitative research in rural India was conducted in Oct and Nov 2019 in 5 villages in Mewat District in Haryana. Its results highlighted four themes that influence vaccine uptake. First, Vaccines are associated with positive health outcomes and broader benefits. Participants showed positive perceptions like the vaccine-preventable disease and

vaccination services brought broad health gains, including improved nutrition, antenatal guidance, and social support in Anganwadi. Second, community health workers (ASHA and AWW) have a very important role in the vaccine and healthcare workers' ability to connect with the community. Thirdly, Community health workers have suboptimal ownership over vaccine acceptance and uptake, which explains the influential role of HCW. CHW was addressing side effects, but in a limited way due to limited resources. Participants also shared that there was a lack of coordination between ANM and ASHA/AWW and delineation role among CHWs. Community health workers faced gaps in their education and training, such as limited training on vaccine side effects, placing them at a disadvantage when dealing with families. Caregivers (parents) and community influencers found negative perceptions of AWW and ASHA workers due to their belief that they did not work to their full potential. Community rumours were also found to be one of the hindrances. Fourthly, they explained that even non-caregivers also have an influential role in vaccine acceptance, like mother-in-law having a very important role in broader families, and men also discussed children's vaccination and its side-effect. Certain groups of caregivers were less likely to permit their children due to broader spiritual influence and belief (29).

A cross-sectional community-based study by Mathur et al. was conducted from May to August 2019 to assess Predictors of 'Out-of-Pocket Expenditure' on Routine Immunization of Under-five children. Loss of income for adults was calculated by multiplying the self-reported duration spent (travelling duration+ waiting duration + time spent for vaccination) with daily wages, in result significant contributors found such as the age of vaccinee, area of residence, birth order of vaccinee, longer waiting time, travelling and long distances travelled to reach vaccination centre. They found travelling time of more than 15 minutes (OR = 3.47, 95% CI = 1.49-8.09) showed approximately 3.5 times higher OOPE, Waiting time of fewer than 15 minutes (OR = 0.15, 95% CI = 0.03-0.85) showed lesser out-of-pocket expenditure while and distance travelled of more than 5 km (OR = 10.40, 95% CI = 2.57- 42.03) to reach the vaccination centre found to have a significantly higher association in the context of out-of-pocket expenditure (30).

An observational study by Avula et al. conducted a phone survey of 5500 frontline workers to explore disruptions, restorations and adaptations to health and nutrition services, including immunisation delivery in multiple states (Bihar, Chhattisgarh, MP,

Odisha, Telangana, Tamil Nadu. Uttar Pradesh) and compared the changes in service provision among T0 (Pre- COVID-19 period), T1 (lockdown, April 2020) and T2 (post-lock down, June 2020). Between T0 and T1, immunisation was reduced by 47%. Uttar Pradesh had the greatest disruption, followed by Bihar and Madhya Pradesh. For restoration, AWWs made several adaptations to preserve service delivery during T1 and T2 like visiting beneficiaries' homes to remind, coordinating with the supervisor to arrange transport, reminding over WhatsApp/Phone calls, making an appointment for immunisation venue to control overcrowding with appropriate COVID-19 protocol safety measures at VHND day. Multiple challenges faced by health care while delivering services like walking for long distances due to unavailability of transport, experiencing resistance to home visits etcetera (31).

Chapter 4: METHODOLOGY

4.1 Study Design

This was a mixed-methods study. An explanatory sequential (QUAN-QUAL) mixed methods design was used. First, a quantitative study was done, followed by a qualitative study.

4.2 Study Setting

Rural Luni community development block (CDB) was selected by convenient sampling out of ten blocks in the Jodhpur district of Rajasthan. Luni block is one of the blocks whose villages are covered by rural field practice centres of the Department of Community Medicine and Family Medicine, AIIMS Jodhpur. This block has 196 villages and 10 peripheral health centres (6 PHC & 4 CHC) and a population of 312000. (Annexure-1)

4.3 Study Period

April 2021 to December 2022

4.4 Quantitative Study

Study Design

Community-based cross-sectional study

Study Population

Children in the age group of 12-23 months.

Sampling Frame

List of all the villages with population in the Luni block

Sampling method

World Health Organization-Expanded Program on Immunization (WHO-EPI) 30 x 7 cluster sampling method was used in this study. This is a 'two-stage sampling' method with a precision of 10%. In the first stage, 30 clusters were selected from the Luni CBD. In cluster sampling, sampling is made that uses a frame consisting of clusters. In the

present study, a village has been considered as a cluster. These clusters are mutually exclusive. After that, in the second stage, seven individuals per cluster were selected by simple random sampling. A total of 210 individuals were included in the study. (**Figure 3**)

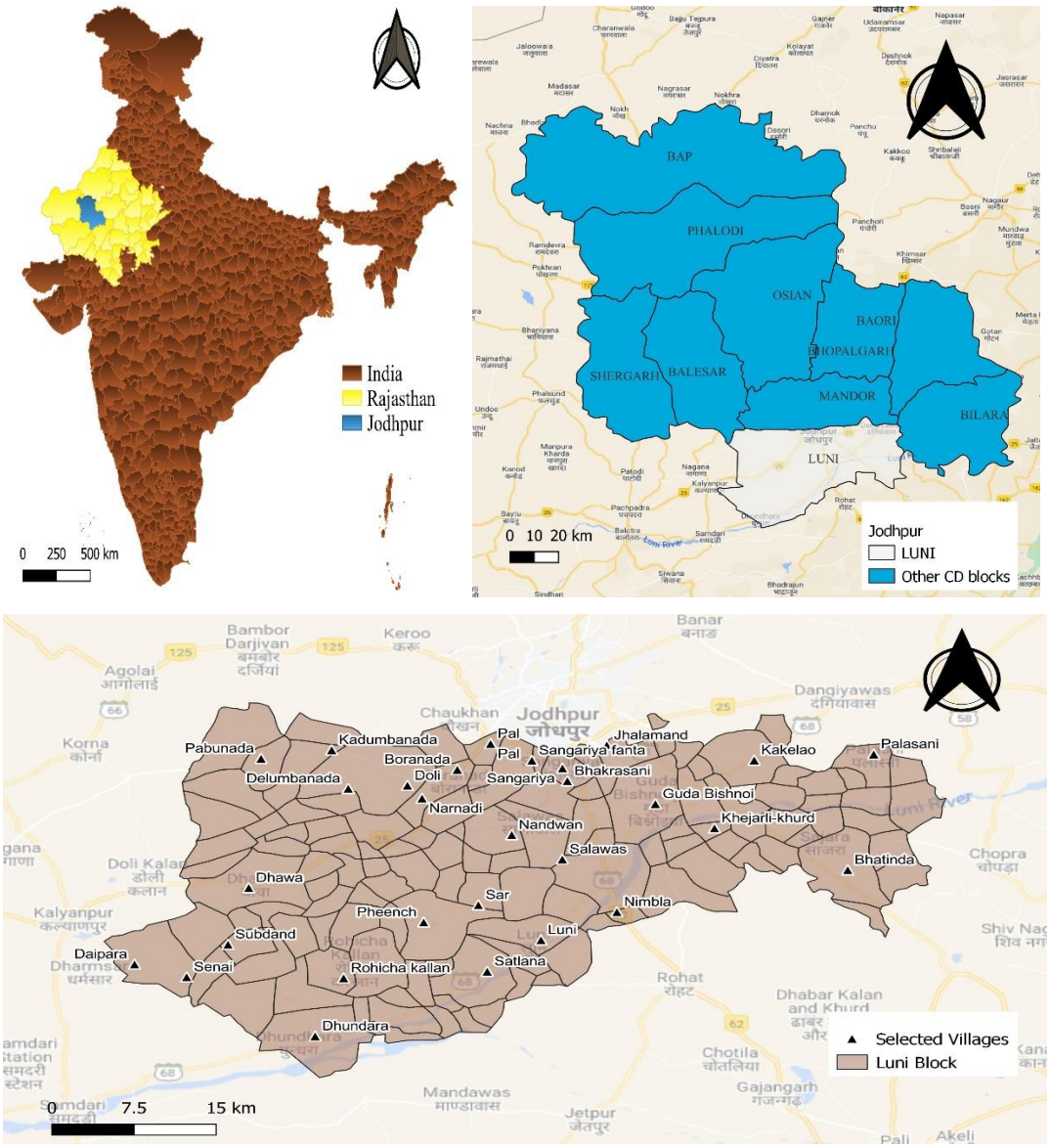


Figure 3 Showing selected 30 villages in Luni Community development block of Jodhpur, Rajasthan.

Selection of Clusters

Based on the 2021 census of the village population 30 clusters (villages) were identified by the following method: (Annexure-B)

The total cumulative population of Luni CBD was 312000

Number of clusters needed = 30

Sampling interval 31200/30 = 10,400

One random number was selected between 1 to 10,400 by computer-generated random number (The first random number was 4837). The second and subsequent clusters were identified by cumulative addition of sampling interval to the previous number. (Annexure-A)

Selection of households

The first house to be visited in each cluster was selected at random, most of the villages had more than 100 houses, so it was not feasible to number them. Hence, we searched for a central location in the village, such as the Anganwadi centre, school, hospital, and temple.

The locations were near the approximate geographical centre of the village, and then for selecting the direction randomly, we spun a bottle on even ground and wherever the bottle pointed when it stopped indicated direction. Walked in the selected direction and counted houses till the end and selected the first house by random number table between one and the total number of houses along the directional line. After visiting the first household the second household to be visited was the one that was nearest to the first. The nearest household is defined as the household reachable in the shortest time on foot from the household just visited. The nearest household need not be in a direct line of vision or on the same side of the street or road. If there are two or more households equally near to the one just visited, we selected the one on the immediate right or left as one stands in the doorway of the house looking out. (32)

Selection of target population

The target population was children in the age group of 12-23 months. Since this survey was conducted to represent the most recent performance of the immunization system, the youngest possible child in the household was chosen. A total of 7 children were selected from the 7 households.

Sample size

Seven children from each of the 30 clusters. A total of 210 children in the age group of 12-23 months were included in the study.

Data collection

Pre-designed pretested questionnaire was used for data collection. The questionnaire included socio-demographic data, antenatal data, place and type of delivery, details of vaccination, and reasons for not vaccinating/partial vaccination. Parents of eligible children in the selected households were contacted, and the objectives of the study were explained to them. Written informed consent was obtained from them. (Annexure-G)

Operational definitions

Immunization coverage (IC): Proportion of immunized individuals in the target population. (1)

Fully vaccinated child (FVC): A child who received BCG, 3 doses of OPV, 3 doses of Rotavirus, 3 doses of Pentavalent, 2 doses of fractional IPV, 3 doses of PCV, MR vaccine -1st dose.

Validated Fully vaccinated child (V-FVC): A child who received BCG, three doses of OPV, 3 doses of Pentavalent, 2 doses of fractional IPV, 3 doses of PCV, MR vaccine -1st dos within 12 months of age, as per vaccination card.

Partially vaccinated child (PVC): A child who missed any one vaccine among 3 doses of OPV, 3 doses of Rotavirus, 3 doses of Pentavalent, 2 doses of fractional IPV, 3 doses of PCV, MR vaccine -1st dose.

Appropriate to age (AVC): A child was considered appropriately vaccinated if he/she has received all vaccine doses at the right age and with the right interval, as per the national vaccination schedule. AVC met the following conditions: (a) BCG vaccine – given before attainment of one year of age, (b) Pentavalent vaccine - first dose given after six weeks of birth and two subsequent doses with an interval of at least four weeks and receipt of all the three doses before the first year of life, (c) measles vaccine - administered after completion of nine months (270 days) but before the first year of life.

This is important because if a child does not receive the recommended immunizations as early as possible, he/she will not receive the maximum protection from vaccine-preventable diseases. (2)

Data Management and Statistical Analysis

Data entry and analysis was done on the basis of stated objectives. The data was entered in Microsoft Excel spread sheet. It was checked for errors and cleaned before being analysed. SPSS 23.0 software was used for statistical analysis. The categorical variables were presented as proportions. The proportion of fully immunized, partially immunized, and unimmunized children—were calculated. Shapiro-Wilk and Kolmogorov-Smirnov tests were used to check the distribution of the data. Normally distributed numerical or continuous data were presented as mean and standard deviation. Non-normal data presented as median and interquartile range. Chi-square test was applied for testing the association between two categorical variables.

Independent predictors for partial immunization were found by using binary forward logistic regression modelling. The factors which were found significant at 5% level on univariate analysis were included in the regression model. Hosmer and Lemeshow goodness of fit and Nagelkerke R^2 value were also calculated. All tests were two tailed and p value less than 0.05 was considered as statistically significant.

4.5 Qualitative Study

This part of the study included Non-participatory Observations (NPO) of immunization sessions (session-site monitoring), Focused Group Discussions (FGDs) and In-depth Interviews (FGDs).

Sample Size

Data was collected till saturation was present in the answers.

Study Population

For the Non-participatory observation (NPO) 9 immunization sessions were visited. Five FGDs were conducted among the parents of 12-23 months aged children. Three IDIs each were held with Medical Officers, ANMs and ASHAs.

Sampling method

Convenient sampling method was used.

Study tools

For NPOs WHO supportive supervision checklist (Annexure-J) was used. Separate interview guides were prepared for FGDs (Annexure-H) and IDIs (Annexure-I) by review of relevant literature and in line with the objectives of the study. It was pilot tested and then used.

Study Procedure

Non-participatory observations of routine immunization sessions were done in the Anganwadi centres. All places were visited without prior information to the concerned person. Permission from CMHO was already taken. Routine immunization activity was observed for 30-40 minutes in each session site and filled out the WHO session site monitoring checklist. After completion of the activity, health worker (ANMs) and other support staff were appreciated for their favourable practices. Unfavourable practices were identified and the health workers were instructed to improve the same by following supportive supervision guidelines and referring to standard operating procedures

Five FGDs were conducted among the Parents of 12-23 months aged children in the Anganwadi centres and included parents of fully immunized and partially immunized children, around 5–6 participants were present in each FGD. All FGDs were facilitated by the researcher. One individual accompanied the researcher and was responsible for taking notes and co-ordinating the activity in each focus group. Average duration of each FGD was 20-30 minutes. After completing the session, any doubts or queries raised by the participants related to RI, fear related to adverse events were addressed, and benefits of RI for children were reemphasized. Refreshments were given as a compliment for sparing their valuable time and participation. .

Three IDIs each were conducted among Medical Officers, ANMs and ASHAs in the PHC, sub-centres or Anganwadi centres as per the convenience of the health worker. Each IDI lasted for 15-20 minutes. All the in-depth interviews and focused group discussions were voice recorded.

Data Analysis

Voice recorded information was transcribed verbatim by the researcher and later translated to English. Meaningful data was coded and grouped into sub-themes and finally into main themes using deductive thematic analysis method. The coding, grouping into sub themes and themes were done by two researchers with experience in qualitative research. (3)

Ethical consideration

Ethical clearance for the study was obtained from the Institute Ethics Committee (IEC) of All India Institute of Medical Sciences, Jodhpur (Annexure-A). Written permission was also obtained from Chief Medical & Health Officer, Jodhpur district. The purpose of the study and the description of the interview was explained to all the participants (Annexure-C, D), with the freedom to opt out of the study anytime during the interview. Written informed consent was obtained from all the participants before the study (Annexure-E, F). In the case of the illiterate participant, a thumb impression was recorded. The privacy and confidentiality of the study participants were maintained at all times during and after the completion of the study.

Figure 4 Focus Group Discussion

Figure 5 Data collection procedure

Figure 6 In-Depth Interview

Chapter 5: RESULTS

5.1 Cross Sectional study

A total of 210 children aged 12-23 months in 30 villages were included in the cross-sectional study. The median age of the children was 15 months (interquartile range 12-19). The median age of the mother and father was 25 years (interquartile range 23-27) and 27 years (interquartile range 23-27), respectively.

Table 5 Sociodemographic characteristics of study participants (N=210)

Variable	**n (%) ***
Gender of the child	
Male	119 (56.7)
Female	91 (43.3)
Type of family	
Nuclear	47 (22.4)
Joint	163(77.6)
Number of children	
>2	68 (32.3)
≤2	142(67.7)
Mother's educational status	
Graduate/Postgraduate	21 (10.0)
Intermediate/Post-high school	3 (1.4)
High school	47 (22.4)
Middle	50 (23.8)
Primary	39 (18.6)
Illiterate	50 (23.8)
Father's educational status	
Graduate/Postgraduate	42 (20.0)
Intermediate/Post-high school	4 (1.9)
High school	78 (37.1)
Middle	52 (24.8)
Primary	24 (11.4)
Illiterate	10 (4.8)

Variable	n (%) *
Mother's occupational status	
Professional	2 (1.0)
Skilled	2 (1.0)
Semi-skilled	2 (1.0)
Unskilled	5 (2.4)
Housewife	199 (94.8)
Father's occupational status	
Professional	5 (2.4)
Clerical/Shopkeepers/farmers	30 (14.3)
Skilled	55 (26.2)
Semi-skilled	5 (2.4)
Unskilled	108 (51.4)
Unemployed	7 (3.3)
SES (Modified BG Prasad)**	
Upper	4 (1.9)
Upper middle	55 (26.2)
Middle	97 (46.2)
Lower middle	50 (23.8)
Lower	4 (1.9)

* The percentage shows in the table are column wise

** SES-Socio-economic status.

Out of the 210 participants, 119 (56.7%) were male, and 91 (43.3%) were female. Of the participants, 47 (22.4%) were from nuclear families, and 163 (77.6%) were from joint families. Out of 210, 68 (32.3%) households had more than two children, while 142 (67.7%) had less than two children, The study found that the majority of mothers had a lower level of education, with 47 (22.4%) having a high school education, 50 (23.8%) having a middle school education, 39 (18.6%) having a primary school education, and 50 (23.8%) being illiterate. Only 21 (10.0%) mothers had a graduate or postgraduate degree. The father's educational status was quite varied. The largest group (37.1%) studied up to high school, followed by 24.8% with middle school education. About 20.0% of the fathers had a graduate or postgraduate degree, and 11.4% were educated up to primary school. Lastly, 4.8% of the fathers were illiterate. Talking about profession among the mothers, most of them were homemakers 199 (94.8%). There were equal number of mothers who were professional, skilled, and semi-skilled, each

one representing 2 (1.0%) and while 5 (2.4) were unskilled. The majority of the fathers were unskilled workers 108 (51.4%), followed by skilled 55 (26.2%), professional 5 (2.4%), clerical/shopkeepers/farmers 30 (14.3%) and semi-skilled 5 (2.4%), and 7 (3.3%) were unemployed.

Overall, the most common socio-economic category was middle class (46.2%), followed by lower middle (23.8%) and upper middle classes (26.2%), according to the Modified BG Prasad scale. The upper and lower categories are the least common, representing 1.9% of the population for each.(**Table 5**)

Table 6 Antenatal care details of mothers of children aged 12-23 months (N=210)

Variable	**n (%)**
Registration	
Registration done	209 (99.5)
Registration not done	1 (0.5)
Number of ANC	
<4	49 (23.3)
4-8	157 (74.8)
≥ 8	4 (1.9)
Place of delivery	
Government hospital	171 (81.4)
Private hospital	18 (8.6)
Home	21 (10.0)
Delivery conducted by	
Doctor/ANM/Nursing staff	190 (90.6)
Traditional birth attendant	2 (1.4)
Untrained Person	18 (8.1)
Type of Delivery	
Normal Vaginal Delivery	181 (86.2)
Lower Segment Caesarean Section	29 (13.8)
Immunisation Card	
Present	201 (95.7)
Absent	9 (4.3)

* The percentage shows in the table are column wise

Out of 210 mothers, 209 (99.5%) were registered for ANC, while one (0.5%) was not. Additionally, registering for antenatal care allows healthcare providers to keep a track of children's vaccination status in the MCP card. Out of 210, 49 (23.3%) reported having less than 4 antenatal care visits, 157 (74.8%) reported having 4 to 8 visits, and 4 (1.9%) reported having more than 8 visits. (**Table 6**)

Regarding the place of delivery, it was observed that the majority 171(81.4%) pregnant women delivered in a government hospital, 18 (8.6%) pregnant women delivered in a private hospital while 21 (10%) of them delivered at home. A total of 190 (90.6%) deliveries were conducted by a doctor or an ANM or nursing staff, 3 (1.4%) deliveries were conducted by a traditional birth attendant, and 17(18.1%) deliveries were conducted by an untrained person. Out of the 210 children, 181 (86.2%) were delivered via normal vaginal delivery, while 29 (13.8%) underwent lower segment caesarean section.

5.2 Immunisation coverage according to parents' recall or vaccination card

In the study, 61.9% were fully immunised and 37.9% were partially immunised as per parents' recall or vaccination card. Only one person (0.5%) was not immunised. Proportion of appropriately vaccinated children (AVC) among fully vaccinated children as per parents' recall or vaccination card was found to be 45.4 %. (**Table 7**) (**Figure 7**)

Table 7 Immunisation status of 12‑23 months old children based on parents' recall or vaccination card (N=210)

Immunisation status	**n (%)**
Fully Immunised	130 (61.9)
Partially Immunised	79 (37.6)
Not Immunised	1 (0.5)

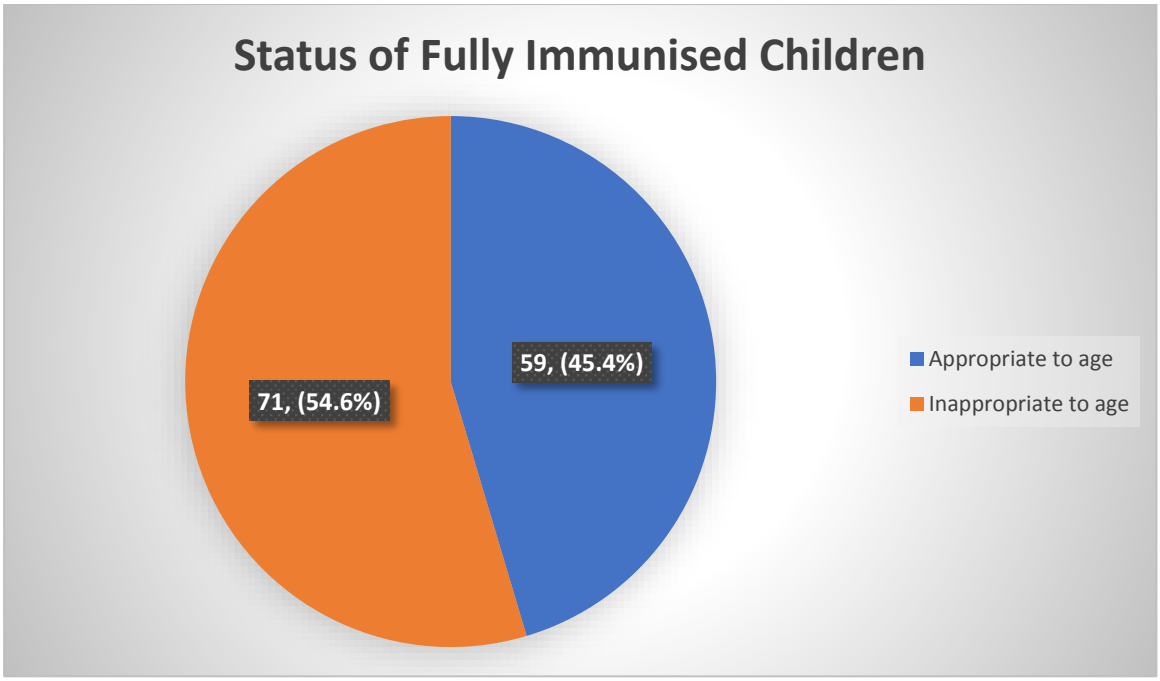


Figure 7 Proportion of appropriately vaccinated children among fully immunized children (according to parents' recall or vaccination card, (n=130)

5.3 Immunisation coverage according to vaccination card only

Immunization coverage based solely on immunisation card were almost similar [Fully immunized=123 (61.2%)] to the findings from parents' recall or vaccination card, and no child was found to be not vaccinated. Proportion of appropriately vaccinated children (AVC) among fully vaccinated children as per vaccination card alone was found to be 42.3 %. (**Table 8**) (**Figure 8**)

Table 8 Immunisation status of 12‑23 months old children based on vaccination card only (N = 201)

Immunisation status	**n (%)**
Fully Immunized	123 (61.2)
Partially Immunized	78 (38.8)
Unimmunised	No

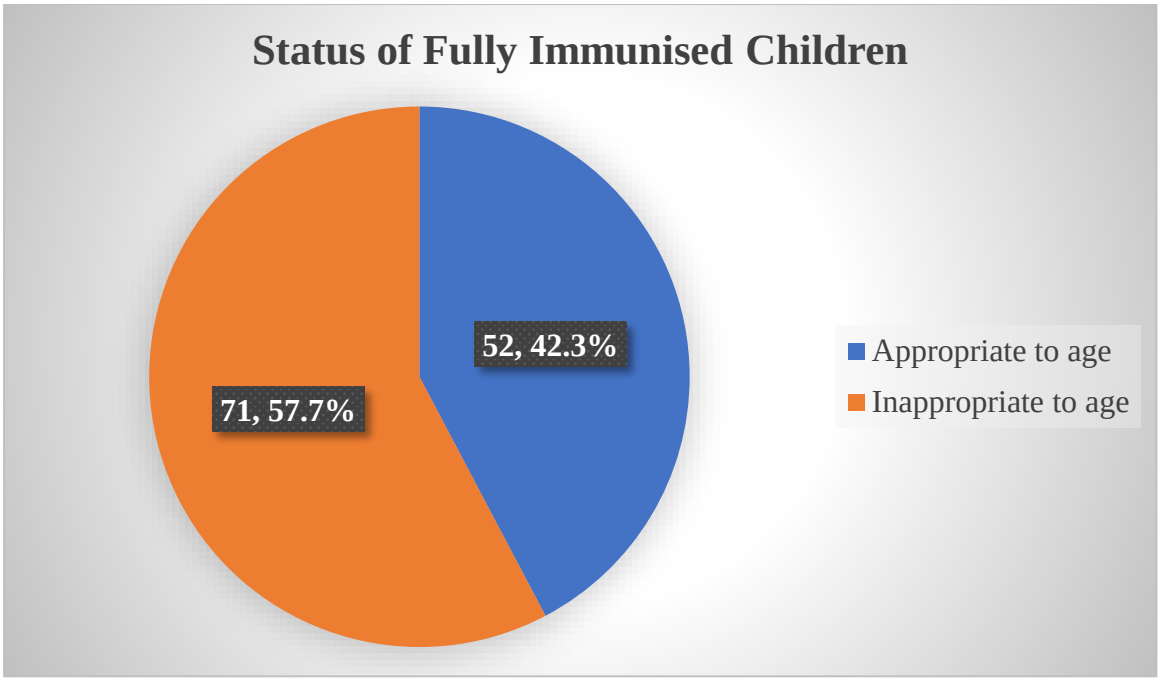


Figure 8 Proportion of appropriately vaccinated children among fully immunized children (according to vaccination card, (n=123)

Table 9 Vaccination coverage for different vaccines

Vaccine Antigen		Parental recall or Vaccination card (N=210)		Vaccination card only (N= 201)	
		Frequency (n)	%	Frequency (n)	%
BCG		203	96.6	196	97.5
Hepatitis B (birth dose)		161	76.6	152	75.6
OPV	OPV 0	179	85.2	169	84.1
	OPV 1	203	96.6	193	96.1
	OPV 2	204	97.4	194	96.5
	OPV 3	200	95.2	191	95.0
IPV	IPV 1	179	85.2	171	85.1
	IPV 2	175	83.3	167	83.1
DPT containing vaccine	Pentavalent1	201	95.7	191	95.0
	Pentavalent2	203	96.6	193	96.1
	Pentavalent3	196	93.3	187	93.0
PCV	PCV 1	192	91.4	183	91.0
	PCV 2	190	90.4	181	90.1
	PCV b	188	89.5	179	89.0
ROTA	ROTA 1	202	96.2	192	95.5
	ROTA 2	203	96.6	193	96.1
	ROTA 3	198	94.2	189	94.1
Measles containing vaccine	Measles	198	94.3	189	94.0
Fully Vaccinated		130	61.9	123	61.2

* The percentage shows in the table are column wise

In the study, the proportion of fully vaccinated children using both parents' recall & or vaccination card and vaccination card only were 61.9% and 61.2%, respectively. Different vaccine coverage according to parent recall or vaccination card were higher

than vaccination card only. (Table 5). Maximum coverage was seen for BCG (97.5%) and minimum for Hepatitis-B birth dose (75.6) based on vaccination card alone. Highest dropout was found between BCG-Measles (3.5%) followed by BCG-Penta1 (2.5%), Penta1-Penta3 (2%) and Penta1-Measles (1%) based on vaccination card alone. (**Table 9**)

5.4 Univariate Analysis:

Table 10 Association of sociodemographic factors with Immunisation status of children. (N=210)

Characteristics	**Fully Immunised** (n = 130)	**Partially Immunised n** (n = 80)	**Total** (n = 210)	**Crude odds ratio**	**p-Value**
Gender of child					**0.036**
Male	81 (68.1)	38 (31.9)	119 (100.0)	**1.83 (1.04-3.21)**	
Female	49 (53.8)	42 (46.2)	91 (100.0)	1 (ref)	
Type of family					0.082
Nuclear	25 (53.2)	22 (46.8)	47 (100.0)	0.63(0.33-1.20)	
Joint	105 (64.4)	58 (35.6)	163(100.0)	1 (ref)	
Number of children					**0.015**
>2	34 (50.0)	34 (50.0)	68 (100.0)	1 (ref)	
≤2	96 (67.6)	46 (32.4)	142(100.0)	**2.09 (1.15-3.77)**	
Mother's educational status					**0.045**
More than 10^{th} standard	51(71.8)	20 (28.2)	71 (100.0)	2.17 (1.01-4.64)	
Upto the 10^{th} standard	52 (58.4)	37 (41.6)	89 (100.0)	1.20 (0.59-2.40)	0.61
Illiterate	27 (54.0)	23 (46.0)	50 (100.0)	1 (ref)	

Characteristics	Fully Immunised (n = 130)	Partially Immunised n (n = 80)	Total (n = 210)	Crude odds ratio	p-Value
Mother's occupational status					0.431
Working	08 (72.7)	3(27.3)	11 (100.0)	0.59 (0.15-2.30)	
Housewife	127 (62.3)	77 (37.7)	204 (100.0)	1 (ref)	
Father's educational status					
More than 10th standard	80 (69.0)	44 (31.0)	42 (100.0)	1.81(0.50-6.62)	0.36
Upto the 10th standard	45 (63.5)	31 (36.5)	52 (100.0)	1.45 (0.39-5.44)	0.58
Illiterate	05 (50.0)	05 (50.0)	10 (100.0)	1 (ref)	
Father's occupational status					0.303
Working	127 (62.6)	76 (37.4)	203 (100.0)	1 (ref)	
Not working	03 (42.8)	04 (57.2)	07 (100.0)	0.45 (0.09-2.06)	
SES (Modified BG Prasad)					0.625
Upper/ Upper middle	37(62.7)	22 (37.3)	59 (100.0)	1 (ref)	
Middle	57(58.8)	40(41.2)	97(100.0)	1.19 (0.55-2.58)	
Lower middle	36(66.7)	18(33.3)	54 (100.0)	0.85 (0.44-1.65)	

* The percentage shows in the table are raw wise

In univariate analysis, it was found that male children were more likely to be fully vaccinated (OR=1.83, 95% CI = 1.04-3.21) than female children. Children whose parents had two children or less (OR=2.09, 95% CI =1.15-3.77) were more likely to be fully vaccinated than children whose parents had more than two children**.** Children whose mothers were educated up to 10th standard (OR=1.20, 95% CI =0.59-2.0) or above 10^{th} standard (OR=2.17, 95% CI =1.01-4.64) were more likely to be fully vaccinated than children whose mothers were illiterate. Other factors were not found to be significantly associated with immunization status of children (**Table 10**).

Table 11 Association of antenatal care characteristics of mothers with immunisation status of children(N=210)

Characteristics	**Fully Immunised**	**Partially immunised**	**Total**	**odds ratio**	**p-Value**
	(n = 130)	(n = 80)	(n = 210)		
Number of ANC					**0.004**
<4	22 (44.0)	28 (56.0)	50 (100.0)	1 (ref)	
≥4	108 (67.5)	52 (32.5)	160 (100.0)	**2.90 (1.49-5.63)**	
Place of delivery					**<0.01**
Institutional Delivery	127 (97.7)	62 (77.5)	189 (100.0)	**18.58 (4.18-82.61)**	
Home	03 (14.3)	18 (85.7)	21 (100.0)	1 (ref)	

Characteristics	Fully Immunised	Partially immunised	Total	odds ratio	p-Value
	(n = 130)	(n = 80)	(n = 210)		
Delivery Conducted by					**0.001**
Skilled Birth Attendant	126 (65.6)	66 (34.4)	192 (100.0)	8.99 (2.49-32.36)	
Unskilled Birth Attendant	4 (22.2)	14 (77.8)	18 (100.0)	1(ref)	
Type of Delivery					0.101
Normal Vaginal Delivery	108 (59.7)	73 (40.3)	181 (100.0)	2.124 (0.86-5.23)	
Lower Segment Caesarean Section	22 (75.9)	07 (24.1)	29 (100.0)	1 (ref)	
Immunisation Card					0.328
Present	123 (61.2)	78 (38.8)	201 (100.0)	2.22 (0.45-10.98)	
Absent	07 (77.7)	02 (22.3)	09 (100.0)	1 (ref)	

Children whose mothers had ≥4 ANC visits (OR=2.90, 95% CI =1.49-5.63) were more likely to be fully vaccinated than children whose mothers had <4 ANC visits. Children who were delivered in an institution (OR=18.58**,** 95% CI =4.18-82.61) were more likely to be fully vaccinated than children who were delivered at home. Children delivered by skilled birth attendant (OR=8.99**,** 95% CI =2.49-32.36) were more likely to be fully vaccinated than children who were delivered by unskilled birth attendant. (**Table 11**)

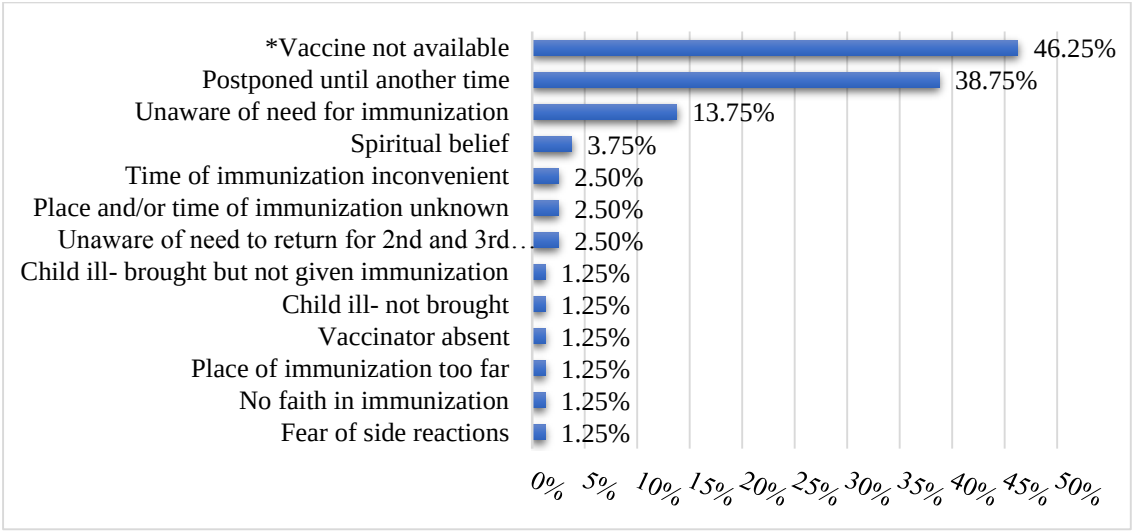
5.5 Multivariate analysis

Table 12 Binary logistic regression (forward stepwise) analysis of factors associated with full immunization status of children

Characteristics	Adjusted odds ratio (95% CI)	pValue
Gender		
Male	1.89 (1.03-3.47)	**0.040**
Female	1 (ref)	
Place of Delivery		
Institutional	12.92 (3.55-47.03)	**<0.001**
Home	1(ref)	
No of children		
>2	1(ref)	
≤2	2.00 (1.05-3.83)	**0.036**

The variables which were found significant in univariate analysis at 5% level were included in the binary logistic regression (forward stepwise) analysis. Based on the forward regression analysis, male children (aOR: 1.89, 95% CI = 1.03–3.47) were more likely to be fully vaccinated than female child. Children whose parents had≤2 Children (aOR: 2.00, 95% CI = 1.05–3.83), were more likely to be fully vaccinated than parents who had >2 children. Children who were delivered in an institution (aOR: 12.92, 95% CI =3.55-47.03) were more likely to be fully vaccinated than children who were delivered at home. (**Table 12**)

5.6 Reasons for partial or non-immunisation



*Vaccine availability issue specially for fIPV

Figure 9 Distribution of parents based on the reasons for their children being not fully immunized (n=80)

Various reasons for children being not fully immunized were mentioned by the parents (figure 3). The most common reason was that the vaccine was unavailable, which was a major obstacle accounting for 46.25% of the cases. Other reasons were parents postponed until a later date 38.75%. Additionally, some parents were unaware of the need for immunisation, accounting for 13.75%. (**Figure 9**)

Table 13 Number of activities under qualitative survey with participants' type and duration

Activity	Participants	No of activities	Duration (minutes)
Session Site Monitoring	Non-participatory observation	9	30-40
Focus Group Discussion	Parents of children	5*	20-30
In-Depth Interview	Medical Officer ANM ASHA	3 3 3	15-20 15-20 15-20

*Around 5–6 participants, mostly women, took part in focus groups.

Qualitative study was done by using SSM at different vaccination sites, FGD of beneficiaries and IDI of health care workers (**Table 13**)

5.7 Immunisation session site monitoring

During the study period, nine vaccination sites were visited namely, Sanai, Subhdand, Dhawa, Sangariya, Sangariya-Fanta, Jhalamand, Salawas, Boranada, and Luni. Almost at all the vaccination sites, healthcare workers like ASHA, ANM, AWW, CHO and Sahayaka worked in an integrated way. Most Anganwadis were running on the school premises. Favourable and unfavourable practices are described below.

Favourable practices that were observed during vaccination session site monitoring were, most of the sessions were held as per the plan and celebrated on VHND day. Most of the vaccines were available at the session site, vaccine labels were intact and readable; reconstitution time was mentioned. Logistics were available like AD syringes with different types, reconstitution syringes, blank RI cards, weighing machine, BP apparatus, ORS packets, paracetamol, and red and black biomedical waste disposal bags were present at most of the places. In some places, both ANM and ASHA made the due list. ANM was found to be trained in giving Intramuscular, subcutaneous and intra-dermal injections at the right places. ASHA was found mobilizing the beneficiary's parents and has contact details of beneficiaries.

Unfavourable practices observed were alternate vaccine delivery (AVD) was not available in most places. At one site vaccine and diluent were not kept in vaccine in vaccine carrier during transportation and at two sites four icepacks were not present in the vaccine carrier vaccine carrier. At one site interchange of capping between OPV and IPV vaccine was observed. At few sites, some vaccines were found not usable (stage III/IV), expired medicines were found in the AEFI kit and, at one site expired vaccine was also found. At few places, IPV vaccines was not present. Most sites did not have hub-cutter, they directly collected syringes with intact needles, and almost at all the sites Immunisation waste was carried to PHC/CHC. However, at one site open burning of immunization waste was done. Most of the sites did not have AEFI kits. Counterfoil was not present at most of the places. ANM did not keep records of vaccines, batch numbers of diluents and expiry dates at most of places. All four key messages were not delivered after vaccination, in which most common was "why the vaccine is given and what disease it prevents." Caregivers did not ask beneficiaries to sit for 30 minutes after vaccination. At one site, CHO was found to be vaccinating beneficiaries in the absence of ANM. ANM did not vaccinate the child when they had mild fever or loose motion at most of the sites.

Figure 10 Pictures taken from vaccination sites

5.8 Focus Group Discussion

Totally five FGDs were conducted among parents of 12-23 months aged children. Around 5-6 participants were present in each FGD and each FGD lasted for about 20-30 minutes. Support was obtained from ASHA, Anganwadi workers and ANM in communicating about the activity and importance of their participation. FGDs, were conducted in the Anganwadi centre or at health centre. Total twenty-five women and one man participated. Objectives of the study and the importance of their active participation was explained and written consent was obtained from all of them. The following themes emerged from the FGDs.

Positive community perception

Parents who utilised the vaccination program for their children had a positive perception regarding the vaccines preventing illness and providing immunity to their children. Parents had responded with enthusiasm and relief that the vaccine is available to protect their children. They recognised the importance of the vaccine in protecting against serious illnesses and were eager to take advantage of vaccine benefits.

To the question why children should be vaccinated, they answered as below:

"Vaccination does not cause disease in children and also protects them from complications of diseases"

"Immunity also gets improved by giving vaccines, and diseases don't spread."

"Diseases like polio, measles, pneumonia and TB that were once common are now less common."

Long-term benefits from vaccination

Parents perceive indirect benefits from vaccination as a positive outcome for their children. Vaccines help develop a child's immunity, which can help protect them from illnesses and other health conditions. Additionally, with strong immunity, children can eat and drink well without having to worry about getting sick, which can lead to healthier development. Ultimately, parents see vaccinations as a way to ensure their child's health, safety, and overall well-being.

After asking about what other benefits they see after vaccinating their children, another mother said:

"Children's fighting power increases, and they will not get sick often; the child eats and drinks properly, so the risk of malnourishment is less."

Incentives provided by the government

Services provided through ICDS scheme like supplementary nutrition acts as an incentive for parents to bring their children for vaccination.

One of the participants shared her view on other beneficiaries and said

"People visit Anganwadi because of the food they get; this makes vaccinations simple. Few of the parents expressed their concerns regarding the vaccination which can probably be linked with partial vaccination. Following themes emerged based on their viewpoints."

Lack of information regarding adverse effect:

Parents may be worried about vaccine side effects among children due to lack of information. Parental concern was even more exaggerated with a male child born after much difficulty. Furthermore, they may have a false belief that the risk of side effects from the vaccine outweighs the benefits of immunisation, leading them not to vaccinate their child. Ultimately, it is important for parents to be informed about the need for immunisation and the common minor adverse events which can be easily managed so that the child doesn't miss the benefits of immunisation.

Few mothers expressed their concerns with the following words:

"Children get fever, therefore, cry a lot, then mothers have to be engaged with them."

"Children develop swelling and don't recover after receiving cold compression or develop high fever, so people tend to be afraid. Sir, not every home in the village has access to ice cubes."

"There were some houses in the village where the boy child was born after much difficulty. So, they refused the vaccination due to much concern about side effects."

One participant shared her view after being asked if any person or group is spreading false information regarding routine vaccination in your village.

"Sir, a few elderlies do not believe in vaccination due to spiritual beliefs".

Postponed until another time:

Parents mentioned that they were not aware of the national vaccination schedule and hence, the vaccine was postponed until another time, especially birth dose. Parents were eager to ensure vaccination for their child to keep them healthy and protected from potential illnesses. However, they were not able to find assistance after delivery when their child should be vaccinated.

An important reason was quoted by a mother for not receiving birth dose of vaccine.

"Women are rushing out of the hospital to go home. They stay in the ward for 2-3 hours after delivery. If a nurse administers a vaccination, it is beneficial; otherwise, how will they know which vaccines, when and where should be given?"

Vaccine hesitancy and delay

Parents' vaccine hesitancy and delay was due to fear of number of vaccinations given in a single visit may increase the risk of adverse reactions. To address this fear, parents may opt to delay the administration of vaccines.

one of the mothers said:

"Too many vaccines given together- there is fear among mothers when three injections are given together to babies".

Further, vaccine hesitancy and delay can be attributed to several factors, including difficulty in verifying the vaccine and communication when the mother went to her maternal house. we found, at time of antenatal period female were registered in nearby Anganwadi from her home where she stays with her husband but she goes to her maternal house specially for delivery, and stay there till recovery period.

Different participants mentioned the above concern for the vaccine delay and hesitancy with the following words:

"When a mother goes to her maternal house, in that case, it is difficult to manage due to no contact between the Anganwadi of two villages, preventing the child from receiving the proper vaccinations."

Even though vaccination is free of cost, the indirect cost of vaccine like loss of daily wage due to taking time off work for vaccination of their children can be a factor for hesitancy. This cost can be especially burdensome for parents who are already struggling financially.

When the vaccination centres are too far, it takes them longer to visit the place, resulting in a loss of their daily wages.

A mother mentioned long waiting time at Anganwadi centre for vaccination because of lesser number of beneficiaries to a particular vaccine.

"ANM doesn't open the BCG vaccine unless there are a minimum of 5 beneficiaries"

Obstacles:

There were interrelated issues like accessibility of vaccination centres, nonavailability of vaccines and lack of a reminder system. Some people have a home (in DHANI) far from the vaccination centre, mostly located around the village centre. If there is a nonavailability of the particular vaccine on that day, they have to come again for that particular vaccine which may not be feasible for them. If ASHA does not communicate about the vaccine's availability, there was high chance of not being vaccinated.

Some participants expressed their views as follows:

"Anganwadi is far from home and is done only on Thursday in a month. If the vaccine is not available on that day, it is very difficult for us to come again."

"Many times, the vaccine is unavailable at centres, especially IPV."

"There is no alternative method to remind people if ASHA forgot to discuss vaccination time."

Role of Influencers:

Community leaders and influencers can play a key role in encouraging and motivating people to get their children vaccinated. Their words were generally honoured and may help to reduce any fear or anxiety that people may have about the vaccination. They can also serve as role models and demonstrate vaccinations' importance by getting their children vaccinated, and spread the word about the far-reaching benefits of vaccinations. Finally, they can advocate and raise awareness about the need for vaccinations in their communities.

In response to our question, "what could be the different methods to improve vaccination coverage in your village?" participants said that

"Sir, as the sarpanch belongs to the Scheduled caste community, if he generates awareness among the people about the vaccination, then people belonging to his community will follow his advice as most of the hesitant belongs to the same community."

"Spread information through such people as Pandit, Maulvi, Sarpanch or Wardpanch whom people believe. If they influence people, then they surely get their children vaccinated."

"In certain villages socially, active women can be involved for awareness activities as they deliver their points effectively and can contribute much to improve vaccination acceptance."

5.9 In-depth Interviews:

A total of 9 In-Depth Interviews were conducted 3 each with the Medical Officer, ANM and ASHA. Open ended questions related to the barriers and, the challenges faced in providing immunization services to the community, the impact of COVID-19 and the strategies used deal with them were asked. Each interview lasted for about 20-30 minutes. Following major themes emerged from the IDIs.

Scarcity of human resources:

Scarcity of human resources was mentioned by all the three types of participants (MO, ANM and ASHA)

An ASHA mentioned:

We have only one ANM, so the vaccination session was not possible when she was on leave. Sometimes we have to call another ANM from a neighboring village.

An ANM expressed her difficulty "*My supervisor says that you also have to do the work of other healthcare workers because healthcare workers are not sufficient according to the village population, so my vaccination also remains due and unable to give proper time to ANC."*

A lady medical officer described her experience of the scarcity of human resources in her village:

"ANM sends the requirements generated in the field to us; still, we do not have a vaccine delivery boy who delivers the vaccine from here to the field."

Another MO mentioned "Yes, there is a problem with the healthcare staff. Bana (name changed to maintain confidentiality) CHC has six sub-centers; out of these, two sub-centers don't have ANM. The village has 2 ANM, but one is not well, so she doesn't work in the field. CHO has been appointed but not trained for vaccination till now."

Demand and supply issues:

One ANM kept her view in the context of demand and supply issues in her village:

"Sir, f-IPV is scarce. The supply is limited from above."

An ASHA expressed her concern as *"Though we receive all the vaccines on time, sometimes vaccines fall short if any women come to her mother's home because we don't have the prior details."*

Another ANM expressed her concern related to AEFI kit, *"Sir an AEFI kit was provided, which had adrenaline injections, but once they expire, we don't get new adrenaline; hence I still have those expired adrenaline injections."*

A MO mentioned *"Sir, sometimes there is a problem in the supply of certain vaccines PCV, IPV and hence it does not reach the periphery"*

Logistics issues:

A MO expressed the risk of cold chain failure due to issues with electrical supply; *"If the electricity is not there for a longer duration, then we shift the vaccines to the nearby PHC if they have electricity or else there will be cold chain failure."*

Issues with communication, skills and training:

In some villages, ANM and MO appointed were not so much familiar with the local language, but that was managed with the help of local healthcare workers. The unfavourable practices while transporting vaccines from PHC/CHC to the vaccination site were quite concerning. ANMs often lack the knowledge and skill to administer adrenaline and intra-dermal vaccine due to lack of training.

An ANM expressed the difficulty to understand the local language and the solution:

"Sometimes, it is a problem to understand the local language, but with the help of ASHA, we are managing this situation."

ASHA mentioned unfavourable practices:

"Sir we receive vaccines in vaccine carrier with only one ice pack, we set the ice pack at home or the subcenter and take it with us on vaccination day."

One ANM expressed her concern about the need for regular training:

"Sir, we were given training during COVID-19 how to use adrenaline; before that, we didn't know how to use it. If we don't administer a vaccine for a long time, we tend to forget how to administer it."

A lady MO also expressed her concern about the need for regular training:

"Training does not occur from time to time, and serious cases come very rarely, so it is not in practice, and they don't know how to administer adrenaline and the quantity to be administered."

Impact of COVID-19:

Due to COVID-19 19 pandemic and the fear related to it, many health programmes in villages have been suspended, including the vaccination programme for children. This has put many children at risk of contracting diseases that could have been prevented. Later, the government took steps to ensure that the vaccination programme was resumed with COVID-19 protocol and that the people in these villages were provided with the necessary information and resources that would help them to vaccinate their children.

One Medical officer expressed his perception of the effect of COVID-19, and almost similar views were found from ASHA and ANM interviews

In 2021, there were orders from the administration to close it for three months. Sir, people were very scared at that time. They didn't want to go out of their home. There was also problem with the vaccine supply, and the government had given instructions to avoid crowding.

"Some people were infected during that time, and if anyone in the family was positive, then the family members and children were also not allowed to come outside."

One ANM also mentioned in her interview regarding fear among people:

People were afraid that their children might get exposed, and hence did not bring them for vaccination. Also, health care staff was shifted from vaccination and involved in some other work during the COVID-19 time.

An ASHA worker mentioned:

Vaccination was suspended for three months. Sir orders were given from higher authorities that crowding had to be avoided. Also, people were afraid to come.

Catch-up Vaccination:

After the COVID-19 pandemic, various methods were used to ensure vaccination in children. Awareness programs were launched to spread information about the importance of vaccinations and to encourage parents to bring their children for the vaccines. Additionally, intersectoral coordination was initiated to ensure that all

necessary stakeholders were involved in the process. This included healthcare providers, schools and local authorities. Furthermore, more vaccination sessions were scheduled, and session times were extended to ensure that all children could receive the necessary vaccinations. Lastly, to ensure the safety of children and healthcare providers, COVID-19 guidelines were strictly followed during the entire process.

One Medical officer shared his view on different methods adopted during catch-up vaccination:

"Sir, as soon as the peak of covid was over, with the help of ASHAs and Anganwadi workers and school teachers, we organised an awareness programme and made people aware by going door to door."

"We had received proper guidelines, which we followed. ANM was asked to start the vaccination with gloves and other protective equipment. We even made people aware that if you come to the vaccination centre, wear your masks. People were made to sit 2 feet away from each other. We had stick posters of Corona Preventive measures in the centre too."

ANMs mentioned the awareness generation activities and due vaccination coverage via organised outreach session:

"We sensitized people by saying that not getting vaccinated could have severe consequences in the long run, and hence people also cooperated."

"We took help from school teachers for awareness regarding vaccination. Sessions were organized in the field. Some sessions were organized on school premises so that children could get vaccinated under the guidance of teachers."

"Sir, we increased the number of sessions for vaccination. A door-to-door survey was done, and an outreach session was planned at schools and temples where people could come easily. The Mission Indra-Dhanush also helped later on."

One ASHA mentioned in her interview about increased session numbers and duration *"We increased the timing of Anganwadi. It used to be from 8-12 PM, but it was open till 2 PM, and the number of sessions also increased from 4 to 8 in a month, meaning two session were conducted in a week.*

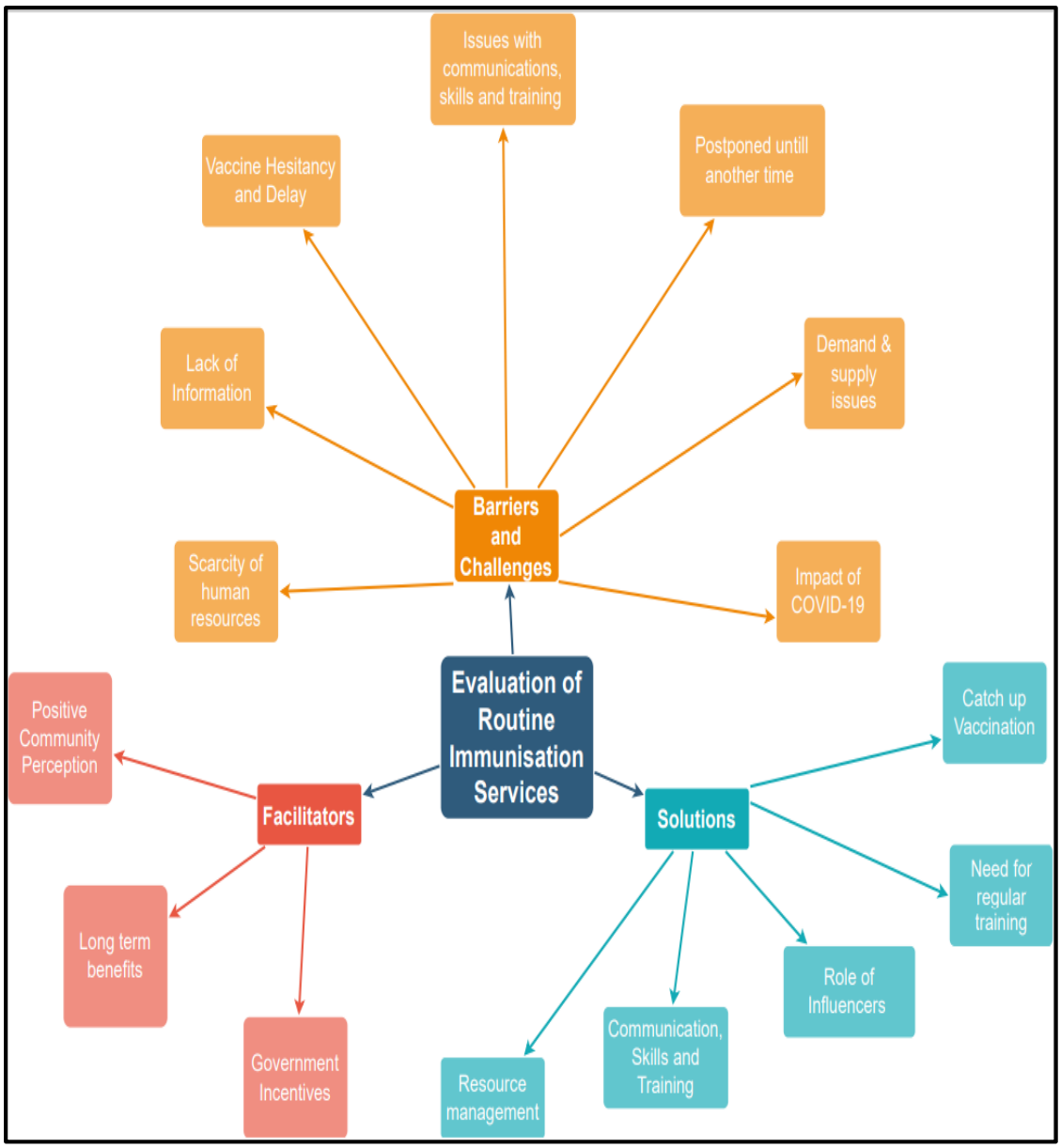


Figure 11 Thematic framework for evaluation of Routine Immunisation services

There were three themes included facilitator, barrier and challenges and strategies, in which multiple subthemes were described.

Chapter 6: DISCUSSION

This study was carried out to evaluate the routine immunisation services in Jodhpur's rural community development block (Luni). It was a sequential mixed-methods study consisting of a cross-sectional study followed by a qualitative one. A cross-sectional study was conducted to determine the immunisation coverage and determinants related to full immunisation. To explore the challenges and barriers related to routine immunisation, focus group discussions of parents', and In-Depth interviews of ASHA, ANM and Medical officers were conducted. Vaccination session site monitoring was also conducted to see the favourable and unfavourable practices while vaccinating the child.

6.1 Immunisation coverage

There were 210 children in the age group 12-23 months, and the immunisation coverage was 61.9% and 61.2%, respectively, based on parents' recall or vaccination card and vaccination card only. Appropriately vaccinated among the fully immunised children based on parents' recall or vaccination card and vaccination card only were 45.4% and 42.3 %, respectively. Only one (0.5%) child was found to be unimmunised according to parents' recall or vaccination card, and no one was found unimmunised according to vaccination card only. Maximum coverage was seen for BCG (97.5%) and minimum for Hepatitis B (75.6). The highest dropout was found between BCG-Measles (3.5%) followed by BCG-Penta1 (2.5%), Penta1-Penta3 (2%), OPV1-OPV3 (1.1%) and Penta1-Measles (1%).

According to WHO (2021), the global vaccination coverage (81%) was higher than in the current study. According to NFHS 5 data, full vaccination coverage based on parent recall or vaccination card and vaccination card only in India (76.8%, 84.0%), Rajasthan (79.7%, 84.5%), and Jodhpur (81.2%,77.0%) were higher than the current study. (33–35). Appropriately vaccinated children were also higher in Rajasthan (65.5%) and Jodhpur (73.7%) than in the present study. Even though this study was done in a rural area, the coverage was lower than the national, state and district rural area data. However, in the current study, unimmunised children were lower than in India (3.6%), Rajasthan (2.6%) and Jodhpur (2.3%). According to NFHS 5 data, most districts with lower vaccination coverage than our study were found in Uttar Pradesh, Madhya

Pradesh, Bihar, and most of the north-east states like Nagaland, Manipur, Assam, and Meghalaya. In comparison to our study, other previous studies in Rajasthan(21), Bihar(19), and Haryana(22), Tamil Nadu(26), Puducherry(24), and Vellore(25) found higher vaccination coverage. Non-immunised children were found to be higher in some studies (21,22,36) and lower in some other studies (18,19,23) than in this current study. Some studies reported immunisation coverage estimates combining parents' recall and vaccination cards (18,19,21–23,36). In this study, this coverage was calculated separately. In the current study, full immunisation coverage was much lower than the mission Indra-Dhanush target (>90%) (33–35). This lower full immunisation coverage might be due to disruption in the routine immunisation services caused due to COVID-19 19 pandemic. Among all the vaccines in the RI schedule, BCG coverage was higher in the study, incongruence with the nationwide survey report (NFHS 5) in India and other previous studies (33–35). Amid, Hepatitis B coverage was the lowest in our study, similar to reports of NFHS 5 in Rajasthan and Jodhpur, but in India, the coverage was lowest for OPV3. A study by Singh CM et al. (19) found the lowest coverage for PCV1, Agrawal et al.(37) found the lowest coverage for Vitamin A, Francis et al. (25) for OPV3, and Krishnamoorthy et al. study found the lowest coverage for Measles(24). One study in Puducherry (24) done only for MR vaccine coverage found lower coverage than our study. In the current study, maximum dropouts were seen between BCG-Measles (3.5%), but it was lower than India (7.0%), Rajasthan (4.5%) and Jodhpur (5.1%) (33–35). Other studies also found similar maximum dropouts between BCG-Measles, but the proportion was higher than ours study. (18,26) .

6.2 Determinants of Routine Immunisation:

In our study, place of delivery was one of the important determinants for the full vaccination of a child. Children born in an institution were at higher odds of receiving full immunisation. Mothers who delivered in an institution and their family members are probably more aware of the health services. Also, during their stay, they might be educated by the health care worker regarding child caring, rearing practices, and the importance of complete immunisation. [(37),(18), (20)]. We found a significant association between a fully immunised child and the gender of the child. This possibly reflects the gender bias favouring male children, which may persist in the western part of Rajasthan. Another study in Dhule, Maharashtra (37) found this gender association with immunisation coverage. Parents with 2 or less children were twice as likely as

parents with more than 2 children to fully vaccinate their children. Parents with 2 or lesser children might be able to devote their time to appropriate care of their children. A study in Maharashtra (37) also found similar result in their study. We did not find any association between immunisation status and parents' education & occupation. In contrast, some previous studies found an association between parents' education (18,22–26,36) and occupation (25,26).

6.3 Barriers and Challenges in implementing RI services:

We found vaccine nonavailability was one of the major reasons for partially immunised children, which was similar to other studies. In a study conducted by Goyal et al., 2017 in Rohtak, Haryana (13), the reason for vaccine nonavailability was inadequate supply, resulting in partial immunisation of children. Similar results were reported by other previous studies (19,27,28). At a few sites, we did not find fIPV during session site monitoring. Some participants mentioned during FGD that fIPV was unavailable for the last few times. One ANM expressed her concern over IPV availability. The government will be planning three doses of IPV until the child is aged one year (15), so as per this study, procurement of this particular vaccine was a challenge.

We also found a gap between the demand and supply of vaccines which could be due to the COVID-19 pandemic. This might have led to an outbreak of vaccine-preventable diseases like measles in some states like Maharashtra and Tamil Nadu (38).

Unaware of the need for immunisation was one of the common reasons for being partial and not getting immunised in our study. During FGD, we found that some people were unaware of why children should get the recommended vaccination.

During the antenatal period, the woman registers in the nearby Anganwadi around her husband's home. Then, there is a culture in rural areas where the mother goes to the maternal house for delivery. In the absence of an immunisation card, the chance of incorrect or lack of communication by the mother with the two different Anganwadis/ANMs/ASHAs may lead to difficulty verifying the vaccine schedule and ensuring full vaccination to the child. Additionally, the parent may be concerned about the vaccine's safety or lack access to reliable information and resources to make a fully informed decision. One of the studies by Francis et al. in Vellore (25) found travel out of the village on the due date of vaccination, and misplaced vaccination cards were the common causes of partial immunisation.

Parents' vaccine hesitancy and delay in context to fear of a large number of vaccinations at one time in children was a common concern among many parents. This fear was often driven by a perception that the number of vaccines given in a single visit may increase the risk of adverse reactions. To address this fear, parents opted to delay the administration of vaccines. Some other studies found that fear of side effects was the common reason for parents' hesitancy or delay in immunisation (18,22).

The reason for vaccine delay to the ill child in this study was found to be misperception of HCW regarding vaccination. It was observed at the time of session site monitoring if the children had loose stool or mild fever. Though, there was no absolute contraindication for vaccination, the HCW, to be on the safer side, delayed or denied the vaccination (18,26,37).

The potential reasons for less appropriate vaccination coverage were, first, unaware of the need for and correct schedule of immunisation, especially for birth dose. (Participants of FGD shared the events when the mother did not stay in the hospital for the recommended period after delivery and was in a hurry to go back to their home. Hence, the child missed the birth dose. Secondly, lack of knowledge regarding the national immunisation schedule or the need to return for 2nd and 3rd doses; could be the reason for the lower proportion of appropriately vaccinated children in this study.

A study in Bihar by Singh CM et al.(19) and Agrawal et al.(22) mentioned the lack of information about vaccination, and another study by Dutta et al. (18)reported unaware of the need to return for a second and third dose and other vaccines as possible reasons for partial vaccination. We found 77.6% of beneficiaries belong to joint families where elder people (mother and father-in-law) played an important role in not vaccinating grandchildren due to strong spiritual beliefs. A study by Dhaliwal et al. (29) explained the non-caregivers role (Mother-in-law) in vaccine acceptance. Awareness generation only by HCW was not found to be sufficient (28,39) (in FGD). Participants felt that Influencers in the village also play a very important role in vaccination awareness, acceptance and avoiding rumours (24). Partial triangulation of quantitative data with qualitative was achieved. During the house-to-house survey, seven children who were not vaccinated with birth doses. Further, during IDI with HCW belonging to that village, it was discovered that, even though deliveries were conducted there, birth doses were missed as there was a lack of infrastructure related to cold chain equipment (28).

Few participants reported accessibility issues and inconvenient immunisation time vaccination session was on a working day (Thursday every month), so parents must take time off from work. Long travel time (23) and long waiting periods (22,27) at vaccination sites contribute to the loss of their daily wages (Especially for lower-middle-class families). One of the operational difficulties that led to a long waiting time at the vaccination site was the BCG vaccine, which does not follow the open vial policy. To prevent vaccine wastage, ANM opened the vial after an adequate number of people gathered. A study by Mathur et al. (30) focused on this indirect cost as a predictor of out-of-pocket expenditure.

During the Covid 19 pandemic, vaccination sessions were suspended for a long period due to fear among people. Also, as per government directives to avoid crowding and HCW being shifted to other activities there was disruption in the RI services. Most of the studies reported similar causes of disruption during and after covid-19 pandemic (31,40). Despite the limitations thrown by the pandemic, healthcare workers continued to provide RI services as per government guidelines.

Chapter 7: STRENGTHS AND LIMITATIONS

7.1 Strengths of the study

The present study has many strengths; use of the WHO 30 x 7 cluster sampling method selection of beneficiaries from 30 clusters. Use of mixed methods study design to explore the challenges and barriers related to routine immunisation services. We used parental recall and vaccination records to calculate the vaccine coverage and proportion of appropriately vaccinated children among fully vaccinated children. Also, calculating the dropouts between the different vaccines gave the idea of when HCW should reinforce the parents to prevent the dropout rate. The qualitative component involved data collection from multiple sources to know the barrier, challenges, and reasons behind them, which helped remove recall bias. Partial triangulation of quantitative and qualitative results was achieved in the study.

7.2 Limitations of the study

The study was done in a single community development block (CDB) Luni. Hence, generalizability to other blocks in other districts of Rajasthan or other states might be limited. However, findings might be generalised to similar blocks in the western part of Rajasthan. In the sampling method in the second stage, simple random sampling was used. Hence, it was not possible to cover the whole of the cluster, due to which results might be an overestimate or underestimate of the population studied.

Chapter 8: CONCLUSION

In this study, nearly 62% of the children aged 12-23 months were fully vaccinated. Nearly equal proportion of children were fully vaccinated based parental recall and/or vaccination card and vaccination card only. Proportion of children appropriately vaccinated to age among fully vaccinated were 45.4% and 42.3% respectively, according to parental recall and/or vaccination card and vaccination card only. Female children were less likely to be fully vaccinated than male children. Children whose mothers had institutional delivery and whose parents had ≤2 children were more likely to be fully vaccinated than children whose mothers delivered at home and whose parents had >2 children. In our study, the most common reasons for partial immunisation were, vaccine not available, postponed until another time or vaccine delay, unawareness of the need for immunisation, and spiritual belief.

In session site monitoring, certain favourable practices like sessions being held as scheduled and availability of the logistics were observed. ANM was trained in giving the vaccine and coordinated with ASHA and AWW for smooth functioning. There were few unfavourable practices also. Certain Standard Operating Procedures (SOPs for vaccine storage, transportation and doing vaccination were not followed. A few vaccines were not usable as per VVM and expiry date. Absence of a particular vaccine (fIPV), Bio-Medical Waste (BMW) not disposed of properly due to lack of awareness regarding disposal and unavailability of a hub cutter at the vaccination site. Most of the centres did not maintain the vaccination records properly. Most centres were unprepared for AEFI due to the unavailability of AEFI kits or not maintaining the kit regularly. The HCW and beneficiaries were not clear with exclusion criteria for routine immunisation.

In FGD, we found positive community perceptions regarding routine vaccination. Parents responded with enthusiasm and relief that the vaccine was available to protect their children. Barriers and challenges were unaware of schedule of vaccination, lack of information regarding adverse effects, postponing the vaccine for another time, vaccine hesitancy and delay, and obstacles (lack of Accessibility). Community leaders can play significant role to improve vaccination. Based on IDIs among health care workers, scarcity of human resources, demand and supply issues, logistic issues, and

communication, skill and training issues were the possible barriers and challenges. COVID -19 pandemic also impacted the RI services. However, significant efforts were made by HCW to improve and catch-up immunisation adhering to the government directions.

Chapter 9: RECOMMENDATIONS

1. Considering the low proportion of full vaccination coverage, significant efforts should be made to improve the same.
2. Training, retraining, and regular refresher training of HCWs should be provided with emphasis on strictly following SOPs for successful immunisation.
3. Regular awareness generation activities should be conducted in the community regarding the need for immunisation and the importance of timely vaccination. Also, the community should be educated about the common AEFIs and measures to deal with them. To ensure their children's safety and protection, parents should be encouraged to discuss vaccine concerns with their healthcare providers.
4. Addressing the logistics and supply issues through good governance and administration. Vaccines which do not follow open vial policy should have lower doses in one vial so that wastage can be prevented and waiting time can be reduced.
5. Research and development of innovative solutions to deal with public health emergencies like COVID-19 19 pandemic should be encouraged. Appreciation and recognition of good work by HCW to enhance the motivation among them. During regular monthly meetings at health centers identifying the issues and challenges and devising feasible solutions at the local level should be encouraged.

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ANNEXURES

Annexure 'A': Ethical Clearance Certificate

अखिल भारतीय आयुर्विज्ञान संस्थान, जोधपुर
All India Institute of Medical Sciences, Jodhpur
संस्थागत नैतिकता समिति
Institutional Ethics Committee

No. AIIMS/IEC/2021/ 3511 **Date: 12/03/2021**

ETHICAL CLEARANCE CERTIFICATE

Certificate Reference Number: **AIIMS/IEC/2021/3346**

Project title: **"Evaluation of Routine Immunisation Services in a Community Development Block of Jodhpur: A mixed method study"**

Nature of Project:	**Research Project Submitted for Expedited Review**
Submitted as:	**M.D. Dissertation**
Student Name:	**Dr. Bharat Vaishnav**
Guide:	**Dr. Naveen K H**
Co-Guide:	**Dr. Pankaj Bhardwaj, Dr. Manoj Kumar Gupta, Dr. Akhil Dhanesh Goel & Dr. Prem Prakash Sharma**

Institutional Ethics Committee after thorough consideration accorded its approval on above project.

The investigator may therefore commence the research from the date of this certificate, using the reference number indicated above.

Please note that the AIIMS IEC must be informed immediately of:

- Any material change in the conditions or undertakings mentioned in the document.
- Any material breaches of ethical undertakings or events that impact upon the ethical conduct of the research.

The Principal Investigator must report to the AIIMS IEC in the prescribed format, where applicable, bi-annually, and at the end of the project, in respect of ethical compliance.

AIIMS IEC retains the right to withdraw or amend this if:

- Any unethical principle or practices are revealed or suspected
- Relevant information has been withheld or misrepresented

AIIMS IEC shall have an access to any information or data at any time during the course or after completion of the project.

Please Note that this approval will be rectified whenever it is possible to hold a meeting in person of the Institutional Ethics Committee. It is possible that the PI may be asked to give more clarifications or the Institutional Ethics Committee may withhold the project. The Institutional Ethics Committee is adopting this procedure due to COVID-19 (Corona Virus) situation.

If the Institutional Ethics Committee does not get back to you, this means your project has been cleared by the IEC.

On behalf of Ethics Committee, I wish you success in your research.

Dr. Praveen Sharma
Member Secretary

Member secretary
Institutional Ethics Committee
AIIMS, Jodhpur

Basni Phase-2, Jodhpur, Rajasthan-342005; **Website:** www.aiimsjodhpur.edu.in; **Phone:** 0291-2740741 Extn. 3109
E-mail : ethicscommittee@aiimsjodhpur.edu.in; ethicscommitteeaiimsjdh@gmail.com

Annexure 'B': Selection of Clusters by WHO 30x7 cluster sampling

S.No	Block	PHC/CHC	Subcenter	Name of Village	Population as on 2011 according to census	Cummulative Frequency		
1	Luni	Bhatinda	Bhatinda	Bhatinda	5699	5699		Cluster 01
2			Lolawas	Lolawas	1621	7320		
4				MOKLASANI	390	7710		
5				MORTUKA	1090	8800		
6			Modi Joshian	Modi Joshian	1744	10544		
7			Modi Sothara	Modi Sothara	678	11222		
8			Pabupura	Pabupura	1355	12577		
9			Palasani I	Palasani	2744	15321		Cluster 02
10				GOLIYA	487	15808		
11			Palasani II	Palasani II	2543	18351		
12				KHARI KALLA	1102	19453		
13				KHARI KHURD	500	19953		
14				SEWALO KI DHANI	412	20365		
15			Sajada	Sajada	371	20736		
16				NEW SAJADA	679	21415		
17				NEW SAJADA KHURD	1036	22451		
18				SINGHASANI	896	23347		
19		Dhava	Dhava		4988	28335		Cluster 03
				Dhava 2	160	28495		
				Dhawecha Nagar	314	28809		
				Pipral Nagar	426	29235		
				RAJESHWAR NAGAR	397	29632		
20			Bhandhu Kalla	Bhandhu Kalla	1499	31131		
22				ROHILA BHANDU	36	31167		
23				THUMBALI	438	31605		
24			Bhandu Khurd	Bhandu Khurd	1883	33488		
25			Chali	Chali	1689	35177		
26				SEVALA	856	36033		
27			Daipara	Daipara	2397	38430		Cluster 04
28			Gelawas	Gelawas	1448	39878		
29			Katarda	Katarda	2104	41982		
30			Khatawas	Khatawas	2181	44163		
31				JATIYASNI	771	44934		
32			Lunawas Charna	Lunawas Charna	1443	46377		
33				DOLA NADA	392	46769		Cluster 05
34				LUNAWAS KHURD	722	47491		
35			Lunawas Kalla	Lunawas Kalla	1491	48982		
36				VISHNU NAGAR	1196	50178		
37			Melba	Melba	1350	51528		
38				MODHATHALI	402	51930		
39				REBARIYAWAS	672	52602		
40			Pariharo ki Dhani	Pariharo ki Dhani	1080	53682		

41				BISHNOIA KI DHANI	300	53982		
42				JODLIYO KI DHANI	220	54202		
43		Dhundhara	Dhundhara		5612	59814		Cluster 06
				Aram garh	387	60201		
				Devaram Nagar	371	60572		
				Likhmaram Nagar	407	60979		
		Dhundhara	DADASAR	DADASAR	1067	62046		
44		Feench	Feench	Feench	5739	67785		Cluster 07
45				HANUMAN NAGAR	1191	68976		
46		Feench	Hamirnagar	Hamirnagar	1207	70183		
48		Dhundhara	LAKHAAR THUMB	LAKHAAR THUMB	551	70734		
49		Dhundhara	LOLASANI	LOLASANI	722	71456		
50		Dhundhara	Piparali	Piparali	2824	74280		
51				TAJALIYA	123	74403		
52		Feench	Rohicha Kalla	Rohicha Kalla	4474	78877		Cluster 08
53				KRISHNA NAGAR	284	79161		
54				SAMPAT NAGAR	363	79524		
55				SAMRATHAL NAGAR	214	79738		
56		Dhundhara	Rohicha Khurd	Rohicha Khurd	2327	82065		
57				ARNIYALA	331	82396		
58		Dhundhara	Uttesar	Uttesar	2354	84750		
59				KAGNADA	520	85270		
60				MAGRASAR	261	85531		
61		Guda Vishnoiyan	Guda Vishnoiyan	Guda Vishnoiyan	5109	90640		Cluster 09
				Balaji Nagar	1179	91819		
				Basani Baghela	223	92042		
				mangal Nagar	894	92936		
				Raika Guda	815	93751		
62			Jhalamand	Jhalamand	6917	100668		Cluster 10
63			Kharabera Bhimawata	Kharabera Bhimawata	1069	101737		
64				DEV NAGAR	214	101951		
65				RAJ NAGAR	209	102160		
66			Kharabra Purohitan	Kharabra Purohitan	2722	104882		
67				DHINGANA	787	105669		
68				PABUPURA	372	106041		
69				RAJPURIYA	588	106629		
70			Kuree	Kuree	1213	107842		
				Bhakarasani	1312	109154		Cluster 11
71		Jhanwar	Jhanwar	Jhanwar	6648	115802		
				Badla Nagar	1056	116858		
				Delumba	1286	118114		
				Dhana Vishnoian	293	118437		
				Dhand	400	118837		
				Kadumba Nada	986	119823		Cluster 12
				Kherli	755	120578		
				Nimbli	431	121009		
72			Ajit Nagar	Ajit Nagar	636	121645		

74				Rad Nagar	631	122276		
75			Basni Silawata	Basni Silawata	1961	124237		
77			Boranada	Boranada	6028	130265		Cluster 13
78			Bujhawar	Bujhawar	1067	131332		
79			Chicharli	Chicharli	1844	133176		
80				Purkhawas	1242	134418		
81			Dhinala Nada	Dhinala Nada	2254	136672		
82			Doli	Doli	5163	141835		Cluster 14
83				KERLA	795	142630		
84			Gangana	Gangana	2735	145365		
85			Hingola	Hingola	725	146090		
86				CHIRAI NAGAR	658	146748		
87				RANA NAGAR	945	147693		
88				SAWAN NAGAR	147	147840		
89			IMAM NAGAR	IMAM NAGAR	589	148429		
90				MERAN NAGAR	789	149218		
91			Janadesar	Janadesar	1141	150359		
92				BAPANADA	597	150956		Cluster 15
93				GULAB NAGAR	448	151404		
94			Khudala	Khudala	2976	154380		
95				SURTA NAGAR	341	154721		
96			Lunawas Kara	Lunawas Kara	2648	157369		
97				BEVTEA	472	157841		
99			MEHRAM NAGAR	MEHRAM NAGAR	393	158234		
100				KHEJARLA NADA	493	158727		
101			Narnadi	Narnadi	3861	162588		Cluster 16
102				Kharda Bhandu	1499	164087		
103			Pal	Pal	20621	184708		Cluster 17,18
105			Rabariya	Rabariya	635	185343		
106				KANASAR	398	185741		
107				SHERANI NAGAR	436	186177		
108			VISHNU NAGAR	VISHNU NAGAR	1590	187767		
109		Khejdlikal aan	Khejdlikal aan		3697	191464		
			KHEJARLI KHURD	KHEJARLI KHURD	732	192196		Cluster 19
110			Baniyawas	Baniyawas	1093	193289		
111			Bhagtasni	Bhagtasni	1163	194452		
112			Birami	Birami	2318	196770		
113				Gujrawas	353	197123		
114			Birdawas	Birdawas	1437	198560		
115				PITHASNI	633	199193		
116			Fitkasani	Fitkasani	1335	200528		
117				Bidasni	704	201232		
118				Rashida	1179	202411		
119			Kakelaw	Kakelaw	4767	207178		Cluster 20
120				Charna Basni	307	207485		
121			Miyasani	Miyasani	1134	208619		
122			Peesawas	Peesawas	724	209343		
123			Sangasni	Sangasni	1238	210581		
124		Luni	Luni		6419	217000		Cluster 21
				Rajor	683	217683		
125			Dhandhiya	Dhandhiya	547	218230		
126				Devpura	267	218497		
127				KISHAN PURA	569	219066		
128			Kakanni	Kakanni	2201	221267		

129				JAMBHESHWAR NAGAR	1216	222483		
130				RAJESHWAR NAGAR	330	222813		
131				SEWALA NAGAR	349	223162		
132			Nimbla	Nimbla	743	223905		Cluster 22
133				Dholi kakani	205	224110		
136			Shikarpura	Shikarpura	2871	226981		
137			Vishnu Nagar	Vishnu Nagar	1103	228084		
138				BISHAWAS	46	228130		
139				RANDERI	618	228748		
140		Salawas	Salawas		7016	235764		Cluster 23
				Kishna sar	296	236060		
				Salawas Railway St.	670	236730		
141			Mogda Kalla	Mogda Kalla	4049	240779		
142				MOGRA KHURD	851	241630		
143				SHEKHA NADA	154	241784		
144			Nandwan	Nandwan	5648	247432		Cluster 24
145				CHANVALO KI DHANI	757	248189		
146				HIRKHERA	442	248631		
147			Sangaria	Sangaria	10853	259484		Cluster 25
148			Sangariya Fanta	Sangariya Fanta	13000	272484		Cluster 26
149			Sar	Sar	2902	275386		Cluster 27
150				BHILO KI DHANI	0	275386		
151				NIMBLA SAR	789	276175		
152				SARDAR GARH	595	276770		
153			Sarecha	Sarecha	1447	278217		
154				BASNI JHUTHA	857	279074		
155				Khera Sarecha	1221	280295		
156			Tanawda	Tanawda	2844	283139		
158		Satlana	Satlana		2508	285647		Cluster 28
				Kishan khera	416	286063		
				Madhopura	1787	287850		
159			Bhacharna	Bhacharna	1624	289474		
160				GODAVASS	800	290274		
161				JANGUAVAS	552	290826		
162			BHAKHARI	BHAKHARI	592	291418		
163			CHAINPURA BHATAN	CHAINPURA BHATAN	382	291800		
164			Dudia	Dudia	1187	292987		
165			Golia Magara	Golia Magara	1098	294085		
166			Karniyali	Karniyali	285	294370		
167			Modi	Modi	455	294825		
168		Subdand	Subdand		1594	296419		Cluster 29
				Mahadev Nagar	494	296913		
				Mainasar	567	297480		
31-0			Barlia	Barlia	1783	299263		
170				KARNI NAGAR	846	300109		
171				MUKAN PURA	421	300530		
172			GODARO KI DHANI	GODARO KI DHANI	0	300530		
173			Kalijal	Kalijal	2831	303361		
174				MEHRIO KI DHANI	100	303461		
175				NIMBALI NADI	200	303661		

176				SHAKTI NAGAR	400	304061		
177				SIVGANVE	846	304907		
178		feench	Ram Nagar	Ram Nagar	618	305525		
179				Ram Nagar 2	0	305525		
180		Subdand	Sanai	Sanai	1919	307444		Cluster 30
181		Subdand	PANNE SINGH NAGAR	PANNE SINGH NAGAR	454	307898		
182				BAJRANG NAGAR	310	308208		
183				LUNAWAS JATA	809	309017		
184				MAHELAWAS	525	309542		
185		Subdand	Sinli	Sinli	2458	312000		
312000/30 = 10400 interval Rtio								
Random Number= 4837								
cluster zero= 5393								

Annexure 'C': Participant information sheet (English)

ALL INDIA INSTITUTE OF MEDICAL SCIENCES, JODHPUR

DEPARTMENT OF COMMUNITY MEDICINE AND FAMILY MEDICINE

PARTICIPANT INFORMATION SHEET (PIS)

Title of the Project: Evaluation of Routine Immunization Services in a Community Development Block of Jodhpur: A mixed method study

Name of the Principal Investigator: Dr.Bharat Vaishnav, Postgraduate Resident,
Department of Community Medicine and Family Medicine
Ph:7014784954

This study is being conducted to evaluate the routine immunization services which will help to improve the health care outcomes.

For this a number of questions will be asked to you about the current practices being followed in health care facility.

I would like you to know that this study will not provide you any monetary benefit, but it will help to generate data for the benefit of the community. You can refuse to answer any question and can withdraw yourself from the study at any point of time.

The data obtained from you and the beneficiaries will be used for the purpose of the study only. All the records will be kept confidential.

For further details or any other query, you may contact the following person who is the Guide for my study:

Dr. Naveen K H
Mobile No- 9036773746

Annexure 'D': Participant information sheet (Hindi)

अखिल भारतीय आयुर्विज्ञान संस्थान जोधपुर, राजस्थान

प्रतिभागी सूचना पत्रक (पीआईएस)

परियोजना का शीर्षक: जोधपुर के सामुदायिक विकास खंड में नियमित टीकाकरण सेवाओं का मूल्यांकन: एक मिश्रित विधि का अध्ययन

प्रधान अन्वेषक का नाम: डॉ.भरत वैष्णव, स्नातकोत्तर निवासी,

सामुदायिक चिकित्सा और परिवार चिकित्सा विभाग

फोन: 7014784954

यह अध्ययन नियमित टीकाकरण सेवाओं का मूल्यांकन करने के लिए आयोजित किया जा रहा है जो स्वास्थ्य देखभाल परिणामों को बेहतर बनाने में मदद करेगा।

इसके लिए स्वास्थ्य देखभाल सुविधा में वर्तमान प्रथाओं का पालन करने के लिए कई प्रश्न पूछे जाएंगे।

मैं आपको यह जानना चाहूंगा कि यह अध्ययन आपको कोई मौद्रिक लाभ प्रदान नहीं करेगा, लेकिन यह समुदाय के लाभ के लिए डेटा उत्पन्न करने में मदद करेगा। आप किसी भी प्रश्न का उत्तर देने से इनकार कर सकते हैं और किसी भी समय अपने आप को अध्ययन से हटा सकते हैं।

आपके और लाभार्थियों से प्राप्त डेटा का उपयोग केवल अध्ययन के उद्देश्य के लिए किया जाएगा। सभी रिकॉर्ड गोपनीय रखे जाएंगे।

अधिक जानकारी या किसी अन्य प्रश्न के लिए, आप निम्नलिखित व्यक्ति से संपर्क कर सकते हैं, जो मेरे अध्ययन के लिए मार्गदर्शक है:

डॉ। नवीन के एच

मोबाइल नंबर- 9036773746

Annexure 'E': Informed consent form – Participants (English)

All India Institute of Medical Sciences Jodhpur, Rajasthan

Informed Consent Form

Title of Project: Evaluation of Routine Immunization Services in a Community Development Block of Jodhpur: A mixed method study

Name of Principal Investigator: Dr. Bharat Vaishnav, Postgraduate Resident,
Department of Community Medicine and Family Medicine
Ph: 7014784954

Volunteer Identification No.: _____

I, _____S/o or D/o or W/o _____, give my full, free, voluntary consent to be a part of the study titled: Evaluation of Routine Immunization Services in a Community Development Block of Jodhpur: A mixed method study, the procedure and nature of which has been explained to me in my own language to my full satisfaction.

I confirm that I have had the opportunity to ask questions.

I understand that my participation is voluntary and I am aware of my right to opt out of the study at any time without giving any reason.

I understand that the information collected from me and any of the records about immunization provided by me may be looked at by a responsible individual from AIIMS, Jodhpur or from regulatory authorities. I give permission to these individuals to have access to my records and undertake all study related procedures.

Date: _____ Place: _____ Signature/Left thumb impression of Participant	Date: _____ Place: _____ Signature of Investigator

This to certify that the above consent has be

Witness 1 Signature/Thumb impression Name: Date:	Witness 2 Signature/Thumb impression Name: Date:

Annexure 'F': Informed consent form – Participants (Hindi)

अखिल भारतीय आयुर्विज्ञान संस्थान, जोधपुर
सामुदायिक चिकित्सा एवं परिवार चिकित्सा विभाग
सूचित सहमति प्रपत्र – अध्यापक

परियोजना का शीर्षक: जोधपुर के सामुदायिक विकास खंड में नियमित टीकाकरण सेवाओं का मूल्यांकन: एक मिश्रित विधि का अध्ययन

प्रधान अन्वेषक का नाम: डॉ. भरत वैष्णव, स्नातकोत्तर निवासी,
सामुदायिक चिकित्सा और परिवार चिकित्सा विभाग
फोन:7014784954

स्वयंसेवक पहचान संख्या: _____

I, _____ S/o या D/o या W/o _____, पूर्ण, नि: शुल्क, स्वैच्छिक सहमति शीर्षक के अध्ययन का एक हिस्सा होने के लिए: जोधपुर के एक सामुदायिक विकास खंड में रूटीन टीकाकरण सेवाओं का मूल्यांकन: एक मिश्रित विधि का अध्ययन, प्रक्रिया और प्रकृति। जो मुझे अपनी पूरी संतुष्टि के लिए मुझे अपनी भाषा में समझाया गया है।
मैं पुष्टि करता हूं कि मुझे सवाल पूछने का अवसर मिला है।
मैं समझता हूं कि मेरी भागीदारी स्वैच्छिक है मुझे बिना किसी कारण के किसी भी समय अध्ययन से बाहर निकलने के मेरे अधिकार के बारे में पता है।
मैं समझता हूं कि मेरे द्वारा प्रदान किए गए टीकाकरण और मेरे द्वारा प्रदान किए गए टीकाकरण के किसी भी रिकॉर्ड को एम्स, जोधपुर के एक जिम्मेदार व्यक्ति या नियामक अधिकारियों से देखा जा सकता है। मैं इन व्यक्तियों को अपने रिकॉर्ड तक पहुंचने और अध्ययन संबंधी सभी प्रक्रियाओं को करने की अनुमति देता हूं।
यह प्रमाणित करने के लिए कि मेरी उपस्थिति में उपरोक्त सहमति प्राप्त की गई है

तिथि: _____ _____
स्थान: _____ हस्ताक्षर / बाएं अंगूठे का निशान

यह प्रमाणित किया जा रहा है कि उपर्युक्त सहमति मेरी उपस्थिति में प्राप्त की गई है -

तिथि: _____ _____
स्थान: _____ **स्नातकोत्तर छात्र के हस्ताक्षर**

1. गवाह

_____
हस्ताक्षर
नाम _____
निवासी_____

2. गवाह

_____
हस्ताक्षर
नाम _____
निवासी_____

Annexure 'G': Semi Structured Questionnaire

ALL INDIA INSTITUTE OF MEDICAL SCIENCES, JODHPUR

DEPARTMENT OF COMMUNITY MEDICINE AND FAMILY MEDICINE

Questionnaires

A Indicators to know about hesitancy for immunization:

BACKGROUND CHARACTERISTIC:

1.1 Name of village/ Mohalla:

गाँव / मोहल्ले का नाम:LONG

1.2 Name of head of household:

परिवार के मुखियाँ का नाम:

1.3 Details of Parents/Guardians:

माता - पिता / रख-रखाव करने वाले का विवरण :

Details	Father पिता	Mother माता	Guardian अभिभावक
Name नाम :			
Age उम्र :			
Education शिक्षा :			
Occupation **व्यवसाय :**			

1.4 Type of family :

टाइप फैमिली का :

1.5 Monthly income :

महीने की कमाई

2.DETAILS OF MOTHER :

माता के बारे में :

2.1 Number of children :

बच्चो की संख्या :

2.2 Was pregnancy registered :

क्या गर्भावस्था का पंजीकरण हुआ था :

2.3 Antenatal Care: 1. Yes 2. No

गर्भावस्था के दौरान अस्पताल गए थे : 1. हा 2. ना

2.4 No. of ANC:

कितनी बार अस्पाल गए थे :

2.5 ANC conducted by: 1.Doctor 2.ANM 3.Don't know 4. Others (Please specify)

अस्पाल में किसने आपको देखा और जाँच की थी :

2.6 Place of delivery: 1.Government hospital 2.Private hospital 3.Home 4.Don't know 5. Others (Please specify)

बच्चे का जन्म कहा हुआ था :

2.7 Delivery conducted by: 1.Doctor 2.ANM 3.Dai 4.Untrained personn 5. Don't know 6. Others (Please specify)

बच्चे का जन्म किसने करवाया था :

2.8 Mode of delivery: Simple vaginal/Instrumental/Caesarean

बच्चे का जन्म किस रास्ते से हुआ था :

2.9 Gestational Age at Delivery:

गर्भावस्था के कितने महीनो या सप्ताह में बच्चे का जन्म हुआ था :

3.CHARACTERSTIC OF THE CHILD :

बच्चे के बारे में :

3.1.Name of child :

बच्चे का नाम

3.2 Age (in months) :

उम्र (महीने में) :

3.3 Gender : 1.Male 2.Female 3.Transgender

लिंग :

3.4 Birth order :

ये आपके कोनसे नंबर का बच्चा हैं :

3.5 Birth interval with preceding child (In years) :

बच्चो के जन्म के बीच कितना अंतराल है :

4.IMMUNIZATION STATUS OF THE CHILD :

बच्चे के टीकाकरण के बारे में ?

4.1 What is the source of information regarding immunization :

1.Healthcare worker 2. Mass Media 3. Others (Please specify)

टीकाकरण के बारे में आपको कहा से पता चलता हैं :

4.2 Health facility of immunization: 1. Govt. 2. Private 3. Outreach

टीकाकरण कहा से करवाते हैं :

4.3 Do you have immunization card : 1.Yes 2.No (If yes verified)

आपके पास टीकाकरण कार्ड (ममता कार्ड) है :

Age उम्र	Vaccine Antigen टीका	Yes/No हा / ना	Date तारीख़	If yes any side effect अगर हा तो कोई साइड इफेक्ट	If not vaccinated (Reason) अगर नहीं तो (कारन)
At Birth जन्म पर	BCG / बी.सी.जी. (Scar) (निशान)				
	Hep B/ हेपेटाइटिस बी				
	OPV -0/ ओ.पी.वी.- 0				
At 6 weeks 6 सप्ताह पर	OPV-1ओ.पी.वी.- 1				
	Pentavalent- 1/ पेंटावैलेंट-1				
	Rota Virus-1/ रोटा वायरस-1				

	IPV-1/ आई.पी.वी.-1				
	PCV 1/ पी.सी.वी.-1				
At 10 weeks 10 सप्ताह पर	OPV-2/ ओ.पी.वी.- 2				
	Pentavalent-2/ पेंटावैलेंट-2				
	Rota Virus -2/ रोटा वायरस-2				
At 14 weeks 14 सप्ताह पर	OPV-3/ ओ.पी.वी.- 3				
	Pentavalent-3/ पेंटावैलेंट-3				
	Rota Virus-3/ रोटा वायरस-3				
	IPV-2/ आई.पी.वी.-2				
	PCV-2/ पी.सी.वी.-2				
At 9 months 9 महीने पर	Measles / मीज़ल्स				
	J.E./ जे.ई.				
	Vitamin/ विटामिन-ए				
	PCV -booster /पी.सी.वी.- बूस्टर				
At 16 to 23 months 16 से 23 महीने के बीच	Measles-2/ मीज़ल्स-2				
	JE-2/ जे.ई.-2				
	OPV booster / ओ.पी.वी.- बूस्टर				
	DPT booster/ डी.पी.टी.- बूस्टर				

5.Immunization up to date:

उम्र के अनुसार टीकाकरण :

6.Reasons for not having completely immunized:

6.1 Lack Of Information जानकारी का अभाव	a. Unaware of the need for immunization टीकाकरण की जरूरत का पता न होना
	b. Unaware of need to return for 2nd and 3rd doses दूसरे और तीसरे टीके के लिए कब वापस आना है
	c. Place and/or time of immunization unknown टीकाकरण की जगह और समय का पता न होना
	d. Fear of side reactions साइड इफ़ेक्ट का डर
	e. Wrong ideas about contraindication निषेध के क़ारनो की गलत जानकारी होना
	f. Others अन्य
6.2 Lack of motivations	g. Postponed until another time अगले समय के लिए बचाकर रखना
	h. No faith in immunization टीकाकरण में विश्वास न होना
	i. Rumours अफवाह
	j. Other अन्य
6.3 Obstacles	k. Place of immunization too far टीकाकरण की जगह का बहुत दूर होना
	l. Time of immunization inconvenient टीकाकरण का समय आपकी सुविधा के अनुसार न होना
	m. Vaccinator absent टीकाकरण करने वाले का न होना
	n. Vaccine not available टीका का अभाव

	o. Parents are too busy आप अपने काम में बहुत बिजी है
	p. Family problem and/or illness of mother घर की समस्या या माँ बीमार हो
	q. Child ill- not brought बच्चा बीमार रहता है इसीलिए नहीं ले गए
	r. Child ill- brought but not given immunization बच्चे को लेकर गए लेकिन बीमारी की वजह से टीका नहीं दिया
	s. Long waiting time लम्बे समय तक इंतज़ार करना पड़ता है
	t. Other अन्य

Date :
Place :

Annexure 'H': Interview Guide for Focus Group Discussion

No:	FGD
1.	Why do you think children given vaccine/immunization? आपको क्या लगता है बच्चो को वैक्सीन क्यों दिया जाना चाहिए ? ये बीमारी या बीमारी की गंभीरता या दोनों के लिए असरदार है ? ये आपके बच्चे के साथ अन्य बच्चो में भी फैलाव को रोकता है ?
2.	Are there situations when you failed to bring your child for immunization? ऐसे कोनसे हालात है जिसमे आप बच्चे को टीकाकरण के लिए नहीं ले जा पाते है ? घर के अंदर और बाहर की समस्याये (काम ज्यादा, बाहर किसी तरह की रुकावट भौतिक या सामाजिक तौर पर) ?
3.	Do you think most parents from your area accept taking their children for immunization? Are there those who do not? What are some of the reasons why the drop out to take the children for immunisation? आपको क्या लगता है के आपके आस पास के लोग बच्चो को टीके के लिए ले जाते है ? कुछ ऐसे भी है जो नही ले जाते है ? आप कुछ ऐसे कारन बता सकते है लोग क्यू बच्चे को टीके के लिए नहीं ले जाते है ? उनका क्या मानना है टीकाकरण को लेकर ?
4.	Are there days you went to a health facility and found when there were no vaccines? If yes than Which vaccine was it? What did you do get your child vaccinated? ऐसा कोई दिन जब आप किसी अस्पताल में गए हो और अपने पाया हो वहा कोई टीका उपलब्ध नहीं है ? अगर हा तो कोनसा टीका था ? आपने अपने बच्चे को टीका लगवाने के लिए फिर क्या किया ? सामने से आपके पास क्या सुझाव और आए, आपका किसी जगह नाम लिखा हो के आने पर आपको बताया जायेगा ?

6.	Are there any religious groups or cultural groups you know of, (maybe not from your area) that do not encourage or promote immunization for children? If yes, what are their reasons for being against vaccines/immunization? आप ऐसे किसी धार्मिक या साँस्कृतिक समूह को जानते हो (आपके एरिया का न भी हो) जो टीकाकरण को प्रोत्सहित नहीं करता हो ? अगर है तो क्या आप बता सकते है इस नकारात्मक भाव के बारे में ? गांव के लोगो का उनके बारे में क्या विचार है ? चिकित्सा से जुड़े लोगो ने क्या कदम उढ़ाये है ?
7.	What is the first thing the government does when they want to introduce a new vaccine to your area? Do they educate the community enough? Do they usually get feedback from community? सरकार का पहला कदम क्या होना चाहिए जब कोई नया टीका आपके एरिया में लगाया जाता है ? क्या ये समुदाय को अच्छे से जागरूक करते है? क्या इन लोगो को समुदाय की तरफ से कोई सुझाव दिए जाते है ? उसके फायदे और नुकसान के बारे में बताया जाता है ?
8.	What can be done or in what ways do you think parents/mothers from your locality can be better empowered or helped to demand for or access immunization services? आपको क्या लगता है क्या और तरीके अपनाये जाने चाहिए की आपके एरिया के माता- पिता जागरूक हो टीकाकरण को लेकर और मांग करे टीकाकरण की सुविधा आप लोगो तक पहुंच पाए? क्या आपकी स्वास्थ्य समस्याओ के बारे में कही किसी जगह बातचीत की जाती है ?

CC

Date :

Place :

Annexure 'I': Interview Guide for In-depth interview

1. Name of informer and post :
   आपका शुभ नाम एवं पद ?

2. Sufficient health care workers to ensure coverage?
   गाँव की जनसँख्या के हिसाब से स्वास्थ्य कर्मियों की संख्या पर आपके क्या विचार है?

3. Language barrier in between health care workers & beneficiaries if yes how are they managed
   स्वास्थ्य कर्मियों और गाँव के लोगो के बीच किसी तरह की भाषा से सम्बंधित कोई परेशानी होती है , अगर हा तो आप लोग उसे कैसे मैनेज करते है ?

4. How to manage the cold chain system?
   क्या आप बता पाएंगे के आप यहां कोल्ड चैन सिस्टम को कैसे मैनेज करते है?

5. What is the management system for vaccine supply chain and storage?
   क्या आप बता पाएंगे के आप यहां वैक्सीन सप्लाई चैन सिस्टम एंड स्टोरेज को कैसे मैनेज करते है?

6. What you do when patient came with AEFI?
   आप क्या करते है अगर आपके पास कोई वैक्सीन लेने के बाद उससे जुड़ा कोई प्रभाव लेकर आता है ?

7. Is there any covid related disruption present ? If yes, what could be the reasons according to you ?
   आपके यहा कोविड समय में टीकाकरण को लेकर कुछ समस्या आई थी, अगर हा तो उसके पीछे आपको क्या कारण नजर आते है ?

8. Outreach sessions timing and management? (specially in Covid pandemic)
   कोविड में जिन बच्चो का टीकाकरण रह गया, बाद में उनके लिए आपकी की तरफ से कोई अतिरिक्त प्रयास और बाहरकोई सेशन रखे गए थे ?

Annexure 'J': Session Site Monitoring Checklist

4 Key Messages	
Message 1	What vaccine was given and what disease it prevents.
Message 2	When to come for the next visit.
Message 3	What are the minor side-effects and how to deal with them.
Message 4	To keep the immunization card safe and to bring it along for the next visit.

Session Monitoring Format for Routine Immunization

For (*) marked questions multiple responses may be applicable; "NOB" means "Not Observed"   Form No: (_) _ _ / _ _ _ / MON / YY / _ _ _ _

Name of Monitor: .... Organization: ☐ Govt. ☐ WHO/NPSP ☐ UNICEF ☐ Others Designation:........
Date ☐/☐/☐ **Time:** .... **Day:** Wed ☐ Others........ Last Polio SIA date........

State code ☐☐ **District** ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐
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***Reason for monitoring[1] This session site:** ☐ HR ☐ MG ☐ SL ☐ XR ☐ VS ☐ MOB ☐ VDPV ☐ WPV ☐ OTH
Type of Session Site: ☐ **Fixed site** (☐ Sub Centre ☐ Others) ☐ **Outreach** (☐ Sub Centre ☐ ICDS Centre ☐ Others)

	Q1 to Q 24: Observe and ☐ Tick, whichever is applicable	
1	a) Is session held : ☐ Yes ☐ No	1b) If session is not held, reason for session not held[2] : ☐ A2 ☐ B2 ☐ C2 ☐ D2 ....
	If session is not held, please stop session monitoring and go for house-to-house monitoring	
	c) If session is held, is session as per plan : ☐ Yes ☐ No	
2	Is the session happening with Village Health & Nutrition Day (VHND)?	☐ Yes ☐ No
3	Who has brought vaccines & logistics to this session site:	☐ Alternate Vaccine Delivery (AVD) ☐ ANM ☐ Supervisor ☐ Others ....
4	a) Vaccines & diluents kept in Vaccine Carrier (VC): ☐ Yes ☐ No	b) Vaccines & diluents in zipper bag: ☐ Yes ☐ No
	c) How many icepacks are in the Vaccine Carrier : ☐ Four ☐ Less than four	
5	Which of the vaccines/diluents are available at session site	BCG ☐ Yes ☐ No; Measles ☐ Yes ☐ No; OPV ☐ Yes ☐ No; BCG Diluent ☐ Yes ☐ No; Measles Diluent ☐ Yes ☐ No; Hepatitis B ☐ Yes ☐ No; DPT ☐ Yes ☐ No; DT ☐ Yes ☐ No; TT ☐ Yes ☐ No; JE ☐ Yes ☐ No; JE Diluent ☐ Yes ☐ No; Pentavalent ☐ Yes ☐ No
6	Has ANM recorded the following	☐ Vaccine Batch No ☐ Vaccine Expiry date ☐ Diluent batch ☐ Diluent Expiry date
7	Observe vaccines vials ANM is using or going to use (unopened vials in VC). ***Is any vial found in the mentioned condition?*** if 'Yes', ***Tick*** ☐ and ***record*** the vaccine	☐ Without label........ ☐ Unreadable label........ ☐ VVM **Stage** III or IV........ ☐ **Expired** Vaccine Vial........ ☐ **Frozen** Vaccine (DPT, TT, Hepatitis–B, DT)........ ☐ BCG/☐ Measles vaccine reconstituted ***more*** than **4 hours** back........ ☐ JE vaccine reconstituted **more** than **2 hours** back........
8	Which of the mentioned Logistics are ***adequately*** available	☐ AD (0.1ml) Syringes ☐ AD (0.5 ml) Syringes ☐ 5ml Reconstitution Syringes ☐ Vitamin-A Solution ☐ Blank RI Card ☐ Counterfoils
9	Which of the mentioned Logistics are available ☐ Weighing machine	☐ ORS Packet ☐ Paracetamol ☐ B P Apparatus ☐ Plastic Spoon/cap for Vitamin-A ☐ Tracking Bag ☐ Functional Hub Cutter ☐ Nutritional Supplements ☐ Zinc Tablet ☐ IFA Tablet
10	Is due list available with the ANM	☐ Yes ☐ No ☐ NOB
11	Is due list available with the Mobiliser	☐ Yes ☐ No ☐ NOB
12	Has ANM written time of reconstitution on reconstituted vial/s	☐ Yes ☐ No ☐ NOB
13	Which kind of syringe Is ANM using to inject vaccines	☐ AD syringe ☐ Glass syringe ☐ Disposable Syr
14	Is DPT vaccine given on outer (anterolateral) aspect of mid thigh	☐ Yes ☐ Others site........ ☐ NOB
15	Route of Measles vaccine given	☐ Sub Cutaneous ☐ Intra Muscular ☐ Intra Dermal ☐ NOB
16	Site of Measles vaccine given	☐ Right Upper Arm ☐ Others ☐ NOB
17	Is ANM touching any part of the needle while giving injection	☐ Yes ☐ No ☐ NOB
18	Is ANM following "no recapping" procedure after giving injection	☐ Yes ☐ No ☐ NOB
19	Is ANM cutting each syringe with hub cutter just after use	☐ Yes ☐ No ☐ NOB; If No,Why3: ☐ A3 ☐ B3 ☐ C3 ☐ D3*
20	How is ANM segregating immunization waste	☐ Red & Black bag ☐ others ☐ Not done ☐ NOB
21	How is ANM recording after vaccinating each child	☐ No record ☐ Tally sheet ☐ Others______ ☐ NOB
22	Is ANM delivering all 4 Key Messages to the care-givers (see back)	☐ Yes ☐ No ☐ NOB
23	If all 4 Messages are not delivered, the most commonly missed message	☐ Message 1 ☐ Message 2 ☐ Message 3 ☐ Message 4
24	Is ANM advising the care-givers to wait for 30 mins after vaccination	☐ Yes ☐ No ☐ NOB
	Q 25: Interview three caregivers	
25	Who has mobilized you to **this** session site[4]?	**Caregiver 1** / **Caregiver 2** / **Caregiver 3**
	Q 26 to Q 29: Ask the ANM/ Vaccinator following questions and Check the records, if needed	
26	a) Will you vaccinate, If a child comes with mild fever ?	☐ Yes ☐ No
	b) Will you vaccinate, If a child comes with loose motions ?	☐ Yes ☐ No
27	How do you dispose off the immunization-waste[5] ?	☐ A5 ☐ B5 ☐ C5 ☐ D5
28	Has any supervisor visited you in last 3 months ?	☐ None ☐ Health Supervisor ☐ MO ☐ Others........
29	How many sessions have you planned and conducted in last 3 months ?	Planned........, Conducted........
30	If, any Vaccine or logistic is not available or ANM is absent, please visit the PHC to ascertain the reason of non-availability:	

[1] **Response keys for " Reason for monitoring "- HR**= Hard to reach, **MG**= Migrant, **SL**= Slum, **XR**= Refusing community, **VS**= Vacant Sub Centre, **MOB**= Measles Outbreak in last 1 year **VDPV**= Vaccine derived Polio Virus detected ever in the area, **WPV**= Wild Polio Virus in last 3 yrs, **OTH**=Others

[2] **Response keys for " Q1b"- A2** = Neither ANM/ Vaccinator nor vaccines/logistics is available, **B2** = ANM/vaccinator present but vaccine/logistics not available, **C2** = Vaccine / logistics available but ANM / vaccinator absent, **D2** = Others (specify);

[3] **Response keys for " Q 19"- A3** = Hub-cutter not available, **B3** = Hub-cutter not functioning, **C3** = Untrained ANM, **D3** = Others,

[4] **Response keys for " Q 25"- 1** = ASHA, **2** = ICDS worker, **3** = ANM, **4** = SHG, **5** = PRI personnel, **6** = NGO, **7** = Relative/Neighbor, **8** = CMC, **9** = others, **10** = None

[5] **Response keys for " Q 27"- A5** = Dumped near session site, **B5** = Carried to PHC, **C5** = Open burning, **D5** = Others