Estimating Childhood Vaccination Coverage and Timeliness Using Pregnancy and Child Tracking System (PCTS) in Udaipur District, Rajasthan

By

Shivani Bhandari

Dissertation submitted in partial fulfillment of the requirements of the degree

MBA Hospital and Health Management

Academic year, 2017-2019

The IIHMR University, Jaipur

1, Prabhu Dayal Marg, Sanganer, Airport
Jaipur 302029, Rajasthan
Ph: 0141 3924700, Fax: 3924738
Website: **www.iihmr.edu.in**

Estimating Childhood Vaccination Coverage and Timeliness Using Pregnancy and Child Tracking System (PCTS) in Udaipur District, Rajasthan

By

Shivani Bhandari

Dissertation submitted in partial fulfillment of award of

MBA Hospital and Health Management

Academic year, 2017-2019

Lords Education and Health Society (LESH) / Wadhwani Initiative for Sustainable Healthcare (WISH), Madhya Pradesh

The IIHMR University, Jaipur
1, Prabhu Dayal Marg, Sanganer, Airport
Jaipur 302029, Rajasthan
Ph: 0141 3924700, Fax: 3924738
Website: **www.iihmr.edu.in**

INSTITUTE OF HEALTH
MANAGEMENT RESEARCH
(WHO Collaborating Centre for District Health System Based on Primary Health Care)

IIHMR UNIVERSITY

TO WHOMSOEVER MAY CONCERN

This is to certify that Shivani Bhandari, student of MBA Hospital and Health Management from The IIHMR University, Jaipur has undergone internship training at LEHS WISH from 1st February 2019 to 30th April 2019.

She has successfully carried out the study designated to her during internship training and her approach to the study has been sincere, scientific and analytical.

The Internship is in fulfilment of the course requirements.

I wish her all the success in all her future endeavors.

Col. (Dr.) Ashok Kaushik
Dean, Academics and Student Affairs
The IIHMR University, Jaipur
16 May 2019.

Dr. Mohan Lal Bairwa
Associate Professor
The IIHMR University, Jaipur

1, Prabhu Dayal Marg, Near Sanganer Airport, Jaipur- 302029, Rajasthan, India.
Ph.: 0141- 3924700, 2791431- 32, Fax: 0141 3924738, E-mail: iihmr@iihmr.edu.in, Web.: www.iihmr.edu.in

LORDS EDUCATION & HEALTH SOCIETY

WISH
Transforming Healthcare Through Innovation

Ref No: LEHS|WISH/HR – Internship/ 2018-19/2018/006

Date : May 13, 2019

To whosoever it may concern

This is to certify that **Dr. Shivani Bhandari**, has completed her internship at the **Lords Education and Health Society**, under its flagship program, **Wadhwani Initiative for Sustainable Healthcare (WISH)** from **February 01, 2019 to April 30, 2019**. She work under the innovations team.

We wish her all the success for her future endeavors.

For Lords Education and Health Society

LORDS EDUCATION HEALTH SOCIETY
Building No. 24 (3rd Floor) Okhla Industrial Estate Phase-3, New Delhi 110020

Sheena Gujral

Head of Human Resource and OD

CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled **"Estimating Childhood Vaccination Coverage and Timeliness Using Pregnancy and Child Tracking System (PCTS) in Udaipur District, Rajasthan"** and submitted by **Shivani Bhandari**, Enrolment No IIHMR- U/01/2017-19/0669 under the supervision of **Dr. Mohan Bairwa** for award of MBA in Hospital and Health Management of the University carried out during the period from 01-02-2019 to 30-04-2019 embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other institute or other similar institution of higher learning.

Shivani Bhandari

Dr. Shivani Bhandari

Abstract

Background: Immunization against common childhood diseases has been an integral component of mother and child health services in India since the adoption of the primary health care approach in 1978. Various strategies were adopted by the government of India to improve coverage of immunization service throughout India. Another important element is to track whether the vaccine is administered on time. Data on vaccines administered in Rajasthan is currently recorded on pregnancy and child tracking system (PCTS). It provides coverage estimates and line lists for timeliness of immunization which has not been fully used to date in the vaccination literature. **Objectives:** The study specifically focuses on how data held on PCTS can be used to estimate the childhood vaccination coverage and timeliness. Additionally, the study also delineates the views and experiences of PCTS officials in implementing PCTS in relation to immunization services**. Methods:** Two rural primary health centers (PHCs) namely Bikarani and Mandwa run by LEHS|WISH in Udaipur district were selected for the study. To estimate the childhood vaccination coverage and timeliness, cross-sectional study based on secondary data analysis using an excel template was conducted. Exploratory study using a qualitative approach involving interviews was done to explore the view and experiences of PCTS officials. **Results:** The analysis of Rajasthan's PCTS data on immunization revealed that in spite of a tribal area immunization coverage achievement was high although with a scope for improvement. PHC Mandwa showed universal immunization coverage achievement while PHC Bikarani had 76 % achievement. Majority of recommended childhood vaccines except for BCG showed delayed administration resulting in three-fourth or more OPV 1, OPV 2, OPV 3, penta 1, penta 2, penta 3 and, measles doses being given after the recommended ages. Lack of proper connectivity, slow speed of server, frequent power failures, inadequate trainings, data quality and data usage were revealed as major challenges faced by PCTS officials. **Conclusion:** Although enormous improvement is seen in the overall immunization coverage achievement but timeliness still shows a gross underperformance in Udaipur district. PCTS has led to improved supervision of healthcare workers, but several challenges are being faced in the implementation.

Keywords: Estimating, Pregnancy and Child Tracking System(PCTS), Immunization coverage, Vaccination timeliness

ACKNOWLEDGEMENT

As I think about those whose influence and support has aided me in the completion of my project, it is, therefore, for the almighty and my family that owe first thanks. I am grateful for their blessings and unwavering faith in me.

I must acknowledge the judicious oversight of my dissertation guide Dr. Mohan Lal Bairwa for his able guidance and useful suggestions which helped me in completing the project. He has been my constant source of inspiration and learning throughout my journey at The IIHMR University.

Special thanks to my Organization guide Mr. Dinesh Songara, State Programme and Technical Head for the faith shown in me, whose valuable support and constant inspiration taught me a strong groundwork to be a public health professional now and thereafter.

My heartfelt thank you to Dr. Ambey Kumar Srivastava, Research Monitoring Evaluation & Learning Specialist for the valuable guidance and cooperation throughout the study. Further, I would like to thank Mr. Kapil Zutshi, State Director for his interest in my work, his encouragement, and wise guidance.

This acknowledgement is incomplete without thanking Dr. Arvind Rinkoo, Project Director-Innovations for providing support in completing my project successfully as well as giving insight into my operational issues that came across during the project at LEHS WISH.

I would also like to thank Mr. Vinod Rathore (Senior Research Monitoring Evaluation & Learning Specialist), Dr. Meenakshi Pareek (Innovation Manager), Mrs. Varsha Sharma (HR Manager), Mr. Mukesh Jain (Finance Head), Mrs. Samprada, Dr. Vivek Thakur, Dr. Aditya Bhandari, Mr. Prashant, Mr. Vijender, Mr. Amar, Miss Abhilasha, Mr. Nafees and the field staff for providing immense support and motivation at various stages.

I also want to give special recognition to my friends, Kaavish, Kanika, Shimona, Prachi, Preet, Sameer, Kabir, Niharika, Rama, Divleen, and Simar who have always upheld me.

Without this circle of support, I would not have been able to complete this project.

Regards,

Shivani Bhandari

MBA HM-22

Table of Contents

Acknowledgement 5

1. Background 9

2. Rationale 13

3. Research Questions 14

4. Objectives 14

5. Methodology 14

5.1 Study Setting 14

5.2 Study Design 15

5.3 Study Sample 15

5.4 Study Participants 15

5.5 Study Tools 15

5.6 Duration of Study 16

5.7 Data Collection 16

5.8 Data Analysis Plan 17

5.9 Ethical Considerations 17

6. Results 18

6.1 Section A: Full immunization coverage achievement 18

6.2 Section B: Timeliness of Vaccination 19

6.3 Section C: views and experiences of PCTS officials 21

7. Discussion 25

8. Suggestions 27

9. Conclusion 28

10. References 28

Annexures 31

List of Figures

Figure 7.1.1: Gender wise full immunization coverage achievement for PHC Bikarani (n=756) and PHC Mandwa (n=545) 18

Figure 7.2.1: Timeliness of vaccination for PHC Bikarani (n=1122) and PHC Mandwa(n=591) 20

Abbreviations

AEFI	Adverse Event Following Immunization
AHS	Annual Health Survey
ANC	Ante Natal Care
ANM	Auxiliary Nurse Midwife
ASHA	Accredited Social Health Activist
BCG	Bacille Calmette Guerin
CI	Confidence Interval
DC	District Coordinator
DEO	Data Entry Operator
DLHS	District Level Household Survey
DPT	Diphtheria, Pertussis and Tetanus
FIC	Full Immunization Coverage
GOI	Government of India
HiB	Haemophilus Influenzae Type B
HMIS	Health Management Information System
IMR	Infant Mortality Rate
LHV	Lady Health Visitor
MCTS	Mother and Child Tracking System
MCV	Meningococcal Vaccine
NFHS	National Family Health Survey
NIC	National Informatics Center
OPV	Oral Poliovirus Vaccines
PCTS	Pregnancy, Child Tracking & Health Services
PHC	Primary Health Center
PICME	Pregnancy and Infant Cohort Monitoring and Evaluation
RMEL	Research Monitoring Evaluation & Learning
SC	Sub- Center
TT	Tetanus Toxoid
UNICEF	United Nations International Children's Emergency Fund
VPDs	Vaccine-Preventable Diseases
WHO	World Health Organization

1. BACKGROUND

Immunization against common childhood diseases has been an integral component of mother and child health services in India since the adoption of the primary health care approach in 1978 (1). In a joint effort with WHO, UNICEF, and other international and national organizations, the Government of India (GOI) has been working to accomplish the universal immunization coverage of children. Even with all the constant work done by the governmental and non-governmental institutes for 100% immunization coverage, there are yet zones with very low coverage. According to WHO with the exception of safe water, no other modality even the antibiotics have had such a major effect on mortality reduction like immunization has.

Globally immunization saves more than 3 million lives every year in all age groups, being largely responsible for the reduction in under-five mortality. The Government's Universal Immunization Programme has helped to reduce the under-five mortality by focusing on Immunization coverage. However, vaccine-preventable diseases(VPDs) are still responsible for over 5 lakh deaths annually in India and another 89 lakh children remain at risk, because they are either unimmunized or partially immunized against vaccine-preventable diseases(2). Four States together contribute to 56% of all child deaths in the country, namely-Uttar Pradesh (2.45 lakhs), Bihar (1.2 lakhs), Madhya Pradesh (1.0 lakh) and Rajasthan (0.75 lakh)(3). According to the National Family Health Survey (NFHS-4) 2015-16, in India 62% of children of one to two years of age have been fully immunized, though in Rajasthan just 54.8 % were fully immunized. The rate further drops to 53.1% in rural Rajasthan, the setting of the present study, and to 37.2 % in the selected study area (an underserved population in rural Udaipur district). Demographic barriers (minority ethnicity, parents' lack of education, and low socioeconomic status), populations living in difficult-to-reach areas, programmatic challenges such as vaccine stock-outs, and conflict continue to prevent certain children from receiving the benefits of being fully vaccinated (4). According to the Full Immunization definition given by WHO- A fully immunized child is the one who receives 1 dose each of BCG, and Hepatitis-B, 3 doses of DPT and Polio vaccine and first dose of measles at 9 months. In numerous states like Rajasthan, as opposed to DPT vaccine, the Penta vaccine is given which is a combination of 5 vaccines

(DPT, Hepatitis-B, and HiB). In India, immunization services are offered free in public health facilities, but the full immunization coverage still remains low in some areas. Various strategies like outreach immunization sessions, Mother and child tracking system, the involvement of ASHA, Anganwadi workers, were adopted by the Government of India to improve coverage of immunization service throughout India and it has yielded success.

The ability to reliably measure vaccine coverage plays an essential role in evaluating the success of various strategies, identifying susceptible populations for further interventions and informing future vaccine policy decision. Another important element is to track whether the vaccine is administered on time. The timeliness of vaccination, that is the vaccine administration at the earliest appropriate age should be an important public health goal. Studies have demonstrated that adhering to the recommended ages and intervals between doses of the same antigen(s) provides optimal protection and the best evidence of efficacy. Children receiving late vaccination remain susceptible to vaccine preventable diseases, which may jeopardize their own health, as well as that of younger siblings and compromise herd immunity with a consequent potential risk of disease outbreaks.

Data on vaccines administered in Rajasthan is currently recorded on Pregnancy and Child Tracking System (PCTS). It is an online software used as an effective planning and management tool by Medical, Health & Family Welfare Department, the government of Rajasthan with one major objective being the improvement of immunization coverage to reduce infant mortality. The system maintains the online data of government health institutions in the state. It helps to track all pregnant women and children, services provided, the listing of left out & dropouts, listing of beneficiaries for timely vaccination, duelists of ANC, delivery, immunization, monthly reporting of progress, etc. The main purpose of PCTS is enabling data entry at the different facility level, allowing users to preview, compare, make changes and forward to the subsequent level. The same is being implemented at different levels in the state by designated PCTS officials.

The data stored can be used for statistical analysis to consolidate data entered at each facility which can be stored at a central database. Planners and decision-makers need certain information on programmes to track and assess how far the set target is achieved, areas of the program that need revision, areas that meet or exceed expectations. PCTS thus, helps to monitor the progress closely through statistics.

Literature Review

- The study on vaccination coverage and timeliness by Fadnes et. al. (2011) in South African areas suggested that the percentage of children receiving recommended vaccines were 94% in Paarl, 62 in Rietvlei and 88% in Umlazi. There was a diminished vaccination coverage pattern towards the vaccines to be administered later the vaccination Programme.(5)
- The study by Ramaswamy et al. (2017) in rural areas of Puducherry, South India on the timeliness of primary childhood vaccination, coverage of immunization was 100% for all vaccines. Vaccination delay for more than two weeks from the due date of vaccination for DPT1, DPT2, DPT3, and measles were 7.4%, 41.9%, 64.4% and 38.8% respectively.(6)
- Cherian et al., (2019) in their study on assessment of timely immunization in an urbanized agglomeration of East Delhi found, 67.1 % children were full and timely immunized whereas fully vaccinated but with a delay of four weeks from the recommended age of the administration was 19.7 %. Partial vaccination was found in 11.2% of children and 2% of children were found to be non-vaccinated.(7)
- Sood et al. (2015) in Kangra, Himachal Pradesh, India on high immunization coverage and data reflection gaps in HMIS, an immunization evaluation study revealed that only 29% of the children were fully immunized as per schedule, one vaccination delay from the recommended schedule for more than 32 days was found in almost 68% of the children. The study also revealed, the updated field coverage estimates were lower than reported which might be due to the incorporation of migrant`s children in the numerator but not in the denominator. (8)
- Shrivastwa et al. (2016) in their study on vaccination timeliness in children under India`s universal Immunization Program found that 31%, 19% and 34% children were timely immunized with BCG, DPT3, and MCV respectively. Total estimation of vaccination probability increased for DPT and BCG around the age of 24 months, whereas there was 5% uptake of MCV after 24 months of age.(9)

- Shrivastwa et al. (2015) in a study on understanding disparities of immunization coverage among Indian Children analyzed DLHS-3, India data which uncovered that, most of the required childhood vaccine administration are being delayed because; in two-thirds or more children, BCG, DPT3, and MCV doses are given after the prescribed ages. 66% and 54% children were fully immunized in urban and rural areas were respectively.(10)
- An initiative was taken up by Earth Institute and Dausa district officials in July-August 2014 to improve data quality by identifying gaps in PCTS data and formulating strategies for strengthening data based on gaps noticed that a difference was present in the figures quoted in form 6 and their corresponding line listing (area wise reporting of pregnancy, delivery, immunization, etc.). Also, the immunization template does not have the Form-6-listing of all figures. Training was planned as a corrective action to improve data quality.(11)
- An in-depth assessment was conducted by Gera et al. (2015) on India`s Mother and Child Tracking System (MCTS) in Uttar Pradesh and Rajasthan, revealed about the large incomplete beneficiary profiles for Rajasthan, and there was a struggle in Uttar Pradesh to register beneficiaries in MCTS. The primary data source demonstrated much higher completeness than MCTS for the indicators such as ANC and TT vaccination for pregnant women and DPT (1,2,3), OPV (1,2,3) and Hepatitis B (1,2,3) for children.(12)
- Sherpa D (2016) in her study in Udaipur, Rajasthan on developing a mHealth Solution as an Alternative recording and reporting system for Auxiliary Nurse Midwives found that there was a delay in reporting information. ANMs complained that even though they provide regular information and reports; the data does not get uploaded in the portal and there are days when the mother`s PCTS ID does not get generated on time.(13)
- Samal et al. (2016) in their study on perspectives and challenges of HMIS Officials in the implementation of HMIS with reference to maternal services in Assam reported that HMIS officials found HMIS formats helpful for data collection, planning at various levels, tracking maternal and neonatal deaths, institutional deliveries. Several

challenges were raised by them that would require interventions at local as well as policy level.

- Pahwa et al. (2019) in their study in Udaipur, Rajasthan on the evaluation of immunization coverage and its determinants in children aged 12-24 months from rural and urban areas found that 60.25% and 29.5% of children were immunized completely and partially respectively and 10.25% children were not immunized at all. The main reason given by the parents of unimmunized children was lack of knowledge regarding immunization in 44.4% of the parents. Only 6.25 % of the families had the immunization record. (14)

2. RATIONALE

Udaipur has a full immunization coverage rate of 43.9 % according to NFHS 4 (2015-2016). Immunization coverage rate among children is utilized as an essential indicator to assess the performance of vaccination programmes with timeliness factor indicating the quality of services. Literature suggests that high vaccination coverage does not necessarily imply timely vaccination. Few studies reported a limitation of the non-availability of vaccination cards, findings were based on the mother's recall due to lack of data source which provides information on the timeliness of vaccination. Thus, making the study findings, not a true representative. AHS 2012-13 reports immunization card retention at 59.5 % among mothers in the Rural Udaipur district for their children aged 12-23 months.

PCTS provides coverage estimates and line lists for timeliness of immunization which has not been fully used to date in the vaccination literature. Thus, the study specifically focuses on how data held on PCTS can be used to estimate the childhood vaccination coverage and timeliness.

Additionally, while modern approaches to improve immunization services are increasingly used, their appropriateness for resource poor settings has received little attention. The views and experiences of the PCTS officials is important to learn about the usefulness, scope for improvement and challenges faced while implementing PCTS. Thus, the study also delineates the views and experiences of PCTS officials in implementing PCTS in relation to immunization services.

3. RESEARCH QUESTIONS

- What is the full immunization coverage achievement among eligible children in Udaipur district according to data held on PCTS?
- Are the eligible children receiving one dose of BCG, three doses of oral polio vaccine, three doses of Pentavalent and measles vaccine on time as per the schedule in Udaipur district according to data held on PCTS?
- What are the experiences of officials in implementing PCTS with reference to Immunization services?

4. OBJECTIVES

- To find out the full immunization coverage achievement among eligible children according to data held on PCTS.
- To assess the timeliness of one dose of BCG, three doses of oral polio vaccine, three doses of Pentavalent and measles vaccine according to data held on PCTS.
- To explore the views and experiences of officials in implementing PCTS with reference to Immunization services.

5. METHODOLOGY

5.1 Study Setting

Udaipur, a predominantly tribal region is a high focus district with poor key developmental indicators like infant mortality rate (IMR) is 63 per 1000 live births (AHS 2012-13). As per Census 2011 out of 4.51 lakh population in Udaipur, 80.2% lives in the rural areas. Udaipur has 12 blocks, 2589 villages, 167 wards, 1 satellite hospital, 4 medical colleges & Hospital, 1 sub-divisional hospital, 29 CHCs, 110 PHCs, 624 sub centers, 5 city dispensaries and 3 private hospital(accredited). Two Rural Primary Health Centers (PHCs) namely Bikarani and Mandwa run by LEHS|WISH in Udaipur district were selected for the study. Both PHCs come under Kotra Block which has six PHCs in total. PHC Bikarani has 5 sub centers (Bera Katra, Koliya, Nayavas, Sulav, Juda) and PHC Mandwa has 3 sub centers (Aajani, Kagvas, Thep).

5.2 Study Design

- Cross-sectional study based on secondary data analysis to estimate childhood vaccination coverage and timeliness.
- Exploratory study using a qualitative approach to explore the view and experiences of PCTS officials

5.3 Study Sample

Two Rural Primary Health Centers (PHCs) namely Bikarani and Mandwa run by LEHS|WISH in Udaipur district were selected to study the immunization coverage achievement and vaccination timeliness according to data held on PCTS.

One Research Monitoring Evaluation & Learning (RMEL) Specialist, one Research Monitoring Evaluation & Learning Coordinator, one District Coordinator (DC), and two Data Entry Operators (DEOs) were recruited for the qualitative part of the study.

5.4 Study Participants

Selected study participants were playing active role in PCTS implementation at different levels - State, District and PHCs.

Inclusion criteria:

Persons holding responsibility for or directly involved in the working of PCTS at the selected PHCs were recruited as the study participants.

Exclusion criteria:

Participants who did not consent were excluded.

5.5 Study Tools

A template on MS Excel (Annexure 1) was designed for the quantitative research with the aim to collect PCTS held data on immunization coverage achievement and vaccination timeliness.

An Interview guide (Annexure 3) was designed to explore the views and experiences of PCTS officials with reference to immunization services. Key areas of Interview guide were identified in discussion with experts.

5.6 Duration of Study

The study was conducted during April 2019 (1 month)

5.7 Data Collection

Secondary data was collected from the PCTS for the financial year 2017-18 since the data updating for financial year 2018-19 was pending. PCTS provides aggregated coverage estimates for immunization. Full immunization achievement is measured against the target set for the financial year. The system also gives a monthly line list for timeliness of vaccine administration based on eligible child registered in PCTS. The immunization details on timeliness according to PCTS is reported using color codes (Green for Immunization on Time, Blue for Immunization after Time, Red for Immunization Due) as shown in Annexure 2. Data extracted from the PCTS was entered into the designed template.

For qualitative data, appointments were scheduled for the interview to be carried out. Interviews were conducted using an interview guide. Participation in the study was voluntary and prior to conducting the interviews; the willing participants were given verbal briefings by the researcher regarding the purpose of the study, notification that the discussion would be audio-recorded, and all data, with respect to both demographic information and behavioral information, would remain confidential. Face-to face interview were conducted with the state PCTS officials (RMEL team). Telephonic interviews were conducted with the DC and the DEOs due to time constraint. Consent was obtained. Audio recording done during discussion was later transcribed into the Microsoft Office Word. Each interview lasted for 20 min on an average.

5.8 Data Analysis Plan

Quantitative data was analyzed using MS Excel. Percentage of full immunization achievement, timely immunization, after time immunization and due immunization were computed for the financial year 2017-18 and depicted using tables and graphs for the PHC Bikarani and PHC Mandwa.

Transcripts for the qualitative data were analyzed using thematic content analysis. Analysis began with reading the transcripts and coding of text with progressive development of themes.

5.9 Ethical Considerations

All the study participants were requested to participate after informing them the objectives of the study. Consent was taken in the presence of witness thereof. The respondents were informed the right to refuse and withdraw anytime from study. All information collected during the study was kept confidential. Nobody other than investigators had access to the information recorded. All unique identifiers were removed from the transcripts. The study results provide valuable evidences to step forward towards capacity building, to plan local as well as policy level interventions for effective implementation of PCTS and society benefits at large.

6. RESULTS

According to PCTS, for the financial year, 2017-18 Udaipur ranked 23rd among 34 districts of Rajasthan for achievement of full immunization while it ranked 15th in 2016-17.

The results are divided into three sections according to the objectives of the study for better understanding.

6.1 Section A: Full immunization coverage achievement

Annual targets of full immunization were 1000 for Bikarani and 544 for Mandwa. PCTS included information of 9 and 11 months' children who have been fully immunized. Observations made for full immunization coverage achievement is given below.

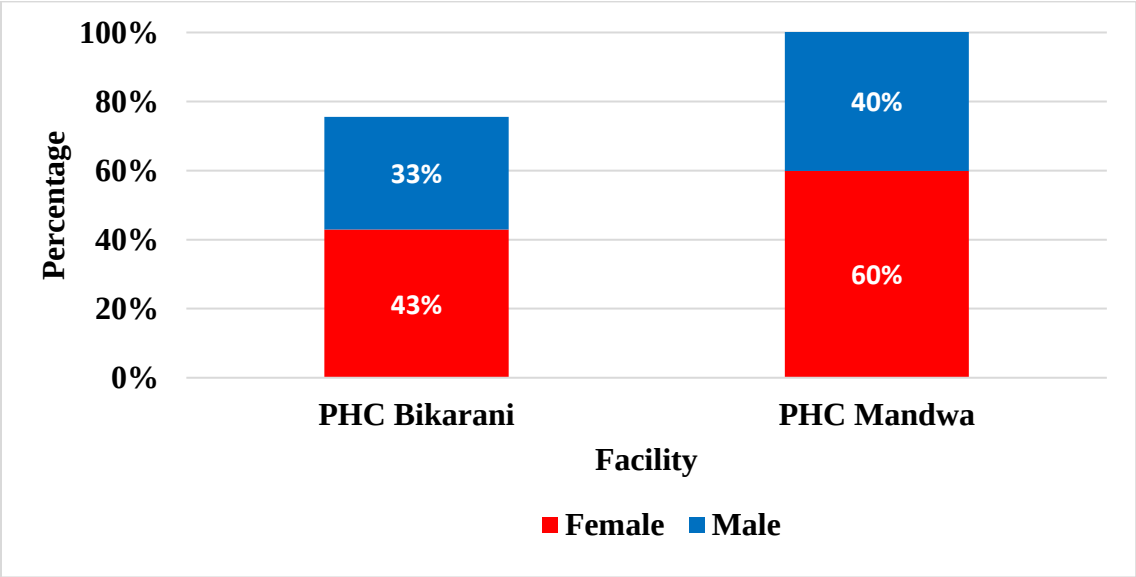

Figure 7.1.1: Gender wise full immunization coverage achievement for PHC Bikarani (n=756) and PHC Mandwa (n=545)

The full immunization coverage (FIC) achievement was found to be 76% for PHC Bikarani (including the 5 sub-centers) and it was found to be universal (100%) for PHC Mandwa (including the 3 sub-centers). When explored according to gender, it was heartening to note that the achievement percentage in both the PHCs was more for girls than for boys. The percentage of fully immunized male children was 33 % and female children were 43 % in PHC Bikarani. Almost similar result was found in PHC Mandwa where fully immunized male children were 40 % and female children were 60 %.

6.2 Section B: Timeliness of Vaccination

PCTS included information on a total of 1122 children for PHC Bikarani and 591 children for PHC Mandwa born any time between April 2017 to March 2018 provided in the line lists. The immunization details on timeliness according to PCTS is reported using color codes (Green for Immunization on Time, Blue for Immunization after Time, Red for Immunization Due). The study includes observation on timeliness for BCG, OPV 1, OPV 2, OPV3, Penta 1, Penta 2, Penta 3 and measles 1.

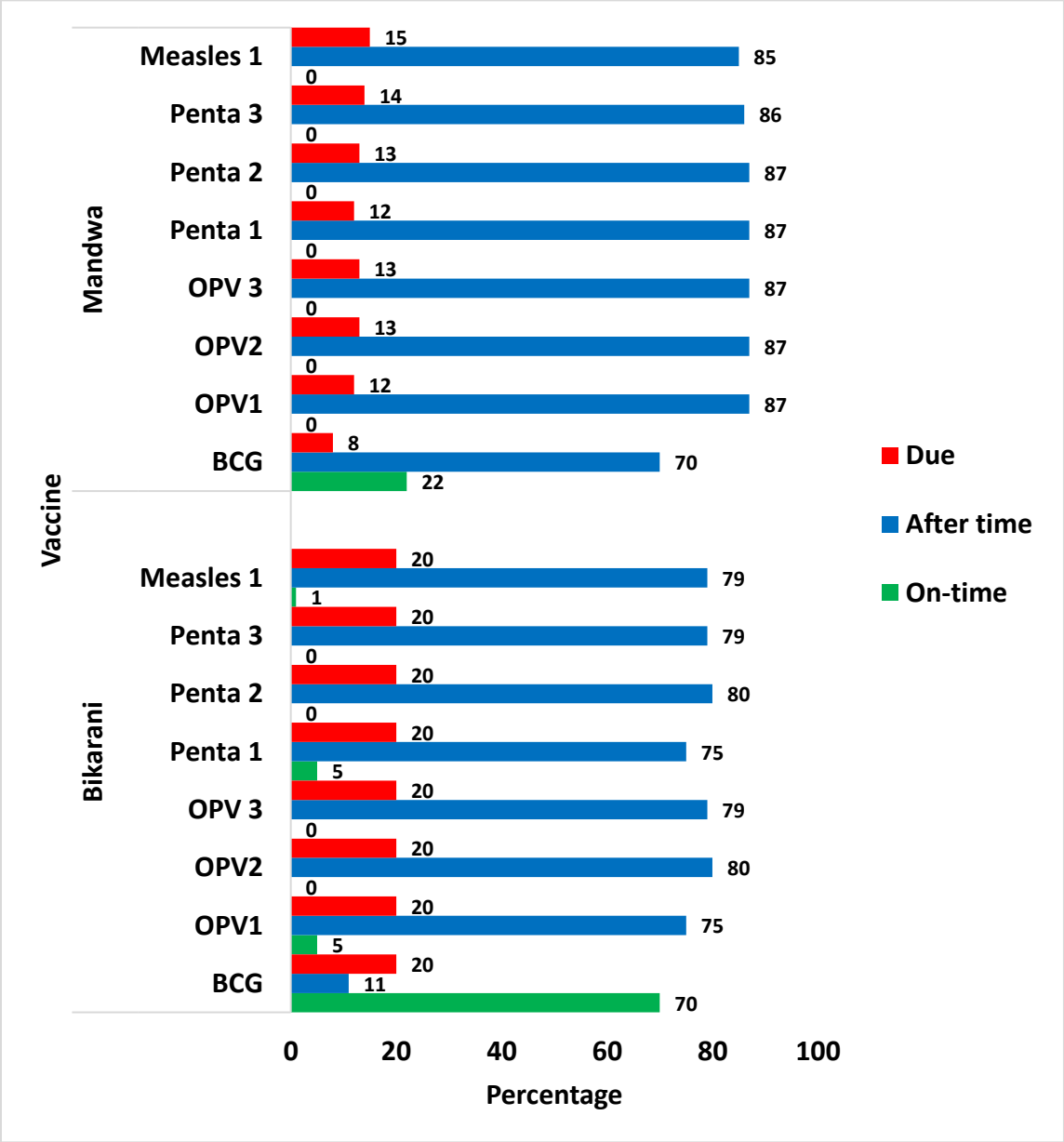

Figure 7.2.1: Timeliness of vaccination for PHC Bikarani (n=1122) and PHC Mandwa(n=591)

In PHC Bikarani, analysis of the timeliness revealed that 70 % of children received the BCG vaccine as per the schedule and 5 % received OPV1 and Penta 1 on time. Only 1 % of children received measles on time. When seen on PCTS, it was found that 33 % of the deliveries were done at home and 67 % deliveries were done at public or private institutes. This clearly indicates that the reason for BCG being given on time. This signifies that though children receive the BCG vaccine on time (in case of institutional deliveries), their guardians either do not understand the importance of timely immunization or there are significant reasons which need to be considered to find solution for the same.

In PHC Mandwa except for BCG (22%), no child received the vaccine on time in PHC Mandwa. 46 % of the deliveries were done at home while remaining 54 % were done at the public and private institution. Therefore, although 54 % were institutional deliveries, timeliness of BCG which is given at birth was found to be 22 %.

Eleven percent (11%) of the children in PHC Bikarani received BCG after time whereas for all remaining vaccines the after time percentage was found to be 75-80 %. A different scenario was seen in PHC Mandwa where 70% of children received BCG after the time schedule and for all other vaccines 85-87 % of children received the dosages after time. Henceforth, no child was reported to be fully immunized as per the schedule in both the PHCs.

It is very clear from the graph that in PHC Bikarani 20 % children as per PCTS were due for all the vaccines. There seems to be some significant reason for this which needs to be explored. On interpreting the graph for PHC Mandwa it is seen that 8 % of children as per PCTS were still due for the BCG vaccine and 12-15 % were due for the remaining vaccines.

6.3 Section C: views and experiences of PCTS officials

Five interviews were carried out that included 2 state level officials, 1 district level official and 2 facility level official. The following themes were identified:

1. **Usefulness of PCTS**

   PCTS is linked to Ashasoft and OJAS. The data automatically goes into that and so the payment is generated for ASHA and for JSY...(R5)

   PCTS officials reported that PCTS is useful for monitoring individual health status of the mother and child. PCTS formats were considered useful for data collection, target versus achievement, making work plans, tracking child immunization, missed out children and institutional deliveries. Further planning can be done according to the information available. In addition, this act as monitoring and dissemination tool of the local information to higher levels.

   One of the interviewee mentioned how PCTS is linked to other software like OJAS and ASHA soft which helps in generating the payment automatically. They also considered the capacity of PCTS to inform the performance of various facilities and to rule out the reasons for any gap encountered.

2. **Exhaustive information collection**

   PCTS is just being used for data entry. It is not used properly. The utilization is not done up to the mark. All the data should be used…. (R1)

   There is repetition in data on PCTS. Same data is given here and there in different forms. …. There are many tools in PCTS from which we can see many things which the DEO does not know. (R5)

   It was emphasized by the interviewee that PCTS is being used as an input tool for data entry, but utilization for monitoring, decision making, etc. is not being done. The information collected on immunization from the facilities every month is exhaustive but is not optimally used which can actually help to improve the services. There should not be any information that is not used.

   The interviewees mentioned that, there are multiple forms in PCTS which give the same information thereby increasing the unnecessary volume of data in PCTS. One of the interviewee explained this stating that immunization cumulative coverage report and achievement report both gives the achievement of individual vaccines.

3. **Data accuracy and quality**

This issue everyone knows. Data quality is poor which we try to work on. For this we have to go to the field to match with the SDR. ….There is mismatching in the forms (R2)

Form 6 and 7 are to be entered get closed by 8th of every month, and line list is entered later, so the error captured later is difficult to rectify and involves calling the district officials to correct the number. (R4)

Almost all the interviewees mentioned that large volume of data is held in PCTS, but the reliability remains an issue. One of the interviewee reported pointing on the web portal of PCTS that the immunization cumulative coverage report data and achievement report data did not match. The reliability of data depends on the efficiency of ANM who collects the information. Checking of the forms is also one of the responsibilities of the Lady Health Visitor (LHV) of the concerned facility. However, this is not being followed sincerely leading to errors in data. Thus, the accountability of the database lies at the grass root level workers. Also, sometimes error encountered in forms already entered in PCTS involves difficulty in rectifying them.

4. **Content related issues**

Few forms are still not updated for Penta vaccine. This way we will lose the track of vaccine…. (R 2)

If you see the immunization coverage found in the achievement report, there you will see that the achievement is actually overachievement because the unregistered children are also added…(R1)

Interviewees referred to the lack of listing penta vaccine in few forms in PCTS. Therefore, a track on immunization coverage of Penta remains missing. It was also mentioned that PCTS tracks the vaccination timeliness only in one direction, i.e. delayed or after time vaccine administration. Vaccines given too early or with a shortened interval between doses also result in a suboptimal immune response, leading to a false sense of protection.

As mentioned by one of the interviewee, due to migration the children who have moved away remained on the system. These were reported as due for all vaccines. This inflates the denominator and therefore under-estimation of vaccine coverage and timeliness as per the line list is reported in PCTS. The greatest underestimates occurred in areas with the lowest reported coverage and the highest population mobility. Full Immunization coverage achievement in PCTS given in the appraisal report includes unregistered children leading to an overestimation of true coverage.

5. **Operational issues**

PCTS is a little slow. When we don't use it for 2-3 min, it gets logged out, so we have to log in again and again. If there is no internet connectivity, it will not work. Also, the data we need cannot be extracted all in one go. We have to go to different fields. Data extraction is tough…(R2)

The PHC I am working in does not have connectivity, so I go to the SC which is 12 km and I call the ANM there and do my work…There is a lot of problem of electricity. (R3)

When many people are working on PCTS its server becomes slow. When internet connectivity is low, it becomes difficult to enter data…(R5)

In view of the above statements it can be mentioned that several operational issues are faced in PCTS. The interviewee found difficulty in extracting the data. It was consistently mentioned by the interviewees that the facility lies in areas that have poor logistics support in terms of power supply and internet connectivity. Giving an example the interviewees said that in PHC Bikarani and Mandwa the data entry operator has to travel with the system to other sub-centers, or block that are very far from the PHC to get access to internet connectivity.

Another issue faced is during the starting of the new financial year, the web portal is updated for the targets which involve an interruption in data entry for a few days. As a consequence, creates a backlog in data entry. The delay in entry and gaps in subsequent updates leads to compromised data quality. Also, timely tracking for dropouts is affected. During the working hours, several users log in simultaneously, which slows down the server considerably, thus increasing the time investment and delaying timely data entry.

6. **Failure of timely and full immunization**

People go to Gujarat for work, and when they come back, they come for vaccination, that is why vaccine is not given on time…(R4)

ANM keeps changing in 5-6 months and then when new comes she is not aware of area and work. Security problem is also there. They take leave for 15-20 days. (R5)

The interviewees reported that migration of people to Gujarat was the major challenge faced for implementation of immunization services. This leads to delayed vaccination, incomplete vaccination due to loss of track of the child for immunization. Since the geographic spread of the area is large, the area is hilly and houses are present at large distances, transportation remains an issue. Being a tribal area, security issues lead to absenteeism from work, vacant positions or ANMs changing every 5-6 months. The new recruitment is not properly oriented with the area, thus affecting immunization coverage. On the demand side, there is lack of understanding for benefits of immunization, lack of information about the schedule and importance of subsequent doses, lack of awareness on normal after-effects of vaccination.

7. **Educational advancement and training**

There should be training given for PCTS. The field staff does not get regular training. LHV has less idea. They should be trained from time to time and should be updated on the changes. (R 2)

LHV has less idea of forms and vaccination. She should be given training for PCTS and also immunization. (R5)

There should be training for the ANM and LHV regarding the PCTS and immunization which would help to motivate and improve the quality of data collected by her. Also, group discussion with experts can be beneficial. Wrong data entry at field level by field health workers needs continuous training and orientation. The training programs must accentuate value of data quality integrated with supportive supervision, so as to ensure that health workers in the peripheral facilities are encouraged to be share their weaknesses and are available to learning. Refresher trainings with agenda of implementation weaknesses should be built into the training plan.

7. Discussion

The analysis of Rajasthan's PCTS data on immunization revealed that in spite of a tribal area immunization coverage achievement was high although with a scope for improvement. PHC Mandwa showed universal immunization coverage achievement while PHC Bikarani had 76 % achievement. Vaccination timeliness showed delays in vaccine administration. Majority of required childhood vaccines in tribal areas of Udaipur district, Rajasthan showed delayed administration resulting in three-fourth or more OPV 1, OPV 2, OPV 3, Penta 1, Penta 2, Penta 3 and, Measles doses being given after the recommended ages. The fact that BCG vaccine showed better timeliness, points to BCG being a birth dose providing an opportunity to catch-up on timely BCG administration during the institutional delivery. The implications of systematic deferrals in the receipt of the most of the vaccine doses in most Indian children for vaccine- preventable disease-related morbidity and mortality are significant. The recent global measles crisis as per the provisional data based on monthly data reported to WHO (Geneva) as of April 2019, in which India ranks 3rd, can be explained by underperformance of measles timeliness and children being missed out.

The available data on PCTS can be utilized in not only addressing the issue of missed opportunities but also improving timeliness of vaccine administration, and increasing full-vaccination coverage rates. Few other states such as Gujarat(E-Mamta), Tamil Nadu (Pregnancy and Infant Cohort Monitoring and Evaluation (PICME) and Chhattisgarh has successfully tried similar tracking system. "E- Mamta" also provides a name-based tracking information management system and generates facility –wise reports with real- time information. PICME launched in Tamil Nadu closely tracks pregnant women till delivery and children up to 1 year of age.(15)

As per the findings of the study, PCTS is still facing several challenges such as lack of internet facilities, issues of data accuracy, data quality, timeliness of data entry, etc. Additionally, it is a complicated system due to its multiple interface with several levels and the amount of data being tracked. The challenge is to sustain the accurate and timely collection of vaccination data ensuring optimal utilization for better service delivery, policy decisions and public health action. The findings of our study is consistent with the published literature. Despite the limitations, PCTS has demonstrated an improvement in delivery of MCH services through close monitoring and generation of monthly work plans.

Though the findings of the study may not be true representative as the sample size is very small and also does not include officials of Government run PHCs, but they do highlight the few challenges and issues faced. Although, selection of district with poor health indicator and, moving down to the most peripheral health units within this district, was meant to provide a picture of PCTS implementation for immunization and challenges that may be prevalent in locations with similar resource constraints.

A mobile app PCTS (Pregnancy Child Tracking & Health Services Management System), designed and developed by National Informatics Centre (NIC) to address the gaps in PCTS, is currently underway. The app facilitates Auxiliary Nurse Midwives to update details of various health services to the beneficiaries at village level on Real Time Basis. This would also potentially ease the workload of frontline health workers and the data entry operators. The State of Karnataka also came up with innovations in the use of mobile phones for frontline health workers. Greater research in existing innovations for Health Management Information System (HMIS) should be thoroughly investigated to learn lessons for better implementation of appropriate deployment strategies and forming Health Information System policy in resource- poor settings.

8. Suggestions

The recommendations drawn after the study are:

- Immunization coverage and timeliness evaluation should be a regular feature of the system through impendent agencies.
- There can be an addition of column highlighting reasons for children not being fully immunized. A broad list of reasons such as migration, awareness gaps, AEFI gaps, operational gaps, and others can be listed. This would help the public health managers to work on reducing the gap of overestimation.
- Educating health workers regarding the importance of timeliness of vaccination.
- A track on vaccine doses received earlier than the recommended age should also be included.
- A strong web-based online portal should be built to remove the gap of server slow down due to simultaneous multiple user log in.
- Formal system of feedback in writing should be developed.
- Offline data entry capabilities should be incorporated into the PCTS software for areas with resource constraints such as poor power supply and internet connectivity.

9. CONCLUSION

PCTS provides a platform to help in not only increasing the full immunization coverage rates but also improving timeliness of vaccine administration. Although enormous improvement is seen in the overall immunization coverage achievement but timeliness still shows a gross underperformance in Udaipur district. This can be attributed to the migration and lack of understanding among tribal population about the importance of timeliness of vaccination. Thus, lack of timeliness still remains a significant problem.

The study was able to capture the experiences of PCTS officials which revealed that they are aware of the significance of PCTS. They raised several challenges such as: lack of proper connectivity, slow speed of server, frequent power failures, inadequate trainings, data quality and data usage. Although PCTS has led to improved supervision of healthcare workers, there is still a lack in extracting optimum knowledge from the child immunization data held in PCTS.

10. REFERENCES

1. Kadri AM, Singh A, Jain S, Mahajan RG, Trivedi A. STUDY ON IMMUNIZATION COVERAGE IN URBAN SLUMS OF AHMEDABAD CITY [Internet]. Vol. 33, HPPI. [cited 2019 Apr 20]. Available from: http://medind.nic.in/hab/t10/i1/habt10i1p50.pdf
2. Vashishtha VM, Kumar P. 50 years of Immunization in India: Progress and Future [Internet]. Vol. 111, INDIAN PEDIATRICS. 2013 [cited 2019 Apr 20]. Available from: http://medind.nic.in/ibv/t13/i1/ibvt13i1p111.pdf
3. Health C. Twelfth Five Year Plan [Internet]. National Health Mission. 2000 [cited 2019 May 12]. Available from: https://mohfw.gov.in/sites/default/files/04Chapter.pdf
4. Feldstein LR, Mariat S, Gacic-Dobo M, Diallo MS, Conklin LM, Wallace AS. Global Routine Vaccination Coverage, 2016. MMWR Morb Mortal Wkly Rep [Internet]. 2017 Nov 17 [cited 2019 Apr 20];66(45):1252–5. Available from: http://www.cdc.gov/mmwr/volumes/66/wr/mm6645a3.htm
5. Fadnes LT, Jackson D, Engebretsen IM, Zembe W, Sanders D, Sommerfelt H, et

al. Vaccination coverage and timeliness in three South African areas: a prospective study. BMC Public Health [Internet]. 2011 Dec 27 [cited 2019 Apr 1];11(1):404. Available from: http://www.ncbi.nlm.nih.gov/pubmed/21619642

6. Ramaswamy G, Pruthu TK, Selvaraj K, Vinayagamurthy VM, Chinnakali P. Timeliness of primary childhood vaccination in a rural area of Puducherry, South India: evidence from routine management information system. Int J Contemp Pediatr [Internet]. 2017 Feb 7 [cited 2019 Apr 1];1(3):131–4. Available from: https://ijpediatrics.com/index.php/ijcp/article/view/597
7. Cherian V, Kumar Saini N, Kumar Sharma A. Assessment of timely immunization in an urbanized agglomeration of East Delhi, India. Int J Community Med Public Heal [Internet]. 2019 Feb 22 [cited 2019 Apr 1];6(3):1156. Available from: https://www.ijcmph.com/index.php/ijcmph/article/view/4200
8. Sood RK, Sood A, Bharti OK, Ramachandran V, Phull A, Sood RK, et al. High Immunization Coverage but Delayed Immunization Reflects Gaps in Health Management Information System (HMIS) in District Kangra, Himachal Pradesh, India—An Immunization Evaluation. World J Vaccines [Internet]. 2015 Apr 16 [cited 2019 Apr 1];05(02):69–78. Available from: http://www.scirp.org/journal/doi.aspx?DOI=10.4236/wjv.2015.52009
9. Shrivastwa N, Gillespie BW, Lepkowski JM, Boulton ML. Vaccination Timeliness in Children Under India's Universal Immunization Program. Pediatr Infect Dis J [Internet]. 2016 Sep [cited 2019 Apr 1];35(9):955–60. Available from: http://www.ncbi.nlm.nih.gov/pubmed/27195601
10. Shrivastwa N. Understanding Disparities in Vaccination Coverage among Indian Children [Internet]. [cited 2019 Apr 6]. Available from: https://deepblue.lib.umich.edu/bitstream/handle/2027.42/111362/nijikas_1.pdf?sequence=1&isAllowed=y
11. Tracking PC. Pregnancy Child Tracking and Health Services Management System Rajasthan.
12. Gera R, Muthusamy N, Bahulekar A, Sharma A, Singh P, Sekhar A, et al. An in-depth assessment of India's Mother and Child Tracking System (MCTS) in Rajasthan and Uttar Pradesh. BMC Health Serv Res [Internet]. 2015 Dec 11 [cited

2019 Apr 1];15(1):315. Available from: http://www.ncbi.nlm.nih.gov/pubmed/26259836

13. Shepra D. A study on developing an m?Health solution as an alternate recording and reporting system for Auxiliary nurse midwives in Udaipur district of Rajasthan. The IIHMR University, Jaipur; 2016.
14. Pahwa HS, Goyal D, Sareen D. Evaluation of immunization coverage and its determinants in children aged 12-24 months from rural and urban areas of Udaipur, Rajasthan, India. Int J Contemp Pediatr [Internet]. 2019 Feb 23 [cited 2019 Apr 20];6(2):837. Available from: https://www.ijpediatrics.com/index.php/ijcp/article/view/2273
15. Nagarajan P, Tripathy J, Goel S. Is mother and child tracking system (MCTS) on the right track? An experience from a northern state of India. Indian J Public Health. 2016;60(1):34.

ANNEXURES

Annexure 1:

final data_bikarani - Excel

Vaccination Timeliness for PHC Bikarani-2017-18

Month 2017-18	Timeliness of BCG			Timeliness of OPV 1			Timeliness of OPV 2			Timeliness of OPV 3			Timeliness of Penta 1			Timeliness of Penta 2			Timeliness of Penta 3			Timeliness of Measles 1		
	On time	After time	Due	On time	After time	Due	On time	After time	Due	On time	After time	Due	On time	After time	Due	On time	After time	Due	On time	After time	Due	On time	After time	Due
April	46	6	25	2	50	25	0	52	25	0	52	25	2	50	25	0	52	25	0	52	25	0	52	25
May	50	9	55	0	59	55	0	59	55	0	59	55	0	59	55	0	59	55	0	58	56	1	58	55
June	75	23	14	10	88	14	1	97	14	1	97	14	10	88	14	1	97	14	1	97	14	0	98	14
July	65	30	12	2	93	12	1	94	12	1	94	12	2	93	12	1	94	12	1	94	12	1	94	12
August	50	29	11	0	79	11	0	78	12	0	78	12	0	79	11	0	78	12	0	78	12	0	78	12
September	51	18	10	1	68	10	0	69	10	0	69	10	1	68	10	0	69	10	0	69	10	0	69	10
October	77	1	17	2	76	17	0	78	17	0	78	17	2	76	17	0	78	17	0	78	17	1	77	17
November	86	0	15	8	78	15	0	86	15	0	86	15	8	78	15	0	86	15	0	86	15	0	86	15
December	80	1	17	5	76	17	0	81	17	0	80	18	5	76	17	0	81	17	0	80	18	2	78	18
January	81	0	9	5	76	9	0	81	9	0	81	9	5	76	9	0	81	9	0	81	9	2	79	9
February	69	0	25	13	56	25	2	67	25	1	68	25	13	56	25	2	67	25	1	68	25	2	67	25
March	51	1	13	5	47	13	1	50	14	1	49	15	5	47	13	1	50	14	1	49	15	0	50	15
Number	781	118	223	53	846	223	5	892	225	4	891	227	53	846	223	5	892	225	4	890	228	9	886	227
Percentage	70%	11%	20%	5%	75%	20%	0%	80%	20%	0%	79%	20%	5%	75%	20%	0%	80%	20%	0%	79%	20%	1%	79%	20%

Annexure 2:

PCTS

https://pctsrajmedical.raj.nic.in/private/ReportsLineList/ImmunizationDetails.aspx

Department of Medical, Health & Family Welfare
Government of Rajasthan
चिकित्सा, स्वास्थ्य एवं परिवार कल्याण विभाग
राजस्थान सरकार

th Services Management System (Ver 10.1.2.19)

Developed by NIC

Users Online: 901 Help LogOut

Major Indicators | Reports on Linelist | Monitoring Desk | Swasthya Sandesh Sewa | Utility

zation
019 11:21:33 AM

Back

Period: April 2017 | Immunization On Time | Immunization After Time | Immunization Due

Mobile No.	Place Of Birth	Date Of Birth	ANM Name & Mobile Number	ASHA Name & Mobile Number	Immunization Date																
					BCG	OPV0	HB0	DPT1	OPV1	HB1	DPT2	OPV2	HB2	DPT3	OPV3	HB3	Measles	Vitamin A-1	Penta1	Penta2	Penta3
SubCenter : Bera Katra																					Unit Code :0
8107555343	Kotda (CHC)	01/04/2017	Dhanki Devi 8107555343	Saku Devi 8003880432	01/04/2017	01/04/2017			15/05/2017			19/06/2017			24/07/2017		15/02/2018	15/02/2018	15/05/2017	19/06/2017	24/07/2017
8107555343	other State	12/04/2017	Dhanki Devi 8107555343	Saku Devi 8003880432	12/04/2017	12/04/2017			25/05/2017			29/06/2017			15/02/2018		15/02/2018	15/02/2018	25/05/2017	29/06/2017	15/02/2018
8107555343	Kotda (CHC)	06/04/2017	Dhanki Devi 8107555343	Saku Devi 8003880432	06/04/2017	06/04/2017			18/05/2017			22/06/2017			27/07/2017		22/02/2018	22/02/2018	18/05/2017	22/06/2017	27/07/2017
8003880432	other State	05/04/2017	Dhanki Devi 8107555343	Saku Devi 8003880432	05-04-2017	05-04-2017	05-04-2017	17-05-2017	17-05-2017	17-05-2017	14-06-2017	14-06-2017	14-06-2017	12-07-2017	12-07-2017	12-07-2017	31-12-2017	31-12-2017	17-05-2017	14-06-2017	12-07-2017
Unit Code :05320100300																					
9672517309	Home	08/04/2017	vecant		08-04-2017	08-04-2017	08-04-2017	20-05-2017	20-05-2017	20-05-2017	17-06-2017	17-06-2017	17-06-2017	15-07-2017	15-07-2017	15-07-2017	03-01-2018	03-01-2018	20-05-2017	17-06-2017	15-07-2017

Annexure 3: Interview guide

The intent of this interview is to explore the views and experiences of various PCTS officials at different levels in using PCTS with reference to Immunization services. The results can be helpful for the various stakeholders to plan local as well as policy level interventions for effective implementation of PCTS. I will use PCTS in place of Pregnancy and Children Tracking System.

- Age…….
- Gender…….
- Work Experience (in years) ……
- Position/Area of responsibility in PCTS implementation……
- Date/Time……

1. Please explain the present PCTS at your workplace briefly?
   Probe:
   - Data collection- By whom? In what format?
   - Data Entry- By whom? In what format?
2. What all difficulties do you encounter while working on PCTS?
   Probe:
   - Data quality
   - Data cleaning
   - Operational Issues-Data entry and upload
3. What initiatives are taken to minimize the errors and challenges faced while working on PCTS?
4. Please explain the various immunization related information that you manage with PCTS?
5. How is the immunization information available on PCTS used further?
6. What are the various challenges faced with regard to immunization data held in PCTS?
   Probe:
   - migration, multiple forms
7. What are the errors (if any) seen in PCTS with regard to immunization data?
   Probe: estimation of coverage
8. What are some of the reasons that contribute to untimely and incomplete childhood vaccination in the context of tribal area of Udaipur district?
   Probe:
   - Delayed Vaccination
   - Due Vaccination
9. Do you see a need for opportunities for further capacity building and educational advancements in regard to PCTS and immunization? (If yes, please describe)
10. Do you wish to add anything more to what has been discussed?

Thank you so much for participating in interview, giving me valuable time, and sharing your opinions.