Evaluation of Universal Immunization Program (UIP) in Botad District, Gujarat, India: A Cross-Sectional Study

Jaymeen Trivedi[1], Ghanshyam Ahir[2], Vijay Sondarva[1]

[1]Senior Resident, [2]Associate Professor, Community Medicine Department, Government Medical College, Bhavnagar, India

Correspondence: : Dr. Jaymeen Trivedi, Email: drjaymeen91095@gmail.com

Abstract:

Introduction: The Universal Immunization Program (UIP) is a key public health intervention aimed at reducing morbidity and mortality from vaccine-preventable diseases. Despite substantial national progress in India, regional disparities in coverage and implementation still persist. **Objective:** To evaluate the implementation of the Universal Immunization Program in Botad district. **Methods:** A cross-sectional study was conducted in Botad district (Gujarat) from 2023 to 2025. Ten Primary Health Centres (8 rural and 2 urban) were selected using stratified random sampling, and 30 villages were chosen through WHO cluster sampling. Data were collected using structured checklist for facility assessments, immunization session observations, interviews, and household surveys of 150 children aged 12–23 months, 30 antenatal women, and 30 adolescents. Evaluation indicators included human resource availability, training status, microplanning, cold chain management, session quality, supervision, and immunization coverage. **Results:** The evaluation revealed absence of routine immunization training for healthcare workers in the past three years. Only 30% of PHCs had complete routine immunization microplans, supervision plans were available only in 10% of facilities. Cold chain maintenance was satisfactory. However, session observations identified gaps in safe injection practices (40%), post-vaccination observation (10%), and delivery of four key messages (20%). Full immunization coverage among children aged 12–23 months was 79.3%. Td coverage was 100% among pregnant women, while among adolescents it was 60% for Td1 and 40% for Td2. **Conclusion:** UIP implementation in Botad district showed moderate coverage and satisfactory cold chain management but was limited by gaps in training, supervision, microplanning, and session quality.

Keywords: Cold chain, Evaluation, Gujarat, Immunization, Universal Immunization Program

Introduction:

Immunization is widely recognized as one of the most cost-effective and successful public health interventions, capable of preventing significant morbidity and mortality from infectious vaccine preventable diseases. In India, the Universal Immunization Program (UIP), launched in 1985, represents one of the largest public health initiatives globally, targeting approximately 26 million newborns and 30 million pregnant women annually.[1] About 1.3 crore routine immunization sessions are planned annually and to ensure quality and safety, vaccines are stored at more than 30,000 cold chain points across India.[1] The program has achieved notable milestones, including the elimination of polio and maternal and neonatal tetanus in 2015.[1] As a result of consistent

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efforts through routine immunization activities and focused immunization drives across country, India has achieved full immunization coverage of 76.4% in 2019-21.[2]

Despite these advances, many children and pregnant women in India still remain partially vaccinated and unvaccinated. Vaccine-preventable diseases such as measles, diphtheria, pertussis, and rubella remain prevalent, indicating persistent gaps in immunization delivery, especially in hard-to-reach and underserved populations. Additionally, operational barriers including gaps in proper microplanning and Head Count Survey (HCS), human resource shortages, inadequate training, weak supervision, cold chain failures and logistical constraints often impede optimal UIP implementation.[2]

Quality of healthcare services can be systematically evaluated using the Donabedian framework, which consists of three components: input (structure), process, and outcome. Input refers to the resources and organizational settings required for healthcare delivery, such as hospital facilities, equipment, and the qualifications of healthcare personnel. Process refers to the activities involved in providing care, including diagnosis, treatment, preventive services, and interactions between healthcare providers and patients. Outcome refers to the results of medical care on the patient's health, such as recovery, improvement in health status, survival, and patient satisfaction.[3] This framework can be applied to the evaluation of an immunization programme by assessing the availability of vaccines and trained staff (input), proper vaccine delivery and cold-chain maintenance (process), and the resulting immunization coverage (outcome).

District-level performance for immunization coverage varies considerably across the country. According to the National Family Health Survey-5 (NFHS-5), only 65.1% of children aged 12–23 months in Gujarat's Botad district were fully immunized.[4] As Botad district was formally established on August 15, 2013,[5] till date, no comprehensive evaluation of UIP implementation has been conducted in this region. This study was aimed to fill that gap by systematically evaluating the input, process, and outcome components of UIP in Botad district.

Methods:

A community-based cross-sectional study was conducted in Botad district, Gujarat, from 2023 to 2025. Botad district comprises of Botad city and four talukas and is served by 4 Urban Primary Health Centres (UPHCs) and 18 Primary Health Centres (PHCs). For input and process evaluation stratified random sampling was used to select ten health facilities (2 UPHCs and 8 PHCs) from the district ensuring equal representation from each taluka. For outcome evaluation, 30 villages from district were selected using World Health Organization's (WHO) 30 cluster sampling technique. From selected clusters (villages), house to house survey was conducted using the spinning bottle method to determine direction of visit of house. From each village, 7 participants were selected: 5 children aged 12-23 months, 1 antenatal woman and 1 adolescent (10-19 years). This yielded a total sample size of 210. Those study participants who were not willing to give consent for this study, were excluded.

For facility assessment, at PHC and UPHC data was collected using a structured checklist to evaluate availability of human resource, training status, routine immunization (RI) microplanning, cold chain infrastructure and management and record keeping. From each PHC/UPHC, one sub-centre (SC) was selected conveniently and data regarding SC level RI microplanning was reviewed and ongoing RI session site were visited. A structured observation checklist was used at session site, to assess session setup, vaccine handling, adherence to safe injection practices, waste disposal methods etc. Caregivers and antenatal women at session sites were interviewed regarding session awareness, satisfaction, and service experience. Data was collected by observation, interview and record review.

To assess immunization coverage (Outcome), investigator conducted house to house visit in selected villages with help of ASHA of the respective village and data regarding immunization status was collected from vaccination card and recall method. Reason for partial or non-immunization were asked to beneficiaries or caretakers. Children who had received BCG, 3 doses of Oral Polio Vaccine (OPV), 3 doses of pentavalent and 1

dose of Measles-Rubella (MR) vaccine by 12 months of age were considered fully immunized (Definition according UIP guidelines in 2024). Children who initiated vaccination but did not complete the age-appropriate immunization were drop out or partially immunized and children who did not receive any vaccine were considered as left out or unimmunized. Coverage of the Tetanus toxoid-diphtheria (Td) vaccine among adolescents was assessed based on receipt of the vaccine at 10 and 16 years of age, as per the UIP schedule. Similarly, Td vaccination coverage among antenatal women was assessed based on whether they received the Td vaccine according to the UIP schedule. This includes women who received both doses of Td one month apart during the current pregnancy, those who received the first dose and are yet to complete the four-week interval for the second dose, or those who received a Td booster dose as recommended.

Data was analysed using Microsoft Excel and Jamovi software (version 2.4.7). Descriptive statistics such as frequencies, proportions, and percentages were computed. This study was approved by Institutional Review Board (IRB) with approval number EC-1297/2023. Informed consent of participants was taken before data collection and confidentiality was maintained.

Results:

Input & Process evaluation:

At the selected PHC/UPHCs, 8 out of 10 sanctioned Medical Officers were present, however none of them had received UIP training in the past three years. Only 4 of 10 FHS were available, and none of them were trained. All 10 cold chain handlers/pharmacists were present, however, only 50% had received training and none had training certificates. Among frontline workers, 46 of 52 FHWs were present, with 54% trained, while all 53 MPHWs were present but all untrained. (Table 1)

PHC maps with sub-centre demarcation were available in 9 of 10 facilities. However, only 3 PHCs had complete RI micro plans from all SCs. ANM rosters plans were available in 6 PHCs. Supervision plans were documented in only 1 PHC, and updated coverage monitoring charts were present in only 3 (Table 2). Among 10 PHCs, 8 had matching records of planned versus conducted sessions. Two PHCs lacked session records entirely. Supervision of sessions was largely undertaken by AYUSH Medical Officers (50%), with only 10% supervised by MBBS Medical Officers. Master lists of villages/ high-risk areas (HRAs) and RI micro plans were available at all SCs. Maps with village names were present in 70% of sites, but beneficiary lists, estimation plan of vaccines and logistics, and drop our/ left out children list were largely absent at SC level.

Regarding cold chain management, all facilities had functional Ice Lined Refrigerator (ILR) and Deep Freezers (DF) and at 90% of the facilities ILRs & DFs were levelled and protected from sunlight. At 80% facilities, it was placed on wooden platforms, and all had functional stabilizers and thermometers. Vaccines and ice packs were properly arranged in 90% of facilities, and the First-In-First-Out principle was followed in 90% of facilities. No expired or unusable vaccines were found. (Table 3) Date and time of reconstitution was written on open vials. Entries of vaccines and logistics

Table 1: Availability of human resources and training status for UIP at PHC & UPHC Level (N = 10)

Cader	Sanctioned	Currently available	Trained for UIP in last three year	Certificate of training /record
Medical officer (MO)	10	8 (80%)	0	0
Female Health Supervisor (FHS)	10	4 (40%)	0	0
Vaccine and cold chain handler (VCCH)/ Pharmacist	10	10 (100%)	5 (50%)	0
Female Health Worker (FHW)	52	46 (88%)	25 (54%)	22 (88%)
Multi-Purpose Health Worker (MPHW)	53	53 (100%)	0	0
Accredited Social Health Activists (ASHA)	227	225 (99%)	0	0

(PHC= Primary Health Centre, UPHC= Urban Primary Health Centre)

Table 2: Routine immunization micro-plan Assessment at PHC & UPHC Level (N = 10)

Component	Available n (%)
Map of PHC showing SCs/ANM area demarcation	9 (90%)
Completed RI micro-plans	3 (30%)
SC/ANM area workload and session plan	7 (70%)
ANM roster plan	6 (60%)
Vaccine distribution plan including Alternate Vaccine Delivery (AVD)	2 (20%)
Vaccine and logistics estimation for PHC/UPHC	3 (30%)
Supervision plan at PHC/UPHC	1 (10%)
Latest coverage monitoring chart	3 (30%)

Table 3: Cold chain findings at PHC & UPHC Level (N=10)

Indicator	n (%)
CCE away from sunlight	9 (90%)
CCE placed on wooden platform	8 (80%)
CCE at least 10cm away from wall	10 (100%)
CCE Locked	2 (20%)
CCE connected with functional stabilizer	10 (100%)
CCE plugged permanently to the socket	10 (100%)
CCE has a functional thermometer available	10 (100%)
Frost less than 5 mm	10 (100%)
Ice packs are arranged in crisscross pattern in DF	10 (100%)
Vaccines are stacked neatly in ILR	9 (90%)
Vaccines are placed in basket	10 (100%)
Vaccines are arranged in first-in-first-out order in ILR	9 (90%)
Any unusable vaccine (Expired/VVM with Discard point) found	0

(PHC= Primary Health Centre, UPHC= Urban Primary Health Centre, CCE= Cold Chain Equipment, VVM= Vaccine Vial Monitor)

were updated in the electronic Vaccine Intelligence Network (eVIN) 90% of facilities. Adverse Event Following Immunization (AEFI) kits were available at all PHCs.

In session site monitoring, all 10 observed sessions were conducted as per the RI microplan. Vaccines were transported in vaccine carriers with conditioned ice packs, and reconstitution times were correctly recorded at all sessions. However, safe injection practice was followed in only 40% of sessions, and biomedical waste management was fully compliant in only 50%. Key health messages were communicated in only 20% of sessions, and post-vaccination observation for 30 minutes was ensured in only 10% of sessions. Anaphylaxis kits were available in all (100%) sessions. Regarding beneficiaries' interview at session site, all selected beneficiaries reported learning about the session through ASHAs. Satisfaction about immunization services was 100% among antenatal women and caregivers of vaccinated children.

Outcome (Immunization Coverage) evaluation:

Among 150 children of 12-23 months of age, 54% were males and 46% were females and vaccination cards were available for 96% of children. Full immunization

Table 4: Immunization coverage among children aged 12-23 months (N=150)

Immunization status	n (%)
Fully Immunized	119 (79.3 %)
Partially Immunized (drop out)	25 (16.7%)
Unimmunized (left out)	6 (4%)

coverage among children was 79.3% and rest were partially or unimmunized (Table 4). The common reasons for left out or drop out were illness of child (38.71%), family resistance (22.58%), and fear of side effects (19.35%). Other reasons included fear of multiple injections, and lack of perceived need of immunization.

Among the 30 selected antenatal mothers, Td vaccine coverage was 100%, with all mothers having received Td1, Td1 and Td2, or a Td booster dose as per their eligibility. Among 30 adolescents, 18 (60%) had received Td 1 dose. And out of 5 adolescents eligible for Td 2 dose, 2 (40%) had received the vaccine. Common reasons for not taking Td vaccine among adolescents were inappropriate health worker behaviour (53.33%), lack of knowledge about vaccination sites (33.33%), and fear of side effects (13.33%).

Discussion:

Training of healthcare staff is important for improvement in immunization program performance by developing essential competencies, including professional attitudes, appropriate vaccine administration techniques and documentation practices. However, in present study it was found that only about 50% of VCCHs and FHWs were trained for UIP in last 3 years while, rest of the healthcare staff and ASHAs were untrained. Similar findings were observed in study by Kumar P, et al. (2023)[6] in Dehradun, in which the ASHAs had never undergone any training regarding routine immunization. Frontline health workers are often overburdened with multiple program-related duties and reporting targets, which restricts their availability for training and capacity-building activities.

Inadequate microplanning and weak supervision are critical bottlenecks for success of immunization program. In present study, only 30% of PHCs had complete RI microplans,70% had session plan and supervision plans were almost absent (90%). Patel T, et al. (2011)[7] in their study in Anand (Gujarat) also found that 93.2% of the PHCs had no supervision plan. Similarly, collaborative study conducted across various states of India also revealed poor results regarding planning for immunization i.e. a map of the catchment area was available in only 39% of the PHCs, estimation of number of beneficiaries and logistics as a part of microplan was limited to 61% of 10 PHCs, ANM roster plan was available at 88% of the PHCs and the AVD plan was available in only 61% of the PHCs.[8] However, study conducted on Urban Health Centres (UHCs) of Ahmedabad by Nogas J et al. (2024)[9] found that all UHCs were having microplans and session plans but other aspects like catchment areas and dropout charts were not present at many UHCs.

Some good findings like functional ILRs and DFs, functional stabilizers and thermometers and proper placement of ILR/DFs were observed in all PHCs. Study conducted in Anand district also reported similar findings for cold chain management.[7] This could be due to training of VCCHs in cold chain management.

All the immunization sessions were conducted as per RI microplan. Despite high beneficiary satisfaction, session observations revealed notable gaps in critical components of service delivery, including safe injection practices, biomedical waste management, counselling and communication of four key messages, and post-vaccination observation of beneficiaries. Similar findings were reported in studies conducted by Parmar A et al (2014)[10] in Vadodara, Panika RK et al (2018)[11] in Damoh (Madhya Pradesh) and Nath L et al (2015)[12] in Haridwar (Uttarakhand). These consistent findings across diverse settings suggests systemic issues with lack of training of health workers in immunization practices.

The 79.3% full immunization coverage in present study was higher than the NFHS-5 estimate for Botad district (65.1%), which could be due to small sample size in present study compared to NFHS survey. However it remains below the national target of achieving more than

90% full immunization coverage[1]. Studies conducted to assess full immunization coverage among children across various regions of Gujarat, India also revealed similar findings.[13–15] Failure to achieve the national target shows the persistence of gaps related to service delivery, follow-up of dropouts, and lack of parental awareness about immunization.

The observed 100% Td vaccine coverage among pregnant women may be attributed to strong antenatal care services utilisation, effective integration of Td vaccination into routine ANC services, and high awareness among beneficiaries and health workers. However, Td vaccination coverage was suboptimal among adolescents, with Td1 and Td2 coverage of 60% and 40%, respectively. Similar gaps have been reported by Singh A et al. (2000)[16] in Haryana, where coverage for the first and second doses of tetanus-containing vaccine among adolescent girls was 26.7% and 44.3%, respectively. This could be attributed to limited programmatic focus on adolescents and poor health seeking behaviour.

Conclusions:

This evaluation identified several systemic gaps affecting the performance of the Universal Immunization Program (UIP) in Botad district, including deficiencies in human resource training, supportive supervision, routine immunization microplanning, and service delivery. Full immunization coverage among children aged 11–23 months was 79.3%. Td immunization coverage was 100% among antenatal women, while coverage among adolescents was 40-60%.

Limitations:

The limitations of this study include reliance on participant recall and available records for data collection, as well as the exclusion of migrant populations from the coverage assessment. Furthermore, the relatively small sample size used for estimating immunization coverage may have contributed to the higher coverage observed in this study.

Recommendations:

Based on the findings, it is recommended to strengthen training by providing mandatory Universal Immunization Program (UIP) courses for all health cadres—including Medical Officers, Field Health Supervisors, cold chain handlers, FHWs, MPHWs and ASHAs with regular re-training and certification. Microplanning should be enhanced at every PHC and sub-centre through the development and use of comprehensive RI microplans that track dropouts, left-out children, vaccine distribution, and supervision schedules. Additionally, targeted strategies are needed to improve Td vaccine coverage among adolescents.

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