

# Uptake of Immunization and Its Determinants among Children of Migrant Population Residing in Amreli, Gujarat, India

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## ABSTRACT

**Aim and background:** Immunization stands as a cornerstone of public health advancements, offering unparalleled effectiveness and cost-efficiency. The overall known vaccination coverage of resident children in Amreli was 60.1%, as per the National Family Health Survey-5 (NFHS-5). Regardless of these efforts, an issue of inequity is observed on different platforms. This study was an effort to understand the immunization uptake and its determinants influencing the utilization of immunization services among migrant children from September 2022 to February 2023.

**Materials and methods:** Demographic and socioeconomic information, migration history, the child's immunization status, and the mother's usage of healthcare services were included in the questionnaire. Some of the data were taken from vaccination cards.

**Results:** A total of 110 eligible mothers were contacted for the survey. Children were from 12 to 60 months old. Full immunization coverage was found among 38 (34.5%) children. Among them, 26.3% (12–24 months) and 73.7% (>24–60 months) children were having full immunization. Coverage of individual vaccines was Bacillus Calmette–Guérin (BCG) (94.5%), Penta 1 (41.8%), Penta 2 (38.2%), Penta 3 (35.5%), measles and rubella 1 (MR 1) (34.5%), diphtheria, pertussis, tetanus 1 (DPT 1) (34.5%), oral polio vaccine (OPV) booster (66.4%), and MR 2 (29.1%). The major factors associated with low immunization coverage were recent migrant status ( $p = 0.001$ ), male gender ( $p = 0.04$ ), age <24 months ( $p = 0.04$ ), and home birth ( $p = 0.04$ ). The study also found that settled migrants, female children, hospital-born children, and children whose mothers received antenatal care (ANC) visits from health workers were more likely to be fully immunized.

**Conclusion:** The coverage among immigrants is less (34.5%) than that of children residents of Amreli (60.1%). The study highlights the need for targeted interventions to improve immunization coverage among children of migrant mothers.

**Keywords:** Coverage, Full immunization, Partially immunization, Recent migrants, Settled migrants.

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## INTRODUCTION

Immunization stands as a cornerstone of public health advancements, offering unparalleled effectiveness and cost-efficiency. Standing as a global benchmark, India's Universal Immunization Program (UIP) ranks among the world's largest public health initiatives, and it has made significant contributions to reducing the number of cases and deaths from vaccine-preventable diseases (VPDs), including infant mortality.<sup>1</sup> In 2014, India launched Mission Indradhanush, a special vaccination drive to reach unvaccinated and partially vaccinated children under the age of 2 and unvaccinated pregnant women. The goal of Mission Indradhanush is to achieve full immunization coverage of over 90% for all children and pregnant women. Despite ongoing efforts, disparities persist across various implementation levels. Therefore, it is crucial for states to pinpoint bottlenecks and potential roadblocks that hinder the program's full realization.<sup>2</sup>

India and Gujarat are already far behind in achieving universal immunization with a marginal differences, as per the National Family Health Survey-5 (NFHS-5),<sup>3</sup> that disclose 39 and 24% of children may not be fully immunized, respectively. Urban immunization coverage remains a persistent challenge to achieving universal coverage. Pockets of informal settlements and expanding peri-urban areas, often characterized by high population density and limited access to public services, including healthcare, heighten the risk of VPD outbreaks. The twin forces of rapid urban expansion, attracting a large population, particularly the underprivileged, and rural poverty push people toward urban centers and shape the

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unique dynamics of urban immunization. These factors necessitate a tailored approach to policy formulation, implementation, and evaluation in urban settings.<sup>4</sup>

Despite significant progress in child health and well-being, several challenges persist in ensuring equitable human development outcomes for all children in Gujarat. Malnutrition, inadequate immunization coverage, gender imbalance, and child marriage remain prevalent, hindering the full realization of children's rights and potential. Immunization coverage, though improved, remains uneven across different communities, with remote areas such as tribal, coastal, and salt pan regions, urban

slums, and migrant populations facing disparities in access to essential vaccinations. These disparities exacerbate existing vulnerabilities and hinder the collective advancement of child health in Gujarat.<sup>5</sup>

This study aimed to investigate the immunization coverage and explore the factors that influence the utilization of immunization services among migrant children. There are no current research studies showing immunization status in migratory children in Amreli, Gujarat. By knowing the status of immunization, we can guide as well as educate them about government services of immunization and also inform the healthcare system about immunization status among the said population.

## MATERIALS AND METHODS

### Study Area and Study Groups

The study was conducted from September 2022 to February 2023 in Amreli, Gujarat, India. Amreli's healthcare system adheres to India's UIP, mandating the administration of specific vaccines to infants—at birth of Bacillus Calmette–Guérin (BCG), oral polio vaccine (OPV) zero and hepatitis B, at 6 weeks OPV 1, rotavirus vaccine (RVV) 1, f-injectable polio virus vaccine (f-IPV), pentavalent 1 and pneumococcal conjugated vaccine (PCV) 1, at 10 weeks—OPV 2, RVV 2 and pentavalent 2, at 14 weeks OPV 3, RVV 3, f-IPV 2, PCV 2 and pentavalent 3, at 9–12 months measles containing vaccine that is either measles or measles and rubella 1 (MR 1), f-IPV 3 and PCV booster, at 16–24 months OPV booster, measles/MR 2, diphtheria, pertussis, tetanus (DPT) booster 1. Some of the vaccines have recently been added.

### Functional Definition of Migration and Migrant

For the purposes of this study, migration was defined as a change in an individual's usual place of residence. A migrant was identified as someone whose last habitual residence differed from their current location. The habitual residence was established as the place where an individual had resided continuously for >6 months. This distinction allowed for a clear demarcation between temporary movements and permanent relocation.

To differentiate between newcomers and established residents, we categorized migrants into two groups—recent migrants and settled migrants. Recent migrants were those who had relocated within the past 3 years, while settled migrants had been residing in the community for at least three years. Both groups primarily originated from North to East India, as well as neighboring states of Gujarat. The distribution of migrants in terms of place of origin, ethnicity, social class, and religion was comparable between the two groups.

### Sampling

Due to the informality of the sector, estimates of the total number of migrants are difficult. So, initially, migrants' residential area was identified. Some of them were residing near construction sites, footpaths, and open-space dwellings. The sample size was calculated using the formula  $4 pq/L^2$  according to Lwanga et al.<sup>6</sup> Taking immunization coverage 60.1% as per NFHS-5 Amreli district factsheet,<sup>3</sup> and to achieve a 95% confidence of interval (CI) level with an absolute precision of 10%, a sample size of 96 children was calculated. Accounting for a 10% nonresponse rate, the final sample size was determined to be 106. Mothers of children aged 1–5 years from the selected locality were recruited for the study. The purpose of the study was explained to the participants, and

informed consent was obtained prior to data collection. The study protocol was reviewed and approved by the Institutional Review Board (registration no. ECR/1519/inst/GJ/2021) (IEC/19/5/22).

### Data

A total of 110 children were included in the survey. Out of them, 56 were recent migrants, while 54 were settled migrants. Using a structured interviewer-administered questionnaire, we collected data on demographic and socioeconomic characteristics, migration history, child immunization status, and maternal healthcare utilization. Child immunization status was primarily ascertained from the Mamta card (immunization card). In the absence of immunization cards, mothers were asked to recall the number of doses of various vaccines their children had received. Separate questions were asked to gather information on each age-appropriate vaccine.

### Measures

Two outcome measures were assessed to evaluate the immunization status of children.

**Full vaccination:** A child aged 1 year or older was considered fully vaccinated if they had received the following vaccines:

- Bacillus Calmette–Guérin (BCG) vaccine at birth.
- Three doses of DPT vaccine or pentavalent vaccine (Penta) at 6, 10, and 14 weeks of age.
- Three doses of OPV at 6, 10, and 14 weeks of age.
- Measles vaccine or measles and rubella (MR) vaccine before 1 year of age.

If the child had also received the RVV and PCV, which are being rolled out nationwide, they were considered fully vaccinated even if they had not yet received all the routinely mentioned vaccines.

**Complete vaccination:** A child was considered completely vaccinated if they had received the following vaccines before the age of 2 years:

- The DPT booster dose (DPT-booster-1).
- The MR vaccine booster dose (MR 2).

Both these outcomes were considered as full immunization. Children with incomplete vaccinations were considered partially immunized, while children who had not taken even a single vaccination were considered not vaccinated.

Factors affecting child immunization status were examined at three levels—individual, household, and system. Individual-level factors like child's gender and age. Household-level factors like parents education (parents with higher education levels are more likely to be aware of the importance of immunization and to seek out vaccination services for their children) parents occupation (it may play a role in childcare and decision-making regarding healthcare), household size and migration status. System-level factors like maternal antenatal care (ANC) attendance, maternal vaccination during pregnancy, place of delivery, and antenatal visits by a health worker.

### Statistical Analysis

Full immunization coverage is the percentage of children, age-appropriate, who receive a particular immunization out of the total number of children. The distribution of independent variables according to their migrant status was calculated using the Chi-squared/Fisher test. Those variables with a minimum *p*-value of 0.05 were considered statistically significant. The two outcome

**Table 1:** Distribution of the children according to their migrant status

Variable	Recent migrants (n = 56) [n (%)]	Settled migrants (n = 54) [n (%)]
Child's age		
12–24 months	25 (44.6)	21 (38.9)
>24–60 months	31 (55.4)	33 (61.1)
Gender of child		
Male	31 (55.4)	31 (57.4)
Female	25 (44.6)	23 (42.6)
Mother's education		
Illiterate	56 (100)	52 (96.3)
Literate	0	2 (3.7)
Father's education		
Illiterate	51 (91.1)	45 (83.3)
Literate	5 (8.8)	9 (16.7)
Occupation of mother		
Housewife	0	13 (24.1)
Working	56 (100)	41 (75.9)
Occupation of father		
Employed	56 (100)	52 (96.3)
Unemployed	0	2 (3.7)
Size of household		
≤5	36 (64.3)	38 (70.4)
>5	20 (35.7)	16 (29.6)

variables, full immunization and partial or no immunization, were considered dependent variables in this study. To assess the associations between these dependent variables and the independent variables, multiple logistic regression analyzes were conducted. Model fit was evaluated using Hosmer–Lemeshow goodness-of-fit tests. The significance of the adjusted odds ratio (AOR) for each independent variable was determined using the Wald test. All analyzes were carried out using Jamovi software developed by Sydney, Australia.<sup>7</sup>

## RESULTS

A total of 110 eligible mothers were successfully contacted and invited to participate in the survey. Full immunization coverage was found among 38 (34.5%) children. Sociodemographic information of the sampled mothers is presented in Table 1 according to their recent and settled status of migrants. Approximately, 40% of the children were between the ages of 12 and 24 months. The male-to-female ratio was similar in both the recent migrant and settled migrant groups. Nearly, all of the mothers had no formal education, while around 12% of the fathers had some level of education. The majority of the fathers were employed.

As per Table 2, over 90% of mothers from both recent migrant and settled migrant groups had given birth in a hospital setting, while home births were less common (9% among recent migrants and 3.7% among settled migrants). This difference was found to be statistically significant. A substantial proportion of mothers, 44.6% in the recent migrant group and 77.8% in the settled migrant

**Table 2:** Distribution of the children according to their migrant status and health service utilization

Variable	Recent migrants (n = 56) [n (%)]	Settled migrants (n = 54) [n (%)]	p-value
Place of delivery			
Home	5 (8.9)	2 (3.7)	0.02
Hospital	51 (91.1)	52 (96.3)	
Immunization (Mamta) Card			
Yes	31 (55.4)	12 (22.2)	0.000
No	25 (44.6)	42 (77.8)	
Vaccination during pregnancy (TT/Td)			
Yes	51 (91.1)	46 (85.2)	0.339
No	5 (8.9)	5 (14.8)	
Health worker's visit during pregnancy			
Yes	50 (89.3)	36 (66.7)	0.000
No	6 (10.7)	18 (33.3)	
Knowledge regarding vaccine			
Yes	52 (92.9)	47 (87)	0.033
No	4 (7.1)	7 (13)	
Knowledge regarding vaccine's side effects			
Yes	49 (87.5)	44 (81.5)	0.383
No	7 (12.5)	10 (18.5)	
Immunization status of child			
Fully immunized	10 (17.8)	28 (51.9)	0.000
Partially/not immunized	46 (82.2)	26 (48.1)	
Reason for not immunization (n = 72)			
Family reasons	3 (6.5)	1 (3.8)	–
Fear of side effects	37 (80.4)	5 (19.3)	
Lack of information (unaware of place/need of immunization)	5 (10.8)	19 (73.1)	
Lost immunization card	1 (2.3)	1 (3.8)	

Fisher's exact test was used in place of Chi-squared test where cell value was <5

group did not have their immunization cards with them, and these differences were statistically significant. A majority of the mothers had received the tetanus toxoid/tetanus toxoid and diphtheria (TT/td) vaccine. While health workers managed to reach 78% of the households, providing immunization information to most mothers, only a minority of children were fully immunized. Among recent migrants, only 18% of children were fully immunized compared to 52% of settled migrant children. This disparity in full immunization rates highlights the challenges faced by recent migrants in accessing and utilizing immunization services. Table 3 represents the dropout rates of various vaccines. It was calculated using the formula (number of children immunized with first vaccine—number of children immunized with later vaccine \*100/number of children immunized with first vaccine).

Coverage of individual vaccines was BCG (94.5–41.3% in 12–24 months and 58.7% in >24–60 months), Penta 1 (41.8–34.8% in 12–24 months and 65.2% in >24–60 months), Penta 2 (38.2–33.2% in 12–24 months and 66.7% in >24–60 months), Penta 3 (35.5–30.8% in 12–24 months and 69.2% in >24–60 months), MR 1 (34.5–23.7% in 12–24 months and 76.3% in >24–60 months), DPT 1 (34.5–21.1% in 12–24 months and 78.9% in >24–60 months), OPV booster (66.4–31.5% in 12–24 months and 68.5% in >24–60 months) and MR 2 (29.1–12.5% in 12–24 months and 87.5% in >24–60 months).

**Table 3:** Drop-out rates of immunization

Category	Percentage
BCG-measle/MR 1	63.46
BCG-measle booster/MR 2	69.23
BCG-Penta 3	62.5
BCG-DPT booster	63.46
BCG- OPV booster	29.81
Penta 1-Penta 3	15.22
Measles/MR 1-measles booster/MR 2	15.79

Table 4 presents the distribution of children by their full immunization status against the immunization status by various independent variables and the results of the multiple logistics regression. A higher likelihood of full immunization was observed among children aged >24 months (AOR 3.027, CI 1.021–8.970) compared to those aged <24 months. Female children were 1.5 times more likely to be immunized than male children (AOR 1.502, CI 0.513–4.397). Settled migrants were nine times more likely to fully immunize their children than recent migrants (AOR 9.211, CI 2.622–32.356). Hospital-born children were nearly 2.5 times more likely to be fully immunized (AOR 2.586, CI 0.220–30.436) than home-born children. The Hosmer–Lemeshow goodness-of-fit test indicated that the model is a good fit.<sup>8</sup>

## DISCUSSION

Immunization programs play a crucial role in safeguarding public health, particularly in developing countries like India. However, achieving equitable immunization coverage remains a challenge due to various factors, including socioeconomic disparities, geographic barriers, and cultural beliefs.<sup>4</sup> The study's findings revealed that the proportion of fully immunized children among settled migrants (34.5%) was comparable to that of recent migrants (34.5%). However, both groups exhibited lower immunization coverage compared to the overall city population (60.1%). These findings highlight the persistent inequities in immunization coverage among migrant populations in India.

Migrant children are disproportionately at risk of not being fully immunized. Studies have shown that migrant populations have lower rates of healthcare utilization compared to nonmigrant populations. This disparity in healthcare access can be attributed to various factors affecting the availability and utilization of health services by migrant communities. One of the key factors is the lack of proactive engagement from healthcare workers. Studies have shown that healthcare workers often fail to reach out to migrant communities, resulting in missed opportunities for immunization

**Table 4:** Proportion of children's immunization status by various variables and results of multiple logistic regression

Variable	Fully immunized	Partially/not immunized	AOR (95% CI)
Child's age			
12–24 months	10 (26.3)	36 (50)	Reference
> 24–60 months	28 (73.7)	36 (50)	3.027 (1.021–8.970)
Gender of child			
Male	20 (52.6)	42 (58.3)	Reference
Female	18 (47.4)	30 (41.7)	1.502 (0.513–4.397)
Size of household			
≤5	29 (76.3)	45 (62.5)	
>5	9 (23.7)	27 (37.5)	
Migration status			
Recent	10 (26.3)	46 (63.9)	Reference
Settled	28 (73.7)	26 (36.1)	9.211 (2.622–32.356)
Place of delivery			
Home	3 (7.9)	5 (6.9)	Reference
Hospital	35 (92.1)	67 (93.1)	2.586 (0.220–30.436)
Mamta card			
Yes	11 (28.9)	32 (44.4)	Reference
No	27 (71.1)	40 (55.6)	1.325 (0.326–5.379)

and other essential health services. Additionally, the quality of healthcare services provided to migrant populations can be suboptimal. Healthcare workers may lack the necessary training or cultural sensitivity to effectively communicate with and engage migrant families. Furthermore, inconvenient service hours and inaccessible vaccination sites can further hinder access to healthcare for migrant children.

These findings corroborate previous research indicating that healthcare worker visits to migrant communities are infrequent and that evening hours are often underserved.<sup>9</sup>

Parental attitudes and knowledge significantly influence immunization utilization among migrant communities. Parents in migrant communities often lack adequate knowledge about immunization schedules, healthcare facilities, and the importance of timely vaccination. This lack of awareness can lead to delays or even the complete avoidance of immunization for their children. Furthermore, concerns about potential side effects of vaccines can deter parents from seeking immunization for their children. These concerns may arise from misinformation, cultural beliefs, or personal experiences. Additionally, the presence of minor illnesses in children can lead to temporary postponements of immunization, further disrupting the vaccination schedule.<sup>10</sup> Family characteristics such as parent literacy, low income, socioeconomic status, and vulnerability of these communities might interact with these factors affecting coverage.

In this study, mothers delivered in the hospital and settled migrants have a higher uptake of full immunization. This result was comparable to the study done by Geddam et al.<sup>11</sup> in Hyderabad, India, and study done by Kusuma et al.<sup>12</sup> in Delhi, India, who did a similar study among migrants.

According to a study done by Dave et al.<sup>13</sup> in Rajkot, Gujarat, India, among construction site laborers, the dropout rate between the pentavalent first dose and the pentavalent third dose was 45.5%, same of BCG to measles was 56.1%. Comparable to that study, BCG to measles was 63.46%. While pentavalent first dose to the third dose was less (15.22%). BCG-measles dropout rates in children of migrant populations ranged differently in different states of India like Uttarakhand<sup>14</sup> (38%), Hyderabad<sup>11</sup> (25%), Andhra Pradesh (19%)<sup>15</sup> and present study (63%). The highest coverage was found for BCG in the present study (94.5%) and study done by Dave et al. (91.7%) and Mishra et al. (92%)<sup>16</sup> while the lowest coverage was found for measles in the present study (29.1%) and study done by Dave et al. (43.3%).

The study's reliance on retrospective reporting introduces a potential limitation due to recall bias. In instances where immunization cards were unavailable, participants were asked to recall the number of vaccine doses their child had received. This method of data collection is susceptible to inaccuracies arising from memory lapses or subjective interpretations. To mitigate the impact of recall bias, future studies should prioritize prospective data collection methods. This could involve directly accessing immunization records or tracking vaccination schedules through electronic health records. Additionally, incorporating standardized questionnaires and providing clear instructions to participants can further enhance the reliability of self-reported data.

Another limitation of the study is the lack of comprehensive data on healthcare centers. Detailed information regarding outreach efforts, vaccine supply, human resources, and infrastructure-related issues was not collected. This precludes drawing definitive conclusions about the overall functioning of the healthcare delivery system.

Furthermore, the dynamic nature of migrant populations poses challenges in maintaining accurate data. The transient nature of migrant communities makes it difficult to establish a stable population count, potentially affecting the interpretation of immunization coverage rates.

Despite the aforementioned limitations, the study possesses several methodological strengths that contribute to its overall value. One key strength is the scientifically drawn sample, which effectively captures the experiences and challenges faced by vulnerable migrant populations. By carefully selecting participants from diverse migrant communities, the study ensures that its findings represent the broader migrant population and provide meaningful insights into their immunization coverage rates and healthcare needs. Another methodological strength lies in the study's comprehensive data collection procedures. The use of structured questionnaires and interviews facilitated the gathering of detailed information on various aspects of immunization coverage among migrant children, including parental attitudes, knowledge, and access to healthcare services. Furthermore, the study's utilization of retrospective data collection, although susceptible to recall bias, offers valuable historical insights into immunization trends and patterns among migrant children.

The findings of this study can't be generalized to the general population, but this study group is more vulnerable to the outbreak of vaccine-preventable disease, which can directly affect to the general population and the health system. This was the very first in these settings, so findings of this study will help migrants in gain appropriate knowledge regarding immunization services and also guide the service provider to focus more on this group.

The children we surveyed were between the ages of 1 and 5, so they may have experienced the COVID-19 pandemic during their early years of life. This could be one reason for the low immunization coverage, as COVID-19 disruptions and lockdowns have led to overcrowded villages, loss or abandonment of vaccination cards, and rapid changes in service demand patterns, mass outflow of migrant workers to rural areas and small towns.<sup>17</sup> This means that children who were born during the pandemic may have missed out on important vaccinations, making them more vulnerable to VPDs.

## CONCLUSION

The study revealed that full immunization coverage was concerningly low among children of migrant mothers, especially among recent migrants. The major factors associated with low immunization coverage were recent migrant status, male gender, age <24 months, and home birth. The study also found that settled migrants, female children, hospital-born children, and children whose mothers received ANC visits from health workers were more likely to be fully immunized. The study underscores the urgent need for tailored interventions to enhance immunization coverage among children of migrant mothers. These interventions should focus on raising awareness about the importance of immunization, providing convenient and affordable access to immunization services, and addressing misinformation and vaccine hesitancy.

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