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Original Research Article

Assessment of Immunization Coverage and Dropout Rates Using Universal Immunization Programme (UIP) Records

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Abstract:

Background: Immunization is a key public health intervention for reducing childhood morbidity and mortality. Despite good initial vaccine uptake under India's Universal Immunization Programme (UIP), completion of the full immunization schedule remains a challenge in many settings.

Aim: To assess immunization coverage and dropout rates among children aged 12–23 months using UIP records and to identify factors associated with immunization dropout.

Methodology: A community-based cross-sectional study was conducted among 90 children aged 12–23 months in the field practice area of the Department of Community Medicine, Nalanda Medical College, Patna. Immunization status was verified using MCP cards and caregiver recall. Dropout rates were calculated using WHO formulas. Data were analyzed using SPSS version 26.0.

Results: BCG coverage was highest (95.6%), while measles/MR coverage was 71.1%. Overall, 67.8% of children were fully immunized and 32.2% were partially immunized. The highest dropout rate was observed between BCG and measles vaccination (25.6%). Low maternal education, distance to health facility, non-institutional delivery, and late ANC registration were significantly associated with dropout.

Conclusion: Although initial immunization coverage was high, dropout rates remained substantial. Strengthening caregiver awareness, follow-up mechanisms, and service accessibility is essential to improve full immunization coverage.

Keywords: Immunization coverage, Dropout rate, UIP, Children, Bihar.

Introduction

Immunization has been proven to be the most effective and reasonably priced public health measures, thus it is widely recognized that it can prevent diseases that are vaccine-preventable, and thereby lessen the case of children dying or getting sick [1]. Individual and community immunity have been accomplished in a large part due to vaccination programs that have been able to control, eliminate, and even eradicate some of the world's deadliest infectious diseases. Nevertheless, despite huge advances in global vaccination programs, diseases that can be prevented by vaccines continue to be a major source of illness and death among children, especially in low- and middle-income countries where immunization programs are not very successful. The distribution of vaccines remains one of the most important health concerns at the national and international levels and it is always associated with improving child survival and reaching the goal of universal health coverage [2].

In the country of India, the immunization services are mainly done by means of the Universal Immunization Programme (UIP), which is apart from being the largest public health initiative in the world, according to some experts [3]. It started in 1985 and gradually became wider, the UIP targeted to prevent kids and expectant mothers from getting infected by a lot of diseases which could have been avoided by vaccination, such diseases which were included since then are tuberculosis, diphtheria, pertussis, tetanus, poliomyelitis, measles, hepatitis B, etc. and later on, as the program got wider the list was updated to include diseases like rotavirus, pneumococcal disease, and Japanese encephalitis in the selected regions [4]. The program is operated via a wide health facility and outreach sessions network utilizing trained health workers and a solid cold chain system simultaneously. The UIP's success is primarily determined by its ability to realize and maintain high immunization coverage among different populations and geographic areas.

Immunization coverage signifies the percentage of those eligible that have received vaccinations as per the recommended schedule [5]. To ensure the whole community is protected and to avoid outbreaks of diseases that can be prevented by vaccines, high levels of coverage are necessary [6]. Nevertheless, coverage is not the only one to indicate the effectiveness of an immunization program. The rates of dropout, which are the percentages of children who begin but do not complete the vaccination schedule, are quite estimable indicators of service utilization, continuity of care, and program effectiveness. A high dropout rate indicates barriers to access, service delivery, caregivers' lack of awareness, or lack of follow-up even when initial contact with immunization services has been made.

What is usually done to compute the dropout rates is comparing the initial vaccine dose recipients' number, such as Bacillus Calmette–Guérin (BCG) and the first dose of pentavalent vaccine, with the number of children who completed the entire vaccination schedule or received the vaccines containing measles [7]. This analysis provides information on where the immunization process loses patients so that health managers can intervene with the right measures. If dropout continues, not only will the protection of individuals be reduced, but also that of the community, thus the occurrence of the disease will be more likely. That is why, in the context of the immunization program, it is necessary to continuously monitor both coverage and dropout rates for a thorough evaluation of the program's performance.

Data regarding routine immunization, documented in the UIP, are a significant source of information for evaluating the coverage and dropout rates across different administrative levels. UIP records are produced through regular reporting from health facilities and outreach sessions, and they consist of vaccine-wise and dose-wise information on the immunization services provided. The records make it possible to continuously keep track of immunization trends, underperformance areas to be identified, and programmatic strategies to be evaluated [8]. Routine UIP data, in contrast to periodic household surveys, make timely assessment and real-time decision-making possible, and thus they become an essential part of the immunization system strengthening process.

Nonetheless, large differences in immunization coverage and dropout rates persist among different regions, economic groups, and other divisions within the population [9]. Among the factors that influence the start and finish of immunization schedules are parental education, socio-economic status, migration, gender roles, constraints within the health system, and geographical access. Lack of knowledge, fear of side effects, missed chances during health facility visits, and insufficient tracking of beneficiaries are some of the reasons that lead to dropout. By analyzing UIP records, these patterns can be recognized and context-specific interventions can be developed, which will improve service delivery and caregiver engagement.

The estimation of inoculation coverage and dropout rates with the help of UIP records is very significant especially considering the national and global commitments which include Immunization Agenda 2030 and SDGs related to children's health [10]. Trustworthy evaluation of routine immunization performance helps health officials to not only determine the level of progress but also to distribute resources properly and enhance accountability in the health system. Additionally, evaluations such as this one are a source of planning and policy formulation to be based on evidence and thus, ensure that no child suffers due to the lack of immunization services that are preventable.

In this context, the current research is centered on the evaluation of the immmunization coverage and dropout rates through data obtained from the UIP records. The study, which focuses on the routine immunization data analysis, aims to shed light on the immunization services performance, define the important points where the vaccine completion is lacking and make known the areas that need programmattic attention. It is anticipated that the results will be in favor of the plans to make the mobile vaccination service more attractive, to ensure the continuity of care, and in the long run, to help reduce the incidence of diseases that could have been prevented by vaccination and to improve the health outcomes of children.

Methodology

Study Design: The current research employed a community-based cross-sectional study design to evaluate immunization coverage and dropout rates among children by utilizing records kept under the Universal Immunization Programme (UIP). The design was considered suitable to measure the percentage of fully and partially immunized children at one point in time and to find out the reasons for immunization dropout.

Study Area: The investigation was carried out in the Department of Community Medicine, Nalanda Medical College, Patna, Bihar, India from April 2025 to September 2025.

Study Participants: The study population comprised children aged 12–23 months residing in the selected study area along with their mothers or primary caregivers.

Inclusion Criteria

- Children aged 12–23 months who had received at least one vaccine under the UIP
- Mothers or primary caregivers who were available and willing to participate

- Caregivers who provided written informed consent

Exclusion Criteria

- Children with incomplete, missing, or unverifiable immunization records
- Families who had migrated recently or were unavailable after two household visits

Sample Size: A total sample size of 90 children aged 12–23 months was included in the study. The sample size was considered feasible based on the available population in the field practice area and logistical constraints, while still allowing meaningful estimation of immunization coverage and dropout rates.

Procedure: Interviews in homes were held in an orderly manner for finding eligible children. Informed consent was secured before starting data collection, which was done by means of face-to-face interviews with mothers or the main caregivers using a questionnaire that had been structured and pre-tested before. The immunization status was confirmed mainly through the mother and the Child Protection (MCP) card. In situations where the MCP card was not present, the caregiver's memory was relied on as per standard survey practices.

To calculate the dropout rates, standard World Health Organization (WHO) formulas were applied, especially for the BCG–Measles and DPT1–DPT3 indicators. Data about socio-demographic characteristics, caregiver knowledge about immunization, accessibility of health facility, and reasons for missed or delayed doses were gathered. Furthermore, primary health facility assessments were done to evaluate the service-delivery-related factors that influenced immunization coverage in terms of vaccine availability, cold chain maintenance, and session planning practices.

Statistical Analysis: Collected data were screened for completeness, coded, and entered into Microsoft Excel, and subsequently imported into SPSS software version 26.0 for statistical analysis. Descriptive statistics such as frequencies, percentages, mean, and standard deviation were used to summarize the data. Immunization dropout rates were expressed as percentages along with 95% confidence intervals. Associations between immunization dropout and explanatory variables were assessed using the Chi-square test and binary logistic regression analysis. A p-value of less than 0.05 was considered statistically significant.

Result

In Table 1, the socio-demographic traits of 90 kids in the age group of 12-23 months are shown. The children were distributed evenly over age groups, as 12 to 15-month-olds made up 35.6%, 16 to 19-month-olds 33.3%, and 20 to 23-month-olds 31.1%. The study sample had a slight male dominance since males were 52.2% of the study group and females only 47.8%. If we look at maternal education, most of the mothers (34.4%) had secondary education while 30.0% had primary education, 20.0% were illiterate, and only 15.6% had higher secondary or above. Most of the children, in terms of family structure, were from nuclear families (62.2%) while 37.8% were from joint families, thus showing that among the participants in the study there was a predominance of nuclear family settings.

Table 1: Socio-demographic characteristics of children aged 12–23 months (n = 90)

Variable	Category	Frequency (n)	Percentage (%)
Age of child (months)	12–15	32	35.6
	16–19	30	33.3
	20–23	28	31.1
Sex of child	Male	47	52.2
	Female	43	47.8
Mother's education	Illiterate	18	20
	Primary	27	30
	Secondary	31	34.4
	≥Higher secondary	14	15.6
Type of family	Nuclear	56	62.2
	Joint	34	37.8

The data presented in Table 2 reveal the vaccination status of UIP vaccines among the 90 study children. BCG vaccination had the highest coverage of 95.6%, followed by OPV-0 with 92.2% and Pentavalent-1 with 90%, which all together show that there was good initial contact with the immunization services. Nevertheless, a continuous fall in the coverage of the pentavalent vaccine was noticed with the subsequent doses going down from 84.4% for Pentavalent-2 to 76.7% for Pentavalent-3, which indicates that there were some dropouts between the doses. On the other hand, measles/MR vaccination coverage was relatively lower at 71.1%. In total, only 67.8% of children received all recommended immunizations, while 32.2% were partially immunized, thus revealing gaps in the completion of the recommended immunization schedule despite the high uptake of the early vaccines.

Table 2: Immunization coverage of UIP vaccines among study children (n = 90)		
Vaccine	**Vaccinated (n)**	**Coverage (%)**
BCG	86	95.6
OPV-0	83	92.2
Pentavalent-1	81	90
Pentavalent-2	76	84.4
Pentavalent-3	69	76.7
Measles/MR	64	71.1
Fully immunized	61	67.8
Partially immunized	29	32.2

By using the WHO method, dropout rates between selected immunization vaccines are depicted in table 3, pointing out the gaps in immunization schedule compliance. The largest dropout rate of 25.6% was reported between BCG and Measles vaccinations, which caused the decline in coverage from 95.6% for the first dose to 71.1% for the last dose, hence substantial loss to follow-up over the period. The dropout rates between Pentavalent-1 and Pentavalent-3 and between OPV-1 and OPV-3 were, however, relatively lower at 14.8% and 15.0%, respectively, but still significant. The coverage of Pentavalent vaccination reduced from 90.0% to 76.7%, while OPV coverage decreased from 88.9% to 75.6% from the first to the third dose. The analysis indicates that multi-dose vaccines given at shorter intervals are better accepted, while later administered singleton measles vaccines in infancy experienced higher dropout rates, reinforcing the importance of strengthened follow-up and tracking mechanisms.

Table 3: Dropout rates between selected UIP vaccines (WHO method)			
Dropout indicator	**First dose n (%)**	**Last dose n (%)**	**Dropout rate (%)**
BCG → Measles	86 (95.6)	64 (71.1)	25.6
Pentavalent-1 → Pentavalent-3	81 (90.0)	69 (76.7)	14.8
OPV-1 → OPV-3	80 (88.9)	68 (75.6)	15

The reasons for immunization dropout among partially immunized children (n = 29) are presented in Table 4. Unawareness of the immunization schedule was the most frequently cited reason which was responsible for 31% of the dropouts. This points to lack of knowledge among caregivers as the major barrier. The fear of side effects was the second most frequently mentioned reason (20.7%), and it shows the fear related to the vaccine's safety. Illness of the child was responsible for 17.2% of the dropouts, which implies that temporary health problems were a reason for missed vaccinations. Distance to the health facility was the cause of dropout for 13.8% of the participants, which indicates problems with accessibility. Non-availability of vaccines was the reason for 10.4% of the dropouts, which suggests issues associated with the healthcare system, whereas other factors accounted for 6.9% of the cases. In conclusion, both caregiver-related and service-related factors were involved in the immunization dropout.

Table 4: Reasons for immunization dropout among partially immunized children (n = 29)		
Reason	**Frequency (n)**	**Percentage (%)**
Lack of awareness about schedule	9	31
Fear of side effects	6	20.7
Child illness	5	17.2
Distance to health facility	4	13.8
Vaccine unavailability	3	10.4
Other reasons	2	6.9

The Chi-square test used for statistical analysis of selected maternal and healthcare-related factors and the immunization dropout has been represented in Table 5. Mother's education level was found to be below secondary schooling and immunization dropout ($\chi^2 = 6.12$, $p = 0.013$), which indicates that among the children of less educated mothers, the dropout is higher. Health facility distance of more than 3 km was also found to be significantly associated with dropout ($\chi^2 = 4.87$, $p = 0.027$), which means that physical access to the health center plays a major role in the decision for the child to be vaccinated or not. The children born through non-institutional deliveries showed a significantly higher proportion of dropout compared to those born in institutions ($\chi^2 = 7.45$, $p = 0.006$). Late registration for antenatal care was another factor significantly associated with immunization dropout ($\chi^2 = 5.01$, $p =$

0.025). To summarize, the results point out that maternal education, access to health facilities, place of delivery, and timely ANC registration are influential factors for the continuation of immunization.

Table 5: Association between selected factors and immunization dropout (Chi-square test)

Variable	Dropout present n (%)	Dropout absent n (%)	χ^2 value	p-value
Mother's education (<Secondary)	18 (45.0)	22 (55.0)	6.12	0.013*
Distance to health facility (>3 km)	14 (50.0)	14 (50.0)	4.87	0.027*
Institutional delivery (No)	9 (47.4)	10 (52.6)	7.45	0.006*
Late ANC registration	10 (45.5)	12 (54.5)	5.01	0.025*

Discussion

This study looked at the immunization coverage and dropout rates of children aged 12-23 months and the data from the Universal Immunization Programme (UIP) indicated a distinct gap between the starting and the finishing of the immunization schedule. Full immunization coverage was low even though the early uptake of vaccines was quite high, and a significant number of children had received only partial immunization. Such a trend has also been seen with the national-level data stating that even though the access to immunization services in India has become easier, the long-term retention of all the recommended doses is still a problem (Dhalaria et al., 2023; Gurnani et al., 2021) [11,12].

The high proportion of infant vaccinations received, especially BCG, OPV-0, and the first dose of pentavalent vaccine, indicates that there was good initial contact with the health services. BCG coverage in India remains over 90% in most of the states including the ones with lower health service accessibility as shown in the analysis based on NFHS data (IIPS, 2021). This trend is an indication of the role played by institutional deliveries and early postnatal care in immunization initiation. On the contrary, the continuous drop in coverage shown by the present study with successive doses indicates that the follow-up system is still not strong enough. Madhavi and Manikyamba (2016) [13] also reported a similar drop from the first to third doses of the primary vaccines which they attributed to lack of proper caregiver counseling and inefficient tracking of beneficiaries.

The most significant dropout rate found in the current study was BCG to measles/MR vaccination. this result is in complete agreement with previous works that pinpointed the BCG-to-measles gap as the weakest point in the immunization schedule (Nath et al., 2015) [14]. for nine months is the time for measles vaccination, the prolonged gap between visits heightens the chances of missing appointments, moving, and the caregiver forgetting. Such trends have been observed in both district-level and national analyses, where vaccinations with measles-containing vaccines have been consistently lower than those with the vaccines given earlier in infancy (Dhalaria et al., 2023). On the other hand, the dropout between pentavalent-1 and pentavalent-3, although inferior to the BCG–measles dropout, was still significant, thus pointing out that even short-interval multi-dose schedules are subject to noncompliance, as also indicated by Gurnani et al. (2021).

In the current research, the share of children receiving the full immunization was below the programmatic targets and on par with the NFHS-4 estimates, which indicated that approximately one-third of the children were not vaccinated completely although they had started the shots (IIPS, 2021). However, the NFHS-5 survey had reported that the full immunization of the nation had improved, but there were still marked disparities both between districts and in socio-demographic terms (Bhadoria et al., 2019) [15]. The results of the current research add to the alarm that national improvement figures might hide the places where immunization completion is still low.

Maternal education came out as a strong predictor of immunization dropout, and the children of mothers educated below the secondary level had the highest dropout rates. The literature is definite on the point, as maternal education affects health literacy, comprehension of immunization schedules, and access to preventive health services (Nandi et al., 2020) [16]. The research has proved over and over that mothers with a good education are much more likely to have and keep immunization cards, follow vaccination programs, and go to the doctor on time, thus minimizing the probability of dropout (Dhalaria et al., 2023).

In the current research, one of the accessibility-related issues that had a major impact on the immunization dropout rate was the distance to health facilities. In rural and peripheral urban India community studies, similar associations have been found, where long distances and bad transport are major hurdles to making children get their vaccinations repeated (Nath et al., 2015). Indirect expenses like traveling and loss of wages could still make caregivers reluctant to take their children for immunization even when the service is free (Gurnani et al., 2021).

Significant correlation was found between non-institutional deliveries and late registration of antenatal care with higher dropout rates. The institutional delivery has been empowered to connect the child to

the routine immunization services very early via the three processes of immediate registration, issuance of immunization cards, and caregiver counseling (Zewde et al., 2017) [17]. The mothers exposed to delayed or inadequate antenatal care will be less educated on the matter of the importance of timely and complete immunization and thus they are more likely to dropout. Similar findings have been reported under Mission Indradhanush evaluations, which highlight the necessity of integrating maternal and child health services in improving immunization outcomes (Bhadoria et al., 2019; Dhawan et al., 2023).

The reasons reported by caregivers for dropout in the current research offer a broader perspective to these findings. The most common reason given was lack of knowledge about the immunization schedule which is in line with other studies that reported lack of knowledge among caregivers as a major cause of partial vaccination (Madhavi & Manikyamba, 2016). Another significant reason was fear of side effects, which indicates that there are still misconceptions among people and communication by health professionals is not good enough. These issues have been pointed out before and they highlight the need for good personal communication and counseling to help overcome vaccine hesitancy (Nandi et al., 2020).

In summary, the current research shows that even though the immunization coverage for children under the UIP is very early, the dropout rates are still a major health issue. The results of this study agree mostly with the previous research and point out that the problem of immunization dropout is caused by many factors such as maternal education, access, service utilization, and caregiver awareness. It is very important to make counseling stronger, to track defaulters better, to make accessibility easier, and to integrate maternal and child health services to improve full immunization coverage and lower dropout rates.

Conclusion

The study in question reveals the fact that the Universal Immunization Programme at the beginning had very good acceptance of its immunization services among the population, but the end point of full immunization for children of 12-23 months was very low. A great percentage of children were at the immunization stage just before the one with measles vaccination and the highest dropout rate here denotes the loss to follow-up in time. There were both caregiver-related factors, such as low maternal education and lack of awareness, and health system-related factors like distance to health facilities and none-institutional births that greatly affected immunization dropout. The results of this research point to the necessity of not only caregiver consulting but also tracking of beneficiaries, making services more accessible, and integrating maternal and child health interventions. It is very important to fill these gaps to increase full immunization coverage and to decrease the incidence of diseases that can be prevented by vaccination.

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