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Determinant Of Childhood Immunization Dropout Rates

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Abstract
Routine childhood immunization is one of the most effective public health interventions for preventing vaccine-preventable diseases, reducing child morbidity and mortality, and strengthening population immunity. However, children who begin vaccination but fail to complete the recommended schedule remain vulnerable to measles, diphtheria, pertussis, tetanus, polio, hepatitis B, Haemophilus influenzae type b, rotavirus and other preventable conditions. Immunization dropout is a sensitive indicator of continuity of care and programme follow-up. The present thesis was undertaken to assess determinants of childhood immunization dropout rates among children aged 12-23 months, with special attention to maternal education, socioeconomic status, birth order, migration, distance from session site, antenatal care, institutional delivery, immunization card retention, caregiver knowledge, reminder systems and health-service barriers. An analytical community-based cross-sectional study approach was used. The study population included caregivers of children aged 12-23 months from selected urban, peri-urban and rural field practice areas. Data were collected using a structured questionnaire, immunization card review, maternal and child protection card verification and health-system assessment. Data were analysed using frequencies, percentages, chi-square tests, odds ratios and multivariable logistic regression. A p value less than 0.05 was considered statistically significant. Among 300 children included in the analysis, 84 children were classified as dropout and 216 children had completed age-appropriate immunization. The overall dropout proportion was 28.0%. Higher dropout was observed among children of mothers with no formal or primary education, low socioeconomic status, higher birth order, rural or peri-urban residence, distance more than 5 km from session site, fewer than four antenatal visits, home delivery, unavailability of MCP card, low caregiver knowledge, absence of ASHA/ANM reminders, vaccine session cancellation, fear of adverse events and recent migration.

Keywords: Childhood immunization, dropout rate, vaccine coverage, Universal Immunization Programme

I. INTRODUCTION

Immunization is a cornerstone of public health because it prevents serious infections before they occur and protects children during the period of greatest biological vulnerability. Vaccination has contributed to major reductions in child deaths, disability and outbreaks of vaccine-preventable diseases. The World Health Organization reported that global DTP3 coverage was 85% in 2024, while 14.3 million children remained zero-dose, showing that

progress in routine immunization is substantial but still incomplete. Childhood immunization dropout occurs when a child receives an initial vaccine dose but does not return for the subsequent scheduled doses or fails to complete ageappropriate vaccination. This is different from a zero-dose child, who has not received the first dose of DTP-containing vaccine. Dropout is therefore a continuity-of-care problem rather than a pure access problem. A child may have entered the health system, obtained one or more vaccines and still remained under-immunized because the system, household or community failed to maintain contact until completion. The issue is important for Master of Public Health research because it links epidemiology, behaviour, health services, equity and programme management. Immunization dropout reflects the performance of several systems: caregiver counselling, birth notification, antenatal care, postnatal follow-up, vaccine logistics, session planning, ASHA and ANM follow-up, data recording and community trust. Studying determinants of dropout therefore provides practical evidence for improving immunization coverage in hard-to-reach and vulnerable populations. In India, the Universal Immunization Programme provides free vaccines against major vaccine-preventable diseases and has expanded substantially over time. Despite national progress, local pockets of partial immunization continue in rural areas, periurban settlements, urban slums, migrant communities and areas with weak follow-up. NFHS-5 reported full immunization coverage of approximately three-fourths of children aged 12-23 months, indicating that a substantial proportion of children still miss at least one recommended vaccine dose.

II. LITERATURE REVIEW

Global Burden of Under-Immunization

WHO reported that in 2024 around 109 million infants received three doses of DTP vaccine, corresponding to global DTP3 coverage of 85%. However, 14.3 million children remained zero-dose and 20.6 million missed the first dose of measles vaccine, indicating continuing gaps in global routine immunization systems.The available evidence indicates that the determinant should be interpreted within the local health-system context. A factor such as distance becomes more important when sessions are infrequent, while low knowledge becomes more important when counselling is weak. Therefore, determinants are not isolated; they interact with programme organization and community circumstances.

Immunization Agenda 2030 and Equity

The Immunization Agenda 2030 emphasizes leaving no one behind and reaching zerodose and under-immunized children. Dropout reduction is central to this goal because it improves continuity of vaccination, reduces missed opportunities and converts initial contact into completed protection.3 The available evidence indicates that the determinant should be interpreted within the local health-system context. A factor such as distance becomes more important when sessions are infrequent, while low knowledge becomes more important when counselling is weak. Therefore, determinants are not isolated; they interact with programme organization and community circumstances.

Immunization Coverage in India

NFHS-5 and UNICEF India sources indicate improvement in full immunization coverage but also show that not all children complete the schedule. Differences between survey estimates

and administrative coverage underline the importance of household-level verification and defaulter tracking. The available evidence indicates that the determinant should be interpreted within the local health-system context. A factor such as distance becomes more important when sessions are infrequent, while low knowledge becomes more important when counselling is weak. Therefore, determinants are not isolated; they interact with programme organization and community circumstances.

Universal Immunization Programme and Mission Indradhanush

The Universal Immunization Programme and Mission Indradhanush provide the policy and operational framework for reaching missed children. Intensified Mission Indradhanush targeted low-coverage districts, urban slums, nomadic groups, migrants, brick-kiln workers and other vulnerable populations. This approach reflects the need to address both access and continuity.7,8 The available evidence indicates that the determinant should be interpreted within the local health-system context. A factor such as distance becomes more important when sessions are infrequent, while low knowledge becomes more important when counselling is weak. Therefore, determinants are not isolated; they interact with programme organization and community circumstances.

Conceptual Studies on Dropout

Dropout is a key indicator of programme performance because it reflects whether children who begin vaccination continue to later doses. A programme can have acceptable BCG coverage but poor measles or Penta-3 coverage if caregiver reminders and session planning are weak. Therefore, dropout analysis must examine both early access and retention. The available evidence indicates that the determinant should be interpreted within the local health-system context. A factor such as distance becomes more important when sessions are infrequent, while low knowledge becomes more important when counselling is weak. Therefore, determinants are not isolated; they interact with programme organization and community circumstances.

Maternal Education and Knowledge

Maternal education is consistently linked with immunization completion. Educated mothers are more likely to understand vaccine schedules, recognize the need for repeated doses, keep the MCP card safely and seek information after minor AEFI. Low literacy may not prevent vaccination if counselling is strong, but it increases dependence on health-worker follow-up. The available evidence indicates that the determinant should be interpreted within the local health-system context. A factor such as distance becomes more important when sessions are infrequent, while low knowledge becomes more important when counselling is weak. Therefore, determinants are not isolated; they interact with programme organization and community circumstances.

Socioeconomic Status and Poverty

Poverty affects dropout through transport cost, opportunity cost of time, unstable residence, crowded housing and limited control over work schedules. Low-income caregivers may delay visits when daily wage loss is expected. Socioeconomic disadvantage also overlaps with low education, poor access and migration. The available evidence indicates that the determinant

should be interpreted within the local health-system context. A factor such as distance becomes more important when sessions are infrequent, while low knowledge becomes more important when counselling is weak. Therefore, determinants are not isolated; they interact with programme organization and community circumstances.

III. MATERIALS AND METHODOLOGY

Study Design

The study design was community-based analytical cross-sectional. This design was appropriate because caregiver, child, socioeconomic and health-system variables were assessed at one point in time and compared between dropout and completedimmunization groups.

Study Area

The study was conducted in selected rural, urban and peri-urban field practice areas served by primary health facilities and outreach immunization sessions. Areas were selected to represent variation in accessibility, population density, migration pattern, socioeconomic status and health-service availability.

Study Population

The study population consisted of caregivers of children aged 12-23 months residing in selected areas during the study period. Children in this age group were selected because most primary infant vaccines should have been received by this age and immunization card verification is feasible.

Study Period

The study period was planned for one year, including preparatory work, tool development, pilot testing, household survey, data entry, analysis and report writing. Data collection was conducted after obtaining institutional permission and communitylevel coordination.

Sample Size

A sample size of 300 children aged 12-23 months was included. The sample consisted of 84 dropout children and 216 children who had completed age-appropriate immunization. The sample was adequate for descriptive analysis and chi-square testing of major determinants.

Sampling Technique

A multistage sampling technique was used. First, field practice areas and outreach session areas were listed. Second, households with eligible children were identified through ASHA due lists, MCP cards and household visits. Third, eligible caregivers were approached and enrolled after informed consent. Dropout and completed children were classified after card verification and caregiver history.

Inclusion Criteria

Children aged 12-23 months residing in the selected area for at least six months; caregiver aged 18 years or above; availability of caregiver information regarding vaccination; and willingness to participate were included.

Exclusion Criteria

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Children with unavailable or unreliable immunization history after repeated probing; caregivers not willing to participate; households locked during repeated visits; children who recently migrated into the area after completion of infancy; and children with contraindications documented by a medical officer were excluded.

Study Variables

The dependent variable was childhood immunization dropout status. Independent variables included age and sex of child, birth order, maternal and paternal education, socioeconomic status, residence, distance from session site, ANC visits, place of delivery, MCP card availability, caregiver knowledge, reminder/follow-up, healthsystem barriers, adverse-event concern, vaccine hesitancy and migration.

Table 1: Study variables and measurement approach

Variable group	Variables	Measurement approach
Dependent variable	Childhood immunization dropout status	Dropout / completed immunization
Child variables	Age, gender, birth order	Caregiver report and records
Caregiver variables	Mother education, father education, knowledge, fear of AEFI	Structured questionnaire
Socioeconomic variables	Income group, occupation, residence, family size	Questionnaire and observation
Access variables	Distance, transport, waiting time, session timing	Questionnaire
Health-system variables	Reminder, due list, session cancellation, stockout, counselling	Questionnaire and health-worker record
Documentation variables	MCP card availability and completeness	Card review

IV. DATA ANALYSIS AND INTERPRETATION

The analysis includes 300 children aged 12-23 months. Of these, 84 children were classified as dropout and 216 were classified as completed immunization. Frequencies, percentages, chi-square values and p values are presented. Interpretation is provided after each table to explain public health relevance.

Table 2: Sociodemographic profile of children and caregivers

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Variable	Category	Dropout n=84	Completed n=216	Total n=300
Age group	12-15 months	24 (28.6%)	60 (27.8%)	84 (28.0%)
Age group	16-19 months	28 (33.3%)	75 (34.7%)	103 (34.3%)
Age group	20-23 months	32 (38.1%)	81 (37.5%)	113 (37.7%)
Gender	Male	47 (56.0%)	113 (52.3%)	160 (53.3%)
Gender	Female	37 (44.0%)	103 (47.7%)	140 (46.7%)
Birth order	Third or above	38 (45.2%)	46 (21.3%)	84 (28.0%)
Birth order	First/second	46 (54.8%)	170 (78.7%)	216 (72.0%)
Maternal education	No formal/Primary	36 (42.9%)	35 (16.2%)	71 (23.7%)
Maternal education	Secondary	32 (38.1%)	88 (40.7%)	120 (40.0%)
Maternal education	Higher secondary and above	16 (19.0%)	93 (43.1%)	109 (36.3%)
Socioeconomic status	Lower	45 (53.6%)	55 (25.5%)	100 (33.3%)

The sociodemographic profile shows that dropout was distributed across all child age and gender categories. However, dropout was higher among children of higher birth order, mothers with lower education and households of lower socioeconomic status. These patterns indicate that dropout is less related to child sex or narrow age group and more related to household vulnerability and caregiver capacity for continued follow-up.

Table 3: Distribution of dropout by age group of child

Category	Dropout n=84	Completed n=216	Total n=300
12-15 months	24 (28.6%)	60 (27.8%)	84 (28.0%)
16-19 months	28 (33.3%)	75 (34.7%)	103 (34.3%)
20-23 months	32 (38.1%)	81 (37.5%)	113 (37.7%)

Chi-square value for age group was 0.05 with 2 degrees of freedom and p value 0.974. Age group was not significantly associated with dropout status. The slight variation across age groups may reflect the expected accumulation of missed doses as children become older, but age alone was not a decisive determinant.

Table 4: Distribution of dropout by gender of child

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Category	Dropout n=84	Completed n=216	Total n=300
Male	47 (56.0%)	113 (52.3%)	160 (53.3%)
Female	37 (44.0%)	103 (47.7%)	140 (46.7%)

Chi-square value for gender was 0.19 with 1 degree of freedom and p value 0.661. Gender difference was not statistically significant. This suggests that in the present study context, household and service factors were more important than child sex in explaining dropout.

Table 5: Association between maternal education and immunization dropout

Category	Dropout n=84	Completed n=216	Total n=300
No formal/Primary	36 (42.9%)	35 (16.2%)	71 (23.7%)
Secondary	32 (38.1%)	88 (40.7%)	120 (40.0%)
Higher secondary and above	16 (19.0%)	93 (43.1%)	109 (36.3%)

Chi-square value for maternal education was 27.85 with 2 degrees of freedom and p value <0.001. Lower maternal education was strongly associated with dropout. Education may improve understanding of vaccine schedules, MCP card use and response to minor post-vaccination reactions.

V. RESULTS

Overall Dropout Rate

Among 300 children aged 12-23 months, 84 children were categorized as dropout and 216 as completed immunization. The overall dropout proportion was 28.0%. Stage-wise dropout was observed between BCG and MR1, Penta1 and Penta3, and Penta1 and MR1, indicating that both early and later schedule points require follow-up.

Results Related to Child Characteristics

Age group and gender were not significantly associated with dropout status. This indicates that the risk of dropout was distributed across male and female children and across the 12-23 month age range. However, higher birth order showed a significant association, suggesting that family size and caregiver workload influence completion.

Results Related to Maternal and Paternal Education

Maternal education was one of the strongest determinants of dropout. Children of mothers with no formal or primary education had higher dropout than children of mothers with higher education. Paternal education was also associated with dropout, indicating that household decision-making and support for accessing services may influence completion.

Results Related to Socioeconomic Status

Lower socioeconomic status was significantly associated with dropout. Poor households may experience difficulties related to transport, daily wage loss, unstable residence and limited access to information. The result highlights the need for equitysensitive microplanning.

Results Related to Residence and Distance

Rural and peri-urban residence and distance more than 5 km from the session site were significantly associated with dropout. These findings show that routine immunization completion depends on geographic access and repeated service contact.

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Results Related to Maternal Health-Service Contact

Fewer than four ANC visits and home or non-institutional delivery were significantly associated with dropout. This suggests that maternal health services provide an important platform for counselling, birth-dose vaccination and linkage to the child immunization schedule.

Results Related to MCP Card Availability

MCP card unavailability was strongly associated with dropout. The MCP card functions as a household-held record, reminder tool and verification document. Card retention and explanation should therefore be strengthened during ANC, delivery and immunization sessions.

Results Related to Caregiver Knowledge

Low caregiver knowledge was significantly associated with dropout. Caregivers who did not know the next due date, the need for multiple doses or the importance of completing vaccination were more likely to miss later doses.

Results Related to Reminder and Follow-Up

Absence of reminder or follow-up was strongly associated with dropout. This finding supports active due-list preparation, home visits by ASHA workers, phone reminders and monthly review of defaulters at sub-centre and PHC level.

Results Related to Health-System Barriers

Session cancellation, vaccine stockout, long waiting time and poor counselling were associated with dropout. Caregivers who experience unreliable service may lose motivation to return, especially when travel cost or wage loss is involved.

Results Related to Behavioural and Mobility Factors

Fear of AEFI, rumours, hesitancy and migration were significantly associated with dropout. These factors require specific strategies: counselling for minor reactions, community trust-building, engagement of local influencers and tracking of mobile families.

VI. DISCUSSION

Interpretation of Overall Dropout Rate

The observed dropout proportion of 28.0% indicates that a considerable share of children who entered the immunization system did not complete the age-appropriate schedule. This finding is important because dropout children are not completely unreached; they have already had contact with the system. Therefore, the programme challenge is to maintain contact and ensure return for subsequent doses.

Maternal Education and Dropout

The association between lower maternal education and dropout is consistent with studies showing that caregiver education influences understanding of vaccination schedules, ability to interpret the MCP card and confidence in dealing with minor adverse events. Dhalaria et al. reported that maternal education contributed to reducing dropout in India, while Ghosh and Laxminarayan found that children of mothers with no schooling were more likely to drop out between DPT doses.

Socioeconomic Vulnerability

The association between low socioeconomic status and dropout indicates that immunization completion is affected by the social conditions in which families live. Poor households may face transport cost, wage loss, unstable housing and lower access to reminders. These results support equity-focused strategies rather than uniform messages alone.

Birth Order and Family Responsibilities

Higher birth order was significantly associated with dropout. This may be due to caregiver workload, competing responsibilities, reduced attention to due dates and larger family demands. Health workers should give special attention to households with multiple young children and provide practical reminders.

Distance and Accessibility

Distance greater than 5 km was associated with dropout. Repeated visits are harder to complete when transport is unavailable or expensive. Outreach sessions, mobile teams and flexible catch-up opportunities can reduce this barrier. Accessibility should be considered not only as physical distance but also as time, cost and caregiver convenience.

VII.CONCLUSION

The study concluded that childhood immunization dropout rates are determined by a combination of caregiver, socioeconomic, accessibility and health-system factors. Dropout was significantly associated with low maternal education, low socioeconomic status, higher birth order, rural or peri-urban residence, distance from session site, fewer ANC visits, home delivery, MCP card unavailability, low caregiver knowledge, absence of reminder/follow-up, health-system barriers, AEFI concern, rumours and migration. The findings show that dropout is not simply a matter of caregiver negligence but a reflection of how effectively the health system maintains contact with families after the first vaccine dose.

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