

Determinants of Vaccination Dropout among Children in Urban Slums of Lucknow: A Cross-Sectional Study

Santosh Kumar^{1*}, Monika Agarwal², Dinesh Kumar H³

¹Department of Community Medicine, Autonomous State Medical College Kaushambi, U.P, India

^{2,3}Upgraded Department of Community Medicine and Public Health, KGMU, Lucknow, U.P, India

DOI: 10.55489/njcm.161120255694

ABSTRACT

Context: Immunization is one of the most effective public health interventions to prevent infectious diseases and reduce childhood mortality. Urban slums in cities like Lucknow are characterized by overcrowded living conditions, limited access to healthcare, poor sanitation, and socioeconomic disadvantages. The aim was to determine the vaccination dropout rate among children aged 0-24 months in an urban slum of Lucknow and to assess the barriers to vaccination faced by families living in urban slums.

Methods and Material: Community-based cross-sectional study among 320 children (0-24 months) residing in 16 randomly selected urban slums and 20 children were chosen randomly for participation within each selected slum in Lucknow, Uttar Pradesh. Multi-stage random sampling was applied pre structured, semi structured interview schedule was used to collected the data along with conformation of immunization status from MCP card and chi square test was used to association and $p < 0.05$ considered significant.

Results: Overall dropout rates ranged from 10.07% at birth to the cumulative dropout increased to 19.79 percent at 9 months. Significant associations were found between dropout and child sex, caste and delivery type. Children born at home 56.25% had higher dropout rate compared to institutional births 20%.

Conclusions: Despite high institutional delivery rates and MCP card coverage, barriers such as parental literacy, healthcare access, and economic constraints persist.

Keywords: Vaccine Dropout, Child Immunization, Barriers, Immunization Coverage

ARTICLE INFO

Financial Support: None declared

Conflict of Interest: The authors have declared that no conflict of interests exists.

Received: 18-06-2025, **Accepted:** 24-09-2025, **Published:** 01-11-2025

***Correspondence:** Dr. Santosh Kumar (Email: santoshjs87@gmail.com)

How to cite this article: Kumar S, Agarwal M, Kumar HD. Determinants of Vaccination Dropout among Children in Urban Slums of Lucknow: A Cross-Sectional Study. Natl J Community Med 2025;16(11):1095-1100.
DOI: 10.55489/njcm.161120255694

Copy Right: The Authors retain the copyrights of this article, with first publication rights granted to Medsci Publications.

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-Share Alike (CC BY-SA) 4.0 License, which allows others to remix, adapt, and build upon the work commercially, as long as appropriate credit is given, and the new creations are licensed under the identical terms.

www.njcmindia.com | pISSN: 0976-3325 | eISSN: 2229-6816 | Published by Medsci Publications

INTRODUCTION

Immunization is one of the most effective public health interventions to prevent infectious diseases and reduce childhood mortality. In 2023, global coverage of the third dose of diphtheria-tetanus-pertussis (DTP3) vaccine (often used as a marker of how well countries are providing routine immunization services to children) stagnated at 84 percent.¹ The World Health Organization (WHO) recommends a series of vaccinations to protect children from vaccine-preventable diseases, yet a significant proportion of children globally fail to complete the full vaccination schedule.

In India, the vaccination coverage stands at about 84 percent² and in Uttar Pradesh it was 78 percent³. Urban population of Lucknow had vaccination coverage of 84.5 percent⁴. Despite substantial progress in increasing vaccination coverage, there are persistent challenges, particularly in disadvantaged and marginalized communities, such as those living in urban slums.

Urban slums in cities like Lucknow are marked by overcrowding, poor sanitation, limited access to healthcare, and socioeconomic disadvantages. Overcrowding not only increases disease transmission risks but also hampers the logistics of vaccine delivery such as maintaining cold chains, organizing outreach, and ensuring follow-up visits.

Several factors contribute to vaccination dropout, including lack of awareness, misinformation about vaccine safety, socio-economic barriers, and inadequate healthcare infrastructure. Moreover, cultural and behavioural factors, including parental attitudes and beliefs about vaccination, can influence the decision to initiate or complete a vaccination schedule.

Although national surveys like NFHS provide important macro-level insights, they do not sufficiently capture the local, slum-specific determinants of dropout in cities like Lucknow. This lack constitutes a significant research gap.

This study aims to determine the vaccination dropout rate among children aged 0-24 months in Lucknow's urban slums and to assess the barriers faced by these families. The insights gained are intended to support targeted public health interventions to improve immunization coverage and reduce vaccine-preventable disease risk in this vulnerable population.

METHODOLOGY

It was a community based cross-sectional study conducted to determine vaccination dropout among children aged 0-24 months residing in urban slums of Lucknow, Uttar Pradesh, India. The study was carried out over a period of one and half year, from October 2020 to march 2022. Inclusion criteria for participation included Children aged 0-24 months who

are residents of the slum and parents or caregivers who are willing to participate and provide informed consent. Parents or caregivers who are not available for interview and children with serious medical conditions that prohibit vaccination were excluded.

Sample size determination: The sample size was calculated using the following formula:

$$n = \frac{Z_{(1-\alpha/2)}^2 p(1-p)}{d^2}$$

Where, $Z_{1-\alpha/2}$ is value of two tailed alpha errors at 95 per cent confidence interval (1.96). According to NFHS 4 (2015-2016), about 56.1 percent of mothers have had at least 4 antenatal care visits, in urban areas in Lucknow⁵. Taking margin of error ($d=7$ percent), the calculated sample size is 193 and by using design effect 1.6, the sample size become 309 recently delivered women. 8 Urban Primary Health Centres were selected and 40 RDWs (by rounding off) were chosen from each U-PHC making the total figure 320.

Sampling technique: A multistage random sampling technique was used. In the first stage, 8 Urban Primary Health Centres (UPHCs) were randomly selected from a list of 52 UPHCs in Lucknow city. In the second stage, two urban slums were randomly selected from each chosen UPHC catchment area, yielding a total of 16 slums. In the third stage, 20 children randomly selected from each slum based on the beneficiary list enumerated by ASHA and achieved the required sample size.

Data were collected using a pre-tested semi-structured questionnaire. The questionnaire consisted of the following sections: Sociodemographic details - age, gender of child, education, occupation, and socio-economic status of parents/caregivers. Vaccination history - based on Mother and Child Protection (MCP) cards or health records; where vaccination cards were unavailable (16 children), information was obtained through caregiver recall and cross-verified with local health worker records when possible. Barriers to vaccination - assessed through both close-ended questions (yes/no responses on accessibility, awareness, distance, cost, etc.) and open-ended questions to capture additional reasons. Some items were recorded on a 3-point Likert scale (no difficulty/some difficulty/significant difficulty) to quantify perceived barriers. The dependent variable was vaccination dropout (failure to receive age-appropriate vaccines after initiation). Independent variables included demographic factors (child's age, gender, socio-economic status), maternal education, awareness of vaccination schedules, healthcare access, and reported barriers to vaccination.

Socioeconomic classification: Quantitative data were entered and analyzed using Statistical Package for Social Sciences (SPSS, version 26; IBM, Chicago, USA). Continuous variables were presented as mean $\pm$ standard deviation (SD), and categorical variables as frequencies and percentages. Chi-square test was applied to compare proportions between groups. A

p-value <0.05 was considered statistically significant. Barriers were analyzed using descriptive statistics for quantitative items, while open-ended responses were grouped thematically to identify common patterns.

Ethical clearance was obtained from the Institutional Ethics Committee of King George's Medical University, Lucknow before commencing the study (No. 101st ECM IIB-Thesis/P55, Dated 20/6/2020). Written informed consent was obtained from all parents or caregivers before participation. For illiterate participants, the consent form was read aloud in the local language, and thumb impressions were taken in the presence of a witness. Privacy, confidentiality, and voluntary participation were ensured throughout the study.

RESULTS

A total of 320 children aged 0-24 months were enrolled in the study. Of these, 16 children did not have MCP cards, and hence vaccination status could not be verified; therefore, analyses of vaccination coverage, dropout, and associations were conducted on 304 children (n=304). The majority of children (95%) have a MCP (Mother and Child Protection) card, only 5% of children do not have this card.

Table 1: sociodemographic characteristic of study participant (N=320)

Variables	Participants (%)
Children characteristic	
Age	
<6 month	98 (30.7)
≥6 month	222 (69.3)
Sex	
Male	156 (48.5)
Female	164 (51.5)
MCP Card	
Yes	304 (95)
No	16 (5)
Respondent characteristic	
Religion	
Hindu	228 (71.4)
Muslim	92 (28.6)
Category	
General	57 (17.8)
OBC	184 (57.8)
SC/ST	79 (24.4)
Education	
Literate	189 (59.4)
Illiterate	131 (40.6)
Occupation	
Working	24 (7.5)
Not working	296 (92.5)
Type of family	
Nuclear	245 (76.6)
Joint	75 (23.4)
Health centre access	
<2.0 km	190 (59.4)
>2.0 km	130 (40.6)
Delivery	
Home delivery	21 (6.6)
Institutional	299 (93.4)

A majority of the children (69.3%) are aged 6 months or older, while 30.7% are younger than 6 months with sex nearly even, with 48.5% being male and 51.5% being female.

The majority of respondents are Hindu (71.4%), with Muslims constituting 28.6% of the sample. Respondents belong primarily to the OBC category (57.8%), followed by SC/ST (24.4%) and General Category (17.8%). A significant portion of respondents (59.4%) are literate, while 40.6% are illiterate. Most respondents (92.5%) are not working, while only 7.5% are engaged in employment. The majority of families are nuclear (76.6%), and 23.4% of families are joint families. A majority of respondents (59.4%) live within 2 km of a health centre, indicating relatively good access to healthcare facilities. However, 40.6% live farther away. A large proportion of deliveries (93.4%) were institutional, with only 6.6% of deliveries taking place at home (table 1).

At birth, 288 participants were initially eligible for vaccination. Of these, 259 participants were successfully vaccinated, resulting in 29 dropouts, which equates to a dropout rate of 10.07%. At 6 weeks, 282 participants remained eligible, and 266 participants were vaccinated, leaving 16 dropouts. The dropout rate decreased to 5.67% at this stage. The dropout rate at 10 weeks dropped further to 1.87%, with only 5 participants missing from the vaccination coverage. At 14 weeks, 241 participants were eligible, and 237 were vaccinated, with just 4 dropouts, resulting in a dropout rate of 1.66%. This brought the cumulative dropout rate to 18.75% percent. At 9 months, 129 participants were eligible for vaccination, and 126 received the vaccine, leaving only 3 dropouts. This represents a dropout rate of 2.33%. The cumulative dropout increased to 19.79 percent. Finally, by the time participants reached the 16-24month mark, the cumulative dropout rate stabilized at 19.79 percent, with all remaining eligible participants (43) receiving the vaccine. (Table 2)

The BCG vaccine had 304 eligible children, with 259 (85.2%) receiving the vaccine, resulting in a dropout rate of 14.8%. The 3 doses of oral Polio vaccine showed a higher vaccination rate of 92.2%, with 237 out of 257 eligible children vaccinated, and a dropout rate of 7.8%. Similarly, the 3 doses of Penta vaccine had a high vaccination rate of 92.6% (262 out of 283 eligible children) and a dropout rate of 7.4%. Regarding the 3 doses of Rota vaccine, 230 out of 257 eligible children were vaccinated, yielding a vaccination rate of 89.5% and a dropout rate of 10.5%. The 2 doses of Measles/MR vaccine had the lowest vaccination rate, with only 43 out of 59 eligible children vaccinated, corresponding to 72.9%, and a dropout rate of 27.1%. (Table 3)

Vaccination dropout was higher among those aged <6 months (22.8%) compared to ≥6 months (17.0%), though not statistically significant ($\chi^2=1.438$, $p=0.230$; AOR 1.28, 95% CI 0.67-2.44).

Table 2: Vaccination coverage and dropouts at successive stage of the vaccination schedule (n=304*)

Timeline	Non-eligible participants†	Eligible participants	Vaccination coverage	Vaccination Dropout (%)	Cumulative Coverage (%)	Cumulative Dropout (%)
At birth	16	288	259 (89.93)	29 (10.07)	259 (10.07)	29 (10.07)
At 6 weeks	16 + 6 = 22	282	266 (94.33)	16 (5.67)	243 (84.37)	45 (15.63)
At 10 weeks	22 + 15 = 37	267	262 (98.13)	5 (1.87)	238 (82.64)	50 (17.36)
At 14 weeks	37 + 26 = 63	241	237 (98.34)	4 (1.66)	234 (81.25)	54 (18.75)
At 9 months	63 + 112 = 175	129	126 (97.67)	3 (2.33)	231 (80.21)	57 (19.79)
At 16-24 months	175 + 86 = 261	43	43 (100)	0 (0)	231 (80.21)	57 (19.79)

*16 participants do not have MCP Card

† Non-eligible participants = age ineligible + cumulative dropouts from earlier stages.

Table 3: Vaccine specific coverage and dropout rates (n=304)

Vaccine	Eligible	Vaccinated (%)	Dropout (%)
BCG vaccine	304	259(85.2)	45(14.8)
3 doses of Oral Polio vaccine	283	262(92.6)	21(7.4)
3 doses of Pentavalent vaccine	257	237(92.2)	20(7.8)
3 doses of Rota virus vaccine	257	230(89.5)	27(10.5)
2 doses of Measles/ MR vaccine	59	43(72.9)	16(27.1)

Table 4: Association between socio-demographic characteristics of participants and vaccination status (n=304)

Variable	Vaccinated n (%)	Dropout n (%)	χ^2 , p value	OR (95% CI)	Adjusted OR (95% CI), p
Child age					
<6m	71 (77.2)	21 (22.8)	1.438, p=0.230	1.42 (0.80-2.53)	1.28 (0.67-2.44), p=0.45
≥6m	176 (83.0)	36 (17.0)		Ref	Ref
Sex					
Male	128 (86.5)	20 (13.5)	5.19, p=0.0227	Ref	Ref
Female	119 (76.3)	37 (23.7)		1.97 (1.11-3.48)	1.88 (1.03-3.42), p=0.04
Caste category					
General	49 (89.1)	6 (10.9)	12.05, p=0.0024	Ref	Ref
OBC	147 (84.5)	27 (15.5)		1.50 (0.59-3.84)	1.42 (0.55-3.63), p=0.47
SC/ST	51 (68.9)	24 (31.1)		3.85 (1.42-10.4)	3.12 (1.12-8.71), p=0.03
Education					
Literate	155 (85.2)	27 (14.8)	4.562, p=0.0326	Ref	Ref
Illiterate	92 (75.4)	30 (24.6)		1.85 (1.05-3.25)	1.69 (0.91-3.15), p=0.09
Delivery					
Institutional	240 (83.3)	48 (16.7)	15.58, p=0.0001	Ref	Ref
Home	7 (43.8)	9 (56.3)		6.43 (2.27-18.2)	5.96 (2.01-17.6), p=0.001
Socioeconomic status					
Upper	22 (81.5)	5 (18.5)	$\chi^2=2.198$ p= 0.333	Ref	Ref
Middle	192 (82.8)	40 (17.2)		0.91 (0.31-2.65)	0.88 (0.29-2.63), p=0.82
Lower	33 (73.3)	12 (26.7)		1.60 (0.46-5.58)	1.47 (0.40-5.34), p=0.55

Female children had significantly higher dropout (23.7%) than males (13.5%) ($\chi^2=5.19$, $p=0.0227$; AOR 1.88, 95% CI 1.03-3.42, $p=0.04$). Caste showed strong association ($\chi^2=12.05$, $p=0.0024$), with SC/ST children having the highest dropout (31.1%) compared to OBC (15.5%) and General (10.9%) categories, and remaining at higher risk after adjustment (AOR 3.12, 95% CI 1.12-8.71, $p=0.03$). Children of illiterate caregivers had higher dropout (24.6% vs. 14.8%) ($\chi^2=4.562$, $p=0.0326$), though the effect was not significant after adjustment (AOR 1.69, 95% CI 0.91-3.15, $p=0.09$). Place of delivery was highly significant, with home-delivered children showing markedly higher dropout (56.3% vs. 16.7%) ($\chi^2=15.58$, $p=0.0001$; AOR 5.96, 95% CI 2.01-17.6, $p=0.001$). Socioeconomic status showed no significant association ($\chi^2=2.198$, $p=0.333$), with dropout rates of 18.5%, 17.2%, and 26.7% among upper,

middle, and lower groups respectively (AOR for lower class 1.47, 95% CI 0.40-5.34, $p=0.55$). (Table 4)

The most frequently reported barriers were lack of awareness of the vaccination schedule (23.7%), fear of side effects (19.1%), and vaccine unavailability (15.1%). (Table 5)

Table 5: Reported barriers to vaccination (n = 304)

Barrier	Respondent(%)
Lack of awareness of schedule	72 (23.7)
Fear of side effects	58 (19.1)
Vaccine not available / stock-out	46 (15.1)
Distance / transport difficulties	41 (13.5)
Family opposition / cultural beliefs	34 (11.2)
Child illness at due time	28 (9.2)
Other (e.g., mother's illness, migration)	25 (8.2)

DISCUSSION

The present study shows a gradual increase in vaccination dropout rates. The dropout rate was lowest at birth (10.07%) but increased to 5.67% by 6 weeks, and to 2.33% by 9 months, resulting in a cumulative dropout rate of 19.79%. Although no new dropouts were observed at 16-24 months, the cumulative effect persisted due to missed earlier doses. By the time the children reach 2 years' age, nearly 20% of the original cohort has missed at least one vaccination. Similar progressive dropout patterns have been reported in NFHS-5, though with slightly lower rates overall.²⁻⁴ Several other studies also reported comparable findings^{6,7} while a large multi-state study by Pritu Dhalaria et al. noted a similar trend but with much higher dropout rates⁸. This highlights the challenge of maintaining consistent follow-up for vaccinations, especially as children grow older. The factors influencing dropouts may include logistic barriers, awareness gaps and accessibility.

BCG vaccine coverage was 85.2%, with a dropout of 14.8%, likely reflecting missed opportunities at delivery or logistical barriers. NFHS-5 reported higher coverage (national ~95%, UP ~93%, Lucknow ~92%)²⁻⁴. Polio vaccine coverage was 92.6%, with a dropout of only 7.4%, reflecting successful awareness campaigns; NFHS-5 reported slightly lower levels (national 80%, UP 74%, Lucknow 73%)²⁻⁴. Pentavalent coverage was also high (92.2%) with a dropout rate of 7.8%, whereas NFHS-5 showed slightly lower coverage (87%, 80%, and 78%, respectively). Rotavirus vaccine coverage in this study was 89.5% with a dropout rate of 10.5%. By contrast, NFHS-5 data reported much lower coverage (36% nationally, 49% in UP, and 61% in Lucknow)²⁻⁴. This discrepancy may reflect intensified local interventions in the study setting. Measles/MR vaccine coverage was lowest (72.9%), with the highest dropout rate of 27.1%. NFHS-5 reported lower coverage for the first dose (32%, 30%, and 34% nationally, UP, and Lucknow, respectively)²⁻⁴. The better coverage in this study compared to NFHS-5 could be due to more recent programmatic improvements, though follow-up for the second dose remains a challenge. Similar coverage patterns have been observed in multiple studies from 2016-2023, which reported 89-92% coverage for most vaccines but only 30-50% for measles.⁶⁻¹⁰

Analysis of socio-demographic factors revealed important disparities. No significant association was observed between child age (<6 months vs. ≥6 months) and dropout rates ($\chi^2 = 1.438$, $p = 0.230$). However, sex of the child was significant ($\chi^2 = 5.19$, $p = 0.0227$): females had higher dropout rates than males, consistent with evidence that gender bias in healthcare-seeking persists in some communities. Caste and social category were strongly associated ($\chi^2 = 12.05$, $p = 0.0024$), with children from OBC and SC/ST families showing higher dropout rates compared to General category, underscoring the role of

socio-economic inequities. Parental literacy was also significant ($\chi^2 = 4.562$, $p = 0.0326$): literate caregivers had lower dropout rates, likely due to better awareness and health system navigation. By contrast, occupation, family type, and distance from health facilities showed no significant effect. Notably, place of delivery was highly significant ($\chi^2 = 15.58$, $p = 0.0001$): home deliveries were strongly associated with higher dropouts, confirming earlier studies that institutional births improve vaccination continuity.^{7-9,11-15}

These socio-demographic associations likely reflect underlying barriers such as illiteracy (linked to low awareness), caste-based disadvantage (linked to poor access and financial constraints), and non-institutional delivery (linked to missed linkage with immunization services). Addressing these gaps requires targeted interventions, such as health education for illiterate mothers, community mobilization in SC/ST groups, and promotion of institutional deliveries.

Study limitations should be acknowledged. Reliance on MCP cards and caregiver recall may have underestimated dropouts due to missing data. The cross-sectional design prevents causal inferences. Some subgroups, such as home deliveries ($n = 16$), were small, limiting statistical power. Additionally, while NFHS-5 provided a useful benchmark, our study setting may have benefited from recent programmatic improvements not fully captured in NFHS data.

Implications for policy and practice include the need for targeted education programs focusing on disadvantaged groups, strengthened follow-up mechanisms for measles/MR vaccination, and continued emphasis on institutional deliveries. Future studies with larger and more diverse samples, including post-2023 program data, will further clarify the evolving trends in vaccination coverage and dropout.

The present study identified lack of awareness of the vaccination schedule (23.7%), fear of side effects (19.1%), and vaccine unavailability (15.1%) as the most common barriers to immunization. Similar findings have been reported in another study where poor awareness and inadequate communication contributed to low coverage.^{16,17}

CONCLUSION

In conclusion, vaccination coverage at birth and early infancy is encouraging, nearly one-fifth of children fail to complete the full schedule by two years of age. The steep dropouts observed for Measles/MR and Rotavirus vaccines underscore the urgent need for targeted interventions. Key determinants such as caregiver literacy, social category, and place of delivery should guide program priorities. To address these gaps, community-based strategies like literacy and awareness programs for caregivers, gender-sensitive health education, and strengthening follow-

up through mobile vaccination units in underserved slums are recommended. Linking institutional delivery with structured postnatal vaccination counseling may further reduce early dropouts. Future research should adopt longitudinal designs to better capture causal pathways of vaccine dropout and explore the impact of socio-economic barriers not fully assessed in this study. Addressing these issues will be critical to achieving equitable and sustained immunization coverage.

Individual Authors' Contributions: **SK**- Definition of intellectual content, Literature survey, prepared first draft of manuscript, implementation of study protocol, data collection, data analysis, manuscript preparation and submission of article; **MA**- Concept, design, clinical protocol, manuscript preparation, editing, and manuscript revision; **DKH**- Design of study, statistical Analysis and Interpretation.

Availability of Data: The data in the study was collected as part of academic thesis work, conducted under institutional supervision and approved protocol.

Declaration of Non-use of Generative AI Tools: We authors affirm that no generative artificial intelligence tools were utilized in the design, analysis, interpretation of data, or preparation of this manuscript. All content is the result of the authors' original work.

REFERENCES

- World Health Organization. Immunization coverage. Geneva: WHO; 2025 [cited 2025 July 19]. Available from: <https://www.who.int/news-room/fact-sheets/detail/immunization-coverage>
- Ministry of Health and Family Welfare (MoHFW), GOI. National Family Health Survey (NFHS-5), 2019–21: Compendium of Fact Sheets – Key Indicators, India and 14 States/UTs (Phase-II). New Delhi: MoHFW; 2021. [cited 2025 Feb 19] Available from: https://mohfw.gov.in/sites/default/files/NFHS-5_Phase-II_0.pdf
- International Institute for Population Sciences (IIPS). National Family Health Survey (NFHS-5) 2020-21: Uttar Pradesh Fact Sheet. Mumbai: IIPS; 2021 [cited 2025 Feb 9]. Available from: https://planning.up.nic.in/Go/SDG/Uttar_Pradesh_NFHS-5%20fact%20sheet.pdf
- International Institute for Population Sciences (IIPS). National Family Health Survey (NFHS-5) 2020-21: Lucknow District Fact Sheet. Mumbai: IIPS; 2021 [cited 2025 Feb 9]. Available from: https://www.dhsprogram.com/pubs/pdf/OF43/UP_Lucknow.pdf
- International Institute for Population Sciences (IIPS) and ICF. 2017. National Family Health Survey (NFHS-4), India, 2015-16: Uttar Pradesh. Mumbai: IIPS. [cited 2025 Feb 9]. Available from: <https://dhsprogram.com/pubs/pdf/FR338/FR338.UP.pdf>
- Pandey S, Ranjan A, Singh CM, Kumar P, Ahmad S, Agrawal N. Socio-demographic determinants of childhood immunization coverage in rural population of Bhojpur district of Bihar, India. *J Family Med Prim Care*. 2019 Jul;8(7):2484-2489. DOI: https://doi.org/10.4103/jfmpc.jfmpc_356_19
- Dhalaria P, Kapur S, Singh AK, Priyadarshini P, Dutta M, Arora H, Taneja G. Exploring the Pattern of Immunization Dropout among Children in India: A District-Level Comparative Analysis. *Vaccines (Basel)*. 2023 Apr 13;11(4):836. DOI: <https://doi.org/10.3390/vaccines11040836> PMID: 37112748 PMCID: PMC10143302
- Dhalaria P, Soni GK, Singh AK, Priyadarshini A, Awasthi A, Kumar V, et al. Vaccines on time: exploring determinants of delaying child vaccination in states of India. *Clin Epidemiol Glob Health*. 2022;14(2):100996. DOI: <https://doi.org/10.1016/j.cegh.2022.100996>
- Madhavi N, Manikyamba D. Evaluation of immunization status and factors responsible for dropouts in primary immunization in children between 1-2 years - a hospital-based study. *Int J Pediatr Res*. 2016;3(5):329-334. DOI: <https://doi.org/10.17511/ijpr.2016.i05.10>
- Singhal G, Mathur HN, Dixit M, Khandelwal A. Factors affecting immunization of children aged 12-23 months in a rural area of Malpura Panchayat Samiti in district Tonk, Rajasthan. *Int J Community Med Public Health*. 2016;3(3):641-646. DOI: <https://doi.org/10.18203/2394-6040.ijcmph20160625>
- Gupta P, Prakash D, Srivastava JP. Determinants of immunization coverage in lucknow district. *N Am J Med Sci*. 2015 Feb;7(2):36-40. DOI: <https://doi.org/10.4103/1947-2714.152076> PMID: 25789246 PMCID: PMC4358046
- Devasenapathy N, Ghosh-Jerath S, Sharma S, Allen E, Shankar AH, Zodepy S. Determinants of childhood immunisation coverage in urban poor settlements of Delhi, India: a cross-sectional study. *BMJ Open*. 2016;6(8):e013015. DOI: <https://doi.org/10.1136/bmjopen-2016-013015> PMID: 27566644
- Johri M, Subramanian SV, Sylvestre MP, Dudeja S, Chandra D, Koné GK, et al. Association between maternal health literacy and child vaccination in India: a cross-sectional study. *J Epidemiol Community Health*. 2015;69(9):849-857. DOI: <https://doi.org/10.1136/jech-2014-205436> PMID: 25827469 PMCID: PMC4552929
- Angadi MM, Jose AP, Udgiri R, Masali KA, Sorganvi V. A study of knowledge, attitude and practices on immunization of children in urban slums of Bijapur city, Karnataka, India. *J Clin Diagn Res*. 2013;7(12):2803-2806. DOI: <https://doi.org/10.7860/JCDR/2013/6565.3763> PMID: 24551642
- Singh PK. Trends in child immunization across geographical regions in India: focus on urban-rural and gender differentials. *PLoS One*. 2013;8(9):e73102. DOI: <https://doi.org/10.1371/journal.pone.0073102> PMID: 24023816 PMCID: PMC3762848
- Joseph J, Devarashetty V, Reddy SN, Sushma M. Parents' knowledge, attitude, and practice on childhood immunization. *Int J Basic Clin Pharmacol*. 2017 Jan. 16;4(6):1201-1207. DOI: <https://doi.org/10.18203/2319-2003.ijbcp20151359>
- Rahman M, Obaida-Nasrin S. Factors affecting acceptance of complete immunization coverage of children under five years in rural Bangladesh. *Salud Publica Mex*. 2010 Mar-Apr;52(2):134-140. PMID: 20485870