

Original Research Article

Immunization coverage, quality, and socio-demographic determinants: a cross-sectional study of children aged 0-24 months in Pune slums under the National Immunization Programme

Surjit Singh Gangwar^{1*}, Rajesh Sahu¹, Harpreet Singh², Kunal Chatterjee²,
Rahul Nayak¹, Chandan Panigrahi²

¹Armed Forces Medical Services, India

²Department of Community Medicine, Armed Forces Medical College, Pune, Maharashtra, India

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*Correspondence:

Dr. Surjit Singh Gangwar,

E-mail: gangwar65@gmail.com

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ABSTRACT

Background: Immunization is an established and effective method for controlling and even eradicating diseases. However, despite decades of commitment to achieving universal coverage, the current vaccination rates for EPI vaccines remain incomplete. Immunization is a cornerstone of global health and development, playing a crucial role in achieving the SDGs, particularly SDG 3. Aim and objectives were to assess immunization coverage, quality, and socioeconomic demographic determinants with it among 0-24 months children.

Methods: This community-based, descriptive cross-sectional study was conducted from January 2023 to July 2024 at the urban health centre under the department of community medicine. The study included all 179 children aged 0-24 months residing in the slums of the urban field practice area. Data analysis was performed using SPSS software version 23 and Microsoft Excel.

Results: 164 (91.62%) study subjects were fully immunized and 15 (8.38%) were partially immunized. Proportion of study subjects fully immunized differs significantly from those partially immunized with respect to type of family, education and occupation of mother. No significant association was observed between gender, religion, socioeconomic scale, immunization card and birth order of child with immunization status.

Conclusions: The study concluded high immunization coverage among children in the slums of Pune Cantonment. However, areas for improvement still exist, particularly in addressing partial immunization and ensuring that all children receive complete protection against vaccine-preventable diseases. There is need to evaluate different aspects of religion and socioeconomic status which are responsible for significant difference in immunization coverage.

Keywords: Immunization coverage, Partial immunization, Urban slums, Vaccine-preventable diseases

INTRODUCTION

Immunization stands as one of the most remarkable achievements in medical history. Universal child immunization against vaccine-preventable diseases is widely recognized as one of the most cost-effective strategies for reducing infant and child mortality, particularly in developing countries.¹ India was among the first nations to adopt the World Health Organization's

Expanded Programme on Immunization (EPI). Since its initiation, significant progress has been made in reducing the burden of vaccine-preventable diseases.² Immunization stands as a critical saviour for children's lives. Undoubtedly, immunization represents the most economically efficient intervention for child health.³

Despite these advancements and notable economic and technological progress, the burden of vaccine-preventable

diseases remains alarmingly high in India compared to both developed and many developing nations. Approximately 3 million children die annually from vaccine-preventable diseases, with a substantial proportion living in developing countries. Recent estimates suggest that around 34 million children are not fully immunized, with nearly 98% residing in developing nations.⁴ According to National Family Health Survey 5 (NFHS-5) 2019-21, the full immunization coverage for children aged 12-23 months was 76% in urban areas and 66% in rural areas.⁵

In India, the urban poor, many of whom live in slums, constitute about one-fourth of the country's 285 million urban population. While 60% of children aged 12-23 months in urban India are fully immunized, the coverage among urban poor children remains dismally low at just 43%.⁶ Maharashtra, India's second-largest state, presents a troubling scenario. Full immunization coverage, which showed improvement from 64% in 1992-1993 to 78% in 1998-1999, declined drastically to 59% in 2005-2006 despite increased healthcare expenditures.

Even if national immunization coverage is sufficient to block disease transmission, pockets of under-vaccinated populations can act as reservoirs for infection, posing significant public health challenges. Identifying inequalities in coverage and addressing under-vaccination in specific population groups is crucial.

In India, a significant proportion of the urban population, around 100 million individuals (35.0%), live in informal and unorganized settlements commonly known as slums. The United Nations Human Settlements Program (UN-Habitat) provides a widely accepted definition for slums, which primarily focuses on households. According to this definition, a slum is described as "a group of individuals residing under a single roof, characterized by the absence of one or more of the following conditions: access to improved water sources, proper sanitation facilities, adequate living space, durable housing structures, and secure tenure".⁷

The COVID-19 pandemic disrupted essential immunization services worldwide, putting millions of children at risk of vaccine-preventable diseases. This disruption has affected not only low- and middle-income countries but also industrialized nations. Children born between 2020 and 2022 faced challenges in receiving vaccines due to restrictions, lockdowns, infections, enhanced focus on COVID-19 related services, disruptions in routine immunization/healthcare services, etc. As a result, many of these children might receive only vaccines for which they are now eligible. The evidence of the widespread impact of the COVID-19 pandemic on immunization services globally is enumerated in subsequent paragraphs highlighting the challenges faced in maintaining routine vaccination schedules for children born between 2020 and 2022. Causey et al estimated that in 2020, the global vaccine

coverage for DTP3 and MCV1 dropped significantly due to the pandemic, resulting in millions of children missing their routine vaccinations.⁸ Gurley et al highlighted the disruptions to essential health services, including immunizations, in low- and middle-income countries during the pandemic.⁹ Bahl et al found a significant decline in routine childhood immunizations in a tertiary care centre in New Delhi, India, during the pandemic.¹⁰

This cross-sectional study was conducted to evaluate immunization coverage, assess the quality of immunization services, and examine the socio-demographic factors influencing immunization among the urban slum population of Pune Cantonment, India.

METHODS

The study was undertaken in urban field practice area of the department of community medicine. The urban health centre is located in Wanawadi Bazaar which is 2 km away from medical college having 2 km radius. It was community based descriptive cross-sectional study conducted from January 2023 to July 2024 among 0-24-month children residing in slums of urban health centre. All 179 children residing in slums of urban field practice area for less than 24 months were included in the study. Data was collected using a structured and predesigned prequestionnaire schedule by personal interview method. Institute ethical committee approval was taken prior to the study. A single interviewer collected data by conducting personal interview of the mothers/caretaker of eligible children by house to house visit. Mothers of the children were explained the purpose of the study by the use of respondent information sheet, which was prepared in two languages namely Marathi and Hindi in simple words. Informed consent was obtained prior to the study which was signed by the mothers and interviewer. The information of children regarding age, sex, religion, type of family, and occupation, educational status of mother was collected. Detailed information was obtained regarding socio-economic class, birth history and source and motivation for immunization were also collected. The immunization status of the child was assessed by vaccination card and by mothers/caretaker recalls where vaccination card was not available.

Sample size

To determine the immunization coverage among children under 24 months in the slums of Pune Cantonment, the following parameters were considered: the population correction factor $n=300$ (total number of children in the studied slums), a level of confidence of 95%, an absolute margin of error of 5%, and an assumed proportion of children fully vaccinated at 50% (resulting in the maximum sample size). After applying the finite correction factor, the minimum sample size was calculated to be $n=169$. For this study, 179 children under 24 months were included.

Inclusion criteria

Children aged under 24 months residing in the slums of Pune Cantonment, with their parents or primary caregivers as respondents. Availability of either an immunization card or a caretaker, and the age of the respondent being 18 years or above, along with consent to participate in the study. Permanent residency status, defined as residing in the area for more than 6 months.

Exclusion criteria

Parents/caregivers of children under 24 months who have not provided consent to participate. After three non-successive visits to a household, inability to establish contact. Non-permanent residents, defined as residing in the area for less than 6 months.

The study participants were selected using a simple random sampling method. Health posts in the slums i.e. Anganwadi centres (health posts) were considered as point of contact. A total of 179 children selected from slum areas under Pune cantonment were selected using a simple random sampling method. This approach ensured that every household in the target population has an equal chance of being selected, minimizing bias and enhancing the reliability of our findings. The process began with compiling a comprehensive list of all households in the study area with help of AWWs and MSW of community medicine department. Each household was then assigned a unique number.

We used a random number generator to select households from this list, ensuring that the selection was entirely random. This method eliminated any potential selection bias and ensured a representative sample of the population.

After selecting the first household which was randomly selected as the mentioned procedure, and the remaining households were continuously surveyed until the required sample size participants were identified. If the eligible participant was absent/door was locked during the first visit, second visit and third visit was made so that researcher doesn't miss the vaccination coverage. Those houses which were found to be locked in the third visit were excluded from the study. If more than one respondent aged under 24 months were found eligible in a household, all were interviewed as an individual participant as described in the WHO's vaccination coverage cluster survey methodology. Investigator has interviewed the study participants at their homes during January 2023 to July 2024, using a pretested structured questionnaire.

Standard definitions were used to classify children based on immunization status as per NFHS-5.⁵ (a) Fully immunized: children who had received BCG and three doses of DPT/(PENTA) and OPV and measles vaccine as scheduled in the first year of life were classified as fully

immunized. (b) Partially immunized: those children who had missed any dose of six primary vaccines were labelled as partially immunized. (c) Unimmunized: those children who had not received any vaccine, except OPV in PPI, up to 12 months of age were defined as unimmunized.

Data was analyzed using SPSS software 23 version and MS Excel. Vancouver system of listing and citing of references was used. As per this system, the references were numbered and listed consecutively in the order in which they are first cited in the text.

RESULTS

Socio-demographic profile of all the 179 children aged 0-24 months are given in Table 1.

Table 1: Socio-demographic profile of 0-24 months children.

Factors	Category	N	%
Age group (months)	<18	54	30.2
	>18	125	69.8
Gender	Male	103	57.5
	Female	76	42.5
Religion	Hindu	138	76.67
	Muslim	37	20.56
	Christian	2	1.11
	Jain	2	1.11
Type of family	Nuclear	11	6.11
	Joint	168	93.33
Mother's education	Illiterate	8	4.44
	Primary	18	10
	Middle School	39	21.67
	High School	95	52.78
	Intermediate/diploma	3	1.67
Mother's occupation	Graduate	16	8.89
	Homemaker (not working)	48	26.8
Socioeconomic scale status	Working	131	73.2
	Upper lower class	109	52.4
	Lower class	14	6.7
Place of delivery	Lower Middle class	56	26.9
	Home	00	00
	Government	154	86.03
Immunization card availability	Private	25	13.97
	Yes	152	87
	No	22	13

Immunization status

Out of 179 study subjects, no child remained unimmunized. 164 (91.62%) study subjects were fully immunized, and 15 (8.38%) study subjects were partially immunized.

Table 2: Association between immunization status and demographic factors.

Variable	Category	Fully immunized (FI)	Partially immunized (PI)	Chi-square (χ^2)	P value	Significance
Gender	Male	92	11	1.67	0.196	Not significant
	Female	72	4			
Religion	Hindu	128	10	1.86	0.600	Not significant
	Muslim	32	5			
	Christian	2	0			
	Jain	2	0			
Type of family	Nuclear family	7	4	11.95	0.001	Significant
	Joint family	157	11			
Education of mother	<10 th class	55	10	6.52	0.011	Significant
	>10 th class	109	5			
Socioeconomic status	Lower middle class	45	5	0.560	0.756	Not significant
	Upper lower class	115	10			
	Lower class	4	0			
Occupation of mother	Housewife (not working)	33	15	44.68	<0.05	Significant
	Working	131	0			
Immunization card	Yes	22	0	2.29	0.13	Not significant
	No	142	15			
Birth order	1	75	5	1.64	0.441	Not significant
	2	72	7			
	3	17	3			

Table 3: Quality of immunization coverage.

	Strongly agree	Agree	Strongly disagree	Neither agree nor disagree	Disagree
Timing of routine immunization sessions or camps for your child was generally convenient to you	96	34	18	18	13
Satisfied with the quality of routine immunization services offered to me for my child	89	50	10	26	4

Table 4: Reasons for partial immunization.

Reasons for non immunization	Frequency (15)	Percentage
Child sick after past vaccination	11	73.33
Festival on day of vaccination	3	20
Difficulty in accessing immunization facility	14	93.33
Travel out of area	13	86.67
Death in family or community	3	20
Bad experience with health provider/healthcare facility/waiting time	1	6.67
Religious reasons	3	20
Fear of covid	4	26.67
*Other reasons	11	73.33

*Other reasons-includes visit to native place or other siblings not well.

Socio-demographic factors association with immunization status are given in Table 2.

Quality of immunization coverage among study population

In our study to assess the quality of immunization coverage, we utilized a Likert scale to gauge respondents'

attitudes, perceptions, and experiences. The Likert scale is a psychometric tool commonly used in survey research to measure respondents' levels of agreement or disagreement with a series of statements.

Respondents indicated their responses on a scale ranging from strong agreement to strong disagreement as given in Table 3.

Reasons for partial immunization

Various reasons contributing to partial immunization among children were given in Table 4.

DISCUSSION

In present study, among 179 study subjects, no child remained unimmunized. 164 (91.62%) study subjects were fully immunized, and 15 (8.6%) study subjects were partially immunized. This coverage rate surpasses the national average of 76.2% reported in the National Family Health Survey-5 (NFHS-5) for 2019-21.⁵ The findings from study by Kumar et al revealed that 59.9% of the children were fully immunized, 30.3% were partially immunized, and 9.8% were not immunized.¹¹ In a study carried out by Vohra et al at urban and rural areas of Lucknow, Uttar Pradesh 62.7% children were fully immunized, 24.4% partially immunized and 12.9% remained unimmunized.⁴ In another study by Singh et al in Mumbai slums; full immunization coverage was found to be below the expected level i.e., 73.1% while 23.8% were partially immunized and 3.1% were unimmunized and also revealed that the awareness regarding the importance of adequate immunization was still lacking in the slum population.¹² However, our study didn't find any child unimmunized. Most immunizations (93%) were conducted in government hospitals, among them Cantonment Hospital being the leading provider (68%) is consistent with Singh et al which also reported a high proportion of immunizations in government health posts.¹² However, it is higher than the proportion reported in Kaur et al.¹³ Research conducted by Sharma et al in urban slums of Surat, Gujarat revealed that only 25% of children were completely immunized.¹⁴ Similarly, Rajasthan and Karnataka showed lower rates of fully immunized children compared to Maharashtra. In rural areas of Jaipur, Rajasthan, 76.19% of children were fully immunized, while in urban slums of Bijapur, Karnataka, the rate was 34.84%.^{15,16} The variation in immunization coverage across different studies may be attributed to geographical differences and survey methodologies employed.

There was significant association between immunization status of the children and the type of family, maternal education, and maternal occupation.

The present study in Pune Cantonment slums found 8.38% of children under 24 months to be partially immunized, mainly due to access issues and travel. Similar studies in Mumbai, Amritsar, and Kanpur reported higher partial immunization rates (23.8-34.15%), citing reasons like lack of awareness, motivation, and scheduling conflicts. These findings underscore the need for improved accessibility and targeted awareness interventions in urban slum areas.

This study has several limitations that need to be acknowledged. Firstly, the cross-sectional design limits

the ability to establish causal relationships between the identified factors and immunization coverage. Secondly, the study relies on self-reported data from parents or caregivers, which may be subject to recall bias and social desirability bias. Thirdly, the study is limited to the slums of Pune Cantonment and may not be generalizable to other urban slum settings in India. Fourthly, during data collection after third visit if houses were locked due to which data on immunization of boosters were not available. Fifthly, the study did not assess the quality of immunization services in detail, which is an important aspect of immunization coverage. Finally, the study's focus was on demographic determinants and the quality of immunization services did not delve into the intricacies of addressing partial immunization. While the study identified access barriers and travel constraints as primary reasons for partial immunization, it did not explore potential solutions or interventions to mitigate these challenges. This limitation underscores the need for future research to investigate effective strategies for improving access to immunization facilities and addressing other barriers to complete immunization in the slums of Pune Cantonment.

Despite these limitations, the study has several strengths. By utilizing simple random sampling, we can confidently generalize our findings to the broader population, providing an accurate assessment of immunization coverage quality across the study area. Secondly, it provides valuable insights into the immunization coverage and associated factors in a specific urban slum setting. Thirdly, the study utilizes an appropriate/adequate sample size, which enhances the statistical power of the findings. Fourthly, the study employs a standardized questionnaire and methodology, which ensures the reliability and validity of the data. Finally, the study's findings have important implications for policy and practice, as they highlight the need for targeted interventions to address the barriers to immunization and improve immunization coverage in urban slum.

CONCLUSION

This cross-sectional study assessed the immunization coverage, quality, and demographic determinants among children aged 0-24 months in the slums of Pune Cantonment, as part of the National Immunization Programme. Employing a cross-sectional design, the study gathered data from 179 children using structured questionnaires and immunization records. The data were analysed through both descriptive and inferential statistics. The findings revealed high overall immunization coverage, with 91.62% of the children fully immunized, 8.38% partially immunized, and none completely unimmunized.

The analysis of demographic determinants revealed that maternal education, type of family, and maternal occupation significantly influenced immunization status. Higher education levels of mothers were associated with

higher rates of full immunization. Children from joint families were more likely to be fully immunized compared to those from nuclear families. Additionally, children of working mothers had higher rates of full immunization compared to those of housewives. These findings highlight the importance of maternal education and empowerment in improving child health outcomes through better immunization coverage. In contrast, factors such as gender, religion, socioeconomic status, and birth order did not show a significant association with immunization status.

Despite the high coverage, the study identified areas for improvement in the quality of immunization services. Issues such as accessibility, the convenience of session timings, and the ability of parents to discuss concerns with health staff were noted. While most parents were satisfied with the services, a significant proportion expressed the need for better communication and support from health staff. Enhancing the quality of immunization services through improved healthcare worker training, better communication strategies, and ensuring convenient and accessible service delivery can further increase immunization coverage and parental satisfaction, leading to better health outcomes for children in these communities.

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