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Original Research Article

A Study of Immunization Status of Children Under Five Years in a Defined Rural and Urban Population: A Temporal Trend

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Abstract:

Background: Individuals who encounter obstacles in obtaining immunization services are at a heightened risk of developing morbidities associated with vaccine-preventable illnesses. The spectrum of variables that may hinder immunization programmes and their health benefits includes affordability, accessibility, lack of knowledge, and other constraining elements.

Aims and Objectives: The present study aimed to study the immunization status of children aged one month to sixty months in a defined urban and rural population and to evaluate the impact of National Immunization Schedule and assess the progress made in the areas studied.

Materials and Methods: The study was conducted as an OPD based cross sectional survey on children aged one month to sixty months in defined urban and rural areas from 01 March 2021 to 31 August 2022 where 608 children were randomly taken from the study areas which was the Department of Pediatrics Tertiary health care center, a community health centre and Primary Health Centre belonging to central India. Our data were collected from the parents of the children coming to the study area. The immunization status of these children was analyzed and the cause for partial immunization was studied. Data was analyzed by using statistical software SPSS version 21. The chi-square test was used to compare various determinants. A p-value <0.05 was considered significant.

Results: Highest percentage of study participants in both urban as well as rural areas belonged to the 1-12 months of age group (35.7% and 61.7%) respectively. There was no statistically significant difference found between gender and place of residence for study participants ($p = 0.07$). The association between socioeconomic status of the family, mother's as well as father's education and occupation and the place of residence was found to be statistically significant ($p < 0.0001$). It was observed that 256 (84.5%) in the urban areas were fully immunized while 255 (83.6%) in the rural areas were fully immunized ($p=0.08$). A total of 47 (48.5%), of participants gave the reason for delay as domestic work followed by non-availability of health staff at centre which was the reason given by 16.5% of the participants. This difference was found to be statistically significant between urban and rural population ($p <0.0001$).

Conclusion: The importance of parental education in improving child health and the socioeconomic status of the family were found to be significant determinants of incomplete immunization. Coverage of optional vaccines was found to be very low in comparison with routine vaccines. From this study, policymakers and social workers can target young pregnant women to increase female education. These findings emphasize the need for regular monitoring and evaluation of immunization coverage to achieve the benefits of vaccination in all strata of society.

Keywords: Coverage; Vaccine; Immunization status; Rural population; Urban population.

Introduction

Immunization is a well-established strategy for the management and eradication of life-threatening communicable illnesses, with an estimated capacity to prevent more than 2 million fatalities annually. It is well recognized as a very economical health investment, employing established approaches that enhance its accessibility to communities that are typically difficult to engage with and particularly susceptible to health risks. Missing Routine Immunization (RI) can be life-threatening for infants. Immunization is one of the most effective and cost-effective ways to protect children's lives and futures. Vaccines are also critical to the prevention and control of infectious disease

outbreaks. They underpin global health security and will be a vital tool in the battle against antimicrobial resistance. [1] Knowledge (K), positive attitudes (A) and appropriate perceptions (P) about vaccination hence become one of the main tools to reduce the incidence of vaccine-preventable diseases (VPDs) thus reducing infant mortality and morbidity. The Ministry of Health and Family Welfare of the government of India implemented the Expanded Programme of Immunization (EPI) in 1978, marking the inception of the immunization programme in India.

The scheme underwent modifications in 1985 and was subsequently renamed as the Universal Immunization scheme (UIP). Its implementation was planned in a stepwise way, aiming to encompass all districts in the country by 1989-90. This initiative stands as one of the largest immunization initiatives globally. Despite having been in operation for an extended period, the Universal Immunization Programme (UIP) has achieved a complete immunization rate of just 65% among infants and young children. [2]

In December 2014, the Government of India initiated the "Mission Indradhanush" programme with the aim of enhancing and revitalizing immunization efforts to rapidly attain comprehensive coverage for children and pregnant women. The immunization programme "Intensified Mission Indradhanush" was begun on October 8, 2017, with the aim of considerably enhancing its effectiveness. [3] In order to enhance the extent of routine immunization in the nation, the Government of India (GOI) has implemented "Intensified Mission Indradhanush 2.0." This initiative aims to ensure the provision of all available vaccines to previously inaccessible populations and expedite the immunization coverage of children and pregnant women in designated districts and blocks.

The programme is scheduled to operate from December 2019 to March 2020. The primary objective of Intensified Mission Indradhanush 2.0 is to effectively diminish mortality rates among children below the age of five, with the overarching goal of attaining the Sustainable Development Goal of eradicating avoidable child fatalities by the year 2030. [4]

Despite the implementation of various maternal and child health programmes by the Government of India aimed at enhancing immunization coverage, it remains persistently low in a majority of regions within the country. This is particularly evident in rural areas and the north central parts of India, which are home to approximately three-fourths of the population. The concept of equity in immunization should extend beyond the provision of equal opportunities for vaccinating children in urban and rural areas. It is worth noting that such equality already exists, as vaccination is universally accessible to all infants throughout the country at no cost, facilitated by an extensive network of public sector institutions.

Additionally, this field of study focuses on the identification of demographic groups that are most susceptible to maintaining a lack of vaccination, as well as the efforts made to address and rectify any disparities or inequities that may exist. Therefore, a study to compare the immunization status of children above one month to the age of 5 years in Urban and Rural areas is required to focus on the challenges of immunization at various levels of hospitals i.e. Rural and urban.

Aims and Objectives:

The present study aimed To study the immunization status of children aged one month to sixty months in a defined urban and rural population with respect to B.C.G., OPV, Hepatitis B, Rotavirus, P.C.V., F.I.P.V., M.R., DPT Booster and to evaluate the impact of National Immunization Schedule and assess the progress made in the areas studied.

Materials and Methods

The study was conducted as a OPD based cross sectional survey on children aged one month to sixty months in defined urban and rural areas from 01 March 2021 to 31 Augest2022 where 608 children were randomly taken from the study areas which was the Department of Pediatrics Tertiary health care center, a community health center and Primary Health Centre belonging to central India. The research was accepted by the Institutional Ethical Committee and complete informed written consent was acquired from the patients.

Inclusion criteria: All the children from age one month to 60 months went through immunization at the study area.

Exclusion criteria: children less than 1 month and above 60 months of age.

Sample size calculation: $N = Z^2pq/d^2$ (N=sample size, p = prevalence in the population, q = 1 – p, d = Absolute precision), where, Z= 1.96 at 93% CI, p = 30.37% i.e. 0.3037, Z = 1-p i.e. 1 – 0.3037 = 0.6969, d = 5% i.e. 0.05, so, n = 324.94. By adding a 10% non-responding rate, Sample size (n) = 324.5 + 32.45 = 356.95 rounded off to 360.

Data collection: Our data were collected from the parents of the children coming to the study area. The immunization status of these children was analyzed and the cause for partial immunization was studied. An oral questionnaire proforma was prepared and a written National Immunization Schedule was adopted to assess their Immunization

status and social factors influencing immunization coverage and caregiver knowledge about vaccines, and attitude towards immunization. Ideally, National Immunization Schedule was considered to assess their Immunization status. All the information was filled, studied, tabulated, and interpreted through standard statistical methods.

Statistical analysis: Codes were prepared for the options of the questionnaire. Data were entered in an excel sheet to prepare a master chart and Data was analyzed by using statistical software -SPSS version 21. The chi-square test was used to compare various determinants. A p-value <0.05 was considered significant.

Results

Highest percentage of study participants in both urban as well as rural areas belonged to the 1- 12 months of age group (35.7% and 61.7%) respectively. No children belonging to the age group of 37 to 48 months was found in a rural and urban area.

The distribution was found to have a statistically significant difference (p<0.0001).There was no statistically significant difference found between gender and place of residence for study participants (p = 0.07).

The association between socioeconomic status of the family, mother's as well as father's education and occupation and the place of residence was found to be statistically significant (p < 0.0001). [Table 1]

Table 1: Demographic data & factors affecting immunization status

Variables		Rural (N=305) N (%)	Urban (N=303) N (%)	Total (N=608) N (%)	P- Value
Age (in months)	1-12	188 (61.7)	108 (35.7)	296 (48.7)	<0.0001*
	13-24	50 (16.4)	90 (29.7)	140 (23.0)	
	25-36	26 (8.5)	24 (7.9)	50 (8.2)	
	49-60	41 (13.4)	81 (26.7)	122 (20.1)	
Gender	Male	186 (61.0)	163 (53.8)	349 (57.4)	0.07
	Female	119 (39.0)	140 (46.2)	259 (42.6)	
Type of family	Single parent	16 (5.3)	62 (20.5)	78 (12.8)	<0.0001*
	Nuclear	138 (45.2)	162 (53.5)	300 (49.4)	
	Joint	151 (49.5)	79 (26.0)	230 (37.8)	
Socio-economic status of family	Upper	0 (0)	112 (37.0)	112 (18.4)	<0.0001*
	Upper Middle	0 (0)	134 (44.2)	134 (22.0)	
	Upper lower	143 (46.9)	08 (2.6)	151 (24.9)	
	Lower Middle	26 (8.5)	45 (14.9)	71 (11.7)	
	Lower	136 (44.6)	04 (1.3)	140 (23.0)	
Level of mother's education	Illiterate	05 (1.6)	36 (11.9)	41 (6.7)	<0.0001*
	Primary	38 (12.5)	41 (13.5)	79 (13.0)	
	Middle	66 (21.6)	52 (17.2)	118 (19.4)	
	High School	144 (47.2)	20 (6.6)	164 (27.0)	
	Intermediate	25 (8.2)	22 (7.3)	47 (7.7)	
	Graduate	27 (8.9)	95 (31.3)	122 (20.1)	
	Postgraduate	0 (0)	37 (12.2)	37 (6.1)	
Level of father's education	Illiterate	01 (0.3)	15 (4.9)	16 (2.6)	<0.0001*
	Primary	01 (0.3)	54 (17.8)	55 (9.1)	
	Middle	69 (22.6)	13 (4.3)	82 (13.5)	
	High School	61 (20.0)	56 (18.5)	117 (19.2)	
	Intermediate	84 (27.6)	17 (5.6)	101 (16.6)	
	Graduate	89 (29.2)	116 (38.3)	205 (33.7)	
	Postgraduate	0 (0)	32 (10.6)	32 (5.3)	

*statistically significant. **Table 2** depicts the distribution of study participants according to immunization status. It can be seen that 256 (84.5%) in the urban areas were fully immunized while 255 (83.6%) in the rural areas were fully immunized. On applying $\chi 2$ statistic, this difference was found to be statistically not significant. (p=0.08)

Table 2: Distribution of study participants according to immunization status

Immunization status	Rural (N=305) N (%)	Urban (N=303) N (%)	Total (N=608) N (%)	P- Value
Fully Immunized	255 (83.6)	256 (84.5)	511 (84.0)	0.08
Partially Immunized	50 (16.4)	47 (15.5)	97 (16.0)	

A total of 47 (48.5%), of participants gave the reason for delay as domestic work followed by non-availability of health staff at centre which was the reason given by 16.5% of the participants. This difference was found to be statistically significant between urban and rural population. (p value <0.0001). **[Table 3]**

Table 3: Causes of incomplete immunization

Causes	Rural (N=305) N (%)	Urban (N=303) N (%)	Total (N=608) N (%)	P- Value
Domestic work	32 (64)	15 (31.9)	47 (48.5)	<0.0001*
Non availability of health staff at centre	13 (26)	3 (6.4)	16 (16.5)	
Other reasons	5 (10)	29 (61.7)	34 (35)	

*statistically significant

Discussion

In the present study, the highest percentage of study participants in both urban, as well as rural area belonged to the 1-12 months of age group (35.7% and 61.7%) respectively. A similar study conducted in Nigeria had a proportion of female children to be 51%.[5] Sanjay Pandey et al. conducted a similar study in Bhojpur Bihar, where this proportion was 58.1% of males and 41.9% of females.[6]

In present study, the association between the educational status of the mother and occupation with place of residence was found to be statistically significant ($p < 0.0001$).

A similar study conducted in Nigeria showed that 93.9% of mothers were at least educated till secondary level or higher.[5] In the study by Sanjay Pandey et al. 41.4% were found to be illiterate. Out of those who were literate, the majority were educated up to high school.[6]In a study conducted by Latika Nath et al. majority of mothers were illiterate (85%). [7] A similar study was conducted in Nigeria and they found that three-quarters (75.5%) of the mother were employed.[5]

The association between educational status and occupation with the place of residence was found to be statistically significant ($p < 0.0001$). Rammohan et al concluded that having a father with an education of secondary (high school) schooling and above is statistically significant and positively correlated with the likelihood of a child being vaccinated for measles, in the six countries analyzed. Paternal education at secondary or higher levels was significantly and independently correlated with measles immunization uptake after controlling for all potential confounders.[8]

In the present study it was found that while the vaccine coverage at birth was extremely low, maximum coverage was seen for the age group 16-24 months where 160 (26.3%) of the children had received their age-appropriate vaccine. Vaccine coverage for 5 years was 24.4% in Urban and 12.5% in rural. This difference was found to be statistically significant. ($p < 0.01$). As per the study conducted by Sanjay Pandey et al. in Bhojpur, Bihar, the coverage was highest for BCG (98.1%) and lowest for measles (77.5%).[6]

According to the study of Young Eun Kim in Nagaland individual immunization coverage was 81% for BCG, between 66% and 71% for DTP3, OPV3, and measles.[9]

In a study in the Rural area of Gambia individual vaccination coverage was about 88.5% for BCG, 71% for OPV 3, 82.5% for Penta 3, and 72% and 71% for Measles-Rubella and yellow fever, respectively.[10]

In the present study, it was seen that a total of 47 (48.5%), of participants, gave the reason for the delay as domestic work followed by instantaneous non-availability of health staff at the time of the patient's visit to the centre which was the reason given by 16.5% of the participants. This difference was found to be statistically significant between the urban and rural populations ($p< 0.01$).

According to a Nigerian study the barriers were single mothers and low-income families.[11]

Children in the middle and richer wealth quintile households were 43–57% more likely to have full immunization coverage compared to children in the poorest wealth quintile households.[12]

In Nigerian settings the contributory factors of complete immunization detected by a study by Paul Eze et al. were children of single mothers and low-income families. [11] A research conducted in Togo, led by Didier K. Ekouevi et al, revealed that children whose mothers had received education up to high school or beyond had a 33% lower likelihood of experiencing insufficient immunization coverage, in contrast to children whose mothers had not received any formal education. There is a positive correlation between lower home income and an increased probability of inadequate immunization in children. [13]

As per A. Ali et al a study in Pakistan, it was found that mothers with no education have more odds of incomplete immunization. Other contributory factors for incomplete immunization were rural residents, and children belonging to a poor economic background.[14]

Limitations of the study: As the study was conducted in limited areas, results may not be extrapolated to urban or rural areas of other states. At many centers, the older version of the MCP card is still being used which does not have a slot for newer vaccines therefore the data sometimes had to be cross-verified from the ANM register.

Conclusion

This study was one among the few studies regarding vaccination coverage and assessment of determinants of incomplete immunization and quality of immunization services conducted in central India with a comparison between Urban and Rural areas and also with previous studies.

The importance of parental education in improving child health and the socioeconomic status of the family were found to be significant determinants of incomplete immunization. Coverage of optional vaccines was found to be very low in comparison with routine vaccines. From this study, policymakers and social workers could target young pregnant women to increase female education. These findings emphasize the need for regular monitoring and evaluation of immunization coverage to achieve the benefits of vaccination in all strata of society.

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