

ORIGINAL RESEARCH

Assessment of immunization coverage and determinants among children enrolled in Anganwadi centers in rural south India

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ABSTRACT

Background: Immunization is a cornerstone of public health, crucial in preventing childhood diseases. This study assesses immunization coverage and determinants among children enrolled in Anganwadi centers in rural South India, addressing the challenges faced in achieving complete vaccination. **Methods:** A community-based cross-sectional study was conducted with 400 children under six years, using immunization records from Anganwadi workers. Children were classified as fully immunized if they received all required vaccines by their first birthday. Statistical analyses were performed using SPSS, employing descriptive statistics and Chi-square tests to evaluate associations between sociodemographic factors and immunization status. **Results:** Among the children, 368 (92%) were fully immunized, while 32 (8%) were partially immunized. Significant associations were found between immunization status and parental education. The availability of immunization cards also correlated strongly with full immunization. The immunization coverage results show high compliance across vaccines, with 100% coverage for BCG and OPV-0 at birth, strong rates (over 97%) for most early and follow-up doses, and slightly lower coverage for booster doses, particularly DPT and OPV boosters. The primary reasons for partial immunization included inadequate knowledge (75%) and health-related issues at vaccination time (18.75%). **Discussion:** The study highlights the high immunization rates among children in Anganwadi centers, aligning with national data while identifying barriers such as lack of awareness and misconceptions about vaccines. Parental literacy was a significant determinant, indicating the necessity for educational interventions aimed at enhancing knowledge and promoting adherence to vaccination schedules. **Conclusion:** While immunization coverage is commendable, efforts must focus on addressing knowledge gaps and misconceptions to improve overall vaccination rates. Community engagement and educational initiatives targeting parents are essential for sustaining and enhancing immunization coverage among children in rural areas.

Keywords: Immunisation, Anganwadi Centers, Parental Education, Vaccination Coverage

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INTRODUCTION

Immunization is universally acknowledged as a cornerstone of public health strategy, pivotal in preventing childhood diseases and significantly reducing child mortality rates. Vaccines have proven to be one of the most effective tools in safeguarding children from potentially life-threatening diseases, such as measles, polio, and tuberculosis. In India, the government implements comprehensive immunization services through programs like the Universal

Immunization Programme (UIP) and the Rashtriya Bal Swasthya Karyakram (RBSK). These initiatives are designed to provide access to vaccines for all children, aiming to ensure that every child is protected against vaccine-preventable diseases, thereby contributing to improved overall health outcomes and fostering community resilience against outbreaks.

Despite these substantial efforts, significant challenges persist in achieving universal immunization coverage, particularly in rural and

socioeconomically disadvantaged communities. Data from the National Family Health Survey (NFHS) highlights these disparities. The NFHS-5 (2019–21) indicates that 76.4% of children aged 12–23 months were fully vaccinated based on either vaccination cards or maternal recall, reflecting an improvement from 62% reported in NFHS-4 (2015–16). However, while initial vaccination coverage is commendable, subsequent doses remain a challenge, resulting in incomplete immunization. For instance, the first dose of the measles-containing vaccine (MCV) coverage stands at 87.9%, but the coverage for the second dose drops significantly to only 31.9%. In Tamil Nadu, although vaccination coverage is better than the national average, a similar trend of incomplete vaccination is observed; for example, the coverage for the first dose of measles vaccine is 95.8%, while the second dose is only 44.7%.^[1]

The National Full Immunization coverage for FY 2023-24 has reached 93.5%, according to the Health Management Information System. Under the Universal Immunization Program (UIP), vaccinations are administered to all eligible children up to the age of 2 years, following the standard immunization schedule. To increase coverage in areas with low immunization rates, regular catch-up campaigns such as Mission Indradhanush (MI) and Intensified Mission Indradhanush (IMI) target left-out and dropped-out children, as well as pregnant women. In Tamil Nadu, the current immunization coverage stands at 85.13%.^[2]

Urban areas generally exhibit slightly higher immunization coverage, which can be attributed to better access to healthcare facilities, increased awareness, and education regarding the importance of vaccinations. However, a worrying trend is the lower rates of subsequent vaccinations, particularly among children from rural backgrounds, who may face barriers such as limited access to healthcare services, lack of awareness about vaccination schedules, and socioeconomic challenges.^[3] Anganwadi centers, established under the Integrated Child Development Services (ICDS) scheme, serve as critical access points for maternal and child healthcare in rural areas.^[4] They provide essential services, including health education, nutritional support, and immunization services, making them vital in the fight against childhood diseases. These centers not only administer vaccinations but also play a crucial role in raising awareness among parents and caregivers about the importance of timely immunizations.^[5] Understanding the immunization status of children enrolled in these centers is essential for identifying the factors that influence vaccination coverage. Various elements, including parental literacy, socioeconomic status, and

awareness of immunization schedules, can significantly impact vaccine uptake.

Parental literacy, for example, is a critical determinant of health-seeking behaviour; educated parents are often more aware of the immunization schedule and the importance of adhering to it. Socioeconomic status may affect access to healthcare services, transportation, and the ability to take time off work to attend immunization sessions. Furthermore, awareness and knowledge about vaccinations can vary significantly, leading to hesitancy or outright refusal in some cases.

This study aimed to assess the immunization status among children enrolled in Anganwadi centers in the rural field practice area of a private medical college in South India. By investigating factors such as parental literacy, socioeconomic status, and awareness of immunization programs, the study sought to identify barriers to vaccine uptake and opportunities for intervention.

MATERIALS AND METHODS

This community-based cross-sectional study involved 400 children under the age of 6 years enrolled in Anganwadi centers. Ethical approval was obtained from the Institutional Ethics Committee to ensure compliance with ethical standards. The immunization status of the children was evaluated using the immunization records maintained by Anganwadi workers as part of the Rashtriya Bal Swasthya Karyakram (RBSK) scheme. Several operational definitions were established for the study: children were deemed fully immunized if they received three doses each of Diphtheria, Pertussis, and Tetanus (DPT), Hepatitis B, and Oral Polio Vaccine (OPV), as well as a single dose of BCG and measles vaccine by their first birthday. Children who received one or more doses but did not complete the vaccination schedule by one year of age were considered partially immunized. Data analysis was performed using SPSS, with results displayed in tables, figures, and graphs. The statistical methods employed included descriptive statistics (percentages and mean), Chi-square test, and Fisher's exact test, with a P-value of less than 0.05 regarded as statistically significant.

RESULTS

The distribution of Anganwadi centers in this study area includes 36 centers in rural locations, representing 56.25% of the total, and 28 centers in urban areas, accounting for 43.75%. [Table No.1] In the present Study, among the 400 children included, 214 (53.5%) were male and 186 (46.5%) were female children. The mean age in the present study was 33.8±13.2 months.

Table No.1.: Type of Anganwadi included for the study

Anganwadi type	No. of Anganwadi	Percentage
Rural	36	56.25
Urban	28	43.75

Total	64	100
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Table 2 summarizes the relationship between sociodemographic factors and immunization status. Age groups were evaluated for immunization completeness, revealing that while younger age groups (12–24 months) showed higher full immunization rates, the statistical analysis yielded a Chi-square value of 5.45 with a p-value of 0.142, suggesting no significant association between age group and immunization status. Gender analysis showed an equal likelihood of being fully immunized between male and female children, with 197 males and 171 females fully immunized. Parental education, however, was significantly associated with immunization status. Among mothers, children with literate mothers had a higher full immunization rate, with a Chi-square value of 13.15 and a highly

significant p-value of 0.00029. Similarly, fathers' education showed an association, where children of literate fathers were more likely to be fully immunized. This was supported by a Chi-square value of 10.16 and a p-value of 0.0014. The availability of an immunization card was one of the strongest factors associated with full immunization, with 273 children having cards and only 6 partially immunized among them. This factor showed the strongest association with full immunization among all variables assessed. Birth order was assessed for its influence on immunization, with children of birth order ≤ 2 showing a slightly higher rate of full immunization compared to those with a birth order > 2 . However, birth order showed no significant association with immunization status statistically.

Table No.2.: Association between sociodemographic factors and immunisation status

Factor	Fully Immunized (n=368)	Partially Immunised (n = 32)	Total	χ^2 value; p value
Age (in months)				5.45; 0.142
12 – 24	81	3	84	
25 – 36	73	6	79	
37 – 48	98	14	112	
49 -60	116	9	125	
Gender				0.00; 1.00
Male	197	17	214	
Female	171	15	186	
Mothers Education				13.15; 0.00029
Illiterate	148	24	172	
Literate	220	8	228	
Fathers Education				10.16; 0.0014
Illiterate	111	19	130	
Literate	257	13	270	
Immunisation card				40.29; 2.19×10^{-10}
Available	273	6	279	
Not Available	95	26	121	
Birth order				1.84; 0.175
≤ 2	213	23	236	
> 2	155	9	164	

Among the study subjects who were partially immunized, the primary reasons identified included inadequate knowledge about immunization, reported by 24 participants (75%). Misconceptions about immunization accounted for 1 participant (3.12%), while 4 participants (12.5%) cited lack of motivation as a contributing factor. Family authority influenced 2

participants (6.25%) in their decision-making regarding vaccinations. Health-related issues were also significant, with 6 participants (18.75%) indicating that their child was sick at the time of vaccination. Additionally, 1 participant (3.12%) reported a reaction during the first dose as a reason for partial immunization. [Table No.3]

Table No.3.: Reasons for partial immunisation in the study subjects

Reasons	Number (n =32)	Percentage
Inadequate knowledge about immunisation	24	75%
Misconceptions about immunisation	1	3.12%
Lack of motivation	4	12.5
Family Authority	2	6.25%
Sick child	6	18.75%
Reaction during first dose	1	3.12%

The immunization coverage results for individual vaccines are as given in Table No.4. For BCG and OPV – 0, there was 100% coverage, with all 214 males and 186 females immunized. The coverage for OPV – 1 was 99.5% for males (213) and 99.46% for females (185). For OPV – 2, 98.5% of males (211) and 97.8% of females (182) were immunized, and the same percentages applied to OPV – 3. The OPV – Booster had 92.9% coverage among males (199) and 95.6% among females (178). In the case of IPV – 1, coverage was 98.5% for males (211) and 98.38% for females (183), while IPV – 2 also showed 98.5% coverage for males and 97.8% for females. The Hepatitis - B Birth dose was administered to all 214 males (100%) and 99.5% of females (185). For Penta

– 1, 99.5% of males (213) and 99.46% of females (185) were immunized. The Penta – 2 and Penta – 3 vaccines showed 98.5% coverage for males (211) and 97.8% for females (182) in both instances. The DPT Booster coverage was 93.9% for males (201) and 93.01% for females (173). The Rota vaccines demonstrated high coverage, with Rota – 1 at 99.5% for males (213) and 98.9% for females (184), Rota – 2 at 98.5% for males (211) and 97.3% for females (181), and Rota – 3 at 97.6% for males (209) and 96.2% for females (179). Finally, coverage for MR – 1 was 96.7% for males (207) and 98.9% for females (184), while MR – 2 had 95.3% coverage for males (204) and 97.3% for females (181).

Table No.4.: Immunization status for individual vaccines among the study subjects

Vaccine	Immunisation Status		
	Male (%)	Female (%)	Total (%)
BCG	214 (100)	186 (100)	400 (100)
OPV – 0	214 (100)	186 (100)	400 (100)
OPV – 1	213 (99.5)	185 (99.46)	398 (99.5)
OPV – 2	211 (98.5)	182 (97.8)	393 (98.25)
OPV – 3	211 (98.5)	182 (97.8)	393 (98.25)
OPV – Booster	199 (92.9)	178 (95.6)	377 (94.25)
IPV – 1	211 (98.5)	183 (98.38)	394 (98.5)
IPV – 2	211 (98.5)	182 (97.8)	393 (98.25)
Hepatitis - B Birth dose	214 (100)	185 (99.5)	399 (99.75)
Penta – 1	213 (99.5)	185 (99.46)	398 (99.5)
Penta – 2	211 (98.5)	182 (97.8)	393 (98.25)
Penta – 3	211 (98.5)	181 (97.3)	392 (98)
DPT Booster	201 (93.9)	173 (93.01)	374 (93.5)
Rota – 1	213 (99.5)	184 (98.9)	397 (99.25)
Rota – 2	211 (98.5)	181 (97.3)	392 (98)
Rota – 3	209 (97.6)	179 (96.2)	388 (97)
MR – 1	207 (96.7)	184 (98.9)	391 (97.75)
MR – 2	204 (95.3)	181 (97.3)	385 (96.25)

DISCUSSION

In this study, Anganwadi centers were predominantly located in rural areas, with 56.25% of centers situated in rural locations and 43.75% in urban areas. This distribution reflects a significant effort to extend early childhood services to rural regions, potentially improving healthcare access, including immunization services, for children in less accessible areas. In the study conducted by Deshmukh et al., 52% of children under six were male, while 48% were female which is in concordance with the current study. [6]Mandal et al. found that 49.20% of children were male and 50.79% were female. [7]The current study shows that the percentage of fully immunized children is consistent with NFHS-5 figures, underscoring the effectiveness of vaccination programs in the region. The data reveals that while the majority of children are fully vaccinated, a notable fraction remains partially immunized. This pattern mirrors the trends observed in the NFHS-5 data, which highlights the challenges still faced in achieving complete vaccination

coverage. Debata et al in their observational study reported that 97.5% of participants were fully immunised. Ankit Bhagora et al. report that only 31.3% of subjects were fully immunized, with urban (29.4%) and rural (29.5%) rates being similar, while tribal areas showed a slightly higher rate at 36.7%. Partial immunization was more prevalent in urban areas (48.8%) compared to rural (48.1%) and tribal regions (35%) in their study. [8]Anil Moluguri et al observed that 87.6% of the study subjects were fully immunised in their study while 12.4% were partially immunised. [9]The enhanced immunization coverage observed in our study compared to earlier studies can be attributed to several factors, including advancements in health system coverage in recent years, greater awareness about immunization, and the successful implementation of Mission Indradhanush. The analysis of age groups revealed that younger children (12–24 months) exhibited higher rates of full immunization; however, the statistical analysis indicated no significant association between age and

immunization status. This suggests that while age may influence immunization rates, other underlying factors could also play a crucial role in determining vaccination completeness.

Parental education emerged as a significant factor influencing immunization status. Children with literate mothers demonstrated higher rates of full immunization, indicating that maternal education positively correlates with the likelihood of children being fully vaccinated. A similar trend was observed with fathers' education, underscoring the importance of parental knowledge and awareness regarding immunization. Availability of immunization card has strong association with immunization status. This finding emphasizes the importance of record-keeping in promoting immunization adherence, as it likely aids parents in tracking vaccination schedules and encourages timely vaccinations. Similar findings have been reported in studies by Odusanya et al. and Kulkarni et al., where children without immunization cards had significantly higher odds of being partially immunized.^[10,11]

The analysis of birth order suggested that children with a birth order of ≤ 2 had slightly higher rates of full immunization, the lack of statistical significance indicates that this factor may not have a substantial impact on immunization status.

The immunization coverage results align closely with the national immunization schedule. Some vaccines are administered together, leading to similar or identical coverage percentages. For instance, BCG, OPV-0, and the Hepatitis B birth dose are all given at birth, resulting in 100% coverage for each vaccine in both males and females. Similarly, vaccines like OPV-1, IPV-1, Rota-1, and Penta-1 are scheduled together at the 6th week, yielding comparable coverage rates. The same pattern is observed with OPV-2, Rota-2, and Penta-2 at the 10th week, and OPV-3, IPV-2, and Rota-3 at the 14th week, which have consistent coverage levels. This scheduling supports high early-stage immunization coverage and ensures that children receive multiple critical vaccines during the same visit. The immunization coverage data demonstrates high compliance across most vaccines, with near-complete coverage for initial doses such as BCG and OPV-0 at birth (100%) and strong coverage for follow-up doses of OPV, IPV, Hep B, and Penta. However, there is a slight drop in coverage for booster doses, with DPT and OPV boosters showing lower percentages compared to the initial doses. Comparing these findings with the study by Basti BD et al., our results show higher coverage overall, especially for DPT/OPV doses, which they reported at 96% for the third dose, while our dataset shows 98.5% coverage for males and 97.8% for females. However, similar to Basti BD et al., our findings reflect lower coverage for booster doses, particularly the DPT booster, which reached around 93% in our dataset versus only 52% in their study. The findings from Koppad et al.'s study

(2016) align with the high primary immunization coverage rates observed in the current study.^[12]

In our study, inadequate knowledge emerged as the primary reason for partial immunisation, reported by 75% of participants, highlighting a significant gap in awareness that may hinder vaccination completion. Misconceptions were noted by 3.12%, while 12.5% cited lack of motivation. The influence of family authority affected 6.25% of participants, and health-related issues at the time of vaccination were reported by 18.75%. Additionally, 3.12% mentioned a reaction to the first dose as a concern. Comparatively, the study by Bharatesh Devendra Basti et al. also identified inadequate knowledge (52.1%) as a major factor for un-immunization or partial immunization, alongside forgetfulness (9.86%) and lack of reminders from health workers (7.04%).^[13] In the study by Dubey DK et al., significant barriers to immunization were identified, with 71% of participants unaware of immunization days, highlighting a critical lack of awareness regarding vaccination schedules. Additionally, 51% reported a general lack of awareness about immunization, and 23.1% cited the busyness of mothers as a contributing factor to missed vaccinations.^[14] These studies underscore the need for enhanced education and community engagement to address knowledge gaps and other barriers to immunization. Overall, these findings highlight the critical role of parental education and the importance of maintaining immunization records in enhancing vaccination coverage, while also suggesting areas for further investigation to address barriers to immunization.

CONCLUSION

The study reveals that while most children associated with Anganwadi centers are fully immunized, a notable number remain partially immunized due to inadequate knowledge and misconceptions about vaccination. The strong correlation between parental education and immunization status highlights the need for educational initiatives targeting parents. Additionally, maintaining immunization records is essential for promoting adherence to vaccination schedules, emphasizing the importance of community engagement to improve overall immunization rates.

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