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Original Research Article

ASSESSMENT OF VACCINE COVERAGE AMONG CHILDREN OF 12 TO 23 MONTHS AGE IN TRIBAL SETTLEMENTS OF CHAMARAJANAGAR DISTRICT IN KARNATAKA

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ABSTRACT

Background: Vaccination is a critical part of preventable health care. The tribal communities record lower antenatal care and immunization coverage. The study was aimed to assess the immunization coverage and to find the associated socio-demographic factors among the children in the age group 12-23 months in tribal settlements.

Materials and Methods: This was a cross- sectional study conducted between July 2022 to June 2024 in the tribal settlements of Chamarajanagar among 210 children in the age group of 12 to 23 months. The samples were selected by WHO 30×7 cluster sampling method. The data was collected by using a standard validated questionnaire after obtaining the ethical clearance.

Results: The fully immunized, partially immunized and un- immunized were 73.8%, 22.9% and 3.3% respectively. In bivariate analysis, the factors significantly associated with immunization coverage rate were mother's age ($p < 0.005$), father's age ($p < 0.005$), mother's education ($p = 0.014$) and father's occupation ($p = 0.033$). In multiple logistic regression analysis, there were no significant predictors of partial immunization or un- immunization status in children.

Conclusion: The FIC rate was found to be low among the children in tribal settlements of Chamarajanagar district. The key determinants of immunization status included parental age and education, occupation, socio-economic status.

Keywords: vaccine coverage, fully immunized, 12 to 23 months, tribal settlements, WHO 30x7 cluster sampling, COVID- 19.

INTRODUCTION

Vaccination is a critical part of preventable health care which is a simple, safe, and effective way of administering vaccines, the backbone of public health. Immunization is one of the cost-effective and safest measures in public health, to protect children from life threatening diseases. According to the World Health Organization (WHO), existing vaccines currently avert an estimated 3.5 to 5 million deaths of young children annually from vaccine-preventable diseases.[1] The global immunization initiatives have averted an estimated 154 million premature deaths since 1974. The infants were the primary beneficiaries of these efforts, representing 101 million of the lives saved, effectively maintaining a rate of six lives saved every minute for five decades. Consequently, the Expanded Programme on Immunization (EPI) has evolved significantly over the past 50 years, transitioning

from a localized initiative into a cornerstone of global public health.[2]

Despite the developments in global immunization programmes, routine vaccine coverage remains stagnant. The COVID- 19 pandemic had widely interrupted the routine immunization services across the globe and dented the critical routine immunization coverage.[3] There was 26% fall in immunization coverage in the first quarter of 2020 from previous year in India.[4]

For decades, indigenous communities have faced the most significant representation gaps in India's health system, a disparity reflected in their persistently low rates of Full Immunization Coverage (FIC). In Karnataka, the Koragas of Dakshina Kannada district and the Jenu Kurubas who are concentrated in the districts of Mysore, Chamarajanagar and Kodagu are classified as 'primitive-tribes' or now called as "Particularly Vulnerable Tribal Groups" (PVTG's). But the major tribes of the Chamarajanagar district were 'Soligaru' and 'Iruliga.'These communities record lower antenatal care and immunization coverage, with higher proportions of home deliveries when compared to others.[5,6] Fear of side effects and lack of awareness, loss of wages, inaccessible session sites, scattered population, vaccine hesitancy due to resistance by family members, migration of families, vaccine delivery in hard-to-reach areas, language barrier, lack of proper healthcare facilities, shortage of human resources, poor inter-sectoral coordination were identified as common factors causing low vaccination coverage in the tribal population (PVTG's).[7]

The Full Immunization Coverage (FIC) and Complete Immunization Coverage (CIC) are the two important indicators of routine vaccination under Universal Immunization Programme (UIP). According to the NFHS-5 survey (Karnataka), the vaccine coverage among the children between the age group of 12 to 23 months was about 84.1 %.8 In 2019, the first phase of National Family Health Survey- V had reported that in Chamarajanagar district, the FIC rate among 12 to 23 months age children was 93.9%.9Considering the COVID- 19 background and the health inequity in tribal population, always there exists a need to conduct periodic vaccine surveys for bridging the gap of information regarding routine immunization. Hence, this study was conducted to assess the vaccination status of children among 12 to 23 months of age residing in tribal settlements of Chamarajanagar district.

Objectives: To estimate the full immunization coverage (FIC) rates among children in the age of 12-23 months in the tribal settlements of Chamarajanagar district and to determine the socio-demographic factors associated with immunization coverage among tribal children

MATERIALS AND METHODS

This study was conducted among children in the age group of 12- 23 months in the tribal settlements of the Chamarajanagar district which included five taluks, namely Chamarajanagar, Gundlupet, Yelandur, Kollegal and Hanur.10This was a cross- sectional study which had used WHO 30 × 7 cluster sampling method. It was conducted during the period of July 2022 and June 2024. The children in the age group of 12 – 23 months in the tribal settlements and their mother or any caregiver who were local resident for at least for a period of 24 months during interview were included. Those children whose mother or any caregiver was not available up to 3 consecutive visits were excluded from study.

Sampling methodology: The WHO cluster sampling method was done in 3 stages. The cluster sampling method was used for selecting 30 clusters from the whole list of available clusters by population probability sampling method and 7 children were selected from each cluster by simple random sampling. The cluster (tribal settlements) is the primary sampling unit (PSU) which was selected by PPES (probability proportional to estimated size - PPES) method and the households inside the cluster are the secondary sampling units (SSU) using WHO method.

Sample size estimation: Sample size was estimated using the full immunization coverage rate i.e., 93.3% among 12-23 months in Chamarajanagar district according to NHFS V (Phase I).[9]

Formula: N = (P (100-P) Z^2)/E^2

P is the percentage occurrence of a state or condition = 93.3%, E is the percentage maximum error required = 5%, Z is the value corresponding to level of confidence required = 1.96, the design effect for cluster sampling, DEFF = 2.[11]

Corresponding sample size, N = 193, with 5% non-response rate 193 + 10 = 203 samples are required. However, 210 children were recruited in selected 30 clusters.

Data collection: After obtaining the ethical clearance, a pre- tested semi- structured questionnaire after validation was used by the data collector to record the details regarding the vaccination coverage and socio- demographic factors. It was translated into Kannada and back- translated to ensure the content valid and meaningful. A pilot testing was done to check the feasibility and ensure internal validity. The data was recorded through in- person interview method with child's primary care giver. The age of child if not known by caregiver was verified using government identity proofs such as Aadhar card, birth certificate, Thayi Card or Mother and Child Protection (MCP) cards and growth charts whichever was available at the site. The immunization status of child was particularly verified using Thayi Card or Mother and Child Protection Cards and growth charts. The immunization recall and location of BCG scar were considered for those with no possession of vaccination records. The GPS documentation was done to geolocate the participant families in tribal hamlets. The vaccine coverage was assessed and classified with working definitions. A child who had received all due vaccines as per ongoing NIS within

first year age of child were classified as fully immunized, a child who had missed any of the vaccines given under the UIP till one year of age were partially immunized or "drop- outs" and those children who had not received any due vaccine up to 12 months of age or received only pulse polio vaccine were un- immunized or "left- outs."[12]

Statistical analysis: The data was entered in Microsoft Excel Version 2019.The categorical data was represented in the form of frequencies and proportions. The bivariate and multiple logistic regression were performed using Epi Info™ Build 7.2.5 2021by CDC. The Chi-square test was used for bivariate analysis for categorical data. The p value (probability that the result is true) of <0.05 was considered as statistically significant.[13]

RESULTS

In the present study, gender distribution shows that there were 49.5% boys and 50.5% girls among the study participants, 51.9% of mothers had attended high school, 30.5% mothers were illiterates followed by 14.3% mothers who had studied till PUC, 53.3% of fathers had attended high school, 31.54% fathers were illiterates followed by 10.5% fathers who had studied till PUC, 93% of mothers were unemployed and/ or housewives and 7% were employed, 79.1% of fathers were unskilled or daily wage workers and 20.9% were skilled or semi- skilled workers, 77.6% of families were classified as lower class and 22.4% were lower middle class and above according to modified B G Prasad scale of socio- economic status. [Table 1]. In the present study, 73.8% children were fully- immunized, 22.9% were partially immunized and 3.3% were un- immunized. [Table 2]

For bivariate analysis, partial immunized and unimmunized were clubbed together as not fully immunized while comparing with fully immunized. In this study, there was a significant statistical association between immunization status (fully immunized and not fully immunized) and socio-demographic variables such as mother's age (p=0.008), father's age (p= 0.005), mother's education (p= 0.014), father's occupation (p=0.003). [Table 3]

The multiple logistic regression analysis was performed to predict the likelihood of a child being partially immunized or unimmunized based on various predicted factors such as mother's age (aOR=0.707, p= 0.411), father's age (aOR=0.504, p= 0.106), mother's education (aOR=0.681, p=0.295), father's education (aOR=0.715, p=0.35). There were no significant predictors of children being partial immunized and un-immunized. The father's occupation approached significance suggesting it as a likely predictor (aOR=0.397, p= 0.063). (aOR: adjusted odds ratio). [Table 4]

Table 1: Socio-demographic profile of the study participants

Socio-demographic variables		Frequency (N=210)	Percentage (%)
Gender	Male	104	49.5
	Female	106	50.5
Mother' education	Graduate & above	7	3.33
	PUC	30	14.3
	High school	109	51.9
	Illiterate	64	30.5
Father's education	Graduate & above	10	4.8
	PUC	22	10.5
	High school	112	53.3
	Illiterate	66	31.4
Mother's occupation	Employed	15	7.1
	Unemployed/ Housewife	195	92.9
Father's occupation	Skilled and Semi- skilled	44	20.9
	Unskilled or unemployed	166	79.1
Socio- economic status (SES)	Upper class	3	1.4
	Upper middle	4	1.9
	Middle	13	6.2
	Lower middle	27	12.9
	Lower	163	77.6

Table 2: Distribution of the children based on the vaccine coverage status(N= 210)

Vaccination status	Frequency (N= 210)	Vaccine coverage (%)
Fully Immunized	155	73.8
Partially Immunized	48	22.9
Un- Immunized	7	3.3

Table 3: Bivariate analysis of factors associated with vaccine coverage status (N=210)

Socio- demographic variables		Vaccine Coverage Status				P value
		Full immunized (n= 155)		Partially Immunized or Un-immunized (n= 55)		
		Frequency	Percentage	Frequency	Percentage	
Age of Child	12 to 16 months	57	77.0	17	23.0	0.434
	16 to 23 months	98	72.1	38	27.9	
Gender of child	Male	75	72.1	29	27.9	0.580

	Female	80	75.5	26	24.5	
Mother's age (yr)	<25	112	79.4	29	20.6	0.008*
	>25	43	62.3	26	37.7	
Father's age (yr)	<30	111	79.9	28	20.1	0.005*
	>30	44	62.0	27	38.0	
Mother's Education	Literate	115	78.8	31	21.2	0.014*
	Illiterate	40	62.5	24	37.5	
Father's Education	Literate	112	77.8	32	22.2	0.053
	Illiterate	43	65.2	23	34.8	
Mother's Occupation	Employed	12	80.0	3	20.0	0.571
	Unemployed	143	73.3	52	26.7	
Father's Occupation	Semi-skilled or skilled	38	86.4	6	13.6	0.033*
	Unemployed or unskilled	117	70.5	49	29.5	
Socio- Economic Classification	Lower class	120	73.6	43	26.4	0.907
	Above lower class	35	74.5	12	25.5	

*Pearson Chi-Square Tests (p value<0.05 was considered as statistically significant)

Table 4: Multiple logistic regression analysis of factors associated with partial and un-immunization status

Multiple regression model			β*	P value (Sig.)	aOR#	95% CI for Adjusted OR	
						Lower	Upper
Predictors of partial and un immunization status	Mother's age (yr)	<25	-0.346	0.41	0.707	0.31	1.615
		>25	Ref				
	Father's age (yr)	<30	-0.686	0.10	0.504	0.22	1.156
		>30	Ref				
	Mother's Education	Literate	-0.384	0.29	0.681	0.333	1.396
		Illiterate	Ref				
	Father's Education	Literate	-0.336	0.35	0.715	0.354	1.445
		Illiterate	Ref				
	Father's Occupation	Semi-skilled or skilled	-0.924	0.06	0.397	0.15	1.053
		Unemployed or unskilled	Ref				

*Regression coefficient, #Adjusted odds ratio, Ref - reference category
(p value<0.05 was considered as statistically significant)

DISCUSSION

Immunization is a cornerstone in reducing under-five mortality. In this study, the prevalence of fully immunized children (FIC) was 73.8%, with 22.9% partially immunized and 3.3% unimmunized. While these figures demonstrate a resilient effort during the COVID-19 pandemic, they remain below the 90% national target set by Mission Indradhanush.

The pre-pandemic immunization in neighbouring countries like Sri Lanka and Nepal demonstrated high stability. However, the COVID-19 era introduced significant variance in vaccine coverage globally. Our findings are comparable to a study by Hussain et al. (2021) in Pakistan with FIC rate of 76.5% and surpass the FIC rate of 65.8% in a study by Wassenaar et al. (2021) in Sierra Leone. These disparities likely reflect the varying degrees to which lockdowns and resource diversion hindered routine vaccination.[14-17]

There were evidences of low rates of FIC in Indian studies with tribal settings even before COVID, as in studies of Kusuma YS et al. (2020) and Mithrason et al. (2019) had reported FIC rates of 51.9% and 47.62%, respectively which lie below the current rate of 73.8%.[18,19]

There was another study conducted by Arun KSR et al. (2022) during the COVID period who reported a low FIC of 64.4% indicating that the pandemic may have exacerbated existing access barriers in vulnerable tribal tracts more severely than ever before.[20]

Interestingly, our FIC estimates lie between the performance extremes of rural Doda, Jammu & Kashmir (66.2% FIC; Kumar R et al., 2018) and rural Bihar (90.85% FIC; Singh CM et al., 2019). Notably, our low "left-out" rate suggests a robust initial reach on a positive note, even when Chamarajanagar district was not a part of Intensified Mission Indradhanush 4.0 campaign.

A high drop- out rate of 52.38% and 35.6% were reported from the recent studies in tribal area. However, the 22.9% partial immunization rate in our study still remain a concern, indicating that the "dropout" rate is the primary hurdle to reach national targets in the post-pandemic landscape.[18,20-22]

There was a significant association between maternal age and immunization status, contrasting with Eze P et al., who found no such link. Furthermore, while the role of fathers is often overlooked—Wassenaar et al. reported only 13% of caretakers were male—our findings highlight a significant association between paternal characteristics and vaccine coverage, suggesting that fathers are key stakeholders in this population.[17,23]

Regarding education, several studies (Francis et al., and Mugali et al.) found that higher maternal education strongly correlates with increased coverage ($P < 0.001$).[24,25] In our study, this association was significant in bivariate analysis but did not persist in the multivariate model, suggesting that education may interact with other unassessed household factors. Similarly, paternal occupation showed a significant association in our bivariate analysis, aligning with Francis et al. ($P = 0.005$) but differing from Arun KSR et al. ($P > 0.05$).[20,24] Higher coverage among children of employed fathers may stem from increased health awareness and financial stability. Finally, our study found no significant link between socio-economic status and vaccination, diverging from Khargekar N.C. et al., who observed higher rates among lower-class families.[26] These variations underscore how local cultural and economic contexts uniquely shape immunization behaviours.

Strength and Limitations: The study had a comprehensive data collection on vaccine coverage rates post COVID in the whole district on underserved population such as tribal groups. The coverage estimates were recorded using recommended research methods suggested by WHO and using MCP cards. But the study had certain limitations such as recall bias, limited generalizability and sample size and social desirability bias.

CONCLUSION

This study highlights a critical gap in childhood immunization within the tribal settlements of Chamarajanagar, revealing a significant prevalence of unimmunized and partially immunized children aged 12–23 months. While younger parental age and higher education influence vaccination coverage, the inability of socioeconomic factors to distinguish partially from unvaccinated children necessitates targeted, equitable interventions to fulfil the Universal Immunization Programme (UIP) goals and protect the children who define the future of tribal community.

Recommendations: The local public health authorities should prioritize tailored social and behavioural change communication strategies using local dialects and low-literacy tools to bridge the education gap. Activities such as universalization and further strengthening the U-WIN digital platform is essential for real-time tracking and hence in reducing "partial" immunization through automated defaulter alerts. Also, the prospective researchers may employ longitudinal designs with larger, more diverse samples across multiple regions to validate these findings and establish causal relationships. These insights will empower data managers and administrators to optimize and effectively implement Universal Immunization Programme (UIP) strategies.

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