

Original Research Article

Assessment of immunization status among under five children in a census town of South India

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ABSTRACT

Background: Deaths among children of less than five years are preventable, mostly by vaccination. In India, the coverage still remains low, as low as 44% children between 12 to 23 months age are fully immunized. This study was intended to assess the immunization status of the children between the age group of 12-60 months, and study the possible socio demographic factors influencing it.

Methods: This cross-sectional study was conducted in 16 wards of a census town, selected by Multi-stage simple random sampling, for a period of 4 months among 400 children. Data was collected from the mothers of these children, using structured questionnaire.

Results: Immunization status among these children showed that 32.5% were fully immunized, 52.0% were immunisation update, 14% were partially immunized, and 0.5% was not immunized. Immunization status was highest for BCG and OPV-0 (99%) and least for Measles 2nd dose and DPT booster (52%). Inadequate knowledge about immunization was the most common reason for partial and un-immunization. Multivariate Logistic regression analysis showed that, factors like religion (Hindus had 2.843 odds of being partially immunised than other religions), availability of Immunization card (Those without Immunisation card had 2.025 odds of being partially immunised than those with immunisation card) and place of immunization (Those immunised at private facilities had 1.441 odds of being partially immunised than those at government facilities), were found to be significantly associated with the immunization status of the child.

Conclusions: Government facilities remain the main pillars of immunisation. Coordination with Anganwadi centres is the key. Tracking of the child for subsequent doses of immunisation remains a challenge.

Keywords: Under five children, Immunization status, Urban area, Fully immunized

INTRODUCTION

Globally, deaths in children less than five years of age declined from 12.7 million in 1990 to almost 6 million in 2015. But still in 2015, around 16,000 under five children continue to die every day & majority of these deaths are preventable, mostly by vaccination.^{1,2} Immunization is the

process whereby a person is made immune or resistant to an infectious disease, typically by the administration of a vaccine, which stimulates the body's own immune system to protect the person against subsequent infection or disease.³ In addition to the 2 to 3 million deaths prevented by immunization annually, an additional 1.5million deaths could be avoided if global vaccination

coverage improves, as an estimated 18.7 million infants worldwide are still missing out on basic vaccines.^{4,5} In India, under the National Immunization Program, infants are immunized against seven vaccine preventable diseases (VPDs) namely tuberculosis, diphtheria, pertussis, poliomyelitis, measles, tetanus and hepatitis B. In addition to DPT and Hepatitis B vaccine, Haemophilus influenza type B (Hib) vaccine is a new addition, all these given together called Pentavalent.⁶ Primary immunisation is most essential in preventing the morbidity and mortality due to VPDs. Fully immunized child is one who has received all the vaccines recommended in the National immunization schedule by one year of age. Though vaccination is offered for free, the coverage still remains low, as only 44% children between 12 to 23 months age are fully immunized, according to the National Family Health Survey (NFHS-3).⁷ This shows that, uptake of immunization services is dependent not only on provision of these services, but also on other factors including knowledge and attitude of mothers, religion, culture, density of health workers, accessibility to vaccination clinics etc.⁸

With this background, this study is intended to assess the immunization status of the children between the age group of 12-60 months, in the urban area of Kuppam, and study the possible socio demographic factors influencing it.

METHODS

This cross-sectional study was conducted between January 2017 to April 2017 in Kuppam. Kuppam is a census town in Chittoor district of Andhra Pradesh, South India. Multi-stage random sampling was used. Sixteen wards from of all the enlisted wards of Kuppam census town were selected by simple random sampling in the first stage. The houses in each of these wards were numbered. Then 25 houses were selected from each of these wards by simple random sampling. If no children were available in a selected house, subsequent numbered houses with children were included in the study. A total of 400 Children aged 1-5 years formed the study population. Based on the 80% prevalence of fully immunised children found in the Sulakshana S Baliga et al,⁹ considering 95 % confidence interval, 5% Relative precision, sample size worked out to be 400 using the following formula:

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

Mothers' of these children were interviewed using a pretested semi-structured questionnaire. Those houses without the mothers at the time of visit were revisited. If still unavailable the children from subsequent house were included in the study. Ethical clearance was obtained from Institutional Human Ethics Committee of the medical college, before beginning the study. After obtaining written informed consent, data was collected

from the mothers of these children. Those unwilling to participate or not giving consent were not included in the study. Semi-structured questionnaire document containing general information like socio demographic details, supporting family details, immunisation/vaccination details were used.

Operational definitions used in this study

- **Fully immunized:** Children having received three doses of Diphtheria, Pertussis, Tetanus, (DPT), Hepatitis B and OPV each and single dose of BCG and measles vaccine by one year of age.
- **Immunization up-to-date:** Children of 1-5 years age should have received all the doses of all the vaccines as recommended for their age by the Universal Immunization Programme, 2017 in the country.¹⁰
- **Partially immunized:** Children having received one or more doses of the recommended vaccines, but not all the recommended vaccine doses by one year of age.
- **Unimmunized:** Those who had not received even a single dose of any of the recommended vaccines.
- **Literate:** A person above 7 years able to read, write and understand in any one language. Otherwise was considered as illiterate.

Regarding the reasons for un-immunization/ partial immunization, mothers were allowed to select multiple responses from the given options.

Statistical analysis

The data collected was entered using Epidata 3.1 version software and analysed using Epi Info[™] 3.5.4 version. Categorical data were summarized using percentages and the continuous data were summarized using means and standard deviation. Inferential statistical tests like chi square test, univariate and multivariate logistic regression analysis by forward stepwise (conditional) method were used. The p value of less than 0.05 was considered as statistically significant.

RESULTS

In the present study, 203 (50.75%) were female children and 197 (49.25%) were males. The mean age of the study participants was 34.9±15.6 months. Majority 148 (37%) of the children were in the age group 49-60 months. 273 (68.75%) were Hindus, 120 (30%) were Muslims and 7 (1.75%) were Christians. Majority 372 (93%) of the deliveries of these children were institutional, among them 244 (65.6%) deliveries were in government hospitals. 365 (91.25%) children were immunised at government centres [Anganwadi centres 311 (77.75%), Primary health centres 46 (11.5%), sub centres 8 (2.0%)] and rest were from private centres/hospitals 35(8.75%). Anganwadi centres were the place of immunization for majority of children (77.75%). 241 (60.3%) were from nuclear families. 333 (83.25%) of the mothers and 307

(76.75%) of fathers were literates. Literacy status was better among mothers than fathers. Immunization cards were available only with 219 (54.75 %). 61% of them had deliveries at government centres, 32% at private centres and 7% at home. 297 (74.25%) had vaginal delivery and

103 (25.75%) had by caesarian section deliveries. 356 (89%) were of birth order less than two. 44 (11%) of more than two birth order. 382 (95.5%) had BCG scar 18 (4.5%) did not have BCG scar (Table 1).

Table 1: Socio demographic factors and their association with immunization status.

Factor	Fully Immunized/Immunization up-to-date			χ^2 value; p value
	Yes (%) (n=342)	No (%) (n=58)	Total	
Age (in months)				
12-24	77 (83.7)	15 (16.3)	92 (23)	1.2577; 0.739
25-36	54 (90)	6 (10)	60 (15)	
37-48	85 (85)	15 (15)	100 (25)	
49-60	126 (85.1)	22 (14.9)	148 (37)	
Gender				
Male	169 (85.8)	28 (14.2)	197 (49.25)	0.0258;
Female	173 (85.2)	30 (14.8)	203 (50.75)	0.872
Religion				
Hindu	224 (82.1)	49 (17.9)	273 (68.3)	8.5491; 0.014*
Muslim	111 (92.5)	9 (7.5)	120 (30)	
Christian	7 (100)	0 (0)	7 (1.8)	
Place of immunization				
Government	318 (87.1)	47 (12.9)	365 (91.25)	8.8663;
Private	24 (68.6)	11 (31.4)	35 (8.75)	0.003*
Mother Education				
Illiterate	52 (77.6)	15 (22.4)	67 (16.75)	4.0392;
Literate	290 (87.1)	43 (12.9)	333 (83.25)	0.044*
Father Education				
Illiterate	80 (86)	13 (14)	93 (23.25)	0.0266;
Literate	262 (85.3)	45 (14.7)	307 (76.75)	0.870
Type of Family				
Nuclear	211 (87.5)	30 (12.5)	241 (60.25)	6.7774; 0.034*
Joint	83 (87.4)	12 (12.6)	95 (23.75)	
Three generation	48 (75)	16 (25)	64 (16)	
Immunization card				
Available	195 (89)	24 (11)	219 (54.75)	4.8952;
Not available	147 (81.2)	34 (18.8)	181 (45.25)	0.027*
Place of delivery				
Home	25 (89.3)	3 (10.7)	28 (7)	0.4302; 0.806
Government hospital	207 (84.8)	37 (15.2)	244 (61)	
Private hospital	110 (85.9)	18 (14.1)	128 (32)	
Type of delivery				
Vaginal	260 (87.5)	37 (12.5)	297 (74.25)	3.8797;
Caesarian	82 (79.6)	21 (20.4)	103 (25.75)	0.049*
Birth order				
≤2	304 (85.4)	52 (14.6)	356 (89)	0.0297;
>2	38 (86.4)	6 (13.6)	44 (11)	0.863
BCG scar				
Present	326 (85.3)	56 (14.7)	382 (95.5)	0.006
Absent	16 (88.9)	2 (11.1)	18 (4.5)	0.940

* p<0.05 is significant.

Assessing the immunization status among study participants, it was found that 134 (33.5%) were fully immunized, 208 (52%) were immunization up-to-date, 56 (14%) were partially immunized, and 2 (0.5%) children

were not immunized. Overall 342 (83.5%) children were fully immunised. 58 (14.5%) were either partially/not immunized (Figure 1).

Regarding the immunization coverage of individual vaccine, highest coverage was seen for BCG vaccine /OPV zero dose with 99% followed by 1st dose of OPV/DPT with 98% of coverage, DPT/OPV 3rd dose 96%, Measles 86.25% coverage. Least coverage was seen for booster dose of DPT/Measles 2nd dose with 52% coverage for each (Table 2).

Multiple responses were allowed for expressing the reasons for un-immunization/ partial immunization, and majority 37 (52.1%) expressed that inadequate knowledge about immunization/ subsequent dose was the reason. The other reasons being forgetfulness 7 (9.86%) and no reminders from health workers 5 (7.04%) (Table 3).

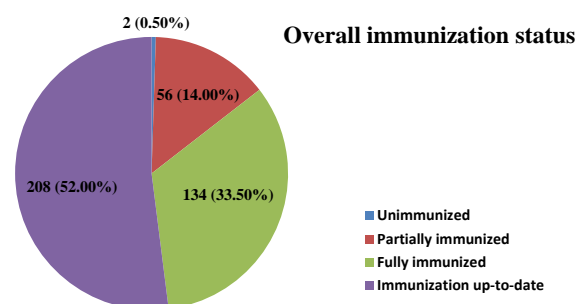


Figure 1: Immunization status among the study subjects.

Table 2: Immunization status for individual vaccines among the study subjects:

Vaccine	Immunization status		
	Male (%) (n=197)	Female (%) (n=203)	Total (%) (n=400)
BCG	194 (98.48)	202 (99.51)	396 (99.00)
OPV-0	194 (98.48)	202 (99.51)	397 (99.00)
OPV-1	191 (96.95)	201 (99.01)	392 (98.00)
OPV-2	190 (96.45)	199 (98.03)	389 (97.25)
OPV-3	187 (94.92)	198 (97.54)	385 (96.25)
DPT-1	191 (96.95)	200 (98.52)	391 (97.75)
DPT-2	189 (95.94)	197 (97.04)	386 (96.50)
DPT-3	187 (94.92)	197 (97.04)	384 (96.00)
DPT booster	103 (52.28)	105 (51.72)	208 (52.00)
Hepatitis B-1	191 (96.95)	199 (98.03)	390 (97.50)
Hepatitis B-2	187 (94.92)	198 (97.54)	385 (96.25)
Hepatitis B-3	187 (94.92)	198 (97.54)	385 (96.25)
Measles-1	170 (86.29)	175 (86.21)	345 (86.25)
Measles-2	103 (52.28)	105 (51.72)	208 (52.00)

Table 3: Reasons for non-immunization/partial immunization among the study subjects.

Reasons for un-immunization/partial immunization	Frequency (n=58)	Percentage (%)
Inadequate knowledge about immunization/subsequent dose	37	52.11
Forgetfulness	7	9.86
No reminders from health workers	5	7.04
Migration	4	5.63
Busy/no time	3	4.23
Fear of injection	3	4.23
Inaccessibility of immunization services	3	4.23
Vaccine not available	3	4.23
Reaction during first dose	2	2.82
Illness of child	2	2.82
Postponed for next convenient time	1	1.41
Lack of faith in effectiveness	1	1.41

Factors like religion, mother's education, type of family, type of delivery, place of immunization, and availability of immunization card were found significantly associated ($P < 0.05$) with the immunization status (Table 1).

With fully immunized status as reference, and partially immunized status (two unimmunized children were

included) as risk, the associated factors were further subjected to Univariate analysis followed by multivariate logistic regression analysis by forward stepwise (conditional) method, to know the predictors for immunization status of under-five children.

Univariate logistic regression analysis showed that, factors like religion, education status of mother, type of family, place of immunization and availability of immunization card were found to be significantly associated with the immunization status of the child (Table 4).

Multivariate logistic regression analysis by forward stepwise (conditional) method showed that, factors like

religion (Hindus had 2.843 odds of being partially immunised than other religions), availability of immunization card (those without immunisation card had 2.025 odds of being partially immunised than those with immunisation card) and place of immunization (Those immunised at private facilities had 1.441 odds of being partially immunised than those at government facilities), were found to be significantly associated ($p < 0.05$) with the immunization status of the child (Table 4).

Table 4: Univariate and multi-variate logistic regression for predictors of immunization status by forward stepwise method (reference=fully immunised; risk=partially immunised).

Variable	Unadjusted			Adjusted		
	Odds ratio	95% CI	P value	Odds ratio	95% CI	P value
Gender						
Male (reference)						
Female	1.047	(0.600-1.827)	0.873	-	-	-
Age (in months) [#]	1.003	(0.985-1.021)	0.755	-	-	-
Religion						
Muslim and others (reference)						
Hindu	2.868	(1.362-6.041)	0.006*	2.843	(1.331-6.072)	0.007*
Place of immunization						
Govt (reference)						
Private	1.509	(1.170-1.947)	0.002*	1.441	(1.108-1.875)	0.006*
Type of family						
Nuclear (reference)						
Extended	1.469	(1.039-2.076)	0.029*	-	-	-
Education status of mother						
Literate (reference)						
Illiterate	1.945	(1.008-3.755)	0.047*	-	-	-
Education status of father						
Literate (reference)						
Illiterate	0.946	(0.486-1.842)	0.870	-	-	-
Birth order						
<2 (reference)						
>2	0.923	(0.372-2.293)	0.863	-	-	-
Place of delivery						
Govt. (reference)						
Private	1.031	(0.634-1.678)	0.901	-	-	-
Type of delivery						
Vaginal (reference)						
Caesarean	1.800	(0.997-3.247)	0.051*	-	-	-
Monthly income (in Rupees) [#]	1.00	(1.00-1.00)	0.247	-	-	-
Immunization card availability						
Available (reference)						
Not available	1.879	(1.068-3.305)	0.029*	2.025	(1.133-3.618)	0.017*

[#]: Continuous variables; *: $p < 0.05$ is statistically significant; CI: confidence interval

DISCUSSION

Immunization against vaccine-preventable diseases is essential to reach one of the Millennium Development Goals. It is also one of the most cost-effective health investments and with proven strategies; it can be made accessible to all the vulnerable populations. Majority of the children were Hindus with equal preponderance of male and female children. Interestingly 93% of the

deliveries were institutional a key objective of National health mission. 65.6% deliveries were conducted in Government health facilities. Astonishingly 91.25% of the immunizations were availed from government facilities. Anganwadi centres remain one of the key place/pillar of immunisation. Surprisingly literacy status was better among mothers than fathers. Though 75% deliveries were vaginal, large number of deliveries [103 (25.75%)] was by caesarian section deliveries. 95.5% of

children had BCG scar which does substantiate that indeed children had received immunisation and the process of vaccination is astonishingly good. Encouraging 89% of children were of birth order less than two.

In the present study proportion of children who were fully immunized as well as immunized up-to-date combined was 84.5% and 15.5% were partially immunized/unimmunised. This was similar to a study done in Bangalore, which showed 86% children were fully immunized, and the rest 14% were partially immunized.¹² The immunization coverage was higher in our study when compared to a study done in Maharashtra where 78.5% were fully immunized and 20.5% were partially immunized.¹³ Another study done in coastal Karnataka gave lower estimate of 64.8% for fully immunized status.¹⁴ In Andhra Pradesh, in 2015-16, the percentage of fully immunized children aged 12-23 months was 65.3%.¹⁰ Various other studies have estimated lesser immunization coverage than our study like those conducted by Mutua et al and Jain et al.^{15,16} The improved immunization coverage in our study when compared to previous studies may be due to multiple reasons like improved coverage by the health system in the recent years, increased awareness regarding immunisation and implementation of mission Indradhanush.

Among the individual vaccines, it was found that the immunization status for BCG & OPV- 0 was highest, which was similar to the findings from most of the other studies.¹⁷⁻²¹ These are the vaccines given at the time of birth, and the highest percentage of vaccination for these is justified as institutional delivery was reported by most, i.e., at Government and private hospitals. Immunization status for subsequent vaccines showed a downtrend. These results are in comparison with the findings by various other studies.²²⁻²⁴ Dropout rates were highest for DPT booster/ 2nd dose of measles. There is a need for strengthening the system to track the children for subsequent immunization.

Among the reasons for un-immunization/ partial immunization, majority (52.1%) expressed that inadequate knowledge about immunization/ subsequent dose was the main reason. Similar observations were made in different studies conducted at Bangalore and Rajasthan.^{12,24} Sickness of the child was another important reason quoted for partial immunization. Thus, there is a need to create awareness among the mothers regarding immunization schedule, alert them with reminders for subsequent doses, maintaining the immunisation card etc.

On univariate analysis factors like religion, mother's education, type of family, type of delivery, place of immunization, and availability of immunization card were found significantly associated with the immunization status. But multivariate Logistic regression

analysis showed that, factors like religion, availability of Immunization card and place of immunization were found to be significantly associated with the immunization status of the child.

There was 2.843 times more risk for a child to be partially immunized if the child religion was Hindu. This finding was in contrary to the Bonu S et al study which showed Muslim children were significantly less likely to be immunized.²⁵ Are the children of Hindus missing the doses increasing? Or improvement in immunisation status among Muslim children opening up the lacunae among Hindu children needs to further evaluated.

Government facilities need to be further strengthened for providing immunisation as majority of mothers are dependent on government centres. Coordination with the ICDS (Integrated child development services) remains the key as Anganwadi centres are the main site of immunisation. Though the percentage of children immunized at private facilities is less, Immunisation status of the children getting immunization at Government facilities was better than those at private facilities. People need to be made aware of the immunisation facilities and proper maintenance of cold chain at government sectors. There is a need for public private partnership to encourage better immunisation status of the children at private facilities.

It was found that immunization cards were not available with majority of respondents making the verification of information provided by them difficult. Children who did not have immunization card had significantly higher odds (2.025) of being partially immunized similar to findings reported by Odusanya et al and Kulkarni et al.^{26,27} Preserving immunisation cards shows that the mothers/family members are interested in immunizing their children. It is unlikely for those without the card to remember about the next immunisation scheduled dates too.

There was no significant association of immunization status with the sex of the child similar to conducted by Odusanya et al and S Phadnis.^{14,26}

CONCLUSION

In the present study, among children aged below 5 years, 32.5% were fully immunized, 52% were immunization up-to-date, 14% were partially immunized, and 0.5% was not immunized. Factors like religion, place of immunization, and availability of Immunization card were found to be significantly associated with the immunization status of the child.

Awareness regarding immunisation, immunisation schedule, maintaining immunisation card, setting reminders to mothers to complete immunisation schedule, tracking the child, public private partnership are some of

the measures to further improve the immunisation status towards attaining the universal immunization coverage.

Government facilities remain the main pillars of immunisation. Coordination with Anganwadi centres is the key. Tracking of the child for subsequent doses of immunisation remains a challenge.

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