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Determinants of Immunization Status Among Children Between 13-24 Months of Age in Maharashtra, India – A Community Based Cross-Sectional Study

Sachin A Gawade[1], Harishchandra D Gore[2], Abhay B Mane[3]*

[1]Assistant Professor, Department of Community Medicine, SKNMC and GH, Pune, India. [2]Associate Professor, Department of Community Medicine, SKNMC and GH, Pune, India. [3]Professor, Department of Community Medicine, SKNMC and GH, Pune, India.

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***Corresponding Author:**
Abhay Mane
Department of Community Medicine
Smt. Kashibai Navale Medical College and General Hospital
S.No. 49/1, Narhe, Off Mumbai - Pune Bypass, Pune - 411 041, Maharashtra
Email: drabmane@gmail.com / psm@sknmcgh.org
Tel/Fax: +912024106271/ +912024699884

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ABSTRACT

Introduction: In India, only 56.3% of children between one to two years of age have received full immunization. In some area, despite of good health care delivery system, immunization coverage is not reaching up to the mark due to some unaddressed issues. Therefore, identification of these determinants will help to improve the immunization status of each child. **Methods:** Community-based cross-sectional study was conducted in the field practice area of the Rural Health Training Centre (RHTC) affiliated to the medical college in Maharashtra, India. The sample of 350 participants was taken from 19 villages in the rural area and 17 administrative wards in the urban area by 'Probability Proportional to population Size' method. All married women in 15-49 years of age, having child in the age group 13- 24 months were included in the study. **Results:** 83.71% children were fully immunized while remaining 16.29% were either partially or unimmunized. The dropout rate for measles compared to BCG was 16.3%. Main reasons for partial and un-immunization were lack of information and forgotten about the date. Occupation of mother, family type, parity, place of delivery and knowledge of immunization were significantly associated with immunization status of child. **Conclusions:** The determinants of immunization coverage if studied locally will help the programme managers to implement programme effectively to increase the overall coverage.

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INTRODUCTION

Immunization is the process by which a any person can be made resistant to an infectious disease by administrating a vaccine [1]. Immunization played crucial role in smallpox eradication program. Therefore in 1974, WHO (World Health Organization) launched "Expanded Programme on Immunization" (EPI). Main aim was to protect a child against six most common, childhood diseases such as polio, tuberculosis, tetanus, diphtheria, pertussis and measles [2] The Government of India also started EPI in 1978 and further renamed as Universal Immunization Programme in 1985 which also includes immunization of pregnant women against tetanus [3, 4] Routine immunization is the most efficient and cost-effective tool of intervention at community level to reduce childhood mortality as well as morbidity. Though routine immunization helped in preventing around 2 to 3 million deaths from vaccine-preventable diseases (VPDs), approximately 14 million infants still did not received any vaccine in the year 2019 and out of them over 1.5 million deaths occurred from the diseases which could be prevented simply by immunization. Majority of these children were coming from developing countries [5].

In India Immunization services are provided free of cost under National Immunization Programme. Governmental and non-governmental agencies are putting all the efforts to achieve 100% immunization coverage, but in some areas the immunization rate remains low [6-11].

According to survey done by NFHS-4 (National Family Health Survey), only 56.3% children between the age group of

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one to two years had received the full immunization in country, while in Maharashtra state only 65.3% children were fully immunized as per DLHS-4(District Level House Hold Survey) [4, 12]. Previous studies showed that various socio-demographic factors and parental knowledge regarding vaccines, have influence immunization coverage [3, 6, 8-10]. Regular evaluation of immunization coverage is necessary to identify determinants causing low immunization coverage and to take necessary corrective actions to strengthen routine immunization process. Therefore, the present study was undertaken to find out immunization coverage among children between age group of 13 to 24 months of age in the rural and urban areas affiliated to medical college and identify various socio-demographic factors associated with incomplete immunization in Maharashtra region.

MATERIALS AND METHODS

Present Community based cross-sectional study was conducted in the rural and urban areas under the Rural Health Training Centre (RHTC) affiliated to medical college in Maharashtra, India. Under RHTC there were seven sub centers having 19 villages with total population of 44,472 and an urban area having 17 wards with a population of 37,135. All married women in the age group of 15-49 years and who had a child in the age group 13- 24 months were included in the study and those who did not willing to participate were excluded. Before the commencement of the study, approval was taken from the Ethical Committee of the Medical College. The willingness of participant was confirmed after informed consent.

Sample Size Estimation

On basis of immunization coverage of Maharashtra sample size was calculated. According to District level household & facility survey (DLHS-4)[13], percentage of fully immunized children in Maharashtra state was 66.2%. Sample size was calculated with help of formula as below:

$$n = [DEFF*Np(1-p)]/ [(d2/Z21-\alpha/2*(N-1)+p*(1-p)]$$ (14)

where n′ = sample size, N = Population size, Z = Z statistic for a level of confidence 95% P = Expected proportion DEFF = Design Effect.

(95% confidence level & 5% absolute precision)

The calculated sample size was 344. Therefore 350 participants were included in the study

Sampling Procedure

The sampling was done by PPS (Probability Proportional to population Size) method suggested by WHO for health surveys.(15) First, field area was divided into rural and urban areas. The sample was divided according to Probability Proportional to population Size (PPS) into respective 19 villages in the rural area and 17 wards in the urban area to obtain the desired sample of 350. In each village in rural area and ward in urban area, all the lanes were identified and numbered with help of a map and one lane was selected randomly. Within the selected lane all the households were identified. The first household in the lane was selected randomly and subsequent households were visited as per right-hand rule to obtain the desired sample size in particular area.

Data Collection and Analysis

Data was collected using a pretested and structured questionnaire. Information collected regarding socio-demographic factors, age, education, religion, occupation, income, type of family, parity, area of residence, place of deliver and immunization status of a child. Information was verified with available immunization card, discharge card and examining BCG scar. The level of knowledge about immunization of mothers was assessed depending on the number of vaccines and its time of vaccination that they were able to mention. Those who could not mention any type of vaccine or time of vaccination had poor knowledge. Those who able to mention 1 -3 had partial knowledge and > 3 types of vaccine and its schedule had good knowledge.(8) Data was collected, compiled, and tabulated with help of Microsoft Excel 2007. The analysis was done using proportions. Association between attributes was tested by the Fisher's exact test and Chi-square test with the help of Epi-Info and Open-Epi statistical software.

Operational Definition [4, 12, 13]

Fully immunized Child

Child who has taken at least one dose of BCG, one dose of measles and, three doses of DPT, Hepatitis-B and OPV before completion of 12 months of age.

Partially Immunized Child

Child who has missed even a single dose of any vaccine mentioned above.

Unimmunized Child

Child who has never received any vaccine at all.

RESULTS

Table 1 shows distribution of socio-demographic determinants of study participants.

As shown in Table 2, 83.71% children were fully immunized and remaining 16.29% children were either partially immunized or unimmunized against six vaccine-preventable diseases.

Table 3 shows that 97.4% mother had preserved the immunization card. The individual vaccine coverage was concerned, highest coverage was reported for BCG (100%) and lowest for measles (83.7%). Table 3 shows, about 92.9 % children had received third dose of DPT, Hepatitis B, and OPV. Therefore, the dropout rate of 3rd dose of OPV, DPT and hepatitis B as compared to first dose was 6.28 %, and for measles compared to BCG was 16.3%. Main reasons for partial and un-immunization were lack of information about schedule of immunization (36.84%), forgotten due date of next dose of immunization (31.58%) and child sick on the due date (22.81%), other reasons.

The association between various socio-demographic factors and immunization status of child mentioned in table.5. The proportion of partial immunization or un immunization was significantly more in mothers who were working, living in a nuclear family, delivered at home and having partial or no knowledge about the vaccine.

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Table. 1. Socio-demographic profile of study participants

Age of mother in Years	Frequency (n=350)	%
15 - 19	4	1.14
20 -24	197	56.29
25 -29	132	37.71
30 - 34	14	4.00
>34	3	0.86
Religion		
Hindu	322	92
other	28	8
Literacy(Mother)		
Illiterate	14	4.00
Primary (1st - 4th std.)	32	9.14
Secondary (5th - 10th std.)	160	45.71
Higher secondary (11th - 12th std.)	119	34.00
Graduate & Above	25	7.14
Occupation (Mother)		
Working	44	12.57
Housewife	306	87.43
Type of Family		
Nuclear	132	37.7
Joint	218	62.3
Parity		
1	153	94
2	166	73
≥3	31	13
Area of residence		
Rural	190	54.29
Urban	160	45.71
Modified B.G. Prasad classification For socioeconomic status (2018)*		
I(Upper Class)	38	10.86
II(Upper middle Class)	117	33.43
III (Middle Class)	78	22.29
IV (Lower middle Class)	89	25.43
V (Lower Class)	28	8.00
Gender of child		
Male	181	51.71
Female	169	48.29
Place of delivery		
Institutional delivery	346	98.86
Home delivery	4	1.14
Correct knowledge about vaccine**		
Good	13	3.71
Partial	274	78.29
Poor	63	18.00

*Per month Per capita income in Indian currency(Rupee) of different Socio Economic Class as follows : Class I- 6574 and above, Class II- 3287 to 6573, class III-1972 to 3286, Class IV 986 to 1971, Class V-985 and Below

**The level of knowledge about immunization of mothers was assessed depending on the number of vaccines and its time of vaccination that they were able to mention. Those who could not mention any type of vaccine or time of vaccination had poor knowledge. Those who able to mention 1 -3 had partial knowledge and > 3 types of vaccine and its schedule had good knowledge.

Table. 2. Immunization status of children

Immunization coverage	Frequency (n=350)	%
Fully Immunized child	293	83.71
Partially immunized child	54	15.43
Unimmunized child	3	0.86
Total	350	100.00

Table. 3. Coverage for individual immunizing

Sr no	Parameter	Yes (%)	No (%)
1	Immunization card available	341(97.43)	9(2.57)
2	Mother read complete immunization card	93(26.57)	257(73.43)
Immunization			
3	BCG, OPV	350(100)	0(0.00)
4	OPV1, DPT1, HBV1	345(98.57)	5(1.43)
5	OPV2, DPT2, HBV2	332(94.86)	18(5.14)
6	OPV3, DPT3, HBV3	323(92.29)	27(7.71)
7	Measles, Vit. A	293(83.71)	57(16.29)

Table no 4: Common reasons (multiple responses) for partial/ unimmunized children

Sr.No	Reasons	Frequency (n=57)	%
1	Lack of information	21	36.84
2	Forgotten about date	18	31.58
3	Child sick on due date	13	22.81
4	Time not convenient	9	15.79
5	Long waiting time	9	15.79
6	Distance is too far	8	14.04
7	Vaccine not available	6	10.53
8	Fear of side effects	2	3.51
9	Other	4	7.02

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Table. 5. Determinants of immunization status

Age in Years	Completely Immunized n=293 (83.71%)	Partially+ Unimmunized n=57 (16.29%)	Total n=350 (100%)	chi square value (df)	p
15 - 19	3(75.00)	1(25.00)	4(100)		
20 -24	166(84.26)	31 (15.74)	197 (100)		
25 -29	108(81.82)	24(18.18)	132 (100)	1.72	>0.05
≥30	16(94.12)	1(5.88)	17 (100)	df=2	
Religion					
Hindu	269(83.54)	53(16.46)	322 (100)		
other	24(85.71)	4(14.29)	28 (100)	0.08	>0.05
Literacy (Mother)					
Illiterate	12(85.71)	2(14.29)	14 (100)		
Primary (1st - 4th std.)	24(75.00)	8(25.00)	32 (100)		
Secondary (5th - 10th std.)	133(83.13)	27(16.88)	160 (100)	2.5	>0.05
Higher secondary (11th - 12th std.)	103(86.55)	16(13.45)	119 (100)	df=4	
Graduate & Above	21(84.00)	4(16.00)	25 (100)		
Occupation					
Working	33(75.00)	11(25.00)	44 (100)	2.8	<0.05
Housewife	260(84.97)	46(15.03)	306 (100)		
Type of Family					
Nuclear	103(78.03)	29(21.97)	132 (100)	5.02	<0.05
Joint	190(87.16)	28(12.84)	218 (100)		
Parity					
1	119(77.78)	34(22.22)	153 (100)		
2	149(89.76)	17(10.24)	166 (100)	8.62	<0.05
≥3	25(80.65)	6(19.35)	31(100)	df=2	
Area of residence					
Rural	164(86.32)	26(13.68)	190(100)	2.06	>0.05
Urban	129(80.63)	31(19.38)	160 (100)		
Gender of Child					
Male	155(85.64)	26(14.36)	181 (100)		
Female	138(81.66)	31(18.34)	169 (100)	1.02	>0.05
Socio Economic Class (Modified B.G. Prasad classification- 2018)					
I (Upper Class)	32(84.21)	6(15.79)	38 (100)		
II (Upper middle Class)	98(83.76)	19(16.24)	117 (100)	0.4	>0.05
III (Middle Class)	64(82.05)	14(17.95)	78 (100)	df=4	
IV(Lower middle Class)	76(85.39)	13(14.61)	89 (100)		
V (Lower Class)	23(82.14)	5(17.86)	28 (100)		
Place of delivery					
Institutional delivery	292(82.10)	54(17.90)	346 (100)	Fisher exact	
Home delivery	1(25.00)	3(75.00)	4(100)		<0.05
Correct knowledge about vaccine					
Good	13(100)	0(0.00)	13 (100)	24.45	<0.001
Partial	240(87.59)	34(12.41)	274 (100)	df= 2	
No knowledge	40(63.49)	23(36.51)	63 (100)		

df - degree of freedom

DISCUSSION

Present study shows fully immunized children were 83.71% while remaining 16.29% either partially or unimmunized. Therese observations were comparable to the study done by Bhatt *et al* [16]. where the immunization coverage was 83.4-86.4% in Gujarat state . In present study only 3 (0.86%) children were unimmunized which might be lesser than actual as we selected next house hold if house was locked to obtain desired sample size in selected area which may had unimmunized child. Estimated coverage was more as compared to figures for India (NFHS-4) [12] and Maharashtra state (DLHS-4) [13], where 62.0% and 62.2% children had received complete immunization. Reported higher coverage of immunization in present study probably attributed to availability of health services in the study area through dedicated RHTC of medical college.

In the present study 97.43% mother had immunization card of baby but only 26.57 % had read it completely. Another study done in Pune district of Maharashtra by Gupta *et al* [3] reported that the immunization card was available only in 60.95% with the mothers. Overall, the BCG coverage in present study was 100% while for Measles vaccination it dropped to 83.71%. Almost similar findings were noted with respect to BCG

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vaccination in other studies conducted in various parts of country [6, 10, 16] Observed coverage was higher compared to overall BCG coverage of India and of Maharashtra [12, 13] The high coverage of BCG was mainly attributed to higher numbers of institutional deliveries (98.86%) in study area. Similar pattern of high BCG coverage and institutional deliveries was observed in other studies conducted in different parts of India. [16-18] Present study shows low dropout rates from BCG to DPT-1(1.43%) compared to BCG to measles (16.29%). These results were quite consistent with the studies conducted in the other Indian states like Gujarat and Tamilnadu by Bhatt GS *et al*. [16] and Murugesan D *et al*. [19] respectively. We also observed that the dropout rates between BCG and measles were less compared to India as well as Maharashtra state [12, 13] Same findings were reported in other studies [6, 9, 12] conducted in various parts of country might be due to better availability and accessibility of health services. Present study shows, the most common reasons which halts immunization of the child were lack of information about the correct schedule and time of the subsequent dose(36.84%), forgotten about due date(31.6%) and child was sick on due date (22.8%). Similar causes were also observed in another study conducted in western Uttar Pradesh by Agrawal *et al* [6] where lack of knowledge (37.7%), forgetfulness (33.7%) and illness of child (25.5%) were the most commonly observed reasons for partial or unimmunization. A study conducted at Udaipur, Rajasthan, India by Pahwa HS et al. [9] showed lack of knowledge regarding immunization (4.4%), no faith in vaccination (14.8%) and customs and beliefs (25%) were the main reasons for partial or unimmunization.

In present study maternal age, religion, literacy of mother, literacy of father, occupation of father, socio economic status and gender of child did not show any significant association with immunization status of child in contrast to study done by Agrawal *et al* [6] where literacy of mother, literacy of farther, occupation of father, socio economic status and gender of child showed significance association with immunization status of child.

In present study 84.97% children of housewife were completely immunized compared to 75% of working women which is statistically significant. Similar observations were noted by Kurane *et al* [20] where 66.01% children of housewife were completely immunized, but in other studies [8, 17] did not show any significant influence of occupation of mother on immunization status of children. Present study shows completely immunized children is significantly less in nuclear family (78.03%) compared to joint family [87.16]. Similar results were observed in study done in Bhojpur district Bihar by Pande *et al*.(10) and Murugesan *et al*.(19) Children who delivered in institute shows higher proportion of complete immunization compared to children delivered at home similar finding were noted by Pandey S[10] *et al*, Pahwa HS et. al. [9] and Datta A *et al* [17]. In present study, area of residence also did not show any significant difference in immunization status of children which were consistent with other studies [6, 21].

CONCLUSION

In this study we found that the overall coverage of immunization in study area was better than national average. Important socio-demographic determinants like place of delivery, occupation of mother, type of family, parity and knowledge about immunization were significantly associated with complete immunization status of child. Major reasons for incomplete Immunization like lack of knowledge about correct schedule and the time of the subsequent dose can be addressed by increasing the awareness about the importance of childhood immunization in the community. Health workers should be motivated to increase awareness among mother about importance of timely immunization and educate them about utility of immunization card.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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