

An Evaluation of Primary Immunization Coverage in the rural area of Western Maharashtra, using the WHO Thirty by Seven Cluster Sampling Technique

¹Dr. Vilas Sarjerao Mane, MD, Department of Community Medicine, Dr. Vaishampayan Memorial Govt. Medical College, Solapur.

²Dr. Gajanan M Jatti, Associate Professor, Department of Community Medicine, Dr. Vaishampayan Memorial Govt. Medical College, Solapur.

³Dr. Viresh A. Nandimath, Assistant Professor, Department of Community Medicine, Dr. Vaishampayan Memorial Govt. Medical College, Solapur.

⁴Mr. SM. Mulje, Statistician Cum Assistant Professor, Department of Community Medicine, Dr. Vaishampayan Memorial Govt. Medical College, Solapur.

Corresponding Author:Dr. Vilas Sarjerao Mane, MD, Department of Community Medicine, Dr. Vaishampayan Memorial Govt. Medical College, Solapur.

How to citation this article:Dr. Vilas Sarjerao Mane, Dr. Gajanan M Jatti, Dr. Viresh A. Nandimath, Mr. SM. Mulje, “An Evaluation of Primary Immunization Coverage in the rural area of Western Maharashtra, using the WHO Thirty by Seven Cluster Sampling Technique”, IJMACR- January- 2024, Volume – 7, Issue - 1, P. No.35–44.

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Type of Publication:Original Research Article

Conflicts of Interest: Nil

Abstract

Background: Immunization is amongst the most cost-effective public health interventions for reducing global childhood morbidity and mortality. Vaccine-preventable diseases are major causes of under- 5 children in India. The objective of study was to determine the immunization coverage and find out the various factors and its reasons for partial or non-immunization of child.

Material and Methods: A community-based cross-sectional study has been conducted among the children of 12 to 23 months age group from rural area, under the rural field practice area of Department of Community

Medicine, Government Medical College, using WHO 30x7 cluster Sampling technique for a period of one year. A pre-designed, pre-tested questionnaire has been used to collect required information with verification of immunization card and where the card is not available, by examination of scar mark or interviewing the respondent. Data has been analysed using computer software SPSS version 21.0 and data are expressed in the form of diagrams and tables in percentages.

Results: Out of total 210 children between 12-23 months age group surveyed, 46.20% were males and

53.80% were females, and 165(78.56%), were fully immunized and 45(22.44%), were partially immunized.

Conclusion: Higher coverage of Full immunization in our study population indicates better access to immunization services by the selected rural population of Maharashtra.

Keywords: Immunization coverage, Full immunization, WHO 30X7 Cluster, Rura areal.

Introduction

Infectious diseases are major cause of morbidity and mortality in children[1]. One of the most cost effective and easy methods for the child survival is immunization[2]. In May 1974, The World Health Organization (WHO) officially launched a global immunization programme known as Expanded Programme of Immunization EPI to protect all the children of the world against six vaccine preventable diseases by the year 2000[3]. Following the successful launch & implementation of universal Immunization programme in 1985, there has been considerable reduction in vaccine preventable diseases[4]. In 2005, some of the initiatives undertaken by the government under NRHM so strengthen the immunization by mobilization of children and pregnant Women by ASHA/Inked workers to increased coverage [5]. Urban Slums constitute one of the high-risk areas for the vaccine preventable diseases [6]. About one -quarter or 25% of the under - 5 mortality is due to vaccine preventable diseases [7]. In India, immunization services offered free in public health facilities, but despite rapid increases, the immunizations rate remains low in some areas [8]. Globally over 70% of infants who do not receive three doses of vaccine against diphtheria, tetanus, and pertussis, live in Africa and Asia (more than third live in India alone) [9]. Immunization program in

India was Started with aim to protect the children from vaccine preventable diseases, due to suboptimal immunization Coverage in UIP, this programme has achieved only partial Success in reducing the burden of VPD's[10].

World Health Assembly endorsed the Global Vaccine Action Plan in 2012 to extend immunization to all children across the globe GVAP's key targets include achieving and sustaining 90% national Penta coverage and greater than equal to 80% Penta coverage in every district by 2015[11]. Currently the world including India is facing COVID- 19 pandemic. All government are trying hard to control this pandemic Health services department all over the country at each level is trying to control COVID -19. Due to this other health important care services may be affected, and immunization services is one of them. In India according to the National Family Health Survey-4(2015-16), 62% of children between age group 12-23 months were fully immunized [12]. In Maharashtra according to the National Family Health Survey-4 (2015-16) & (NFHS-5) 2019-20, 56.2% and 73.5% of children between age group 12-23 months were fully immunized respectively [13]. In rural proportion of children fully immunized in age group between 12-23 months is 74.7% according to NFHS-5[14].

The present study is planned to find out immunization coverage and the reasons for partial or non-immunization of children in rural area and various factors affecting the immunization coverage.

Material & Methods

A Community based Cross-Sectional Study was conducted during March 2021 to October 2022 in an rural area under the department of community medicine of a tertiary care center, catering population of

approximately 44457. The sampling size of 210 was determined according to the WHO 30x7 cluster sampling method. 30 clusters from the study area were identified and from each cluster 7 children were taken into the study.

Inclusion Criteria

Children aged between 12-23 months at the time of study. Children in the age group of 12-23 months whose parents are residing in the study area for a period of ≥ 2 years. Children whose parents willing to give consent for participating in the study.

Exclusion Criteria

Those children who are seriously ill. Those children who advised by paediatrician not take immunization for any reasons, Any other contraindications for immunization.

Sample size calculation

A total of 30 clusters from all 40 rural areas (villages) will be selected through 30x7 cluster sampling method as proposed by WHO. A total of 7 children from each cluster will be taken in study i.e., $30 \times 7 = 210$ children from rural areas were taken. Thus, giving us the sample size of 210. The village wise population and cumulative population of the study area will be noted. The sampling interval is calculated by dividing total cumulative population by 30. Then a random number \leq sampling interval will be drawn, and the first cluster will be identified, thus by adding sampling interval to the random number next clusters will be identified till the 30 clusters. All the decimals are rounded off to the nearest whole number. Selecting a random number which is less than or equal to sampling interval with equal number of digits. First cluster located in which cumulative population equals or exceeds the random number. Identifying the community in which cluster two is located by adding the sampling interval to the random

number. Identify the village whose cumulative population equals or exceeds the calculating number. Once the 30 clusters identified, then select children within each cluster. Starting point in each cluster that is the start of first household will be done by a random method. Seven children will be selected from each cluster by moving in one direction till the desired number of children will be completed. If a house found locked, then next house in the lane having child eligible for study will be selected. If there will be more than one eligible child available in the house, all of them will be selected by random method. Information collected using a pretested Semi structure questionnaire using door to door approach after explaining the purpose of informed consent. Immunization card will be verified physically to validate information and confirm the date of vaccination. If the immunization card not available, the verification will be done by BCG scar and interviewed the respondent during the home visit for every child.

Cluster identification in rural area: Sampling interval = Total cumulative population / Number of Clusters. Sampling interval = $44457 / 30 = 1481.9 = 1482$

Cluster Number 1. 0001 to 1482 Random number chosen from a currency note of RS. 100 which was OEM691170. The last four digits were less than sampling interval. Therefore, the random number is 1170. The first cluster is located in which the cumulative population equal or exceeds the random number is 1338 the first cluster located.

Data Analysis

Information collected using the above mention method is converted into a computer-based Excel sheet. All data have been expressed in terms of numbers and percentages. Data analysis done using SPSS-21.0

statistical software. Data will be represented in tabular and graphical format.

Immunization of status	Definitions
Fully immunized	Children who had received BCG and three doses of DPT(PENTA)/OPV and measles vaccine as scheduled in the first year of life were classified as fully immunized[15].
Partially-immunized	Those children who had missed any dose of six primary vaccines were labelled as partially immunized[15].
Non-immunized	Those children who had not received any vaccine, except OPV in PPI, up to 12 months of age were defined as non-immunized[15][].
Cluster	A small group that is part of a population that is being surveyed; for the purposes of evaluating immunization coverage, a cluster is defined as seven or more children in the age range being evaluated[16].

Results

Out of 210 children, 97(46.20%) were males more than females 113(53.80%). Most of the children were 148(70.48%) Hindu followed by 44(20.95%) were Muslim. The majority children from rural area 99(47.15%) belonged to three generation family. Most of the mothers of children from rural area educated up to

Secondary school and College were 98 (46.66%), and 98 (46.66%). Immunization card was available at all children 210(100%) from rural area. 45 children from rural area were partially immunized. In rural area, 20(44.45%) were obstacles of immunization from rural area. 11 (24.44%) children’s parents were having lack of motivation. Only 3 (6.67%) children’s parents had fear of covid19 and 11(24.44%) were lack of information from rural area respectively. (Table 1 & 2)

Table1: Distributions of children according to their Socio-demographic Characteristics in rural area (N=210)

Variables	Characteristics	Total N=210(%)
Gender of children	Male	97(46.20%)
	Female	113(53.80%)
Age in months	<18 months	146 69.52%)
	≥18 months	64(30.48%)
Religion	Hindu	148(70.48%)
	Muslim	44 (20.95%)
	Buddha	12 (5.72%)
	Others	6 (2.85%)
Type of Family	Nuclear family	91(43.33%)
	Joint family	20(9.52%)
	Three generation family	99(47.15%)
Mother’s education	Illiterate	7(3.34%)
	Primary	7(3.34%)
	Secondary	98(46.66%)
	College and above	98(46.66%)
Father’s education	Illiterate	5(2.38%)
	Primary	7(3.34%)
	Secondary	78(37.14%)

	College and above	120(57.14%)
Occupation of mother	House wife (Not working)	194(92.38%)
	Working	16(7.62%)
Socioeconomic status (Modified BG Prasad's Classification)	Class-I	16(7.61%)
	Class-II	37(17.62%)
	Class-III	66(31.43%)
	Class-IV	75(35.73%)
	Class-V	16(7.61%)
Immunization card	Available	210(100%)
	Not Available	0 (0%)

Table 2: Reasons of partial or non-immunization of children in Rural area

Reasons of immunization failure	Rural area (N=45)
Lack of information	11(24%)
Unaware of need of immunization 2 nd dose	3(27.27%)
Unaware of need of immunization	2 (18.19%)
Place of immunization unknown	3 (27.27%)
Fear of side reactions	3 (27.27%)
Lack of motivation	11(24.44%)
Postponed until another time	7 (63.63%)
No faith in immunization	4 (36.36%)
Obstacles	20(44.45%)
Child ill but not brought	10 (50%)
Place of immunization too far	7 (35%)
Mother too busy	3(15%)
Fear of Covid 19	3 (6.67%)

Pie chart-Showing of Immunization status of children in rural area

Out of 210 children, fully immunized 165(78.56%), partially immunized 45(22.44%), Non immunized 0(0%) from rural area.

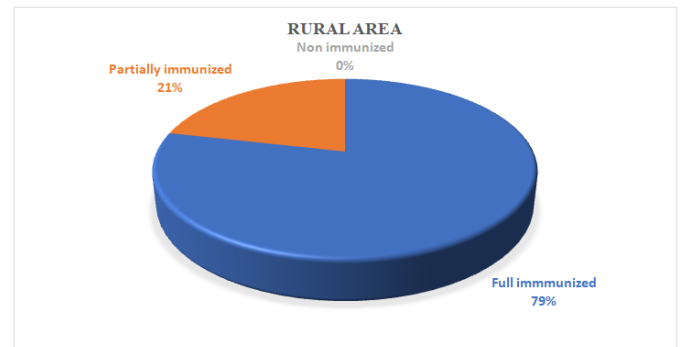


Table 3: Showing Association Between immunization status with variables

Variables	Category	Immunization status (N=210)		X ² =Chi-square test, DF=Degree of Freedom, P=Test of significance
		FI* (165) N (%)	PI* (45) N (%)	
Gender	Male	81(83.50)	16(16.50)	X ² =2.60, DF=1, P>0.05, Statistically not Significant
	Female	84(74.33)	29(25.67)	
Religion	Hindu	115(69.69)	33(73.30)	X ² =0.33, DF=3, P>0.05, Statistically not Significant
	Muslim	35(21.21)	9(20)	
	Buddha	10(6.06)	2(4.44)	
	Others	5(3.03)	1(2.22)	
Type of Family	Nuclear family	66(73)	25(27)	X ² =3.48, DF=1, P>0.05, Statistically not Significant
	Joint family*	99(83)	20(17)	
Education of mother	Illiterate	1(14.28)	6(85.71)	X ² =18.9, DF=3, P<0.05, Statistically Significant
	Primary school	5(71.42)	2(28.57)	
	Secondary school	77(87.57)	21(21.42)	
	College and above	82(83.67)	16(16.32)	

SES*	Class-II*	42(79)	11(22)	X ² =0.49, DF=3, P>0.05, Statistically not Significant
	Class-III	53(80)	13(20)	
	Class-IV	57(76)	18(24)	
	Class-V	13(81)	3(19)	
Immunization card	Yes	165 (78)	45 (22)	Fisher's exact- Test=1.0, DF=1, Not Significant
	No	0(0)	0(0)	
Occupation of mother	House wife (Not working)	153 (78.86)	41 (21.14)	X ² =0.13, DF=1, P>0.05, Statistically not Significant
	Working	12(75)	4(25)	
FI*-Fully Immunized, PI*-Partially Immunized, NI*-Non-Immunized, Class I* Merged with Class II by applying test, SES*-Socioeconomic Status.				

Discussion

The present study was carried out to assess the immunization status of children of aged 12-23 months in rural area under the department of Community Medicine. **Table No.1** shows the distribution of the children according to their Socio-demographic Characteristics(N=210), 97(46.20%) males were more than females 113(53.80%). Similarly in the study using Evaluation of Immunization Coverage in the Rural Area of Pune city carried out by **Pankaj Kumar Gupta, et al**¹⁷ using the 30 Cluster Sampling Technique Observed that 113 (53.8%) were males and 97 (46.2%) were females. The proportion of less than 18 months children is almost two times the rural area in the present study. The children from rural area 148 (70.48%) were Hindu, 44(20.95%) were Muslim, 12(5.72%) were Buddhist and 6(2.85%) were from other religions. Most of the children belonged to the Hindu religion. Similar findings were observed by **Vilas R. Malkar, et al (2013)**¹⁸ in his study in rural population of Beed district. He found children belonging to Hindu were 167(79.52%), Muslim were

31(14.76%), Buddhist were 6(2.85%) and others religion were 6(2.86%) respectively. The children from rural area, 91(43.33%) belonged to nuclear family, 20(9.52%) belonged to joint family and 99(47.15%) belonged three generation family. Quite different findings were observed by **Vilas R. Malkar, et al (2013)**¹⁸ in his study in rural population of Beed district where he found children belonging to nuclear family were 62(29.52%), joint family were 144(68.57%), & three generation family were 4(1.91%). respectively. This difference could be explained by different family size in different geographical area of the present study and study by Vilas R. Malkar. The present study shows that, mothers of children from rural area educated up to Primary school, Secondary school and College were 7 (3.34%), 98 (46.66%), and 98 (46.66%) respectively. **Vilas R. Malkar, et al (2013)**¹⁸ in their study in rural population of Beed district. They have found that 51(24.28%) children had illiterate fathers, 44(21%), 87(41.42%), 28(13.33%) children had fathers educated up to primary school, secondary school and graduate respectively. A study conducted at rural population block Malpura, district Tonk, Rajasthan by **Govind Singhal, et al (2016)**¹⁹ found that mothers of 140(66.67%) children were housewife (not-working) and 70(33.33%) were working. In rural area of Jaipur city by **Laxmi Nidhi Pandey, et al (2015)**⁶³ in their study found 187(89.04%) children had immunization card and 23(11%) children had not immunization card. Immunization card was available at all children 210(100%) from rural area **Govind Singhal, et al (2016)**¹⁹ in the study rural population of block Malpura, District. They found 127(60.47%) children had immunization card and 83(39.53%) children had not immunization card.

Table No.3 shows the distribution of the children according to various variables in rural area. Out of 210 children, 165(78.56%) fully immunized, 45(21.42%) partially immunized children were from rural area. In our study coverage of fully immunization was more in rural area. This is in concordance with a study conducted by **Venkatachalam B et al (2015)**⁷⁶ in and around Hyderabad district where full immunization coverage seen more in rural area 88%.

According to **National Family Health Survey-4(2015-16)**¹³ the proportion of fully immunized children were 62% and as per **NFHS-5 (2019-2020)**^{14,15} it was 81.7% and the coverage of fully immunized children at Maharashtra state level was 73.5% (74.7% rural). The fully immunized children were more in the current study as compared to NFHS-4 and NFHS 5. Although the proportion of fully immunized females from rural area are more as compared to the males from rural area. In rural area of Beed district **Vilas R Malkar, et al (2013)**⁵⁷ found immunization status of males were better than that of females as 90(81.08%) males and 75 (75.76%) females were found to be fully immunized.

115(69.69%), 33(73.30%), fully immunized, partially immunized and Hindu children were from rural area respectively. 35(21.21%), 9(20%) fully immunized, partially immunized, and Muslim children were from rural area respectively. In rural population of block Malpura, district Tonk, Rajasthan, **Govind Singhal, et al (2016)**¹⁹ found from Hindu religion children the proportion of completely immunized children were 121(81.20%) and partially immunized children were 29(58%). while from muslim religion, proportion of completely immunized children were 28(18.79%) and proportion of partially immunized children were 21(42%). The proportion of fully immunized children

from Hindu and Muslim religion, are comparable with the current study findings.

In rural area 66(73%), 25(27%), fully immunized, partially immunized, children belong to nuclear family respectively. While 99(83%), 20(17%), fully immunized, partially immunized, children belong to joint family respectively. A study conducted in rural population of block Malpura, district Tonk, Rajasthan Ruchi by **Govind Singhal et al (2016)**¹⁹ found 90(71.42%) fully immunized children and 30(23.80%) partially immunized children belong to nuclear family while 59(70.23%) fully immunized children and 20(23.80%) partially immunized children belong to joint family. The similar proportion of fully immunized children in nuclear and joint families was found by Govind Singhal. In rural area 77(87.57%) & 82(83.67%) fully immunized children had mothers educated as secondary school and college & above respectively. while 21(21.42%) and 16(16.32%) partially immunized children had mothers educated as secondary school and college & above respectively. In rural area no child was nonimmunized. The present study shows that as the education of mothers increased, the coverage of fully immunised children also increased. This fact highlights the role of female education for the utilization of child health services is important. The proportion of fully immunized children who had illiterate mothers are less in the present study as compared to the study by **Govind Singhal**¹⁹. But the proportion of fully immunized children who had literate mothers are comparable with the current study findings. In rural area 42(79%), 53(80%), 57(76%) and 13(81%) fully immunized children belong to class II, class III, class IV and class V socioeconomic status respectively. While in rural area 11(22%), 13(20%), 18(24%) and 3(19%) partially immunized children belong to class II,

class III, class IV and class V socioeconomic status respectively. A study conducted by **Vilas R Malkar et al (2013)**¹⁸ in rural population of Beed district found that 19(90.48%), 112(82.35%) and 32(62.75%) fully immunized children were from class III, Class IV and Class V respectively. While 2(9.52%), 24(17.65%), and 17(33.33%) partially immunized children were from class III, Class IV and Class V respectively. These study results are different from the present study findings. All children (100%) from rural area had immunization card. and in the rural area 165(78%), 45 (22%), 0(0%) fully immunized, partially immunized and nonimmunized children had immunization card from rural area respectively. A study conducted in rural area of Jaipur city, Rajasthan by **Laxmi Nidhi Pandey, et al (2016)**⁶³ found 152(81.3%) fully immunized children had immunization card and 35(18.7%) partially immunized children had immunization card respectively. Thus, more fully immunised children had immunization card as compared to partially immunised children. These study results are comparable with current study findings. The mothers of 153(78.86%), 41(21.14%) & 0(0%) fully immunized, partially immunized and nonimmunized children respectively in rural area were not working. and mothers of 12(75%), 4(25%) & 0(0%) fully immunized, partially immunized, and nonimmunized children respectively in rural area were working. In rural area of Beed district, a study conducted by **Vilas R Malkar et al (2013)**⁵⁷ found that mothers of 79(84.95%) fully immunized children and mothers of 14(15.05%) partially immunized children were not working (Housewife) respectively and mothers of 86(73.5%) fully immunized children and mothers of 29(24.79%) partially immunized children were working mothers (Not Housewife)

respectively. This finding is similar with the current study findings.

Various variables studied was, Gender, Religion, Type of family, Socioeconomic status, Immunization card and, Occupation of mother. Out of which Education of mother and Immunization status of children was found significant ($P < 0.05$). In rural area, 20(44.45%) children had obstacles like illness, too far away the distance of the immunisation session from their house, mother was too busy etc. 11 (24.44%) children's parents were having lack of information. 11 (24.44%) children's parents found unmotivated. Only 3 (6.67%) children's parents had fear of covid 19. **Laxmi Nidhi Pandey et al (2016)**⁶³ conducted a study in rural area of Jaipur city, Rajasthan found immunisation failure in 136(64%) children. The reasons of immunization failure among them found as obstacles 40(29.4%), lack of information 46(33.8%) and lack of motivation 50(36.8%). The lack of information and lack of motivation, these two reasons were more in the study by Laxmi as compare to present study.

Conclusion

The present study shows that as the education of mothers increased, the coverage of fully immunised children also increased. Education helps in better understandings of the health care needs of individual and hence improves the health seeking behaviour. The reason behind better immunization coverage in rural area could be due to better infrastructure and manpower in peripheral health institution especially after launch of National Health Mission. The availability of immunization card were also the major determinants of immunization status and can act as a reminder for next immunization session. It is one of the important tools for assessing immunization status.

Ethical Considerations: Institutional Ethical Committee permission was taken before conducting study.

Acknowledgment: We also thank Dr Gajanan Jatti for their constant support through-out the study. I would like to thank Mr. S.M. Mulje, Statistician at Dr. VMGMC, Solapur for his contribution in data analysis.

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