



# A Cross Sectional Study on Vaccination Coverage of Children in the Urban Slums of Bangalore

Manuja LM<sup>1</sup>, Viswanatha PG<sup>2</sup>, Veena NH<sup>3</sup>, Ranganath TS<sup>4</sup>

**Financial Support:** None declared

**Conflict of Interest:** None declared

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## How to cite this article:

Manuja LM, Viswanatha PG, Veena NH, Ranganath TS. A Cross Sectional Study on Vaccination Coverage of Children in the Urban Slums of Bangalore. Natl J Community Med 2018; 9(10): 745-750

## Author's Affiliation:

<sup>1</sup>Asst Prof, Dept of Community Med, Adichunchanagiri Institute of Med Sci, B.G. Nagar; <sup>2</sup>Tutor, Dept of Community Med, Shimoga Institute of Med Sci, Shimoga; <sup>3</sup>Statistician, Dept of Community Med, Adichunchanagiri Institute of Medical Sciences, B G Nagar; <sup>4</sup>Prof & Head, Dept of Community Med, Bangalore Medical College and Research Institute, Bangalore

## Correspondence

Viswanatha PG  
vgowda300@gmail.com

**Date of Submission:** 10-02-18

**Date of Acceptance:** 13-10-18

**Date of Publication:** 31-10-18

## ABSTRACT

**Background:** Despite their public health benefit, vaccination programs face obstacles. The objectives of the study were to determine the vaccination coverage among the children in urban slums in Bangalore and to determine the factors associated with partial immunization.

**Methodology:** This cross sectional study was carried out among 210 children aged between 12-23 months in urban slums of Bangalore from June 2015 to May 2016 using 30-cluster survey method. Information regarding immunization status, socio demographic and personal details was collected using pretested semi structured questionnaire after obtaining the consent. Data was entered in MS EXCEL and was analyzed, using percentages and chi square test.

**Results:** Among 210 children, Male children constituted 53.8%. Full immunization coverage was 83.3% and Partial immunization coverage was 16.7%. The relation between socio demographic variables like religion, type of family, total number of children in family, birth order, place of delivery, father's and mother's educational status, socioeconomic status and immunization status was found to be statistically significant.

**Conclusion:** Illiterate father, illiterate mother, low socio economic status, no exclusive breast feeding and non availability of immunization card were determinants of partial immunization.

**Key words:** Vaccination coverage, Partial immunization, children, urban slum

## INTRODUCTION

The written description of concept of immunity was first made by Thucydides in 430 B C when the plague hit Athens. But later it was Louis Pasteur's Germ theory of diseases which explained how bacteria causes disease and following the infection how human body gained resistance against that disease.<sup>1</sup>

Vaccine is an immuno-biological substance designed to produce specific protection against a given disease and stimulates the production of protective antibody and other immune mechanisms.<sup>2</sup>

With the exception of safe water, no other modality, not even antibiotics, has had such a major effect on mortality reduction, declared the "WHO and UNICEF report on The State of the World's Vaccines and Immunization"-Vaccination is one of the cheapest and safest methods of primary prevention.<sup>3</sup>

The Center for Disease Control (CDC) has placed vaccination as one of top ten achievements in the field of public health in the twentieth century. Through herd-effect, it not only protects individual but also provides protection to the community and

thus hinders circulation of the infectious agent. In doing this, effects of vaccination are seen much rapidly, as evident by the eradication of small pox. Thus, vaccine helps healthy individuals to stay healthy and therefore aids to human development.<sup>4</sup>

The Expanded Programme of Immunization (EPI) was launched by the World Health Organization (WHO) in May 1974 to protect all children of the world from 6 vaccine preventable diseases (VPD) by the year 2000. The programme is now called Universal Child Immunization programme and the Indian version of it, under the name Universal Immunization Programme (UIP) was launched in Nov 19th 1985.<sup>5</sup>

Mission Indradhanush was launched by Ministry of Health and Family Welfare (MOHFW), Government of India on 25th December 2014. The Mission Indradhanush, depicting seven colors of the rainbow, targets to immunize all children against seven vaccine preventable diseases, namely: Diphtheria, Pertussis (Whooping Cough), Tetanus, Tuberculosis, Polio, Hepatitis B, Measles. In addition to this, vaccines for Japanese Encephalitis (JE) and Haemophilus influenza type B (Hib) are also being provided in selected states.

Widespread use of vaccines has prevented millions of premature deaths, paralysis, blindness, and neurologic damage.<sup>6</sup> despite their public health benefit, vaccination programs face obstacles. One obstacle is public perception of the relative risks of vaccination. Vaccine scares and sudden spikes in vaccine demand remind us that the effectiveness of mass vaccination programs is governed by the public perception of vaccination.<sup>7</sup> Each individual and family weigh perceived risks and benefits, reflect on the value of participation, and consider potential consequences of vaccination.<sup>8</sup> This study was initiated in order to determine the vaccination coverage among the children in urban slums in Bangalore and to determine factors associated with partial immunization.

## MATERIALS AND METHODS

It was a community based cross-sectional study done in notified urban slums of Bangalore for a period of one year (June 2015 to May 2016). the study population consisted of all the children aged between 12-23 months in notified urban slums in Bangalore. Inclusion criteria were all the children between 12-23 months of age and children who were resident of that area since birth. Exclusion criteria were children from migrant families and children of parents who are not willing to give consent.

Sample Size was based on WHO's 30 cluster survey method for immunization, a total of 210 children aged 12-23 months were included in the study. 30-cluster survey method was utilized. WHO recommends this method for rapid estimation of immunization coverage in children, using a linear systematic sampling technique proportional to the population size.

The following steps were followed:

**Identification of Clusters:** All the notified urban slums of Bangalore were listed along with their population. There were around 270 notified urban slums in Bangalore. The urban slum population was cumulated and the total cumulative population of all the slums was determined. The cumulative population of under-five children was 62,698 and the sampling interval is 2089. Then the sampling interval was calculated by dividing the total cumulative population by 30 and the decimals were rounded off to the nearest whole number (2089). Then a random number was chosen less than or equal to the sampling interval keeping the number of digits same as that of the sampling interval. The slum where this random number was located was the first cluster. Then the sampling interval was added to the random number to get the second cluster and third cluster and so on and 30 clusters were identified.

**Random selection of children in a cluster:** A sampling frame of children aged 12-23 months was prepared for each selected cluster. A total of 7 children from each selected cluster were selected by using simple random sampling method using Random number Table.

**Method of Collection of Data:** Institutional ethical clearance was obtained. After obtaining the consent, data was collected using Pre tested semi structured Questionnaire by interview technique. The informants were informed about the study and each question was explained to them in their local language in which they could understand.

The following variables with three parts were collected: Part 1: Information related to socio demographic factors.

Includes data on name of head of family, address, religion, total family members, type of the family, total no of children and no of children in age group 12-23 months, parents education, occupation and income. Part 2: Information related to personal details of child. Includes child's name, age in completed months, sex, birth order, place of delivery and breastfeeding details..Etc. Part 3: includes information related to immunization. Includes the details about the availability of immunization card, details of various vaccination received.

Data was entered in Micro soft excel and analyzed using Statistical Package for Social Sciences (SPSS) version 16 and statistical tests like Proportion, Chi square test and Odds ratio (with 95% CI) was used. Informed written consent for the study was obtained from the parents of the children before collecting information.

**Few terms used in study:**

**Fully immunized:**<sup>9</sup> Children who had completed the recommended EPI immunization schedule of BCG, OPV, DPT and Measles vaccine before one year of age.

**Partially Immunized:** A child who was not yet fully immunized (i) partially immunized but up to age. (ii) Partially immunized but not up to age. **Unimmunized:** Child who had not yet received any vaccine for the age, though eligible.

**Socio Economic Status:**<sup>10</sup>

In the present study, socio economic status was assessed using Modified Kuppaswamy scale 2014.

**RESULTS**

Among 210 children, highest proportion of children were in the age group of 21 months (10.5%) followed by 18 months (10.0%), 15 months (9.5%) & 22 months (9.5%). Few (7.5%) children were in the age group of 13 months. Male constituted 53.8% and female children to be 46.2%. In this study, 63.0% of children belonged to Hindu religion, 29.5% to Muslim religion and 7.5% belong to Christian religion. Nearly 70% of children belong to family having up to 5 members and 30% belong to family having members more than five. 68.5% of children belong to Nuclear family, 21.0% to joint family and 10.5% to three generation family.

It was found that, 59% were from family with two children, 11.4% of were from family with three children, 3.8% were from family having total children of four. 25.7% of study children were from family with only one child. Nearly more than 50% of children were of second birth order, 33.3% of children were of first birth order, 10% were of third birth order and 3.3% of children were of fourth birth order.

In this study, it was revealed that 75.7% of deliveries was conducted in government hospitals and 24.3% at Private hospital and only 67.6% of children had exclusive breast feeding. 21.9% of children's fathers were illiterate, 10.0% had education up to primary, 19.5% to middle school, 37.1% to high school, 8.1% to PUC/Diploma and 3.3% of children's fathers were graduates. With regard to

their occupation, 7.6% were unemployed, 35.2% were unskilled, 5.2% were semi skilled, 36.7% of children's fathers were skilled, 7.1% were Shop/clerical/farmers, 7.6% were Semi profession and 0.5% belonged to professional job.

With respect to the children's mothers educational status, 15.7% of children's mothers were illiterate. Majority of them had studied up to high school and middle school i.e. 35.7% and 29% respectively. Very few had studied till PUC and graduation. 61.4% of mothers were unemployed, 33.8% were unskilled and very few were in some other occupation. According to modified Kuppaswamy SES classification highest proportion of children belonged to upper lower (49.5%) followed by lower middle (36.7%), lower (7.6%) and upper middle socioeconomic status (6.2%).

**Table 1: Distribution of children based on Vaccination status**

Vaccine	Frequency (%)
BCG	207 (98.6)
OPV 0	206 (98.1)
OPV and Pentavalent 1	203 (96.7)
OPV and Pentavalent 2	195 (92.9)
OPV and Pentavalent 3	188 (89.5)
Measles 1	178 (84.8)
Measles 2	103 (75.7)

**Table 2: Distribution of children based on immunization status**

Immunization status	Frequency (%)
Fully immunized	175 (83.3)
Partially immunized	35 (16.7)
Total	210 (100)

Main reasons for partial immunization were 60% due to Ignorance, lack of awareness, 34.3 % due to Unaware of need to return for 2nd dose, 22.9% mentioned unaware about time of vaccination, health center far away and 17.1% mentioned inability to bring child for vaccination due to ill health and fear of side effects. Nearly 90% of families had immunization card.

Among fully immunized children, 53.7% were male and 46.3% were female. Among partial immunized children, 54.3% were male and 45.7% were female children. The relation between gender and immunization status was not found to be statistically significant. The relation between socio-demographic variables like religion, type of family, total number of children in family, birth order, place of delivery, father's and mother's educational status, socioeconomic status and immunization status was found to be statistically significant.

**Table 3: Relation between socio demographic variables and immunization status (n=210)**

Variable	Immunization status		Adjusted odd s ratio (95% CI {LL, UL})	P value
	Partially immunized (%)	Fully immunized (%)		
<b>Gender</b>				
Female	16 (16.5)	81 (83.5)	0.97 (0.47, 2.02)#	
Male*	19 (16.8)	94 (83.2)	1	
<b>Religion</b>				
Christian	4 (25)	12 (75)	2.29 (0.39, 13.25)	0.35
Muslim	17 (27.4)	45 (72.6)	2.04 (0.64, 6.44)	0.23
Hindu*	14 (10.6)	118 (89.4)	1	
<b>Type of family</b>				
Three generation	10 (45.5)	12 (54.5)	2.00 (0.53, 7.57)	0.31
Joint	8 (18.2)	36 (81.8)	0.27 (0.05, 1.41)	0.12
Nuclear*	17 (11.8)	127 (88.2)	1	
<b>No of children</b>				
>2	11 (34.4)	21 (65.6)	2.78 (0.13, 57.65)	0.51
≤2*	24 (13.5)	154 (86.5)	1	
<b>Birth order</b>				
>2	10 (35.7)	18 (64.3)	1.51 (0.07, 32.88)	0.79
≤2*	25 (13.7)	157 (86.3)	1	
<b>Place of delivery</b>				
Private	17 (33.3)	34 (66.7)	2.08 (0.68, 6.34)	0.19
Government*	18 (11.3)	141 (88.7)	1	
<b>Immunization card</b>				
No	16 (72.7)	6 (27.3)	12.86 (3.45, 47.88)	<0.001
Yes*	19 (10.1)	169 (89.9)	1	
<b>Mother's literacy status</b>				
literate	17 (9.6)	160 (90.4)	0.17 (0.05, 0.55)	0.003
illiterate*	18 (54.5)	15 (45.5)	1	
<b>Father's literacy status</b>				
literate	14 (8.5)	150 (91.5)	0.24 (0.08, 0.68)	0.007
illiterate*	21 (45.7)	25 (54.3)	1	
<b>Mother's occupation</b>				
unemployed	15 (18.5)	66 (81.5)	1.23 (0.59, 2.58)#	
employed*	20 (15.5)	109 (84.5)	1	
<b>Socio economic status</b>				
V	10 (62.5)	6 (37.5)	Chi sq value-29.26	<0.05
IV	21 (20.2)	83 (79.8)		
III	4 (5.2)	73 (94.8)		
II	0 (0.0)	13 (100)		

#unadjusted odds ratio; \*Reference group

## DISCUSSION

In the present study, the vaccination coverage among children aged 12-23 months reflects that 83.3 % of the children are fully immunized which is almost near to the desired goal of achieving 85 % coverage. Similar level of coverage was documented in other studies by Khokhar et al. and Kar et al. in urban slums of Delhi.<sup>11, 12</sup> Singh et al. have reported the complete coverage for India to be lower at 63.3 per cent.<sup>13</sup> National Family Health Survey-III reports that only 54.7 per cent of the urban children are fully vaccinated.<sup>14</sup> According to recent studies on routine immunization coverage, there has been a considerable decline in the coverage in some major states.<sup>15,16,17,18</sup>

In the current study, vaccination coverage for all the vaccines was almost matching the NFHS-III data. It was seen that coverage of measles was the lowest which was around 84.8% as observed by

others also.<sup>12,13</sup> This result was almost similar to the study conducted by a National Family Health Survey-3 (NFHS-3) in the year 2005-06 all over India by Ministry of Health and Family Welfare Govt. of India. It showed that the total measles vaccination coverage all over Karnataka was 72%, for urban population 79.5% and for rural 67.5%. And also the total measles vaccination coverage all over India was 58.8%, for urban population 71.8% and for rural 54.2%. When compared to national coverage, it is more in our study. This could be explained by different geographical area and the time at which study was conducted or could be because of different methodology adopted.

The present study was conducted to also determine various socio demographic factors affecting immunization status of children. Standard WHO 30\*7 cluster sampling method was used here. Out of 210 children, 83.3% were fully immunized, 16.7% were partially immunized. These study find-



ings were in resemblance with the studies conducted at different parts of India.<sup>19,20</sup> But some other studies in the country showed incomparable results in this respect.<sup>21</sup> It might be due to different level of provision and utilization of immunization services in different parts of India.

Similar to the findings of other studies in India, no significant difference was observed between immunization status and the gender.<sup>21, 22</sup> This fact is contrary to the general observation that many a times female children are neglected for their health care, especially in developing countries like India. Similar to this, completion of immunization was found independent from the type of family to which child belonged. Immunization of Hindu children was more often found to be completed than that of Muslim children. Various socioeconomic, cultural, behavioral and other such factors of different religious groups in the study area might be responsible for this fact. Significant influence of religion on completion of immunization as observed in the present study was also documented by Dalal A et al.<sup>22</sup> but contradictory to the study conducted by Malini Kar et al.<sup>12</sup>

Children of literate parents were found to have more chance of completing their immunization. In this respect mother's literacy was more strongly associated than father's. As far as level of education of parents is considered, both mother's education level, and the father's, was significantly associated with immunization status of their children. This fact highlights the role of female literacy and female education for the utilization of child health services. Similar significant association with maternal education was also reported by NFHS III and surveys as well as various studies from India,<sup>14,22</sup> and other developing countries.<sup>23, 24</sup>

Like maternal education, father's education was observed to be significantly associated with his child's immunization status. Other studies reported the same results.<sup>22, 13</sup> But Malini Kar et al.<sup>12</sup> results were contrary to this. These studies revealed significant difference in immunization status of children of fathers having different level of education. Just like father's education, their occupation was also observed to be related to the completion of immunization of their children. Similar to mother's education, her working status was also observed to be an important factor for completion of immunization of child. Children of non-working women were more likely to be fully immunized than those of working women (housewife). This could be due to the fact that as nonworking women (housewife) is free to spend more time with children and she can address their healthcare needs by utilizing child health services more efficiently and effectively as compared to working

women. Perry H et al. supported this fact in their study which showed that children of women who worked for money had lower immunization coverage than those whose mothers did not.<sup>25</sup> Another study by Malini Kar et al. observed that 69.5% and 68.6% children of nonworking and working women had completed their full immunization.<sup>12</sup>

In the present study, the proportion of upper lower class was high among partial immunized children (60%) compared to fully immunized (47.4%). The proportion of lower class was high among partial immunized children (28.6%) compared to fully immunized (3.4%). Significant influence of socioeconomic class on immunization status of children as observed in the present study was also found by BholaNath et al. and Dalal A et al.<sup>26, 22</sup> This could be due to the fact that parents, more importantly mothers, from lower socioeconomic class had lower level of education thus less awareness, less motivation hence under-utilization of all preventive health services in general.

The highest coverage for complete immunization was among the children having birth order 2, went on decreasing as birth order increased and was the lowest among those having birth order 4. First child had less chances of being completely immunized than that of second and third one. It reflects more sensitization and awareness of parents regarding immunization of second and third child as compared to first due to their previous experiences. Lower immunization coverage among children having higher birth order could be explained by the fact that they belonged more likely to lower socioeconomic classes, had less education and had working mothers. They are more neglected for their health care in general. Similarly Bholanath et al. and Lumen E T et al. also documented negative impact of higher birth order of children on their completion of immunization was by logistic regression analysis.<sup>26,24</sup> (Odds ratio for full and partial immunization was 0.8, 0.6 and 2.0, 4.3 respectively).

In the current study, the main reasons for partial immunization were lack of awareness (60%), unaware of need to return for further doses (34.3%) and fear of side effects (17.1%). We learnt that the proportion of deliveries at government hospitals was high among fully immunized children (80.6%) compared to partially immunized children (51.4%) and this difference was found to be statistically significant. Children born at home were found at greater risk of being partially immunized as compared to those born in hospital. The study in India had also observed the same fact.<sup>23</sup>

Immunization coverage was significantly less among the children whose immunization cards were unavailable at the time of assessment of their

immunization status. Chhabra P et al. also clearly pointed out greater risk of children being partially immunized whose immunization card was not retained. They observed only 27.7% children not having cards were fully immunized as compared to 68.2% children having cards. Corresponding values in the present study, all the fully immunized children had immunization card with them and few of partially immunized children had immunization card, this difference was statistically significant.<sup>27</sup> This could be reflection of parent's negligence in preserving immunization card of their child for long time. Immunization card can act as reminder for the next immunization session

## CONCLUSION

Even after decades of implementation of UIP, Not all the children were fully immunized as it is still 83.3% in our study. Vaccination coverage was highest for BCG followed by OPV. Religion, Type of family, Parents Education, Parents Occupation, Birth order, Place of delivery, Exclusive breast feeding, Socioeconomic status and availability of Immunization card were significant associates of immunization status of children. Hence there is need to improve the socio economic status, education and awareness among the population for better utilization of the immunization services.

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