

## **Original Research Article**

### **Determinants of Immunization: A Study from Uttar Pradesh using Multinomial logistic Regression Approach**

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**Abstract:** The objective is to examine socio-economic and demographic factors influencing partial and non-immunization of children in Uttar Pradesh. Data for this study was taken from National Family Health Survey (NFHS-3). The unit level information on 5157 children aged 12-59 months has been included in analysis. Covariates of low immunization coverage were examined using multinomial logistic regression model for partial and non-immunization including variables found significant in bi-variate analysis. Odds ratio and 95% confidence interval for each significant predictor was computed. In results the Mother's education (OR: 3.75, CI: 2.29-6.15) and ANC visits (OR: 15.77, CI: 10.73-23.19) are the most dominant factor affecting partial and non-immunization among children respectively. In conclusion the District level health personnel should focus more on vulnerable groups identified in this study to motivate them to fully immunize their children.

**Keywords:** Immunization, non-immunization, Partial immunization, multinomial logistic regression

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#### **INTRODUCTION:**

Immunization is one of the well known and most effective method of preventing childhood diseases [1, 2] With the implementation of Universal Immunization programme (UIP), significant achievements have been made in preventing and controlling the Vaccine Preventable Diseases (VPDs) namely Tuberculosis, Diphtheria, Tetanus, Pertussis, Polio and Measles [3]. Introduction: Uttar Pradesh, the most populous state of India according to 2011 Census had 199 million people. However, in the state immunization coverage is quite low. The Annual Health Survey (AHS) 2012-13 shows that only 53% children aged 12-23 months were fully immunized. Access to immunization with BCG coverage of 86% is somewhat satisfactory but due to overall dropout rate of 24%, immunization coverage is low (AHS) [4, 5].

India has one of the largest Universal Immunization Program (UIP) in the world in terms of quantities of vaccines used, number of beneficiaries (27 million infants and 30.2 million pregnant women) covered, geographical spread and manpower involved [6,7,8]. India spends more than Rs. 2000 crores every year in immunization program to immunize children against VPDs including polio eradication programme [6,7]. Immunizations services are provided through vast health care infrastructure which primarily include

primary health centres and sub-centres. Planning for routine immunization is a continuous process of analyzing data, evaluating progress and constraints and making decisions about reaching programme objectives(1) According to UNICEF, VPDs cause an estimated 2 million deaths or more every year, of which 1.5 million deaths occur among children below 5 year. About 29% deaths in children 1-59 months of age are vaccine preventable (World Health Organization, 2012).Immunization currently averts an estimated 2-3 million deaths every year in all age groups from diphtheria, tetanus, pertussis and measles [16]. Immunization coverage was decreased as per the National Family Health Survey (NFHS) - 3, in many states of India including Uttar Pradesh [9]. Children are considered fully immunized if they receive one dose of BCG, three doses of DPT and polio vaccine each, and one measles vaccine. In India, only 44% of children aged12-23 months are fully vaccinated and about 5% have not received any vaccination at all [10].In spite of 20 years of efforts and millions of dollars poured into Universal Immunization programme (UIP), our coverage rate has still not crossed the 50% mark. Immunization coverage showed improvement since National Family Health Survey-1 (NFHS-1), when only 36% of children were fully vaccinated and 30% had not been vaccinated at all. But there was very little change in immunization coverage between NFHS-2 (42%) and

NFHS-3 (44%) [10]. This paper reports on a study to identify the possible socioeconomic determinants of the Immunization status of children from state Uttar Pradesh.

#### **MATERIAL AND METHOD:**

##### **Objectives:**

To examine the socio-economic and demographic factors influencing partial and non-immunization of children in Uttar Pradesh.

#### **DATA AND METHODS:**

Data for this study has been taken from National Family Health Survey (NFHS- 3). In NFHS-3, information about immunization coverage of all the children aged 0-59 months in the household was collected; however the unit level information on 5157 children aged 12-59 months has been included in the analysis. Due to Pulse Polio Immunization (PPI) programme, which was launched in India in the year 1995, all children in the age-group 0-5 years were administered Polio drops. In UP, every new born child was identified and vaccinated during the PPI and was tracked for 8 subsequent rounds. Those children who were not brought to the camps were followed up at their respective homes for administration of polio drops. As a result, nearly all the children received one or more polio drops. NFHS-3 shows that while 56% received DPT-1 vaccine, the Polio-1 coverage was 95%. Due to this reason, for the analysis of this paper Polio vaccine has not been considered for estimating partial and non-immunization. Partially immunized children are those who have received either BCG or DPT or Measles vaccines. Likewise, fully immunized children are those who have received BCG, measles and three doses each of DPT and Polio vaccines.

The covariates of low immunization coverage have been examined using a multinomial logistic regression model for partial and non-immunization. To identify the variables for multivariate model, Bi-variate analysis was first carried out to examine the association of each possible predictor with partial and non-immunization coverage of children. Odds ratio and 95% confidence interval for each significant predictor was computed and presented.

The variables found significant on Bi-variate analysis were included in multivariate analysis. Ten socio-demographic variables of mother's and child's characteristics were found significant on Bi-variate analysis and were included in the final model. While performing multinomial logistic regression analysis, all the predictors were transformed into categorical variables and results were given for partial and non-immunization with reference to full immunization.

#### **RESULTS:**

Bi-variate analysis show that immunization coverage among children is significantly associated with wealth index, standard of living index, type of place of residence, mother's age, mother's educational and working status, religion, type of caste/tribe and number of ANC visits.

#### **Partial Immunization:**

Findings reveal that mother's education (OR: 3.75, CI: 2.29-6.15) is the most dominant factor affecting partial immunization among children depicting that children whose mothers have no education are nearly four more likely to be partially immunized than children whose mothers have education of 12 years or more. This is followed by Mother's age (OR: 3.71, CI: 1.43-9.66), indicating that mother's in age group 15-19 years are also about four times more likely to have partially immunized children as compared to mother's of age 35 years or more. Following this is number of ANC visits (OR: 3.20, CI: 2.23-4.57), birth order (OR: 2.31, CI: 1.40-3.81) and mother's working status (OR: 1.48, CI: 1.07-2.03). Non-Immunization: Results show that here, ANC visits (OR: 15.77, CI: 10.73-23.19) is emerging as the most significant factor affecting non-immunization among children indicating that children whose mothers go for no ANC visit are nearly 16 times more likely to be non-immunized than those whose mothers go for 3+ ANC visits. Following this is mother's education (OR: 10.35, CI: 4.40-24.34), mother's age (OR: 3.78, CI: 1.28-11.12), birth order (OR: 3.31, CI: 1.81-6.09) depicting that children having birth order 4 or higher have three times more chances of getting non-immunized than children having birth order 1 and religion (OR: 1.86, CI: 1.26-2.74).

#### **DISCUSSION:**

The present study was conducted to assess various socio demographic factors affecting immunization status of children in state of Uttar Pradesh. Mothers are often strongly influential in the vaccination of their children. It is therefore important to ensure that public health interventions for promoting childhood vaccinations address maternal concerns and barriers [11]. The National Family Health Surveys (NFHS) I, II, III [12,13,14] have reported gradual increase in immunization coverage in India over a period of time as 35.4%, 42.2% and 43.5% children between 12-23 months age group were found fully immunized in NFHS I, II, III(12,13,14) respectively. But this improvement is far from satisfaction. Again these figures vary widely across the regions, states and stratus of society depending upon socioeconomic factors and availability of health care. In multinomial logistic regression, characteristics most strongly associated with partial immunization included no education (OR: 3.75, CI: 2.29-6.15) when compared

with 12 years or more. Followed by Mother's age (OR: 3.71, CI: 1.43-9.66), indicating that mother's in age group 15-19 years are also about four times more likely to have partially immunized children as compared to mother's of age 35 years or more having birth order 4 (OR 2.28 when compared with only one child. Following this is mother's education (OR: 10.35, CI: 4.40-24.34), mother's age (OR: 3.78, CI: 1.28-11.12), birth order (OR: 3.31, CI: 1.81-6.09) depicting that children having birth order 4 or higher have three times more chances of getting non-immunized than children having birth order 1 and religion (OR: 1.86, CI: 1.26-

2.74). Elizabeth T. Luman [11] have shown that less than a high school education (odds ratio[OR] 0.6 when compared with college graduates), having 4 or more children (OR 0.6 when compared (with having only 1 child). For children of Uttar Pradesh, for Immunization status mother's educational status was also found to have an impact. Educated mothers are well aware of the Immunization of infants and are thereby capable of taking proper care as compared to illiterate mothers [15]. Size of birth also plays a significant role in Immunization for the state of Uttar Pradesh.

**Table 1: Results of multinomial logistic regression analysis**

S. N.	Variables	Partial Immunization			Non-Immunization		
		$\beta$	Exp( $\beta$ )	95% C.I. for Exp( $\beta$ )	$\beta$	Exp( $\beta$ )	95% C.I. for Exp( $\beta$ )
<b>Mother's age(Ref. Cat: 35 years or more)</b>							
1	15-19	1.31	3.71*	1.43-9.66	1.33	3.78*	1.28-11.12
2	20-24	0.61	1.84*	1.08-3.15	0.56	1.75	0.97-3.18
3	25-29	0.43	1.54	0.98-2.42	0.25	1.28	0.79-2.08
4	30-34	-0.10	0.90	0.58-1.41	-0.23	0.79	0.49-1.28
<b>Mother's education(Ref. cat: 12 years or more)</b>							
1	No education	1.32	3.75*	2.29-6.15	2.33	10.35*	4.40-24.34
2	<5 years	0.60	1.82	0.79-4.12	1.64	5.18*	1.68-15.95
3	5-7 years	0.90	2.45*	1.44-4.16	1.58	4.86*	1.96-12.06
4	8-9 years	0.47	1.59*	0.95-2.69	1.23	3.44*	1.40-8.41
5	10-11 years	0.58	1.78*	1.06-2.99	0.44	1.55	0.51-4.72
<b>Number of ANC visits (Ref. cat: 3 or more)</b>							
1	None	1.16	3.20	2.23-4.57	2.76	15.77*	10.73-23.19
2	one	0.85	2.35	1.39-3.98	1.92	6.82*	3.90-11.92
<b>Mother currently working(Ref. cat: Not working)</b>							
1	Working	0.39	1.48*	1.07-2.03			
<b>Birth order(Ref. cat: 1)</b>							
1	2	0.84	2.31*	1.40-3.81	1.20	3.31*	1.81-6.09
2	3	0.51	1.66*	1.04-2.63	0.67	1.96*	1.10-3.49
3	4 and above	0.50	1.65*	1.11-2.47	0.82	2.28*	1.35-3.86
<b>Religion(Ref. cat: Hindu)</b>							
1	Muslim				0.62	1.86*	1.26-2.74
2	Intercept	-2.14			-4.82		

**CONCLUSION:**

District level health personnel should focus more on the vulnerable groups identified in this study to spread awareness among them about the importance of various vaccines and motivate them to fully immunize their children. Because most mothers play an important role in their children's vaccination, it is important to address maternal concerns and barriers when developing public health interventions for promoting childhood vaccinations. Encouraging eligible women and provide support and encouragement for immunization to mothers with multiple children may improve early childhood vaccination coverage.

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