

## EFFECTS OF DEMOGRAPHIC AND SOCIOECONOMIC FACTORS ON CHILD IMMUNIZATION IN INDIA

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### *Abstract*

India has always vaccinated children against the six vaccine-preventable diseases. In 1978, India launched the Expanded Immunization Programme (EIP) to vaccinate children against dangerous diseases like polio, measles, mumps, and rubella. Polio was added in 1979–80, TB BCG in 1981–82, and measles in 1985–86. UIP expanded EIP. The UIP provided free immunizations to all children. The effort aimed to vaccinate at least 85% of newborns under one year. In future years, UIP expanded its goal to provide all eligible children one treatment of BCG, three doses of DPT and OPV, and one dose of measles. UIP launched the Pulse polio immunization programme in 1995 to eradicate the disease. Free immunizations were ineffective. This study examines the effect of demographic and socioeconomic variables on child immunization and drop-outs. In 2005-06, polio had no gender discrimination, but in 1992-93, key states did. Higher birth order children were less likely to receive polio and non-polio immunizations. Children of older mothers were more likely to be polio-vaccinated. Hindu higher caste and non-Muslim minority (Sikh, Jain, Christian) children were immunized more often. Rich families have more immunized children. Mother's education boosts vaccination chances. Adjusted results showed no significant effect of residence or delivery on polio immunization uptake. Despite 1992-93 gender discrimination, non-polio immunizations were no longer linked to child sex. In both periods, child birth orders affected immunization. In 2005-06, caste, religion, and SLI still affect child immunization. In 2005-06, father's education no longer corresponded with child immunization, unlike 1992-93.

**Keywords:** Immunization, Polio, Non-Polio, Demographic, Socioeconomic

## INTRODUCTION

Indian public health services have long included immunizing children against the six vaccine-preventable illnesses. In 1978, the Indian government implemented the Expanded Immunization Programme (EIP) to vaccinate children against potentially deadly diseases like polio, measles, mumps, and rubella. The polio vaccination was included in the schedule in 1979–80, the tuberculosis BCG vaccination was given in 1981–82, and the measles vaccination was added in 1985–86. The expansion of EIP was accomplished with the implementation of UIP. Under the UIP, all children received all of these immunizations at no cost to their families. The primary objective of the initiative was to successfully vaccinate at least 85 percent of all newborns less than one year. The original intent of UIP was to provide one dose of BCG, three doses of DPT and OPV, and one dose of measles vaccination to all eligible children; this goal was expanded in subsequent years. In 1995, the Pulse polio immunization campaign began with UIP with the goal of completely eradicating the disease. Free vaccinations were offered, but the results were still inadequate. According to the National Family Health Survey (NFHS)-1, only 34.2% of West Bengal's one-year-olds had received all recommended vaccinations. Even while the rate of completely vaccinated children in Tamil Nadu climbed from 64.9 percent to 80.9 percent between 1992 and 1998, the rate of fully vaccinated children in the rest of India increased by only 8 percentage points between 1992 and 1998 and by only 64 percent between 2005 and 2006. Additionally, there were 1600 cases of paralytic polio in India in 2002 (Blumenthal et al. 2011, The National Polio Surveillance Project), with roughly 29% incidence in West Bengal despite the state's small population (Chowdhury et al. 2005, Polio Eradication And Strengthening Routine Immunization Commitment Networking and Community Ownership: West Bengal; Presented by Polio and RI teams, UNICEF, KOLKATA, 2005). After 20 years of UIP, there is still a large gap in West Bengal between polio vaccination and other vaccination rates, which in turn leads to a large gap in dropout rates. The polio vaccine had a 13.41% dropout rate in 2005–2006, the DPT vaccine had a 20.21% dropout rate, and the BCG–measles vaccine had a 17.11% dropout rate (NFHS-3).

## LITERATURE REVIEW

Several studies were conducted to find out the determinants of child immunization in the developed and developing countries. Li and Taylor (1993) showed that living place, birth order and family status were significantly associated with immunization in Thames region. Wright and Polack (2005) found that education, population density, place of living and socioeconomic class have significant association with immunization in United Kingdom. They also showed that population density and deprivation strongly associated with low uptake of immunization. Study by Maekawa and the others (2007) in order to find out the factors affecting immunization coverage, revealed that distance, literacy, mother's knowledge of immunization were the influential factors in Western Specific region. Evidence in Russia has shown that stronger health communications can improve immunization coverage (Porter et al. 2010). Hisnanick and Dale (2000) have found that ethnicity, race, private health insurance, labor force status and place of residence were more likely to have close associations with full uptake of immunization in United States of America. Study by Markland and Durand (1976), revealed that parental age, education, family size income have significant associations with child immunization in United States of America.

Along with developed countries, studies in developing countries have also shown the strong correlation between socio-economic and demographic factors and child immunization uptake. Usman et al. (2009) found that family income and travel time to visit immunization centre were the main significant reasons for dropouts in DPT vaccination in Pakistan. Studies in Bangladesh have shown that nearness to health facilities, education, age, mother's mobility, ownership of radio, health workers visit, mass media exposure, family economic condition, education, sex of children, mother's age, antenatal care have significant impact on full uptake of immunization (Bhuiya and chowdhury, 1995; Rahman and Sarker, 2010). Reynolds and others (2006) showed that maternal age was one of the most significant deciding factors of child immunization in developing countries like India, Bangladesh, Peru, Uganda, Nicaragua and Indonesia. Evidence in Developing countries has revealed that maternal education had a strong correlation with child immunization (Desai and Alva, 1998; Streatfield and Singarimbun, 1990; Waters et al. 2004). Owais et al. (2011) found that educational intervention among low-literate people have significantly improved the immunization coverage rate in Karachi.

### OBJECTIVE OF THE STUDY

To examine the effect of demographic and socioeconomic variables on child immunization and drop-outs.

### DATA AND METHODOLOGY

Data were drawn from the first and third round of the National Family Health Survey (NFHS) for India. NFHS-1, undertaken during 1992-93 and NFHS-3, undertaken during 2005-06 were conducted by ORC Macro International, the International Institute of Population Sciences and the East-West Center. NFHS-3 provides data on fertility, mortality, morbidity, family planning, important aspects of nutrition, health and health care, were collected from 124,385 women of aged 15-49 years residing in 109,041 households from 29 states which the sample cover almost 99 percent of India's population.

This study aims to examine the effects of selected socioeconomic and demographic variables on immunization. Child immunization is a binary variable which indicates whether a child is fully immunized or not. To identify the influence of demographic and socio-economic on child immunization, multivariate logit models were used. In this present study, multivariate logit models ran for Polio and as well as for Non-polio vaccines separately.

The multivariate binary logit model is specified as:

$$P = F(z) = \frac{1}{1 + e^{-z}} \quad \dots (1)$$
$$P / (1 - P) = e^z = \text{Odds}$$

$$\text{Where } z = \alpha + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k$$

Where e represents base of natural logarithm and P is the estimated probability of vaccination given X's.

### RATIONALE FOR INCLUSION OF VARIABLES

Each determinant's presence is explicable. It has been stated that in India's patriarchal society,

girls are more likely to receive less care than boys and are consequently less likely to be immunized, which is why sex of child was included in the survey. The children at the top of the birth order in a large family are statistically less likely to receive attention than those at the bottom. Given that older mothers are more likely to have completed formal education and be familiar with preventative health measures like immunizations, this study adjusted for their age. In this case, the standard of living index has been used as a surrogate for the financial stability of a household. Cultural disparities in child care across socioeconomic classes necessitated the elimination of social variables like caste and religion. More exposure to the outside world means that parents with higher levels of education should have a better understanding of the importance of personal hygiene, preventative measures, and curative medicine than those with lower levels of education. Children's immunization rates have been shown to increase after media exposure was limited on the theory that public knowledge of immunization schedules would increase vaccination rates. Because mothers who choose to give birth in hospitals are exposed to doctors and nurses and learn about preventative health measures like immunizations, this variable ('site of delivery') is under medical supervision. Because of its correlation with households' financial stability, residence information has been added. Due to variations in level of development, states have been managed. This study attempts to find out the factors affecting immunization in both the time periods 1992-93 and 2005-06. Most of the studies have found out the correlates of full immunization but we are mainly focusing on the correlates of polio and non-polio vaccinations separately in both the rounds of NFHS data. Here a child is vaccinated with polio and non-polio means s/he received all the doses of polio and non-polio vaccines. Polio and non-polio vaccinations are taken as dependent variables which imply a child is fully immunized with polio and non-polio vaccines or not. The hypothesis here is that child immunization is strongly associated with the socio-economic and demographic variables. Demographic factors are - sex of the child, birth order of the child, sex of households head and mother's age. Socio-economic factors are - wealth index, parental education, exposure to electronic mass media such as watching TV, listening radio, caste/religion, and place of delivery. The spatial variables used are place of residence and state.

**Table-1 Variable tested for significant correlation with polio and non-polio in multivariate logit regression models 1-4**

Model	Description
Model 1	sex of child, birth order of child, mother's age, sex of household head
Model 2	Sex of child, birth order of child, mother's age, sex of household head, standard of living index and caste/religion
Model 3	Sex of child, birth order of child, mother's age, sex of household head, standard of living index, caste/religion, parental education, mother's media exposure and place of delivery
Model 4	Sex of child, birth order of child, mother's age, sex of household head, standard of living index, caste/religion, parental education, mother's media exposure, place of delivery, place of residence and states

**Effect of demographic, socioeconomic and spatial variables on polio in major states in 1992-93 and 2005-06**

Odds ratios (OR) with 95% CI of multivariate logistic regression models are presented in Table-

4.2. During nineties demographic variable like sex of child had significant effects on polio vaccination. The likelihood of polio immunization was significantly lower for girl child (OR=0.86, 95% CI=0.76, 0.96 for girl child), however no such gender difference in polio was observed during 2005-06 after controlling for selected demographic, socio-economic and spatial variables. Controlling for all predictor variables it has been observed that the effect of child birth order on polio vaccination decreases and mother's age did not play any significant role in enhancing polio immunization during 1992-93, however mother's age was significantly correlated with polio immunization during 2005-06.

It has been observed that even after controlling for all the predictor variables, likelihood of polio immunization varies significantly by economic condition of families. Children belonging to rich families were found to have significantly higher odds of being immunized with polio compared to middle and poorer sections of society (OR=1.43, 95% CI=1.18, 1.73 for richer sections and OR=1.12, 95% CI=0.97, 1.30 for middle) during 1992-93. The effects of economic condition of families were also observed during 2005-06. Likewise, caste and religion were also found to have significant association with polio vaccination after controlling for all the predictor variables. Children belonging to the Muslim families were least likely to be immunized in polio compared to 'others socio-religious group' which comprises mostly households from upper castes. It has also been observed that children belonging to SCs and STs were less likely to be immunized in polio compared to forward caste (OR=0.71, 95% CI=0.60, 0.84 for SCs, OR=0.45, 95% CI=0.37, 0.53 for Muslims and OR=0.77, 95% CI=0.63, 0.95) during 1992-93. However it has been observed that children belonging to ST families were least likely to be immunized in polio compared with other castes (OR=0.84, 95% CI=0.69, 1.03 for SCs, OR=0.75, 95% CI=0.61, 0.93 for Muslims and OR=0.44, 95% CI=0.34, 0.57 for STs) during 2005-06.

From Model 4 it has observed that parental education was one of strong predictors of uptake of polio immunization. Children of educated mothers were significantly more likely to be immunized in polio (OR=1.65, 95% CI=1.39, 1.97 for primary educated mothers and OR=2.24, 95% CI=1.82, 2.76 for secondary and above educated mothers) during 1992-93, however no such significant correlation was observed during 2005-06. Education of father was also found to be one of the significant predictors of child immunization as observed in case of maternal education (OR=1.42, 95% CI=1.18, 1.62 for primary education and OR=1.38, 95% CI=1.17, 1.61 for secondary and above), however unlike maternal education it was still continuing one of the predictors of polio vaccination though its effect decreases during 2005-06.

It has been observed that mother's media exposure was significantly associated with uptake of polio immunization during 1992-93 even after controlling for all variables which depicted from Model 4. Chances of a child being vaccinated in polio increases if mothers watch TV at least once a week (OR=1.57, 95% CI=1.31, 1.88 for who watches TV at least once a week). Children of mothers who listens to radio at least once were found to have significantly higher odds of polio vaccination (OR=1.48, 95% CI=1.29, 1.69 for who listens to radio at least once a week) during 1992-93 and it was also significantly associated with polio immunization during 2005-06. Place of delivery was found to have significant predictor of polio immunization. Chances of a child being vaccinated in polio increases if s/he born in any institutions (OR=2.24, 95%CI=1.90, 2.64 for institutions) during 1992-93, however no such association was found during 2005-06. Significantly children belonging to West Bengal were found to have higher odds in polio vaccinations (OR=1.36, 95% CI=1.01, 1.83 for West Bengal) compared to other major states during 2005-06.

**Effect of demographic, socioeconomic and spatial variables on non-polio in major states in 1992-93 and 2005-06**

The odd ratios of multivariate logistic regressions of selected demographic, socio-economic and spatial variables on non-polio vaccination. During 1992-93, likelihood of non-polio immunization uptake was significantly associated with sex of a child (OR=0.87, 95% CI=0.78, 0.98), however likewise polio vaccination, no such significant difference has been found during 2005-06 after controlling for all the variables. Moreover unlike polio vaccination, higher birth order of children had strong negative effect on uptake of non-polio immunization (OR=0.82, 95 CI=0.70, 0.98 for second/third birth order and OR=0.49, 95 percent CI=0.37, 0.63 for 4 and above birth order children) during 2005-06. After controlling for all predictor variables it was observed that mother's age was not significantly associated with uptake no-polio immunization during 1992-93, however it was found to have significant correlation between non-polio immunizations (OR=1.12, 95% CI=0.86, 1.45 for mothers aged between 20-24 years, OR=1.47, 95% CI= 1.10, 1.97 for mothers aged between 25-29 years and OR=1.54, 95%CI= 1.11, 2.14 for mothers aged between 30-49 years) during 2005-06.

Economic conditions of households were also found to have a very strong positive relationship with non-polio vaccinations. Likewise polio, children belonging to richer families were more likely to be immunized with non-polio vaccines compared to other sections of societies (OR=1.17, 95 CI=1.00, 1.37 for the middle and OR=1.44, 95 CI=1.19, 1.75 for richer section) during 1992-93. Caste/religion was found to be very significant predictor variables of non-polio immunization uptake in major states. It was observed that the likelihood of non-polio immunization uptake was significantly lower for Muslim children (OR=0.71, 95 percent CI=0.59, 0.85, for SCs, OR=0.54, 95 percent CI=0.45, 0.65 for Muslims and OR=0.94, 95 percent CI=0.75, 1.7 for STs) during 1992-93 and more or less similar result was also observed during 2005-06.

A child of a mother with at least primary educated was more likely to be vaccinated in non-polio vaccinations than that of non-educated mothers (OR=1.47, 95 percent CI=1.24, 1.75 for primary educated mother and OR=1.2.18, 95 percent CI=1.81, 2.62 for secondary+ educated mother). However unlike polio vaccination, maternal education was found to have significant associations with uptake of non-polio vaccinations during 2005-06. Father's education was also found to have a significant influence on non-polio immunization uptake during 1992-93, though no such association was observed during 2005-06. Mother's media exposure was significantly associated with non-polio vaccinations. Children of mother who watches TV or listens to radio at least once a week were found to have significantly higher odds of non-polio immunization during 1992-93 (OR=1.27, 95 percent CI=1.07, 1.50 for who watches TV at least once a week and OR=1.42, 95 CI=1.24, 1.62 for who listens to radio at least once a week). Moreover, mother's media exposure was also significantly associated with uptake of non-polio vaccination during 2005-06. Place of delivery play a crucial role in enhancing uptake of non-polio vaccination. Children who born in any institutions were more likely to be vaccinated with non-polio vaccination compared to those who born in home (OR=1.91, 95 percent CI=1.65, 2.22 for institutional delivery). However the impact of states was not significantly correlated with non-polio immunization uptake during 1992-93, the chances of being immunized in no-polio increases for children in West Bengal (OR=3.17,95% CI=2.35, 4.26) during 2005-06.

## CONCLUSION

The present study provides demographic, socio-economic and spatial variations in child immunization. Here immunizations in polio and non-polio vaccinations have been taken as response variables. During 2005-06, it has been observed that sex of child was no longer significantly associated with both polio and non-polio vaccinations in major states. This result contradicts other studies (Bhuiya and Chowdhury, 1995; Patra 2008; Rahman and Sarker, 2010). Mother's education was no longer significantly associated with polio vaccination. In this case perhaps the Pulse Polio Immunization (PPI) campaign has played a crucial role in reducing education based inequalities in polio vaccination. Similar findings were also observed by others (Bonuet al. 2003; Goel et al. 2010)). However, mother's education has significant effect on non-polio vaccination where chances of being immunized with non-polio vaccines increased if mothers were educated. Similar finding was also observed by many studies (Streatfield and Singarimbun, 1990; Desai and Aliva, 1998; Waters et al. 2004). However being PPI campaign since 1995-96 and door-to-door polio immunization, the caste, religion and standard of living have significant effects on polio vaccination and these socio-economic variables were also very significantly associated with non-polio vaccinations. These findings were in agreement with other studies (Nath et al. 2007; Patra, 2008; Lauridson and Pradhan, 2011). Moreover, though mother's age was not significantly associated with polio and non-polio vaccination during 1992-93 but the chances of being vaccinated increases for children of aged mothers during 2005-06. It is possibly because older mothers are likely to be more educated and have more knowledge about the immunization than younger mothers during 2005-06. Similar findings were also observed by different studies on India (Pruitt et al.1995; Nath et al. 2007; Patra, 2008). Mother's media exposure was still significantly associated with polio and non-polio vaccination during 2005-06. However, place of delivery has no longer strong correlation with polio vaccination during 2005-06, it has been found that in case of institutional delivery, the chances of being vaccinated in non-polio vaccines increases which is also supported by earlier study (Chhabra et al 2007).

This study's empirical results could suggest the following policy directions: As many studies have shown, the pulse polio campaign has effectively reduced drop-out rates and increased immunisation uptake in polio, which has reduced the inequality in non-polio vaccinations. Therefore, effective programmes are needed to reduce the drop-outs rate in non-polio vaccination. Immunisation rates among children have increased significantly in countries where maternal education is high. In addition to influencing factors like socioeconomic position and marriage age, maternal education is also highly correlated with child immunisation rates across all of India. Therefore, improving maternal education should be prioritised. Muslim children were also found to have a lower immunisation rate in several large states. Therefore, it is essential to carefully watch over regions having a disproportionate number of Muslims.

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