



Child Vaccination In Assam: An Investigation Of Its Trend And Variation Across Socio-Geographic Factors

Dr. Baharul Alom Laskar

Assistant Professor, Department of Economics

Govt. Model College Borkhola, Cachar, Assam

Abstract: Several studies have been conducted in the context of the issue of child vaccination but there is hardly any study which focused on the trend and variation in child vaccination in the context of Assam. This paper is an attempt to investigate the trend in child vaccination and analyzing the variation in the same across the crucial socio-geographic factors like residential status, religion and mother's educational attainment in Assam. The targeted children are in the age group of 12 to 23 months. Based on the data collected from the National Family and Health Survey (NFHS) reports, it has been found that, the child vaccination trend is on hike in recent times but the overall vaccination trend and coverage is not at all satisfactory. Significant variation in child vaccination has been found in the context of the selected socio-geographic factors mentioned.

Keywords: Universal Immunization Programme, Child Vaccination, Mother's Educational Attainment, Residential Variation

I. INTRODUCTION

World Health Organization (WHO) in the year 1974 introduced the expanded programme on immunization which resulted in globalized efforts across all countries and population groups to expand and derive the benefits of vaccines. In the year 1985, a full-fledged universal vaccination programme (UIP) was started in India which initiated free vaccination for children in different health care institutions across the country. Under the UIP, vaccination against 11 (eleven) life harming diseases have been given namely Tuberculosis, Diphtheria, Pertussis, Tetanus, Polio, Hepatitis B, Pneumonia and Meningitis, Measles, Rubella, Japanese Encephalitis (JE) and Rotavirus diarrhea. Vaccination is an important and most fundamental cost-effective life-saving interventions in protecting children against several diseases. In fact, Immunization has been described as the first line of defense against disease. Routine vaccination of children is quite necessary for survival of children in good health. To make the immune system of children stronger, vaccination has been proved a beneficial tool to fight against life threatening and infectious diseases. It is found that, on an average 2 to 3 million deaths are averted each year due to child vaccination (UNICEF-2022). An overview of previous studies reveal that, among the most cost-effective life-saving interventions, routine childhood vaccines occupies a vital position. In addition to this, vaccines have been linked with reduced stunting and improved health and other outcomes in later life. Beyond immediate reduction in disease morbidity and mortality, routine childhood vaccines could also generate substantial long-term schooling and economic gains for India. The benefits are higher for women, narrowing the male female gap in schooling and wages (Nandi et al. 2020). It has been found that, in India during the time period 1990–2015, the annual number of deaths among children under the age of five years has been drastically reduced from 12.7 million to 5.9 million globally and from 3.4 million to 1.2 million. (You et al., 2015). Childhood vaccinations on routine basis have substantially contributed in improving the child survival rates with a special contribution of preventing an estimated figure of 2 to 3 million deaths each year

across global context. (World Health Organization, 2018). Vaccines are among the most cost-effective life-saving interventions in the life of children, especially in low and middle-income countries (Ozawa et al., 2012). Routine childhood vaccinations can not only lessen the immediate burden of diseases, but could also reduce stunting and thereby improve health and other outcomes over the life cycle (Anekwe et al., 2015; Anekwe & Kumar, 2012; Bloom et al., 2012; Canning et al., 2011; Driessen et al., 2015; Nandi et al., 2019; Nandi and Shet, 2020; Upadhyay and Srivastava, 2017). A set of factors have been found to be associated with childhood complete vaccination in Ethiopia which are maternal education, wealth status, ANC visit, maternal occupation, residence, region, and sex of household head etc. (A. Debie et al. 2020). Disparities in vaccination is latent in the context of national averages on immunization coverage often do not reflect the underlying disparities within countries which results in inequalities in immunization often go unobserved or are underreported widely (Restrepo-Mendez et al., 2016). A wide range of socio-demographic, economic, and behavioural factors affect the immunization coverage in low- and middle-income countries like India. We found that inequality favoured the lower-income group in the study areas from Bihar and Assam. The immunization coverage gap due to income-based inequality was widened by maternal education and place of residence and narrowed by caste and age of the child. (Sharma, 2021). Despite steady progress in the routine childhood immunization coverage in India over 30 years, there are wide disparities or inequalities within the population subgroups (Gurnani, V. et al. 2018). Immunization is widely regarded as an essential measure to prevent infectious disease and improve human health. Administering a vaccine helps the immune system to protect against infection (Aslam, F., et al. 2022). There are still challenges that exist in achieving targeted vaccination coverage and inequalities in countries' access to immunization (WHO, 2017). Even after decades of implementation of UIP, not all the children were fully immunized. Vaccination coverage was highest for DPT first dose followed by BCG (Parmar R., et al. 2020). Full immunization coverage has grown yearly at 2.65% and 0.82% in rural and urban areas in India, respectively whereas partial immunization coverage declined by -2.44% and -0.69%, respectively. Percentage of non-immunized children did not show a statistically significant trend in either (Kulkarni et al. 2023). Vaccination or immunization is a modern day scientific advancement in the process of reducing and preventing morbidities and mortalities due to certain infectious diseases, which have been a major challenge to the medical fraternity (Gopalakrishnan, S., & P. Sujitha, 2020). In Kenya, The predictors of full vaccination among children living in the slums households have been found to be assets and expenditure, ethnicity, place of delivery, mother's level of education, age and parity (Mutua et al. 2011). In India, timely vaccination was poor for most of the types of vaccines except Measles. About 72.7% children received their basic vaccination in first year of life. Religion and mother's education were found to be associated with delay in all vaccination (Dhalaria, 2022).

Several studies so far reviewed which focused on the issue of child vaccination but there is hardly any study which analyses the trend and variation in child vaccination across the socio-geographic factors in the context of Assam. To address this research gap this paper attempts to analyse the trend of child vaccination along with investigation of its variation across selected socio-geographic factors in Assam.

II. OBJECTIVES OF THE STUDY

1. To analyse the vaccination trend among the children in the age group of 12 to 23 months during the period 1992-93 to 2019-21 in Assam.
2. To investigate the extent of variation in child vaccination among children in the age group of 12 to 23 months in Assam across residence, religion, and mother's educational attainment.

III. DATA SOURCE AND METHODOLOGY

This study has been carried out on the basis of secondary sources of data. Required data to meet the specific objectives of the study has been collected from the reports of the National Family and Health Survey Reports NFHS- 1, NFHS- 2, NFHS- 3, NFHS- 4, NFHS- 5 from the period 1992-93 to 2019-21 published by the International Institute for Population Sciences, Govandi Station Road, Deonar, Mumbai-400088 under the Ministry of Health and Family Welfare (MoHFW), Government of India. In this study, the targeted children are in the age group of 12 to 23 months who are entitled to be vaccinated. The data has been analyzed with the help of descriptive statistics like tabular presentations, and line graph. Moreover, in order to check the significance level of variation in the selected socio-geographic factors data has been tested using t-Test: Two Sample Assuming Unequal Variances and ANOVA: Single Factor.

Vaccination Types

Although there are different types of vaccination given to children at different ages after birth but a set of vaccine has been selected in the study termed as basic vaccinations including BCG, MCV, Measles, MMR, MR and three doses of DTP, Penta & Polio Vaccine (Excluding the polio vaccine given at birth) given to the targeted group of children. A brief description of the basic vaccination applied to the children in the light of World

Health Organisation (WHO) and the United Nations International Children's Emergency Fund (UNICEF) are outlined below.

BCG Vaccine: The Bacille Calmette-Guerin (BCG) vaccine has been invented by Leon Charles Albert Calmette, a French physician, bacteriologist and immunologist and Jean-Marie Camille Guérin, a French veterinarian, bacteriologist and immunologist. It is one of the oldest and universally used vaccine which helps to prevent children from the meningitis and Tuberculosis (TB).

MCV Vaccine: Meningococcal Conjugate Vaccine (MCV) has been invented by Emil C. Gotschlich, a Physician-Scientist of American origin (Paouly (2019)). It prevents bacteria which cause the meningococcal disease along with protecting the child from infections related to the lining of the brain and spinal cord (Wikipedia)

Measles Vaccine: this vaccine has been invented by John Franklin Enders, an American Biomedical Scientist. It is one of the most beneficial vaccine which protects children from measles which is basically a viral infection that has a characteristic pattern of prodromal symptoms, mumps and rubella. (Wikipedia)

MMR and MR Vaccine: Measles, Mumps, Rubella (MMR) Vaccine was developed by Maurice Ralph Hilleman, a leading microbiologist of American origin who was specialized and developed more than 40 vaccines (Wikipedia). It protects children from ear infection, diarrhea, pneumonia and brain damage.

DTP Vaccine: Diphtheria, Tetanus, Pertussis (DTP) a combined vaccine has been invented by Emil Adolf Von Behring, a German Physiologist and Leila Alice Denmark, an American Pediatrician. This Vaccine protects the children from the problem of breathe and swallow which further attacks the heart, kidneys and nerves. Moreover, it also protects children from cough uncontrollably.

Penta Vaccine: This vaccine was developed and manufactured by Crucell in Korea and co-produced by Chiron Corporation in the year 2006. It protects children from five life threatening diseases like Diphtheria, Pertussis, Tetanus, Hepatitis-B and Hib (Haemophilus influenzae type B)*

Polio Vaccine: Polio vaccine was first developed in the year 1952 by Jonas Edward Salk, an American virologist and medical researcher. It protects children from poliovirus which causes Poliomyelitis, a disabling and potentially deadly disease.

IV. ANALYSIS OF DATA, DISCUSSION AND FINDINGS

Trend in Child Vaccination in Assam among the 12 to 23 months Children during 1992-93 to 2019-21

It is important to investigate the trend in child vaccination over time which reflects the achievement status of Universal Immunization Programme. Analysis of child vaccination in terms of trend line is an indicator of successful implementation and successive outcome of child health care system. In order to investigate the trend in child vaccination in Assam during the time period from 1992-93 to 2019-21, an analysis has been carried out in terms of percentage of children who got vaccinated against all basic vaccination in general and BCG, Polio, DTP and Measles Vaccine in particular. The trend of vaccination among the children as mentioned is presented in figure-1.

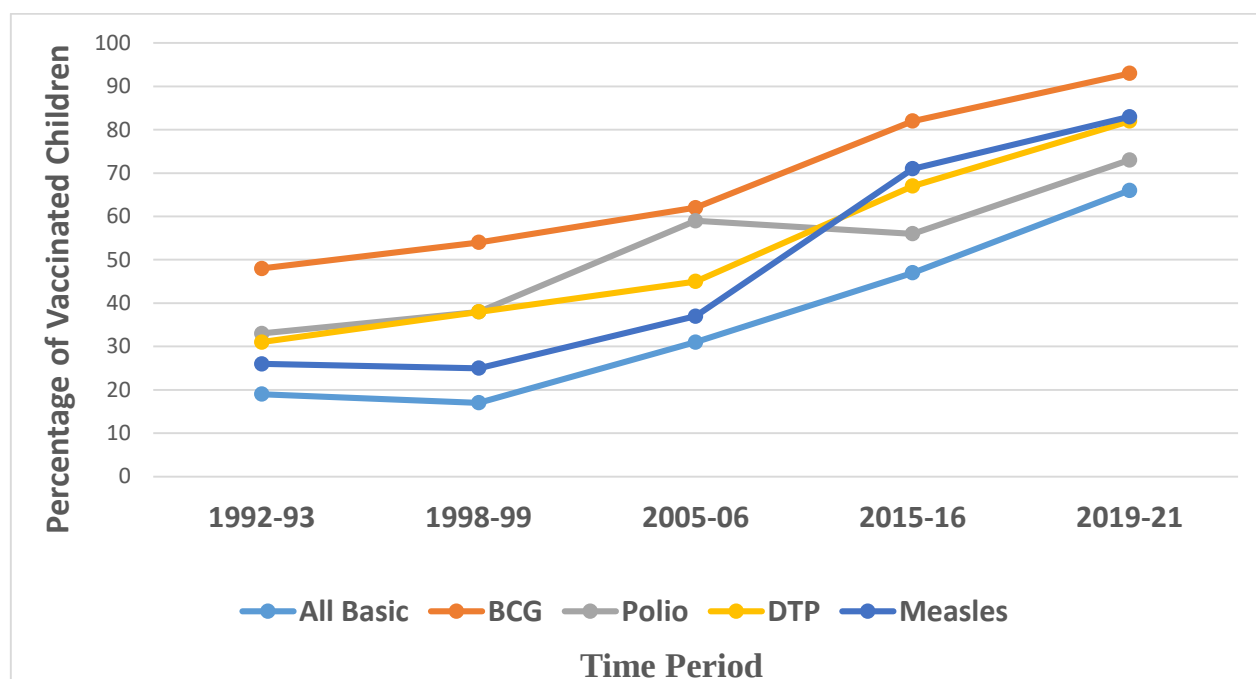


Figure 1: Trend in Child Vaccination in Assam

In figure 1 it is seen that, percentage of vaccinated children in Assam against all types of vaccine in the age group of 12 to 23 months has been on rise from the time period 1992-93 to 2019-21 except a sudden fall in the polio vaccinated children in the year 2015-16. From 1992-93 percentage of vaccinated children has been increased as evident from the upward trend lines except with a steady trend in the percentage of vaccinated children against Measles vaccine up to 1998-99. Surprisingly it is observed that, there has been a sharp fall in the percentage of Polio vaccinated children in 2015-16 followed by a rising trend in the same up to 2019-21. BCG vaccination among the targeted group of children is showing a steep rising trend which implies that the higher percentage of children got vaccinated against BCG vaccine as compared to other types of vaccine over the study period. Percentage of children got measles vaccine has shown a steep rising trend from 2005-06 onwards deviating the DTP and polio vaccinated children in percentage. However, percentage of vaccinated children has been hiked suddenly in the year 2005-06 followed by a down-up trend in this regard. The trend analysis in the figure reveals that though the percentage of vaccinated children against specific vaccine is showing rising trend but the overall vaccination status in terms of all basic vaccination among children is not satisfactory. In the recent times during 2019-21, it is seen that, percentage of vaccinated children against all type of vaccine has been sharply increased which is a good sign of child immunization programme.

Variation in Child Vaccination among 12-23 months age group across Residence in Assam

Residence is an important geographical factor which influence the child vaccination on the ground of availability and accessibility of vaccines across rural and urban health care systems. A tabular analysis of the Residential variation in Child Vaccination across rural and urban residence is presented in table 1.

Table 1: Residential Variation in Child Vaccination in Assam

Residence	Vaccinated Children: 12-23 moths (in %)	t value
Rural	66.9 (6.57)	2.07**
Urban	63.1 (8.28)	

Source: National Family and Health Survey (NFHS)-5 Report 2019-21

** denotes significant at 5% level of significance ($p < 0.05$)

Notes: Figures in the parentheses indicate Standard deviation

Table 1 depicts the proportion of children who got vaccinated across rural urban residence in Assam. It reveals that, in the rural area of the state nearly 70 percent of children in the age group of 12 to 23 months got vaccinated against the most vital lifesaving vaccines like- BCG, Polio, DTP and Measles. On the counter part, in urban area of the state almost 63 percent of the targeted group of children got vaccinated against the same vaccines. There has been a wide variation found in the child vaccination in the urban area compared to the rural area of Assam as evident from the value of standard deviation of both the area. The residential variation in child vaccination has been found to be statistically significant. The lesser percentage of vaccinated children in the urban area is an indicator of inefficient and non-uniform immunization campaign. It is further reported that, the

vaccination status of rural urban residence in Assam is not satisfactory in line with the most aspiring Universal Immunization Programme (UIP) launched by government of India.

Variation in Child Vaccination among 12-23 months age group across Religion in Assam

In societal life religious belief and instructions are important guidance in human life regarding choice in the several aspects. An analysis has been carried out to understand the variation in child vaccination across three religion Hindu, Muslim and Christian. The result of such analysis is reported in table 2.

Table 2: Religious Variation in Child Vaccination in 12-23 months age group in Assam

Religion	Vaccinated Children: 12-23 months (in %)	F value
Hindu	70.6 (8.19)	7.48*
Muslim	61.8 (12.37)	
Christian	60.5 (13.41)	

Source: National Family and Health Survey (NFHS)-5 Report 2019-21

*denotes significant at 1% level of significance ($p < 0.01$)

Notes: Figures in the parentheses indicate Standard deviation

Table 2 depicts the access to vaccination of the children in the age group of 12 to 23 months in Assam across religion. It is revealed from the table that, Hindu religion is in the top most position in vaccinating almost 71 percent of the targeted children compared to Muslim and Christian religion. It is seen from the table that, nearly 62 percent children belongs to Muslim religion and 61 percent children belongs to Christian religion received vaccine against the vital lifesaving vaccines like- BCG, Polio, DTP and Measles. As evident from the value of standard deviation surprisingly in the Christian religion with the lowest percentage of vaccinated children has highest variation in vaccination compared to other two religion. It is observed from the table that, Hindu religion has lowest variation in case of child vaccination. The degree and extent of variation in child vaccination is almost similar in case of Muslim and Christian religion with a slight difference. This variation in child vaccination across religion is also found to be statistically significant. It is thus reported that, religion has impact on the decision of child vaccination by the parents.

Variation in Child Vaccination among 12-23 months age group across Mother's Educational Attainment in Assam

Child vaccination vitally depends on the awareness and healthy attitude of parents free from superstitious fear and blind belief. This in turn depends on the education level of parents in general and the educational attainment of mother in particular. In this study we have re termed the schooling duration of vaccinated children in five categories as Less than lower primary level, Lower Primary to less than Upper Primary, Upper Primary to less than HSLC, HSLC to less than HS and More than HS level of education. An analysis of percentage of vaccinated children against mother's educational attainment is presented in table 3. In vaccinating the infants at their very early age, the parental decision is a vital factor. However, the mother's educational attainment is an important factor in deciding whether a child is to be vaccinated or not as per vaccination programme. A brief analytical data is presented in table 3 in this regard.

Table 3: Child Vaccination in Assam across Mother's Educational Attainment

Mother's Educational Attainment	Vaccinated Children: 12-23 months (in %)	F value
Less than lower primary level	67.4 (9.07)	5.15*
Lower Primary to less than Upper Primary	67.7 (9.11)	
Upper Primary to less than HSLC	67.4 (6.75)	
HSLC to less than HS	66.3 (8.37)	
More than HS	69.5 (7.88)	

Source: National Family and Health Survey (NFHS)-5 Report 2019-21

*denotes significant at 1% level of significance ($p < 0.01$)

Notes: Figures in the parentheses indicate Standard deviation

Table 3 reveals the proportion of vaccinated children in the age group of 12 to 23 months across the different level of their mother's educational attainment in Assam. It is seen from the table that, almost 67 percent children got vaccinated who mothers' attained education levels from lower primary level to less than High School Leaving Certificate (HSLC) level. It is surprising to note that, compared to low level of mother's education nearly 66 percent children has been vaccinated against the vital vaccines like BCG, Polio, DTP and Measles who's mothers' attained high education level from HSLC to less than Higher Secondary (HS). It is worth to be noted that, almost 70 percent of targeted children got vaccinated whose mothers attained more than HS level of education. As evident from the standard deviation value, more variation in child vaccination is prevalent in the group of less educated mothers and less variation in the same is prevalent in the group of more educated mothers. Further this variation is also statistically significant. It thus indicates that, decision of child vaccination is not unanimous among the less educated mothers.

V. CONCLUSION

The primary focus in this paper is to analyse the trend and variation in child vaccination among the children in the age group of 12 to 23 months in the context of Assam. It has been found from the study that, the growth rate in specific child vaccination has been increased but vaccination growth rate in the context of covering basic vaccination is lagging behind. Further, percentage growth rate in the vaccinated children against measles vaccine is low compared to other types of vaccinated children. Significant variation in child vaccination has been found across the rural urban residence, religion of children and mother's educational attainment. More variation and lower percentage in child vaccination has been found in the context of urban residence and in the context of Christian religion. Moreover, lower percentage of vaccinated children with more variation has been found in case of mothers with low educational attainment. The overall analysis indicates that, although the child vaccination trend in recent times has been increased substantially but the coverage and growth rate in the same is not at all satisfactory in Assam. Since this study is explorative in nature aimed at exploring and analyzing the trend and variation in child vaccination. Therefore, it will be too early to provide any policy suggestions and recommendations at this stage. Extensive research in the area is required to come up with any constructive policy suggestions. Future research in this area shall focus on the factors behind the child vaccination and causes responsible for variation in the same.

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