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Determinants of immunisation of children under 2 years of age in Rural Barak Valley: An explorative study

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ABSTRACT

Background: In 1978, India launched the "Expanded Programme on Immunisation" (EPI) to minimise the prevalence of "Vaccine-Preventable Diseases" (VPDs). Despite years of health and medical progress, children in India continue to suffer from VPDs, and significant disparities in immunisation coverage may be seen among regions, states, socioeconomic groups, and other factors. Barak Valley's socioeconomic and environmental characteristics reveal an overall underdevelopment pattern. Furthermore, in the valley, healthcare services such as comprehensive immunisation institutional delivery are underutilised, resulting in poor immunisation coverage. Despite this evidence, there have been limited studies to identify the factors that influence child immunisation. In this context, this article is a modest attempt to identify and quantify the inequality in socio-economic factors in explaining inequality in Child immunisation in rural Barak Valley.

Materials and Methods : A multistage stratified random sampling was used to collect information on immunisation and related variables by using a pre-tested questionnaire from the universe of children aged between 12-23 months of rural Barak Valley. And, binary logistic regression model has been used to analyse the data and draw inferences.

Result: The immunisation coverage is the Barak Valley region is very poor. The highest immunisation coverage has been observed for the BCG vaccine, around 90%. And with 64% coverage, vaccination against measles stands at the bottom of the list. The extent of full immunisation in the valley is not satisfactory at all. Around 54% of children aged 12-23 months have received all the WHO recommended vaccines, implying half of the eligible children are left out.

Conclusion: The study identifies religion, a strong cultural affiliation that significantly influences the immunisation coverage of the child. Furthermore, the gender of the child, unequal access to ante-natal care, and birth order of the child are the prime factors associated with inequality in child immunisation in the region.

1. Introduction

Immunisation is one of the most cost-effective public health interventions.[1] Immunization is acknowledged as an important preventative strategy that improves health and allows individuals to contribute to economic growth in a variety of ways.[2,3] Globally, the immunisation programme began with the objective of lowering vaccine-preventable diseases (VPDs), yet low immunisation coverage remains a barrier in many countries. India was one of the first

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nations to implement the World Health Organization's (WHO's) "Expanded Programme on Immunisation" (EPI) in 1978.[4] The goal was to achieve a minimum of 80% coverage of immunisation against VPDs during infancy. The Government of India (GoI) established the Universal Immunisation Programme (UIP) in 1985 as a pilot programme in 31 districts with the goal of immunising all pregnant women and at least 85 percent of infants against six VPDs namely diphtheria, pertussis, tetanus, poliomyelitis, measles and tuberculosis. Even after more than four decades, India has failed to meet the objective, and a large number of VPDs are still reported across different healthcare facilities of India. According to the recent National Family Health Survey (NFHS 4), just 62 percent of children aged 12-23 months have received all of their recommended vaccines, which is way below the target.[5]

India, the second-most populous country in the world, has the highest mortality rates among children under the age of five in the area, accounting for one-fifth of all under-five fatalities worldwide.[6] Children under the age of five account for around 9.32 percent of India's total population, and an estimated 5 lakh children die each year from vaccine-preventable diseases.[7,8] Approximately 2,500 children died per day in India in 2018, with the majority of the deaths related to vaccine-preventable illnesses. Poor immunisation coverage is also responsible for a considerable number of VPDs.[9,10] In 2002-04, the full immunisation coverage rate in Barak Valley was only 2.33 percent, but by 2007-08, it had risen to 37.22 percent. And, in 2015-16, the complete immunisation coverage rate in Barak valley was registered at 45.78 percent.[11] Though these figures appear to be decent, yet they are much below the national average. Furthermore, these data say nothing about the current immunisation coverage inequalities. Despite these facts, no study has been undertaken in Barak Valley to explore and identify the factors that influence child immunisation.

In light of these circumstances, a study was conducted in rural Barak Valley to describe the extent of immunisation coverage. The primary objectives of this research are to evaluate vaccine coverage among children in Assam's rural Barak Valley, as well as the socio-demographic variables that impact immunisation coverage.

2. Review of Literature

Vaccines are now largely considered as a low-cost means of improving health. Immunisation of children against major illnesses is now a standard practise in all nations, and it has become a cornerstone of worldwide public health initiatives.[1] However, the evolution of India's immunisation efforts is far more complicated than one might imagine; reluctance, opposition, and slow acceptance of immunisation have been hallmarks of India's immunisation history, and the contents of countless child deaths, particularly from most preventable diseases, cannot be erased from that history.[12] India's economic performance has been outstanding since the implementation of the New Economic Policy, but growth in human development indices and health outcomes has been moderate and unequal.[13] Empirical evidence indicates that three types of inequities have influenced India's health sector: historical disparities rooted in British colonial policies and programs, socioeconomic inequities resulting in caste, class, and gender differentials, and inequities in the accessibility, utilisation, and availability of healthcare services.[14] According to Chuma et al. (2007), availability, accessibility, and affordability of health care are the most essential variables for improving health status among all the many factors that impact health.[15] In India, enormous discrepancies exist throughout states, between rural and urban locations, and within communities, particularly when it comes to health and access to health care.[16–19] According to several studies, healthcare finance and provisioning systems have a crucial role in eliminating or sustaining existing imbalances, as well as shaping the structure of health service usage and expenditure.[20]

The majority of socioeconomic disparities are encountered across castes.[19,21] The National Family Health Survey (NFHS 4) indicated significant geographical and socioeconomic disparities in health outcomes among lower castes, the poor, and less developed countries. Inequities are also observed in the case of the under-five-mortality rate (U5MR), i.e., mortality among children less than five years, which is regarded as an important indicator. High rates of infant mortality and U5MR are often inversely related to economic level, and these disparities are accompanied by substantial gender and caste disparities.[16,22] Furthermore, Kaplan et al. (1992) reported that higher birth order, which is a prevalent feature of rural India, is one of the most important variables for incomplete immunisation.[23] Additionally, Chen et al. (2019) indicated that urban-rural variations in the availability and accessibility of health care facilities influenced immunisation coverage considerably and, the findings are congruent with those of Bhuiya et al. (1995).[24,25]

3. Materials and Methods

3.1. Study design and sample size

The design of the study was cross-sectional and was based on household investigation. Infants aged between 12 and 23 months were included in the study. A multistage stratified random sampling has been followed to collect primary data. At the initial stage, development blocks have been selected randomly from each of the three districts of Barak Valley viz. Cachar, Karimganj and Hailakandi. Three development blocks from Cachar district, two from Karimganj and 1 from Hailkandi district has been selected. In the second

stage from each of the randomly selected development blocks, two villages have been selected randomly. And at the final stage, from each of the selected 12 villages 30 households have been selected purposively, depending on the availability as per the requirement of the study. This gives us a total of 360 sample size (12 x 30=360).

3.2. Data collection

A predesigned and pretested semi-structured questionnaire was used to collect data. Firstly, household and parental information were acquired, followed by information about the infant, including immunisation status from the immunisation card. For children who did not have immunisation cards, the information provided by the child's mother or any other credible and responsible person was accepted.

3.3. Statistical analysis

Descriptive statistics are used to get socioeconomic and demographic characteristics and immunisation coverage. Additionally, to identify factors that determine child immunisation in rural Barak Valley, we have estimated the following Logistic Regression Model

$$FVi = \frac{1}{1+e^{-Zi}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where, $Zi = \beta_0 + \beta_1 Rel + \beta_2 CT + \beta_3 GD + \beta_4 BO + \beta_5 Age + \beta_6 Edu + \beta_7 Occ + \beta_8 ANC + \beta_9 Gap + \beta_{10} Int + \varepsilon_i$

In the regression model the variables used are:

FV → Full Immunisation; Rel → Religion; CT → Caste; GD → Gender of the child; BO → Birth Order of the child; Age → Age of the mother at the time of child birth; Edu → Educational attainment of the mother of the child; Occ → Occupation of the father of the child; ANC → Ante Natal Check-ups; Gap → 24 months gap between births of the child; Int → Interaction between Gap and Boy child.

4. Results and Discussion

Immunisation cards are useful health records that contain information about immunisation dates and doses. Possession of the same and its easy reachability also shows the keen interest of the mothers towards immunisation. It has been observed that around 89 percent of the eligible mothers have possessed the immunisation card, while 4.72 percent have reported the possession but fail to produce the same on request and 6.11 percent respondents have mentioned that they do not have the immunisation card of their children. The distribution of children according to the possession of immunisation card is shown below.

4.1. Distribution of children based on Vaccination status

In rural Barak Valley, it has been observed that around 54.44 percent children are fully vaccinated and around 45.56 percent children aged 12-23 months have not received all the UIP recommended vaccines. It has also been noticed that out of the 45.56 percent drop out cases, around 41.95 percent are partially vaccinated, i.e, have received vaccines but have not completed the recommended doses and 3.61 percent are not at all vaccinated. The distribution of children based on their vaccination status is presented inFigure 1.

Table 1: Distribution of children according to the possession of immunisation card (%)

Possession of VC	No. of Respondents	Proportion
Have Card, seen	321	89.16
Have card, not seen	17	4.72
Do not have card	22	6.11
Total	360	100

Source: Computed by the researcher from field survey, January 2017-June 2019

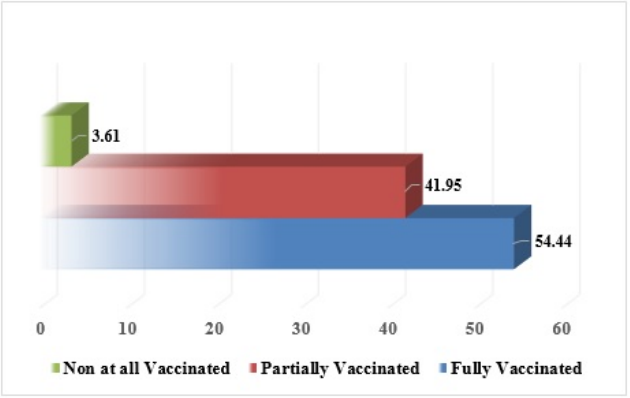

Fig. 1: Distribution of children according to vaccination status.

4.2. Distribution of children based on reasons behind incomplete immunisation

Increasing and maintaining immunisation uptake is critical to vaccine effectiveness. And tackling low immunisation rates necessitates a full knowledge of the underlying causes. Immunisation apprehension can dampen excitement, leading people to reject it for themselves or their children. Person, community, and contextual variables, as well as any vaccine-specific concerns, may all raise doubts. Furthermore, vaccine reluctance is the primary cause of inadequate immunization.[26] Around 45 percent of children aged 12-23 months in rural Barak Valley have not received all of the recommended vaccines, and it has been observed that fear of side effects of immunisation, specifically post-immunisation symptoms that often lead to mild pain or fever in the child, is the main reason for incomplete immunisation in the valley, followed by a lack of faith in immunisation. Family support is also important in completing the required courses of immunisation, particularly in rural Barak Valley,

a lack of family support accounts for around 16% of incomplete immunisation.Table 2 shows the distribution of children based on the causes for inadequate immunisation.

Table 2: Distribution of children b on reasons for incomplete immunisation (%).

Reasons	No. of Respondents	Proportion
Fear of side effects	66	40.20
Lack of faith on immunisation	40	24.40
Postponed to another time	32	19.50
Lack of family support	26	15.90
Total	164	100

Source: Computed by the researcher from field survey, January 2017-June 2019.

4.3. Age specific immunisation coverage across districts in rural Barak Valley

Immunisation coverage varies across district in the Barak Valley and the coverage rate also differs across age-specific immunisations.Table 3 shows the disparity in immunisation coverage between districts in rural Barak Valley.

How's the immunisation status of all age-specific immunisations among districts in rural Barak Valley? In terms of age-appropriate immunisation coverage, BCG is the only vaccine with a reasonably decent coverage rate in the valley. The Karimganj district has the greatest BCG coverage (92 percent), followed by Hailakandi (90 percent) and Cachar district (88 percent), with the valley's overall BCG immunisation coverage being 90 percent. The WHO recommends three doses of DPT and Polio for a child during his or her infancy, and we have noticed a decrease in the valley's coverage of subsequent doses of both DPT and Polio immunisation. While coverage for the first dosage of the Polio immunisation was reported to be 90 percent in the Cachar district, 81 percent and 83 percent in Karimganj and Hailakandi districts, respectively, coverage for the second and third dose has gradually reduced. Similarly, immunisation coverage for the DPT vaccine has decreased dramatically from the first to the third dosage in all of the valley's districts. The Measles vaccine has the lowest immunisation coverage of among any of the particular vaccines. The valley's total Measles immunisation coverage is barely 60.60 percent, with the Hailakandi district having the lowest coverage among the three districts (51.70 percent). The last column ofTable 3 depicts the valley's full immunisation coverage across districts. In rural Barak Valley, full immunisation coverage is extremely low, at only 54.40 percent. The Cachar district (57.20 percent) has the highest rate, followed by Karimganj (53.30 percent) and Hailakandi (48.30 percent).

Table 3: Immunisation status acrossdistricts in rural Barak Valley (%).

Vaccine	Cachar	Karimganj	Hailakandi	Barak Valley
BCG	88.00	92.00	90.00	90.00
DPT1	90.00	81.00	83.00	86.00
DPT2	78.00	70.00	65.00	73.00
DPT3	69.00	63.00	55.00	64.00
Polio 1	90.00	85.80	86.00	88.00
Polio 2	87.00	76.00	75.00	81.00
Polio 3	75.00	71.00	66.00	72.00
MEASLES	64.40	59.20	51.70	60.60
Full Immunisation	57.20	53.30	48.30	54.40

Source: Computed by the researcher from Field Survey, January 2017-June 2019.

4.4. Determinants of child immunisation in rural Barak Valley

In order to identify the socio-demographic factors associated with child immunisation in rural Barak Valley, we estimated the Binary Logistic Regression. The analysis of the binary logistic regression model is presented inTable 4.

It should be mentioned that the diagnostic tests presented in the last raw of the regression result (Table 1) validate the model's reliability. The regression result reveals that religion is significantly predictive of a child's immunisation status. The coefficient's negative sign implies that children from Muslim households had a lower chance of being completely vaccinated than children from non-Muslim households. Previous studies in the area of determining the predictors of child immunisation in India back up this finding.[19,27,28] Caste, similar to religion, is a deeply ingrained cultural designation that influences parental views and attitudes toward health-seeking actions, such as immunisation decisions for their children.[29–31] However, in contrast to earlier studies (Mathew, 2012; Shrivastwa et al. 2015), we found that social class had no effect on child immunisation status in rural Barak Valley.[27,32] Persistent preference for son, often lead to gender discrimination in many aspects and the discrimination was also observed in terms of health seeking behaviors.[29,33] And, in the present study we also observed gender disparity in receiving full immunisation. More precisely, we observed that in rural Barak Valley, boy child had a higher likelihood of receiving full immunisation compare to girl child. The finding is also in consistent with the findings of the previous study.[30,34] The order of birth was also identified to be a significant factor of full immunisation. As the number of children in a family grows, the mother becomes busy in meeting their needs, and her attention is more frequently split between them if she has a large family.[18,35] Earlier studies revealed that children with a higher birth order had a lower chance of

Table 4: Logisticregression result dependent variable: full Immunisation

Indicators	Coefficient	Z- value
Religion	-0.53	-1.64*
Caste	0.49	1.50
Gender	0.57	1.73*
Birth Order	-0.84	-2.12**
Age of Mother	1.79	5.30***
Education of Mother	0.70	1.53
Occupation of Father	-1.05	-2.68***
Ante-Natal Check-ups	0.87	1.97**
24 months gap	1.66	3.25***
Interaction	0.83	1.13
Scaled Deviance Scaled	169.03 (Value / df = 1.04)	
Pearson X^2 Log	167.72 (Value / df = 1.03)	
Likelihood LR X^2	-105.29 202.152***	

Note:
(i) The value of the intercept term is not presented in the table as it is not necessary to determine the determinants of child immunisation.
(ii) Most of the newborns are born in institutional setups and immunisation cards are available in the majority of instances so we could not include the place of delivery and availability of immunisation cards in the current study. Working status of the mother was also taken into account, since a minimal proportion of eligible moms were found to be employed.
(iii) *p < 0.1; **p < 0.05; ***p < 0.01.
Source: Computed by the Researcher from Field survey, January 2017-June 2019.

obtaining full immunisation.[19,36] And, in line with earlier studies, we found a robust link between birth order and immunisation status. The negative sign of the coefficient suggests that higher birth order children were less likely to receive complete or full immunisation. In line with Kumar & Ram (2013), Debnath & Bhattacharjee (2018), and Sarker et al. (2019), we observed that the likelihood of childhood immunisation increased with maternal age.[19,21,37] That is in comparison to their counterparts, children born to older moms had a greater chance of being completely vaccinated. This might be due to the influence of things such as information and experience gained over time. However, in contrast with Nirmal et al., (2012) and Anokey et al., (2018) we did not find any association between maternal education child immunisation.[38,39] Occupation of father was also identified as a predictor of child immunisation. We found that across occupational group, children born to father engaged to agricultural/manual work were less likely to receive full immunisation compare to their counter parts. The finding is also supported by the findings of Herliana & Douiri (2017).[36] The positive "coefficient" of antenatal check-ups and gap between last two births indicates that children born to the mothers who sought all of the recommended antenatal check-ups and kept a minimum 24-month gap between their last two children's births had a higher likelihood of their children being fully vaccinated than their counterparts. This might be because antenatal check-ups give would-be mothers the chance to promote health-care utilisation, such as institutional delivery, immunisation, and family planning. These findings are also backed by the findings of Debnath & Bhattacharjee (2018) and Roy and Roy (2018).[11,19] We also observed the composite effect of maintaining gap between last two births and the last born child being a boy having positive impact on receiving full immunisation, however, the resultant outcome is not statistically significant.

5. Conclusion

The status of full immunisation in the valley depends on a number of factors. It has been observed that cultural factors like religion and caste are strong predictors of full immunisation in the valley. Children belong to Muslim religion are less likely to be fully vaccinated compare to Non-Muslim children. Similarly, children belong to general category of the social class are more likely to receive all the recommended vaccines during their infancy period. The existing difference in the cultural predictors also found to increase the inequality in child immunisation by a minimum margin across the economic class. We have also found that gender of the child and birth order are important decisive factors in explaining the status of full immunisation. Girl child and children of higher are less likely to be dully vaccinated and these difference also contribute in the wealth based inequality in full immunisation. Children born to slightly older mothers have been found to be more vaccinated compare to their counter parts. Similarly, the eligible mothers who have attained minimum primary level of educated has also been observed to be an important determinant of full immunisation in the valley. The existing difference in age of mother and educational attainment of the mother also increases the inequality in full immunisation across the wealth strata. Occupation of father has been identifies as a vital determinant of full immunisation. More precisely, children born to fathers who are engaged with agricultural and manual activities are less likely to receive all the recommended vaccines compare to their counter parts and this difference increases the inequality in full immunisation across economic class by a significant margin. The status of complete immunisation has been found to be favourably linked with WHO-recommended ANCs and family planning guidelines. This is most likely due to the fact that ANC visits allow for the provision of health care usage, such as institutional delivery, post-natal check-ups, immunisation, and family planning.

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7. Conflict of Interest

The author declares that there is no conflict of interest.

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