Socioeconomic impact on child immunisation in the districts of West Bengal, India

Som S, Pal M, Chakrabarty S, Bharati P

ABSTRACT

Introduction: Knowledge of inter-district variations in immunisation coverage and the reasons for their existence is of utmost importance in a region in which variations in the socioeconomic factors are known to have a marked influence on immunisation coverage.

Methods: This study was based on a sample of 1,279 children aged 12–35 months. Data was obtained from the District Level Household Survey under the Reproductive and Child Health project (DLHS-RCH-2) that was conducted from 2002 to 2004. Descriptive studies and logistic regression analyses were conducted to examine the variations in immunisation coverage.

Results: Approximately 54 percent of children in West Bengal were covered for immunisation. The results for receiving full immunisation varied greatly between the various districts, ranging from 23.3 percent in Murshidabad to 72.2 percent in Hugli. Low rates of coverage were found among the vulnerable groups of poor minorities, especially in rural areas. No evidence of gender differences was found. The educational level of the parents was found to have a significant influence on child immunisation coverage.

Conclusion: In order to improve upon the rates of child immunisation coverage in West Bengal, efforts should be concentrated on poor children from minority groups and those living in rural areas.

Keywords: child, districts of West Bengal, immunisation, India, socioeconomic factors

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Sociological Research Unit, Indian Statistical Institute, 203 BT Road, Kolkata 700 108 West Bengal, India

Som S, MSc
Associate Scientist

Economic Research Unit

Pal M, PhD
Professor

Biological Anthropology Unit

Chakrabarty S, MSc, PhD
Senior Research Fellow

Bharati P, PhD
Professor

Correspondence to:
Dr Premananda Bharati
Tel: (91) 33 2575 3210
Fax: (91) 33 2578 1834
Email: bharati@isical.ac.in

INTRODUCTION

Immunisation is a basic requirement to ensure child health. Vaccine-preventable diseases are responsible for the high rates of infant mortality and morbidity. The World Bank has reported that cost-effective public health initiatives are essential for poor children living in low- to middle-income countries, where a large number of children die due to undernourishment and preventable diseases. Immunisation is a form of intervention that can prevent the occurrence of a number of diseases such as tuberculosis, poliomyelitis, measles, diphtheria, pertussis and tetanus.[1] It is therefore essential for every child to be vaccinated; however, a large number of children, mainly in developing countries, do not receive a full course of immunisation.[2]

The National Population Policy aims to immunise all children against the six diseases mentioned above by 2010.[3] Although immunisation coverage has increased substantially in recent years, a large gap remains among the various socioeconomic categories. In India, there is no uniform immunisation program among the different states and even among the districts within each state. The extent of childhood immunisation varies based on socioeconomic and regional inequality.[4] The District Level Household Survey under the Reproductive and Child Health project (DLHS-RCH-2) has also shown district level differences in immunisation coverage,[5] but there are hardly any studies that seek to understand the influence of district level socioeconomic factors on child immunisation.

The goal of universal immunisation is not achieved in many developing countries because the poorest segments of society receive the least coverage. In India, children from the lowest 20% of the poorest households show worse immunisation coverage than those from the wealthiest 20% of the poorest households.[6] Full immunisation coverage in India is currently at 45.8%. This varies among the various Indian states, ranging from 13% in states like Nagaland, Assam and Bihar to 91% in Tamil Nadu. West Bengal has slightly higher immunisation coverage (50.4%) than the national average.[7] Moreover, the level of uniformity in terms of the district level immunisation coverage is quite satisfactory in West Bengal, with only a few exceptions. In this study, we investigated immunisation coverage in

Table I. Distribution of vaccination coverage in India[5] and West Bengal.

Vaccination	India (% vaccinated)		West Bengal (% vaccinated)	
	12–23 mths	24–35 mths	12–23 mths	24–35 mths
Polio 0	43.0	41.9	62.3	58.7
BCG	75.0	74.5	90.1	88.7
DPT (3 doses)	58.2	59.9	70.9	68.2
Polio (3 doses)	57.7	59.8	67.2	65.5
Measles	56.0	60.0	66.5	63.4
Full vaccination*	45.8	49.4	52.9	54.8
Total no.	62,505	64,377	618	661

*One dose of BCG, three injections of DPT, three doses of polio (excluding polio 0) and one injection of measles.
BCG: bacillus Calmette-Guérin; DPT: diptheria, pertussis and tetanus

Table II. Distribution of vaccination coverage in the districts of West Bengal.

District	% of vaccination taken up				Received all vaccinations (%)	Ranking
	BCG	Polio (3 doses)	DPT (3 doses)	Measles		
Darjeeling	93.4	65.6	63.9	65.6	54.1	10
Jalpaiguri	91.0	82.1	79.5	69.2	67.9	3
Cooch Behar	93.3	65.3	78.7	72.0	58.7	6
North Dinajpur	74.6	44.8	44.8	34.3	25.4	17
South Dinajpur	92.1	73.0	73.0	63.5	57.1	7
Maldah	86.4	66.7	65.2	59.1	51.5	14
Murshidabad	78.1	35.6	60.3	57.5	23.3	18
Birbhum	91.3	62.5	66.3	58.8	52.5	12
Bardhaman	91.8	71.2	67.1	65.8	56.2	9
Nadia	95.9	71.6	77.0	73.0	63.5	4
North 24 Parganas	90.8	71.1	75.0	73.7	56.6	8
Hugli	96.3	77.8	85.2	81.5	72.2	1
Bankura	97.5	77.8	80.2	75.3	69.1	2
Purulia	91.0	67.2	68.7	56.7	53.7	11
Midnapur	85.2	67.0	64.8	59.1	47.7	16
Howrah	86.3	67.1	74.0	67.1	58.9	5
Kolkata	94.7	60.5	63.2	76.3	47.4	15
South 24 Parganas	83.7	64.1	63.0	65.2	52.2	13
Total	89.4	66.3	69.5	64.9	53.9	

BCG: bacillus Calmette-Guérin; DPT: diptheria, pertussis and tetanus

the districts of West Bengal and compared these figures with the state figures in order to determine the relative achievements of the districts.

For over 30 years, West Bengal has had a stable Left Front government, whose unique contributions have been the introduction of land reform through the distribution of land among landless groups from different castes and communities, and the registration of share croppers and the establishment of three-tier Panchayats (local governing bodies that operate only in the rural areas of West Bengal). Moreover, West Bengal is multi-ethnic, and is home to geographically diverse people and very diverse economic groups. Although there are a number of health outcomes that can be examined, this study is restricted to testing the probable causes of inequities in access to immunisation services in the districts of West Bengal due to the influence of socioeconomic factors.

Since India's independence, many important steps have been taken to immunise children through different programs, such as the Expanded Program on Immunisation launched by the World Health Organization and the United Nations Children's Fund in the late 1970s as well as the Universal Immunisation Program in 1985–1986; however, a large number of children continue to be deprived of complete vaccination. It has been found that there is a lack of access to health services and low rates of participation in vaccination coverage among poor households,[8] minorities[9] and people living in rural and remote areas.[10] Studies have also shown evidence of gender inequities in child immunisation coverage,[11,12] and have found that religion[13] and the mothers' education level also play a role.[14,15] Considering the extent of inconsistencies and instabilities in immunisation coverage, it is very important to know the gaps in

Fig. 1 Map of West Bengal shows the immunisation status by district.

coverage. Therefore, the main objectives of the study were to unveil the inequalities in immunisation coverage, to identify the most vulnerable groups for immunisation coverage and to identify the gaps in coverage. This study did not seek to address the availability or accessibility of immunisation services in the districts of West Bengal, but only considered immunisation coverage with respect to sociocultural and economic variables.

METHODS

Data from the DLHS, which was a part of the Reproductive and Child Health project (Round 2, 2002–2004), was used for the analysis.[5] A systematic multistage stratified random sampling design was employed for the purpose of data collection. In total, 593 districts in India were surveyed. The present study only utilised the data obtained from the 18 districts in the state of West Bengal.

As part of the DLHS survey, every woman who had delivered at least one child within the three years preceding the survey was asked about immunisation. The present analysis considered only newborns at the age 12–35 months. Within this age group, a total of 1,279 children in West Bengal were considered.The RCH-DLHS-2 data on immunisation was based on each child's vaccination card, or on the mother's report in cases where the card was unavailable. According to international guidelines, children should be fully immunised by 12–23 months of age. However, considering the overall situation in India, this age can be extended to up to 35 months for full immunisation coverage.

Children who received vaccinations of bacillus Calmette-Guérin (BCG), measles and three doses of diptheria, pertussis and tetanus (DPT) and polio (excluding Polio 0), were considered to be fully

Table III. Distribution of immunisation coverage based on various socioeconomic factors among children aged 12–35 months.

Socioeconomic factor	% of vaccination taken up				Full immunisation	Total no.
	BCG	Polio (3 doses)	DPT (3 doses)	Measles		
Residence						
Rural	87.1	61.8	65.0	59.3	48.9	855
Urban	93.9	75.5	78.5	76.2	63.9	424
Religion and caste						
Hindu SC/ST	90.6	62.7	67.3	61.4	47.5	440
Hindu OBC	94.6	66.1	69.6	69.6	57.1	56
Hindu general	93.9	77.9	81.1	78.3	68.2	475
Muslim	78.9	53.1	54.4	48.0	39.8	294
Other religion	92.9	64.3	64.3	57.1	50.0	14
Mother can read and write						
Yes	92.9	72.5	75.9	73.0	61.2	879
No	81.5	52.8	55.5	47.0	37.8	400
Father can read and write						
Yes	92.6	71.4	74.3	71.9	59.9	931
No	80.7	53.4	56.6	46.3	37.6	348
Standard of living						
Low	85.7	57.4	60.9	55.0	44.6	680
Medium	90.7	72.1	74.6	69.3	58.0	398
High	99.0	85.1	88.6	89.6	77.1	201
Gender of child						
Male	88.6	65.1	69.2	64.8	53.0	630
Female	90.1	67.5	69.8	65.0	54.7	649
Age of child						
12–23 mths	90.1	67.2	70.3	66.5	52.9	618
24–35 mths	88.7	65.5	68.2	63.4	54.8	661

BCG: bacillus Calmette-Guérin; DPT: diptheria, pertussis and tetanus; SC: scheduled caste; ST: scheduled tribe; OBC: other backward classes

vaccinated. According to the immunisation schedule, all primary vaccinations including measles should be completed by the time a child reaches 12 months of age. However, the data set showed that at the age of 12–23 months, only 45.8% of children had undergone full immunisation, and this proportion was 49.4% in children aged 24–35 months. The target age group was thus taken to be 12–35 months of age.

The study focused on individual and socioeconomic variables in order to find the gap in immunisation coverage. Assuming that inequality is the root cause of the gap, three variables were considered to measure it: poor status (measured through the household standard of living index), rural status (considered to be a weak area) and minority status, which included the Scheduled Castes (SC)/Scheduled Tribes (ST) and Muslims, as their overall development status is low. It was assumed that the interaction between poverty and selected independent variables would have a significant influence on the immunisation coverage gap. The independent factors that were considered included the gender (boy/girl) and age of the child (indicated as 12–23 or 24–35 months), the mother's educational level (literate/illiterate), father's educational level (literate/illiterate), and mother's religion and caste. The household standard of living index (SLI) reflects the economic status of the household, and was calculated by adding up the scores prepared by the National Family Health Survey of some durable goods used by the household, the land, the source of drinking water, sanitation, type of housing, etc. A combination of some independent factors may help to detect the most vulnerable groups. Due attention should be paid to these groups in order to improve the health status of the whole community through full immunisation coverage.

Logistic regression (binary) analysis was used to examine the likelihood of the full immunisation of children in terms of the various socioeconomic factors. The outcome variable is the immunisation status. The dependent variable takes a value of 1 or 0 depending on whether the child is fully immunised or not. An estimated odds ratio (OR) of 1 indicates that the nature of the dependent variable is not different from that of the reference category. An estimated OR > 1 indicates that the probability of complete immunisation coverage is higher in this category compared to that in the reference category, and if OR < 1, then the probability is lower. All the calculations were done using the Statistical Package for the Social Sciences version 11.0 (SPSS Inc, Chicago, IL, USA).

Table IV. Results of the logistic regression analysis of full immunisation coverage among children aged 12–35 months from different socioeconomic backgrounds in West Bengal.

Variable	Reference category	Category	B	Exp (B)	Significance level
Gender of the child	Male	Female	0.059	1.061	NS
Mother's education level	Illiterate	Literate	0.470	1.601	*
Living standards	Low	Medium	0.179	1.196	NS
		High	0.843	2.323	*
Religion	Muslim	Hindu	0.737	2.089	*
		Other religion	0.533	1.704	NS
Caste	SC/ST	OBC	0.145	1.156	NS
		General	0.416	1.516	**
Residence	Urban	Rural	0.100	1.105	NS
Log likelihood			1639.719		
R^2 (Cox & Snell)			0.094		

*Significant at 1% level. ** Significant at 5% level.
B: coefficient; Exp (B): odds ratio; NS: not significant; SC: scheduled caste; ST: scheduled tribe; OBC: other backward classes

It should be noted that the set of regressors used for the regression analysis was tested for multicollinearity. Since there is more than one item for immunisation, the analysis could have been conducted for each item. However, we were interested in the overall immunisation status, and hence combined all the items into one in order to obtain the full immunisation status. Child immunisation status was found to be poor among poor households, minority groups and rural populations in comparison with those from non-poor households, non-minority groups and urban populations. The gender and age of the child, the literacy level of the parents, the mother's caste and religion were included in the regression model in order to examine the impact of these variables.

RESULTS

Table I shows the general status of immunisation in West Bengal in relation to that at the national level for children aged 12–35 months. The data shows that for each type of vaccination coverage, West Bengal had a higher level of immunisation than the whole of India.

Table II shows the distribution of districts based on the coverage of each type of immunisation among children aged 12–35 months. The coverage for BCG was around 90%, whereas that for measles was much lower in comparison. The highest level of measles vaccination coverage was found in the district of Hugli (81.5%), and the lowest, in North Dinajpur (34.3%). Only 23.3% of children in the district of Murshidabad were found to be fully vaccinated. This was followed by North Dinajpur (25.4%). The highest level of full vaccination was found in the Hugli district (72.2%). North Dinajpur showed a consistently poor result for each type of vaccination. Mixed results were found for the other districts. Fig. 1 shows the percentage of full immunisation coverage in the various districts of West Bengal among children aged 12–35 months.

Table III shows that there was more coverage of each type of vaccine in urban than in rural areas. Approximately 49% of the children in rural areas had received all the recommended vaccinations by the age of 12–35 months, compared to 63.9% in urban areas. A large rural-urban gap in receiving the different types of vaccinations can be observed from Table III. The data did not show any gender bias. In addition, there was no substantial difference in the immunisation coverage among children from different ethnic communities. The household SLI was found to have a strong positive relationship with vaccination coverage. 44.6% of children who came from households with a low standard of living were fully vaccinated, whereas 77% of children from households with a high standard of living were fully vaccinated. Parental literacy was also found to play a major role in child immunisation.

Table IV shows the results of the logistic regression analysis of immunisation coverage on the socioeconomic characteristics of children aged 12–35 months. Children with full immunisation coverage (FIC) were assigned the value 1 and children who were not fully immunised were assigned the value 0; i.e. not fully immunised children were treated as the reference category. The correlation analysis showed that there was a high correlation between the mother's and father's education level (0.516, significant at 1% level). For this reason, the father's education level was not considered as one of the determinants. Regression analysis led to the conclusion that the mother's education level and the

living standards were significantly associated with FIC. Fig. 2 describes the changes in the key parameters of the parent's minority (including Muslim and SC/ST) status and rural residence. The highest rates of child immunisation were related to socioeconomic status. Fig. 2 shows two extremes in receiving FIC. In the worst case scenario, full immunisation for poor minority children in a rural area was 13.6% lower than the state average (53.9%). In the other extreme, for non-poor, non-minority and urban children, the probability of receiving FIC was 20.6% higher than the state average. Therefore, full immunisation for the extreme poor was about 34.2% (13.6% + 20.6%) lower than for urban, non-poor and non-minority children. Table II shows that the mean FIC in the state was 53.9%; therefore, the predicted FIC value for the extreme poor would be 40.3% (53.9% – 13.6%) and that for the urban, non-poor and non-minority children would be 74.5% (53.9% + 20.6%). This means that the chances of the extreme non-poor receiving full immunisation was about 1.8 times (74.5%/40.3%) higher than for extremely poor children. It also shows that the groups of poor, non-minority and rural children and those of the non-poor, non-minority and rural children were in a less severe position compared to poor, minority and rural children. Therefore, it can be concluded that neither poverty nor minority status by itself accounted for the sharp gap in FIC but rather, a combination of the two. Rural residence was found to be a key factor only for the non-poor and non-minority classes, and the net effect of the rural factor was –10.1% (10.5% – 20.6%). The results did not show any marked rural-urban differences among children in the poor and minority categories; therefore, the prediction is not shown in Fig. 2.

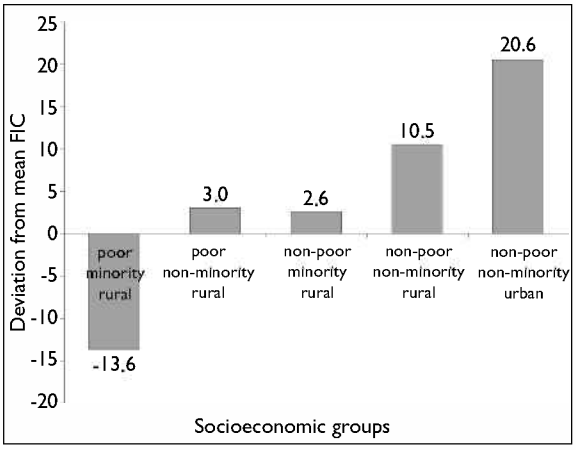

Fig. 2 Prediction of the effect of poverty, minority status and rural residence on the probability of full immunisation coverage (FIC). The differences were obtained through an estimation of the mean FIC of the state. It should be noted that the zero line illustrates the prediction of the mean FIC.

DISCUSSION

The importance of immunisation coverage for children should be emphasised, not only to ensure the improvement and prevention of child mortality and morbidity, but also to secure the overall development of the state. The results highlight two salient points. First, the likelihood of children receiving full immunisation increases with their age. The attitudinal reluctance toward immunisation at an early age (data is not shown) is a combination of unawareness of places where the program is conducted, poor knowledge of the proper age for immunisation and a lack of faith in immunisation. The cost may also impede participation in an immunisation program. There may be travel costs to the immunisation coverage site, waiting costs or lost wages involved that may be substantial for a poor daily wage earner. In this context, it should be noted that among the 1,279 children, only 83 (6.5%) children were not immunised at an early age due to a lack of awareness. Second, the immunisation coverage itself, which was very uneven across the districts of West Bengal, may be due to sociocultural phenomena such as the concentration of minorities in certain districts, or a combination of poverty and low literacy levels.

The two districts of North Dinajpur and Murshidabad were found to have the least immunisation coverage, and this has set them apart from the rest of the districts. The combined effects of a low literacy level and minority status may be the reason for such low coverage in these two districts. Mothers' literacy levels were 46.3% and 54.8%, respectively, for these two districts, and the concentration level of Muslims was 45.6% and 63.7%, respectively.[16] Although the female literacy rate was quite low in South Dinajpur (37.2%) and in Purulia (37.1%), the rate of immunisation in these two districts was not as low as that in North Dinajpur and Murshidabad.[16] Apart from these combined effects, natural conditions may also be responsible for such poor immunisation coverage in the two districts. While the survey was being conducted in 2002, two rivers, Nagar and Kulik, wrecked major devastation in North Dinajpur. More than 20 villages were reported to have been submerged in water due to erosion and flooding. Similar incidents occurred in Murshidabad, where some families were also displaced due to erosion of the Ganga river.

The results did not show any significant gender bias in immunisation coverage, although evidence of a preference for sons has been found in previous studies.[17] It has been observed that both girls and boys with only surviving siblings of the opposite gender are in a better

position than other children. Conversely, children with two or more surviving siblings of the same gender are worse off in terms of their health outcomes.[18] The results show some evidence of caste/ethnicity differences in immunisation coverage. For instance, Muslim children were clearly worse off. In addition, children belonging to SC/ST were found to be less likely to be fully immunised compared with upper caste children.[13] Parental education, specifically the mother's education level, played a key role in child immunisation coverage, a finding that is also supported by other studies.[19]

The present study has shown that there is a large gap in immunisation coverage between poor and non-poor households, which is more intensely unfavourable to poor minority groups and rural populations. Previous health studies involving children in India have also shown the precarious conditions of children with the combined status of being poor, a minority[20] and a rural resident.[21-23] Our findings corroborate this. Often, FIC could not be performed due to the high drop-out rates from DPT and polio immunisation series. The drop-out rate from DPT (approximately 27%) and polio (approximately 28%) was higher among poor children than among non-poor children (DPT and polio 14% each). Other reasons for poor immunisation coverage in such areas may be system failure in reaching under-privileged populations or inadequate immunisation supplies, including services.

It is clear from the above findings that it is necessary to improve the immunisation coverage of children from poor and minority families. The rural-urban difference alone does not have a very significant effect on immunisation coverage, but when coupled with poverty and minority status, it may signal stark differences in immunisation coverage. From a policy perspective, emphasis should be placed on serving the vulnerable groups as signified by religion, caste, economic conditions and accessibility. Improvements are also required in education, especially among parents.

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