



INEQUALITY IN CHILD IMMUNIZATION ACROSS MAJOR STATES IN INDIA WITH SPECIAL REFERENCE TO WEST BENGAL

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ABSTRACT

Universal Immunization Programme (UIP) was launched by Government of India in 1985-86 which aimed at providing free of cost vaccinations to all children. Consecutive rounds of National Family Health Surveys (NFHS) data show that while in West Bengal the percentage of fully vaccinated children increased from 34.2 in 1992-93 to 64.3 in 2005-06, during the same period it increased from 64.9 to 80.9 in Tamil Nadu. Out of 1600 paralytic cases which were reported in India, 29 percent of the cases belonged to west Bengal. Moreover, West Bengal shows a significant difference between rates of polio and non-polio vaccinations. This study tries to explain the inequality in polio and non-polio immunization using Concentration Index (CI) from the NFHS 1 & 3 data. Result shows that inequality in DPT and measles vaccinations are greater than that of BCG and polio and among the socio-religious classes, inequality among the Muslims is higher than that of ST, SC and 'others' socio-religious groups. These findings prescribed special efforts on monitoring and immunizations have to be given in areas with higher concentration of Muslims.

Keywords: UIP, Polio, Non-polio, Inequality, Concentration curve, Concentration Index

ACKNOWLEDGEMENTS

I would like to express my gratitude towards Dr. Saswata Ghosh and Dr. Subrata Mukherjee for their untiring efforts, motivation and sincere guidance. Their suggestions and comments helped me to developed new ideas which I tried best to incorporate into my study.

I got enormous support from my parents and this study would not have been possible with their efforts and motivation. I take this opportunity to thank my friends and well-wishers who have given me support and strength all the time. A special mention towards my colleagues from BKGC, Howrah interacting with whom I have enriched my Knowledge and helped me in constructing my paper.

Introduction

Wealth-based inequalities in different health variables are prevalent to many developing countries and India is no exception of that. Inequalities in health sectors are perhaps the most worrisome than any other sectors. Much higher burden borne by poor population in comparison to rich population on many health outcome variables, have been found in many studies. Poor people suffer due to their lower incomes, less access to health sectors and also due to their poor living conditions. Inequalities in vaccination/immunization, if observed, cannot be acceptable to a society since vaccination against six preventable diseases (such as tuberculosis, diphtheria, pertussis, tetanus and measles), are independent of need and are expected to be provided free of cost to all the children in the country. Despite being all free vaccination programme, there are still enormous disparities in immunization across the socio-economic classes, especially in non-polio vaccination. Pande and Yazbeck (2002) have emphasized the inequality by looking beyond the national average and found heterogeneity in immunization across the states, gender and urban-rural division. Gaudin and Yazbeck (2006) also emphasized efficiency and equity of immunization programme rather than focusing only on average immunization rates. Both these studies considered ‘fully vaccinations rate’ for their analysis. By considering all four types of vaccinations separately, our study focuses on wealth related inequality among major states in India and socio-economic inequality in immunization in West Bengal.

In this study an attempt has been made to explain the inequality in immunization. There are different techniques of inequality measurement viz range, Gini coefficient (and the associated Lorenz Curve), a pseudo-Gini coefficient (and an associated pseudo-Lorenz curve), the index of dissimilarity, the slope of index of inequality (and the associated relative index of inequality) and Concentration Index (and the associated concentration curve). In the measurement of range only top and bottom socio-economic groups are considered here. The drawbacks of range are obvious; it does not incorporate the intermediate groups and the difference between top and bottom might be unchanged but the inequality between intermediate groups might be diminishing. The Lorenz curve plots the cumulative proportion of population against the cumulative proportion of health. The cumulative proportion is starting with the sickest person and ending with the healthiest person. The Lorenz curve will be coincides with diagonal if health is equally distributed. The twice the area between Lorenz Curve and diagonal provides the Gini coefficient and it is ranges from 0 to 1. The Gini coefficient reflects experiences of all persons and not just the bottom and top level groups but this technique fails to explain the socio-economic dimension to health inequalities. Index of dissimilarity is another technique of health inequality measurement but likewise Gini coefficient it is also fails to address the socioeconomic dimension to health inequalities. Concentration index is the most frequently use technique of inequality in health. Concentration index is able to reflect the socio-economic dimension to health inequalities and thus capture the experiences of entire population and that is why it is superior to other health inequality measurement techniques (Wagtaff et al. 1991).

Concentration Curve

The concept of concentration curve is very similar to that of Lorenz curve. Two key underlying variables of the concentration curve are the health variable, the distribution of which is the subject of interest and a variable capturing the living standard against which the distribution is to be assessed. The concentration curve plots the cumulative percentage of health variable against the cumulative percentage of population ranked by standard of living of the population, starting with the poorest and ending with the richest. If the value of the health variable is same for everyone irrespective of their standard of living, the concentration curve will be coincides with the diagonal which indicates perfect equality. If the health variable takes higher (lower) values

among poorer people, the concentration curve will lie above (below) the line of equality. The farther the curve is above the line of equality, the more concentrated the health variable is among the poor. As immunization is a pro-rich health variable it will lie below the line of equality which indicates the health variable is more concentration among rich. The health variables included in this analysis are – polio, BCG, DPT and measles vaccinations whereas wealth of families is taken as a proxy for income of the families. A child is vaccinated with polio and DPT means s/he received all the three vaccines of polio and DPT.

Concentration Index

The concentration index is defined as “twice the area between the concentration curve and the line of equality”. If there is no socioeconomic-related inequality, the value of concentration index is zero. The concentration index takes a negative value if the curve lies above the equality line, which indicates disproportionate concentration of the health variable among the poor, and takes a positive value if the curve lies below the equality which indicates the health variable is more concentrated among rich (O`Donnell et al. 2008).

The concentration index is defined as

$$C=1-2 \int_0^1 Lh(p)dp.$$

The concentration index ranges from -1 to +1.

Measures of Wealth Index

In NFHS-3, in constructing the wealth index value for each household, information on 33 types of assets are considered. These are mattress, pressure cooker, chair, cot or bed, table, electric fan, radio or transistor, television (B&W), television (colour), sewing machine, mobile telephone, any other type of telephone, computer, refrigerator, watch or clock, water pump, thresher, tractor, motorcycle or scooter, animal-drawn cart, car, having a bank account, post office account, health insurance and the BPL card. Since our analysis uses both NFHS-1 and NFHS-3 data, for the sake of comparability we consider only those assets which are common in both the data sets. In calculating wealth index, therefore, we have taken into account information about only 14 assets. These assets are: source of drinking water, type of toilet facility, electricity, radio, television,

refrigerator, bicycle, motorcycle or scooter, car, type of cooking fuel, separate room for cooking, watch, electric fan and sewing machine. For our analysis wealth index was calculated as a composite score comprising the above mentioned assets holding.

Wealth inequalities in immunization across the states

An analysis of data from NFHS-1 survey, which was conducted during 1992-93, shows that inequalities in immunization in all four vaccines were high in all the major states except Tamil Nadu and Kerala. From Table 1 it can be seen that among the major states, inequality in polio vaccination is higher in states like Uttar Pradesh, Rajasthan, Assam and Madhya Pradesh. It has also been observed that there were vast rural-urban difference in polio vaccination in states like Andhra Pradesh, Assam, Karnataka and Maharashtra. A comparison between NFHS-1 and NFHS-3 (2005-06) shows that inequality in polio vaccination has come down substantially in all the major states. The most interesting result is found in Uttar Pradesh which shows that inequality has come down so sharply that its' inequality level is just above that of the Tamil Nadu -a state which shows lowest inequality in polio vaccination among the major states. The value of concentration index (C.I) went from 0.27 to 0.05 in urban areas and from 0.32 to 0.04 in rural areas in Uttar Pradesh. The rural-urban difference in polio vaccination has been reduced in all major states. Most strikingly in Kerala, the rural-urban difference in polio vaccination has slightly worsened between 1992-93 and 2005-06. In urban Kerala the polio vaccination rate ranges from 85.71% (poorest group) to 100% (richest group) but in rural Kerala the corresponding figures are 41.38% and 93.33% during 2005-06. Though inequality in the rural areas, measured by concentration index, is greater than that in the urban areas in all the major states, Andhra Pradesh is which shows C.I values 0.06 and 0.03 in the urban and rural areas respectively. While the highest value of C.I (0.19) is observed in rural Assam, no state has achieved a near-equality stage and the level of inequality is lowest in Tamil Nadu (C.I= 0.02) in polio vaccination.

From Table 2 it can be seen that, apart from Tamil Nadu, Kerala and Maharashtra, in all the major states the inequality level in BCG vaccine was very high during 1992-93. NFHS-1 data also showed that there were enormous rural-urban differences in BCG vaccination in all the major states. During 2005-06 it has been observed that the inequality level in BCG vaccination

has come down in all the major states. However, in some states significant rural-urban difference in BCG vaccination still exists. Among the major states, in Rajasthan, Orissa, Assam and Uttar Pradesh the inequality in BCG vaccination is still higher than that of other major states. Significant rural-urban difference in BCG vaccination is found in West Bengal, Haryana, Assam and Madhya Pradesh. Andhra Pradesh and Orissa have higher level of inequality in urban areas in comparison to the rural areas. The most striking result has been found in urban Kerala and urban Tamil Nadu where all the children, aged one year or less, have received the BCG vaccines.

Table 1: Concentration index showing the inequality in polio vaccination in 1992-93 and 2005-06

Year	1992-93			2005-06		
	total	Urban	Rural	total	Urban	Rural
Andhra Pradesh	0.158	0.136	0.170	0.050	0.065	0.039
Assam	0.404	0.198	0.417	0.181	0.152	0.196
Haryana	0.171	0.164	0.169	0.076	0.077	0.077
Karnataka	0.140	0.182	0.134	0.081	0.087	0.084
Kerala	0.114	0.103	0.112	0.073	0.033	0.089
Madhya Pradesh	0.279	0.202	0.288	0.097	0.039	0.116
Maharashtra	0.075	0.113	0.073	0.085	0.067	0.089
Orissa	0.214	0.236	0.214	0.138	0.149	0.145
Rajasthan	0.388	0.299	0.383	0.099	0.118	0.106
Tamil Nadu	0.049	0.041	0.044	0.025	0.027	0.025
West Bengal	0.225	0.182	0.221	0.080	0.070	0.090
Uttar Pradesh	0.318	0.278	0.320	0.046	0.052	0.048

(Data source: Calculated from NFHS-1 & NFHS-3)

When we shift our focus from polio and BCG vaccinations, we observe that inequalities have not been decreased to a great extent. From Table 3 it can be seen that inequalities in DPT vaccination are higher in all the major states in comparison to that of Polio and BCG vaccinations. Andhra Pradesh, Madhya Pradesh, Assam, Haryana, Karnataka, Orissa, Rajasthan, West Bengal and Uttar Pradesh all these states have higher inequalities in DPT vaccinations in comparison to Kerala, Tamil Nadu and Maharashtra. NFHS-1 data also showed that rural-urban difference in

DPT vaccinations were also equivalently higher in these states. Among the major states, Tamil Nadu, Kerala and Maharashtra show lower level of inequalities in comparison to other major states. Rural-urban difference is lower in these states except Maharashtra. NFHS-3 data shows that inequalities in DPT vaccinations have not reduced to a great extent in most of the major states. Andhra Pradesh, Assam, Haryana, Madhya Pradesh, Maharashtra, West Bengal and even Kerala, show high rural-urban differences in DPT vaccinations.

Table 2: Concentration index showing the inequality in BCG vaccination in 1992-93 and 2005-06

Year	1992-93			2005-06		
	Total	Urban	Rural	Total	Urban	Rural
Andhra Pradesh	0.139	0.093	0.158	0.031	0.063	0.010
Assam	0.362	0.185	0.374	0.295	0.194	0.308
Haryana	0.144	0.161	0.139	0.112	0.094	0.126
Karnataka	0.104	0.126	0.104	0.069	0.068	0.063
Kerala	0.082	0.046	0.088	0.018	0.000	0.024
Madhya Pradesh	0.255	0.201	0.258	0.148	0.049	0.179
Maharashtra	0.077	0.096	0.081	0.036	0.019	0.060
Orissa	0.229	0.208	0.235	0.099	0.121	0.103
Rajasthan	0.365	0.254	0.367	0.186	0.183	0.205
Tamil Nadu	0.044	0.042	0.037	0.003	0.002	0.003
West Bengal	0.242	0.219	0.241	0.075	0.030	0.090
Uttar Pradesh	0.286	0.255	0.295	0.237	0.245	0.259

(Data Source: Calculated from NFHS-1 & NFHS-3)

In measles vaccination, the inequality level is higher in compared to all other vaccines. NFHS-1 data showed that in all the major states the gap between poorest and richest was higher in measles vaccinations. The rural-urban gap or difference was also substantial in case of measles vaccinations in most of the major states. A comparison between NFHS-1 and NFHS-3 data also showed that the inequalities in measles vaccinations have not reduced to a great extent in most of the major states and the gap between rural and urban sector has remained very high in measles vaccinations.

Among the major states, Assam and UP show the high level of inequality in measles vaccinations. Only in Tamil Nadu the inequality in measles vaccination has come down substantially between 1992-93 and 2005-06 but rural-urban difference still exists. Assam, Haryana, Karnataka, Kerala, MP, Maharashtra, Orissa, UP and West Bengal -all these states show higher inequalities in rural sector than urban sector in measles vaccinations.

Both NFNS-1 as well as NFHS-3 data shows that the inequality in all the vaccinations is lower in three southern states of Kerala, Tamil Nadu and Andhra Pradesh in comparison to all other major states.

Table 3: Concentration index showing the inequality in DPT vaccination in 1992-93 and 2005-06

Year	1992-93			2005-06		
	Total	Urban	Rural	Total	Urban	Rural
AP	0.166	0.138	0.173	0.105	0.126	0.092
Assam	0.405	0.198	0.417	0.305	0.248	0.324
Haryana	0.169	0.166	0.164	0.149	0.092	0.166
Karnataka	0.145	0.188	0.137	0.110	0.099	0.119
Kerala	0.118	0.114	0.117	0.067	0.035	0.078
MP	0.293	0.232	0.302	0.248	0.125	0.278
Maharashtra	0.081	0.112	0.081	0.093	0.075	0.118
Orissa	0.220	0.259	0.218	0.157	0.176	0.169
Rajasthan	0.400	0.313	0.395	0.272	0.239	0.273
Tamil Nadu	0.050	0.045	0.047	0.012	0.017	0.009
WB	0.242	0.203	0.242	0.121	0.083	0.140
UP	0.322	0.281	0.325	0.315	0.337	0.341

(Data source: Calculated from NFHS-1 & NFHS-3)

The rural-urban difference is also lower in these three states in comparison to other major states. Among the major states, Assam and Uttar Pradesh show very high level of inequality in BCG, DPT and measles vaccinations whereas Tamil Nadu has the lowest levels of inequality in all the vaccinations. Inequalities in immunization (measured by concentration index) vary substantially across all major states and the degree of variability seems to be wider for DPT and Measles vaccinations. Whereas NFHS-1 data showed that the inequality levels in all types of vaccinations – polio and non-polio were higher in comparison to NFHS-3 data. The levels of inequality in all

types of vaccinations have reduced significantly between 1992-93 and 2005-06, but the reduction in inequality has been less for non-polio vaccination. This is a pattern which is observed in all major states.

Table 4: Concentration index showing the inequality in measles vaccination in 1992-93 and 2005-06

Year	1992-93			2005-06		
	Total	Urban	Rural	Total	Urban	Rural
Andhra Pradesh	0.267	0.231	0.268	0.113	0.219	0.057
Assam	0.563	0.375	0.578	0.469	0.483	0.494
Haryana	0.266	0.297	0.258	0.169	0.136	0.180
Karnataka	0.257	0.314	0.234	0.169	0.153	0.171
Kerala	0.237	0.276	0.224	0.102	0.044	0.122
Madhya Pradesh	0.338	0.329	0.329	0.273	0.147	0.319
Maharashtra	0.159	0.225	0.162	0.103	0.097	0.146
Orissa	0.332	0.353	0.327	0.210	0.245	0.231
Rajasthan	0.466	0.374	0.448	0.351	0.330	0.363
Tamil Nadu	0.150	0.147	0.167	0.030	0.046	0.019
West Bengal	0.355	0.377	0.360	0.149	0.105	0.175
Uttar Pradesh	0.426	0.412	0.430	0.393	0.348	0.431

(Source: Calculated from NFHS-1 & NFHS-3)

Inequality in Immunization in West Bengal

Wealth inequalities in West Bengal

During 1992-93, in West Bengal the inequality in measles vaccination was higher compared to Polio, BCG and DPT vaccinations. Concentration Index (C.I) showed that during 1992-93 the BCG, Polio and DPT vaccinations show similar level of inequality though their immunization rates are different. NFHS-1 data showed that rural-urban inequalities were higher in case of BCG, Polio and DPT vaccinations. Though the inequality level was higher in measles but C.I showed that rural-urban difference was lower in case of measles vaccinations. NFHS-3 data showed that the inequality levels in all the vaccinations have reduced but in comparison to BCG and Polio vaccinations the inequality levels are higher for DPT and measles vaccinations. The rural-urban difference in polio vaccination has significantly reduced in 2005-06 but scenario is somewhat different for non –polio vaccinations.

Inequality in immunization across social-classes in West Bengal

During 1992-93, inequalities in all types of immunization across the social classes show significant differences. In polio and DPT vaccinations the inequality levels were worst in ST community and in BCG and measles vaccinations the inequality level was worst in the SC community. The disparity in all the immunization was lower among the others (which include non-backward castes Hindus, Sikhs and Jain and OBC). The inequality in polio vaccinations was lower compared to non-polio vaccinations among the SC and 'others' community. Among the ST and Muslims inequality level was lower in BCG vaccinations in comparison to others vaccinations. NFHS-3 data shows that inequality levels have reduced among all communities. Differentials in polio vaccinations have significantly reduced among ST, SC and 'others' but inequality is still at a very high level among the Muslims. In BCG vaccinations, the poor-rich differences are lower among SC and Others. The BCG vaccinations rates range from 89.85% to 99.67% for the 'others' community but it is ranges from 80.20% to 100% for the SC community and most interestingly poorest 20% of the population has 100% vaccinations rate in BCG. BCG vaccinations rate is ranging from 33.33% to 100% among the ST. In DPT vaccinations, inequality level is highest among Muslims and lowest among the 'others' group. In Measles vaccinations, the inequality levels have reduced significantly among the all social-classes but except for the 'others' it is still very high among ST, SC and the Muslims.

Conclusion

From NFHS-1 and NFHS-3 it has been found that southern states have the lower inequality levels in all types of immunization when compared with other major states. Inequalities in all types of vaccinations have reduced in all the major states. Rural-urban difference has also been significantly reduced and high rural-urban differences still exists in measles in comparison to other vaccinations. Among all types of immunizations, inequality in polio vaccinations is lower compared to non-polio vaccinations. Among the non-polio vaccinations, disparity in BCG is lower in all the major states. In West Bengal inequality in DPT and measles vaccinations are greater than that of BCG and Polio. Among the social-classes, inequality among Muslims is higher than that of ST, SC and 'others' class. The findings of this study may indicate certain policy pointers. Along with the Pulse Polio Immunization Campaign effective programmes are

needed to reduce the inequality in non-polio vaccinations. Areas with higher concentration of Muslims population are needed to be monitor properly.

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