

Understanding the Inequalities in Full Immunization Coverage in India: A Decomposition Approach

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Introduction

- The importance of childhood immunization for healthy child growth and development is well recognized and is considered to be the best and most cost-effective lifesaver.
- The World Health Organization defines immunization as the process whereby a person is made immune or resistant to an infectious disease, typically by the administration of a vaccine (WHO, 2019).
- India's immunization program covers around 26.7 million infants and 30 million pregnant women annually (MoFHW, 2016). In terms of numbers, it seems as though most children in India are immunized, but this generalization might not show the real picture.
- India's commitment to attaining full immunization with all available vaccines for children up to 2 years of age is still doubtful, and the country still has a significant proportion of children who are not fully immunized – 38% (IIPS & ICF, 2017).
- Low socioeconomic status has been shown to be associated with low child immunization and health care utilization, but the inequalities in immunization coverage due to social and economic factors are poorly understood.

Aim

- This study aimed to explore the association between child immunization coverage and various socioeconomic factors and to quantify their contributions to generating inequalities in immunization coverage in India.

Data Source

- The study data from the National Family Health Survey-4 conducted in 2015–16.

Outcome Variables: The outcome variable used in this study is whether the child had received all the basic vaccinations by the age of 12–23 months or not with '0' representing children who had not received all the basic vaccinations at the time of the survey, and '1' representing those who had.

Predictor Variables: Various demographic and socio-economic characteristics such as: sex of the child, birth order, place of residence, mother's education, religion, social group, sex of household head, region and wealth index.

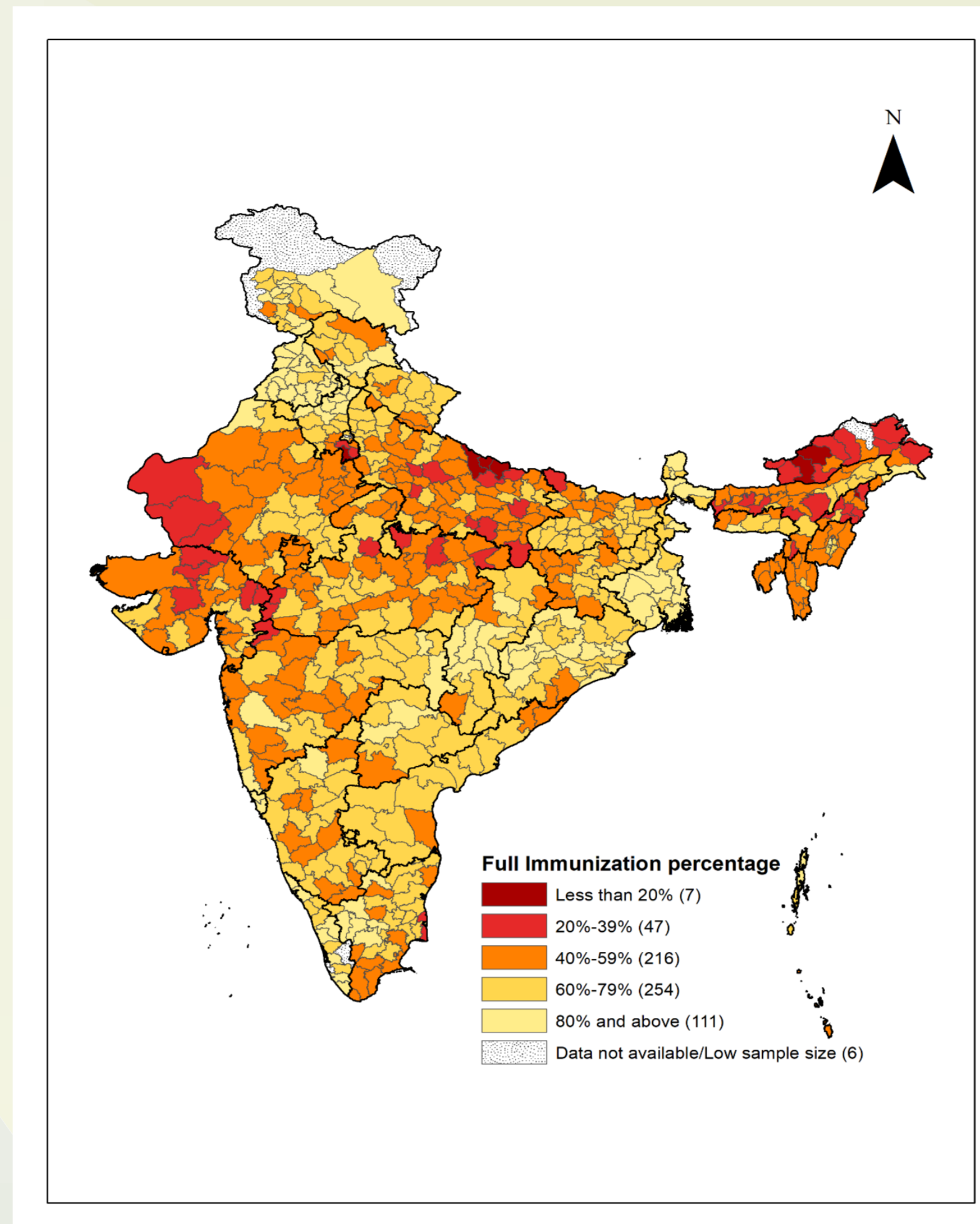
Methodology

- The association between socioeconomic determinants and child full immunization coverage was estimated using the χ^2 test and binary logistic regression.
- Concentration indices were estimated to measure the magnitude of inequality, and these were further decomposed to explain the contribution of different socioeconomic factors to the total disparity in full immunization coverage.

Results

- The results showed that immunization uptake was highly associated with the mother's educational status and household wealth.
- Immunization coverage was slightly lower among female than male children, and urban areas had higher coverage than rural areas.
- When different geographical regions were considered, the East and South states had more fully immunized children than the Northeast and Central states.
- Many districts in the northern and eastern parts of the country with similar geographies have a low percentage of fully immunized children (Figure 1).
- Of the 640 districts covered, only 111 had more than 80% of children fully immunized, while seven districts had less than 20% and 47 districts had 20–39% of children fully immunized. The majority of districts (216 and 254) had 40–59% and 60–79% of children fully immunized, respectively.
- The χ^2 test and logistic regression results showed that uptake of full immunization was highly associated with mothers' educational status, birth order, and household wealth.
- The concentration index shows that the estimated value of the relative contribution was negative for factors such as weak economic status (concentration index: -0.539), the mother being illiterate (concentration index: -0.161) and birth order of 4 or more (concentration index: -0.057).

Figure-1: Distribution of Indian districts by the percentage of children fully immunized NFHS 2015–16



- The concentration index decomposition reveals that inequality was highest among the vulnerable economic group (43.90%) and children whose mothers were illiterate (32.78%).
- The overall concentration index value indicates that the weaker socioeconomic groups in India are more disadvantaged in terms of immunization interventions.

Table 1. Percentage of children aged 12–23 months with full immunization, adjusted odds ratios (AORs) and χ^2 values by background characteristics, India, 2015–16.

Background characteristics	Full immunization (%)	AOR	95% CI	χ^2	n
Sex					
Male (Ref.)	62.05	1.00			24,750
Female	61.93	1.00	[0.949, 1.056]	0.016	23,089
Place of residence					
Urban (Ref.)	63.85	1.00			13,602
Rural	61.25	1.14**	[1.047, 1.242]	88.8639	34,237
Birth order					
1 (Ref.)	67.23	1.00			18,177
2	63.47	0.89**	[0.837, 0.956]	707.9715	15,900
3	56.89	0.78***	[0.721, 0.849]		7320
4 or more	49.35	0.70***	[0.646, 0.766]		6442
Mother's education					
No education (Ref.)	51.50	1.00			13,165
Primary	60.36	1.33***	[1.221, 1.448]	1179.588	6649
Secondary	66.52	1.46***	[1.352, 1.580]		22,468
Higher	70.50	1.47***	[1.286, 1.673]		5557
Religion					
Hindu (Ref.)	63.00	1.00			37,474
Muslim	55.36	0.75***	[0.690, 0.821]	452.2034	8088
Christian	61.70	0.92	[0.732, 1.154]		1000
Other	74.73	1.61***	[1.294, 2.002]		1277
Caste/Tribe					
SC (Ref.)	63.18	1.00			10,207
ST	55.81	0.92	[0.828, 1.013]	327.176	4956
OBC	61.87	0.94	[0.870, 1.014]		21,104
Other	63.81	0.99	[0.901, 1.097]		11,571
Sex of household head					
Male (Ref.)	61.88	1.00			41,865
Female	62.79	1.01	[0.932, 1.099]	10.889	5974
Wealth index					
Poorest (Ref.)	52.81	1.00			11,742
Poorer	60.60	1.39***	[1.286, 1.493]	10,308	
Middle	64.20	1.61***	[1.470, 1.761]	1195.057	9683
Richer	66.87	1.83***	[1.634, 2.051]	8939	
Richest	69.95	2.12***	[1.838, 2.456]	7167	
Region					
North (Ref.)	63.93	1.00			6291
Central	53.81	0.84***	[0.772, 0.924]	12,447	
East	70.08	1.89***	[1.706, 2.101]	1019.45	12,495
North-east	49.61	0.68***	[0.599, 0.778]		1691
West	54.53	0.65***	[0.569, 0.740]		6010
South	68.09	1.12	[0.994, 1.261]		8904
All India	61.99				47,839

Ref.: reference category; CI: confidence interval.
*** $p < 0.001$, ** $p < 0.005$, * $p < 0.010$

Table 2. Decomposition analysis of concentration index for full immunization among children aged 12–23 months by background characteristics, India, 2015–16

Background characteristics	Mean of full immunization	Elasticity	Concentration index	Contribution to concentration index	Percentage contribution
Male child	0.483	-0.002	0.002	0.000	-0.020
Rural residence	0.716	-0.054	0.180	0.010	-10.47
Birth order 4 or more	0.135	-0.199	-0.057	-0.011	12.24
Mother illiterate	0.275	-0.190	-0.161	-0.031	32.78
Belong to SC/ST	0.104	-0.088	0.043	-0.004	4.030
Household head a woman	0.125	0.043	0.013	0.001	-0.61
Poor economic status	0.461	0.076	-0.539	-0.041	43.90
Residual	0.059				
Percentage contribution of residual				-0.637	
Concentration index				-0.093	
Percentage contribution of fixed effects				0.818	

Discussion and Conclusions

- The study results suggest that household wealth is a significant factor in the persistence of inequalities in child full immunization coverage in India, low economic status, low illiteracy of mothers and high birth order families being most deprived.
- Since immunization is given to children free of charge through several interventions, underlying factors such as accessibility, vaccine hesitancy and awareness through education play vital roles in accessing vaccination among the weaker economic sections of society.
- The tragic effect of these inequalities is to deny specific sub-groups their right to be healthy. Efforts to support immunization must focus on those not currently being reached, such as stigmatized, marginalized and geographically isolated children.
- This may require the strengthening of health personnel and an increase in health facilities, medicines, equipment and vaccines.
- Public policies in India should target deprived communities where the uneducated and poor are concentrated and demonstrated low vaccination coverage.
- As this study was based on secondary data, many crucial factors such as per capita expenditures on immunization, health system performance, supervision, follow-up, household health awareness, effective communication, community participation, and other supply-side factors remain unaddressed.
- An in-depth analysis looking at the effectiveness of the resources deployed to immunize children across India might better understand the inequalities from the supply side.
- The results offer insight into the dynamics of the variation in immunization coverage in India and help identify vulnerable populations targeted to decrease socio-economic inequalities in the country.

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- Full paper available at: Kannankeril Joseph VJ. Understanding inequalities in child immunization in India: a decomposition approach. J Biosoc Sci. 2021 Mar 16:1-13. doi: 10.1017/S0021932021000110

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- The author has no conflicts of interest to declare.

Ethics Statement

- This research used a publicly available secondary data source (NFHS), without any identifiers, available in the public domain on the following website: <https://dhsprogram.com/data/available-datasets.cfm>. All procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.