Geospatial Pattern and Disparity in Immunisation Coverage in India.

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Background

The coverage of immunisation in India still remain far from being realised in keeping with the Sustainable Development Goals. Complete Immunization not only prevents from vaccine-preventable diseases but also reduces the child mortality and morbidities. For which WHO endorsed the Expanded Immunization Programme (EIP) in 1974 and in Global Vaccine Action Plan 2011-20 in 2012. In the same line India also had implemented the parallel programme and policies to ensure the universal immunisation among the children. Despite these efforts around one third of children in India remains unvaccinated. At the same time, the extent of deprivation from the ideal of cent percent compliance on immunisation coverage situate the task of accomplishment and inter-regional differences. Such an exercise exposes the geography of immunisation coverage that is responsive to the observed demographic divide in India. Evidence from this study will let know government and policy makers about the distress geographical cluster, which will help in formulating area specific policies and programme.

Objectives

Achieving high, sustained, and equitable immunization coverage is a prime strategy in reducing child mortality and morbidities in many developing countries. In this concern the primary objective of this paper is to find the spatial pattern, disparity and correlates of full immunization coverage in states and districts of India. The specific objective of the analysis are as follows.

1. Whether spatial dependence in immunisation coverage exists in the districts of India.
2. To understand the pattern of inequality and corelates immunisation coverage among the state, districts and sociodemographic variables.
3. what are the district level contextual factors affecting the immunisation coverage in India.

Data and Methods

The data from the fourth round of National Family Health Survey (NFHS-4) has been used to understand the spatial pattern and the correlates affecting the immunization coverage gap in India. NFHS is is one of the largest household sample survey in the world, collecting the data from more than six lacs households in India.

Moran's I, Univariate and Bivariate LISA analysis had been employed to assess the spatial clustering and risk factors of full immunization coverage gap in the districts of India.

Moreover to understand the inequality the study used various absolute and relative inequality methodology. Apart from that using decomposition analysis we found the contribution of various sociodemographic factors in understanding the inequality.

Findings

We found 38% of the children in India are not fully vaccinated which varies from 11% in Punjab to 63% in Nagaland. Around half of the children in 163 districts of India were deprived of full immunization. The spatial pattern of immunization coverage identified 99 districts as hot spots whereas 111 as cold spots. Results from bivariate LISA map signifies that the districts with higher coverage gap in full immunization also have a higher gap in antenatal and postnatal care and skilled birth attendant. The spatial regression model reveals that female literacy, female-headed households, antenatal and post-natal care have a significant association with full immunization coverage in India.

The study find the significant disparity in immunisation coverage among the various subgroup. There is a huge gap was found among poorest and richest child and the concentration index found positive which explains the greater tendency for higher immunization coverage for the children from richer household. Decomposing the inequality the study finds the antenatal care coverage have the highest contribution in explaining the total inequality in full immunisation coverage in India. Apart from this the educational status of mother and household economic status still remains a factor contributing to total inequality in India.

Conclusion

The existence of clusters indicates the presence of unevenness in immunization coverage and has several implications that should be addressed for better health of the population. The geographical sketch of this assessment demonstrates a divide in attainment in immunization coverage which has a clear linkage with the state of backwardness. Efforts are to be made to ensure the universalization of education, along with accessible and affordable healthcare for all ensuring universal health coverage in India. At the same time appropriate commitment and investment in health sectors are being made by which universal immunization can be possible.
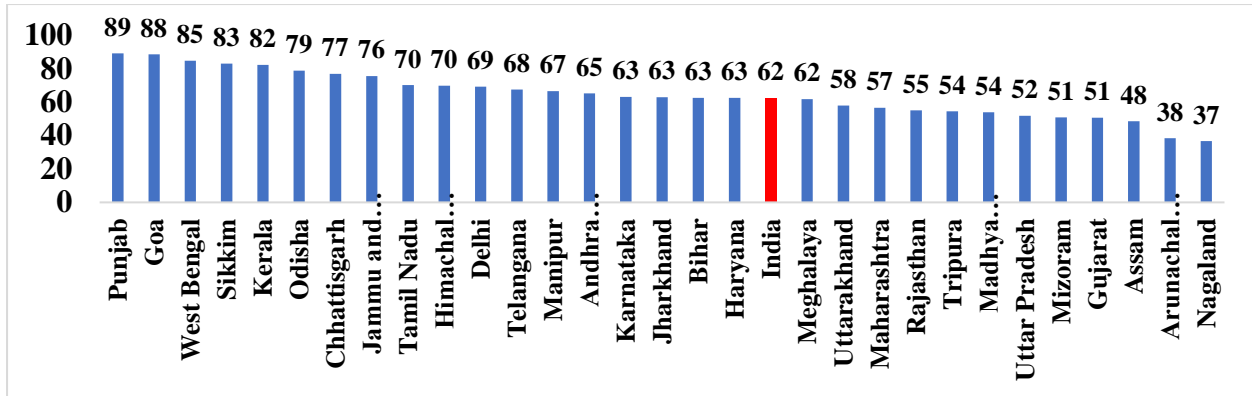
Table 1 Result of OLS model and spatial error model assessing determinants of child immunization in districts of India 2015-16

Variable	OLS			Spatial error model		
	Household Indicators	Healthcare Indicator	All	Household Indicators	Healthcare Indicator	All
Percent urban	-0.08		-0.012	-0.04		-0.006
Female Literacy	0.30***		0.025	0.40***		0.13**
Female headed household	0.03		0.24***	0.13		0.21**
SC/ST	-0.13		-0.028	-0.06		0.005
Poor (%)	-0.15		-0.072*	-0.09		-0.05
ANC		0.23***	0.22***		0.27***	0.23***
PNC		0.29***	0.28***		0.16***	0.17***
SBA		0.30***	0.24***		0.33***	0.28***
Received JSY		0.09***	0.14***		0.63***	0.13***

***p<0.01, **p<0.05, *p<0.10

Table 2: Means, concentration indices, marginal effects and contributions of covariates to inequality in immunization:

Variables	Mean	CI	Marginal Effects	Contribution
Child not fully immunised	0.3754[0.3712-0.3797]	-0.0928	Dependent variable	Dependent variable
Sex of child (Male=1)	0.5174[0.5130-0.5218]	0.0099	0.0020[-0.0064-0.0103]	-0.02
Poor economic status	0.6648[0.6607-0.4652]	0.6690	-0.0522[-0.0619--0.0424]	28.25

Years of education	0.4141[0.4097-0.4184]	-0.3455	0.0541[0.0444-0.0638]	21.27
Rural areas	0.7155[0.7116-0.7195]	-0.1795	0.0012[-0.0091-0.0116]	-4.36
Belongs to SC/ST	0.3169[0.3128-0.3210]	-0.2129	0.0175[0.0087-0.0262]	-0.70
Birth order 3 or more	0.2876[0.2836-0.2916]	-0.2438	0.0363[0.0266-0.0460]	11.31
Ante natal care	0.4798[0.4753-0.4842]	0.201	-0.1151[-0.1240--0.1063]	31.42
Institutional delivery	0.8201[0.8167-0.8235]	0.0836	-0.0900[-0.1015--0.0785]	12.75
Mothers age	1.0391[1.0374-1.0408]	-0.0065	0.0044[-0.0154-0.0241]	0.09
Received JSY	0.3031[0.2990-0.3071]	-0.1476	-0.0648[-0.0747--0.0549]	-9.80

Figure 2: Univariate LISA cluster and significance map of full immunization coverage gap in India. *A: Univariate LISA cluster map, B: Significance map*
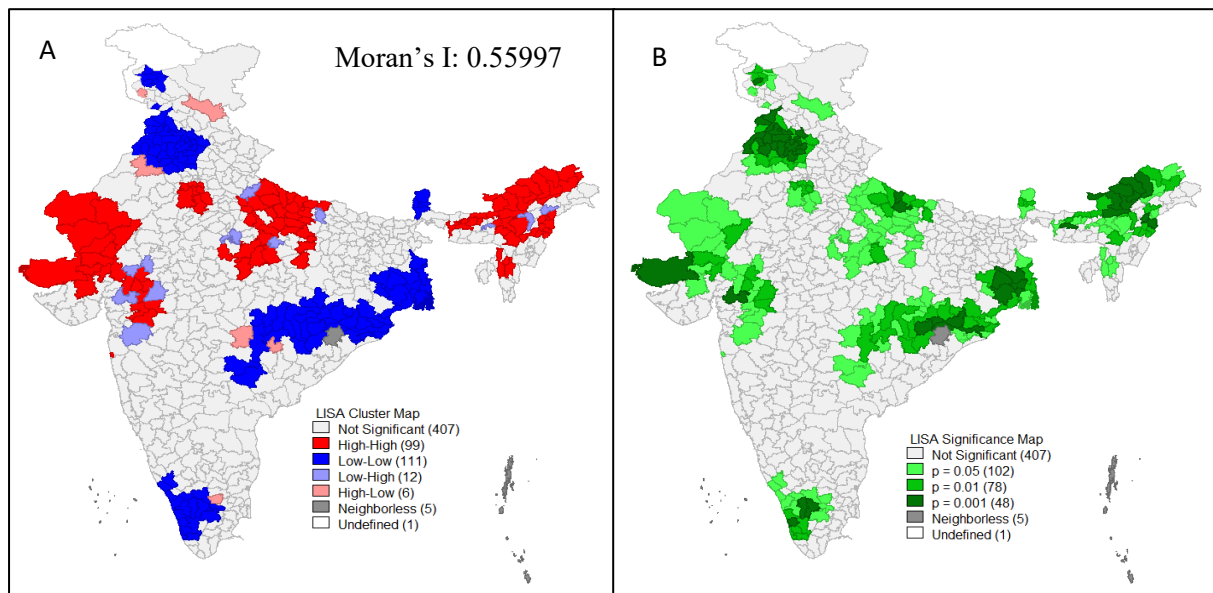

Figure 3: Differential in immunization coverage by wealth quintile in the adminstartive regions of India
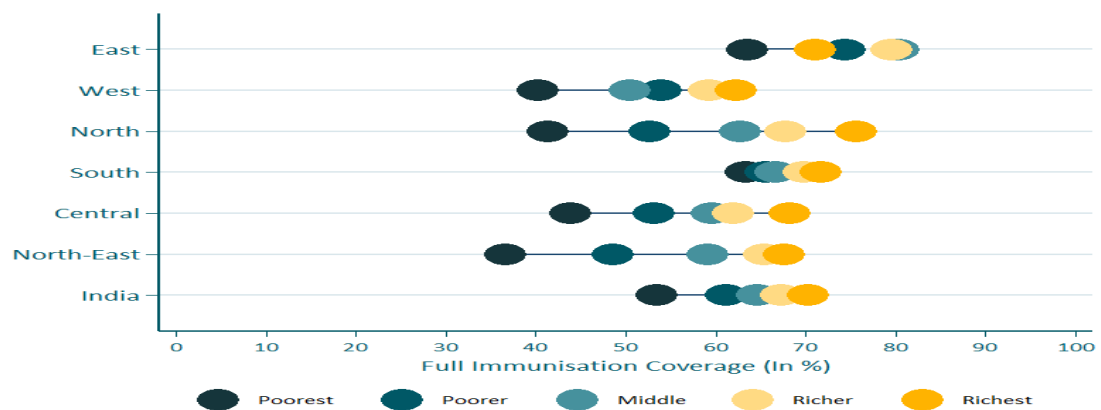
Figure 3: Bivariate LISA cluster map of full immunization coverage gap with selected maternal and child health indicators. *A: Bivariate LISA map of full immunization coverage gap and antenatal care coverage gap. B: Bivariate LISA map of full immunization coverage gap and postnatal care coverage gap. C: Bivariate LISA map of full immunization coverage gap and skilled birth attendant gap. D: Bivariate LISA map of full immunization coverage gap and stunting. E: Significance map of full immunization coverage gap and antenatal care coverage gap. F: Significance map of full immunization coverage gap and postnatal care coverage gap. G: Significance map of full immunization coverage gap and skilled birth attendant gap. D: Significance map of full immunization coverage gap and stunting.*