

Exploratory Spatial Data Analysis (ESDA) of Maternal and Child Healthcare services in India from 1992-93 to 2015-16.

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Background:

The global ambition towards universal health coverage by 2030 needs that the whole population should be ensured with better access to quality and affordable healthcare services. Access to healthcare is essential during pregnancy, delivery, and post-delivery for both mother and child health. From antenatal care, skilled birth and institutional delivery, post-natal care, immunization of children, and treatment of childhood diseases, each stage of motherhood are essential to reduce maternal and child death and improve overall health. The World health organization recommended at least four ANC visits are crucial for pregnant women. The communication and support function of ANC is key in saving lives and improving lives, health care utilization, and quality of care. Studies also confirm that antenatal visits significantly reduce maternal and child deaths and increase skilled birth and institutional delivery. Institutional delivery by skilled birth attendants and doctors minimizes the risk of maternal and child death and early complication of childhood disease. Institutional delivery also has a significant positive association with post-natal care utilization, which provides an opportunity to learn for breastfeeding practices, monitor mother and newborn growth and overall health, treat childhood disease, and counseling of women about their family planning and children should receive full immunization. The three leading causes for death in early childhood are diarrhea, cough with short and rapid breathing (a proxy for pneumonia and other acute lower respiratory infections), and fever (a proxy for malaria and other acute illnesses). Balk et al. (2003) used a predictive model to estimate the cause of death in 42 countries accounting for 90 percent of all deaths among children under age five, found that among the leading cause of death, diarrhea 22 percent, pneumonia 21 percent, malaria 9 percent contribute.

A large geographical inequality in coverage of maternal and child health services exists across India and its regions, which is an urgent need for policy attention towards places at risk of being left behind. This paper tried to map progress in the coverage of MCH indicators and identify which regions of India lag. We also tried to find out unserved or less served areas at the district level, which can be helpful to identify lagging districts within states for better planning and policymaking.

Data:

To access progress in maternal and child health services coverage, we analyzed four rounds of the National family health survey (NFHS), which provides information from 1992-93 to 2015-16. National family health survey (NFHS-4) is the largest global demographic and health survey (DHS) framework, provides estimates on family welfare, maternal and child health, nutrition, marriage, fertility, children's immunization, and childcare, morbidity, and socio-economic development indicators. National and regional level progress were analyzed from all rounds of the survey. Further, district-level analyses

were carried out from the fourth round of NFHS. The NFHS-4 sample was designed to estimate all key indicators at the national, regional, state and districts level for all 640 districts. The sample size of 6,01,509 household which covers 6,99,686 eligible women and 2,59,627 children in 28,526 clusters in India.

Research methods:

We applied two steps of analysis in this paper. First, we assessed how MCH service coverage has improved over the period at the country and regional level. Second, the spatial pattern of MCH service coverage at the district level was analyzed from NFHS-4. District-level analysis is based on the lowest level of administrative units at which MCH services estimates are possible to study. Exploratory spatial data analysis is used to identify unserved areas between and within states. To examine the spatial clustering of districts for all selected maternal and child health indicators, we used global Moran's I and local indicators of spatial analysis (LISA). Moran's I statistic helps to find the existence of global spatial autocorrelation, which further allows exploring at the local level. Queen contiguity first-order spatial weight matrix was used to provide better results among other spatial weight matrixes.

Outcome variables:

We reviewed previous studies, several national and international standard reports, and selected six crucial indicators for both mother and child health. All six indicator follows the continuum of care for maternal and child health which starts from pregnancy and goes through delivery and post-delivery. These six indicators are four or four-plus antenatal care, institutional delivery, modern contraceptive use, post-natal care for the child, full immunization, and treatment-seeking behavior for childhood illness. Due to the unavailability of post-natal care information in early rounds of surveys, five indicators were used to assess MCH service coverage progress at national and regional levels.

Findings:

To assess maternal and child health progress, we observed all selected indicators have improved over the period from 1992-93 to 2015-16. However, modern contraceptive use has declined during the third and fourth rounds of NFHS, and institutional delivery has significantly increased. Figure 1 highlighted that the South region had better coverage of MCH indicators. Another important finding was that full immunization coverage declined from the second round of surveys in the West region. We further looked into components of full immunization and found that dropout from full immunization was mainly contributed by the third dose of DTP and Polio.

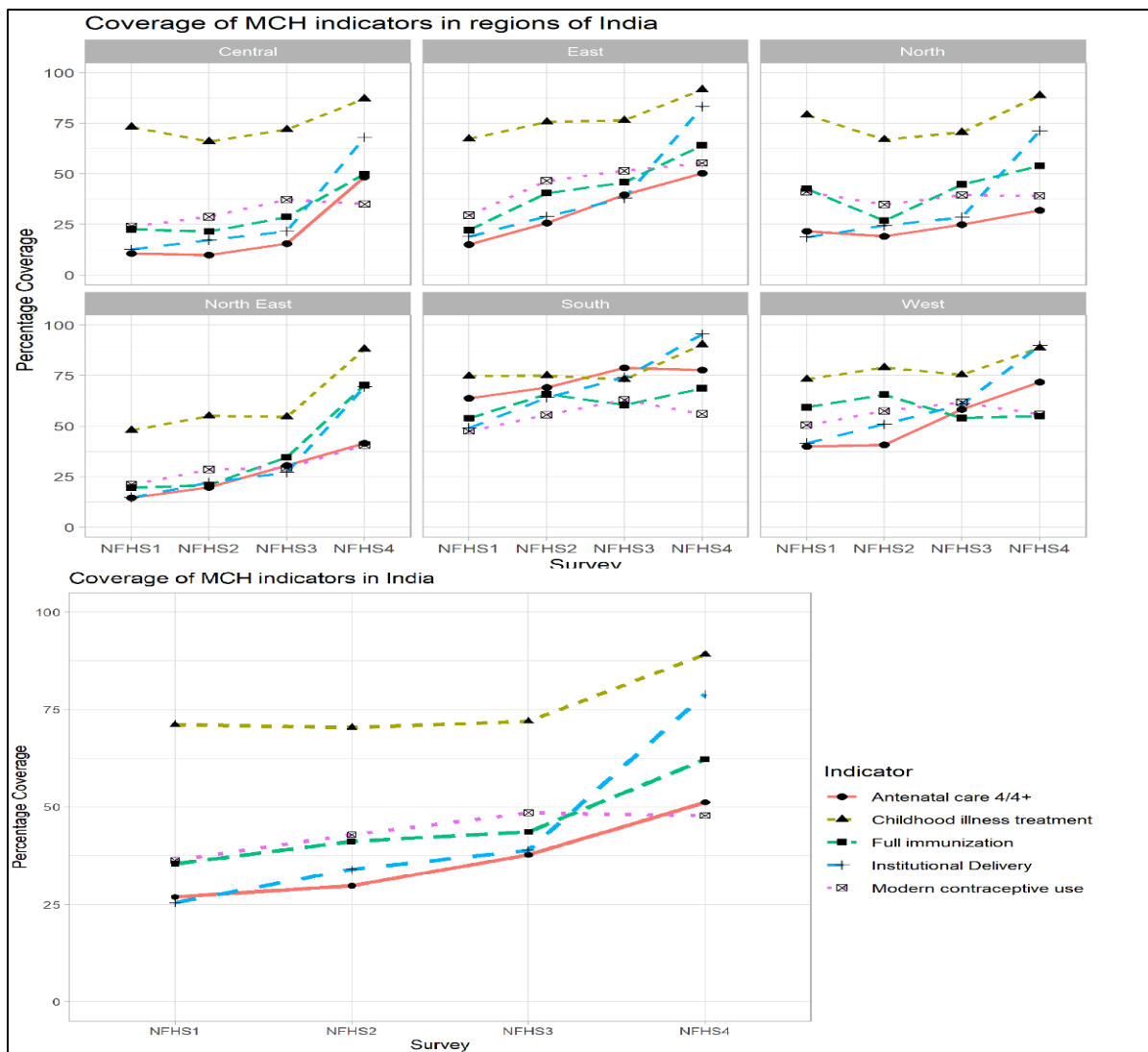


Figure 1: Progress in coverage of maternal and child health (MCH) services at national and regional level during 1992-93 to 2015-16.

Figure 2 highlights that the majority of low coverage of MCH indicators belongs to districts of Uttar Pradesh (UP), Bihar (BR), Madhya Pradesh (MP), Jharkhand (JH), and north-eastern states. Better coverage was observed in districts of southern, northern, and western states. However, within state district level variation observed among all MCH indicators.

Global Morans'I value for all selected indicators was positive, indicating spatial clustering of outcome variables (Table 1). However, the local indicator of spatial association analysis (LISA) revealed that high-high clustering was observed in districts of southern states and northern states. In contrast, low-low clustering was observed in districts of north-eastern states, Uttar Pradesh, Bihar, Madhya Pradesh, Jharkhand, and Rajasthan.

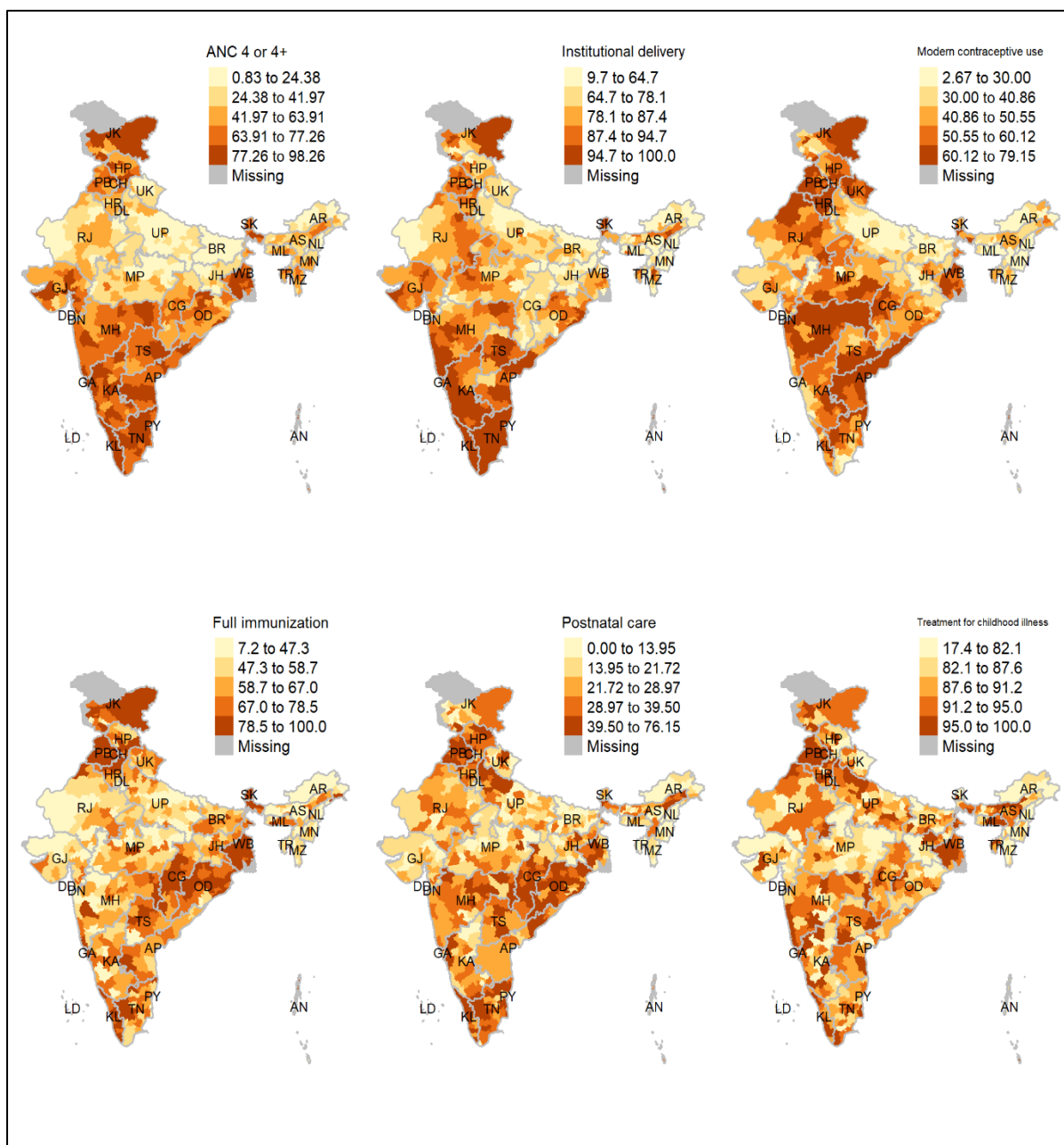


Figure 2: Spatial pattern of maternal and child health (MCH) services at the district level in India 2015-16.

Table 1: Morans'I value and number of districts in each cluster from LISA analysis.

Variable	Morans'I	High-high	Low-low	High-low	Low-high	Not-Significant
ANC 4 /4+	0.778	171	159	4	6	300
Institutional delivery	0.679	148	107	9	1	375
Modern contraceptive	0.712	142	130	2	2	364
Full Immunization	0.532	113	96	11	7	413
PNC	0.429	96	72	12	20	440
Childhood illness treatment	0.311	83	41	10	6	500