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**Measuring the inequality in the coverage of Reproductive,  
Maternal, New-born and Child Health Coverage Indicators in  
India Using National Family Health Survey, 2015-16**

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### **Abstract**

Diligent monitoring of coverage of essential reproductive, maternal, new-born and child health related services (RMNCH) becomes imperative to smoothen the journey towards SDGs. In this study, we aim to measure the magnitude of inequalities in the coverage of RMNCH services. We also made an attempt to divulge the relationship between the various themes of governance and RMNCH indices. We used National Family Health Survey dataset (2015-16) and Public Affairs Index (PAI), 2016 for the analysis by employing two summative indices, namely Composite Coverage Index (CCI) and Co-Coverage (Co-Cov) indicator to measure the RMNCH coverage. Two analytical tools such as Slope Index of Inequality (SII), Relative Index of Inequality (RII) were adopted to measure inequality in the distribution of coverage of RMNCH. In addition, we have used Spearman's rank correlation matrix to assess the association between governance indicator and coverage indices. We found that, both CCI and Co-Cov were inequitably distributed across different states. Our results show that, the RII values for the states like Punjab, Tamil Nadu and West Bengal hover around 1, indicating a movement towards equality. Whereas, the ratio of RII is highest in Haryana, where the utilisation by wealthiest section is 2.01 times more than the poorest sections. It is important to allude that the coverage of essential interventions like ANC4, DPT3, Family Planning, Measles and SBA show bottom level inequalities. The spearman's rank correlation (coefficient ranging between 0.61 and 0.67) exhibited an emergence of strong and positive correlation between governance index and RMNCH services. We suggested that outreach programs related to ANC services at grassroot or village levels can be promoted and monitored by the centralised agency to ensure greater reach.

**Keywords:** Maternal health, Child health, Inequity analysis, Governance index

**JEL Classification:** I140

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## **Measuring the inequality in the coverage of Reproductive, Maternal, Newborn and Child Health Coverage Indicators in India Using National Family Health Survey, 2015-16<sup>1</sup>.**

**Sumirtha Gandhi<sup>2</sup>, Tulasi Malini Maharatha<sup>3</sup>, Umakant Dash<sup>4</sup> and Suresh Babu M<sup>5</sup>**

### **Introduction**

Measuring the coverage of Reproductive, Maternal, New-born and Child Health Services (RMNCH) services is prerequisite to monitor the progress towards Sustainable Development Goals (SDGs), which is superseded by the Millennium Development Goals (MDGs). These goals embody the attainment of universal coverage of essential and preventive interventions as its primal focus. Universal health coverage (UHC) necessitates achievement of equity along with the overall increase in the coverage of RMNCH interventions and it is purported that coverage measures play a crucial role in suggesting policy initiatives striving to achieve universal coverage and SDGs.

There is a copious amount of evidence depicting a considerable progress in the performance of maternal and child health indicators. For instance, the number of global maternal deaths reduced from 532000 to 303000 between 1990 and 2015 and under-five deaths plunged from 12.7 million per year (1990) to 5.9 million (2015). Despite such greater strides, only 9 countries in the world achieved Millennium Development targets pertaining to maternal and child health [44]. Moreover, 15% of the world's maternal deaths are contributed by India alone. According to the World Bank estimates, the MMR in India plummeted from 556 (1990) per 100,000 live births to 174 (2011-13) per 100,000 live births [44]. The under-five mortality ratio fell from 115 (1990) per 1000 live births to 43 (2015) per 1000 live births (SRS, Office of Register General of India). But the progress did not penetrate evenly across different segments of population. This is reflected in burgeoning disparity across different geographical contours.

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For instance, the MMR in EAG states were 520 per 100,000 live births in 1997-98, 375 per 100,000 livebirths in 2004-05 and 246 per 100,000 livebirths in 2011-13. Whereas in the southern states, the corresponding estimates were 187 (1997-97) per 100,000 livebirths, 149 (2004-05) per 100,000 livebirths and 93 (2011-13) per 100,000 livebirths.

These emerging inequities calls for diligent measurement of RMNCH at national as well as sub-national levels. Although this task has been extensively conducted across different countries [5,6] by the countdown team since 2008 [9], studies measuring the coverage of RMNCH interventions are scarce in India [21, 22, 29]. The existing studies have either used Composite coverage index (CCI) or standalone indicators. CCI is the weighted average of eight different indicators ranging across the entire lifecycle of pregnancy and childhood care, it is insensitive to sampling variability and has a strong association with maternal and child health outcomes. Co-Cov, on the other hand provides an assessment of range of preventive public health intervention and also enumerates the percentage of women/ child receiving all or some of the crucial preventive interventions [8]. Researcher have however argued that, CCI along with the Co-Coverage indicator (Co-Cov) is pertinent to comprehend the state of RMNCH in wholesome. Measurement of CCI and Co-Cov across different wealth quintiles and geographical regions provide crucial information about which groups of women and children are lagging behind. One of the contributions of this paper is the usage of two summary measures namely, CCI and Co-Cov to measure inequality across different sub-groups. Another contribution of this paper is that we have gauged the association between different dimensions of Governance Index (OI) and CCI/Co-Cov. This exercise will enable us to understand which indicator of Governance Index is influencing RMNCH more and which indicator has a lesser influence and hence enables us to understand which Governance indicator has to be concerted more attention to observe greater improvement in the coverage of RMNCH interventions.

## **Methods**

### **Data**

For the empirical analysis we used National Family Health Survey (NFHS) conducted in 2015-16 and Public Affairs Index (PAI), 2016. NFHS employs a two-stage stratified random sampling method and interviewed women belonging to their reproductive age group (15-49 years). Total sample of this survey is 601,509 households, 699,686 eligible women and 259,627 children (younger than 5 years). Details are provided in S1 text. Data on "Public Affairs Index

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(PAI)<sup>6</sup> discerning the quality of governance, is extracted from the Public Affairs Centre (PAC). This centre adopted a multifaceted approach considering 10 distinct theme to construct a governance indicator. These themes were normally categorised into rule based and performance based measures (see S2 Text). To ensure the compatibility of PAI with NFHS (2015-16), we used PAI indices published in 2016 for all states, except Telangana and Andhra Pradesh because the information regarding these two states were collated into one (collected before territorial bifurcation). Hence, for these two states we resorted to PAI (2017).

### **Methodology**

We defined a comprehensive list of RMNCH indicators via two summative indices namely, CCI and Co-Cov. These indices elucidate complete information about RMNCH interventions by avoiding information overload.

CCI is constructed using four distinct themes swaying across different stages of the continuum of maternal and child healthcare services, starting from reproductive health (usage of modern contraceptives (FPS)), maternal health care services (four or more antenatal visits (ANC), Skilled Birth Assistance (SBA)) to new-born and child healthcare services (3 doses of DPT vaccine(DPT3), measles vaccination (MSL), BCG vaccination (BCG), Oral rehydration therapy and other fluids for children with diarrhoea (ORT) and utilisation of healthcare services among those diagnosed with pneumonia (CPNM)). A detailed description of these variables is provided in the S1 Text.

Co-Cov indicator entails a range of preventive public health interventions - four or more Antenatal Care Visits, Tetanus Toxoid dosage during pregnancy, Skilled Birth Assistance, BCG vaccination, DPT3 vaccination, Measles vaccination and household's access to improved drinking water [37]. The Co-Cov is defined as the number of interventions utilised by each woman and child pair. It is a binary indicator coded as 1 for (adequate utilisation) woman and child pair receiving 6 or more interventions and 0 for those availing less than 6 interventions (inadequate utilisation).

These two indices have been broadly used in the literature to examine the overall performance of a state/region/country in the provision of maternal and child health care services [2, 7, 20, 33, 34]. For this paper, we have adopted the following formulation for the construction of CCI.

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<sup>6</sup> The data is freely accessible from <http://pai.pacindia.org/#/2016/public-affairs-index>.

$$CCI = \frac{1}{4} \left( FPS + \frac{SBA + ANC}{2} + \frac{2DPT3 + MSL + BCG}{4} + \frac{(ORT + CPNM)}{2} \right)$$

The above equation demonstrates a weighted coverage mean of eight essential interventions by assigning equal weightage for each of its component [43].

This paper aims to undertake an inequality analysis of RMNCH coverage across distinct wealth horizons. Wealth Index have been widely used to measure economic status of the individuals [16]. It is defined in the form of quintiles, where 1st quintile (Q1) represents the poorest 20 percent of the population and last quintile (Q5) reflects the richest 20 percent of the population. Till now researchers have predominantly used absolute and relative methods to demonstrate inequality in the coverage of RMNCH. The absolute inequality (Q5-Q1) ascertained the magnitude of differences in the coverage of maternal and child health services between the richest and poorest quintile groups. Whereas, relative inequality (Q5/Q1) demonstrates the ratio in the coverage of maternal and child health services between the richest and poorest quintile groups.

Although these two methods hold an advantage of easy interpretability from a layman's perspective, they suffer from certain serious drawbacks. First, with the change in the stratification within a concerned sub-groups, the level of inequality also varies. Second, the variations in the overall coverage levels do not necessarily represent a similar variation across different wealth quintiles. In other words, the highest and lowest overall coverage does not necessarily represent a highest and lowest coverage among high and low quintile population. Finally, these two techniques do not take into account the intermediate wealth groups 2nd quintile (Q2), 3rd quintile (Q3), 4th quintile (Q4). In this paper, we adhered to the advanced measurement techniques such as Slope Index of Inequality (SII) and Relative Index of Inequality (RII), these two techniques were introduced to overcome the shortcomings encountered in the previous techniques [18].

To compute inequality for CCI, we gathered indicator-wise information for each quintile group by incorporating national weights. For each quintile group, we followed a systematic approach encompassing 4 stages of computation. First, we collected the disaggregated level dataset for each of the indicator, Second, we computed their proportions, Third, we cumulatively added

these proportions and finally, we divided these cumulative proportions by 2 to attain their mid-point values. These mid-point values were placed across the indicators and we estimated the coefficient values for SII and RII by adopting a logistic regression analysis.

## Results

In Table (1) we have provided the descriptive statistics of the sample population for each state across different wealth quintiles. It is discerned that the percentage of women belonging to the poorest/poor quintile is highest in Bihar (80.93 percent), followed by Jharkhand (72.43 percent). In West-Bengal, Chhattisgarh, Madhya Pradesh and Uttar Pradesh, the percentage of poor/poorest quintile population is comparatively low ranging between 55 and 60 percent. In the western and southern states of India, the percentage of population belonging to the middle, rich or richest quintile (non-poor categories) is more than 70 to 80 percent. In Punjab and Kerala, the percentage of non-poor population is as high as 95 percent.

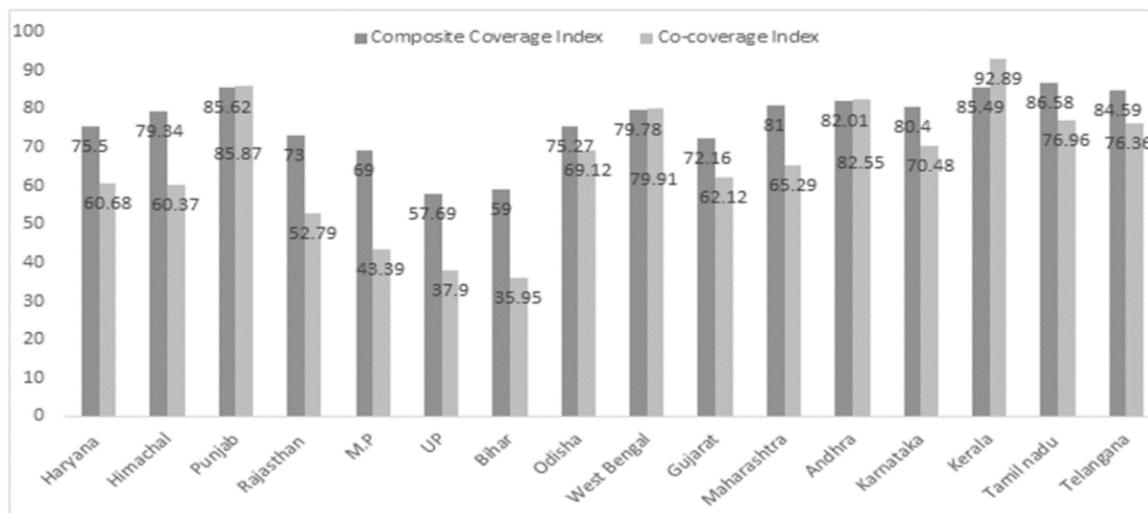
**Table 1. State wise descriptive statistics across wealth quintiles**

States	Poorest (%)		Poor (%)		Middle (%)		Rich (%)		Richest (%)	
Andhra Pradesh	295.00	4.66	1047.00	16.54	2252.00	35.57	1820.00	28.75	917.00	14.48
Arunachal Pradesh	41.00	24.12	43.00	25.29	42.00	24.71	32.00	18.82	12.00	7.06
Assam	1471.00	30.24	1906.00	39.19	825.00	16.96	475.00	9.77	187.00	3.84
Bihar	13489.00	57.57	5473.00	23.36	2477.00	10.57	1531.00	6.53	459.00	1.96
Chhattisgarh	1483.00	34.24	1055.00	24.36	764.00	17.64	528.00	12.19	501.00	11.57
Goa	2.00	1.16	15.00	8.67	19.00	10.98	55.00	31.79	82.00	47.40
Gujarat	875.00	10.90	1558.00	19.41	1928.00	24.02	1797.00	22.39	1867.00	23.26
Haryana	113.00	2.58	379.00	8.64	870.00	19.84	1254.00	28.59	1770.00	40.36
Himachal Pradesh	15.00	1.79	86.00	10.24	187.00	22.26	316.00	37.62	236.00	28.10
Jammu and Kashmir	172.00	9.94	385.00	22.25	437.00	25.26	365.00	21.10	371.00	21.45
Jharkhand	2833.00	50.66	1218.00	21.78	762.00	13.63	466.00	8.33	313.00	5.60
Karnataka	498.00	6.36	1556.00	19.88	2237.00	28.58	2153.00	27.51	1383.00	17.67
Kerala	11.00	0.32	55.00	1.58	405.00	11.67	1410.00	40.62	1590.00	45.81
Madhya Pradesh	4484.00	35.35	2942.00	23.19	1985.00	15.65	1714.00	13.51	1559.00	12.29
Maharashtra	1538.00	9.68	2960.00	18.62	3812.00	23.99	4354.00	27.40	3229.00	20.32
Manipur	44.00	11.31	119.00	30.59	116.00	29.82	72.00	18.51	38.00	9.77
Meghalaya	102.00	16.69	247.00	40.43	182.00	29.79	57.00	9.33	23.00	3.76

Mizoram	14.00	8.38	22.00	13.17	40.00	23.95	45.00	26.95	46.00	27.54
Nagaland	48.00	18.32	100.00	38.17	57.00	21.76	38.00	14.50	19.00	7.25
Odisha	2530.00	40.10	1622.00	25.71	1168.00	18.51	687.00	10.89	303.00	4.80
Punjab	25.00	0.76	138.00	4.22	451.00	13.79	767.00	23.45	1890.00	57.78
Rajasthan	2309.00	21.35	2679.00	24.77	2256.00	20.86	1873.00	17.32	1697.00	15.69
Sikkim	1.00	2.08	5.00	10.42	22.00	45.83	16.00	33.33	4.00	8.33
Tamil Nadu	311.00	2.77	1647.00	14.65	3344.00	29.75	3695.00	32.87	2244.00	19.96
Tripura	82.00	17.67	202.00	43.53	95.00	20.47	63.00	13.58	22.00	4.74
Uttar Pradesh	10688.00	33.68	7650.00	24.11	5434.00	17.12	4290.00	13.52	3671.00	11.57
Uttarakhand	81.00	5.27	295.00	19.19	420.00	27.33	354.00	23.03	387.00	25.18
West Bengal	3402.00	26.48	4174.00	32.49	2543.00	19.80	1879.00	14.63	848.00	6.60
Telangana	327.00	6.06	862.00	15.97	1318.00	24.41	1649.00	30.54	1243.00	23.02
Total	47262.00	25.57	40438.00	21.88	36449.00	19.72	33753.00	18.26	26914.00	14.56

In Figure 1 we presented distribution of CCI and Co-Cov indices across major states of India. In comparison to the Co-Cov indicator, the percentage of CCI is invariably high among all the major states with the exceptions of Kerala, Punjab and Andhra Pradesh which elicit negligible variations between these two indices. The Co-Cov indicator demonstrates the presence of high levels of regional inequality, with Kerala (92.89 percent) being the best performer followed by Punjab (85.87 percent) and Andhra Pradesh (82.55 percent), while Bihar (35.95 percent), Uttar Pradesh (37.9 percent) and Madhya Pradesh (43.39 percent) showed abysmally poor performance. Some of the states with the highest CCIs are Tamil Nadu (86.58 percent), Punjab (85.62 percent), Kerala (85.49 percent), Telangana (84.59 percent), Andhra Pradesh (82.01 percent) and Maharashtra (81 percent), whereas coverage in Uttar Pradesh (57.69 percent) and Bihar (59 percent) is substantially low.

Figure 1: CCI and Co-Coverage Indices across major Indian States



In Table 2, we demonstrated inequality in the CCI and Co-Cov indicators using the difference (Q5-Q1) and ratio (Q5/Q1) methods. The highest absolute difference in the CCI is witnessed in Haryana (37.2 percent) while the lowest is encountered in Karnataka (-4.6 percent). The level of disparity in Haryana, Uttar Pradesh, Gujarat, Kerala, Andhra Pradesh and Telangana is quite prominent exhibiting an absolute disparity of more than 20 percent between richest and poorest quintile population. On the contrary, West Bengal, Tamil Nadu and Maharashtra experienced an absolute gap of less than 10 percent. Karnataka, being the only exception with a negative value of 4.6 percent, shows more usage by the poorer sections of the society than their richer counterparts. The relative gaps elicit additional insights into the degree of unfairness between the richest and the poorest groups. All the states, except Karnataka (0.94 times), show a value greater than the unity, reflecting more usage by the richer population compared to their poorer counterparts. The highest pro-rich inequality in terms of the ratio is witnessed by Haryana, where the richest quintile utilises 1.84 times more than the poorest.

**Table 2: Composite Coverage Index and Co-Coverage Indicators across Indian States and in India**

Country/ States	CCI		Co-Coverage	
	(Q5-Q1)	(Q5/Q1)	(Q5-Q1)	(Q5/Q1)
<b>Himachal Pradesh</b>	13.4	1.189	40.51	2.19
<b>Punjab</b>	8.2	1.103	26.65	1.41
<b>Haryana</b>	37.2	1.846	54.51	3.96
<b>Rajasthan</b>	19.5	1.309	44.34	2.30
<b>Uttar Pradesh</b>	24.5	1.504	42.57	2.70
<b>Bihar</b>	16.7	1.301	41.62	2.45
<b>West Bengal</b>	08.4	1.107	22.84	1.33
<b>Odisha</b>	10.6	1.149	15.61	1.26
<b>Madhya Pradesh</b>	16.9	1.265	46.65	2.74
<b>Gujarat</b>	22.3	1.380	53.69	2.89
<b>Maharashtra</b>	9.5	1.128	23.79	1.49
<b>Andhra Pradesh</b>	21.9	1.329	24.06	1.36
<b>Karnataka</b>	-04.6	0.945	-1.08	0.98
<b>Kerala</b>	20.5	1.306	10.07	1.12
<b>Tamil Nadu</b>	8.7	1.110	13.13	1.20
<b>Telangana</b>	21.0	1.300	32.03	1.59

In the case of Co-Cov indicators, Haryana, Gujarat and Madhya Pradesh experience a greater level of inequality, with each of them showing an absolute gap of 45 percent and above. The absolute inequality is highest in Haryana where coverage of richest population is 54.51 percent higher than their poorest counterparts. While, in Kerala, Tamil Nadu and Odisha, the difference is less than 20 percent. Besides, Karnataka again being an anomaly with a negative value of 1.08, represents more usage by the lowest quintile groups compared to highest quintile. Haryana (3.96) encounters the highest relative inequality, closely followed by Himachal Pradesh, Bihar, Rajasthan, Uttar Pradesh, Madhya Pradesh and Gujarat where the rates of inequalities are greater than 2. Tamil Nadu and Kerala record values of 1.20 and 1.12 respectively, representing almost similar level of disparity. Karnataka, boasting a relative value of 0.98 of Co-Cov indicator, once again shows marginally higher usage of the services by the poorest quintile as compared to the richest quintile of the society.

In addition to the absolute and relative gaps, we have also employed the sophisticated method to elicit the SII and RII across the major states of India. The SII and RII consider the cumulative distribution of all socio-economic groups to provide additional insights on the ratio and difference methods. Table 3 demonstrates the values of SII and RII of CCI across the major states of India. It is ascertained that the level of inequality across different socio-economic categories is invariably high across Central and Northern region (with Punjab being an only

exceptional case). Compared to other states, the highest value of SII is observed in Haryana (43.3%) followed by Uttar Pradesh (29.1%). In Southern region, Karnataka (-6.3 percent) and Tamil Nadu (8.1 percent) have lowest levels of SII. Whereas, in the Western region, SII is higher in Gujarat (25.9 percent) compared to Maharashtra (13.5 percent). Among the eastern states of India, SII is lowest in West Bengal (9.9 percent), followed by Odisha (11.3 percent) and Bihar (21 percent).

The RII is the ratio of health care intervention utilised by the richest population over the poorest population. The ratio of RII is highest in Haryana, where the utilisation by wealthiest section is 2.01 times more than the poorest sections. This is subsequently followed by Uttar Pradesh (1.64) and Gujarat (1.46 times). The RII values for Punjab, Tamil Nadu and West Bengal hover around 1, indicating a movement towards equality. In contrast to this, Karnataka (0.93 times) is the only state witnessing a pro-poor distribution.

**Table 3: Percentage of SII, RII and CIX of Composite Coverage Index across Major Indian States**

Region	Composite Coverage Index	SII (95% CI)		RII (95% CI)	
<b>Southern Region</b>	Andhra Pradesh	0.201	(0.0494-0.354)	1.29	(1.015 - 1.569)
	Karnataka	-0.063	( -0.081 - 0.045)	0.925	(0.904 - 0.946)
	Kerala	0.248	(0.163 - 0.333)	1.37	(1.210 - 1.540)
	Tamil Nadu	0.081	(0.002 - 0.160)	1.10	(0.994 - 1.206)
	Telangana	0.211	(0.111- 0.312)	1.30	(1.128 -1.473)
<b>Eastern Region</b>	Bihar	0.210	(0.199 - 0.222)	1.39	(1.367 - 1.422)
	Odisha	0.113	(0.068 - 0.158)	1.159	(1.088 - 1.230)
	West Bengal	0.099	(0.059 - 0.137)	1.129	(1.074 - 1.185)
<b>Western Region</b>	Maharashtra	0.135	(0.094 - 0.176)	1.186	(1.126 - 1.250)
	Gujarat	0.259	(0.229 - 0.290)	1.459	(1.391 - 1.529)
<b>Northern Region</b>	Haryana	0.433	(0.341 -0.524)	2.01	(1.640 - 2.380)
	Himachal	0.168	(0.121 - 0.215)	1.25	(1.169 - 1.330)
	Punjab	0.097	(0.075 -0.119)	1.125	(1.095 - 1.155)
	Rajasthan	0.225	(0.193 - 0.258)	1.37	(1.308 -1.432)
<b>Central Region</b>	Madhya Pradesh	0.203	(0.178 - 0.228)	1.327	(1.276- 1.370)
	Uttar Pradesh	0.291	(0.252 - 0.329)	1.64	(1.539 - 1.749)

The SII and RII for Co-Cov is presented in Table 4. Surprisingly, Gujarat depicts a greater level of health disparity with an absolute inequality of 56 percent, followed by Madhya Pradesh (52.4 percent) and Rajasthan (48.5 percent). On the other hand, the performance of Karnataka (-1.6%) and Kerala (1.3%) is quite impressive, with the former experiencing a pro-poor distribution and the latter approaching towards equity in the RMNCH coverage. The RII scores elicit a greater extent of inequality in Madhya Pradesh and Uttar Pradesh, where the utilisation of the richer section is nearly 4 times higher than their poorer counterparts. Gujarat (2.80), Bihar (2.72) and Rajasthan (2.73) also exhibit a relatively great extent of inequality (RII).

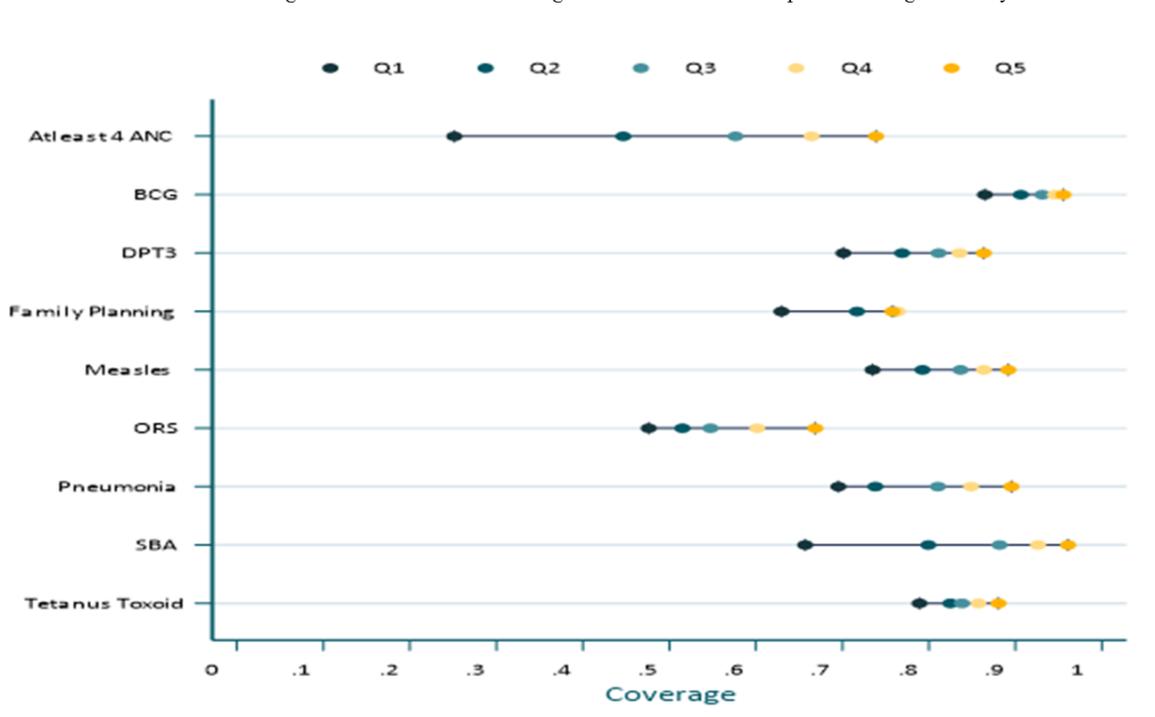
**Table 4: Percentage of SII, RII and CIX of Co-Coverage indicators across the Major Indian States**

Region	Co-coverage Index	SII	(95% CI)	RII	(95%)
Southern Region	Andhra Pradesh	0.196	(0.138 - 0.255)	1.277	(1.178 - 1.375)
	Karnataka	-0.016	(-0.087 - 0.056)	0.978	(0.878 - 1.078)
	Kerala	0.013	(-0.034 - 0.059)	1.010	(0.962 - 1.065)
	Tamil Nadu	0.097	(0.051 - 0.141)	1.136	(1.067 - 1.204)
	Telangana	0.248	(0.170 - 0.325)	1.400	(1.244 - 1.560)
Eastern Region	Bihar	0.347	(0.321 - 0.373)	2.716	(2.490 - 2.940)
	Odisha	0.271	(0.230 - 0.312)	1.501	(1.402 - 1.590)
	West Bengal	0.293	(0.245 - 0.340)	1.472	(1.368 - 1.575)
Western Region	Maharashtra	0.240	(0.184 - 0.295)	1.450	(1.320 - 1.586)
	Gujarat	0.560	(0.519 - 0.602)	2.803	(2.520 - 3.085)
Northern Region	Haryana	0.401	(0.357 - 0.445)	2.029	(1.844 - 2.210)
	Himachal	0.436	(0.362 - 0.509)	2.180	(1.836 - 2.520)
	Punjab	0.262	(0.210 - 0.314)	1.382	(1.282 - 1.480)
	Rajasthan	0.485	(0.457 - 0.512)	2.732	(2.539 - 2.924)
Central Region	Madhya Pradesh	0.524	(0.501 - 0.547)	3.810	(3.530 - 4.090)
	Uttar Pradesh	0.430	(0.411 - 0.449)	3.348	(3.136 - 3.559)

In Figure 2, we depicted the distribution of the utilisation of RMNCH interventions across quintiles. It is commonly known as five-dot plot/equiplot and captures important variations in the coverage of maternal and child health care interventions across different socio-economic groups. In the previous literature, level inequalities are disaggregated into three groups - linear, top and bottom inequalities. Linear inequality occurs when each estimate is equally distanced, while the top and bottom inequalities represent a situation where the gap is concentrated among the top quintiles and bottom quintiles, respectively [43]. Interventions such as ANC4 and skilled birth delivery discerned greater levels of inequality, while for tetanus toxoid and BCG vaccination, the gaps in the extent of inequality was quite minimal. It is important to allude that the coverage of essential interventions like ANC4, DPT3, Family Planning, Measles and SBA

show bottom level inequalities, where the coverage of the lower quintile population lags much behind their richer counterparts. Care seeking interventions for pneumonia and diarrhoea patients reveal linear and top inequalities, respectively.

Figure 2: Five-dot chart showing the interventions & composite coverage index by wealth index



### Inter-state disparity across RMNCH interventions

It can be purported (Table 5) that services necessitating frequent patient-provider consultations are inequitably distributed. Evidently, ANC4 demonstrates the highest level of inequality with an absolute gap of 48.75 percent (Q5-Q1). State level disparities reveal additional insights, with Karnataka recording an absolute gap of 1.6 percent, while in Uttar Pradesh this gap is a whopping 47.66 percent. Similar to ANC4, the coverage of SBA is also unevenly spread across different socio-economic groups, reflected by an absolute inequality of 30 percent (Q5-Q1). Inter-state variations are quite remarkable for SBA services too, with Kerala surpassing other states with nearly zero level of inequality and Haryana displaying a greater level of inequality with an absolute gap of 51.9 percent. Among the child health related interventions, DPT3 is the most inequitable intervention with an absolute gap of 16.2 percent. In Karnataka, the distribution of DPT3 is pro-poor (Q5-Q1=8), while in Haryana (47.7 percent), the distribution of absolute inequality is pro-rich.

**Table 5: Absolute Gap in RMNCH coverage indicators across States**

Region	Country/ States	At least 4 ANC	SBA	FP	BCG4	DPT3	Measles
	India	0.487	0.304	0.091	0.128	0.162	0.157
<b>Southern Region</b>	Andhra Pradesh	0.205	0.166	-0.062	0.083	0.178	0.219
	Karnataka	0.016	0.036	-0.140	-0.044	-0.079	-0.001
	Kerala	0.073	0.000	-0.011	-0.016	0.034	0.047
	Tamil Nadu	0.035	0.049	-0.045	0.030	0.412	0.127
	Telangana	0.224	0.239	-0.017	0.036	0.106	0.040
<b>Eastern Region</b>	Bihar	0.442	0.306	0.132	0.078	0.095	0.139
	West Bengal	0.240	0.302	-0.118	-0.038	-0.071	-0.021
	Odisha	0.197	0.172	-0.020	0.044	0.069	0.082
<b>Western Region</b>	Gujarat	0.458	0.281	-0.009	0.250	0.397	0.366
	Maharashtra	0.228	0.216	-0.053	0.113	0.191	0.124
<b>Northern Region</b>	Himachal Pradesh	0.444	0.406	-0.036	0.017	0.083	0.092
	Haryana	0.429	0.519	0.366	0.263	0.467	0.458
	Punjab	0.271	0.221	-0.049	0.052	0.037	0.022
	Rajasthan	0.390	0.213	0.094	0.171	0.245	0.263
<b>Central Region</b>	Uttar Pradesh	0.477	0.296	0.192	0.144	0.255	0.211
	Madhya Pradesh	0.453	0.312	-0.033	0.106	0.248	0.171

### Governance as a contextual factor for the coverage of RMNCH interventions

Good governance is an impetus to the better performance of the health sector. Hence, it is imperative to understand the relationship between Governance Index (OI) and RMNCH indices. In this section, we carried out this task to understand the correlation of CCI and Co-Cov with OI. Spearman's rank correlation matrices are built to assess this objective. We found that the correlation coefficient values are 0.594 between CCI and OI and 0.491 between Co-Cov and OI. The correlation analysis is conducted across each theme, but we have elucidated results only for the themes which were significant at 1 percent, 5 percent and 10 percent. The overall Governance Index exhibits a strong and positive association with CCI (Figure 3.a) and Co-Cov (Figure 3.b) with a correlation coefficient of 0.68 and 0.61, respectively. A detailed intra- theme-wise disaggregation demonstrated that women and child (WC) as well as health and education (HE) asserted a greater level of association with both the CCI and

Co-Cov indices. Interestingly, overall governance index had greater levels of correlation with CCI (0.68) in comparison to Co-Cov indices (0.61). Among the themes, we found that the correlation between two of themes (WC & HE) were high on CCI, whereas the coefficient values for DJ and EVN on CCI were the lowest. Similar pattern was found for the correlation between these indicators and Co-Cov.

Figure 3.a: Matrix Correlation between CCI and selected Governance Indicators

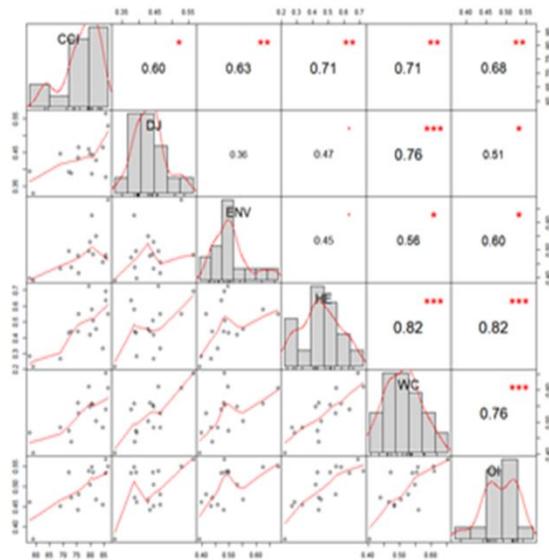
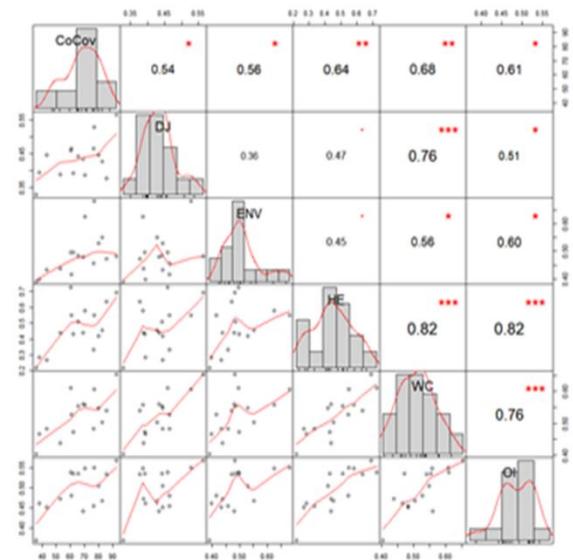
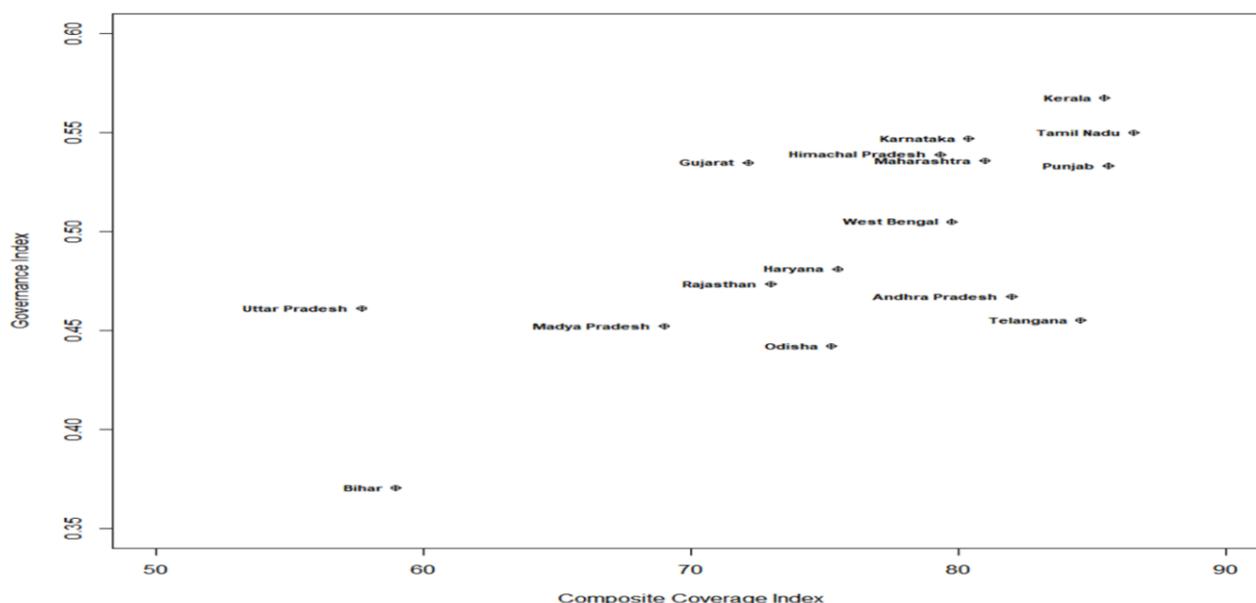


Figure 3.b: Matrix Correlation between Co-Cov and selected Governance Indicators



The state-wise relationship between OI and CCI can be discerned from Fig 4. It has been found that the states with higher governance scores such as, Kerala, Tamil Nadu, Karnataka, Himachal Pradesh, Maharashtra and Punjab experienced greater levels of composite coverage. Whilst, states like Bihar, Madhya Pradesh and Uttar Pradesh performed worst in terms of governance and CCI. The only exceptional states were the recently bifurcated states (Andhra Pradesh and Telangana) which have shown an exceptionally best performance in the coverage of maternal and child health indicators despite having a moderate level of governance scores.

Figure 4: Scatter plot for Overall Governance index (OI) and Composite Coverage Index (CCI)



## Discussion

Monitoring of RMNCH coverage proves to be cornerstone of India’s efforts to improve reproductive, maternal, new born and child health status towards the pursuit of SDGs. In this paper, we have estimated the extent and magnitude of the coverage of maternal and child health care services by employing two coverage indicators adopted by Countdown report (2015) for Maternal New-born and Child Survival Commission. The list of indicators was selected on the basis of their capability to influence policy and programme initiatives related to maternal and child health at local level.

Our findings elucidate the prevalence of inter-regional disparity with southern states outperforming other geographical regions in terms of the coverage of maternal and child health care services. It can be explained through myriad of factors such as stable governance, socio-cultural reasons and robust public health system. The outstanding performance of southern regions could be attributed to the prevalence of strong political commitment in the social sector, better awareness of health services within the community, greater levels of literacy among females, upgraded infrastructure of public health facilities and stronger organisational capacity to deliver healthcare services in the southern India [21,35,39]. It can hence be conferred that states asserting greater levels of attention in terms of the provisioning and dissemination of

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health services are successful in achieving greater levels of coverage [28]. Our results were in tandem with the previous studies [3, 21, 33, 32] who also found that the distribution of the coverage of RMNCH services were disproportionate across geographical contours.

At the national level, the coverage of SBA has tremendously increased, but this increase is not evenly spread out across different socio-economic groups as demonstrated by an absolute inequality of 30 percent (Q5-Q1). Financial barriers together with accessibility impediments act as a major barrier towards the utilisation of RMNCH services amongst the poorer sections [10, 23]. Interstate gaps are quite remarkable in the utilisation of SBA services too, with Kerala surpassing other states with nearly zero level of inequality and Haryana displaying the greatest level of inequality from our studies with an absolute gap of 51.94 percent. Greater levels of accessibility and availability of health care services in Kerala could have attributed to this situation [25]. The National Health Profile in 2017 has shown that the availability of government healthcare facilities in Kerala is 1280, as against Haryana which has only 159 facilities [39].

An in-depth enquiry across the interventions discerned that the overall inequality in the coverage RMNCH services were compounded by the burgeoning disparities in the interventions related to maternal health. Whereas, child related interventions exhibited an equitable distribution. For instance, the maternal health interventions like, the utilisation of ANC was mostly skewed towards the richer section of the population. Whereas, that, child health related interventions such as BCG vaccination demonstrated an equitable distribution across wealth horizons. This could be partly associated with the accessibility hindrances prevalent amongst the poorest quintile population. Typically, utilisation of adequate ANC services entails multiple visits to the facilities, whereas the utilisation of BCG shot requires a one-time visit to the facility.

Furthermore, BCG vaccination found to be more equitably utilised across socio-economic groups compared to other vaccinations, while in other study, measles was found to be the most equitable intervention [34]. The programmatic interventions and outreach programs related to BCG vaccination have percolated to grassroots levels attributing to the early and strict initiative undertaken by the Government of India. Since 1948, BCG has gathered incessant attention as it was the only preventive vaccination available to control Tuberculosis in India [11]. Similar assertion cannot be made for other child hood related immunisations like DPT and Measles.

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For instance, DPT and Measles acquired attention later with the implementation of the National Immunisation Programme called Expanded Programme of Immunisation in 1978 which aimed at expanding the coverage of both the diseases to 80 percent. These targets were however revised to 100 percent in the year 1985 with the initiation of the Universal Immunisation Programme. Despite these efforts, the coverage of DPT3 and Measles has remained sub-optimal and inequitable. This could be due to the dearth of trained personnel managing the programme at the national and state levels, lack of data on disease burden to prioritise, and the absence of a proper mechanism undertaking a system of routine reporting and surveillance [24].

Our state-wise analysis revealed that, the inequality in the coverage of CCI and Co-Cov was highest in Haryana. Convincingly, the state-level inequalities are often attributed by district level inequalities [30]. The existing disparities in the districts of Haryana could be explained by the variations in demand side factors like place of residence and socio-demographic factors and supply side factors like health policies, programme implementation, infrastructure and governance [30].

Another state which caught our attention was Karnataka which demonstrated a pro-poor inequality. We found that the utilisation of RMNCH services among the richest quintile population were proportionality lesser compared to their poorest counterparts. This could be attributed to the success of state-government's initiatives in providing better health infrastructure. As stated by Himanshu and Kallestal (2017) that the coverage of prenatal care services, delivery services, BEmOC and CEmOC facilities has increased across the districts with a concomitant decrease in the inequality of maternal and child health services in Karnataka.

Moreover, a part of Karnataka which is also known as the "Silicon Valley of India" accruing to its technological innovations might have transmuted its benefits to health sector in the form promoting digital health initiatives. The existence of digital monitoring mechanisms at the gram panchayat levels might have turned out to be an effective way to reach out to the poorest quintile population. However, a comparatively poor coverage.

Amongst the states experiencing pro-rich inequality, the absolute and relative disparity of CCI and Co-Cov are found to be the lowest in Punjab. This could be mainly because, in Punjab, the primary health system has undergone a huge transformation, with most of the PHCs upgraded to the Block PHC and infrastructure and quality of these centres are comparable to the Community Health Centres (CHCs). Moreover, various new health facilities were created and

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managed by the Local Governments [31]. It can be concluded that relegation of authority to local governments might be an efficient strategy to reduce health inequity.

Governance, a structural artefact of a society, occurs within social structure created for the purposes of facilitation. It is hypothesised that, the quality of governance is an important structural component determining health system's performance. Our results are in line with this hypothesis and we discovered that OI is significantly correlated with the coverage of RMNCH services. A study conducted in sub-Saharan countries [45] also found similar association between governance and health indicators. In addition to this, we found that HE and WC hold a strong and positive relationship with RMNCH indices. These results suggest that, among governance indicators, apart from health related factors, even non-health related factors (ENV) play a crucial role in determining the performance of health.

### **Strengths & Limitations**

In this paper, we have made a novel attempt to use a combination of two summative indices namely CCI and Co-Cov, which provides comprehensive information about the coverage of RMNCH services. This is the first study to measure the correlation between CCI & governance indicator and Co-Cov & governance indicator.

We have made an attempt to undertake a comprehensive analysis by incorporating all the available information pertaining to the coverage of maternal and child health care services in India. But this study is not free from limitations. Firstly, important information representing the complete coverage of RMNCH services – like clean delivery, thermal management, active management, content and follow up of postnatal care services – are not covered under DHS India (2015-16). Hence, we were unable to capture the quality of maternal and child health care services or the effective coverage. Secondly, our study suffers from recall bias, because the standard recall period ranges up to 5 years. Thirdly, the wealth index, a proxy used to measure socio-economic status, has been criticised. But, so far it is the best indicator available to determine the wealth status of an individual/household.

## **Conclusion**

As India embark upon a journey to achieve the SDGs, it is important to comprehend the past achievements and failures; and this present study is a stepping stone towards that path. We have carried out a sub-national level analysis to gauge the list of interventions that exhibit a pro-poor distribution and the ones eliciting a pro-rich distribution. We also demonstrated a huge disparity across the major states of India. Finally, we highlighted the relationship between governance and RMNCH coverage.

## **Policy Recommendation**

One of the major findings of this study was the extent to which, the disparity in coverage and co-coverage indicator is masked by the limited coverage of maternal health related interventions (particularly, adequate antenatal care services). Based on our analysis, we suggest the following policy prescription to improve the utilisation of RMNCH services. First, outreach programs related to ANC services at grassroot or village levels can be promoted and monitored by the centralised agency to ensure greater reach. Second, inclusion of ANC services in the existing programmatic intervention like JSY. Third, poor performing states might follow the strategies adopted by southern states with respect to upgradation of infrastructure, strong & transparent governance, usage of technologically sound interventions to track mother and child etc. Finally, we have found that, there is a strong and significant correlation between governance indicator and RMNCH coverage indices. This strong relationship reinforces the need to model the dimensions of RMNCH coverage and governance simultaneously to increase the coverage of RMNCH services.

## **Future Research**

Future research could entail a comprehensive study measuring the levels of inequity at a district level to discern policy initiatives at grassroot level. In addition to wealth factors, studies might consider probing into the interaction of wealth and place of residence (urban/ rural) to suggest micro level policies for a more disaggregated groups such as poorest quintile residing in rural areas, richest quintile residing in rural areas, poorest quintile residing in urban areas and richest quintile residing in urban areas. Future studies can delve deeper into the other dimensions of health inequality like social and ethnic parameters to draw a holistic picture of the disparities existing across different contours of the society.

### **Availability of data and materials**

The dataset used for this study is sourced from the Demographic Health Survey (National Family Health Survey, India 2005-06 and 2015-16 and can be obtained from the following website (<https://dhsprogram.com/data/Using-Datasets>). The specific data used in this study will be produced upon request.

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## APPENDIX : S1

Table S1.1: Detailed Description of RMNCH indicators

Indicators used to compute CCI	Definition	Numerator	Denominator
Demand for family planning satisfied with modern methods	Percentage of women of reproductive age (15-49 years) who have their need for family planning satisfied with modern methods	Number of women of reproductive age (15-49 years) who have their need for family planning satisfied with modern methods.	Total number of women of reproductive age in need of family planning
Antenatal Care	Percentage of women attended 4 or more times during pregnancy by skilled provider	Number of women ages 15-49 years who were attended four or more time during the pregnancy that led to their last birth in last 5 years preceding the survey by skilled provider	
Skilled Birth Attendant	Percentage of live births attended by Skilled Health Personnel	Number of Live births to women ages 15-49 years in the 5 years prior to the survey who were attended during delivery by skilled health personnel	Total number of live births to women ages 15-49 years in the 5 years preceding the survey
Immunized with three doses of diphtheria-tetanus-pertussis	Percentage of infants who received three doses of diphtheria-tetanus-pertussis vaccine	Number of surviving infants who received three doses of diphtheria with tetanus toxoid and pertussis containing vaccine	Total number of surviving infants
Immunized against measles (first dose)	Percentage of surviving infants who received the first dose of measles containing vaccine	Number of surviving infants who received the first dose of measles containing vaccine by their first birthday (or as recommended in the national immunization schedule)	Total number of surviving infants
Immunized with BCG	Percentage of surviving infants who received BCG vaccination	Number of surviving infants who received measles vaccination	Total number of surviving infants

Care seeking for symptoms of pneumonia	Percentage of children ages 0–59 months with suspected pneumonia taken to a health care provider	Number of children ages 0–59 months with symptoms of pneumonia (cough with fast breathing due to problem in the chest or problem in the chest and blocked nose) in the two weeks prior to the survey who were taken to a health care provider)	Total number of children ages 0–59 months with symptoms of pneumonia (cough with fast breathing due to problem in the chest or problem in the chest and blocked nose) in the two weeks prior to the survey
ORT treatment of diarrhoea	Percent of children age 0-59 months with diarrhoea in the previous 2 weeks who were given oral rehydration salts (from a packet or pre-package solution) or an appropriate homemade solution (ORT)	Number of children ages 0–59 months with diarrhoea in the two weeks prior to the survey receiving low osmolarity oral rehydration salts and zinc	Total number of children ages 0–59 months with diarrhoea in the two weeks prior to the survey

**Table S1.2: Slope Index of Inequity and Absolute Index of Inequity in Composite Coverage Index across States**

Composite Coverage Index	SII	(CI 95%)	RII	(CI 95%)
Andhra Pradesh	0.201	(0.049 - 0.354)	1.29	(1.015 - 1.569)
Arunachal	0.342	(0.728 - 0.460)	2.29	(1.587 - 2.984)
Assam	0.294	(0.225 - 0.354)	1.58	(1.427 - 1.725)
Bihar	0.210	(0.199 - 0.222)	1.39	(1.367 - 1.422)
Chhattisgarh	0.1327	(0.076 - 0.189)	1.18	(1.092 - 1.266)
Goa	0.480	(0.215 - 0.745)	2.14	(0.915 - 3.358)
Gujarat	0.259	(0.229 - 0.290)	1.46	(1.391 - 1.529)
Haryana	0.433	(0.341 - 0.524)	2.01	(1.640 - 2.380)
Himachal	0.1681	(0.121 - 0.215)	1.25	(1.169 - 1.330)
Jammu and Kashmir	0.233	(0.149 - 0.317)	1.36	(1.200 - 1.520)
Jharkhand	0.257	(0.171 - 0.343)	1.45	(1.252 - 1.657)
Karnataka	-0.063	(-0.081 - 0.045)	0.93	(0.904 - 0.950)
Kerala	0.248	(0.163 - 0.333)	1.37	(1.210 - 1.540)
Madhya Pradesh	0.203	(0.178 - 0.228)	1.33	(1.276 - 1.370)
Maharashtra	0.135	(0.094 - 0.176)	1.19	(1.126 - 1.250)
Manipur	0.335	(0.113 - 0.556)	1.84	(1.041 - 2.630)
Meghalaya	0.425	(0.357 - 0.492)	1.97	(1.728 - 2.217)
Mizoram	0.465	(0.428 - 0.502)	2.28	(2.120 - 2.430)
Nagaland	0.459	(0.334 - 0.584)	3.01	(1.936 - 4.080)
Odisha	0.113	(0.068 - 0.158)	1.16	(1.088 - 1.230)
Punjab	0.0971	(0.075 - 0.119)	1.13	(1.095 - 1.155)
Rajasthan	0.225	(0.193 - 0.258)	1.37	(1.308 - 1.432)
Sikkim	-0.059	(-0.312 - 0.194)	0.92	(0.591 - 1.250)
Tamil Nadu	0.081	(0.002 - 0.160)	1.10	(0.994 - 1.206)
Tripura	0.356	(0.134 - 0.578)	1.72	(1.083 - 2.370)
Uttar Pradesh	0.291	(0.252 - 0.329)	1.64	(1.539 - 1.749)
Uttarakhand	0.307	(0.281 - 0.333)	1.62	(1.549 - 1.680)
West Bengal	0.0985	(0.059 - 0.138)	1.13	(1.074 - 1.185)
Telangana	0.211	(0.111 - 0.312)	1.30	(1.128 - 1.473)

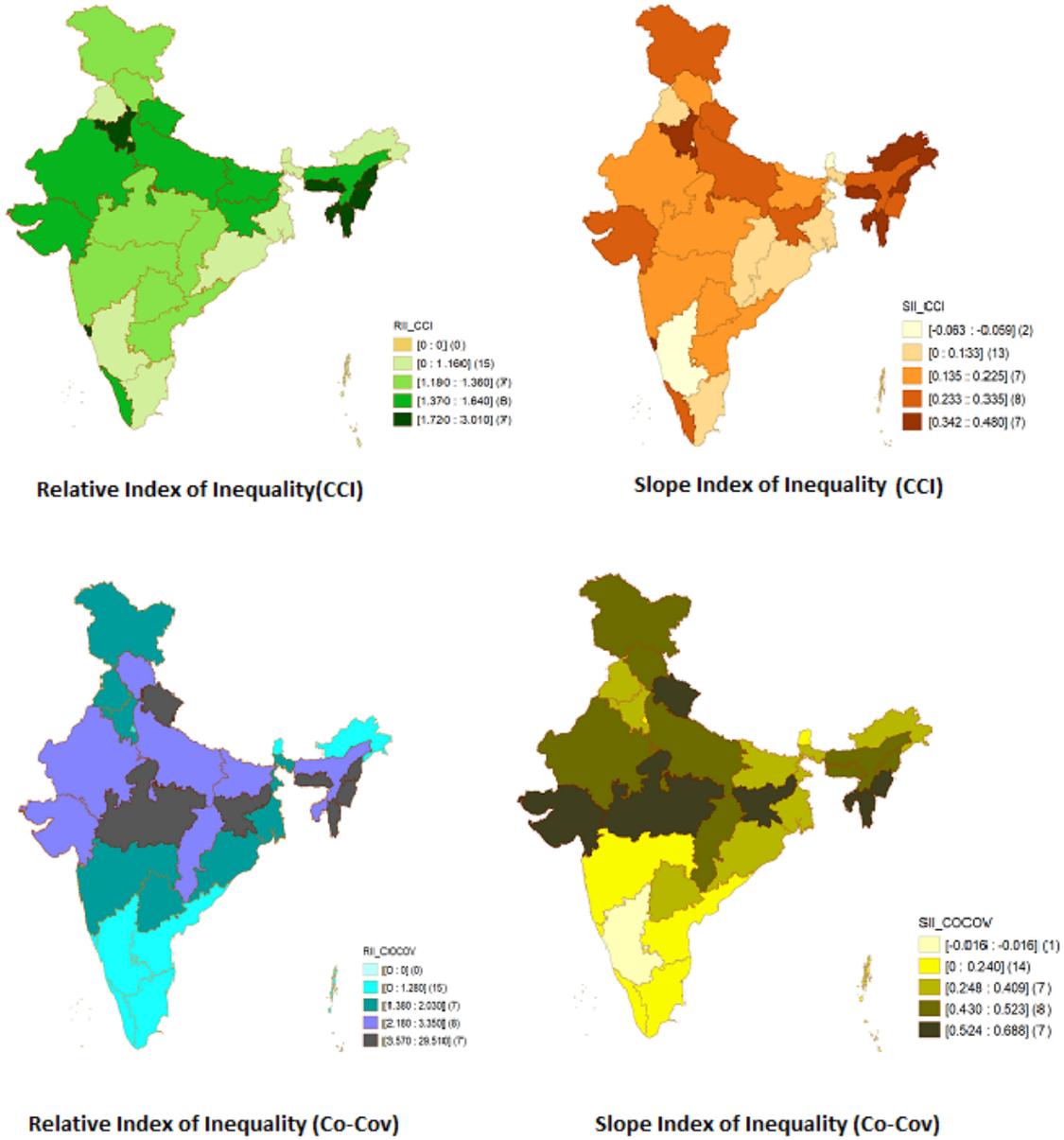
**Table S1.3: Slope Index of Inequity and Absolute Index of Inequity in Co-Coverage Indicator across States**

Co-coverage Index	SII	(CI 95%)	RII	(CI 95%)
Andhra Pradesh	0.196	(0.138 - 0.255)	1.277	(1.178 - 1.375)
Arunachal	0.409	(0.358 - 0.460)	5.946	(4.509 - 7.382)
Assam	0.515	(0.480 - 0.549)	3.057	(2.759 - 3.350)
Bihar	0.347	(0.321 - 0.373)	2.716	(2.490 - 2.940)
Chhattisgarh	0.487	(0.446 - 0.528)	2.246	(2.050 - 2.440)
Goa	0.068	(-0.056 - 0.192)	1.079	(0.926 - 1.234)
Gujarat	0.560	(0.519 - 0.602)	2.803	(2.520 - 3.085)
Haryana	0.401	(0.357 - 0.445)	2.029	(1.844 - 2.210)
Himachal	0.436	(0.362 - 0.509)	2.180	(1.836 - 2.520)
Jammu and Kashmir	0.449	(0.407 - 0.491)	1.966	(1.815 - 2.120)
Jharkhand	0.531	(0.500 - 0.562)	4.271	(3.814 - 4.727)
Karnataka	-0.016	(-0.087 - 0.056)	0.978	(0.878 - 1.078)
Kerala	0.013	(-0.034 - 0.060)	1.010	(0.962 - 1.065)
Madhya Pradesh	0.524	(0.501 - 0.547)	3.810	(3.530 - 4.090)
Maharashtra	0.240	(0.184 - 0.295)	1.450	(1.32 - 1.586)
Manipur	0.688	(0.651 - 0.726)	4.819	(1.325 - 1.586)
Meghalaya	0.522	(0.475 - 0.570)	29.50	(19.40 - 39.59)
Mizoram	0.582	(0.508 - 0.655)	3.565	(2.856 - 4.275)
Nagaland	0.523	(0.474 - 0.570)	29.51	(19.422 - 39.59)
Odisha	0.271	(0.230 - 0.312)	1.501	(1.402 - 1.590)
Punjab	0.262	(0.210 - 0.314)	1.382	(1.282 - 1.48)
Rajasthan	0.485	(0.457 - 0.512)	2.732	(2.539 - 2.924)
Sikkim	0.157	(0.049 - 0.265)	1.199	(1.043 - 1.350)
Tamil Nadu	0.097	(0.051 - 0.141)	1.136	(1.067 - 1.204)
Tripura	0.634	(0.553 - 0.716)	3.347	(2.645 - 4.348)
Uttar Pradesh	0.430	(0.411 - 0.449)	3.348	(3.136 - 3.559)
Uttarakhand	0.565	(0.517 - 0.613)	3.861	(3.303 - 4.421)
West Bengal	0.293	(0.245 - 0.340)	1.472	(1.368 - 1.575)
Telangana	0.248	(0.170 - 0.325)	1.400	(1.244 - 1.560)

**Table S1.4: Absolute Gap in RMNCH coverage indicators across States**

Country/ States	At least 4 ANC	SBA	BCG4	FP	DPT3	Measles
India	0.487	0.304	0.091	0.128	0.162	0.157
Jammu & Kashmir	0.384	0.378	0.177	0.110	0.224	0.277
Himachal Pradesh	0.444	0.406	0.017	-0.036	0.083	0.092
Punjab	0.271	0.221	0.052	-0.049	0.037	0.022
Uttarakhand	0.416	0.436	0.140	0.035	0.332	0.296
Haryana	0.429	0.519	0.263	0.366	0.467	0.458
Rajasthan	0.390	0.213	0.171	0.094	0.245	0.263
Uttar Pradesh	0.477	0.296	0.144	0.192	0.255	0.211
Bihar	0.442	0.306	0.078	0.132	0.095	0.139
Sikkim	0.226	0.215	-0.057	-0.362	-0.150	-0.057
Arunachal Pradesh	0.281	0.686	0.323	-0.006	0.323	0.366
Nagaland	0.568	0.702	0.519	0.124	0.547	0.534
Manipur	0.629	0.580	0.277	-0.022	0.550	0.556
Mizoram	0.736	0.728	0.480	0.301	0.403	0.440
Tripura	0.449	0.411	0.347	-0.040	0.221	0.326
Meghalaya	0.537	0.653	0.278	0.225	0.379	0.393
Assam	0.442	0.420	0.195	-0.064	0.312	0.263
West Bengal	0.240	0.302	-0.038	-0.118	-0.071	-0.021
Jharkhand	0.529	0.390	0.067	0.076	0.125	0.106
Odisha	0.197	0.172	0.044	-0.020	0.069	0.082
Chhattisgarh	0.312	0.303	0.000	0.025	0.077	0.045
Madhya Pradesh	0.453	0.312	0.106	-0.033	0.248	0.171
Gujarat	0.458	0.281	0.250	-0.009	0.397	0.366
Maharashtra	0.228	0.216	0.113	-0.053	0.191	0.124
Andhra Pradesh	0.205	0.166	0.083	-0.062	0.178	0.219
Karnataka	0.016	0.036	-0.044	-0.140	-0.079	-0.001
Goa	0.919	-0.003	0.000	0.567	-0.051	-0.030
Kerala	0.073	0.000	-0.016	-0.011	0.034	0.047
Tamil Nadu	0.035	0.049	0.030	-0.045	0.412	0.127
Telangana	0.224	0.239	0.036	-0.017	0.106	0.040

Figure S1. 1 SII and RII of CCI and Co-Cov Indicators



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## APPENDIX : S2

### Supplementary Document -2

#### 1. Essential Infrastructure

##### I. Power

- a. T & D Losses
- b. Per Capita Consumption of Power
- c. Households electrified as a % of total
- d. % of Households with access to safe drinking water

##### II. Water

- a. Total Irrigated Area vs Total Agricultural Area
- b. Existence of Water Regulatory Commission
- c. Existence of Ground Water Regulation Act

##### III. Roads and Communication

- a. Surface Roads as a % of total Roads
- b. Road Density per 1000 sq. KM
- c. % of households with access to Cellphone

##### IV. Housing

- a. No. of Pucca Houses as a % of total
- b. Slum Population as a % of total Urban population
- c. % of households with toilets inside premises

#### 2. Support to Human Development

##### I. Education

- a. Educational Development Index
- b. ASER Learning Levels
- c. No. of Higher Education Colleges per 1 Lakh Population
- d. Educational Expenditure as a % of GSDP

##### II. Health

- a. IMR
- b. Average Population served per hospital bed
- c. Full Immunization

- 
- d. Health Exp as a % of GSDP
3. Social Protection
    - I. Public Distribution System
      - a. Allocation and offtake of grain under PDS
    - II. Social Justice and Empowerment
      - a. % of Pension beneficiaries of the total population above 60
      - b. % of Households with no land
      - c. Incidence of crime against SC/ST
    - III. Minority welfare
      - a. No. of Minority Children given pre matric scholarship
    - IV. Employment
      - a. Unemployment Rate
      - b. % of Manual Casual Labour
  4. Women and Children
    - I. Child
      - a. Crime against Children
      - b. Percentage of Child Labour
      - c. % of Beneficiaries under ICDS
      - d. Child Sex Ratio
      - e. % of Malnourished children
    - II. Women
      - a. Women Working Population ratio
      - b. Utilization of Janani Suraksha Yojna Funds
      - c. Male Female Literacy Gap
      - d. Institutional Delivery
  5. Crime, Law and Order
    - I. Violent Crimes
      - a. Rapes per ten lakh population
      - b. Murders per ten lakh population
      - c. Dowry Deaths per ten lakh population
    - II. Atrocities

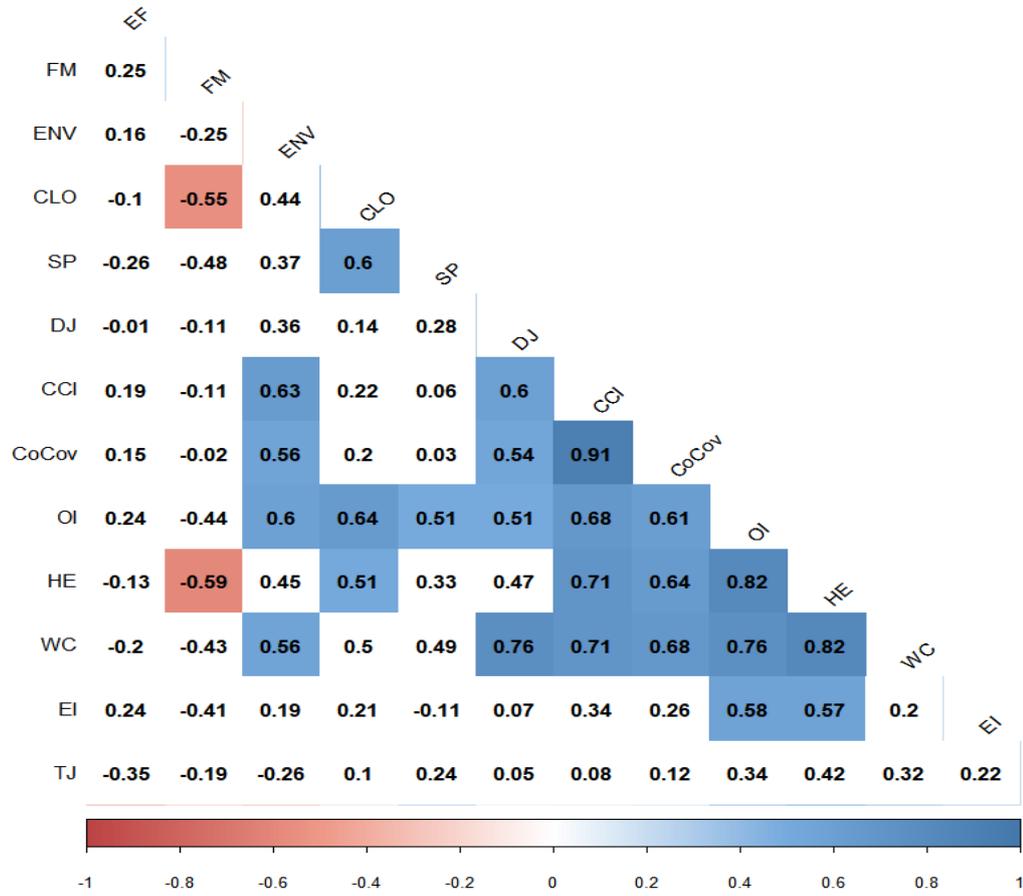
- a. Custodial Deaths per ten lakh population
- III. Policing
  - a. No. of police firings
  - b. No. of police personnel per ten lakh
6. Delivery of Justice
  - I. Pendency of Cases
    - a. Pendency in High Court
    - b. Pendency in District Court
  - II. Vacancies of presiding officers
    - a. Vacancy in High Court
    - b. Vacancy in District Court
7. Environment
  - I. Pollution and environmental violations
    - a. Suspended Particulate Matter
    - b. SO Emissions
    - c. NO Emissions
    - d. No. of Environmental Violations in the State (Per capita)
  - II. Forest cover
    - a. Increase / Decrease in Forest Cover
  - III. Renewable energy
    - a. Renewable Energy as a % of total energy generated
8. Transparency and accountability
  - I. Transparency
    - a. Adherence to Section 4 RTI
    - b. RTPS Act legislated or not
    - c. No. of Services provided under e-Governance plan
  - II. Accountability
    - a. Lok Ayukt: Constituted / Bill Passed, Individual Websites and Chairpersons' appointment
    - b. No. of ACB cases disposed as a % of total cases registered
    - c. Social Audit under NREGA: % of GPs covered
    - d. Panchayat Devolution Index Score
9. Fiscal Management

- 
- I. FRBM indicators
    - a. Revenue Surplus / Deficit (% of GSDP)
    - b. Fiscal Surplus / Deficit (% of GSDP)
    - c. Debt Burden (% of GSDP)
  - II. Resource generation and development expenditure
    - a. Per Capita Development Expenditure
    - b. States own tax revenue growth
10. Economic freedom
- I. No. of Industrial Entrepreneurs Memorandum filed
  - II. Ease of Doing Business
  - III. Value of MSMEs assets (% of GSDP)

### **Steps involved in calculation of Overall Governance Index (OI)**

PAI data were extracted from various union governmental ministries & departments, except the data on underweight children and educational learning levels which was derived from UNICEF and ASER reports. Overall indicator representing governance parameter was derived through a rigorous process. Ranking of the states was done using a three-stage aggregation process. Firstly, a minimum value was subtracted from Indicator's value and divided by its range, where range is the difference between the maximum and the minimum value. For the variables, which indicated lower values as the better, slightly different methodology was adopted. In such cases, indicator's value was subtracted from its maximum value and divided by its range, values for each of the binary variables were allotted 0 for no and 1 for yes. Secondly, the values of each of these indicators were summated using weighted aggregation technique which entailed two important considerations- the extent of dominance the state holds on each of the variable and the amount of impact each variable exerts on societal wellbeing. And finally, all the ten themes were given equal weights of 0.1 to arrive at the overall index value.

Correlation Matrix of CCI, Co-Coverage Index and Governance Indicators



EI- Essential Infrastructure, ENV- Environment, SP-Social Protection, HE- Health and Education, DJ- Delivery of Justice, CLO-Crime, Law and Order, WC-Women and Child, TJ-Transparency and Public Accountability, FM- Fiscal Management , EF-Economic Freedom, OI- Overall Index, CCI-Composite Coverage Index, Co-Cov -Co-Coverage Index

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