



RESEARCH ARTICLE

Sequential impact of components of maternal and child health care services on the continuum of care in India

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Abstract

This paper examines the sequential impact of components of maternal and child health care on the continuum of care in India using data from the Indian National Family Health Surveys conducted in 2005–06 and 2015–16. Continuum of care (CoC) for maternal and child health is defined in this paper as the sequential uptake of three key maternal services (antenatal care, institutional delivery and postnatal care for the mother). Women who received all three services were classified as full CoC recipients. Characteristics odd ratios for achieving CoC were estimated by mother's place of residence, household wealth status, mother's education, birth order and child full vaccination. Odds ratios were computed to understand the relative impact of each preceding service utilization on the odds of subsequent service uptake. At national level, 30.5% and 55.5% of women achieved full CoC in 2005–06 and 2015–16, respectively, and the overall progress of CoC over the 10-year period was 25.5 percentage points, with significant variation across states and socioeconomic groups. Full CoC improved from 7.5% to 32.4% among the poorest women, whereas among the richest women it improved from 70.5% to 75.1%. Similarly, among uneducated women full CoC improved from 11.7% to 35.9% as against 75.1% to 80.5% among educated mothers over the same period. Furthermore, greater CoC was observed among parity one women. The conditionality between various components of CoC indicated that at national level the odds of having an institutional delivery with antenatal care were 9 times higher in the earlier period as against 4.5 times higher in the more recent period. Furthermore, women who had institutional deliveries complied more with mother's postnatal care compared with women who did not have institutional deliveries. This again helps increase the likelihood of a child receiving full vaccination.

Keywords: Institutional delivery; Continuum of Care; JSY

Introduction

Globally, despite several years of focused efforts, maternal and child mortality remains a major concern. This is reflected in Goal 3 of the UN Sustainable Development Goals (SDGs), which aims to reduce maternal mortality to a global ratio of less than 70 per 100,000 live births by 2030. It also aims to reduce neonatal mortality to less than 12 per 1000 live births, and end the preventable deaths of newborns and children under 5 years of age. Regardless of this 2015 commitment, in 2017 300,000 women died from complications relating to pregnancy and childbirth globally, and about 90% of these deaths were in low- and middle-income countries. Globally, under-5 mortality fell from 77 deaths per 1000 live births in 2000 to 39 deaths in 2017. The total number of under-5 deaths dropped from 9.8 million in 2000 to 5.4 million deaths in 2017. About 30% of these deaths occurred in southern Asia (United Nations, 2019). Therefore, to achieve SDG-3,

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significant reductions in maternal, neonatal and under-5 mortality are required in low- and middle-income countries.

In India the maternal mortality ratio declined from 212 per 100,000 live births in 2007–09 to 113 in 2016–18. The decline was from 308 to 161 in the Empowered Action Group (EAG) of states, while in the southern states it was from 127 to 67 and in other states it was from 149 to 83 per 100,000 live births (SRS, 2011, 2020). Under-5 mortality declined from 97 per 1000 live births in 2000 to 39 deaths in 2017 (UNICEF, 2020). Neonatal mortality in India declined from 42 per 1000 live births in 2000 to 20 in 2018.

Clearly, significant reductions in both the maternal mortality ratio and neonatal mortality rate are needed to achieve SDG-3 in India. It is important to further note that about 18% of global maternal deaths occur in India. Although both maternal and neonatal mortality have been declining in India, their relative global share has remained the same. To improve maternal and neonatal health, the Government of India launched the safe motherhood intervention 'Janani Suraksha Yojana' (JSY) in 2005, implemented by the National Health Mission. The core objective of this has been to increase institutional delivery by increasing the demand for services using cash incentives for women conditional on institutional delivery (MoHFW, 2018a).

Generally, the performance of maternal and child health services is measured individually in terms of the coverage/uptake of antenatal visits, institutional delivery and postnatal visits/check-ups (Chopra *et al.*, 2009; Mohammad & Pallikadavath, 2018). In India, coverage of these services has improved substantially over the last few decades. However, improvement in adverse pregnancy outcomes, for instance perinatal mortality, has been slow in all regions except for Central, where is increased from 10.6% to 16.8% from 2005–06 to 2015–16, and did not achieve the anticipated level needed to reach the SDG-3 targets (in the North 14.3% to 11.0%, East 13.7% to 10.0%, North East 17.2% to 14.2% and West 23.7% to 7.2%). Antenatal care (ANC) coverage and institutional delivery uptake in 2015–16 were 83% and 81% respectively, but access to postnatal care for mothers and children was substantially lower at 65% and 37% respectively (NFHS-4). This means that higher coverage with the individual components of service utilization does not ensure that women receive all the essential components (Shibanuma *et al.*, 2018): this deficit is likely to result in persistently poorer health outcomes. Most maternal deaths occur during labour or delivery or in the immediate postpartum period and could be avoided with effective integration of the key services linked to the continuum of care (Iqbal *et al.*, 2017; Rahman *et al.*, 2019). It is important that women and children receive all key services as a continuum to avoid complications that can lead to morbidity and death.

The concept of continuum of care (CoC) for maternal, neonatal and child health (MNCH) incorporates two dimensions, i.e. time and place: for instance, time of pregnancy registration, number of antenatal care (ANC) visits, institutional delivery, mother and child postnatal care within 2 weeks of postpartum and child vaccination. The central idea is that for a better maternal and child health outcome it is important to achieve all the components of MNCH services. The 'place' dimension of CoC for MNCH considers integration of care-giving within the home, the first-level facility and the hospital. This study focused was on the effect of JSY on the coverage of all the services of CoC – antenatal care, institutional delivery and postnatal care – across the Indian states. A limited attempt was made to understand the effect of JSY in improvement of full CoC coverage in India. Two rounds of National Family Health Survey (NFHS) data (2005–06 and 2015–16) were examined because it is important to understand the pattern of CoC for maternal and child health in India and the magnitude by which this varies across states and socioeconomic groups in order to take corrective policy measures. It is particularly important in the context of demand-side financing interventions such as JSY to overcome financial barriers to the utilization of maternal health care services among poor women in the country. Given this context, the objectives of this study were: (1) to assess the levels and patterns of CoC for MNCH in India and its states; (2) to study the role of mothers' education, household wealth status, place of residence,

birth order and full vaccination in full CoC; and (3) to understand the impact of each component of MNCH services on the uptake of subsequent maternal health services to achieve full CoC.

Methods

The study used data from the NFHS-3 conducted in 2005–06 and NFHS-4 conducted in 2015–16. The sampling procedure for the surveys is explained in detail elsewhere (IIPS & ICF, 2007, 2017). Briefly, the NFHS adopted a multi-stage stratified design with a sampling frame based on the 2011 census. Primary Sampling Units (PSUs) were villages in rural areas and Census Enumeration Blocks (CEBs) in urban areas. Within each rural stratum, villages were selected from the sampling frame with probability proportional to size (PPS). In urban areas, CEBs were sorted according to the percentage of the Scheduled Caste/Scheduled Tribe population in each CEB, and CEBs were selected with PPS sampling. In every selected rural and urban PSU, a complete household mapping and listing operation was conducted prior to the main survey. Selected PSUs with an estimated number of at least 300 households were segmented into approximately 100–150 households. Two of the segments were randomly selected for the survey using systematic sampling with probability proportional to segment size. In the second stage, in every selected rural and urban cluster, 22 households were randomly selected with systematic sampling.

Information was analysed from all eligible women aged 15–49 from the Woman's Questionnaire of the surveys who were asked questions, among others, on antenatal care, delivery care and postnatal care. The analysis was restricted to the most recent birth of mothers who gave birth within the past 5 years (36,850 for NFHS-3 and 190,898 for NFHS-4). This was due to the time limit in data collected by the NFHS, and since information was recorded for the most recent birth only.

Outcome variable

A woman who had her delivery in any health facility (public or private) was considered to have had an institutional delivery (ID). This was used as a dependent variable to assess the demand-side financing intervention of the JSY maternal and child health programme, which provides monetary incentives to poor and marginalized mothers to deliver in a health facility (MoHFW, 2018b), and to assess the role of incentivization in shaping compliance with components of continuum of care in maternal and child services.

Correlates

The CoC elements for maternal and child health services were: antenatal care; postnatal care for the mother (PNC-M), i.e. postpartum check-up within 2 days of delivery by a health professional or Accredited Social Health Activists (ASHAs) or traditional birth attendant; and child full vaccination by 12–23 months by a health professional, ASHA or traditional birth attendant.

Those who had any ANC were considered to be 'ANC recipients'. If a woman had her postnatal check-up within 2 days of delivery, she was considered to be a 'postnatal care recipient' (PNC-M), and children receiving full vaccination at age 12–23 months, i.e. who had received all basic vaccinations vaccines by the time of the survey (according to a vaccination card or the mother's report) were considered to have 'full vaccination'. Basic vaccinations were: at least one dose of BCG vaccine, which protects against tuberculosis, three doses of DPT vaccine, which protects against diphtheria, pertussis (whooping cough), and tetanus, three doses of polio vaccine and one dose of measles vaccine. If a woman received all three services she was considered to have 'full CoC'. 'Partial CoC' was when at least one of the services was not received. Women who received none of these services were considered to have 'no service uptake'. The associations

of full CoC with birth order, place of residence, mother's level of education and wealth status of the household were also analysed.

Statistical analysis

The likelihood a woman having 'full CoC' was represented by characteristic odds ratios (CORs) for the exogenous variables urban–rural place of residence, household wealth quintile, mother's level of education, birth order and full child vaccination. For instance, p_i represents the probability of full CoC with a certain feature i – say, urban residence – which can be denoted as p_i (Full CoC for characteristics) and p_j represents the probability of full CoC irrespective of any characteristics, denoted by p_j (Full CoC for India), and was considered as the reference for ease of comparison and interpretation. Characteristic odds ratios can therefore be interpreted as showing an increased or decreased likelihood of full CoC compared with overall compliance with full CoC. They are also used in conditional form to understand the relative importance of preceding components of MNCH on the subsequent components of the continuum of care chain. The computation of the COR is as follows:

$$\text{Odds}_i = \frac{P_i}{1 - p_i} \quad (1)$$

Similarly, the odds for the Services p_i and p_j are calculated as:

$$\text{Odds}_j = \frac{P_j}{1 - p_j} \quad (2)$$

The COR of the Service p_i with Service p_j is calculated using the formula:

$$\text{COR} = \frac{\text{Odds}_i}{\text{Odds}_j} \quad (3)$$

CORs convey the likelihood of compliance with service i conditioned by the compliance with service ' j '. Theoretically the value of a COR varies from zero to infinity.

Logistic regression analysis was used to estimate the association of institutional delivery and other maternal services at the national and state level. The logistic regression model is one of the widely used statistical techniques for the binary dependent variable which provide the valid and reliable regression coefficient adjusting for the study design and confounder. Here, institutional delivery was the binary variable used as the outcome variable. The general equation of the logistic model is:

$$\text{logit}(P_i) = \alpha + \beta_1(\text{ANC}) + e_i \quad (4)$$

$$\text{logit}(P_i) = \alpha + \beta_1(\text{Postnatal care}) + e_i \quad (5)$$

$$\text{logit}(P_i) = \alpha + \beta_1(\text{Full vaccination}) + e_i \quad (6)$$

where α is the intercept. The results of the logistic regression are presented as unadjusted odds ratios (UORs) and the intra-class correlation coefficient (ICC) and variance inflation factor (VIF) were calculated to understand the multicollinearity among the independent variables. Pearson's Chi-squared test, as well as the F -adjusted test statistic, were used to test goodness-of-fit of the model. All analyses were carried out using the STATA 15 software.

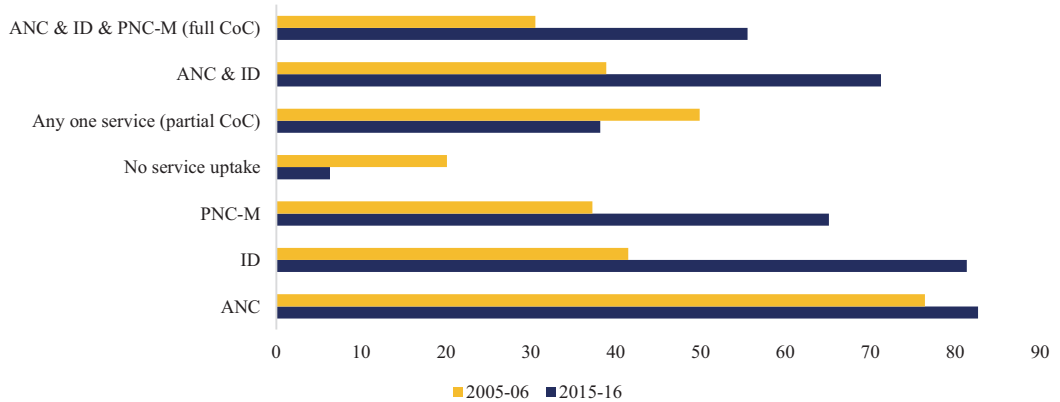


Figure 1. Percentage distribution of maternal services in India, 2005–06 and 2015–16. ANC, antenatal care; ID, institutional delivery; PNC-M, postnatal care for the mother.

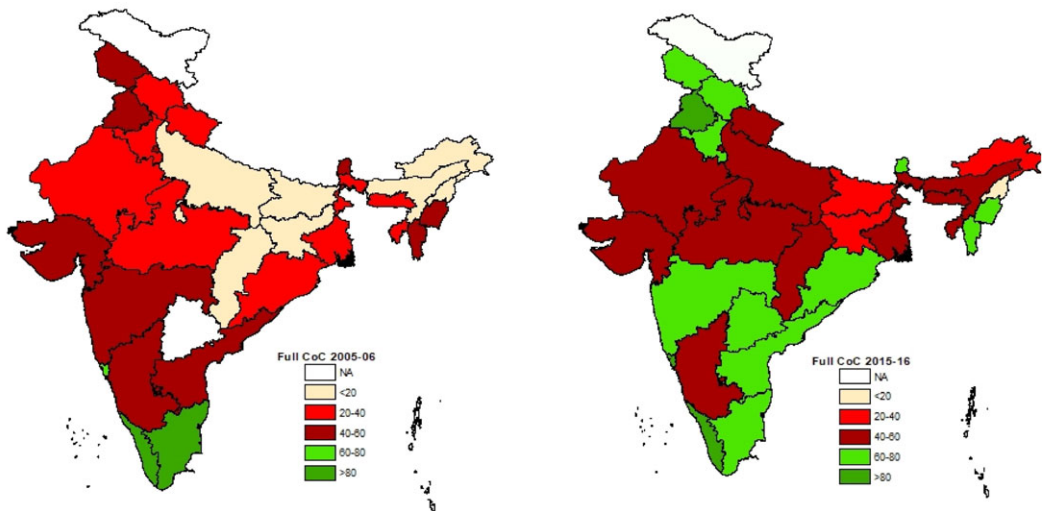


Figure 2. Prevalence of full CoC in Indian states, 2005–06 and 2015–16.

Results

Pattern of continuum of care from 2005–06 to 2015–16

Figure 1 illustrates the significant improvement in CoC in India from 2005–06 to 2015–16. India’s full CoC level improved from 30.5% to 55.5% over the 10-year period. Remarkable progress was achieved in institutional delivery, which increased from 39.0% to 79.0%, and PNC-M, which increased from 37.2% to 65.1%. Whereas together ANC and institutional delivery uptake increased from 38.8% to 71.0%, there was clearly a continuous decline in maternal services uptake moving from antenatal to postnatal care.

The pattern of change in CoC over time differed across states, with the southern states of Tamil Nadu, Kerala and Goa being ahead, even in 2005–06, and the introduction of National Rural Health Mission (NRHM) had made a difference to CoC compliance in the states of Jammu Kashmir, Punjab, Odisha and Maharashtra (Figure 2). On comparing the improvement in full CoC over time across states (Figure 3), it is apparent that those that had a poor CoC in

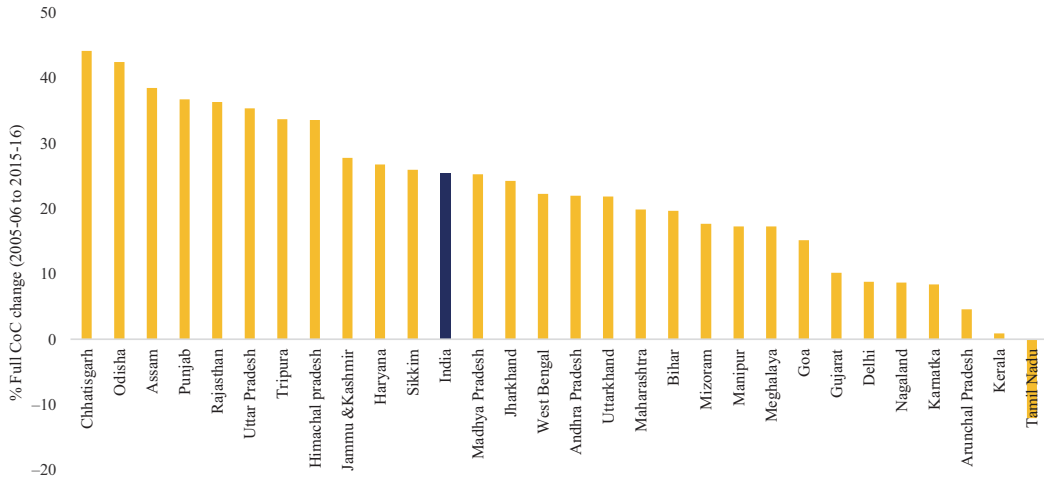


Figure 3. Absolute change of CoC from 2005–06 to 2015–16 in India and states.

2005–06 experienced major gains, above the national gain of 25.5%. All states experienced a gain in level of full CoC, but Chhattisgarh, Odisha, Punjab and Rajasthan experienced phenomenal improvements over the decade.

Phenomenal progress has been made in institutional delivery compared with ANC care and PNC-M (Table 1). However, progress in ANC was also marked for a select set of states where uptake had been poor in 2005–06. To name a few, Uttar Pradesh, Bihar, Jharkhand and Rajasthan experienced a substantial increase in ANC uptake to attain convergence with other states where ANC utilization has risen above 80%. Undoubtedly, there has been a move towards universalization in ANC utilization and greater convergence across the states. However, a few select states, including Madhya Pradesh and Goa, which had previously had a greater ANC component, showed marginal decline over the study period.

Moving on to institutional deliveries, the southern region was near to attaining 100% in 2015–16, with progress made in Andhra Pradesh and Karnataka. In the rest of the country there was a phenomenal rise in institutional deliveries during 2006-06 to 2015–2016, particularly in Haryana, Himachal, Chhattisgarh, Bihar and Rajasthan and Uttar Pradesh. This incremental gain in some states was not in keeping with that of other states, particularly in the north-east. Otherwise a high level of regional convergence in institutional deliveries was attained over the study decade. Rising proportion of institutional delivery has implications for the postnatal care of mothers (PNC-M), which has improved substantially over the decade although far from being universal. While almost all states had near to, or more than 50% uptake of PNC-M in 2015–16, it is rather surprising that this component falls short of uptake levels for institutional deliveries. Therefore, it seems that institutional deliveries do not guarantee PNC-M uptake contributing to the failure of full CoC. The percentage decline in ‘no service uptake’ over time was near to zero, or in single digits, indicating a rise in uptake of maternal services in general. Although improvements in individual components of care are seen, CoC levels remained poor in 2015–16 and there is therefore a need to examine the pattern of all components of these benchmarks. This was therefore done for ANC and ID, and compliance between them not only improved for these over the study period, but there was a conditionality between the two, i.e. ID conditional to ANC. However, the similar compliance between ANC, ID and PNC-M does not seem to be overtly visible, implying that PNC-M is not strictly conditional on its preceding benchmark of ID over time.

Table 1. Percentage distribution of uptake of maternal health services in states of India, 2015–16 and 2005–06

Region/state	ANC		ID		PNC–M		No service uptake		Partial CoC		ANC & ID		Full CoC	
	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06
North														
Delhi	89.2	88.8	87.0	63.0	65.6	58.4	3.6	7.3	39.2	44.4	80.1	60.6	57.1	48.3
Haryana	82.3	88.3	83.5	38.8	70.8	55.8	6.8	9.6	32.3	56.3	73.8	37.8	60.8	34.0
Himachal Pradesh	90.4	86.4	78.2	44.0	76.4	43.1	3.3	9.5	31.1	58.7	73.7	41.2	65.4	31.9
Jammu & Kashmir	90.9	84.7	87.1	53.0	76.0	48.4	3.5	12.2	25.8	45.3	81.7	51.2	70.4	42.6
Punjab	97.1	88.9	92.1	54.8	89.3	61.9	0.6	7.1	15.6	45.9	90.0	52.9	83.8	47.0
Rajasthan	85.5	74.9	85.8	31.8	64.9	28.8	5.0	22.3	36.3	55.4	76.6	29.5	58.6	22.2
Uttarakhand	77.0	69.4	72.0	34.9	58.4	32.4	11.1	25.9	41.4	48.6	61.7	32.1	47.4	25.5
Central														
Chhattisgarh	95.7	88.5	72.8	14.8	69.0	28.2	2.0	10.6	41.2	76.8	70.9	14.7	56.8	12.6
Madhya Pradesh	75.6	79.5	82.3	29.2	56.9	28.5	7.3	17.8	45.9	60.7	66.2	27.4	46.8	21.5
Uttar Pradesh	76.1	66.0	69.9	22.0	58.8	13.2	10.6	30.4	43.5	59.3	58.3	19.0	45.7	10.3
East														
Bihar	55.7	34.1	66.2	21.0	45.9	15.9	17.9	55.4	53.4	35.7	42.0	13.3	28.7	9.0
Jharkhand	76.3	58.9	64.1	19.7	48.5	16.9	12.3	38.4	51.0	49.4	54.2	17.9	36.6	12.3
Odisha	92.9	86.9	86.6	37.9	78.5	33.3	1.8	10.5	28.9	62.9	82.1	36.3	69.1	26.6
West Bengal	90.4	91.9	77.6	44.4	63.7	40.7	3.2	6.9	42.5	61.2	71.8	43.5	54.3	32.0
North-east														
Arunachal Pradesh	56.1	52.6	55.5	32.4	30.2	22.8	25.5	41.0	53.2	42.3	37.8	26.3	21.3	16.7
Assam	87.8	70.7	73.2	24.9	57.7	14.0	6.2	27.3	43.3	60.7	67.8	23.2	50.5	12.0
Manipur	89.5	86.3	72.8	50.1	65.9	46.4	6.5	11.9	32.5	44.4	69.1	48.6	61.0	43.7
Meghalaya	81.1	67.6	54.8	32.3	55.7	28.8	11.7	30.2	45.3	43.9	49.4	30.9	43.1	25.8

(Continued)

Table 1. (Continued)

Region/state	ANC		ID		PNC-M		No service uptake		Partial CoC		ANC & ID		Full CoC	
	2015-16	2005-06	2015-16	2005-06	2015-16	2005-06	2015-16	2005-06	2015-16	2005-06	2015-16	2005-06	2015-16	2005-06
Mizoram	87.9	74.3	81.7	62.3	65.8	50.4	7.5	18.4	31.1	38.1	77.5	55.2	61.3	43.6
Nagaland	45.8	57.8	35.8	13.9	23.4	10.6	43.4	40.4	39.2	50.9	25.7	12.4	17.4	8.7
Sikkim	91.0	89.3	95.0	50.3	74.8	44.9	1.1	8.8	30.9	49.1	87.0	48.6	68.0	42.0
Tripura	88.9	78.3	82.6	50.2	63.0	30.3	4.6	17.8	36.4	57.0	76.2	47.0	58.9	25.2
West														
Goa	96.7	97.3	98.3	93.2	92.6	75.7	0.3	1.8	10.2	24.2	95.7	92.4	89.5	74.0
Gujarat	85.1	86.7	89.9	57.2	66.0	56.5	2.7	9.7	40.5	43.7	78.8	54.4	56.8	46.7
Maharashtra	91.9	90.8	91.6	67.4	79.7	58.7	1.4	7.0	26.2	40.6	85.5	65.5	72.3	52.4
South														
Andhra Pradesh	98.8	94.3	92.5	64.8	80.5	64.0	0.5	4.3	22.5	40.7	91.8	63.6	77.0	55.0
Karnataka	88.0	89.3	94.6	67.3	65.8	58.3	1.7	8.0	38.3	40.5	84.5	65.3	59.9	51.6
Kerala	92.6	94.4	99.9	99.5	88.8	84.9	0.1	0.0	17.4	18.3	92.5	93.9	82.6	81.7
Tamil Nadu	91.4	98.6	99.2	88.5	74.2	87.1	0.3	0.2	30.0	17.9	90.8	87.7	69.8	81.9
Telangana	96.6	NA	92.4	NA	82.6	NA	1.1	NA	20.0	NA	90.3	NA	78.7	NA
<i>N</i>	155,402	29,631	148,185	17,795	119,665	16,023	14,024	5998	129,486	17,285	129,526	16,864	100,941	13567

ANC: antenatal care (any visit); ID: institutional delivery; PNC-M: postnatal care for the mother within 2 days of birth; Partial CoC; any one service; Full CoC: all three services.

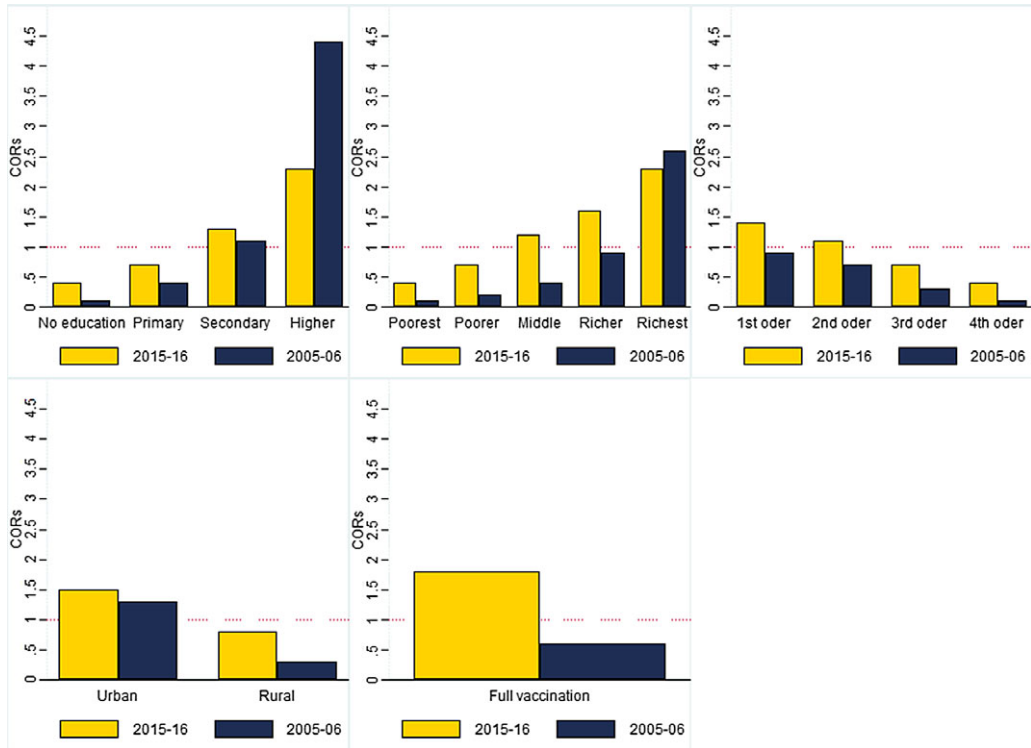


Figure 4. Characteristic odd ratios for continuum of care (CoC) in India, 2005–06 and 2015–16.

Association of CoC with background variables

Figure 4 shows the CORs for CoC for MNCH by urban–rural place of residence, household wealth status (quintile), mother’s level of education, birth order and ‘full vaccination’ levels in 2005–06 and 2015–16. Women residing in urban areas were 1.3 and 1.4 times (10%), respectively, more likely to achieve full CoC compared with women in India as a whole. Conversely, women residing in rural areas were 0.1 times (10%) less likely to achieve full CoC compared with women in India as a whole. Higher household wealth status improved women’s chances of achieving full CoC in India over the 10-year period. The poorest and poor women were 50% and 10% less likely to achieve full CoC compared with ‘all women’, respectively. However, middle, richer and richest women were 20%, 30% and 40% more likely, respectively, to achieve full CoC compared with ‘all women’. The educational status of the mother influenced achievement of full CoC: as this increased, women were more likely to achieve full CoC. Uneducated and primary educated women were 40% and 10% less likely to achieve full CoC compared with ‘all women’, respectively. However, secondary and higher educated women were 20% and 40% more likely to achieve full CoC compared with ‘all women’. Birth order also showed improvement in CoC in 2015, with 1st birth order being 1.4 times higher compared with total women in 2005, and 1st birth order being 0.9 less likely to have full CoC compared with the national CoC. Full vaccination of the child has made more progress over the 10-year period, with this being 1.68 times more and 0.68 less likely in 2015–16 and 2005–06 respectively, to have full CoC compared with total women in India. These analyses confirm that mother’s educational level and wealth status of the household have positive association with full CoC, but education seems to be stronger compared with wealth.

While there has been an overall improvement in CoC during the study period, there has been particularly substantial improvement in rural areas leading to a narrowing of rural–urban differentials across the board (Tables 2 and 3). The improvement in CoC in rural India has been more than two-fold greater than that in urban areas, where improvement was about 10%. The rural improvement in full CoC was significant in Jharkhand, Assam, Rajasthan, Madhya Pradesh and Chhattisgarh. The improvement in rural areas across all the states was significantly larger than in urban areas. Looking at wealth scores, the improvement seems to have been significant among the poorest and poor categories, although improvement was experienced across all wealth classes. There is a differential in the regional pattern of improvement in full CoC across wealth score categories in the sense that it is differentially responsive to economic status across the states.

Such association is made with the distribution of full continuum of care (CoC) by place of residence, household wealth, mother's education level and birth order in India and its states. Nationally, the proportion of women reporting full CoC increased from 55.7% in 2005–06 to 66.3% in 2015–16 in urban areas, and from 21.3% to 50.9% in rural areas. However, in the most recent round of the NFHS, full CoC was higher in rural areas in twelve states. This pattern was noted mainly in the southern and north-eastern states. There were mixed patterns in states within other regions. In Kerala, for example, the percentage of women who had full CoC in rural areas was 79%, compared with 80% in urban areas. In India, based on the household status spike from poorest to richest, full coverage of CoC in 2005–06 and 2015–16 among the richest increased from 70% to 75%, and among the poorest increased from 7.5% to 32%. Thus, there is a significant association between household wealth status and full CoC nationally. However, among states, the association between household wealth and full CoC is stronger in the northern and north-eastern states compared with the southern states. However, the percentage of poorest mothers who received full CoC in northern and north-eastern states was much lower than in the southern states. Furthermore, the difference in the percentage of women having full CoC between poorer and richest mothers is less in southern Indian states compared with the rest of the country. For example, in Kerala, a southern state, the percentage of mothers who had full CoC among the poorest increased from 63% to 71%, but fell for the richest from 84% to 83%.

In India, coverage of full CoC for MNCH services among higher educated mothers fell from 80.5% to 75.1%, compared with an increase from 11.7% to 35.9% among uneducated mothers over the study period. Thus, for those with higher education CoC has declined and for uneducated women CoC has improved. Among primary educated mothers, coverage of full CoC was 24.3%, and for secondary educated mothers coverage increased from 27% to 48.9%. This clearly shows that, generally, education and full CoC are positively related in India. This pattern is generally true for all the states. However, there is a smaller difference in the percentage of women having full CoC between the higher educated women and uneducated women in the southern and western states compared with the states in other regions.

Table 4 shows the percentage distribution of full maternal CoC and child full vaccination at 12–23 months. Nationally, the percentages of maternal uptake of full CoC and child full vaccination were 44.8% and 62.1% in 2005–06 and 2015–16, respectively. It is clear that full maternal CoC improves child full vaccination. However, among the states, full CoC of mother and child full vaccination were more evident. In the west, Goa's achievements of full CoC for mother and child full vaccination were 73.6% and 100% in 2005–06 and 2015–16, respectively, whereas the central states of Chhattisgarh and Uttar Pradesh showed tremendous improvement – from 24.7% to 61.3% and 22.4% to 56.7%, respectively. In the eastern state of Bihar, the percentage of CoC was 13.5% and 35.1% in 2005–06 and 2015–16, respectively, and in the north-eastern state of Assam the corresponding figures were 17.7% and 61.6%.

Table 2. Full continuum of care (%) by mother's place of residence and household wealth status by states of India, 2005–06 and 2015–16

	Place of residence				Wealth status									
	Urban		Rural		Poorest		Poorer		Middle		Richer		Richest	
	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06
All India	66.3	55.7	50.9	21.3	32.4	7.5	49.0	15.3	60.9	28.6	68.3	45.3	75.1	70.5
North														
Delhi	57.1	49.1	76.0	39.4	0.0	33.3	23.2	13.7	49.3	16.7	51.1	23.0	64.5	65.0
Haryana	59.4	58.9	61.7	24.8	16.1	6.7	34.6	7.8	53.3	20.1	59.6	30.7	71.6	64.1
Himachal Pradesh	83.0	45.7	64.0	30.3	29.9	13.7	35.3	11.9	52.7	19.3	68.6	29.2	81.3	48.4
Jammu & Kashmir	82.8	66.4	66.7	35.9	40.4	17.3	60.9	17.5	72.9	32.1	77.9	49.3	82.5	71.3
Punjab	83.3	57.0	84.1	41.0	54.2	6.6	65.8	8.2	74.9	27.3	78.4	36.0	88.9	67.9
Rajasthan	67.7	50.3	56.0	14.3	44.0	8.8	53.2	10.6	58.2	16.4	65.9	30.2	74.5	58.3
Uttarakhand	59.1	48.9	41.6	17.8	20.4	3.1	29.0	4.4	37.5	9.7	50.9	21.2	70.4	58.5
Central														
Chhattisgarh	70.1	51.8	53.1	4.1	41.7	2.3	56.3	3.0	60.0	11.3	65.4	36.1	81.2	83.5
Madhya Pradesh	60.0	46.9	41.8	13.4	29.7	6.3	44.6	15.5	53.8	27.5	60.1	39.8	68.4	68.8
Uttar Pradesh	56.1	26.3	43.0	6.1	30.2	1.7	42.0	4.9	49.2	6.3	57.8	15.1	72.8	45.0
East														
Bihar	41.1	25.9	27.2	6.7	21.2	3.1	31.2	4.4	39.9	8.4	50.4	13.1	65.4	57.3
Jharkhand	54.0	41.0	32.3	5.3	23.2	2.5	41.3	5.1	48.2	17.8	60.1	27.2	69.5	72.8
Odisha	70.7	46.3	69.1	23.1	58.9	10.3	71.2	20.1	76.9	35.3	79.7	51.6	83.1	71.6
West Bengal	61.9	63.3	51.3	22.9	38.7	12.4	50.2	19.9	61.3	35.2	68.6	56.0	76.6	87.8
North-east														
Arunachal Pradesh	24.8	31.1	20.3	11.5	7.5	3.0	19.3	5.6	27.4	13.4	29.6	27.8	26.7	55.0
Assam	67.7	32.5	48.4	9.0	33.3	1.7	48.5	6.4	63.8	14.0	70.6	24.7	78.6	45.0

(Continued)

Table 2. (Continued)

	Place of residence				Wealth status									
	Urban		Rural		Poorest		Poorer		Middle		Richer		Richest	
	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06
Manipur	73.4	62.9	54.2	35.5	24.8	4.9	47.7	17.2	68.4	31.4	76.3	61.3	82.1	82.6
Meghalaya	71.7	66.5	38.2	17.1	22.1	2.5	31.7	4.7	54.2	22.3	73.4	55.2	77.4	75.7
Mizoram	74.1	65.8	46.7	23.3	14.1	4.4	32.5	5.8	57.6	20.5	69.9	52.0	79.1	66.3
Nagaland	28.8	24.4	12.7	4.0	2.9	0.8	8.9	1.5	20.8	4.7	33.2	13.9	46.5	39.4
Sikkim	73.9	78.7	65.1	34.7	67.6	11.1	55.3	17.0	69.0	20.6	69.0	41.3	72.4	78.9
Tripura	69.4	32.5	55.3	23.8	36.7	1.3	55.1	19.0	69.9	27.0	72.6	41.7	74.5	56.7
West														
Goa	89.8	75.2	88.9	72.5	0.0	50.7	78.4	58.2	88.3	74.7	88.8	73.1	92.2	76.8
Gujarat	62.5	65.5	52.5	34.4	39.9	16.0	46.1	26.0	55.7	26.2	62.5	54.7	65.8	76.3
Maharashtra	76.8	66.9	68.8	39.5	50.8	12.5	61.7	27.2	73.6	43.9	78.1	59.7	80.8	77.6
South														
Andhra Pradesh	83.3	70.8	74.6	47.4	62.5	27.5	70.1	42.7	76.6	48.3	80.3	70.0	83.9	83.9
Karnataka	62.1	66.0	58.4	42.4	49.6	17.7	53.6	30.3	59.8	48.3	63.0	65.7	65.3	82.6
Kerala	80.2	86.1	84.7	79.6	71.2	63.6	86.9	61.3	78.5	77.9	83.1	82.5	83.1	84.0
Tamil Nadu	70.0	88.7	69.5	76.2	62.4	54.5	69.5	74.2	67.4	78.2	71.3	91.9	71.8	96.4
Telangana	82.7	NA	75.3	NA	57.3	NA	68.6	NA	82.6	NA	85.4	NA	79.7	NA
<i>N</i>	47,833	14,527	143,065	22,323	46,782	6154	43,739	6468	38,393	7418	33,212	8136	28,772	8674

Table 3. Full continuum of care (%) by mother's education level and birth order by states of India, 2005–06 and 2015–16

	Mother's education level								Birth order							
	No education		Primary		Secondary		Higher		1st		2nd		3rd		≥4th	
	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06
All India	35.9	11.7	48.9	27.0	63.9	50.2	75.1	80.5	65.6	45.7	59.5	40.0	47.6	23.3	33.1	10.8
North																
Delhi	48.7	22.0	50.4	14.3	56.5	53.7	70.6	81.5	63.6	58.2	61.5	57.8	43.4	39.3	44.4	19.2
Haryana	40.9	12.4	52.9	22.3	66.2	47.9	75.4	74.6	69.7	52.7	61.9	36.0	55.8	28.8	38.8	12.9
Himachal Pradesh	36.5	9.6	28.8	12.3	65.1	34.9	84.1	70.6	74.8	43.8	64.9	34.0	51.2	18.3	39.2	15.7
Jammu & Kashmir	60.0	28.2	72.4	37.5	74.8	57.2	82.4	91.4	76.9	60.8	74.0	50.8	67.8	34.1	52.3	25.0
Punjab	72.9	22.9	75.1	32.3	85.7	57.8	90.9	95.0	88.4	61.4	82.3	48.8	81.0	35.3	67.0	20.9
Rajasthan	47.7	12.7	59.7	25.1	65.8	45.3	76.1	83.7	68.1	34.7	61.3	27.6	54.1	17.8	42.7	12.9
Uttarakhand	25.4	6.6	34.4	12.7	49.8	32.4	73.6	77.8	61.8	40.2	49.3	34.2	35.6	16.6	27.2	7.8
Central																
Chhattisgarh	41.7	2.8	50.5	8.1	61.5	23.8	84.2	86.9	66.8	23.3	58.4	16.1	48.6	5.8	41.4	5.9
Madhya Pradesh	34.4	10.7	43.4	22.6	53.5	37.0	70.1	79.2	55.9	34.9	48.4	30.4	42.2	12.9	32.5	11.5
Uttar Pradesh	33.3	4.3	42.6	8.5	54.1	19.2	70.8	58.4	59.3	19.9	50.2	15.7	41.9	8.3	32.0	4.5
East																
Bihar	20.6	4.0	28.4	8.2	39.2	22.0	62.9	55.2	38.5	16.0	31.5	12.3	27.1	6.8	19.4	4.4
Jharkhand	22.9	3.6	32.4	6.6	45.6	33.6	65.2	75.9	47.0	23.5	38.6	17.2	30.9	8.8	23.4	3.7
Odisha	53.7	8.2	68.7	30.0	76.1	42.7	79.9	88.3	77.0	43.6	71.0	29.0	60.9	14.3	47.2	10.1
West Bengal	35.5	15.2	46.0	24.5	59.9	51.0	77.5	86.7	64.5	48.5	52.9	34.3	37.2	20.4	23.1	7.8
North-east																
Arunachal Pradesh	9.0	7.5	19.6	14.1	29.7	31.7	26.5	46.4	29.9	29.7	24.3	17.8	17.7	19.0	8.8	7.4
Assam	33.9	3.0	41.3	7.7	57.5	19.6	73.9	47.2	61.7	22.7	52.5	12.3	39.2	6.4	27.7	2.5

(Continued)

Table 3. (Continued)

	Mother's education level								Birth order							
	No education		Primary		Secondary		Higher		1st		2nd		3rd		≥4th	
	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06
Manipur	37.7	19.3	36.7	25.3	64.7	50.9	79.1	78.7	72.0	62.1	64.7	48.2	54.7	37.0	35.3	23.4
Meghalaya	22.9	13.7	36.2	18.3	50.8	39.0	74.8	82.1	54.1	33.2	46.4	32.4	39.8	20.7	33.8	21.3
Mizoram	8.4	3.8	42.2	28.5	69.8	50.6	70.4	75.5	72.0	50.0	61.6	48.1	60.8	46.6	49.3	29.4
Nagaland	6.5	2.4	10.0	2.3	20.0	12.9	43.8	43.1	26.6	18.5	21.3	13.7	16.8	6.4	6.6	3.3
Sikkim	63.7	16.5	66.4	32.5	68.8	59.8	71.8	89.1	73.5	56.8	67.0	46.2	54.6	31.9	50.5	14.9
Tripura	39.2	7.1	45.5	12.7	64.8	39.5	69.9	61.0	66.6	39.6	57.3	22.5	38.0	9.0	18.3	3.5
West																
Goa	85.4	54.1	86.8	70.2	88.7	76.6	94.4	82.0	93.2	74.3	87.5	74.9	85.4	79.2	82.8	59.8
Gujarat	42.8	25.8	51.8	37.3	61.2	61.7	68.0	85.8	64.6	59.6	56.5	57.9	50.1	35.5	42.1	23.5
Maharashtra	47.0	23.1	61.7	32.6	76.0	61.9	80.7	85.9	77.8	63.1	73.1	56.8	66.3	42.1	55.8	29.3
South																
Andhra Pradesh	65.8	35.6	73.4	55.0	80.8	73.4	84.6	90.3	81.3	65.7	77.7	57.0	71.1	44.5	52.5	33.5
Karnataka	42.7	23.0	48.7	50.4	64.2	65.0	69.0	84.5	65.2	65.4	59.5	56.5	54.2	37.9	42.7	26.4
Kerala	55.1	61.5	76.0	65.2	82.6	80.6	82.9	89.7	81.6	81.9	83.6	83.2	81.7	79.6	85.4	75.6
Tamil Nadu	64.1	68.9	64.5	73.6	70.5	85.9	70.5	97.2	70.1	89.1	71.2	83.8	63.6	71.9	65.3	65.2
Telangana	62.4	NA	71.1	NA	83.8	NA	86.0	NA	83.9	NA	78.7	NA	74.1	NA	56.8	NA
<i>N</i>	55,165	14,094	26,712	5251	88,871	14,215	20,150	3289	61,807	10,394	62,484	10,934	33,064	6297	33,543	9225

Impact of level of a service on the next service to achieve complete continuum of care

Table 5 shows changes in each component of CoC during 2005–06 to 2015–16. It also shows how each component was conditional to its preceding component. The percentage of mothers who had ID with ANC increased from 50.9% to 87.6% over the study decade, whereas the percentage having ID with PNC-M declined from 76.8% to 74.7%. Although compliance with ID was reasonably high with PNC-M, its share was relatively lower without PNC-M. Similarly, the response of compliance with child full vaccination was verified against compliance with ID, and there was an improvement in ID with child full vaccination from 61.31% to 65.6% over time. Compliance with ID was undoubtedly higher among those complying with child full vaccination.

The findings presented in Table 6 indicate that the odds of ID conditioned by the three components decreased over time at the national level. For instance, in 2005–06 the odds of ID with ANC were 9.0 (CI 8.4–9.7) times higher, compared with 4.5 (CI 4.4–4.6) times higher in 2015–16. A similar pattern was observed for PNC-M. Those who had ID had a higher chance of taking PNC-M in 2005–06 (33.8; CI; 31.9–35.9) compared with 2015–16 (11.2; CI 10.9–11.5). Also, mothers who had ID had higher odds of child full vaccination in 2005–06 (3.6; CI 3.3–4.0) compared with 2015–16 (2.3; CI 2.2–2.4).

Therefore, the analysis shows an improvement in CoC over the 10-year period, but the implementation of JSY did not appear to ensure maternal and child health improvement. After the implementation of NRHM in 2005 all over India, with the condition of institutional delivery, the likelihood of having PNC-M and child full vaccination declined. However, the fact remains that the odds of ID are undoubtedly positively conditioned by other components of CoC. Verification of this pattern across the states presents a mixed picture. Furthermore, the variation in the odds of ID in response to compliance with other components of CoC is also influenced by the extent of rising compliance in such components over time. The conditional analysis reveals the extent to which qualifying a specific benchmark in the continuum is conditioned by the qualification of the prior benchmark. Such a depiction can guide the prioritization and emphasis on specific benchmarks that would ensure continuum for the rest of the benchmarks.

Discussion

Increasing the coverage of continuum of care (CoC) for maternal and child health has been shown to be a pre-requisite to ensuring all women and children receive the health care necessary to reduce maternal, newborn and child mortality and morbidity (Bryce *et al.*, 2013). Increasing CoC for maternal, neonatal and child health (MNCH) is key to achieving SDG-3 – mainly reducing the maternal mortality ratio below 70 per 100,000 live births by 2030. This study revealed that in India between 2005–06 and 2015–16 there was an increase of 30.5% and 55.5% of women attaining full CoC with compliance with the three key MNCH indicators ANC, institutional delivery and postnatal care of the mother. At the same period, there was a reduction, from 20.1% to 6.3%, in the proportion of women not complying with any of the three MNCH services, and a reduction of 49.4% to 38.18% in those receiving at least one of the three MNCH services. Significant variations in the level of CoC were noted across states and socioeconomic groups. Overall, socially and economically more advanced states had higher coverage of full CoC than economically less advanced states; broadly, the southern states of Kerala and Tamil Nadu had higher coverage of CoC than other states, particularly those in the north-east. More efficient health systems, greater knowledge about health services and favourable attitudes towards the need for maternal and child health services in the southern states may have contributed to these inter-state variations (Navaneetham & Dharmalingam, 2002). Although the Government of India launched one of the largest conditional cash transfer programmes in the world, the Janani Suraksha Yojana (JSY), in 2005 to reduce maternal and neonatal mortality among the poor, it appears that the programme has had a different impact on maternal and child health service

Table 4. Percentage distribution of full continuum of care and no service uptake with child full vaccination in India and states, 2005–06 and 2015–16

	No service uptake+Full vaccination		Full CoC+Full vaccination	
	2005–06	2015–16	2005–06	2015–16
All India	7.4	3.1	44.8	62.1
North				
Delhi	5.3	0.5	47.5	70.0
Haryana	1.4	2.1	41.9	71.0
Himachal Pradesh	4.9	1.2	34.7	71.3
Jammu & Kashmir	5.3	1.4	56.5	78.4
Punjab	5.4	0.0	55.7	86.9
Rajasthan	2.4	0.9	39.9	70.2
Uttarakhand	15.1	6.6	37.9	52.8
Central				
Chhattisgarh	7.6	1.0	24.7	61.3
Madhya Pradesh	5.4	3.1	35.5	55.3
Uttar Pradesh	9.2	4.4	22.4	56.7
East				
Bihar	42.7	11.3	13.5	35.1
Jharkhand	15.0	8.5	23.1	40.5
Odisha	6.3	0.8	36.2	71.7
West Bengal	1.5	2.9	33.3	57.4
North-east				
Arunachal Pradesh	16.0	5.9	19.0	36.9
Assam	12.4	0.7	17.7	61.6
Manipur	3.5	2.0	65.2	71.4
Meghalaya	17.3	5.7	25.3	47.7
Mizoram	9.0	3.4	52.2	62.4
Nagaland	15.6	21.9	17.0	29.7
Sikkim	2.9	0.0	44.2	73.0
Tripura	3.8	2.9	36.1	65.9
West				
Goa	0.6	0.0	73.6	100.0
Gujarat	3.9	1.0	56.8	63.1
Maharashtra	1.8	0.7	57.5	75.2
South				
Andhra Pradesh	0.0	0.0	70.0	75.7
Karnataka	3.1	0.1	60.1	63.3

(Continued)

Table 4. (Continued)

	No service uptake+Full vaccination		Full CoC+Full vaccination	
	2005–06	2015–16	2005–06	2015–16
Kerala	0.0	0.0	88.5	85.0
Tamil Nadu	0.0	0.0	84.3	73.6
Telangana	NA	0.0	NA	85.5
<i>N</i>	239	978	2239	17,255

indicators across the regions and states of India. It is important to understand bottlenecks in service delivery in each state in terms of accessibility, acceptability, contact and effectiveness of coverage (Tanahashi, 1978).

This study revealed a positive association between household wealth status and women achieving full CoC for MNCH. Previous studies have also reported that wealth status is a determinant of health care utilization in India (Pallikadavath *et al.*, 2004; Kerber *et al.*, 2007; Titaley *et al.*, 2009; Guliani *et al.*, 2012; Johar *et al.*, 2018; Mothupi *et al.*, 2018). It seems that the ability of JSY to increase demand for maternal health care services among poor women by mitigating economic barriers is limited. The rural–urban and educational inequalities in uptake of MNCH services observed in this study is a concern as the JSY focuses on poor, disadvantaged social groups such as Scheduled Castes and Tribes, and low performing states. Generally, the poor and less-educated women in most regions in India have a significantly low uptake of full CoC. It appears that incentive mechanisms and recruitment of poor pregnant women into the JSY programme may not be effective. There is therefore a need to focus on poor and less-educated women when ASHA recruit village women into the JSY programme.

The role of ANC in increasing the chances of institutional delivery was confirmed in this study. Almost all women in the study who had institutional deliveries had availed ANC, with a strong positive association between ANC and institutional delivery. Previous studies have found that women's exposure to ANC determines further use of services in the continuum of care (WHO, 2016; Mohammad & Pallikadavath, 2018). Generally, uptake of ANC depends on women's perception about the services and experience she, or others in her family, have had with the health system (Bloom *et al.*, 1999; Magadi *et al.*, 2003; Bhutta *et al.*, 2010). Given the effect of ANC on institutional delivery, it is important to increase ANC coverage in Indian states where it is currently low. Some of the eastern and north-eastern states have particularly low ANC and they require special attention. As ASHA are the primary contact between pregnant women and the health system, this contact needs to be improved to increase ANC coverage. There is a need to explore how the current payment mechanism of JSY linked to institutional delivery can be extended to ANC in states where ANC uptake is low. It may be noted here that JSY provides cash incentives to both women and ASHA workers for institutional deliveries irrespective of whether or not the women had availed ANC or other MNCH services in the continuum. The primary payment criterion has been institutional delivery (MoHFW 2018b). State-specific amendments to the JSY could be explored to increase ANC utilization in states where ANC coverage is low.

Institutional delivery is a precursor for postnatal care uptake by mothers. This study confirms that women who have had an institutional delivery have a higher likelihood of having postnatal care compared with women who did not have an institutional delivery. It is therefore important that the JSY programme continues its financial support of poor women for institutional delivery. Institutional delivery is particularly low in some of the north-eastern states. This is of particular concern given its effect on the uptake of postnatal care by mothers. The low conditional odds of postnatal care for mothers in these states indicate that women who do not deliver at health

Table 5. Institutional delivery (ID) conditional percentage distribution of ANC, postnatal care for mother (PNC-M) and child full vaccination, 2005–06 and 2015–16

	ID without ANC		ID with ANC		ID without PNC-M		ID with PNC-M		ID without full vaccination		ID with full vaccination	
	2015-16	2005-06	2015-16	2005-06	2015-16	2005-06	2015-16	2005-06	2015-16	2005-06	2015-16	2005-06
All India	12.4	11.1	87.6	50.9	25.3	9.2	74.7	76.8	48.1	31.3	65.6	61.31
North												
Haryana	11.7	9.0	88.3	42.8	20.5	34.4	79.5	89.4	36.4	56.5	68.5	83.84
Himachal Pradesh	5.8	20.6	94.2	47.7	12.4	17.3	87.6	75.9	63.5	70.9	72.0	78.08
Jammu & Kashmir	6.1	11.6	93.9	60.3	15.3	10.0	84.7	82.6	57.5	56.9	77.5	72.77
Punjab	2.3	17.2	97.8	59.4	7.3	29.2	92.7	89.1	66.1	43.0	90.4	74.98
Rajasthan	10.7	9.3	89.3	39.3	26.7	7.4	73.3	74.9	27.9	20.4	59.2	36.96
Uttarakhand	14.3	8.8	85.7	45.8	25.9	8.3	74.2	78.2	50.3	51.3	60.4	76.63
Central												
Chhattisgarh	2.6	1.0	97.4	16.6	20.3	18.2	79.7	86.1	65.7	41.8	80.2	80.77
Madhya Pradesh	19.7	8.5	80.3	34.1	34.5	8.8	65.5	77.1	36.5	31.1	57.6	64.07
Uttar Pradesh	16.6	8.3	83.4	28.8	26.1	2.2	73.9	53.0	37.7	16.2	56.0	43.47
East												
Bihar	36.6	11.7	63.4	38.6	38.1	4.3	61.9	59.9	51.5	28.5	66.4	49.27
Jharkhand	15.4	4.5	84.6	30.2	36.9	4.6	63.1	67.7	56.1	29.4	65.4	58.46
Odisha	5.2	11.6	94.8	41.4	17.1	9.4	82.9	73.1	68.6	46.2	80.2	61.79
West Bengal	7.5	10.5	92.5	47.0	25.6	14.9	74.4	73.5	79.7	57.6	86.3	73.67
North-east												
Arunachal Pradesh	31.8	11.8	68.2	49.7	49.8	2.5	50.2	66.3	24.8	22.8	50.2	44.84
Assam	7.3	5.9	92.7	32.8	27.4	1.9	72.6	50.3	31.4	27.2	53.4	51.58
Manipur	5.2	10.6	94.8	56.3	12.7	3.5	87.3	89.4	37.3	29.5	76.5	68.59
Meghalaya	9.9	4.4	90.1	45.6	16.6	3.4	83.5	82.2	52.4	28.7	70.0	42.82

(Continued)

Table 5. (Continued)

	ID without ANC		ID with ANC		ID without PNC-M		ID with PNC-M		ID without full vaccination		ID with full vaccination	
	2015-16	2005-06	2015-16	2005-06	2015-16	2005-06	2015-16	2005-06	2015-16	2005-06	2015-16	2005-06
Mizoram	5.2	27.4	94.8	74.4	22.2	6.0	77.8	77.3	27.2	33.2	56.2	54.73
Sikkim	8.4	14.0	91.6	54.1	22.3	2.7	77.7	87.3	77.4	60.9	83.0	76.1
Tripura	7.7	14.7	92.3	60.1	25.0	8.1	75.1	52.2	54.3	30.8	55.1	66.07
West												
Goa	2.6	27.9	97.4	95.0	6.8	16.8	93.2	80.0	0.0	69.7	87.9	79.83
Gujarat	12.5	20.6	87.6	62.5	30.6	18.8	69.4	85.1	42.4	31.8	51.7	55.36
Maharashtra	6.6	21.0	93.4	72.0	16.9	16.0	83.1	79.4	44.2	45.4	58.2	65.32
South												
Andhra Pradesh	0.8	22.1	99.2	67.2	16.5	22.6	83.5	86.7	64.6	30.1	65.6	54.14
Karnataka	10.6	18.9	89.4	72.8	31.8	17.2	68.2	78.5	42.3	45.5	64.2	62.07
Kerala	7.4	0.0	92.6	99.4	11.1	0.0	88.9	85.4	0.0	0.0	82.6	74.69
Tamil Nadu	8.4	62.5	91.6	88.9	25.4	41.0	74.6	93.0	58.2	88.2	70.7	80.07
Telangana	2.2	NA	97.8	NA	13	NA	86.7	NA	61.69	NA	70.63	NA

Table 6. Logistic regression odds ratios for institutional delivery (ID), postnatal care for mother (PNC-M) and child full vaccination in India, 2005–06 and 2015–16 and

	OR for ANC with ID		OR for ID with PNC		OR for ID with full vaccination	
	2015–16	2005–06	2015–16	2005–06	2015–16	2005–06
All India	4.5 (4.4–4.6)	9.0 (8.4–9.7)	11.2 (10.9–11.5)	33.8 (31.9–35.9)	2.3 (2.2–2.4)	3.6 (3.3–4.0)
North						
Delhi	5.2 (3.3–8.1)	8.0 (4.7–14.0)	6.6 (4.3–10.3)	11.4 (8.2–15.9)	1.2 (0.4–2.8)	2.4 (1.3–4.6)
Haryana	7.2 (6.1–8.5)	7.4 (3.7–17.0)	10.1 (8.5–11.9)	15.7 (10.5–24.0)	4.1 (3.0–5.7)	3.8 (1.8–8.3)
Himachal Pradesh	4.5 (3.3–6.0)	2.9 (1.8–4.7)	13.5 (10.6–17.1)	12.9 (8.9–18.8)	1.9 (1.2–3.1)	1.4 (0.6–3.0)
Jammu & Kashmir	6.8 (5.7–8.2)	12.2 (6.9–22.9)	38.4 (31.3–47.4)	43.7 (28.6–67.0)	2.7 (2.0–3.7)	2.0 (1.1–3.6)
Punjab	4.4 (2.7–6.9)	6.9 (4.0–12.4)	9.5 (7.3–12.4)	19.5 (13.6–28.1)	3.6 (1.5–7.6)	3.9 (2.1–7.2)
Rajasthan	5.5 (4.8–6.2)	6.8 (4.6–10.5)	18.1 (15.6–21.1)	37.6 (26.8–52.8)	3.6 (2.8–4.7)	2.4 (1.4–4.1)
Uttarakhand	4.4 (3.7–5.1)	9.0 (5.6–14.9)	12.8 (10.8–15.1)	40.1(26.3–61.4)	1.4 (1.0–1.9)	3.2 (1.6–6.4)
Central						
Chhattisgarh	4.7 (3.7–6.1)	16.6 (4.4–139.9)	5.8 (5.2–6.6)	32.4 (20.7–51.9)	2.5 (1.9–3.2)	6.5 (2.9–15.9)
Madhya Pradesh	3.7 (3.4–4.0)	9.4 (6.3–14.5)	10.6 (9.5–11.7)	50.0 (38.0–65.7)	2.2 (1.9–2.7)	5.8 (3.8–8.9)
Uttar Pradesh	3.3 (3.1–3.5)	3.9 (3.2–4.6)	8.9 (8.4–9.4)	31.7 (26.1–38.5)	1.9 (1.7–2.1)	4.9 (3.6–6.6)
East						
Bihar	2.5 (2.4–2.7)	5.4 (4.2–6.9)	11.0 (10.1–12.0)	41.4 (28.4–60.8)	1.8 (1.6–2.1)	2.9 (1.8–4.8)
Jharkhand	3.3 (2.9–3.6)	11.1 (6.9–18.6)	6.1 (5.5–6.8)	46.3 (30.4–70.8)	1.6 (1.3–1.9)	3.2 (1.7–5.8)
Odisha	4.8 (4.0–5.7)	6.2 (3.7–10.7)	5.0 (4.4–5.7)	24.2 (17.7–33.2)	1.9 (1.4–2.5)	1.9 (1.1–3.1)
West Bengal	2.8 (2.3–3.4)	8.2 (4.9–14.2)	8.8 (7.4–10.4)	17.0 (13.3–21.7)	1.6 (1.1–2.4)	2.0 (1.3–3.1)
North-east						
Arunachal Pradesh	4.3 (3.7–4.9)	7.2 (4.7–11.3)	15.9 (12.6–20.0)	75.2 (36.8–167.1)	3.4 (2.5–4.8)	2.9 (1.3–6.5)
Assam	4.5 (3.9–5.2)	8.0 (5.1–13.0)	13.1 (11.6–14.9)	55.1 (31.8–100.6)	2.3 (1.9–2.9)	2.6 (1.4–4.9)
Manipur	7.6 (6.1–9.4)	9.8 (6.2–16.1)	86.4 (68.8–108.9)	236.5 (145.3–392.7)	4.9 (3.6–6.5)	5.0 (3.0–8.2)

(Continued)

Table 6. (Continued)

	OR for ANC with ID		OR for ID with PNC		OR for ID with full vaccination	
	20015–16	2005–06	2015–16	2005–06	2015–16	2005–06
Meghalaya	4.2 (3.5–5.2)	18.9 (10.2–38.0)	19.7 (16.3–23.7)	148.0 (79.8–283.0)	2.4 (1.8–3.3)	1.7 (0.8–3.4)
Mizoram	12.6 (10.0–16.0)	7.5 (4.9–11.6)	20.6 (16.5–25.8)	53.7 (29.1–104.3)	2.8 (1.9–4.0)	2.4 (1.1–5.2)
Nagaland	5.2 (4.4–6.2)	7.5 (4.7–12.5)	66.6 (48.5–92.8)	150.5 (86.4–269.8)	2.7 (2.0–3.7)	2.6 (1.4–4.6)
Sikkim	2.6 (1.0–6.0)	7.6 (3.3–19.1)	12.2 (5.7–28.2)	213.3 (93.1–534.9)	1.1 (0.02–12.6)	2.3 (0.9–5.6)
Tripura	5.6 (3.8–8.3)	9.4 (5.2–17.8)	60.4 (32.2–124.6)	12.0 (7.0–21.1)	1.6 (0.8–3.2)	4.6–(1.9–11.2)
West						
Goa	4.1 (0.4–49.7)	44.3 (15.9–133.5)	7.7 (0.6–70.1)	19.8 (9.2–46.9)	***	1.9 (0.4–6.6)
Gujarat	3.5 (2.9–4.2)	6.3 (4.1–10.0)	3.9 (3.3–4.6)	24.5 (17.6–34.2)	1.8 (1.2–2.6)	2.6 (1.5–4.4)
Maharashtra	4.3 (3.5–5.3)	11.1 (7.5–16.9)	5.8 (4.9–6.9)	17.0 (13.3–21.8)	1.9 (1.3–2.7)	2.3 (1.5–3.4)
South						
Andhra Pradesh	6.3 (2.3–16.0)	7.5 (4.6–12.4)	5.6 (4.0–7.9)	25.6 (19.0–34.6)	0.9 (0.4–1.7)	3.0 (1.7–5.4)
Karnataka	5.0 (3.8–6.4)	11.2 (7.4–17.3)	5.4 (4.2–7.0)	17.5 (13.2–23.1)	1.6 (0.9–2.7)	1.9 (1.2–3.0)
Kerala	6.5 (0.11–125.9)	***	15.2 (0.7–897.4)	***	***	***
Tamil Nadu	5.0 (2.5–9.5)	6.1 (1.8–19.1)	8.5 (4.3–18.0)	20.1 (12.8–31.5)	1.3 (0.2–6.9)	0.6 (0.1–2.4)
Telangana	9.1 (5.1–16.2)	NA	13.5 (9.2–19.8)	NA	1.6 (0.7–3.7)	NA

Note: The outcome reference group OR for ANC with ID is ‘Home delivery’; OR for ID with PNC-M is ‘mothers who had not taken any PNC-M’ and OR for ID with full vaccination is ‘child did not received any vaccination’.

Values in the parentheses are 95% confidence intervals.

***Estimates could not be generated due to small cell frequencies.

facilities are less likely to receive postnatal care. A key to improving postnatal care for mothers in these states is increased institutional delivery. The reasons why institutional delivery remains low in some states is an important question in the context of JSY, which directly incentivizes institutional delivery. Previous studies have pointed out that traditions, difficult geographic terrain for transport, fewer health workers and overall poor health system in those states may be related to low institutional delivery rates (Mukherjee & Roy, 2019).

Surprisingly, institutional delivery did not have a positive impact on postnatal care for children within 2 months of birth. Contrary to expectation, the uptake of postnatal care for children among mothers who had an institutional delivery was lower than among women who did not deliver in a health facility. There could be several reasons for this negative association. It is likely that children delivered at home may have a greater need for postnatal care due to more infections at delivery. It is not clear why some children delivered at health facilities did not receive postnatal care. Whether the poor quality of care women experienced while at the facility during delivery was a deterrent, or if there were out-of-pocket expenditure issues, requires further investigation. There is evidence that the poor have much lower rates of postnatal care for children than their richer counterparts and thus significant inequality in postnatal care uptake in India (Singh *et al.*, 2012).

Full CoC in India is unlikely to be achieved without significant progress in the utilization of postnatal care by mother and children. This study highlights the need to integrate postnatal care for children with existing demand-side financing programmes such as JSY in the country. The significantly low achievement of complete continuum of care in the north-eastern states signals the need for more focused efforts on most of components of CoC. The one-off cash transfer mechanism of JSY to the women on institutional delivery may require review in the light of emerging evidence of low uptake of postnatal care for children. There is a need to consider a range of JSY implementation options, including staggered payment mechanism whereby critical elements of MNCH are completed before full JSY payment. The JSY programme should also consider local variations in health system capacity and population characteristics, including traditions, for better coverage of all components of CoC.

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Ethical Approval. The authors assert that 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.

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