

Socioeconomic Inequality in Progress in SDG Indicators on Maternal Health in India from 2006 - 2016

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Abstract

Poor maternal health poses a substantial threat to the population, health, and social wellbeing in most developing nations like India. Committing to the Millennium Development Goals (MDGs), India reduced maternal mortality by 75% between 1990 and 2015 through various programmes and interventions and is on track to achieve the Sustainable Development Goal (SDG) target of an MMR below 70 by 2030. Despite a substantial improvement in maternal health indicators in India over the last two decades, there are sizeable heterogeneities based on caste, class, social groups, and various other forms of social exclusion. This study aims to exemplify the changes in crucial SDG indicators of maternal health over more than a decade and to decompose the co-factors behind those changes. The data used in this paper have been taken from two recent rounds of the National Family Health Survey (2005 - 06 and 2015 - 16). The predicted probability of change and Fairlie's decomposition are used to decompose the changes in maternal health indicators over the two survey periods. The most crucial indicators to track the progress in maternal health indicators in India are antenatal care (ANC) in the first trimester, four or more ANC visits, use of skilled birth attendants, anaemia among women, and a body mass index (BMI) of 25.0 kg/m² or above, analysed in the context of various socioeconomic, behavioural, and programmatic covariates.

Keywords: *Socioeconomic Inequality; SDG Indicators; Maternal Health in India*

Introduction

Maternal health status is an essential constituent for developing any nation's equitable distribution of resources and poverty reduction. The survival and well-being of mothers are not only important in their own right, but are also central to overcoming broader, economic, social, and developmental challenges. India has witnessed an enormous improvement in most maternal and child health indicators over the last two decades. Particularly between 1992 and 2016, there has been a substantial improvement in most maternal health indicators that affect the health and wellbeing of women and their children. During that period, the Government of India launched several maternal and child health programmes like the Reproductive and Child Health (RCH) programmes and Janani Shishu Suraksha Karyakram (JSSK). The most remarkable improvement was evident in one of the key indicators of maternal health, namely 'institutional delivery' since 2005 - 06, which incidentally coincides with the launch of the National Rural Health Mission (NRHM) and numerous other initiatives launched under this flagship scheme, including the Janani Suraksha Yojana (JSY), which resulted in a surge in institutional deliveries. The Government of India further launched Janani Shishu Suraksha Karyakram (JSSK) to benefit pregnant women who deliver their babies in government medical facilities by MOHFW (2011). Notable strategies included in JSSK included promoting critical postnatal care for the newborn and mother and early initiation of breastfeeding. Soon after that, the Government of India upgraded the National Rural Health Mission into an overarching National Health Mission (NHM) by MOHFW (2014) with two sub-missions: NRHM and the National Urban Health Mission (NUHM). The Government of India has also monitored maternal health indicators through the Health Management Information System (HMIS), the National Family Health Surveys (NFHS), District Level Household and Facility Survey (DLHS), the Annual

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Health Survey (AHS), and other independent surveys like the Coverage Evaluation Surveys (CES) by UNICEF. Although the Government of India has put considerable effort into improving maternal health status in India, there is little evidence regarding the significant cofactors that have led to the improvement in maternal health care indicators in India between 1992 and 2016.

Data from the Sample Registration System (SRS) shows that the maternal mortality ratio in India has gradually declined from 130 per 100,000 live births in 2014 - 16 to 113 per 100,000 live births in 2016 - 18 by SRS (2018). In addition, the increase in the first ANC visit in the first trimester (from 44% in NFHS-3 to 59% in NFHS-4), the increased coverage of 4 or more antenatal care visits (from 37% in NFHS-3 to 51% in NFHS-4), the increase in the percentage of births attended by skilled health personnel (from 47% in NFHS-3 to 81% in NFHS-4), and the decreased prevalence of anaemia (from 55% in NFHS-3 to 53% in NFHS-4) across survey rounds signals improvements in the maternal health status of the country. However, there is tremendous heterogeneity in the improvement of maternal and child health indicators by caste, class, poverty, and various forms of social inclusion. Therefore, any attempt to further improve maternal health and reduce maternal mortality in India requires a comprehensive understanding of the factors causing implicit heterogeneity and significant covariates of various SDG indicators on maternal health and related indicators on health care service utilization.

The existing literature on the subject suggests that many factors are associated with improved maternal health status [1,2]. The review by Yaya, *et al.* (2017) suggests that women with characteristics like rural area of residence, pregnancy at later ages (between 30 and 49 years), higher educational attainment, and higher wealth status were more likely to go for institutional deliveries [1]. The same study also identified that participants belonging to the highest economic stratum were more likely to receive skilled birth attendance than those from the lowest economic stratum. Tarekegn and colleagues (2014) concluded that the education of women, place of residence, ethnicity, parity, women's autonomy, and household wealth were the key covariates leading to improvement of utilization of skilled delivery attendants and antenatal care visits [2]. Nguyen and colleagues (2018) found that increased maternal schooling and improved socioeconomic status played an important role in reducing anaemia among women in India [3]. This study also highlighted that vegetarianism and poor sanitation were predictors of being anaemic. An overall review implies that tackling anaemia in India requires investment in women's education and socioeconomic status and a continuous focus on improving health and nutrition. Gouda and Prusty (2014) found that the prevalence of overweight and obesity was very high among urban women, more noticeably in the non-poor households [4]. That study further found that overweight and obesity increased with age, education, and parity of women. Marital status and media exposure were other covariates that were positively associated with overweight and obesity. Nagarkar and colleagues (2018) found that obesity was significantly associated with working status and hypertension [5].

The current information on maternal health status in India shows that there is no shortage of data on levels, trends, patterns, and factors affecting maternal health indicators in India. Still, none of those studies capture the factors affecting the implicit variability in the changes over time in maternal health care service utilization, and its significant covariates. Whereas existing research has identified the key determinants of maternal health care services in India, there is a lack of sound evidence on the key factors that might have contributed to improving maternal health care service utilization in India, mostly post-NRHM implementation in 2005, to enhance maternal and child health status in the country. Therefore, the present study aims to track the progress in SDG indicators on maternal health care in India with a particular focus on specific contributions of various factors that are responsible for those changes, along with variations across caste, class, social groups, and various other forms of social exclusions. It is expected that the key findings of the study will guide the future direction of programmes and services for the further improvement of maternal health status in the country and in achieving the SDGs related to maternal health by 2030.

Data and Methodology

Data sources

The data used in this study have been taken from two rounds of National Family Health Surveys, namely NFHS-3 (2005 - 06) and NFHS-4 (2015 - 16). The primary objective of the NFHS rounds was to provide essential data on health and family welfare and data on emerging issues, including maternal health indicators and nutritional status of adult women age 15 - 49 years, adult men age 15 - 54 years, and children under five years of age.

The present study is based on a representative sample of women in the reproductive age-group (15 - 49 years) from NFHS-3 and NFHS-4. The study aims to assess the decadal progress of five selected maternal health indicators, namely ANC in the first trimester, four or more antenatal care (ANC) visits, use of skilled birth attendants, anaemia among women, and overweight or obesity, i.e. a body mass index (BMI) greater than 25.0 kg/m². All these indicators are analysed in the context of selected socioeconomic, behavioural, and pregnancy exposure covariates, namely age, education, place of residence, caste, mass media exposure, and birth order. A brief description of the predictors and the response variables used in the analysis is given below.

Outcome variables

The outcome variables analysed are:

- An ANC visit in the first trimester (recoded as one if registered in the first trimester; 0 if not registered in the first trimester).
- Four or more antenatal care visits (recoded as 1 if having four or more ANC visits; 0 if having less than 4 ANC visits).
- Skilled birth attendants (recoded as 1 if the birth was attended by skilled health personnel; 0 if a birth was not attended by skilled health personnel).
- Anaemia among women (recoded as 1 (anaemic) if the haemoglobin level is < 12 grams/decilitre; 0 (not anaemic) if the haemoglobin level is ≥ 12 grams/decilitre).
- Overweight or obesity among women (recoded as 1 if BMI ≥ 25.0 kg/m²; 0 if BMI < 25.0 kg/m²).

Exposure variables

Several socioeconomic and demographic variables have been considered as exposure variables in the study, which were found consistent over both survey rounds, such as the age of respondent (15 - 24 years, 25 - 34 years, 35 or more years), maternal years of schooling (no education, 1 - 5 years, 6 - 10 years, 11 or more years of schooling), exposure to mass media (no, yes), birth order (1, 2, 3, 4 or more), place of residence (rural, urban), caste (scheduled caste, scheduled tribe, other backward class, others), religion (Hindu, Muslim, others), wealth quintile (lowest, second, middle, fourth, highest).

Statistical methods

In the first step, the present study used a bivariate association to see the trend in maternal health indicators from 2005-06 to 2015-16. The study further used the Fairlie decomposition regression analysis to see the adjusted effect of several exposure variables on the outcome variable.

Finally, we used multivariable decomposition, suggested by Powers, Yoshioka, and Yun (2011) for nonlinear response outcomes, to test whether the selected household-level variables, maternal-level variables, child-level variables, and maternal- and child-care program variables are statistically associated with the reductions in neonatal mortality in India between 1992 - 2016 and 2005 - 2016. The multivariable decomposition divides the total decline in neonatal mortality into two components-endowment and coefficient. The "endowment" is the portion that can be attributed to the change in composition or coverage of a set of indicators. The "coefficient" is the portion that can be attributed to the change in effect of indicators included in the analysis. In simple terms, for example, if we take neonatal mortality as an outcome of interest and mother's schooling as a factor that affects neonatal mortality and we decompose the overall changes (over time) in neonatal mortality due to mother's schooling into "endowment" and "coefficient" components, then the "endowment" component is the component that is contributed by the change in the level of mother's schooling and the "coefficient" component is the component contributed by the change in effect or benefit of mother's schooling on neonatal mortality. In actual decomposition of differences in neonatal mortality we have taken a multitude of factors that have been described earlier. Finally, we used multivariable decomposition, suggested by Powers, Yoshioka, and Yun (2011) for nonlinear response outcomes, to test whether the selected household-level variables, maternal-level variables, child-level variables, and maternal- and child-care program variables are statistically associated with the reductions in neonatal mortality in India between 1992 - 2016 and 2005 - 2016. The multivariable decomposition divides the total decline in neonatal mortality into two components-endowment and coefficient. The "endowment" is the portion that can be attributed to the change in composition or coverage of a set of indicators. The "coefficient" is the portion that can be attributed to the change in effect of indicators included in the analysis. In simple terms, for example, if we take neonatal mortality as an outcome of interest and mother's schooling as a factor that affects neonatal mortality and we decompose the overall changes (over time) in neonatal mortality due to mother's schooling into "endowment" and "coefficient" components, then the "endowment" component is the component that is contributed by the change in the level of mother's schooling and the "coefficient" component is the component contributed by the change in effect or benefit of mother's schooling on neonatal mortality. In actual decomposition of changes in neonatal mortality we have taken a multitude of factors that have been described earlier. Based on Fairlie (1999), a decomposition of the logistic equation, is given as:

$$Y^m - Y^n = \sum_{i=1}^{N^m} \frac{zX_i^m \beta^m}{N^m} - \sum_{i=1}^{N^n} \frac{zX_i^n \beta^n}{N^n} + \sum_{i=1}^{N^n} \frac{zX_i^n \beta^m}{N^n} - \sum_{i=1}^{N^m} \frac{zX_i^m \beta^n}{N^m} \dots\dots\dots (1)$$

Where Y^m is the average value of any outcome indicator in 2016, Y^n is the average value of any outcome indicator in 2006, N^m is the sample size for a year, and $t = (m,n)$. The superscripts m and n are covariate values and estimates from the 2016 and 2006 samples, respectively. The observed change between 2006 and 2016 results from group differences in the distribution of observable characteristics (explanatory variable effects) and group differences in unobservable characteristics (coefficient effects). To calculate the decomposition, we define Z as the mean probability of the binary outcome of interest for year t and X as the cumulative distribution functions from the logistic distribution by Fairlie (2004). The above equation can equally be expressed in the form:

$$Y^m - Y^n = \sum_{i=1}^{N^m} \frac{zX_i^m \beta^m}{N^m} - \sum_{i=1}^{N^n} \frac{zX_i^n \beta^n}{N^n} + \sum_{i=1}^{N^m} \frac{zX_i^m \beta^m}{N^m} - \sum_{i=1}^{N^n} \frac{zX_i^n \beta^n}{N^n} \dots\dots\dots (2)$$

The 2006 coefficient estimates, β^n , are used as weights for explanatory variable effects, and the 2016 distributions of the explanatory variables are used as weights for the coefficient effects. Identifying the contributions of individual explanatory variables to the 2006 - 2016 observed gap is not direct by Fairlie (2005). To identify this, we assume $\beta^m = \beta^n$ and that there exists a one-for-one matching between the 2006 and 2016 samples. The individual variables contribution to the pool sample estimate is given as:

$$\frac{1}{N^n} \sum_{i=1}^{N^n} Z\alpha^* + X_{1i}^m \beta_1^* + X_{2i}^m \beta_2^* - Z\alpha^* + X_{1i}^n \beta_1^* + X_{2i}^n \beta_2^* \dots\dots\dots (3)$$

Results

It is evident from table 1 that there has been a substantial improvement in the selected SDG indicators in the decade between NFHS-3 (2005-06) and NFHS-4 (2015 - 16). Findings from the health care utilization indicators show that the percentage of women receiving ANC in the first trimester increased from 44 to 59 percent over that period. The findings further suggest that the percentage of women who received four or more ANC visits has increased from 37 to 52 percent. Additionally, the percent with skilled birth attendance increased from 47 to 81 percent between NFHS-3 and NFHS-4. Considering the nutritional indicators, the overall prevalence of anaemia was 55.3 percent in 2005-06, which declined to 53.1 percent in 2015 - 16. However, the percentage of women who are overweight or obese increased from 12 to 20 percent between 2005 - 06 and 2015 - 16.

The percentage of women receiving ANC in the first trimester increased considerably, from 45 to 60 percent among the younger age cohorts, i.e. 15 - 24 years. Similar to these findings, the percentage of women age 25 - 34 years receiving ANC in the first trimester increased from 46 to 59 percent from 2005 - 06 to 2015 - 16. The percentage receiving ANC in the first trimester was highest for women belonging to religions other than Hindus or Muslims in both the surveys, which increased from 54 percent in NFHS-3 to 64 percent in NFHS-4. Sixty-five percent of women who were exposed to mass media received ANC in the first trimester in NFHS-4, whereas this percentage was 52 percent in NFHS-3.

Table 1 illustrate that receiving four or more ANC visits increased considerably by all background characteristic between NFHS-3 and NFHS-4. The percentage of women receiving four or more ANC visits increased substantially among women age 15 - 24 years (from 37.9 to 53.6%), 25 - 34 years (from 39.5 to 52.4%), and 35 - 49 years (22.8 to 39.5%) from NFHS-3 to NFHS-4. The classification based on birth order shows a subsequent decline in the percentage of women availing four or more ANC visits, a trend that is observed in both the rounds. The increment in the percentage of women receiving four or more ANC visits was found to be higher in rural areas (27.9 to 45.1%) than in urban areas (63.0 to 67.1%).

The increment in the percentage with skilled birth attendance (SBA) was higher in rural areas (37.5 to 78.1%) than urban areas (73.5 to 90.1%). Findings show that the percentage with SBA also increased considerably among women who do not have any mass media exposure, from 24 percent to 65 percent between NFHS-3 and NFHS-4.

Results from table 1 show that the percentage of anaemic women remains almost similar across all age groups. Women in the lowest wealth quintile have a higher prevalence of anaemia than women in other quintiles in both the survey rounds, and a considerable decline was observed in the anaemia prevalence, from 64.3 percent in NFHS-3 to 58.7 percent in NFHS-4.

Background characteristics	ANC in 1 st trimester		4 or more ANC		Skilled birth attendance		Any anaemia ¹ (< 12.0 g/dl)		Overweight and obesity ² (BMI ≥ 25.0 kg/m ²)	
	NFHS-3	NFHS-4	NFHS-3	NFHS-4	NFHS-3	NFHS-4	NFHS-3	NFHS-4	NFHS-3	NFHS-4
Age										
15 - 24	45.1	60.3	37.9	53.6	49.3	84.7	56.2	53.8	4.1	7.4
25 - 34	45.6	59.4	39.5	52.4	46.9	81.1	54.7	52.4	12.8	21.8
35 - 49	29.9	47.2	22.8	39.5	31.6	69.4	54.9	53.0	22.0	32.2
Years of schooling										
No education	25.4	41.2	16.1	28.2	26.1	66.0	60.2	56.4	7.0	16.5
1 - 5	42.6	53.9	35.9	45.9	46.7	77.3	56.7	54.6	11.8	21.3
6 - 10	60.5	63.9	56.7	60.0	69.4	88.4	53.0	52.7	15.3	21.6
11 and above	82.8	74.2	80.7	70.5	90.1	94.7	45.0	49.1	22.1	22.7
Mass media exposure										
No	24.0	38.1	14.3	24.6	24.3	65.3	61.8	56.7	3.9	9.5
Yes	52.8	65.3	47.5	60.5	57.4	87.3	53.4	52.2	15.0	23.0
Birth order										
1	58.5	66.5	53.3	62.3	65.2	89.3	29.7	52.3	13.3	22.7
2	53.2	62.6	48.4	57.0	53.5	83.6	26.5	53.1	18.8	28.9
3	39.5	52.6	32.0	43.0	38.0	74.7	16.4	54.6	15.7	25.9
≥ 4	23.1	38.9	13.8	25.6	23.4	62.1	27.4	54.9	11.9	21.3
Residence										
Rural	36.7	54.2	27.9	45.1	37.5	78.1	57.4	54.2	7.3	14.9
Urban	63.6	69.1	63.0	67.1	73.5	90.0	50.9	50.8	23.2	31.1
Caste/tribe										
SC	36.8	55.1	30.0	49.0	40.4	80.7	58.1	55.9	8.8	17.0
ST	32.4	53.5	22.3	46.2	25.5	71.6	68.6	59.9	3.2	9.8
OBC	42.9	58.5	35.5	48.6	46.6	82.1	54.5	52.2	11.5	20.5
Others	53.5	63.9	49.2	61.4	58.0	85.1	51.5	50.0	17.7	26.5
Religion										
Hindu	44.3	58.6	37.4	51.2	47.5	82.9	55.9	53.7	11.6	19.5
Muslim	38.9	56.5	31.6	49.3	38.8	73.6	54.7	50.6	13.8	23.3
Others	55.0	65.2	53.5	65.3	60.4	84.3	48.2	50.7	20.5	26.3
Wealth quintile										
Lowest	22.9	37.7	12.2	25.1	19.4	64.2	64.3	58.7	1.8	5.8
Second	29.9	52.5	21.3	44.7	31.8	78.3	60.3	55.1	3.9	11.2
Middle	43.7	63.2	36.8	57.6	49.0	86.9	56.0	53.3	7.3	18.6
Fourth	57.8	69.9	53.4	66.4	67.2	91.8	52.2	51.0	15.2	28.0
Highest	78.2	77.4	78.3	73.9	88.9	95.5	46.1	48.2	30.3	36.0
Total	43.9	58.6	37.3	51.6	46.6	81.4	55.3	53.1	12.4	20.4

Table 1: Percentage of women age 15 - 49 reporting selected maternal health indicators included in the SDGs by background characteristics in NFHS-3 (2005-06) and NFHS-4 (2015-16), India.

¹Haemoglobin in grams per decilitre (g/dl). Prevalence is adjusted for altitude and for smoking status, if known.

²Excludes pregnant women and women with a birth in the preceding 2 months.

The percentage of overweight or obese women in the country increased from 12 percent in NFHS-3 to 20 percent in NFHS-4. Twenty-two percent of women age 35 - 49 were found to be overweight or obese in 2005 - 06, which increased to 32.2 percent in 2015 - 16. The percentage of overweight or obese women substantially increased in rural areas from 7 to 15 percent and urban areas from 23 to 31 percent from NFHS-3 to NFHS-4.

Sub-national (State-level) variation in the selected SDG indicators

In NFHS-4, the state of Kerala had the highest percentage of women receiving four or more ANC visits, followed by Goa, Jammu and Kashmir, and West Bengal, while it was found to be lowest in the states of Bihar and Nagaland (Figure 1a). All the states showed an increase in the percentage of women receiving at least four antenatal care visits between NFHS-3 and NFHS-4, except for the states of Uttarakhnad, Goa, Kerala, and Tamil Nadu, where this percentage declined. Figure 1b illustrates that the states of Kerala, Tamil Nadu, and Goa had the highest percent of SBA deliveries. The percentage of deliveries assisted by a skilled birth attendant increased by more than 40 percentage points over the decade in seven states: Rajasthan, Madhya Pradesh, Sikkim, Uttar Pradesh, Jharkhand, Orissa, and Bihar. The percentage of anaemic women declined between 2005-06 to 2015-16 in all states except Haryana, Tamil Nadu, Uttar Pradesh, Meghalaya, Delhi, Punjab, and Kerala (Figure 1c). In NFHS-4, the percentage of overweight or obese women was found to be higher in the states/UTs like Punjab, Kerala, Delhi, Tamil Nadu, Goa, Andhra Pradesh, Himachal Pradesh, Manipur, and Telangana (Figure 1d). The percentage of overweight or obese women was found to be lower for the states of Bihar, Jharkhand, Chhattisgarh, Odisha, Rajasthan, Nagaland, Assam, Tripura, Meghalaya, and Madhya Pradesh.

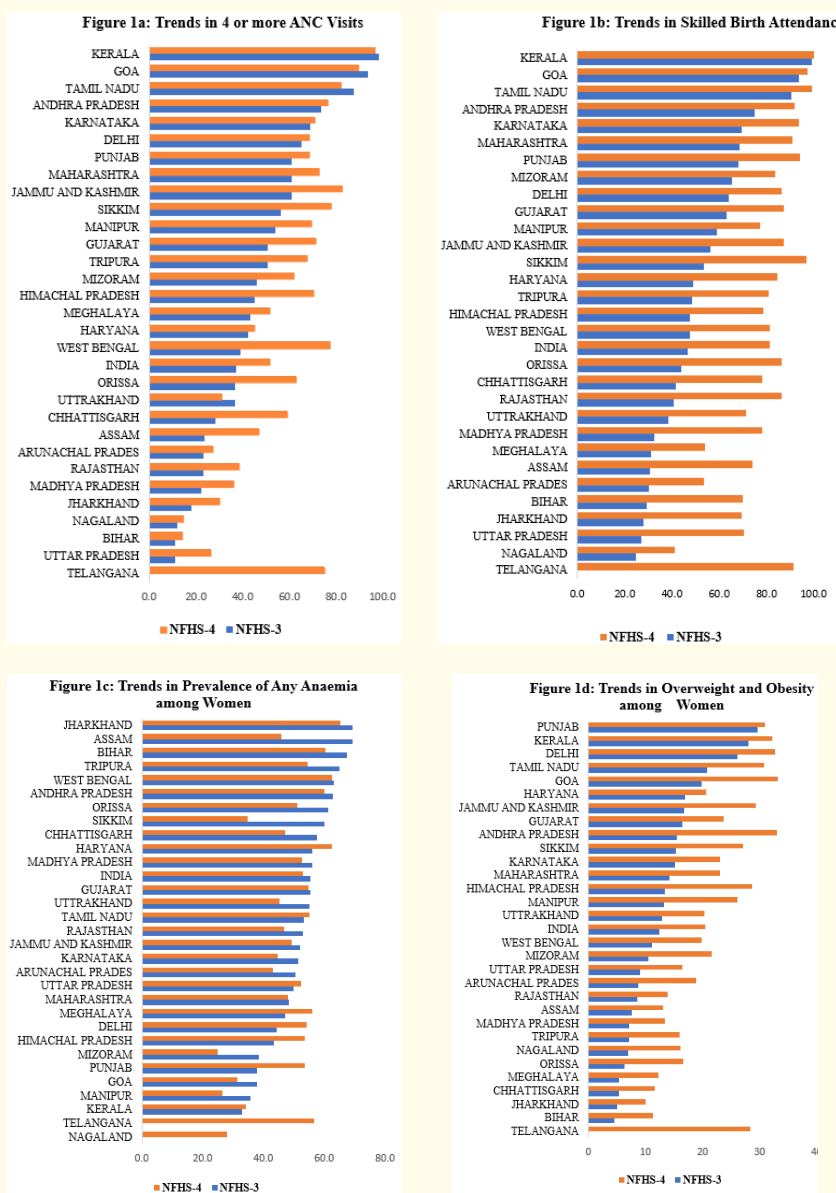
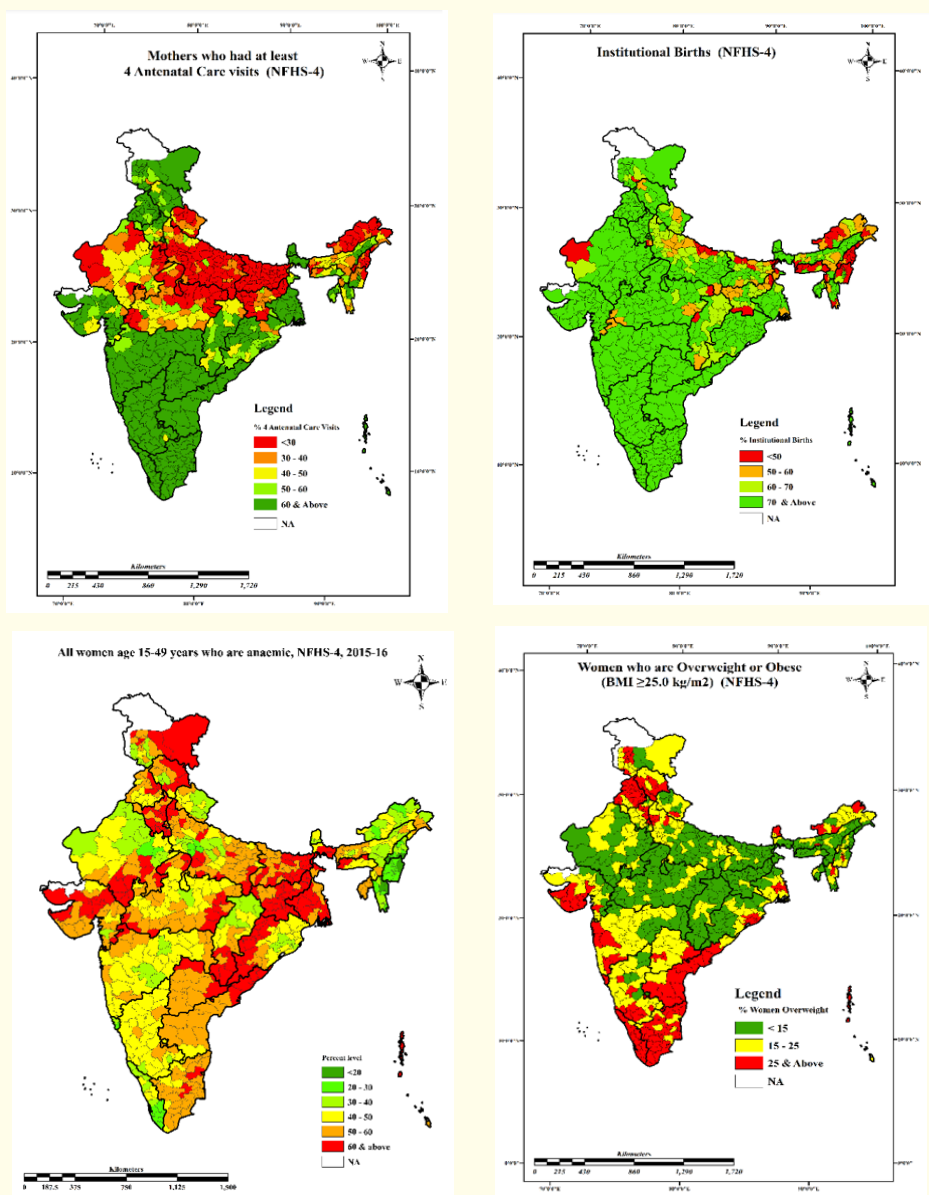


Figure 1: Figure presents the trends in four maternal health indicators from NFHS-3 to NFHS-4 at state level.

Sub-national (District-level) variation in the selected SDG indicators

Map A represents the district-wise distribution of women with four or more ANC visits. The map shows that districts belonging to states like Maharashtra, Goa, Tamil Nadu, Karnataka, Andhra Pradesh, West Bengal, Jammu and Kashmir, Punjab, Haryana, and Sikkim have the highest percentages of women with four or more ANC visits. The districts with the lowest percentage of women with four or more visits were in Rajasthan, Uttar Pradesh, Uttarakhand, Madhya Pradesh, Chhattisgarh, and Bihar. The majority of districts in those state had relatively high percentages of institutional deliveries or home deliveries by skilled birth personnel (Map B). However, these percentages were found to be low for districts in states like Rajasthan, Chattisgarh, Jammu and Kashmir, Arunachal Pradesh, and Meghalaya. The percentage of women with anaemia was found to be higher for districts in states like Jammu and Kashmir, Uttar Pradesh, Bihar, Jharkhand, Bihar, West Bengal, Odisha, Chattisgarh. The districts belonging to Haryana, central Rajasthan, western Madhya Pradesh, and northern Odisha have a lower percentage of anaemic women. The lowest anaemia burden was found in northern Assam, eastern Rajasthan, Arunachal Pradesh, Nagaland, Manipur, Mizoram, southern Kerala, east Maharashtra, and some parts of Madhya Pradesh (Map C). The prevalence of overweight or obesity was found to be lowest in district belonging to coastal Andhra Pradesh, southern Tamil Nadu, southern Kerala, southern Gujarat, western Jammu and Kashmir, and parts of Punjab and Haryana. A relatively high prevalence of overweight or obese women was observed in the districts of interior Andhra Pradesh, Karnataka, southern Maharashtra, Uttarakhand, and southern West Bengal. The lowest prevalence of overweight or obesity was found in northern and western Madhya Pradesh, northern Bihar, and adjoining districts of West Bengal (Map D).



Map 1: Maps of various indicators of maternal health across different districts of the country. (A) Map showing women who had at least 4 antenatal care visits (B) Map of institutional births. (C) Map showing non-pregnant women age 15 - 49 years who are anaemic.(D) Map showing women who were overweight or obesity.

Differentials in selected maternal health indicators

Table 2a illustrates that the adjusted odds ratio (AOR) of women receiving ANC in the first trimester increases with the years of schooling for both the rounds of NFHS. In 2015 - 16, the likelihood of receiving ANC in the first trimester among women having 11 and above years of schooling was 1.53 times ($p < 0.001$) higher than those with no education. Similarly, in 2005 - 06, the likelihood of receiving ANC in the first trimester among women having 11 and above years of schooling was 3.27 times ($p < 0.001$) higher than those with no education. The results from the logistic regression also show that women exposed to mass media were more likely to receive ANC in the first trimester (AOR = 1.52, $p < 0.001$) compared with their non-exposed counterparts in NFHS-4. In both surveys, women with birth order two and above were less likely to receive ANC in the first trimester than women of birth order one. The likelihood of receiving ANC in the first trimester among Scheduled Tribes (STs) women and other caste categories was marginally higher (AOR = 1.04 and 1.07) than for women belonging to Scheduled Castes in NFHS-4. A positive relationship was found between wealth and ANC in the first trimester in both the surveys. During NFHS-3 and NFHS-4, women in the highest wealth quintile had the highest odds of receiving ANC in the first trimester compared with the lowest wealth quintile. Similarly, in NFHS-4, women from the highest wealth quintile were 2.54 times more likely to receive ANC in the first trimester than women from lowest wealth quintile (AOR = 2.54).

Background characteristics	ANC in 1 st trimester (AOR)		4 or more ANC (AOR)		Skilled birth attendance (AOR)	
	NFHS-3	NFHS-4	NFHS-3	NFHS-4	NFHS-3	NFHS-4
Age						
15 - 24						
25 - 34	1.40***	1.16***	1.54***	1.32***	1.36***	1.14***
35 - 49	1.31***	1.15***	1.71***	1.52***	1.60***	1.15***
Years of schooling						
No education						
1 - 5	1.39***	1.21***	1.54***	1.31***	1.52***	1.18***
6 - 10	1.91***	1.36***	2.11***	1.62***	2.34***	1.68***
11 and above	3.27***	1.53***	3.39***	1.83***	4.66***	2.45***
Mass media exposure						
No						
Yes	1.41***	1.52***	1.63***	1.84***	1.39***	1.39***
Birth order						
1						
2	0.77***	0.86***	0.74***	0.80***	0.57***	0.66***
3	0.56***	0.72***	0.49***	0.59***	0.39***	0.51***
≥ 4	0.37***	0.53***	0.27***	0.40***	0.28***	0.38***
Residence						
Rural						
Urban	1.21***	1.06***	1.53***	1.20***	1.78***	1.21***
Caste/tribe						
SC						
ST	0.87***	1.04**	0.77***	1.17***	0.65***	0.69***
OBC	1.09**	0.98	1.03	0.87***	1.13***	1.03**
Others	1.09**	1.07***	1.16***	1.14***	1.2***	0.97*
Religion						
Hindu						
Muslim	0.91***	1.06***	0.99	1.19***	0.74***	0.61***
Others	0.75***	0.76***	0.84***	0.80***	0.85***	0.49***
Wealth quintile						
Lowest						
Second	1.11**	1.30***	1.40***	1.45***	1.33***	1.34***
Middle	1.54***	1.62***	2.22***	1.89***	1.99***	1.91***
Fourth	1.93***	1.95***	2.95***	2.26***	3.02***	2.69***
Highest	3.04***	2.54***	5.18***	2.76***	5.74***	4.17***
Constant	0.36***	0.60***	0.16***	0.26***	0.32***	2.45***

Table 2a: Results of logistic regression odds ratio of ANC in 1st trimester, 4 or more ANC visits, and skilled birth attendance among women age 15-49 in India in NFHS-3 (2005-06) and NFHS-4 (2015-16). AOR= Adjusted odds ratio; *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

Background characteristics	Any anaemia (< 12.0 g/dl)		Overweight or obesity (BMI ≥ 25.0 kg/m ²)	
	(AOR)		(AOR)	
	NFHS-3	NFHS-4	NFHS-3	NFHS-4
Age				
15 - 24				
25 - 34	0.79***	0.81***	2.46***	2.27***
35 - 49	0.77***	0.77***	5.08***	4.10***
Years of schooling				
No education				
1 - 5	1.01	0.92***	1.17***	1.16***
6 - 10	0.99	0.89***	1.31***	1.31***
11 and above	0.88***	0.87***	1.43***	1.30***
Mass media exposure				
No				
Yes	0.90***	0.98**	1.47***	1.29***
Birth order				
1				
2	1.01	1.07***	1.14***	1.07***
3	1.04	1.09***	1.05	1.06***
≥ 4	1.07***	1.06***	1.01	1.04***
Residence				
Rural				
Urban	1.06***	0.97***	1.45***	1.31***
Caste/tribe				
SC				
ST	1.22***	1.01	0.42***	0.72***
OBC	0.95**	0.91***	1.02	1.03**
Others	0.94***	0.85***	1.08**	1.14***
Religion				
Hindu				
Muslim	0.94***	0.92***	1.50***	1.47***
Others	0.66***	0.67***	1.39***	1.26***
Wealth quintile				
Poorest				
Poorer	0.83***	0.86***	1.83***	1.74***
Middle	0.71***	0.82***	3.10***	2.85***
Richer	0.63***	0.80***	5.98***	4.36***
Richest	0.54***	0.81***	11.66***	5.84***
Constant	2.32***	1.86***	0.01***	0.02***

Table 2b: Results of logistic regression odds ratio of any anaemia and overweight or obesity among women age 15 - 49 in India in NFHS-3 (2005-06) and NFHS-4 (2015-16).

AOR= Adjusted odds ratio; *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

Findings from the multivariable logistic regression analysis revealed that women with schooling of 11 years or above were more likely to receive four or more ANC visits than women with no education in both the surveys. The likelihood of receiving four or more ANC visits was higher for Muslim women (AOR = 1.19, $p < 0.001$) than Hindu women and those in other religious groups in NFHS-4. OBC women were least likely (AOR = 0.87) and those belonging to Scheduled Tribes were most likely (AOR = 1.17) to have four or more ANC visits compared with women from Scheduled Castes in NFHS-4. According to NFHS-4, women exposed to mass media were 1.84 times more likely (AOR = 1.84) to have at least four ANC visits than women without mass media exposure.

Women of birth order one have the highest prevalence of SBA at deliveries, while the prevalence subsequently decreases as the birth order increases across both the rounds. The likelihood of deliveries during SBA is also significantly higher for women with 11 or more years of schooling than women without any formal education in 2015 - 16 (AOR = 2.45, $p < 0.001$). OBC women were significantly more likely to have their births delivered by a skilled attendant in both rounds than Scheduled Caste women (AOR = 1.13 in NFHS-3 and AOR = 1.03 in NFHS-4). Women from the highest wealth quintiles had the highest likelihood to have SBA compared with those from the lowest quintile in 2015 - 16 (AOR = 4.17).

Women age 35 - 49 years were 23 percent less likely to be anaemic than women age 15 - 24 years during both the surveys. In both NFHS-3 and NFHS-4, women with 11 or more years of schooling were significantly less likely to be anaemic than women without any formal education (AOR = 0.88 in NFHS-3 and AOR = 0.87 in NFHS-4). Women exposed to mass media showed less likelihood of having anaemia than their non-exposed counterparts in both rounds of NFHS. Regression results also showed that anaemia and wealth were negatively related to each other; the likelihood of anaemia decreased among women as the wealth quintile increased. Women of birth order 4 and above had a higher likelihood of anaemia than those of birth order 1 in both NFHS-3 and NFHS-4 [AOR = 1.07 in NFHS-3 and AOR = 1.06 in NFHS-4]. Compared with their rural counterparts, women in urban areas were significantly more likely (AOR = 1.06) to have anaemia in NFHS-3 and significantly less likely to be anaemic in NFHS-4 [AOR = 0.97]. In both NFHS-3 and NFHS-4, women following religions other than Hinduism and Islam were significantly less likely to be anaemic than their Hindu counterparts [AOR = 0.66 in NFHS-3 and AOR = 0.67 in NFHS-4].

Women age 35 - 49 years were more likely to be overweight or obese in both surveys. Women with 11 or more years of schooling were 1.3 ($p < 0.001$) times more likely to be overweight or obese than those without any formal education in 2015 - 16. Results further revealed that urban women were more likely (AOR = 1.31, $p < 0.001$) to be overweight or obese than women in rural areas. In 2015 - 16, Muslim and other religious groups of women were 1.47 times ($p < 0.001$) and 1.26 times ($p < 0.001$) more likely to be overweight or obese, respectively compared with Hindu women. Women in the highest wealth quintile were 5.84 times ($p < 0.001$) more likely to be overweight or obese than those in the lowest wealth quintile in 2015 - 16, whereas the likelihood of overweight or obesity in 2005 - 06 was 11.66 ($p < 0.001$) compared with women in the lowest wealth quintile.

Table 3a represents predicted probabilities of some selected SDG indicators on India's maternal health in 2005 - 06 and 2015 - 16. For ANC in the first trimester, the likelihood of getting ANC in the first trimester among women with no education increased from 0.41 in 2005 - 06 to 0.53 in 2015 - 16, an increase of almost 30 percent. However, the probability of getting ANC coverage in the first trimester among women with 11 or more years of schooling decreased from 0.67 in 2005 - 06 to 0.62 in 2015 - 16, a decline of about 7 percent. For the same period, the probability of ANC coverage in the first trimester among women from the lowest wealth quintile increased by 20 percent, from 0.40 in 2005 - 06 to 0.48 in 2015 - 16. In the highest wealth quintile, however, the probability of getting ANC in the first trimester was 0.64 in 2005 - 06 and 0.69 in 2015 - 16, an increase of 8 percent. By the place of residence, in rural areas the probability of getting ANC in the first trimester was 0.49 in 2005 - 06 and 0.57 in 2015 - 16, an increase of 16 percent. In urban areas the probability of getting ANC in the first trimester was 0.53 in 2005 - 06 and 0.59 in 2015 - 16, an increase of 11 percent.

Background characteristics	2005-06		2015-16		Change 2006-2016
	Predicted probability	CI (95%)	Predicted probability	CI (95%)	
ANC in first trimester					
Years of schooling					
No education	0.41	(0.40,0.42)	0.53	(0.52,0.53)	0.12
1 - 5	0.48	(0.47,0.50)	0.57	(0.56,0.58)	0.09
6 - 10	0.55	(0.54,0.56)	0.60	(0.59,0.60)	0.04
11 and above	0.67	(0.65,0.68)	0.62	(0.62,0.63)	-0.04
Wealth quintile					
Lowest	0.40	(0.38,0.41)	0.48	(0.48,0.49)	0.08
Second	0.42	(0.41,0.43)	0.54	(0.54,0.55)	0.13
Middle	0.49	(0.48,0.50)	0.60	(0.59,0.60)	0.11
Fourth	0.54	(0.53,0.55)	0.64	(0.63,0.64)	0.10
Highest	0.64	(0.62,0.65)	0.69	(0.69,0.70)	0.05
Place of residence					
Rural	0.49	(0.48,0.50)	0.57	(0.57,0.58)	0.08
Urban	0.53	(0.52,0.54)	0.59	(0.58,0.59)	0.06
Four or more ANC visits					
Years of schooling					
No education	0.36	(0.35,0.37)	0.40	(0.39,0.40)	0.04
1 - 5	0.44	(0.43,0.45)	0.46	(0.45,0.46)	0.01
6 - 10	0.50	(0.49,0.51)	0.50	(0.50,0.51)	0.00
11 and above	0.59	(0.58,0.61)	0.53	(0.52,0.53)	-0.06
Wealth quintile					
Lowest	0.29	(0.27,0.31)	0.36	(0.35,0.36)	0.07
Second	0.35	(0.34,0.36)	0.44	(0.43,0.44)	0.09
Middle	0.44	(0.43,0.45)	0.50	(0.49,0.50)	0.06
Fourth	0.50	(0.49,0.51)	0.54	(0.53,0.54)	0.04
Highest	0.61	(0.60,0.62)	0.58	(0.58,0.59)	-0.03
Place of residence					
Rural	0.43	(0.42,0.43)	0.46	(0.46,0.47)	0.04
Urban	0.50	(0.49,0.51)	0.50	(0.50,0.51)	0.00
Skilled birth attendance					
Years of schooling					
No education	0.43	(0.73,0.74)	0.74	(0.73,0.74)	0.31
1 - 5	0.52	(0.76,0.77)	0.76	(0.76,0.77)	0.24
6 - 10	0.60	(0.81,0.82)	0.82	(0.81,0.82)	0.22
11 and above	0.72	(0.86,0.87)	0.86	(0.86,0.87)	0.14
Wealth quintile					
Lowest	0.38	(0.71,0.72)	0.71	(0.71,0.72)	0.33
Second	0.44	(0.76,0.77)	0.76	(0.76,0.77)	0.33
Middle	0.51	(0.81,0.82)	0.82	(0.81,0.82)	0.30
Fourth	0.60	(0.86,0.86)	0.86	(0.86,0.86)	0.26
Highest	0.71	(0.90,0.91)	0.90	(0.90,0.91)	0.19
Place of residence					
Rural	0.49	(0.77,0.78)	0.78	(0.77,0.78)	0.29
Urban	0.59	(0.80,0.81)	0.80	(0.80,0.81)	0.21

Table 3a: Changes in predicted probabilities of selected SDG indicators on maternal health in India over NFHS-3 (2005-06) and NFHS-4 (2015-16).

The probability of having 4 or more ANC visits among uneducated women increased from 0.36 in 2005 - 06 to 0.40 in 2015 - 16, an increase of about 11 percent. However, the probability of having 4 or more ANC visits among women with 11 or more years of schooling decreased from 0.59 in 2005 - 06 to 0.53 in 2015 - 16, a decrease of for the same period, the probability of 4 or more ANC visits was 0.29 among women in the lowest wealth quintile in 2005 - 06 and 0.36 in 2015 - 16, an increase of 24 percent. In the highest wealth quintile, however, the probability of having 4 or more ANC visits decreased from 0.61 in 2005 - 06 to 0.58 in 2015 - 16, a decrease of 5 percent. By the place of residence, in rural areas the probability of having 4 or more ANC visits was 0.43 in 2005 - 06 and 0.46 in 2015 - 16, an increase of 7 percent. However, in urban areas, the likelihood of having 4 or more ANC visits was the same (0.50) in 2005 - 06 and 2015-16.

For another important SDG indicator on maternal health, i.e., skilled birth attendant (SBA), the probability of births attended by SBA among women with no educated increased from 0.43 in 2005 - 06 to 0.74 in 2015 - 16, an increase of 72 percent. However, the probability of births attended by SBA among women with 11 or more years of schooling increased from 0.72 in 2005 - 06 to 0.86 in 2015 - 16, an increase of 19 percent. For the same period, the probability of SBA among women in the lowest wealth quintile in 2005 - 06 was 0.38, which increased to 0.71 in 2015 - 16, an increase of 82 percent over the last one decade. In the highest wealth quintile, the probability of SBA was 0.71 in 2005 - 06 and 0.90 in 2015 - 16, an increase of 27 percent. By the place of residence, in rural areas, the probability of SBA was 0.49 in 2005 - 06 and 0.78 in 2015 - 16, an increase of 59 percent. However, in urban areas the probability of births attended by SBA was 0.59 in 2005 - 06 and 0.80 in 2015 - 16, an increase of 36 percent. Thus, all three indicators of maternal health care service utilization have recorded impressive increases in the probability of improved service utilization with disproportionately higher increases among rural women, those without formal schooling, and women in the lowest wealth quintiles.

Table 3b shows changes in the predicted probability of some additional SDG indicators of maternal health in India over 2005 - 06 and 2015 - 16. For anaemia, the study found no differences in the likelihood of being anaemic in any category of education for both the rounds of NFHS. The probability of being anaemic was 0.54 in the no education category in both 2005 - 06 and 2015 - 16. For the same period, the likelihood of being anaemic among women in the lowest wealth quintile decreased from 0.62 in 2005 - 06 to 0.56 in 2015 - 16, a decline of 10 percent. In the highest wealth quintile, the probability of being anaemic was 0.47 in 2005 - 06 and 0.51 in 2015 - 16, an increase of 9 percent. By residence, the probability of being anaemic was almost the same in rural and urban areas in both rounds. It may be an indication of more concentration of the Anemia Mukht India programme among women in the lowest wealth quintiles.

Background characteristics	2005-06		2015-16		Change 2006-2016
	Predicted probability	CI (95%)	Predicted probability	CI (95%)	
Prevalence of any anaemia					
Years of schooling					
No education	0.54	(0.53,0.54)	0.54	(0.54,0.54)	0.00
1-5	0.54	(0.53,0.55)	0.52	(0.52,0.52)	-0.02
6-10	0.53	(0.53,0.54)	0.51	(0.51,0.51)	-0.02
11 and above	0.51	(0.49,0.52)	0.50	(0.50,0.51)	0.00
Wealth quintile					
Lowest	0.62	(0.61,0.64)	0.56	(0.56,0.56)	-0.06
Second	0.58	(0.57,0.59)	0.52	(0.52,0.53)	-0.06
Middle	0.54	(0.53,0.55)	0.51	(0.51,0.51)	-0.03
Fourth	0.51	(0.51,0.52)	0.51	(0.50,0.51)	0.01
Highest	0.47	(0.47,0.48)	0.51	(0.5,0.51)	0.04
Place of residence					
Rural	0.53	(0.52,0.53)	0.52	(0.52,0.53)	-0.00
Urban	0.54	(0.54,0.55)	0.52	(0.51,0.52)	-0.02

Prevalence of overweight and obesity					
Years of schooling					
No education	0.16	(0.16,0.17)	0.20	(0.20,0.21)	0.04
1 - 5	0.18	(0.18,0.19)	0.23	(0.22,0.23)	0.04
6 - 10	0.20	(0.19,0.20)	0.25	(0.24,0.25)	0.05
11 and above	0.21	(0.20,0.21)	0.24	(0.24,0.25)	0.04
Wealth quintile					
Lowest	0.04	(0.03,0.05)	0.09	(0.09,0.1)	0.05
Second	0.07	(0.06,0.07)	0.15	(0.15,0.15)	0.08
Middle	0.11	(0.11,0.12)	0.22	(0.22,0.22)	0.11
Fourth	0.19	(0.18,0.19)	0.30	(0.29,0.30)	0.11
Highest	0.30	(0.29,0.30)	0.36	(0.35,0.36)	0.06
Place of residence					
Rural	0.16	(0.16,0.16)	0.21	(0.21,0.22)	0.05
Urban	0.21	(0.20,0.21)	0.26	(0.25,0.26)	0.05

Table 3b: Changes in predicted probabilities of selected SDG indicators on maternal health in India over NFHS-3 (2005-06) and NFHS-4 (2015-16).

For overweight/obesity, it was found that among uneducated women the probability of being overweight or obese increased from 0.16 in 2005 - 06 to 0.20 in 2015 - 16. However, the likelihood of being overweight or obese among women with 11 or more years of schooling increased from 0.21 in 2005 - 06 to 0.24 in 2015 - 16 during the same period. The probability of being overweight or obese was only 0.04 in the lowest wealth quintile in 2005 - 06 and 0.09 in the highest wealth quintile. On the other hand, among women in the highest wealth quintile, the probability of being overweight or obese was 0.30 in 2005 - 06 and 0.36 in 2015 - 16. By residence, in rural areas, the probability of being overweight or obese was 0.16 in 2005 - 06 and 0.21 in 2015 - 16. However, in urban areas, the likelihood of being overweight or obese was 0.21 in 2005 - 06 and 0.26 in 2015 - 16.

Decomposing the inequality in selected SDG indicators of maternal health in India

Table 4 presents the results of Fairlie's decomposition of the gap between the five selected indicators, namely, antenatal care in the first trimester, 4+ antenatal care (ANC) visits, use of skilled birth attendants, anaemia among women, and body mass index (BMI) greater than or equal to 25.0 kg/m² over the 10 years between NFHS-3 (2005 - 06) and NFHS-4 (2015 - 16).

	ANC in 1 st trimester	4+ ANC		Skilled birth attendance		Any anaemia (<12.0 g/dl)		Overweight or Obesity (BMI ≥25.0 kg/m ²)	
ANC in 1 st trimester in 2005-06	0.439	≥4 ANC in 2005-06	0.373	SBA in 2005-06	0.466	Anaemia in 2005-06	0.564	Overweight or Obesity in 2005-06	0.149
ANC in 1 st trimester in 2015-16	0.586	≥4 ANC in 2015-16	0.516	SBA in 2015-16	0.814	Anaemia 2015-16	0.537	Overweight or Obesity in 2015-16	0.253
Difference	-0.147	Difference	-0.144	Difference	-0.348	Difference	0.027	Difference	-0.104
Total explained	-0.080	Total explained	-0.087	Total explained	-0.087	Total explained	0.009	Total explained	-0.016

% of total Difference Explained	54.3	% of total Difference explained	60.8	% of total difference explained	25.1	% of total difference explained	31.3	% of total difference explained	15.0
Details of Total Explanations									
Predictors	Coefficient	Coefficient	% Contribution	Coefficient	% Contribution	Coefficient	%	Coefficient	% Contribution
							Contribution		
Age	-0.003	-0.004	4.7	-0.003	3.7	0.003	37.2	-0.021	131.6
Education	-0.048	-0.047	54.2	-0.048	55.0	0.004	47.7	-0.002	13.2
Residence	-0.002	-0.003	3.2	-0.003	3.3	0.000	-3.5	-0.001	3.3
Religion	0.000	0.000	0.0	0.000	0.0	0.000	0.9	0.000	1.2
Caste/tribe	0.000	0.000	-0.3	0.000	-0.5	-0.001	-7.9	0.001	-5.9
Mass media exposure	-0.004	-0.007	7.5	-0.004	4.2	0.001	12.7	-0.001	5.0
Wealth quintile	-0.002	-0.004	4.9	-0.002	2.7	0.000	2.5	0.008	-53.9
Birth order	-0.022	-0.022	25.6	-0.028	31.6	0.001	10.6	-0.001	5.6

Table 4: Summary table of decomposition of differences in the prevalence of 4+ ANC, ANC in 1st trimester, skilled birth attendance, any anaemia, and Overweight and obesity among women age 15 - 49 from NFHS-3 (2005-06) to NFHS-4 (2015-16).

The findings show that in the case of ANC in the first trimester, there is a total difference of - 14.7 percent between the estimate in 2005 - 06 and 2015 - 16. Out of this, 54.3 percent of the difference was explained by the covariates included in the study. Education, followed by birth order, were the two most contributing covariates in explaining the difference, contributing 59.7 percent and 27.1 percent, respectively.

In the case of 4+ ANC visits, there is a total difference of - 14.4 percent observed between 2005 - 06 and 2015-16. Out of this, 60.8 percent of the difference was explained by the covariates included in the study. Education, followed by birth order, were the two most contributing covariates in explaining the difference, contributing 54.2 percent and 25.6 percent, respectively.

In the case of skilled birth attendance, there is a total gap of -34.8 percent, out of which, 25.1 percent of the difference was explained by the covariates included in the study. Here again, education, followed by birth order, were found to be the two most contributing covariates in explaining the difference, contributing 55.0 percent and 31.6 percent, respectively.

The total difference in anaemia was 2.7 percent, out of which, 31.3 percent of the difference was explained by the covariates included in the study. For the present case, education, followed by the women's age, were found to be the two most contributing covariates in explaining the difference, contributing 47.7 percent and 37.2 percent, respectively.

Table 4 shows that in the case of the Body Mass Index (BMI) being greater than or equal to 25.0 kg/m², there is a total difference of - 10.4 percent between 2005 - 06 and 2015 - 16, out of which, 15.0 percent of the difference was explained by the covariates included in the study. Age was found to be the most influencing covariate in explaining the difference, contributing 131.6 percent of the difference. Wealth emerged as the second most contributing covariate (-53.9%), negatively contributing to the BMI difference between 2005 - 06 and 2015 - 16.

Discussion and Conclusions

This study examined the changes in multiple maternal health indicators and decomposed the factors behind those changes over two survey periods in India. The changes and the progress in maternal health indicators in India have been analysed based on five main elements, namely, antenatal care in the first trimester, four or more antenatal care (ANC) visits during pregnancy, use of skilled birth attendants, anaemia among women, and a body mass index (BMI) of ≥ 25 kg/m², indicating overweight or obesity. Age, years of schooling, caste/tribe, household wealth, place of residence, and birth order emerged as important factors affecting four or more antenatal care (ANC) visits, use of skilled birth attendants, anaemia among women, and overweight or obesity among women in India.

India has worked and achieved tremendously on the socioeconomic front, but the progress in improving maternal health indicators has been quite a slow journey [6]. Nonetheless, the two crucial maternal health factors, i.e. ANC in the first trimester and four or more ANC visits, increased considerably from NFHS-3 to NFHS-4. The most plausible reason for this can be credited to the ASHA workers' constant work and efforts. Many studies have documented the role of ASHAs and ANMs in reconstructing and improving maternal health indicators in India. Qualitative studies also emphasize the importance of ASHAs and their role in improving maternal health care services like early registration of pregnancies, three or more ANC visits, and two TT injections [7]. The success seems partial as the ASHA programme had the highest reach in the most impoverished populations. It does not address the disparities in the utilization of services across women from different socioeconomic and caste groups [8]. Another noteworthy finding is the increase in deliveries by a skilled birth attendant. This change can be attributed to the successful implementation of comprehensive programmes like the National Health Mission and Janani Suraksha Yojna, emphasizing the need to address the loopholes in India's maternal health care system [9].

With increasing age and years of schooling, women were more likely to go for ANC in the first trimester, have received four or more ANC visits, and have births attended by skilled attendants. Higher utilization of maternal health care services was found among women in urban areas, a similar pattern found in both the survey periods. A socioeconomic differential is also observed wherein women in the lowest wealth quintile were less likely to have deliveries in the presence of skilled birth attendants. This pattern remained similar in NFHS-3 and NFHS-4. Women in higher wealth quintiles were in an advantageous position in utilizing maternal health care services, as observed in both NFHS-3 and NFHS-4.

An increase in wealth and education is associated with a decrease in the prevalence of anaemia among women. On the other hand, the chances of women being overweight and obese increased significantly with increased education. The results from the decomposition analysis show that the percentage using maternal health care services like ANC in the first trimester and four or more ANC visits increased significantly from NFHS-3 to NFHS-4, and the factors like education, birth order, and mass media exposure contributed the most in explaining the differences between the two survey periods. The prevalence of anaemia decreased slightly in NFHS-4 compared with NFHS-3, with education, age, and mass media exposure contributing the most to explaining the differences.

Women with higher educational attainment had a higher probability of availing of ANC in the first trimester. These findings are consistent with previous studies indicating similar results [10,11]. Women from higher wealth status had a higher probability of going for ANC visits, as corroborated by the extant literature [12]. A previous study found that the results are consistent with the results of the present study that women in urban areas had higher odds of getting ANC visits in the first trimester [11]. Women with higher education status, higher wealth status, and an urban place of residence had a higher probability of having had four or more ANC visits. The findings are consistent with previous that found that women from high socioeconomic statuses had better chances of having four or more ANC visits [13-15]. Women's educational attainment and their overall socioeconomic status play a catalysing role in deliveries in the presence of skilled birth attendants [16,17]. Moreover, women in urban areas are in a more advantageous position than women in rural areas [1,18].

The prevalence of anaemia among women was higher if they had no formal schooling and belonged to the lowest wealth quintile. Similar findings were also found in previous studies [19]. Overweight and obesity were higher among women of higher educational status and higher wealth status [20]. Some previous studies found that the place of residence had no effect in determining the prevalence of overweight and obese individuals [21].

The study findings establish the level of education and birth order are the two major factors influencing the utilization of three maternal health services, namely ANC in the first trimester, 4 or more ANC visits, and skilled birth attendance. Our study findings are similar to findings in the existing literature which establish education as one of the major positive predictors of health care utilization among women [22-24]. Education helps in increasing the availability and access to maternal health services. Additionally, education simultaneously acts as an agency variable which might impart knowledge required to avail of health services for a safe pregnancy and healthy offspring [22,23].

Furthermore, the study findings suggest that as women's birth order increases, the likelihood of utilizing maternal health services also increases, which is not corroborated by the existing literature [25]. However, this increased utilization of health care services could be due to the increased confidence and increased knowledge among women with higher birth order deliveries, which encourage them to use health care services [26]. Additionally, the level of women's education positively affects the anaemia levels, as substantiated in the existing literature. Higher educational attainment imparts better knowledge about nutritional intake and a healthy lifestyle [3,19,27,28].

Age was found to positively affect the reduction in the prevalence of anaemia among women. This finding may be attributable to the increasing age at marriage among women and a drop in the prevalence of teenage marriages in India [3,29]. Furthermore, in case of overweight or obesity, age has been found to be a positive contributing factor, i.e. increased prevalence of overweight or obesity in the past decade can be attributed to advancing age. A woman's body goes through various biological changes after the initiation of menarche. Furthermore, there are extensive hormonal changes due to childbirth and lactation. These changes, coupled with an inappropriate diet, tend to increase BMI among women in India [3,30].

Recommendations

Tracking progress in SDG indicators on maternal health provides evidence of substantial improvements in each of the three indicators relating to maternal health care utilization analysed in this study. Still, there is implicit heterogeneity by education, caste/tribe, class, and various forms of social exclusion, including household's wealth quintiles. Despite narrowing the rich-poor gap in maternal health utilization over the last decade, lower utilization of maternal health services by less educated women and those having higher-order births is the real challenge in India to achieving the maternal health SDGs. Therefore, frontline workers need special training in client segmentation with focused strategies on awareness and behavioural change in maternal health services utilization. The marginal improvement in the prevalence of anaemia among women of reproductive ages suggests the need for integration and convergence of the 'Anaemia-free India' programme with the overall nutrition programme within the framework of Poshan Abhiyan. The increasing prevalence of overweight or obesity among women of reproductive ages, a marker of various non-communicable diseases, highlights the need for extensive use of mass media to enhance women's awareness of the dangers of being overweight or obese for the health of mothers and the well-being of children.

Bibliography

1. Yaya S., *et al.* "Socio-economic factors associated with choice of delivery place among mothers: A population-based cross-sectional study in Guinea-Bissau". *BMJ Global Health* (2019): e001341.
2. Tarekegn SM., *et al.* "Determinants of maternal health service utilization in Ethiopia: analysis of the 2011 Ethiopian Demographic and Health Survey". *BMC Pregnancy and Childbirth* 14.1 (2014): 161.
3. Nguyen PH., *et al.* "Trends and drivers of change in the prevalence of anaemia among 1 million women and children in India, 2006 to 2016". *BMJ Global Health* 3.5 (2018).
4. Gouda J and Prusty RK. "Overweight and obesity among women by economic stratum in urban India". *Journal of Health, Population, and Nutrition* 32.1 (2014): 79.
5. Nagarkar AM and Kulkarni SS. "Obesity and its effects on health in middle-aged women from slums of Pune". *Journal of Mid-life Health* 9.2 (2018): 79.

6. Vora KS, et al. "Maternal Health Situation in India: A Case Study". *Journal of Health, Population and Nutrition* 27.2 (2009): 184-201.
7. Singh MK, et al. "Utilization of ASHA services under NRHM in relation to maternal health in rural Lucknow, India". *South East Asia Journal of Public Health* 2.1 (2013): 24-27.
8. Agarwal S, et al. "The impact of India's accredited social health activist (ASHA) program on the utilization of maternity services: a nationally representative longitudinal modelling study". *Human Resources for Health* 4 (2019): 1-13.
9. Ghosh A and Ghosh R. "Sexual and Reproductive Healthcare Maternal health care in India: A reflection of 10 years of National Health Mission on the Indian maternal health scenario". *Sexual and Reproductive Healthcare* (2020): 100530.
10. Gupta R and Talukdar B. "Frequency and Timing of Antenatal Care Visits and Its Impact on Neonatal Mortality in EAG States of India". *Journal of Neonatal Biology* (2017).
11. Moore N, et al. "Determinants of first trimester attendance at antenatal care clinics in the Amazon region of Peru: A case-control study". *PLoS ONE* (2017).
12. Arthur E. "Wealth and antenatal care use: Implications for maternal health care utilization in Ghana". *Health Economics Review* (2012).
13. Pandey S. "Socio-economic and Demographic Determinants of Antenatal Care Services Utilization in Central Nepal". *International Journal of MCH and AIDS (IJMA)* (2013).
14. Rurangirwa AA, et al. "Determinants of poor utilization of antenatal care services among recently delivered women in Rwanda; a population based study". *BMC Pregnancy and Childbirth* (2017).
15. Shibre G and Mekonnen W. "Socio-economic inequalities in ANC attendance among mothers who gave birth in the past 12 months in Debre Brehan town and surrounding rural areas, North East Ethiopia: A community-based survey". *Reproductive Health* (2019).
16. Manyeh AK, et al. "Socio-demographic determinants of skilled birth attendant at delivery in rural southern Ghana". *BMC Research Notes* (2017).
17. Wong KLM, et al. "Socio-economic inequalities in skilled birth attendance and child stunting in selected low and middle income countries: Wealth quintiles or deciles?" *PLoS ONE* (2017).
18. Joseph G, et al. "Socio-economic inequalities in access to skilled birth attendance among urban and rural women in low-income and middle-income countries". *BMJ Global Health* (2018).
19. Balarajan YS, et al. "Changing patterns of social inequalities in anaemia among women in india: Cross-sectional study using nationally representative data". *BMJ Open* 3.3 (2013).
20. Tanwi TS, et al. "Socio-economic correlates of overweight and obesity among ever-married urban women in Bangladesh". *BMC Public Health* (2019).
21. Luhar S, et al. "Do trends in the prevalence of overweight by socio-economic position differ between India's most and least economically developed states?" *BMC Public Health* (2019).
22. Dimbuene Z, et al. "Women's education and utilization of maternal health services in Africa: A multi-country and socioeconomic status analysis". *Journal of Biosocial Science* 50.6 (2017): 725-748.
23. Weitzman A. "The effects of women's education on maternal health: Evidence from Peru". *Social Science and Medicine* 180 (2017): 1-9.
24. Barman B, et al. "Impact of education on the utilization of maternal health care services: An investigation from National Family Health Survey (2015-16) in India". *Children and Youth Services Review* 108 (2020): 104642.

25. Srivastava A., *et al.* "Correlates of maternal health care utilization in Rohilkhand Region, India". *Annals of Medical and Health Sciences Research* 4.3 (2014): 417-425.
26. Machira K and Palamuleni M. "Factors influencing women's utilization of public health care services during childbirth in Malawi public health facility utilization". *African Health Sciences* 17.2 (2017): 400-408.
27. Chakrabarti S., *et al.* "Identifying sociodemographic, programmatic and dietary drivers of anaemia reduction in pregnant Indian women over 10 years". *Public Health Nutrition* 21 (2018): 2424-2433.
28. Ahankari AS., *et al.* "Prevalence of iron-deficiency anaemia and risk factors in 1010 adolescent girls from rural Maharashtra, India: a cross-sectional survey". *Public Health* 142 (2017): 159-166.
29. Gautam S., *et al.* "Determining factors for the prevalence of anemia in women of reproductive age in Nepal: Evidence from recent national survey data". *PloS ONE* 14.6 (2019): e0218288.
30. Onyeneho NG., *et al.* "Determinants of childhood anemia in India". *Scientific Reports* 9.1 (2019): 1-7.

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