CAMBRIDGE
UNIVERSITY PRESS

RESEARCH ARTICLE

Inequalities in the utilization of maternal health care in the pre- and post-National Health Mission periods in India

Balhasan Ali[1], Preeti Dhillon[1]* and Sanjay K. Mohanty[2]

[1]Department of Mathematical Demography & Statistics, International Institute for Population Sciences, Mumbai, India and
[2]Department of Fertility Studies, International Institute for Population Sciences, Mumbai, India
*Corresponding author. Email: pdhillon.iips@gmail.com

Abstract

Since the implementation of the National Health Mission (NHM) in India there has been a noticeable improvement in the utilization of maternal care, namely antenatal care (ANC), skilled birth attendants (SBA) and postnatal care (PNC) in the country. The increase in utilization of these services is expected to reduce inequality across geographies and population sub-groups, but little is known about the extent of inequality in maternal care use across socioeconomic groups over time. Using data from the last two rounds of National Family Health Surveys conducted in 2005–06 and 2015–16, this study examined the extent of inequality in utilization of full ANC, SBA and PNC in India and its states. Descriptive statistics were used, a concentration index was computed and decomposition analyses performed to understand the pattern and change of inequality in use of maternal care. The results suggest that the gap in maternal care utilization across socioeconomic groups has reduced over time. The concentration index for SBA showed a decline from 0.49 in 2005–06 to 0.08 by 2015–16, while that of PNC declined from 0.36 to 0.13 over the same period. The reduction in inequality in utilization of full PNC was the least. The results of the decomposition analysis revealed that urban residence, education and belonging to Scheduled Caste and Scheduled Tribes positively contributed to the inequality. Based on these findings, it is suggested that the Janani Suraksha Yojana and Janani Sishu Suraksha Karyakaram schemes be continued and strengthened for poor mothers to reduce maternal health inequality, particularly in full ANC and PNC.

Keywords: Inequality; Maternal care; India

Introduction

Since the declaration of the Millennium Development Goals (MDGs), global effort to improve maternal and child health in developing countries has intensified. Health-related goals attract considerable attention, and the Sustainable Development Goals (SDGs) have extended the objectives to include overall health (Norheim *et al.*, 2015; WHO, 2016a). Despite global and national efforts to improve maternal care, progress in the utilization of maternal health care services has been uneven across and among countries (Magadi *et al.*, 2003; Say & Raine, 2007; Chopra *et al.*, 2009). Moreover, the extent of inequality has been found to be larger within countries than between them (Mohanty & Pathak, 2009; Ahmed *et al.*, 2010; Barros *et al.*, 2012; Singh *et al.*, 2012). Thus, inequality in access to, and utilization of, maternal health care services remains a significant challenge in many developing countries, including India.

According to the World Health Organization, an estimated 3 million maternal deaths occurred in 2015 due to preventable causes related to pregnancy and delivery, of which 99% were in

developing countries (Alkema *et al.*, 2016; WHO, 2016a). Improvement in maternal health care has been used as a strategy to reduce maternal and child mortality in many developing countries (Campbell *et al.*, 2006; Bhutta *et al.*, 2008; Loznao *et al.*, 2011). A large number of studies, in India, Bolivia, China, Egypt, Honduras, Indonesia, Jamaica, Zimbabwe and other developing countries, have suggested that improvement in medical attention at birth significantly improves maternal and child survival (Goldie *et al.*, 2010; Feng *et al.*, 2011). Improving access to prenatal, natal and postnatal health services for women can reduce socioeconomic inequality in the use of maternal health services. Though maternal care is a part of basic health services, it remained far from universal. Specifically, access to improved maternal care remains low among poor, less-educated rural women. Numerous studies haved suggested that reduction in inequality in the access to utilization of maternal health care services can improve maternal and child survival (Marmot *et al.*, 2008; Bhutta *et al.*, 2010).

A decade ago, the state of maternal health in India was characterized by large inter-state variation, low level of maternal and health services and high inequality in the utilization of services. In 2005, the Government of India introduced the National Health Mission (NHM) with the key objective of reducing maternal and child deaths by improving the provision of maternal and health services in poorer states and among poor mothers. Under the NHM, the Janani Suraksha Yojana (JSY) and Janani Shishu Suraksha Karyakaram (JSSK) schemes were introduced. The JSY is the largest ever conditional cash transfer programme worldwide entitling people to cash benefits subject to delivery at public health centres. Similarly, the JSSK provides free health care services for women and children, national-level emergency referral systems, maternal death audits, improvements in transparency and accountability of public health services at all levels. Quality aspects of maternal health services have long been neglected in the public health system in India. With the launch of the NHM, the quality of maternal and child health care has been recognized at the policy and planning levels of the national health programmes (Nair & Panda, 2011).

Recent studies have suggested that the NHM has been helpful in reducing maternal mortality and infant mortality and reducing out-of-pocket expenditure on maternal care (Bonu *et al.*, 2009; Lim *et al.*, 2010; Pathak *et al.*, 2010; Randive *et al.*, 2013; Marten *et al.*, 2014). The maternal mortality ratio in India decreased from 212 deaths per 100,000 live births in 2007 to 130 deaths per 100,000 live births in 2016 (RGI, 2018). Evidence suggests that utilization of four or more ANC visits increased from 37% in 2005–06 to 51% in 2015–16, while institutional births improved from 39% to 79% over the same period. Furthermore, postnatal care has also increased, from 37% to 65%, in the last decade in India (IIPS & ORC Macro, 2007; IIPS & ICF, 2017).

Previous research has found that education and wealth are the main contributors to inequality in maternal health care (Liu *et al.*, 2014; Li *et al.*, 2015; Yaya *et al.*, 2016; Cai *et al.*, 2017). Maternal health care utilization has been found to increase with increased level of education of women, and with exposure to mass media. A few studies have observed that wealth has a positive and significant influence on the use of antenatal care services, even if the maternal health care services are provided free of charge, as people can incur out-of-pocket expenditure (Rai *et al.*, 2012; Mohanty & Kastor, 2017). Numerous studies have suggested that there is a substantial rich–poor gap in the utilization of maternal health services by rural–urban residence, low–high education levels and ethnicity (Ladusingh & Holendro Singh, 2007; Mohanty & Pathak, 2009; Ghosh, 2015; Kumar & Singh, 2015; Kamal *et al.*, 2016).

Caste (Deshpande, 2000) and religion are often considered to be markers of socio-cultural background and are expected to influence beliefs, norms and values about childbirth, and women's status in society (Hajizadeh *et al.*, 2014). These structural determinants have been found to be significantly associated with access to full antenatal care, institutional delivery and use of any modern method of contraception. Several studies have revealed that ethnic minorities, individuals with fewer physical assets, and those with lower social capital and residing in remote areas do not benefit from improved public health services (Goland *et al.*, 2012; Saxena *et al.*, 2013). Many

researchers have also found that the use of postnatal care and skilled birth attendants remains disproportionately low among poor mothers in India, irrespective of place of residence and province (Mohanty & Pathak, 2009; Baru *et al.*, 2010; Pathak *et al.*, 2010; Balarajan *et al.*, 2011; Singh *et al.*, 2012). In explaining these low levels of maternal health care use, only a few studies in India have focused on the socioeconomic factors that contribute to inequality in maternal health care (Pallikadavath *et al.*, 2004; Adhikari *et al.*, 2016; Dehury, 2016). Maternal health care utilization is mostly affected by level of education, wealth, place of residence, distance, quality of health care and ability to pay.

Despite improvements in maternal health services in the last decade, India accounts for about one-fifth of maternal deaths worldwide, with large inter-state variations (Jat *et al.*, 2011). For instance, the maternal mortality ratio in 2014–16 was 173 per 100,000 live births in Madhya Pradesh, 237 in Assam, 165 in Bihar, 61 in Maharashtra, 74 in Andhra Pradesh and 201 in Uttar Pradesh (RGI, 2018). The variation in maternal and child mortality is associated with variations in the provision of maternal services among the states. Hence, understanding regional variation in the utilization of maternal health care services will help to improve service delivery. Second, though the average level in maternal care utilization has increased in the last decade, little is known about the extent of inequality in utilization of services across the states of India. One of the key objectives of the NHM has been to reduce the extent of inequality in maternal health care in India. Third, prior studies have suggested that although income levels are increasing, the distribution of income is becoming more unequal, and this affects health care utilization. Also, inequalities in educational attainment and urban–rural residence account for differentials in maternal health care as well. Fourth, disparities in the diffusion of modern medical services and attitudes towards modern medicine are also significant across the urban–rural dichotomy, with urban areas having better access and better-equipped services. Fifth, while the NHM has made efforts to address critical gaps associated with the quality of maternal health care in the public health system, there is much scope for improvement. In this context, this study examined inequality in, and quantified the relative contribution of socioeconomic factors to, the utilization of full antenatal care and postnatal care, and presence of skilled attendants at birth, in India over the period 2005 to 2016.

Methods

Data

Data were taken from the last two rounds of the National Family Health Survey (NFHS-3 in 2005–06; NFHS-4 in 2015–16). The NFHS provides the most reliable and comprehensive source of data on reproductive and maternal–child health issues in India. It is a large-scale, multi-round survey conducted in a representative sample of households throughout the country (IIPS & ICF, 2017). The survey is cross-sectional in design and follows a multistage stratified random sampling design by rural and urban areas. In addition to state-level estimates, NFHS-4 provides district-level data. More detail about the sampling design and sample size can be found in the survey reports (IIPS & ORC Macro, 2007; IIPS & ICF, 2017).

Each survey respondent completed a consent form before interview. The sample sizes for the present study were 249,967 women in the 2015–16 survey and 56,438 women in the 2005–06 survey. The sample included ever-married women aged 15–49 who had delivered their last birth in the 5 years preceding the survey. However, the sample size for each indicator varied depending on the type and context of the analyses (see Table 1).

For state-level analysis, all 29 Indian states (excluding Telangana) were included and the National Capital Territory of Delhi as the state of Telangana was created after the NFHS-3. The states included in the analyses were: Uttar Pradesh (UP), Bihar (BH), Madhya Pradesh (MP), Maharashtra (MH), Andhra Pradesh (AP), Kerala (KE), Karnataka (KA), Tamilnadu (TN), Uttarakhand (UK), Jharkhand

Table 1. Percentage of women utilizing full ANC, SBA and PNC in India, 2005–16

State	2005–06			2015–16		
	Full ANC	SBA	PNC	Full ANC	SBA	PNC
Nagaland	0.6	24.7	10.2	2.3	41.3	22.1
Bihar	4.3	29.3	13.4	3.1	70.0	41.6
Arunachal Pradesh	5.0	30.2	21.4	3.8	53.8	28.7
Uttar Pradesh	2.7	27.2	12.3	5.8	70.4	53.5
Jharkhand	4.9	27.8	15.6	7.8	69.6	43.7
Tripura	7.9	48.8	26.4	7.8	80.9	62.7
Rajasthan	6.2	41.0	26.9	9.2	86.6	64.0
Madhya Pradesh	4.5	32.7	24.9	11.2	78.1	55.1
Uttarakhand	13.5	38.5	28.0	11.2	71.2	55.7
Assam	7.1	31.0	13.2	18.5	74.3	54.4
Haryana	12.0	48.9	39.6	18.9	84.7	66.7
Meghalaya	4.0	31.1	27.3	20.7	53.8	46.9
West Bengal	9.9	47.6	36.1	20.7	81.6	61.0
Chhattisgarh	5.5	41.6	20.9	20.9	78.0	62.7
Odisha	12.9	44.0	31.7	22.9	86.6	72.1
Jammu and Kashmir	13.4	56.5	44.5	25.9	87.6	74.0
Punjab	12.3	68.2	53.1	29.4	94.1	87.1
Gujarat	20.7	63.0	51.9	29.7	87.3	62.7
Maharashtra	15.0	68.8	57.0	29.9	91.1	78.1
Karnataka	25.4	69.7	56.5	31.1	93.9	64.7
Himachal Pradesh	15.0	47.9	35.7	31.4	78.9	70.3
Manipur	5.7	59.0	45.5	33.2	77.2	64.4
Mizoram	8.7	65.4	49.6	34.5	83.7	63.5
Delhi	27.2	64.1	50.2	37.2	86.7	61.4
Sikkim	21.2	53.7	44.9	40.2	97.1	73.3
Tamil Nadu	27.8	90.6	85.5	41.2	99.3	74.6
Andhra Pradesh	23.1	74.9	62.8	44.1	92.2	79.2
Goa	59.3	94.0	75.3	59.7	97.5	92.6
Kerala	76.8	99.4	84.7	71.4	100.0	89.1
India	**11.7**	**46.6**	**34.5**	**20.1**	**81.4**	**62.1**
Coefficient of variation (CV)	17.0	8.0	10.8	10.8	2.4	4.0
Total sample size (*N*)	34,950	51,555	36,850	185,046	25,9469	190,797

(JH), Rajasthan (R), Odisha (OR), Assam (AS), Gujrat (GJ), Chhattisgarh (CH), Punjab (PJ), Himachal Pradesh (HP), Jammu & Kashmir (JK), West Bengal (WB), Haryana (HR), Nagaland (NA), Goa (GO), Sikkim, Meghalaya (MG), Mizoram (MZ), Delhi (DL), Tripura (TR), Arunachal Pradesh (AR) and Manipur (MN).

Outcome variables

Three maternal health care outcome variables were considered: full antenatal care (ANC), presence of skilled birth attendants at birth (SBA) and postnatal care (PNC). 'Full ANC' was defined as a woman having four or more visits for ANC, having at least two tetanus injections and consuming 100 IFA (Iron and Folic Acid) tablets/syrup for their last birth. A woman had 'SBA' if her last delivery in the 5 years before the survey occurred in a medical institution or at home assisted by a skilled person (doctor/nurse/Lady Health Visitor (LHV)/Auxiliary Nurse Midwife (ANM)). A woman had 'PNC' if she had gone for a check-up at any health facility/doctor's surgery within 2 days of delivery for their last birth within the 5 years preceding each survey. The NFHS-3 and NFHS-4 asked women two questions about postnatal care: 'Did you have any check-up within 48 hours after delivery?' and 'How many days after delivery did the first check-up take place?' for their last birth.

The maternal health care indicators (full ANC, SBA and PNC) were calculated for all states for both rounds of the NFHS by socioeconomic variables.

Explanatory socioeconomic variables

The explanatory variables were: Wealth Index, place of residence (urban, rural), age of mothers (15–24, 25–34 and 35–49), birth order (1, 2, 3 and above), mother's education (no education, primary education, secondary education and higher education), caste (Scheduled Caste (SC), Scheduled Tribe (ST), Other Backward Caste (OBC) and Other) and religion (Hindu, Muslim, Other). In the absence of income and expenditure data, Wealth Index was used as a proxy indicator for household economic status. Both rounds of the NFHS provided Wealth Index in five categories, i.e. poorest, poorer, middle, richer, richest. To examine differentials in maternal health care utilization by wealth status, households belonging to the poorest and poorer quintiles were categorized as 'poor', and those belonging to the middle, richer and richest quintiles as 'non-poor'.

Statistical analysis

A concentration index (CI) was calculated from the Wealth Index and used to examine the extent of inequality in maternal health care utilization. The CI quantifies the income-related inequality in a health variable. The concentration curve is defined as twice the area between the concentration curve and the line of equality. This has been used frequently to measure health inequality (Liu *et al.*, 2014; Makate & Makate, 2017). The CI curve plots the cumulative percentage of the health outcome variable on the *y*-axis against the cumulative percentage of the sample population, ranked by socioeconomic status on the *x*-axis. The value of the CI varies between –1 and +1. If there is no socioeconomic-related inequality, the CI is zero. The index takes a positive value when it lies below the line of equality *a*, indicating the disproportionate concentration of the health variable among the rich, and vice versa.

Finally, using all-India data, Wagstaff decomposition analysis was used to quantify the extent of the relative contribution of explanatory variables to the inequality in maternal health care service use over time.

Decomposition of the concentration index

The CI measures the degree of income-related inequality in a health variable. It is computed as twice the covariance of the health variable and a population ranked by economic status, divided by the variable mean according to Equation (1). The value of the CI indicates the severity of socioeconomic inequality: the larger the CI, the higher the disparity.

$$C = \frac{2}{\mu} cov(y_i, R_i) \tag{1}$$

where C is the concentration index; y_i is outcome variable index; R is the fractional rank of individual i in the distribution of socioeconomic position; μ is the mean of the outcome variable of the sample and *cov* denotes the covariance.

The CI for full ANC, SBA and PNC measures the degree of inequality, which can be decomposed into the contribution of various determinants. The health CI can be decomposed into the contributions of each factor to income-related health inequality, in which each contribution is the product of the sensitivity of health concerning that factor and the degree of income-related inequality in that factor. Based on the linear regression relationship between the outcome variable y_i, the intercept α, the relative contribution of x_{ki} and the residual error ϵ_i, Equation (2) is given as:

$$y_i = \alpha + \sum \beta_k x_{ki} + \varepsilon_i \tag{2}$$

where ϵ_i is an error term. Given the relationship between y_i and x_{ki} in Equation (2), the concentration index for y (C) can be rewritten as:

$$C = \sum \left(\frac{\beta_k \overline{x}_k}{\mu} \right) C_k + \frac{GC_\varepsilon}{\mu} / \mu \tag{3}$$

where μ is the mean of y_i, $\overline{x}_k$ is the mean of x_k, β_k is the coefficient from a linear regression of outcome variables, C_k is the concentration index for x_k (defined analogously to C) and GC_ϵ is the generalized concentration index for the error term (ϵ_i).

Equation (2) shows that C is made up of two components. The first is a deterministic or 'explained' variable, equivalent to a weighted addition of the concentration indices of the regressors, where the weights are simply the elasticities. The second is a residual or 'unexplained' component which reflects the inequality in health that cannot be explained by systematic variation in x_k across socioeconomic groups (Wagstaff *et al.*, 2003; Hosseinpoor *et al.*, 2006; O'Donnell *et al.*, 2007).

The decomposition analysis determines how each explanatory factor contributes to inequality in maternal health care utilization. The contribution of each predictor depends on how wealth is distributed in society and how the distribution of wealth affects the utilization of maternal health services. The absolute contribution indicates the extent of inequality from each explanatory variable. A negative value of absolute contribution indicates that the predictor contributes to pro-poor inequality and vice versa. Hence, pro-rich inequality indicates that the wealthier are using more maternal health care than the poor. As the explanatory variables are categorized, the contribution of each variable is generated by summing up contributions of predictors within each category.

Results

Table 1 presents the utilization of full ANC, SBA and PNC in the states of India in 2005–06 and 2015–16. In India, full ANC increased from 12% in 2005–06 to 20% in 2015–16, while SAB increased from 47% to 81% over the same period. Postnatal care also increased – from 35% to 62% – over the decade. Though each of these three indicators showed improvement in many of the states of India, inter-state variation remained large. For instance, in 2015–16 the utilization of full ANC varied from 2.3% in Nagaland to 71.4% in Kerala; that for SBA ranged between 41.3% in Nagaland and 100% in Kerala; and that for PNC varied between 22.1% in Nagaland to 92.6% in Goa. Over the period 2005–06 to 2015–16, the coefficient of variation for full ANC declined from 17 to 10.8, SBA declined from 8 to 2.4 and PNC declined from 10.8 to 4.0, suggesting a reduction in inter-state variation in maternal care.

The utilization of full ANC was less than 10% in north-eastern states, i.e. Nagaland, Arunachal Pradesh and Tripura, and the Empowered Action Group (EAG) states, namely Bihar, Uttar

Pradesh, Jharkhand and Rajasthan. On the other hand, SBA showed an encouraging trend over time, with an improvement of about 35 percentage points. Nagaland, Arunachal Pradesh, Meghalaya and Jharkhand were the only states having less than 70% SBA utilization in 2015–16. Further, PNC coverage was also lower than 50% in the above states.

Table 2 presents the poor and non-poor differentials in the utilization of full ANC, SBA and PNC by the selected socio-demographic characteristics of women in India. Even though there was an increase in the use of maternal health care between 2005–06 and 2015–16, the gap between the poor and non-poor remained large for each independent variable. In 2005–06, only 1.7% of women in the poor category had availed full ANC compared with 14.4% of the non-poor. By 2015–16, only about 6% of poor women from the older cohort (35–49) reported full ANC compared with 30% among non-poor. The increase in full ANC was higher (in percentage points) among the non-poor than the poor. The pattern was similar for other independent variables such as birth order, educational attainment, caste and religion. In the case of SBA, the poor and non-poor differentials were of a lesser extent and narrowed over time. For example, among illiterate mothers, SBA was 20% among the poor and 41% among the non-poor in 2005–06. By 2015–16, the SBA among poor, illiterate mothers was 63% compared with 79% among illiterate, non-poor mothers. However, interestingly, there was not much variation in the utilization of SBA and PNC among poor women from different caste groups (except poor women from STs who had very low utilization). Even poor women from SCs had higher utilization of SBA and PNC than women from OBCs and General Castes in 2015–16. The pattern was similar to that of other characteristics. The pattern for PNC was similar to that of full ANC.

The gap in the utilization of maternal health care among poor and non-poor women had reduced over time. Interestingly, there was a large gap in maternal care utilization between poor and non-poor mothers with secondary and higher education in 2005–06, which in 2015–16 was more visible in women with no education. The gap in the utilization of maternal care between the poor and non-poor was higher in urban areas in 2005–06, but more in rural areas in 2015–16.

Figure 1 depicts the concentration index for the utilization of full ANC in the states of India in 2005–06 and 2015–16. The CI for full ANC for India declined from 0.49 in 2005–06 to 0.31 by 2015–16. The inequality in utilization of full ANC reduced over the period for all states except Nagaland. The CI was very low the southern states of Goa and Sikkim. Inequality in Arunachal Pradesh and Chhattisgarh reduced much faster compared with other states. The CI of most of the states varied between 0.10 and 0.30 in 2015–16 compared with 0.30 and 0.60 in 2005–06. Although Uttar Pradesh, Bihar, Jharkhand, Uttarakhand, Madhya Pradesh and Rajasthan showed some improvements in CI from 2005 to 2016, their level of inequality remained large.

Figure 2 plots the CI of SBA in the states of India for 2005–06 and 2015–16. The CI of SBA for India declined from 0.3 to 0.08 over this period. The figure also shows that inequality in the utilization of skilled attendants at birth reduced in most states. In the southern states the CI values were low, suggesting lower levels of inequality in SBA. Nagaland, Arunachal Pradesh and Meghalaya were the only states where the CI was high, suggesting high inequality.

Figure 3 presents the CI of postnatal care utilization in the states of India during 2005–16. Inequality in PNC decreased in all states except Nagaland. The CI of PNC for India declined from 0.36 to 0.18 over this period. The southern states improved much more compared with the northern states. The CI for most of the states in 2015–16 was lower than 0.20, whereas it was between 0.20 and 0.50 in 2005–06. Nagaland, Meghalaya and Arunachal Pradesh still had CI values of more than 0.20 in 2015–16.

Concentration curves (graphical presentations of inequality in the utilization) of full ANC, SBA and PNC for India for 2005–06 and 2015–16 are presented in Fig. 4a, Fig. 4b and Fig. 4c respectively. The figures suggest a reduction in inequality in full ANC, SAB and PNC during 2005–06 and 2015–16 in India. However, inequality in the utilization of SBA declined much faster compared with that of full ANC and PNC over time.

Table 2. Differentials in the utilization of full ANC, SAB and PNC by poor/non-poor status and by socioeconomic characteristics in India, 2005–16

Background variable	2005–06						2015–16					
	Full ANC		SBA		PNC		Full ANC		SBA		PNC	
	Poor	Non-poor	Poor	Non-poor	Poor	Non-poor	Poor	Non-poor	Poor	Non-poor	Poor	Non-poor
Place of residence												
Urban	5.5	24.0	38.2	78.8	24.6	63.5	14.1	32.1	75.2	92.4	52.6	74.2
Rural	3.3	15.0	24.3	57.1	14.3	41.4	9.4	25.0	70.4	89.8	48.5	71.3
Age												
15–24	4.0	15.9	31.9	65.3	18.4	48.4	11.7	26.1	77.2	91.7	53.5	72.7
25–34	3.4	21.9	21.5	68.2	13.5	54.2	9.4	29.5	69.3	90.8	48.0	72.8
35–49	1.7	14.4	15.6	56.9	9.1	43.7	5.6	30.0	56.6	88.7	38.2	71.8
Birth order												
1	5.1	26.1	41.5	78.7	24.5	62.2	13.9	32.0	81.3	94.3	58.3	76.9
2	5.7	21.0	30.2	68.6	21.2	56.8	12.0	29.5	73.0	91.3	52.8	73.3
3+	2.0	10.0	16.4	49.2	9.5	34.7	6.1	19.5	61.1	82.7	40.8	63.8
Educational status												
No education	2.0	5.7	20.0	40.7	11.0	26.6	5.9	14.7	62.5	78.6	41.2	59.3
Primary education	6.2	11.4	34.3	57.8	21.9	39.5	10.5	19.5	72.1	85.3	50.6	64.9
Secondary education	8.3	22.6	45.7	78.0	29.4	60.3	14.8	28.6	82.4	92.8	58.4	74.1
Higher education	23.3	44.0	58.3	96.3	57.3	82.5	16.8	39.5	89.3	96.7	65.3	79.8
Religion												
Hindu	3.7	19.4	26.9	67.2	16.2	51.3	10.2	28.4	73.3	91.9	51.1	73.0
Muslim	2.3	15.2	16.8	58.0	9.4	45.2	6.9	25.1	59.3	85.7	37.8	67.9
Other	3.0	22.4	26.2	77.8	14.7	63.4	15.0	35.9	64.7	94.3	47.5	81.1
Caste												
Schedule Caste	3.1	13.3	25.8	62.0	16.6	46.2	10.4	27.2	72.9	90.7	51.0	73.0
Schedule Tribe	3.6	10.5	17.0	53.6	11.8	38.0	11.9	25.4	66.2	87.0	48.4	68.6
OBC	3.3	19.2	27.4	63.7	15.1	48.9	8.1	28.2	71.5	90.7	48.4	71.8
Other	4.4	21.4	28.1	72.4	17.1	56.8	11.1	30.4	70.9	92.1	48.2	75.0
Total	3.4	18.9	25.2	66.2	15.0	51.1	9.8	28.3	70.8	91.0	48.3	72.7

Tables 3 and 4 present the marginal effects and decomposition analyses of full ANC, SBA and PNC in India for 2005–06 and 2015–16, respectively. The decomposition analyses present the contribution to inequality in the utilization of full ANC, SBA and PNC explained by predictor variables, namely place of residence, age, women's education, birth order, caste and religion. A positive marginal effect indicates that the explanatory factor has a positive association with a maternal health care outcome and indicates a higher likelihood of utilizing the health care service, and vice versa. The value of the absolute contribution indicates the extent of inequality contributed by the explanatory variable. For instance, urban women in both the rounds of the NFHS had
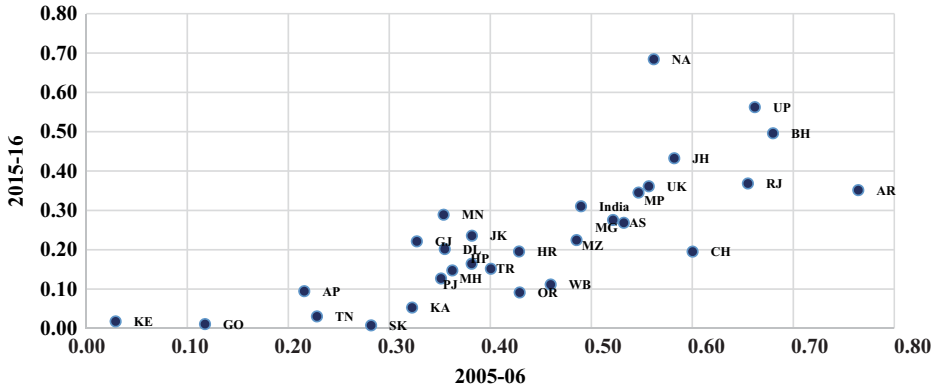
Figure 1. Scatterplot of CI for utilization of full antenatal care in India and its states between 2005–06 and 2015–16.
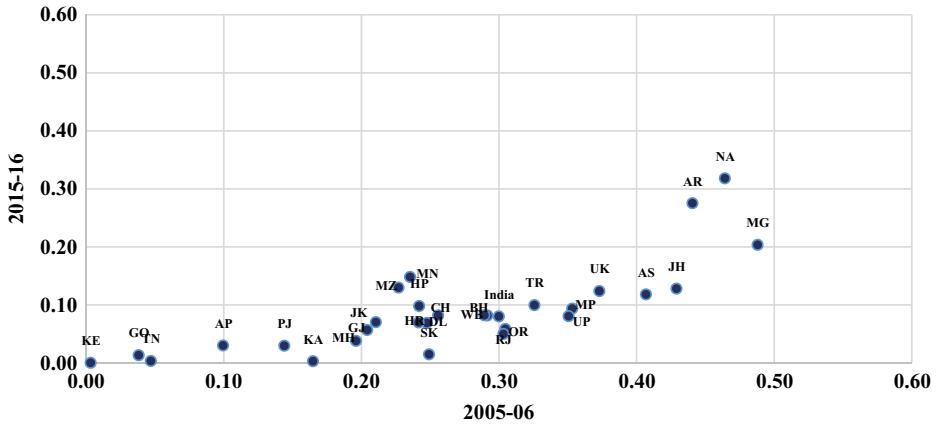

Figure 2. Scatterplot of CI for utilization of skilled attendants at birth in India and its states between 2005–06 and 2015–16.
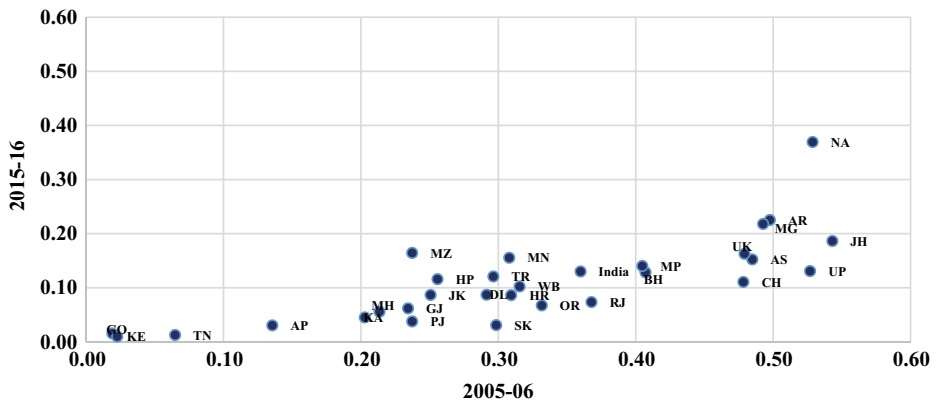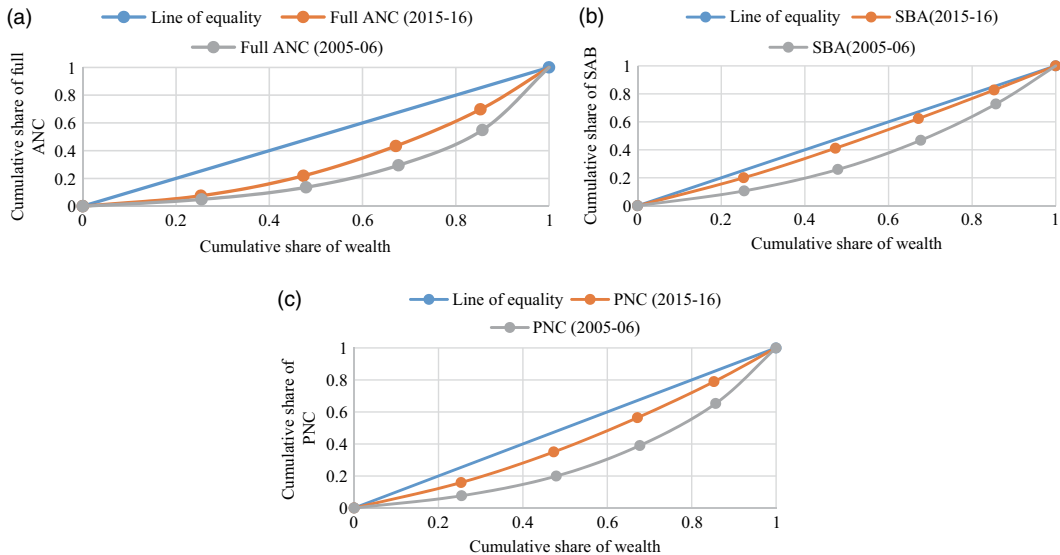

Figure 3. Scatterplot of CI for utilization of postnatal care in India and its states between 2005–06 and 2015–16.

Figure 4. Concentration curves for a) full antenatal care; b) skilled attendants at birth; c) postnatal care for India.

more propensity to utilize full ANC, SBA and PNC. A positive value of CI means that the respondents with the characteristic in question were highly represented among the rich, and vice versa. A positive value of the relative contribution indicates pro-rich inequality, which means that rich individuals used more health care services compared with poor individuals, and vice versa.

The findings suggest that urban residence, secondary and higher education and younger mothers positively contributed to inequality. Mothers living in urban areas, with secondary or higher education, had a higher probability of using maternal health services, which was disproportionally concentrated among rich women. Women from Scheduled Castes and Scheduled Tribes were less likely to use maternal health services than women from other castes, and were more concentrated among poor strata of the population, so their combined contribution to health care inequality was also positive.

Discussion

The utilization of skilled birth attendants in India increased from 47% in 2005–06 to 81% by 2015–16, and the share of women having home deliveries decreased. It is noteworthy that deliveries attended by midwives, ANM/nurses and LHVs increased from 10% to 25% over this period (IIPS & ICF, 2017). The study found that maternal health care utilization had improved in most of the states in India from 2005 to 2016. The increase in utilization of skilled birth attendants was also accompanied by a reduction in the inter-state inequality in this. Further, larger improvements were observed among lower socioeconomic groups and in EAG states. However, some state variations were striking. The utilization of skilled birth attendants remained relatively low in north-eastern states, namely Nagaland, Arunachal Pradesh, Tripura and Meghalaya, and in EAG states, namely Jharkhand, Bihar Uttar Pradesh and Rajasthan in 2015–16.

Compared with SBA, large inequality existed in the use of full ANC and PNC in 2015–16. In India, only a fifth of women were availing four or more ANC visits. However, the latest recommendation from WHO (2016b) is to have eight ANC visits. Among the three components of full ANC, consumption of 100 or more IFA tablets and four or more ANC visits was lower, as IIPS

Table 3. Estimates of marginal effects and decomposition analysis of inequality in the utilization of full ANC, SBA and PNC in India, 2005–06

Explanatory variable	CI	Full ANC		SBA		PNC	
		Marginal effect	Absolute contribution to CI	Marginal effect	Absolute contribution to CI	Marginal effect	Absolute contribution to CI
Urban	0.492	0.054***	0.027	0.206***	0.103	0.182***	0.091
Age (25–34)	0.040	0.058***	0.005	0.052***	0.004	0.075***	0.006
Age (35–49)	−0.174	0.048***	−0.003	0.045***	−0.003	0.068***	−0.004
Birth order (2)	0.116	−0.035***	−0.004	−0.098***	−0.012	−0.049***	−0.006
Birth order (3+)	−0.189	−0.091***	0.029	−0.224***	0.072	−0.184***	0.059
Primary education	−0.019	0.046***	−0.001	0.150***	−0.002	0.116***	−0.001
Secondary education	0.370	0.130***	0.060	0.321***	0.147	0.281***	0.129
Higher education	0.804	0.314***	0.050	0.430***	0.069	0.437***	0.070
Scheduled Caste	−0.153	−0.021**	0.003	−0.067***	0.009	−0.033***	0.004
Scheduled Tribe	−0.416	−0.019**	0.003	−0.159***	0.026	−0.089***	0.015
OBC	0.004	0.007	0.000	−0.025***	0.000	−0.014*	0.000
Hindu	−0.013	0.010	0.000	−0.061***	0.003	−0.057***	0.002
Muslim	0.005	0.003	0.000	−0.135***	0.000	−0.082***	0.000

***$p<0.001$; **$p<0.01$; *$p<0.05$.

and ICF (2017) reported only 30% of women took the recommended IFA tablets and 51% had four or more ANCs. Programmatic efforts could be made to increase these two components of full ANC.

As the NHM mainly focused on delivery care services, there was a large gap in the access to, and utilization of, full ANC services. This could be due to the cost of these services. Under the NHM, there is a conditional cash transfer scheme known as Janani Suraksha Yojana (JSY), in which cash incentives are offered to pregnant women if they opt for delivery in public or government-funded hospitals. This incentive has led to an increase in delivery care. Thus, higher achievement in the utilization of skilled birth attendants may be a result of this incentive under the JSY programme. However, this scheme has not significantly affected the utilization of full ANC and PNC services in India. It is suggested that a 48-hour stay in hospital is offered, free of charge, for delivery of other medical facilities, so that the costs could be covered during the postpartum period. It is essential that both mother and newborn receive crucial medical services free of charge, before and after delivery.

Even though inequality has reduced over time, there is still a significant gap in the utilization of full ANC and PNC services between poor and non-poor women. Women belonging to the upper strata of society tend to use more maternal health care services (Leone *et al.*, 2016; Memirie *et al.*, 2016). Despite improvement in coverage of maternal health care, inequality by wealth remains persistently high in India. This study's findings suggest that in 2005–06 the higher gaps between the poor and non-poor were in urban areas, among those with

Table 4. Estimates of marginal effects and decomposition analysis of inequality in the utilization of full ANC, SBA and PNC in India, 2015–16

Explanatory variable	Full ANC			SBA			PNC		
	CI	Marginal effect	Absolute contribution to CI	Marginal effect	Absolute contribution to CI		Marginal effect	Absolute contribution to CI	
Urban	0.460	0.085***	0.044	0.064***	0.033		0.070***	0.036	
Age (25–34)	0.036	0.044***	0.004	0.009***	0.001		0.032***	0.003	
Age (35–49)	−0.157	0.057***	−0.003	−0.019***	0.001		0.022**	−0.001	
Birth order (2)	0.069	−0.022***	−0.002	−0.041***	−0.004		−0.038***	−0.003	
Birth order (3+)	−0.244	−0.093***	0.027	−0.117***	0.034		−0.129***	0.037	
Primary education	−0.174	0.048***	−0.005	0.087***	−0.009		0.087***	−0.008	
Secondary education	0.183	0.125***	0.041	0.173***	0.058		0.180***	0.060	
Higher education	0.638	0.215***	0.058	0.200***	0.053		−0.020***	0.060	
Scheduled Caste	−0.13	−0.016**	0.002	−0.018***	0.002		−0.020***	0.002	
Scheduled Tribe	−0.359	−0.017**	0.003	−0.082***	0.013		−0.064***	0.010	
OBC	0.033	−0.011*	−0.001	−0.006	0.000		−0.015***	−0.001	
Hindu	−0.018	−0.063***	0.004	0.004	0.000		−0.051***	0.003	
Muslim	0.025	−0.081***	−0.001	−0.078***	−0.001		−0.121***	−0.002	

***$p<0.001$; **$p<0.01$; *$p<0.05$.

secondary and higher education, those belonging to the General Caste and those delivering their first child. Affiliation with a Scheduled Tribe or Scheduled Caste increased the odds of SBA and significantly reduced the likelihood of receiving maternal health care services (Prusty *et al.*, 2015; Dehury, 2016).

Women with higher education, and from urban areas, had a higher propensity to use maternal health care services than women with less or no education and rural residents. Furthermore, maternal care services were more concentrated in the upper-income strata of society. Therefore their combined effects on health care inequality were positive. These findings are similar to those of previous studies on health inequality (Liu *et al.*, 2014; Makate & Makate, 2017). Education can improve knowledge of the benefits of preventive health and awareness of health care services, enhance the ability of individuals to achieve better health by influencing their lifestyle, and increase the utilization of maternal health care services through improved knowledge, attitude and practice of maternal health care (Mezmur *et al.*, 2017; Gao *et al.*, 2017). The finding that age, caste and birth order were the main contributors to inequality in maternal health care utilization in India is consistent with those of earlier studies (Adhikari *et al.*, 2016). Women from SCs and STs had a lower propensity to use health care services and had higher concentration among the poor strata, therefore contributing positively to health care inequality. It is essential to understand that reducing wealth inequalities in the absence of other interventions cannot be an effective tool to reduce inequality in the utilization of maternal health care services. There is a need to tackle other social determinants also such as education, place of residence and caste (Sudha & Morrison, 2011; Nair & Panda, 2011; Rai *et al.*, 2012, Saxena *et al.*, 2013; Sanneving *et al.*, 2013).

In conclusion, the utilization of skilled birth attendants increased significantly more than that of full ANC and PNC over the study period. This improvement could be the result of the cash

incentive programme initiated under the NHM. Despite the progress made over the decade 2005–16, this study has shown a considerable gap in the utilization of maternal health care between poor and non-poor women in India. Inequality in utilization of maternal health care significantly reduced in most states of India over this period. Furthermore, inequality in the utilization of SBA reduced considerably more than that in ANC and PNC. There was a higher contribution of place of residence, education and caste to inequality in maternal health care service utilization. In other words, inequality in service utilization due to the wealth distribution among these socioeconomic groups reduced over the period 2005–16. However, the poor and non-poor gap in maternal care utilization was more prominent in rural areas and among uneducated women, with inequality within rural area and among uneducated classes increasing. This study recommends strengthening the current government programme to focus especially on poor women from low social status groups. Furthermore, a programme similar to JSY and JSSK should be implemented to increase full ANC and PNC utilization.

Author ORCIDs. (iD) Preeti Dhillon, 0000-0001-9757-6492

Conflicts of interest. The authors have no conflicts of interest to declare.

Ethical Approval. The authors assert that all procedures contributing to this work comply with the ethical standards of the National Family Health Survey. NFHS-4 was conducted under the scientific and administrative supervision of the International Institute for Population Sciences (IIPS), Mumbai, India, which is associated with the Ministry of Health and Family Welfare (MoHFW), Government of India (GOI). The institute conducted an independent ethical review of the NFHS protocol.

References

Adhikari T, Sahu D, Nair S, Saha KB, Sharma RK and Pandey A (2016) Factors associated with utilisation of antenatal care services among tribal women: a study of selected States. *Indian Journal of Medical Research* **144**(1), 58–66.

Ahmed S, Creanga AA, Gillespie DG and Tsui AO (2010) Economic status, education and empowerment: implications for maternal health service utilisation in developing countries. *PloS One* **5**(6), e11190.

Alkema L, Chou D, Hogan D, Zhang S, Moller AB, Gemmill A *et al.* (2016) Global, regional, and national levels and trends in maternal mortality between 1990 and 2015, with scenario-based projections to 2030: a systematic analysis by the UN Maternal Mortality Estimation Inter-Agency Group. *The Lancet* **387**(10017), 462–474.

Balarajan Y, Selvaraj S and Subramanian SV (2011) Health care and equity in India. *The Lancet* **377**(9764), 505–515.

Barros AJ, Ronsmans C, Axelson H, Loaiza E, Bertoldi AD, França GV *et al.* (2012) Equity in maternal, newborn, and child health interventions in Countdown to 2015: a retrospective review of survey data from 54 countries. *The Lancet* **379**(9822), 1225–1233.

Baru R, Acharya A, Acharya S, Kumar A S and Nagaraj K (2010) Inequities in access to health services in India: caste, class and region. *Economic and Political Weekly* **45**(38), 49–58.

Bhutta ZA, Ahmed T, Black RE, Cousens S, Dewey K, Giugliani E *et al.* (2008) What works? Interventions for maternal and child undernutrition and survival. *The Lancet* **371**(9610), 417–440.

Bhutta ZA, Chopra M, Axelson H, Berman P, Boerma T, Bryce J *et al.* (2010) Countdown to 2015-decade report (2000–10): taking stock of maternal, newborn, and child survival. *The Lancet* **375**(9730), 2032–2044.

Bonu S, Bhushan I, Rani M and Anderson I (2009) Incidence and correlates of 'catastrophic' maternal health care expenditure in India. *Health Policy and Planning* **24**(6), 445–456.

Cai J, Coyte PC and Zhao H (2017) Decomposing the causes of socioeconomic-related health inequality among urban and rural populations in China: a new decomposition approach. *International Journal for Equity in Health* **16**(1), 128.

Campbell OM, Graham WJ and **Lancet Maternal Survival Series Steering Group** (2006) Strategies for reducing maternal mortality: getting on with what works. *The Lancet* **368**(9543), 1284–1299.

Chopra M, Lawn JE, Sanders D, Barron P, Karim SSA, Bradshaw D *et al.* (2009) Achieving the health Millennium Development Goals for South Africa: challenges and priorities. *The Lancet* **374**(9694), 1023–1031.

Dehury RK (2016) Maternal health services in the tribal community of Balasore district, Odisha: challenges and implications. *BMJ Global Health* **1**, A3–A4.

Deshpande A (2000) Does caste still define disparity? *A look at inequality in Kerala, India. American Economic Review* **90**(2), 322–325.

Feng XL, Guo S, Hipgrave D, Zhu J, Zhang L and Song L *et al*. (2011) China's facility-based birth strategy and neonatal mortality: a population-based epidemiological study. *The Lancet* **378**(9801), 1493–1500.

Gao Y, Zhou H, Singh NS, Powell-Jackson T, Nash S, Yang M *et al*. (2017) Progress and challenges in maternal health in western China: a countdown to 2015 national case study. *The Lancet Global Health* **5**(5), e523–e536.

Ghosh A (2015) Inequality in maternal health-care services and safe delivery in eastern India. *WHO South-East Asia Journal of Public Health* **4**(1), 54–61.

Goland E, Hoa DTP and Målqvist M (2012) Inequity in maternal health care utilisation in Vietnam. *International Journal for Equity in Health* **11**(1), 24.

Goldie SJ, Sweet S, Carvalho N, Natchu UCM and Hu D (2010) Alternative strategies to reduce maternal mortality in India: a cost-effectiveness analysis. *PLoS Medicine* **7**(4), e1000264.

Hajizadeh M, Alam N and Nandi A (2014) Social inequalities in the utilisation of maternal care in Bangladesh: have they widened or narrowed in recent years? *International Journal for Equity in Health* **13**(1), 120.

Hosseinpoor AR, Doorslaer EV, Speybroeck N, Naghavi M, Mohammad K, Majdzadeh R *et al.* (2006) Decomposing socioeconomic inequality in infant mortality in Iran. *International Journal of Epidemiology* **35**(5), 1211–1219.

IIPS and ICF (2017) *National Family Health Survey (NFHS-4), 2015–16.* International Institute for Population Sciences, Mumbai, India.

IIPS and Macro International (2007) *National Family Health Survey (NFHS-3), 2005–06.* International Institute for Population Sciences, Mumbai, India.

Jat TR, Ng N and Sebastian MS (2011) Factors affecting the use of maternal health services in Madhya Pradesh state of India: a multilevel analysis. *International Journal for Equity in Health* **10**(1), 59.

Kamal N, Curtis S, Hasan MS and Jamil K (2016) Trends in equity in use of maternal health services in urban and rural Bangladesh. *International Journal for Equity in Health* **15**(1), 27.

Kumar A and Singh A (2015) Explaining the gap in the use of maternal healthcare services between social groups in India. *Journal of Public Health* **38**(4), 771–781.

Ladusingh L and Holendro Singh C (2007) Rich–poor gap in maternal care: the case of northeast India. *Asian Population Studies* **3**(1), 79–94.

Leone T, Cetorelli V, Neal S and Matthews Z (2016) Financial accessibility and user fee reforms for maternal healthcare in five sub-Saharan countries: a quasi-experimental analysis. *BMJ Open* **6**(1), e009692.

Li C, Zeng L, Dibley, MJ, Wang D, Pei L and Yan H (2015) Evaluation of socio-economic inequalities in the use of maternal health services in rural western China. *Public Health* **129**(9), 1251–1257.

Lim SS, Dandona L, Hoisington JA, James SL, Hogan MC and Gakidou E (2010) India's Janani Suraksha Yojana, a conditional cash transfer programme to increase births in health facilities: an impact evaluation. *The Lancet* **375**(9730), 2009–2023.

Liu X, Gao W and Yan H (2014) Measuring and decomposing the inequality of maternal health services utilisation in Western Rural China. *BMC Health Services Research* **14**(1), 102.

Lozano R, Wang H, Foreman KJ, Rajaratnam JK, Naghavi M, Marcus JR *et al*. (2011) Progress towards Millennium Development Goals 4 and 5 on maternal and child mortality: an updated systematic analysis. *The Lancet* **378**(9797), 1139–1165.

Magadi MA, Zulu EM and Brockerhoff M (2003) The inequality of maternal health care in urban sub-Saharan Africa in the 1990s. *Population Studies* **57**(3), 347–366.

Makate M and Makate C (2017) The evolution of socioeconomic status-related inequalities in maternal health care utilisation: evidence from Zimbabwe, 1994–2011. *Global Health Research and Policy* **2**(1), 1.

Marmot M, Friel S, Bell R, Houweling TA, Taylor S and **Commission on Social Determinants of Health** (2008) Closing the gap in a generation: health equity through action on the social determinants of health. *The Lancet* **372**(9650), 1661–1669.

Marten R, McIntyre D, Travassos C, Shishkin S, Longde W, Reddy S and Vega J (2014) An assessment of progress towards universal health coverage in Brazil, Russia, India, China, and South Africa (BRICS). *The Lancet* **384**(9960), 2164–2171.

Memirie ST, Verguet S, Norheim OF, Levin C and Johansson KA (2016) Inequalities in utilisation of maternal and child health services in Ethiopia: the role of primary health care. *BMC Health Services Research* **16**(1), 51.

Mezmur M, Navaneetham K, Letamo G and Bariagaber H (2017) Socioeconomic inequalities in the uptake of maternal healthcare services in Ethiopia. *BMC Health Services Research* **17**(1), 367.

Mohanty SK and Kastor A (2017) Out-of-pocket expenditure and catastrophic health spending on maternal care in public and private health centres in India: a comparative study of pre and post national health mission period. *Health Economics Review* **7**(1), 31.

Mohanty SK and Pathak PK (2009) Rich–poor gap in utilisation of reproductive and child health services in India, 1992–2005. *Journal of Biosocial Science* **41**(3), 381–398.

Nair H and Panda R (2011) Quality of maternal healthcare in India: has the National Rural Health Mission made a difference? *Journal of Global Health* **1**(1), 79.

Norheim OF, Jha P, Admasu K, Godal T, Hum R J et al. (2015) Avoiding 40% of the premature deaths in each country, 2010–30: review of national mortality trends to help quantify the UN Sustainable Development Goal for health. *The Lancet* **385**(9964), 239–252.

O'Donnell O, Doorslaer EV, Wagstaff A and Lindelow M. (2007) *Analyzing Health Equity Using Household Survey Data: A Guide to Techniques and their Implementation.* World Bank, Washington, DC.

Pallikadavath S, Foss M and Stones RW (2004) Antenatal care: provision and inequality in rural north India. *Social Science & Medicine* **59**(6), 1147–1158.

Pathak PK, Singh A and Subramanian SV (2010) Economic inequalities in maternal health care: prenatal care and skilled birth attendance in India, 1992–2006. *PloS One* **5**(10), e13593.

Prusty RK, Gouda J and Pradhan MR (2015) Inequality in the utilisation of maternal healthcare services in Odisha, India. *International Journal of Population Research*, article ID 531485.

Rai RK, Singh PK and Singh L (2012) Utilisation of maternal health care services among married adolescent women: insights from the Nigeria Demographic and Health Survey, 2008. *Women's Health Issues* **22**(4), e407–e414.

Randive B, Diwan V and Costa AD (2013) India's Conditional Cash Transfer Programme (the JSY) to promote institutional birth: is there an association between institutional birth proportion and maternal mortality? *PloS One* **8**(6), e67452.

RGI (2018) *Special Bulletin on Maternal Mortality in India 2014–16.* Sample Registration System (SRS), Office of Registrar General, India. URL: http://www.censusindia.gov.in/2011-common/Sample_Registration_System.html

Sanneving L, Trygg N, Saxena D, Mavalankar D and Thomsen S (2013) Inequity in India: the case of maternal and reproductive health. *Global Health Action* **6**(1), 19145.

Saxena D, Vangani R, Mavalankar D and Thomsen S (2013) Inequity in maternal health care service utilisation in Gujarat: analyses of district-level health survey data. *Global Health Action* **6**(1), 19652.

Say L and Raine R (2007). A systematic review of inequalities in the use of maternal health care in developing countries: examining the scale of the problem and the importance of context. *Bulletin of the World Health Organization* **85**, 812–819.

Singh PK, Rai RK, Alagarajan M and Singh L (2012). Determinants of maternity care services utilisation among married adolescents in rural India. *PloS One* **7**(2), e31666.

Sudha S and Morrison S (2011) Marital violence and women's reproductive health care in Uttar Pradesh, India. *Women's Health Issues* **21**(3), 214–221.

Wagstaff A, Doorslaer EV and Watanabe N (2003) On decomposing the causes of health sector inequalities with an application to malnutrition inequalities in Vietnam. *Journal of Econometrics* **112**(1), 207–223.

WHO (2016a) *World Health Statistics 2016: Monitoring Health for the SDGS Sustainable Development Goals.* World Health Organization, Geneva. URL: https://www.who.int/gho/publications/world_health_statistics/2016/en/

WHO (2016b) *WHO Recommendations on Antenatal Care for a Positive Pregnancy Experience.* World Health Organization, Geneva. URL: https://www.who.int/reproductivehealth/publications/maternal_perinatal_health/anc-positive-pregnancy-experience/en/

Yaya S, Bishwajit G and Shah V (2016) Wealth, education and urban–rural inequality and maternal healthcare service usage in Malawi. *BMJ Global Health* **1**(2), e000085.