RESEARCH ARTICLE

Decomposing the Socio-economic Inequalities in Utilization of Full Antenatal Care in Jharkhand State, India

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Abstract: It is widely evidenced that low socio-economic status is significantly associated with poor health, but inequalities caused by social and economic factors are poorly quantified. This paper attempts to measure contributions of selected factors to the differences in full antenatal care (ANC) utilization in the state of Jharkhand, India, based on the third wave of District Level Household and Facility Survey (DLHS-3) data in 2007–2008. Full ANC is defined as having a minimum of three antenatal visits, at least two tetanus toxoid injections and receiving folic acid tablets for at least 90 days or more during the last pregnancy. Multivariate and decomposition statistical techniques were employed to examine the factors associated with utilization of ANC services and their contributions to inequalities in utilization. Results show that the factors with the largest contribution to utilization of ANC services were poor economic status of women (37.53%), mass media exposure (30.71%), and residence in a rural area (15.56%). The relative contributions of region, mothers' education, age, and birth order of the women in generating inequalities were small. Therefore, to improve maternal health and to reduce socio-economic gaps in the state, more focus is needed on vulnerable sections of society and regions where the effects of government health programs hardly reach.

Keywords: socio-economic inequality, decomposition, antenatal care, Jharkhand, DLHS, India

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1. Introduction

Antenatal care (ANC) is one of the essential components of maternal health; its contribution to addressing the problem of maternal mortality and morbidity has been widely recognized (Oyerinde, 2013). Global estimates show that maternal deaths mostly occur due to complication during pregnancy (WHO/UNICEF/UNFPA/The World Bank, 2007) such as haemorrhage, sepsis, unsafe induced abortion, a hypertensive disorder of pregnancy, or an obstructed labour (WHO, 2005). More recent estimates also demonstrate that about 830 women die from pregnancy or childbirth-related complications around the world every day. By the end of 2015, roughly 303,000 women died during and following pregnancy and child birth. Almost all of these deaths occurred in low-resource settings,

and most of them could have been prevented (WHO, 2015) with a proper and timely utilization of ANC services and medically-assisted delivery (Adam, Lim, Mehta *et al*., 2005). Some studies have examined the effectiveness of ANC in achieving improved maternal and child health. They concluded that antenatal visits have multiple positive implications such as early detection of pregnancy complications and anaemia, delivery at a medical institution, increased use of contraceptive, and consequently a decline in infant and maternal mortality rate (Adam, Lim, Mehta *et al*., 2005; Campbell and Graham, 2006; Choi and Lee, 2006; Hollowell, Oakle, Kurinczuk *et al*., 2011; Mishra and Retherford, 2006; Navaneetham and Dharmalingam, 2002; Wehby, Murray, Castilla *et al*., 2009).

India continues to have a high maternal mortality rate despite its strong economic growth and advancement in science, technology, and medicine (Pathak, Singh, and Subramanian, 2010). It contributes to 20% of global maternal deaths (Mavalankar, Vora, and Prakasamma, 2008). These estimates clearly show that India is likely to continue to play a significant role in achieving global development goals, in particular, the United Nations Sustainable Development Goals (United Nations, 2015). However, vast socio-economic inequalities, poor health services, political unwillingness, and cultural constraints have posed significant challenges to achieving low maternal mortality rate (Navaneetham and Dharmalingam, 2002; Pallikadavath, Foss, and Stones, 2004a; Ram and Singh, 2006; Sunil, Rajaram, and Zottarelli, 2006). Also, the socio-economic disparities are more pervasive in economically poor states of India such as Jharkhand (Singh and Chaturvedi, 2015), which has a high maternal mortality ratio of 261 compared to the national average of 212 per 100,000 births in 2009 (Ogala, Avan, Roy *et al.,* 2012). ANC services are not uniformly available and accessible to most of the population in the state according to estimates from DLHS-3 (2007–2008), which shows that the utilization of ANC services is significantly lower among scheduled castes, scheduled tribes, Muslims, and the economically poor and in rural areas. Therefore, to ameliorate the maternal health conditions in the state, in-depth research is needed to identify factors that affect maternal health and to quantify their relative contributions so that the socially and economically vulnerable persons could be targeted.

A number of studies previously have examined factors causing inequalities in maternal health (Obiyan and Kumar, 2015; Singh, Kumar, Rai *et al*., 2014; Tsawe, Moto, Netshivhera *et al*., 2015). However, to the best of our knowledge, none of the studies in the existing literature have decomposed the contribution of socio-economic factors in full ANC utilization in Jharkhand state. Therefore, this paper attempts to fill this research gap and aims to examine the associations between socio-economic factors and full ANC utilization as well as their relative contributions towards generating inequalities.

2. Materials and Methods

2.1 Data

This paper used the third wave of the District Level Household and Facility Survey (DLHS-3) data, conducted in India during 2007–2008. The survey covered 601 districts from 34 states and union territories of India. In Jharkhand state (see Figure 1), DLHS-3 survey covered 26,886 ever-married women (aged 15–49) using a multi-stage stratified sampling design. In the first stage, 50 primary sampling units (PSUs), which are census villages in rural areas and wards in urban areas, were selected from each district by using a systematic probability proportional to size (PPS) sampling method. In the second stage, circular systematic sampling was used to select the required number of households from the villages. Among the ever-married women, 11,373 women had their last live/still birth and 1,035 of them used full ANC services.
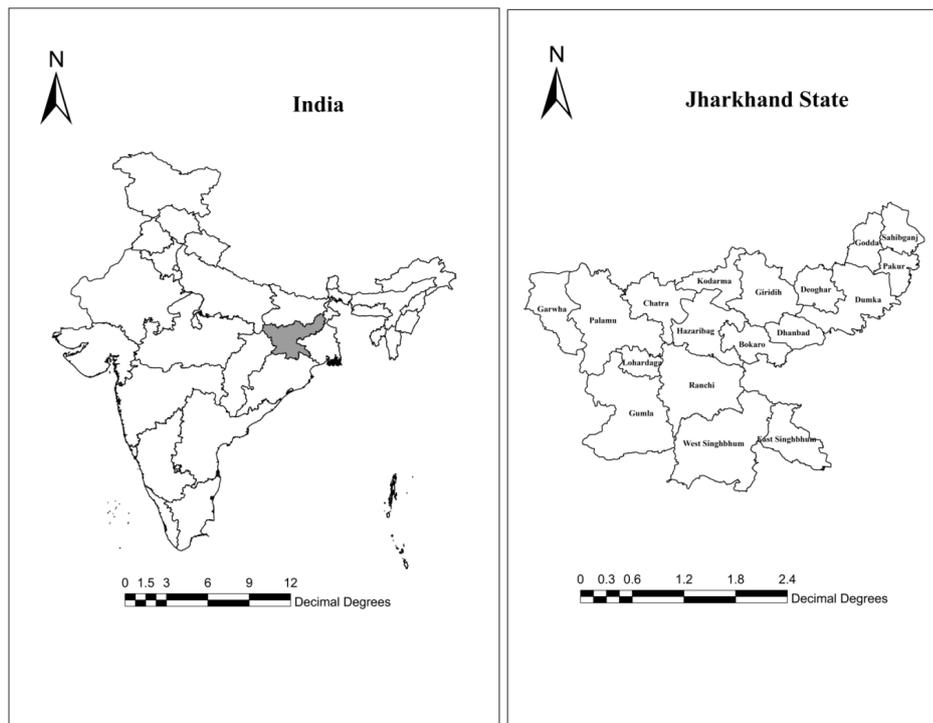
Figure 1. Location of the study area

2.2 Outcome Measurement

Full ANC is one of the most important indicators of maternal health care utilization according to the guidelines developed by the Ministry of Health and Family Welfare (2010) and the WHO (2006). The provision of all components of full ANC services to pregnant women is also an integral part of the Reproductive and Child Health Program in India (Singh, Rai, Alagrajan *et al*., 2012). In this paper, full ANC is defined as having a minimum of three antenatal visits, at least two tetanus toxoid injections, and receiving folic acid tablets for at least 90 days or more during the last pregnancy. It is a binary variable, *i.e*., 0 represents women who either did not receive any ANC service or received partial ANC service, and 1 represents women who received full ANC services during their last pregnancy.

2.3 Predictor Variables

Several studies reported that economic status (Pathak, Singh, and Subramanian, 2010), caste (Mukherjee, Haddad, and Narayana, 2011), mother's education level (Jat, Ng, and Sebastian, 2011), gender, mother's age (Kusuma, Kumari, Pandav *et al*., 2010), and social structure (Sanneving, Trygg, Saxena *et al*., 2013) were important factors which influenced the maternal health. Based on some of these studies, socio-economic and demographic variables such as caste, religion, place of residence, the age of mother, education, marital status, age at first birth, birth order, sex of the child, mass media exposure, wealth quintiles and districts of the state were included as the predictor variables in the study. These selected variables were further categorized on the basis of DLHS-3 report for Jharkhand (International Institute for Population Sciences, 2007–2008). Social groups were classified into Scheduled Castes (SCs), Scheduled Tribes (STs), Other Backward Classes (OBC), and others (SCs and STs are referred to as such because a list of castes and groups were drawn and enumerated in separate schedules of the Indian Constitution). The religion of the mother included Hindu, Muslim, Christian, and others. The place of residence was grouped into rural and urban. Ages of the women were categorized as 15–24 years, 25–34 years, and 35–49 years old. The education status of women

was classified into primary, secondary, and above secondary completion. The marital status of mothers was grouped into currently married and others (married but *Gauna* not performed, separated, deserted, divorced and widowed). Ages of the women at first birth were grouped into less than 20 years and above 20 years old. Birth order of the women ranged from 1 to 4 or higher. The sex of the child included boy and girl. The mass media exposure was categorized as 'no mass media exposure' and 'any mass media exposure' (included those sources from which women received information about full ANC such as watching the TV, listening to the radio and reading the newspapers). Household wealth index was calculated by combining household amenities, assets, and durables using factor analysis (Rutstein and Johnson, 2004). Region was measured by district, namely Garhwa, Palamu, Chatra, Hazaribagh, Kodarma, Giridih, Deoghar, Godda, Sahibganj, Pakur, Dumka, Dhanbad, Bokaro, Ranchi, Lohardaga, Gumla, western Singhbhum, eastern Singhbhum, Simdega, Seraikella, Latehar and Jamatara.

2.4 Analytical Approach

The analytical approach considers that inequalities in maternal health care utilization are mainly caused by socio-economic differences among the population (Obiyan and Kumar, 2015; Singh, Kumar, Rai *et al.,* 2014; Tsawe, Moto, Netshivhera *et al*., 2015). These socio-economic differences are also considered to influence full ANC utilization in Jharkhand state. Therefore, concentration index, proposed by Wagstaff and colleagues (1991), was calculated to estimate the socio-economic inequality in full ANC utilization. It was also decomposed to quantify the factors which led to such disparities. The decomposition analysis evaluated the proportional contribution of each factor in generating imbalances. Decomposition and other estimates were computed using STATA version 12 (StataCrop LP, College Station, Texas 77845, USA).

2.4.1 Concentration Index

Concentration curve is generally used to identify the socio-economic inequality in a health variable. It examines whether inequality exists in one group or not. However, it does not estimate the magnitude of inequality (O'Donnell, VanDoorslaer, Wagstaff *et al*., 2008). Therefore, in this paper, a concentration index is used as a method to measure the degree of socio-economic inequality in the utilization of full ANC services. It can be computed as twice the area between the concentration curve and the line of equality (the 45-degree line). The zero value of the concentration index indicates that there is no socio-economic inequality. A negative value means the disproportionate concentration of full ANC among the poor group while a positive value indicates the concentration of full ANC among the rich group (Szabo, Hajra, Baschieri *et al*., 2016; Wagstaff, Paci, and VanDoorslaer, 1991).

The index value lies between –1 and 1. For measuring the socio-economic inequality in full ANC care, the concentration index (*C*) can be obtained by using the following formula:

$$C = \frac{2}{N\mu}\sum_{i=1}^{n}h_i r_i - 1 - \frac{1}{N} \tag{1}$$

where h_i denotes the health sector variable, μ is its mean and $r_i = i/N$ is the fractional rank of individual in the socio-economic distribution with $i = 1$ for the poorest and $i = N$ for the richest. A more convenient formula for the concentration index is given in equation (2) which defines concentration index in terms of covariance between health variable and a fractional rank in socio-economic distribution (Kakwani, Wagstaff, and VanDoorslaer, 1997; Van Doorslaer and Koolman, 2004).

$$C = \frac{2}{\mu}cov_w(y_i\ r_i) \tag{2}$$

where y_i and r_i are respectively the health status of the ith individual and the fractional rank of the ith individual (for weighted data) regarding the index of household economic status; μ is the (weighted) mean of the health variable in the sample and cov_w denotes the weighted covariance.

2.4.2 Decomposition of Concentration Index

The method proposed by Wagstaff and colleagues (1991) is used to decompose the socio-economic inequality in full ANC utilization. This method has also been used by other scholars in identifying the contributing factors in maternal health (Goli, Doshi, and Perianayagam, 2013; Hosseinpoor, VanDoorslaer, Speybroeck *et al.*, 2006). A decomposition method has an advantage over linear and non-linear regression models as it allows one to estimate the relative contribution of factors to inequality in a health variable (*e.g.*, the gap between poor and rich). For a linear additive regression model; the full ANC utilization variable Y_i is presented in terms of the intercept α, the relative contribution of X_{ki} factors and residual error term ε_i in equation (3) below.

$$Y_i = \alpha + \sum_k \beta_k X_{ki} + \varepsilon_i. \tag{3}$$

Based on equation (3), the concentration index Y_i, C, can be written as equation (4).

$$C = \sum_k \left(\frac{\beta_k \bar{X}_k}{\mu} \right) C_k + \frac{GC_\varepsilon}{\mu}. \tag{4}$$

Equation (4) shows that overall inequality in utilization of full ANC has two components, *i.e.*, deterministic or "explained" and "unexplained". In equation (4), the quantity β_k denotes the regression coefficient of full ANC utilization variable on determinant k, $\bar{X}_k$ is the mean of the determinant k, μ is the mean of full ANC utilization index; C_k is the concentration index for determinant k and GC_ε denotes the generalised concentration index for the error term.

The explained component in equation (4) is equal to a weighted sum of the concentration indices of the regressors where the weights are simply the elasticities (elasticity is a unit-free measure of (partial) association, *i.e.* the percentage change in the dependent variable associated with a percentage change in the explanatory variable). However, the unexplained component reflects inequality in full ANC utilization across socio-economic groups which cannot be explained by the selected predictors (Hosseinpoor, VanDoorslaer, Speybroeck *et al.,* 2006).

3. Results

Table 1 presents percentage distribution of married women who received full ANC services during their last pregnancy by their background characteristics. Findings show that the utilization of full ANC services was significantly low in Jharkhand as only 9% of women utilized these services, compared to 18.8% for India as a whole in the same period. In fact, the utilization of full ANC services also varied across various socio-economic groups. For example, about 19% of married women in other social group received full ANC services as compared to 7% in SC and 6% in ST. Similarly, 10% of Hindu and 27% of urban women utilized full ANC services. With an increase in the education, age at first birth, and income level, utilization of ANC services also increased. Additionally, utilization of full ANC services decreased with increase in number of parity. Knowledge and awareness about antenatal check-ups increased utilization of full ANC services. For instance, 24% of married women who had any mass media exposure received full ANC services as compared to 6% among those who were not exposed to any media. Regional variations were also found with very low utilization of full ANC services among women from the northwest of the State.

Results from the multivariate analysis (Table 2) show that factors such as religion, education level, age at first birth, birth order, sex of the child, exposure to mass media, economic status, and region were statistically significant with the utilization of full ANC. The women belonging to Muslim religion were 27% less likely (odds ratio: 0.73, 95% CI: 0.54–1.00) to utilize full ANC services compared to the Hindu women. The probability of full ANC utilization also increased among women

Table 1. Percentage distribution of women (aged 15–49) who had received full antenatal care by background characteristics, Jharkhand, India, 2007-2008

Background Characteristics	%	Number (n)	Background Characteristics	%	Number (n)
Total	100.00	1,035	Girl	9.15	499
Social Group			**Mass media exposure**		
SCs	6.73	113	No exposure	5.72	537
STs	6.20	254	Any exposure	23.97	498
OBCs	10.19	474	**Wealth quintiles**		
Others	18.96	189	Poorest	4.02	209
Religion			Poor	7.08	234
Hindu	10.23	761	Middle	12.77	182
Muslim	6.72	93	Rich	17.78	164
Christians	8.49	58	Richest	40.47	244
Other	6.29	122	**Districts**		
Place of residence			Garhwa	2.88	15
Rural	7.16	744	Palamu	5.41	36
Urban	27.00	290	Chatra	6.32	39
Age			Hazaribagh	8.82	38
15–24	9.90	428	Kodarma	9.20	52
25–34	9.28	539	Giridih	10.79	75
35–49	5.04	67	Deoghar	7.62	41
Education			Godda	7.91	43
Primary	8.24	113	Sahibganj	4.16	21
Secondary	18.02	415	Pakur	2.88	17
Above secondary	41.21	197	Dumka	6.06	32
Marital status			Dhanbad	16.85	57
Others	7.70	7	Bokaro	16.27	71
Currently married	9.03	1,027	Ranchi	11.58	38
Age at first birth			Lohardaga	8.83	40
<20	6.81	416	Gumla	6.48	36
20+	11.55	615	Western Singhbhum	14.00	75
Birth order			Eastern Singhbhum	21.22	54
1	13.25	394	Simdega	9.24	50
2	11.06	297	Seraikella	19.05	76
3	7.76	168	Latehar	6.17	43
4+	4.74	169	Jamtara	13.09	74
Sex of the child			**Jharkhand**	9.02	1,035
Boy	8.91	535			

Note: (1) SCs: Scheduled castes; STs, Scheduled tribes; OBCs, other backward classes.(2) Because of missing values, the sum of all categories of some variables does not add to total.(3) All 'n' values are unweighted
Source: Computed from DLHS-3 data.

with an increase in their educational level. For instance, women having above secondary schooling were 1.67 times more likely (odds ratio: 2.67; 95% CI: 1.93–3.69) to utilize full ANC services than those who had primary education. Similarly, older women at the time of their first birth were 23% more likely (odds ratio: 1.23; 95% CI: 1.00–1.52) to utilize full ANC services than the younger age women. Furthermore, parity of the mothers also affected the full ANC utilization as the probability

Table 2. Odd ratio and 95% confidence interval (CI) for receiving full antenatal care among married women in Jharkhand, India, 2007–2008

Predictor Variables	Odds Ratio	95% CI	Predictor Variables	Odds Ratio	95% CI
Social Groups			**Age at first birth**		
SC[a]	1.00	–	<20[a]	1.00	–
ST	1.16	0.76–1.76	20+	1.23**	1.00–1.52
OBC	0.96	0.71–1.29	**Birth orders**		
Other	1.05	0.75–1.48	1[a]	1.00	–
Religion			2	0.90	0.73–1.13
Hindu[a]	1.00	–	3	0.70**	0.53–0.94
Muslim	0.73[+]	0.54–1.00	4+	0.57***	0.40–0.81
Christians	0.87	0.54–1.42	**Sex of the child**		
Other	0.72	0.48–1.09	Boy[a]	1.00	–
Place of residence			Girl	1.15[+]	0.97–1.38
Rural[a]	1.00	–	**Mass media exposure**		
Urban	1.04	0.79–1.37	No exposure[a]	1.00	–
Age of the women			Any exposure	1.65***	1.35–2.04
15–25[a]	1.00	–	**Wealth quintiles**		
25–34	1.16	0.92–1.45	Poorest[a]	1.00	–
35–49	1.13	0.67–1.92	Poor	1.56***	1.14–2.17
Women education			Middle	2.06***	1.47–2.91
Primary[a]	1.00	–	Rich	1.97***	1.36–2.87
Secondary	1.62***	1.28–2.07	Richest	3.66***	2.41–5.58
Above secondary	2.67***	1.93–3.69	**−2 log likelihood (−2 LL) = 3338.43**		

Note: (1) SCs: Scheduled castes; STs, Scheduled tribes; OBCs, other backward classes.(2) The odds ratios are based on binary logistic regression model. The model is adjusted for all variables in the table including marital status and district variables. (3)[a] Reference category. (4)+p<0.1; *p<0.05; **p<0.01;***p<0.001.
Source: Computed from DLHS-3 data.

of utilization of full ANC service declined with an increasing birth order. Women with any mass media exposure were 65% more likely (odds ratio: 1.65; 95% CI: 1.35–2.04) to use full ANC services than those who had no exposure to any mass media. Economic status of the women was the most important determinant of the utilization of full ANC services. It was estimated that as the economic status improved, the probability of using antenatal services also increased. Women from the richest wealth quintile were 2.66 times more likely (odds ratio: 3.66; 95% CI: 2.41–5.58) to utilize full ANC as compared to the women of the poorest wealth quintile.

The predicted probabilities obtained from binary logistic regression models also showed associations between socio-economic factors and utilization of full ANC services. Figures 2 and 3 illustrate the adjusted predicted probability of using full ANC services among women across their background
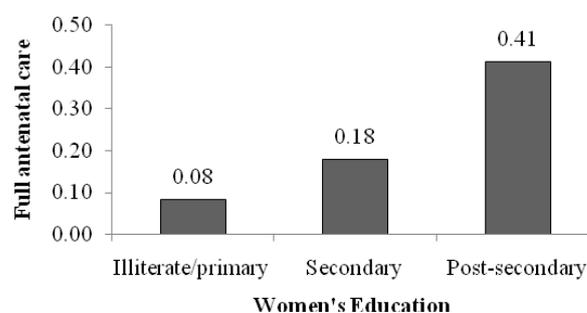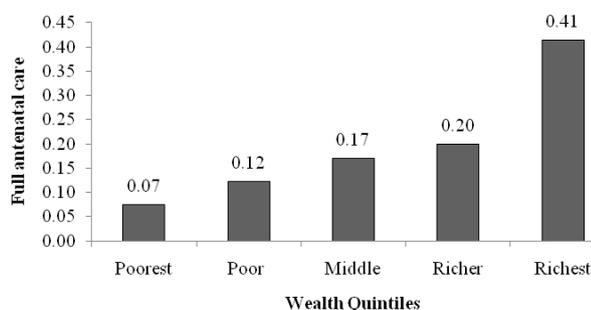
Note: The predicted probability is adjusted for all variables listed in Table 1.
Figure 2. Predicted probability of full antenatal care utilization among women of different wealth quintile groups in Jharkhand, India

Note: The predicted probability is adjusted for all variables listed in Table 1.
Figure 3. Predicted probability of full antenatal care utilization among women by their educational status in Jharkhand, India

characteristics. Figure 2 indicates that the predicted probability of using full ANC services increased with an increase in the economic status of women. For example, the probability of full ANC utilization among women from the richest wealth quintiles was the highest (0.41) compared to the women from the poorest quintiles (0.07). A similar gradient pattern was found for education, with the probability of full ANC utilization highest among women who had post-secondary education (0.41), followed by those who had secondary education (0.18) and those who had primary or had no formal education (0.08) (Figure 3).

Table 3 presents results for decomposing the concentration index for ANC inequality. Decomposition analysis shows that the estimated value of the relative contribution to the concentration index was negative in some selected socio-economic factors such as poor economic status (concentration index= −0.10), SC/ST social groups (concentration index= −0.01), Hindu religion (concentration index= −0.01), and residence in rural area (concentration index = −0.04). Therefore, it reflected that weaker socio-economic groups in Jharkhand were more disadvantaged in accessing full ANC services. An example of the concentration index is presented in Figure 4, which describes the concentration index of full ANC utilization among women in Jharkhand according to their wealth quintiles. It shows that the concentration curve lies above the line of equality, which indicates a disproportionate concentration of utilization of full ANC among the poor.
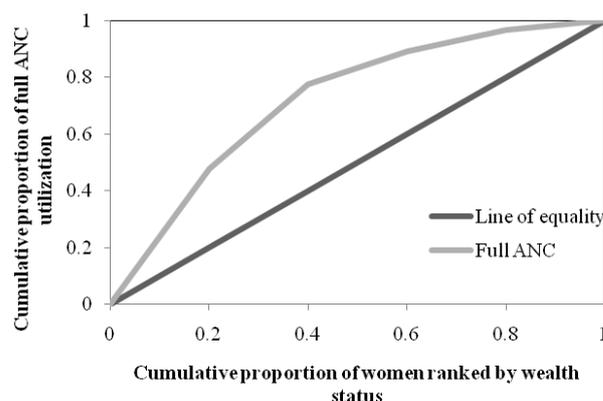

Figure 4. Concentration curve for full antenatal care utilization by economic status of Women in Jharkhand, India

The results of the decomposition analysis also indicate that the largest relative contribution to full ANC utilization inequality was due to the economic status of the women (37.5%) followed by exposure to mass media (30.7%) and place of residence (15.5%). The residual in decomposition analysis was very small (−0.33), implying that factors considered in the analysis explained most of the inequalities. SC/ST and Hindu religious groups contributed 5.4% and 2.7%, respectively, to inequality in full ANC utilization. The first birth order and the four birth orders or higher contributed 1.7% and 2.7% to inequality, respectively. Some of the districts such as Sahibganj (1.3%), Pakur (2.02 %) and Saraikella (1.1%) also contributed to inequality. Overall, results suggest that the inequality in utilization of full ANC was more concentrated among the poor, those not exposed to mass media, those who resided in rural areas, those who belonged to SC/ST social groups, and those from Hindu religion.

4. Discussion

Notwithstanding the significant progress achieved in reducing maternal mortality, India's commitment to attainment of low maternal mortality rate goal is still doubtful. Besides, there has also been a great concern of socio-economic inequalities persistent in India, of which the major burden is borne by the poor and other vulnerable populations in the society. Despite the fact that Jharkhand is rich with natural and mineral resources, it remains one of the poorest states in the country. Around

Table 3. Decomposition analysis of the concentration index of full antenatal care by background characteristics, Jharkhand, India, 2007–2008

Background Characteristics	Elasticity	Concentration Index	Contribution to Concentration Index	Contribution to Concentration Index (%)
Poor economic status	−0.1780	0.5466	−0.0973	37.53
SC/ST social groups	−0.0909	0.1546	−0.0141	5.42
Hindu religion group	0.1778	−0.0392	−0.0070	2.69
Residence in rural area	−0.8867	0.0455	−0.0403	15.56
Age of the women				0.00
15–24	0.0000	−0.0570	0.0000	0.00
25–34	0.0842	0.0104	0.0009	−0.34
35–49	0.0022	0.1400	0.0003	−0.12
Primary education	−0.0178	−0.1011	0.0018	−0.69
Currently married	-0.0396	−0.0015	0.0001	−0.02
Age at first birth				0.00
<20	−0.2436	0.0066	−0.0016	0.62
20+	−0.0895	−0.0071	0.0006	−0.25
Birth orders				0.00
1	0.0847	−0.0510	−0.0043	1.67
2	0.0290	−0.0556	−0.0016	0.62
3	−0.0334	−0.0161	0.0005	−0.21
4+	−0.0747	0.0939	−0.0070	2.70
Boy child	−0.0259	−0.0118	0.0003	−0.12
Any mass media exposure	0.2461	−0.3236	-0.0796	30.71
Districts				0.00
Garhwa	−0.0362	0.0581	−0.0021	0.81
Palamu	−0.0362	−0.0461	0.0017	−0.64
Chatra	−0.0248	0.0711	−0.0018	0.68
Hazaribagh	−0.0207	−0.2063	0.0043	−1.64
Kodarma	−0.0081	−0.0762	0.0006	−0.24
Giridih	0.0081	0.0338	0.0003	−0.11
Deoghar	−0.0187	−0.0851	0.0016	−0.61
Godda	−0.0065	0.0106	−0.0001	0.03
Sahibganj	−0.0243	0.1406	−0.0034	1.32
Pakur	−0.0210	0.2500	−0.0052	2.02
Dumka	−0.0180	0.1405	−0.0025	0.98
Dhanbad	−0.0076	−0.3812	0.0029	−1.12
Bokaro	0.0005	−0.2132	−0.0001	0.04
Ranchi	−0.0021	0.0174	0.0000	0.01
Lohardaga	−0.0075	−0.0399	0.0003	−0.12
Gumla	−0.0087	0.0825	−0.0007	0.28
Western Singhbhum	0.0246	0.0916	0.0023	−0.87
Eastern Singhbhum	0.0000	−0.2318	0.0000	0.00
Simdega	0.0002	0.0550	0.0000	0.00
Seraikella	0.0133	−0.2080	−0.0028	1.07
Latehar	−0.0204	0.1090	−0.0022	0.86
Jamatra	0.0185	−0.0290	−0.0005	0.21
Residual				−0.33

Source: Computed from DLHS-3 data.

12% of SC and 26% of ST population reside in Jharkhand state, and more than 75% of their population lives in rural areas (Office of the Registrar General and Census Commissioner, 2011). It is also evident that nearly 46% of the rural population is living below the poverty line in the state (Chaudhuri and Gupta, 2009). Jharkhand also performs poorly on maternal health in terms of high maternal mortality rate, low utilization of antenatal and safe delivery services (International Institute for Population Sciences, 2007–2008). Therefore, this paper is an attempt in this direction to identify the socio-economic factors and to quantify their contributions in generating inequalities in utilization of full ANC services among women in Jharkhand state, which makes a solid contribution to the existing literature on maternal health disparity determination in India. The results would help identify vulnerable populations and bridge the socio-economic gaps. However, it is worth noting that this paper is based on DLHS-3 data which was conducted in 2007–2008. Recent estimates on ANC services show improved conditions in Jharkhand where 14% of women are using full ANC in 2011–2012 as against 9% in 2007–2008 (Office of the Registrar General and Census Commissioner, 2011–2012). Therefore, much care is needed while drawing inferences.

Results from this paper suggest that factors such as parity of women, their educational level, age at first birth, economic status, and exposure to mass media were significantly associated with the utilization of full ANC services. These findings are consistent with other contemporary studies which have identified socio-economic and regional factors related to maternal health (Hajizadeh, Alam, Nandi *et al*., 2014; Pandey, Roy, Sahu *et al*., 2004). Several studies show that women with fewer number of children prefer to use ANC services as they place their first child at high value even in times of economic crisis (Pell, Menaca, Were *et al*., 2013; Singh and Singh, 2014), whereas high parity mothers receive experience from their past births and show lower concern in ANC utilization (Arthur, 2012). Sometimes, women attend one visit of ANC centers to obtain a health card so that they can deliver their child in a medical institution without the intent to receive further care during pregnancy (Pell, Menaca, Were *et al*., 2013). There are also a number of regional studies showing that education and other factors such as income and higher age at marriage are positively linked with the utilization of ANC services (Gupta, Chhabra, Kannan *et al*., 2010; Navaneetham and Dharmalingam, 2002; Pallikadavath, Foss, and Stones, 2004b). A comparative study of three major states of India demonstrated that the wealthy women living in urban areas with post primary education, low parity and any exposure to mass media were more likely to receive prenatal care than their counterpart groups (Pathak, Singh, and Subramanian, 2010).

Socio-economic disparities in utilization of ANC services can lead to wretched maternal health conditions among vulnerable groups; a study from Bangladesh showed that lower utilization of ANC services along with other components of maternal health among poor, uneducated and rural women posed a major impediment to achieving overall maternal and child health (Hajizadeh, Alam, Nandi *et al.,* 2014). Similar arguments were also raised by scholars who identified that women among lower income strata (Pandey, Roy, Sahu *et al*., 2004), Muslim, Scheduled Tribe, illiterate, and higher age groups were less likely to access ANC services. Poor knowledge, attitude and practices for ANC check-ups may be the main reasons for deplorable conditions of those women (Manna, De, and Ghosh, 2011).

The findings from this paper not only identify the factors affecting the utilization of full ANC but also their quantitative contributions towards inequalities. From our results, the economic status of women emerged as the major contributor of inequalities in ANC access. Furthermore, exposure to any form of mass media contributed around 31% to total inequality in ANC utilization. These results reflect that women who are aware of the importance of ANC choose to utilize those services. Thus, awareness of the health program among women through any source of media makes a difference in the utilization of ANC services. A study found that educational status of women and exposures to mass media were important issues to address to improving maternal health conditions (Kulkarni and Nimbalkar, 2008). Another study which was conducted in urban India demonstrated that mothers' education, economic well-being and exposure to mass media were significant factors contributing

towards inequalities (Goli, Doshi, and Perianayagam, 2013).

Findings from the analysis also show that place of residence is another important contributing factor as it caused 15.6% of inequalities in full ANC utilization. Existing literature has revealed that there are some cultural taboos attached with the health care utilization among women and inadequate knowledge also aggravates the poor utilization of maternal health services in rural areas (Barnes, 2007; Haq, 2008; Van Hollen, 2003). Besides, health care institutions which are mostly located in the countryside depict poor conditions of the health system (Pandey, Roy, Sahu *et al*., 2004) where doctors and other health workers are absent from centers and medicines are unavailable. The low skill levels of health professionals, inadequate supervision, and low interest and attitudinal behaviour of workers are some of the common characteristics of the health system in rural areas (Visaria, Simons, Berman *et al*., 1997). As a result, women at rural community health centers use fewer components of ANC than the areas which have public/private hospitals. Thus, the focus should be made to those areas where either public/private hospitals are not available or users have less access to health care (Gage, 2007). However, a study done in southern states rejected this rural-urban divide (Navaneetham and Dharmalingam, 2002).

The utilization of antenatal services also varies among the social groups. Our results demonstrate that SC/ST social groups contributed to 5% of inequality in full ANC utilization after considering other covariates. The caste system in India governs the status of the household. It is evident that the caste system has a strong association with maternal health (Kavitha and Audinarayan, 1997). An important study from Jharkhand demonstrated that maternal care was worse among Scheduled Tribe women than non-tribal women (Agrawal and Agrawal, 2010). Socio-economic inequalities are the result of dispossession of some segments of population historically, politically, economically and socially. However, the worst part of these inequalities is reflected in exclusion of some subgroups from their fundamental right of being healthy. There are social, economic, cultural and spatial impediments which restrain women's utilization of ANC services (Pallikadavath, Foss, and Stones, 2004a; Sunil, Rajaram, and Zottarelli, 2006). It is ubiquitous that lower caste women lack basic education, reside in rural areas, and have lesser access to public health programs (Borooah, Sabharwal, and Thorat, 2012). The minorities (especially Muslims), Scheduled Caste and Tribes are socially excluded groups. They are vulnerable to differences in access to health services (Sivanand, 2006). However, a study reported diminishing effect of the caste system in India (Subramanian, Nandy, Irving *et al*., 2006).

Cautiousness is needed when interpreting the findings of the present study. First, the size of contribution of each socio-economic factor to the differential use of full ANC is relative. In other words, when other covariates are further controlled in the models, the size of contribution to the use of full ANC and the ranking order of each socio-economic factor may change. Nevertheless, we are confident about the robustness of our analysis and most of these socio-economic factors would be the primary contributors to inequality in the use of full ANC services. Second, the size of contribution of each socio-economic factor may change over time, especially when full ANC service programs become more accessible. We welcome more research on these themes to verify our findings and speculations.

5. Conclusion

Some of the existing studies have attempted to shift their approaches from the identification of maternal health factors to quantification of their contribution in generating health inequalities (Goli, Doshi, and Perianayagam, 2013; Hosseinpoor, VanDoorslaer, Speybroeck *et al*., 2006; Kumar and Singh, 2013; Nawal, Sekher, and Goli, 2013). However, to the best of our knowledge, none of the studies have looked into the quantification of full ANC determinants in Jharkhand State. In this context, this paper offers several insights to explain the dynamics behind the variation in full ANC utilization among various groups using a decomposition method. Findings obtained in this paper suggest that inequalities in full ANC utilization can be minimized by focusing on the economic conditions of

women. The poor households need to be uplifted through the income generating programs and policies. Knowledge and awareness about the importance of antenatal check-ups need to be disseminated among the pregnant women, and more work needs to be done to generate their interest towards the government health programs. The public policies should be targeted and implemented well in deprived communities where the concentration of uneducated, poor, and socially vulnerable women is high. Also, there should be more focus on rural areas which have clearly demonstrated the lower utilization of full ANC and the presence of poor health conditions. Targeting the health programs to the deprived sections and regions not only reduces inequalities, but also helps the country to achieve low maternal mortality rate. Therefore, programs and policymakers should shift their concern from achieving 'average' lower maternal mortality to 'distribution' of the schemes among the neediest groups. The findings of the paper are also relevant in other geographical locations of India such as Chhattisgarh, Uttar Pradesh, Bihar, Odisha, and Assam which constitute of a large number of poor populations living in rural areas and are characterised by low level of health access. Finally, we recommend that future studies must use the decomposition analysis in the health sector so that policies and programs can be directed to the root causes of inequalities.

Conflicts of Interest and Funding

No conflict of interest was reported by all authors.

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Ethics Statement

The analysis done in this paper was performed using secondary data obtained from publicly available sources as outlined in the Data and Methods section.

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