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Utilisation of Safe Delivery Services: Pathways for Determining its Inequality in Jharkhand, India

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Abstract

This paper investigates major socio-economic, demographic and health determinants and their net contribution in generating safe delivery inequalities among various socio-economic groups. Findings suggest that caste, residence, wealth, age at first birth, education, birth order, mass media exposure, antenatal care utilisation and cost of delivery are significant predictors of safe delivery utilisation. Among these covariates, poor economic status, high cost of delivery, low primary education and rural residence contribute more than three-fourths of inequalities in safe delivery care. Results also suggest that the role of wealth, education and antenatal care utilisation declines when controlling other social and economic variables. Based on these findings, this paper suggests that targeting poor and uneducated women living in rural areas not only improves the safe delivery practices among them but also contributes to reduce the inequalities in utilisation of safe delivery practices.

Key words: safe delivery, inequality, decomposition, Jharkhand.

I. Introduction

Empirical evidence suggests that safe delivery is one of the major determinants of maternal and child health along with antenatal and postnatal care. Delivering births in a medical institution or at home by skilled birth attendants with medical assistance can significantly reduce high maternal mortality ratio (MMR) from which India is severely suffering. Complications during pregnancy such as haemorrhage, sepsis, unsafe induced abortion, hypertensive disorder of pregnancy and obstructed labour are major causes of high maternal deaths around the world (WHO, 2005, 2008). Recent evidences are appalling which show as many as 289,000 women died during and following pregnancy and child birth globally in 2013 of which a significant share was in developing countries (WHO, 2014). Massive bleeding is one of the most important factors in maternal mortality in India. Eastern states (especially Jharkhand) show that more than 80 per cent women opt for home deliveries conducted by traditional health workers and 40 per cent women suffer from massive bleeding in the post-partum period. Provision of safe deliveries assisted by trained health personal and medical aid can positively reduce the high maternal deaths caused by massive bleeding during delivery period. However, a great irony is that there is a lack of sufficient and trained health personnel for controlling haemorrhage problem among women (Singh et al., 2009). Besides, cultural practices of the population which are deeply linked with the place of delivery have also been ignored by the government (Haq, 2008) which to some extent force families to opt for home deliveries assisted by untrained dais and locally registered medical practitioners (RMPs). Indian Government has taken strong steps to improve maternal health through the introduction of reproductive and child health (RCH) programmes. However, their

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implementation has not brought a significant change as India still counts for 167 maternal deaths per lakh live births which are much higher than the goal set in national population policy 2000 to reduce MMR below 100 per lakh live births. State specific results are more worrisome as MMR ranges from 300 in Assam to 61 in Kerala and all empowered action group states along with Assam have fairly much higher MMR than the national average (SRS, 2011). Additionally, nine out of 15 major states of the country are not expected to bring down their MMR in few years (Reddy et al., 2012).These alarming estimates are closely linked with poor availability and accessibility of health services. More than 50 per cent deliveries are still reported to take place at home and by traditional birth attendants/friends/relatives/other personsin India (IIPS and Macro International, 2007). It is evident that several socio-economic, demographic, physical and health care predictors (hereafter these variables are termed together as socio-economic) determine low institutional deliveries but studies failed to quantify their contribution in ascertaining more accessibility of safe delivery care. This paper fills this lacuna in literature and attempts to decompose the factors established through various studies in determining safe delivery. For this purpose, Jharkhand state, where there is just 19 per cent institutional delivery with a high MMR of 208 per lakh live births, has been taken as the case study to present our results.

II. Materials and method

Data source

The present study draws its data from the third round of district level household and facility survey (DLHS-3) conducted in 2007-08 by the International Institute for Population Sciences under the aegis of Ministry of Health and Family Welfare (MoHFW), Government of India. The survey covered 601 districts and 34 union territories in the country. In Jharkhand state, DLHS-3 survey included 26,886 married women. Among them, 11,474 married women delivered either at a medical institution, home or any other place. The survey used multi-stage stratified sampling design in each district. It adopted two stages of sampling: in the first stage, 50 primary sampling units (PSUs) which were census villages from rural areas and wards from urban areas were selected by using systematic probability proportional to size (PPS). In the second stage, systematic sampling was used for selecting an appropriate number of households from selected villages.

Outcome measurement

Safe delivery is defined as mothers who had either institutional delivery or home delivery assisted by skilled health persons during their pregnancy. Safe delivery is one of the most important indicators of maternal health care utilisation according to the guidelines developed by the MoHFW (2010) and WHO (2006). Provision of safe delivery of pregnant women is also an integral part of the reproductive and child health (RCH) programme in India.

Predictor variables

Socio-economic variables such as antenatal care (ANC) received, cost incurred for delivery, caste, religion, place of residence, age at first birth, birth order, women's education, mass media exposure and wealth quintiles have been used as the predictor variables in this paper. ANC is categorised into no ANC, partial ANC and full ANC. Full ANC includes mothers who had a minimum of three antenatal visits, at least two tetanus toxoid injections and received iron folic acid tablets for at least 90 days or more during their last pregnancy. Partial ANC is defined as any component of full ANC received during pregnancy. The cost incurred for delivery is divided into four categories: no cost, Rs. 1-500, Rs. 501-2000 and more than Rs. 2000. Social groups are categorised on the basis of women self-reporting their caste as schedule castes (SCs), schedule tribes (STs), other backwards classes (OBCs), and 'others'. The religion of mother is identified as Hindu, Muslim, Christian, and 'others'. Place of residence is classified into rural and urban.

Women's education[1] is clubbed into primary, secondary, and above secondary completion. Age of women at first birth is categorised into less than 20 years, 20-30 years and above 30 years. Birth order of women ranges from 1 to 4 or higher. Exposure to mass media is classified into no mass media exposure and any mass media exposure (which includes those women who have got information about safe delivery through watching TV/listening to radio/reading newspapers). Household wealth index is calculated by combining household amenities, assets and durables using factor analysis (Rutstein & Johnson, 2004).

Analytical Approach

In the paper, concentration index (CI) method is used for measuring inequalities in utilisation of safe delivery services in Jharkhand. Considering these inequalities, CI is decomposed to quantify the contribution of all socio-economic factors in causing health inequalities. Therefore, decomposition analysis evaluates the proportional contribution of each factor in causing inequalities. For measuring inequalities, CI is computed as twice the area between the concentration curve and the line of equality (the 45-degree line). The zero value of CI shows that there is no socio-economic inequality. The negative value shows the disproportionate concentration of safe delivery among disadvantaged group while the positive value indicates the concentration of health service among the advantaged group (Wagstaff et al., 1991). The CI index lies between –1 and 1. Therefore, for measuring socio-economic inequality in safe delivery services, the CI can be written as the following formula:

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

Where h_i is the health sector variable, μ is its mean, and r_i= i/N is the fractional rank of individual i in the socio-economic distribution with i=1 for the disadvantaged and i=N for the advantaged. A more convenient formula for the CI is presented in equation 2 which defines it in terms of covariance between health variable and a fractional rank in socio-economic distribution (Doorslaer & Koolman, 2004; Kakwani et al., 1997).

$$C = \frac{2}{\mu}\mathrm{cov}_w(y_i\, r_i) \quad (2)$$

Where y_i and r_i are respectively the health status of the i^{th} individual and the fractional rank of the i^{th} individual (for weighted data) in terms of 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. Furthermore, the decomposition method proposed by Wagstaff and Colleagues (1991) is used to estimate how predictors proportionally contribute to inequality (e.g. the gap between disadvantaged and advantaged group) in a health variable. For a linear additive regression model, the safe delivery utilisation variable Y_i, the intercept α, the relative contribution of X_{ki} determinants and residual error term ε_i are presented in equation (3).

$$Y_i = \alpha + \sum_k \beta_k X_{ki} + \varepsilon_i \quad (3)$$

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

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

Equation (4) shows that overall inequality in utilisation of safe delivery has two components, i.e., deterministic or "explained components" and "unexplained" components. In equation (4), β_k denotes the coefficient from a regression of safe delivery utilisation variable on

[1] There are only two cases of illiterate women in the sample. So these cases have been excluded and women's education is grouped into primary, secondary and above secondary.

determinant k, $\overline{X}_k$ is the mean of the determinant k, μ is the mean of safe delivery usage index, C_k is the concentration index for determinant k and GC_ε denotes the generalized CI for error term. Explained component 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, namely, safe delivery is associated with a percentage change in the explanatory variable). Unexplained component reflects inequality in safe delivery utilisation which could not be explained by the selected predictors across socio-economic groups (Hosseinpoor et al., 2006).

Therefore, decomposition of inequality in utilisation of safe delivery in state of Jharkhand is carried out by following the steps, described by Wagstaff and colleagues (1991) and O'Donnell and colleagues (2008). Coefficients of the predictor variables (β_k) are estimated by regressing the health variables by linear regression model for its socio-economic predictors. Means of the health variable and each of its determinants (μ and $\overline{X}_k$) are estimated. Calculating the concentration indices for the health variable and its predictors (C and C_k) are estimated by using equation (2) along with generalized concentration index of error term (GC_ε) where Y_i and μ are the value of the predictors for the i^{th} individual and the predictors mean respectively. Net contribution of each determinantis estimated by multiplying the health variable elasticity with respect to the determinants and its concentration index $\left(\frac{\beta_k \overline{X}_k}{\mu}\right) C_k$. Percentage contribution of each predictor is calculated by dividing its net contribution through the concentration index of health variable $\left(\frac{\beta_k \overline{X}_k}{\mu}\right) \frac{C_k}{C}$.

III. Results

Table 1 presents the percentage distribution of socio-economic characteristics of women in Jharkhand. Results reveal that more than 80 per cent women go for home delivery and only 18 per cent women choose their delivery place at medical institutes. Most of the deliveries in the state (91 per cent) are conducted by traditional health workers. Many cases of home deliveries which are mainly performed by traditional health workers account for low transportation and delivery cost. More than 60 per cent woman incur less than Rs. 500 on transportation to health facility and for delivering the birth. Further, 73 per cent women receive partial ANC service, followed by 20 per cent women receiving full ANC. Given the low level of institutional delivery and ANC usage in Jharkhand, it is worth noting that more than one-third women are of SCs and 14 per cent of STs. Most of these women live in rural areas (86 per cent) and belong to poor wealth groups (69 per cent). These poor socio-economic conditions of women are aggravated by lower age at first birth, poor education level and little exposure to mass media.

Table 2 analyses utilisation of the type of delivery by background characteristic. Results show that 87 per cent women who did not receive ANC service preferred their birth delivery at home. On the other hand, 63 per cent women who received full ANC went to a medical institute for delivery. Hence, with the better utilisation of ANC services, the percentage of safe delivery also increases and this association is significant at one per cent level. As far as the cost of delivery is concerned, results show that the usage of safe delivery increases with a rise in the cost of delivery. It is evident from results that safe delivery requires high cost which is less affordable to women given their poor economic status. In addition, 90 per cent deliveries in which no cost is incurred are home deliveries which shows why women go for home deliveries. In the case of social characteristics of women, more than 80 per cent SC, ST, rural and Muslim women go for home deliveries. Further, higher birth order women, less educated, having lower age at first birth and little exposure to mass media show higher percentage of home deliveries. This analysis reflects that there are socio-economic variations in the utilisation of safe delivery in Jharkhand.

Table 1: Percentage distribution of selected socio-economic characteristics in Jharkhand, 2007-08

Background characteristics	Number	%
Place of last delivery		
At institution	2,022	17.6
At home	9405	81.97
Others	47	0.41
Who conducted last delivery		
Skilled assistant	839	8.91
Traditional health worker	8576	91.09
Cost of transportation to health facility for delivery (Rs.)		
No cost	163	8.34
1-500	1240	63.43
501-2000	293	14.99
2000+	259	13.25
Cost incurred for delivery (Rs.)		
No cost	739	6.44
1-500	6846	59.67
501-2000	2343	20.42
2000+	1546	13.47
ANC received		
No ANC	1188	19.72
Partial ANC	4375	72.61
Full ANC	462	7.67
Social group		
SC®	3761	14.01
ST	8823	32.86
OBC	11357	42.30
Other	2910	10.84
Religion		
Hindu	18521	68.89
Muslim	2727	10.14
Christian	1550	5.77
Others	4086	15.20
Place of residence		
Rural	23127	86.00
Urban	3759	k13.90
Women's education		
Primary	3026	30.85
Secondary	5456	55.62
Higher secondary and above	1327	13.53
Age at first birth		
<20	12,827	54.01
20-30	10780	45.39
30+	144	0.61
Birth order		
1	2972	26.07
2	2689	23.58
3	2175	19.08
4+	3566	31.20
Mass media exposure		
No mass media exposure	22102	82.21
Any mass media exposure	4784	17.79
Wealth quintiles		
Poorest	10863	40.40
Second	7540	28.46
Middle	3620	13.40
Fourth	2527	9.40
Richest	2336	8.69

Source: Computed from DLHS III (2006-07) unit level data.

Table 2: Percentage of utilisation of type of delivery[2] by background characteristics in Jharkhand, 2007-08

Background characteristics	Institutional delivery		Home delivery		(λ^2)
	Number	%	Number	%	
ANC received					.000
No ANC	157	13.3	1025	86.7	
Partial ANC	1328	30.5	3032	69.5	
Full ANC	291	63.1	170	36.9	
Cost incurred for delivery (Rs.)					.000
No cost	73	9.9	663	90.1	
1-500	242	3.5	6582	96.5	
501-2000	617	26.5	1715	73.5	
2000+	1090	71	445	29	
Place of residence					.000
Rural	1383	13.4	8968	86.6	
Urban	639	59.4	437	40.6	
Caste					.000
SC®	249	14.7	1442	85.3	
ST	326	8	3770	92	
OBC	968	20.9	3666	79.1	
Other	473	47.7	519	52.3	
Religion					.000
Hindu	1555	21	5856	79	
Muslim	241	17.5	1139	82.5	
Christian	71	10.3	617	89.7	
Others	155	8	1793	92	
Age at first birth					.000
<20	882	14.5	5208	85.5	
20-30	1116	21.4	4109	78.6	
30+	18	21.7	65	78.3	
Birth order					.000
1	850	28.7	2107	71.3	
2	567	21.1	2115	78.9	
3	305	14.1	1860	85.9	
4+	284	8	3268	92	
Women's education					.000
Primary	248	18.1	1125	81.9	
Secondary	822	35.8	1477	64.2	
Higher secondary & above	339	72.1	131	27.9	
Mass media exposure					.000
No mass media exposure	1221	12.5	8542	87.5	
Any mass media exposure	801	48.1	863	51.9	
Wealth quintiles					.000
Poorest	299	5.8	4887	94.2	
Second	463	14.1	2829	85.9	
Middle	371	26.1	1053	73.9	
Fourth	395	42.9	525	57.1	
Richest	2022	82.3	9405	17.7	

Source: As in Table 1.

[2] Type of delivery includes only institutional and home deliveries and excludes 'other types of delivery' as it has only 47 cases.

Table 3: Binary logistic regression model showing odds ratio (OR) and 95% Confidence Interval (CI) for utilisation of institutional delivery in Jharkhand, 2007-08

Background characteristics	Model I		Model II		Model III	
	OR	CI	OR	CI	OR	CI
ANC received						
No ANC®	1		1		1	
Partial ANC	1.99***	1.60 - 2.49	1.66***	1.19 - 2.33	1.27ns	.90 - 1.78
Full ANC	4.68***	3.41 - 6.41	2.60***	1.67 - 4.06	1.76**	1.11 - 2.80
Cost incurred for delivery (Rs.)						
No cost®	1		1		1	
1-500	.29***	.21 - .39	.24***	.16 - .36	.22***	.14 - .34
501-2000	2.19***	1.63 - 2.95	1.65***	1.13 - 2.41	1.27ns	.84 - 1.92
2000+	15.63***	11.44 - 21.36	10.87***	7.26 - 16.26	7.47***	4.80 - 11.64
Women 's age at first birth						
<20®			1		1	
20-30			1.31***	1.07 - 1.61	1.23*	.99 - 1.52
30+			2.49*	.87 - 7.10	3.16*	.92 - 10.75
Women education						
Primary®			1		1	
Secondary			1.70***	1.34 - 2.17	1.16ns	.90 - 1.51
Higher secondary & above			4.86***	3.42 - 6.92	1.99***	1.32 - 3.00
Birth order						
1®			1		1	
2			.74**	.58 - .94	.66***	.51 - .85
3			.62***	.47 - .83	.54***	.40 - .73
4+			.66**	.48 - .91	.59***	.42 - .84
Place of residence						
Rural®					1	
Urban					1.71***	1.20 - 2.44
Caste						
SC®					1	
ST					.64*	.40 - 1.03
OBC					.87ns	.62 - 1.23
Other					1.46*	.97 - 2.19
Religion						
Hindu®					1	
Muslim					.71**	.50 - .98
Christian					.81ns	.44 - 1.47
Other					1.06ns	.67 - 1.69
Mass media exposure						
No mass media exposure®					1	
Any mass media Exposure					1.12ns	.89 - 1.41
Wealth quintiles						
Poorest®					1	
Second					1.52**	1.06 - 2.18
Middle					2.23***	1.54 - 3.23
Fourth					2.54***	1.71 - 3.79
Richest					6.12***	3.65 - 10.23

Source: As in table 1

Note: ® Reference category; Level of significance: *p<.10; **p<0.05; ***p<0.01; ns: not significant; OR: odds ratio, CI: Confidence interval

The role of socio-economic variables in causing inequalities in utilisation of safe delivery is examined in Table 3 in which three models are presented using binary logistic regression. Model I includes variables such as utilisation of ANC and cost incurred on delivery. Model II incorporates women's education, parity level and age at the time of first birth along with Model I variables. Lastly, Model III comprises of socio-economic characteristics of women along with Models I and II variables.

Findings of the logistic regression models demonstrate that the role of ANC utilisation declines when other socio-economic variables are considered. For instance, women who received full ANC (Model I) were five times more likely to use safe delivery than women who did not receive any ANC. However, this likelihood declines to only twice (Model III) when other variables are included in the Model. Similarly, with an increase in the cost of delivery, probability of utilising safe delivery rises though the odd ratios fall down when considered along with other socio-economic variables (Model III). Further results exhibit that women whose age at first birth is higher than 20 years are 1.2 times (in case of 20-30 years of age) and thrice (more than 30 years of age) more likely to utilise safe delivery than women whose age at the time of first birth of the child is less than 20 years. Education level of women also shows significant differences as higher secondary and above pass women are twice (OR 1.99, CI 1.32-3.00) more likely to go for safe delivery than primary educated women. Besides, with the birth order of the child, probability of utilising safe delivery falls down which reflects lower usage of medically-assisted delivery in the case of higher birth order children. Model III further explains that women residing in urban areas, belonging to other caste groups and exposed to mass media are more likely to utilise safe delivery than their counterpart families. Economic status of women significantly determines usage of medically-assisted delivery. Logistic regression results show that with a rise in income level, utilisation of safe delivery increases. For instance, poor women are 1.5 times (OR 1.52, CI 1.06-2.18), middle wealth group women are 2.2 times (OR 2.23, CI 1.54-3.23), rich women are 2.5 times (OR 2.54, CI 1.71-3.79) and richest women are 6.1 times (OR 6.12, CI 3.65-10.23) more likely to use safe delivery than the poorest women. Two major conclusions emerge from: (1) the role of ANC usage and cost of delivery in determining utilisation of institutional delivery declines when other socio-economic variables are considered, and (2) the likelihood of utilising institutional delivery is high among selected groups such as urban educated women belonging to 'other' castes and rich families. Poor, less educated, not exposed to mass media, SC/ST and high birth order women show higher chances to go for home deliveries. Therefore, the probability of utilising safe delivery is significantly determined by socio-economic characteristics of women which cause inequalities among groups.

Table 4 examines how much each determinant contributes to inequality in the utilisation of safe delivery services by decomposing the concentration index of determinants. The residual in decomposition analysis is only 14 per cent which explains that factors considered in the analysis explain maximum inequalities. Further, decomposition results are presented into three models. Model I explains the contribution of poor economic status, ANC service and cost of delivery. Results show that poor economic status contributes to 50.3 per cent of inequality in utilisation of safe delivery service followed by low cost of delivery (41.45 per cent). These results highlight that economic status of women and cost of delivery (less than Rs. 500) together contribute more than 80 per cent of inequality in delivering the birth at a medical institution. However, Model II decomposes the inequality by taking into account women's characteristics along with Model I variables. Findings show that the contribution of poor economic status declines to 41 per cent after controlling women characteristics. Similarly, role of low cost of delivery in causing inequality becomes insignificant and higher cost (more than Rs. 500) makes a dent in inequality generation among groups. Additionally, women's education at primary level explains 21 per cent inequality. Model III incorporates all socio-economic and other variables. Results suggest that the contribution of poor economic status sharply declines to 22 per cent after controlling other socio-economic variables. The contribution of high cost of delivery remains more or less the same in Model III. Role of primary education among women declines from 21 per cent to 13 per cent in Model III. Place of residence in rural areas comes as other significant contributor as it causes 17 per cent;

inequality in safe delivery utilisation. ST women and women exposed to mass media contribute 6 per cent and 4 per cent inequality respectively in safe delivery utilisation. Contribution of women's lower age at first birth, Hindu religion and non-ANC usage is low in inequality generation. These results demonstrate that the economic status, cost of delivery, rural residence and women's education are significant contributors in causing inequality in utilisation of safe delivery. Besides, the role of economic status and women' education decline after controlling their other socio-economic characteristics.

Table 4: Contribution of socio-economic factors to safe delivery inequalities based on decomposition analysis, 2007-08

Background characteristics	Model I		Model II		Model III	
	CI	C (%)	CI	C (%)	CI	C (%)
Poor economic status	0.6566	50.30	0.833	41.64	0.833	22.14
ANC received						
No ANC	0.1424	10.60	0.106	4.81	0.0874	3.22
Partial ANC	-0.018	-3.39	-0.0002	-0.03	-0.0029	-0.39
Cost incurred for delivery (Rs.)						
<500	0.1121	41.45	0.0831	0.00	0.0915	0.00
≥500	-0.1455	0.00	-0.0661	37.13	-0.0727	36.73
Women 's age at first birth						
>20			0.0244	4.99	0.0276	6.46
≤20			-0.021	-4.02	-0.0237	-5.57
Women education						
Primary			0.1459	20.90	0.1424	13.40
Secondary			-0.0314	-7.04	-0.0268	-3.83
Birth order						
1			-0.0099	0.68	0.0014	-0.10
2			-0.0136	0.19	-0.0043	0.04
Place of residence						
Rural					0.0496	16.75
Caste						
SC					-0.0049	-0.03
ST					0.191	6.31
Religion						
Hindu					-0.0378	2.05
Mass media exposure						
Any mass media exposure					-0.1175	4.18
Residual		-0.23		-0.08		0.14

Source: As in Table 1.
Note: CI stands for concentration index and C is percentage contribution of each determinant.
As cases in some variables' categories are low, they have been excluded in the estimation.

IV. Discussion

Delivering birth under the supervision of trained health care providers and at a medical institute where delivery related services are available can significantly reduce the risk of high maternal and child mortality rate. Greater availability and accessibility of trained health personal and services positively promote utilisation of maternal and child health care services. Despite several government efforts to improve safe delivery conditions especially in rural India, more than three-quarters of deliveries still takes place at home. In Jharkhand, more than 80 per cent birth deliveries are done at home by traditional health workers. Maternal mortality ratio is higher in the state with 208 women reportedly died in 2011-12 due to maternal health related complications. There are several socio-economic, demographic and health variables which determine the utilisation of safe delivery among womenanda large portion of literature focuses on them. This paper moves a step forward and aims to decompose the socio-economic factors and to determine their net contribution in causing inequalities in utilisation of safe delivery care among women in Jharkhand. It does not only aim to identify vulnerable sections but also ways to reduce health inequalities among them. For this purpose, nationally representative data of district level household

facility survey (DLHS-3) is used and variables related to social, economic, demographic and health services are selected based on literature of decomposition.

Our findings demonstrate that full antenatal care, high cost of delivery, higher age of women during first birth, lower birth order, education, urban residence, high economic status and exposure to mass media significantly determine utilisation of safe delivery in Jharkhand. These results are consistent with other similar studies done in different cultural settings. A study based on four Indian states showed that women who received antenatal services were more likely to give birth in a medical institute. This study highlights that more focus must be on expansion of already available services in qualitative terms rather than creating new infrastructure (Sugathan et al., 2001). Similarly, a comparative study based on northern and southern India highlighted positive effect of antenatal care on types of professional assistance delivery after controlling socio-economic factors. Impact of antenatal care on institutional delivery was much more on southern than in northern India (Mishra & Retherford, 2008). Thus, antenatal care is one of the important means for increasing utilisation of safe deliveries among women. Since most of the deliveries are conducted at home, hence proper training to traditional health workers regarding antenatal care and deliveries needs to be provided. Another study done in urban areas of Uttar Pradesh shows that though antenatal care has influence on safe delivery, its components need to be revised again for more effectiveness. However, in the present study, the contribution of antenatal care in generating inequality is low which reflects that although antenatal care is a significant predictor of safe delivery, yet its role is limited in causing health inequalities after controlling other social and economic variables. Several studies demonstrate that not only availability and accessibility of health services, but also demand side factors play an important role and are governed by various socio-economic factors (Das et al., 2001).They suggest that delivery care in India is confined within some traditional and personal beliefs which are not correlated with the methods adopted by health professionals. Thus, investigation of different components of antenatal care along with patient education can significantly improve usage of safe delivery care (Bloom et al., 1999). Besides the role of beliefs and cultures, availability of health services also poses a major determinant in utilisation of services. For instance, a study done in Delhi shows that despite high antenatal care among women, utilisation of safe delivery was low due to unavailability of delivery care in nearby areas (Gupta et al., 2010). Evidences show that hospitals are poorly equipped to accommodate the demand for services. There are long waiting periods for women who seek services and some of them return back without availing them and others are discharged soon after delivery showing pressure on government health services (Singh et al., 2009). A study recommended to establish maternity waiting places near health units where mothers are admitted few days back to their delivery (Munaaba, 1995).

Status of women plays a crucial role in determining utilisation of health services in Jharkhand (Barnes, 2007). More than half ofthe women reported that they had no say in deciding about their own medical care in Jharkhand. Husbands and their mothers-in-law are the main decision makers. However, this trend can be changed by educating more and more women (IIPS and Macro International, 2007). Our findings also highlight women's education as an important predicator and it contributes 13 per cent inequality in safe delivery utilisation. Other studies contradict women's education as a significant predictor and estimate that women's education is not a significant predictor, and rather the place of delivery is more influenced by father's occupation level. Besides educating the women about safe delivery care, it is also important to disseminate knowledge of care among their spouses and health education messages need to be targeted to low and medium economic classes and peasants (Nuwaha & Amooti-Kaguna, 1999). Involving men's participation in safe motherhood is a new focus in women's reproductive health programme as men are the prime decision makers of households.

Financial constraints along with less awareness force families to opt for home delivery as our study highlighted that poor economic status and mass media exposure contribute 22 per cent and 4 per cent inequality respectively in safe delivery utilisation. Knowledge and awareness of health services and its outcomes significantly determine the usage of maternal health facility as a

study done in Andhra Pradesh demonstrated that auxiliary mid-wives complained of a lack of community participation due to unawareness. They were regarded as family planning workers and most of the women, especially from lower castes, did not consume IFA tablets given by them (Padma, 2005). Many other studies also showed that exposure to any mass media is positively associated with delivering a birth in a health institute (Navaneetham & Dharmalingam, 2002; Nketiah-Amponsah & Sagoe-Moses, 2009). Similarly, economic status of a household is an important covariate in analysing utilisation of safe delivery care. A study done in rural India shows that economic status of the family is a more crucial factor than accessibility in determining safe delivery. In fact, it also determines choice of private or public health facility within institutional delivery (Kesterton et al., 2010). Many of the government's reproductive and child health programmes exist in Jharkhand but they do not take into account ground realities such as unaffordable cost of institutional deliveries, lack of quality of care and negligence of people's culture and tradition. Besides, long distances and high transportation cost or no means of transportation available and lack of encouragement from the health care providers have also been ignored. A study based on three states of India showed that in Jharkhand most of the institutional deliveries are done in private sector than public sector, depicting the plight of government health care system in the state (Pandey et al., 2004).

Studies also show that choosing a birth place at home in India is more related to cultural practices which is mostly ignored. Home is not only a dwelling place but also a common place for past, present and future generations where ancestors are the presiding deities. Many of the families feel inability to link their cultural preferences with modern institutional sites (Haq, 2008). For example, a study in rural areas of Jharkhand showed that throwing away of placenta in health care facilities was considered inauspicious by women and therefore they were reluctant to go for an institutional delivery (Barnes, 2007). Besides, women also stated that health care providers were insensitive towards their needs. Women were abused, scolded and slapped during labour pain. They were being questioned about their post-partum beliefs and were forced to accept family planning programme against their desire (Van Hollen, 2003). Their family members or dais were not allowed to accompany them. Women also feared of unnecessary caesarean deliveries by health providers. Some of them also complained of physical torture as their legs were tied to iron rods during delivery by health care staff. They showed their preference for home delivery due to easy and timely accessibility of dais or local RMPs, poor quality of care at health facilities, demand of money by health staff and accommodation of their traditions and rituals by local dais. Nonetheless, they also felt saving of money which would have been incurred on transportation and delivery at a health facility (Barnes, 2007). Another study based on perception of women regarding their satisfaction about maternal care in Jharkhand showed poor supply of services, high cost, poor care by providers, lack of accessibility as some of the major reasons for choosing home over a health institution for delivery (Ogala et al., 2012). Thus, a more efficient way to improve utilisation of institutional delivery is to integrate dais and their traditions into the formal system of child birth care. For this purpose, linking dais with public health centres, modifying the education of health personnel similar to dais' skill and work are needed for popularizing institutional deliveries (Sadgopal, 2009).

Our findings also show that caste of the women significantly determines utilisation of services for safe delivery. ST women are 0.6 times less likely to utilise institutional delivery services and contributes 6 per cent to total inequality. These results are comparable with other similar investigations. Studies highlight that tribal and other lower caste women are at a more disadvantaged position as there are no separate maternal mortality estimates for them. A study based on tribals in Odisha showed that their women do not have any option other than home delivery due to non-availability of referral services, remedial measures, lack of social infrastructure, transportation and telecommunication. Thus, unavailability and inaccessibility of the health care system make these women more vulnerable to maternal deaths (Mahapatro & Kumar, 2009). Evidences also exhibit that caste is significantly associated with utilisation of maternal care services. There is less probability of utilising antenatal care and safe delivery among lower caste women than their higher caste counterparts (Kavitha & Audinarayana, 1997).

This paper also suggests that lower birth order and women at higher age during first birth show higher probability of utilising safe delivery practices. These findings can be compared with other similar studies done globally. A study of rural India demonstrated that safe delivery is more common for first birth child than higher birth orders (Kesterton et al., 2010). Similarly, a study for Nepal found that more than 75 per cent women delivered their first birth in health facility and this percentage declines with subsequent birth orders (Pradhan, 2005). In the present study, place of residence is found to be a significant predictor for women delivering birth in a health institute. Rural residence accounts 17 per cent inequality in safe delivery utilisation. This finding is consistent with other studies conducted in India and other countries (Abera et al., 2011; Thind et al., 2008). It is suggested that physical accessibility with low transportation cost and better access to information in urban areas increase the probability of delivering the birth in a medical institute. On the other hand, lack of physical accessibility due to rough terrain and high transportation cost hinders the chances of medically-assisted delivery in rural areas (Habte & Demissie, 2015). Another study done in Haiti reported that odds of delivering a birth at a medical institute and by skilled health personnel were aggravated by mountainous terrain and distance to the nearest health facility (Gage & Guirlène-Calixte, 2006). Investment in community infrastructure like road transportation network can significantly improve maternal health services (Melhado, 2007). On the contrary, studies reported that distance and cost not only determine safe delivery but the quality of care including sufficient staff, equipment and drugs along with awareness about perception of rural women and better training to health staff are other important determinants which need to be worked out in maternal health care (Seljeskog et al., 2006).

V. Conclusion

Despite rich in mineral, forest and other natural resources, Jharkhand is plagued with poverty, socio-economic inequality and resultant poor maternal and child health conditions. Moreover, low utilisation of safe delivery practices conducted by traditional health workers has attenuated the efforts of achieving low maternal mortality rate. Till now efforts have been made to examine the possible determinants of low safe delivery practices but they have failed to explain their quantitative contributionin inequality formation. This paper investigates determinants of safe delivery on the one hand and their net contribution in causing inequalities among different sections of population on the other hand so that real vulnerable groups can be targeted and gaps among them can be reduced to improve maternal and child health conditions. Our results suggest that although, full antenatal care, high cost of delivery, higher age of women during first birth, lower birth order, education, urban residence, high economic status and exposure to mass media significantly determine utilisation of safe delivery which most of the similar studies have also found, yet, among them, poor economic status, education of women, rural residence and high cost of delivery are the root causes for low utilisation of safe delivery. Therefore, efforts must be directed at uneducated women living in rural areas and belonging to poor households not only to improve safe delivery practices among them but also to reduce health gaps.

Limitations of the study

This paper is based on the third round of District Level Household data (DLHS-3) which was conducted in 2007-08. However, recent estimates on safe delivery show improved conditions in Jharkhand. The Annual Health Survey data (2012-13) demonstrate around 46 per cent institutional delivery in the state as against 19 per cent shown by DLHS-3 in 2007-08. These evidences clearly highlight changing maternal health equations. Therefore, much care is needed while drawing inferences from the results of this paper.

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