



## Factors Influencing Maternal Health Care Services Utilization in Northeast States, India: A Multilevel analysis

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**Abstract:** Minimal utilization of maternal health care services in Northeast states, India acts as one of the indicators of maternal mortality rate. The study examined individual and household characteristics, community and district level characteristics associated with maternal health care services and the trend followed by outcome variables over the past decade. District Level Household Survey data of second and fourth round were used to carried out analysis. Women who had given child birth in last five years preceding the survey were considered. The findings showed that wealth quintile and place of residence were the most important factors associated with maternal health care services. The multilevel modeling results revealed that the highest proportion of illiterate women in PSU's and tribal population were less likely to utilize the services.

**Keywords:** Maternal Health Care Services, multilevel analysis, Antenatal Care, Delivery Care and Skilled birth attendant

### I. Introduction

The utilization of maternal health care services in developing countries is still a challenge and shows variation within and between the countries even after the continues efforts made by organizations and government [1]. Near about 830 women die every year because of causes related to pregnancy and during child birth (WHO, 2015). The Maternal Mortality ratio shows a declining trend from 178 per 100,000 live births in 2011-2012 to 167 in the period of 2012-2013 [2, 3]. Surprisingly, 99% of the maternal death occurs especially in developing countries; however the rate of maternal mortality is higher among the woman living in rural and deprived section of economic status (WHO, 2015). The Sustainable Development Goal 3 focuses on the improvement of maternal health care, however decrease the rate of maternal mortality to even less than 70 by 2030 [4]. Also, providing quality services to all women at the time of child birth and during pregnancy are crucial not only to save women's lives, but also to their new born babies too.

In India, the maternal mortality rate is still high, that is, 178 per 100,000 live births [SRS 2010-12]. The proportion of maternal deaths in India varies according to the region because of the variation in the utilization of maternal care services among the educated and uneducated women along with other prevailing factors within the country. Antenatal and delivery care are considered as the key components in reducing the rate of maternal mortality. Antenatal care service is the systematic supervision of mother during the pregnancy period in order to check the well-being of mother and fetus [5]. Antenatal care (ANC) services have numerous benefits for instance, early detection of pregnancy complications, health related issues and increment in the chances of further utilization of services related to delivery care [6, 7]. Also, ANC is vital determinant of safe delivery [8] and may have positive impact towards the utilization of postnatal care services [9]. In India, maternal health program aim at providing at least three antenatal care visit which should include weight and blood pressure checkups, abdominal examination, immunization against tetanus, and anemia management ( iron folic acid tablets or syrups). Antenatal care should monitor pregnant women for any complication (s) and provide further counseling and advice on preventive care. Skilled birth attendant defined as proper care given to mother at the time of delivery by health professionals. The mean coverage of Skilled birth attendant assisted maternal deliveries in rural and urban areas, India in 2010, etc were 30% and 69%, respectively [10]. Globally, 47 million new born babies were delivered by skilled attendants in 2011. Most of the maternal deaths cannot be avoided as 80% of these are caused by sepsis during un-safe delivery, hypertensive issues related to pregnancy, obstructed labor, and hemorrhage. The solutions to this problem are adequate usage of reproductive health services, equipment supplies, and assistance from skilled health care workers. Also, most of the women in developing countries do not have a good access to the health care services. Even though spreading awareness and establishing various services related to maternal and child birth,

there is still large disparities exist among the poor women living in remote areas in providing antenatal care and skilled birth attendant during delivery. North East states of India comprised of seven states, commonly known as seven sisters, that is, Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura. Meghalaya, Manipur and Tripura are among the densely populated states in north-east region of India, whereas literacy rate is high in Mizoram and Sikkim (census 2011).

## II. Data and Methods

We use data from the second and fourth round of District Level Household Survey (DLHS) conducted during 2002-2004 and 2012-2013 respectively. The DLHS is nationally representative and one of the largest ever demographic surveys which is conducted for reproductive and child health outcome variable. A multi-stage stratified with probability proportional to size sampling design was adopted for rounds of survey. In rural area two-stage stratified sampling and in urban area three-stage stratified sampling were adopted [11, 12].

### A. Outcome Variables:

Four outcome variables were considered for this analysis as indicators of maternal health care services. Three or more Antenatal Care (ANC): Variable was coded as 1 if the woman received at least three antenatal care services from health professionals during her last pregnancy in the last five years preceding the survey and 0 if otherwise. Full ANC: it includes those woman who had a minimum of three antenatal care visits, received at least two toxoid injections during pregnancy or one toxoid injection during pregnancy and at least one in three years prior to the pregnancy and consumed iron and folic acid tablets or syrup for 90 days or more, coded as 1 and if any care was not received, it was coded as 0. Institutional Delivery: women whose delivery is conducted in government or private hospitals or at NGO/clinic was recorded as 1 as the delivery was taken place at institution and it was coded as 0 if it was taken place at home or others. Skilled Birth Attendant (SBA): The SBA at the time of delivery was generated from the response to the question that assessed "place of delivery and assistance at the time of delivery". The place of delivery can be institutional or non-institutional. SBA variable was generated from the response of "type of person who assisted in the delivery at home". The response was coded as 1 if "the attendant at the time of birth at home was doctor/nurse/Lady Health Visitor (LHV)/Auxiliary Nurse Midwife/other health professionals and otherwise coded as 0 for non-skilled birth attendant. If a woman had child birth more than one, the most recent birth was assessed on this study.

### B. Analytical Approach:

The analysis includes the descriptive statistics and multilevel logistic regression. Descriptive statistics was carried out to show the utilization of maternal health care services for each category by the selected variables. To take into account the hierarchical structure of the sample, where individuals are nested within communities (PSUs) and communities are nested within districts, a multilevel modeling was approached in this study. Thus, the study focused on the factors associated with the utilization of maternal care services with focus on individual, household, community and district level. Therefore, a multilevel logistic regression with three levels, individual and household (level 1), nested within communities (level 2) and again nested within districts (level 3) on the use of maternal health care services. Variance Inflation Factor (VIF) was computed for all variables to check the collinearity prior to inclusion of multilevel logistic regression. Thus, the presence of collinearity was not found between the explanatory variables in the regression model (highest VIF = 1.94). Results of the multilevel logistic regression were presented as estimated odds ratio (O.R) with 95% C.I. STATA 13.0 version software used for analyzing the present study with svy command and MLwin software.

### C. Ethical Statement:

The data used in the study is available in public domain so, no ethical issue is involved.

## III. Results and Discussions

The socio-demographic profile of the respondent was presented in Table 1. The minimum age of the woman was 15 years while the maximum age was 49 years. The maximum proportion of woman was under the category of 20-34 years at last birth 53.7% in DLHS2, however 80.3% in DLHS4. The majority of the woman in respect of education level was 44.4% for non-literate and only 4.2% for 10years of education and above in DLHS2. While the scenario was totally different in DLHS4, as only 0.5% of the woman was illiterate and 27.5% attain almost 10 years of education. The majority of the woman belongs to Christian religion group, and almost two-third of the woman belongs to Schedule Tribe category and rural region irrespective of the time period. The household economic status was presented in wealth quintile, where poorest category was composed of 21.6% in 2002-04 and 25.3% in 2012-13. Among the whole sample population majority of the respondents belong to Arunachal Pradesh irrespective of the survey time period. To identify the factors associated with maternal health care services, we examined the bivariate differentials in the utilization of antenatal care in Table2 and delivery care in Table3 during 2002-04 and 2012-13 by the selected background characteristics. These tables reveal the weighted percentage of woman who had utilized services during their last birth.

**Table 1:** Percent distribution of woman who had a childbirth during the last five years preceding the survey by selected background characteristics, Northeast States, India

BACKGROUND CHARACTERISTICS	DLHS-2 (2002-04)			DLHS-4 (2012-13)		
	Sample n=18944	Weighted Proportion	95% C.I	Sample n=15461	Weighted Proportion	95% C.I
<b>Maternal Age</b>						
15-19	8032	42.6	[41.6,43.7]	1411	9.1	[8.6,9.6]
20-34	10216	53.7	[52.6,54.8]	12406	80.3	[79.6,80.9]
35-49	696	3.7	[3.3,4.1]	1644	10.6	[10.2,11.1]
<b>Mother's education</b>						
Illiterate	8379	44.4	[42.3,46.6]	84	0.5	[0.4,0.7]
Less than 5 years	6554	34.7	[33.5,35.9]	5209	33.6	[31.9,35.5]
5-9 years	3192	16.7	[15.3,18.1]	5914	38.3	[37.2,39.4]
10 or more years	819	4.2	[3.7,4.9]	4254	27.5	[25.9,29.2]
<b>Husband's education</b>						
Illiterate	5893	31.7	[30.0,33.5]	3068	19.8	[18.6,21.1]
Less than 5 years	6629	34.8	[33.9,35.8]	1320	8.6	[7.9,9.3]
5-9 years	4563	24.0	[22.8,25.3]	5714	37.0	[36.2,37.9]
10 or more years	1859	9.4	[8.4,10.5]	5358	34.6	[32.8,36.4]
<b>Occupation</b>						
Working	-	-	-	3406	22.1	[21.2,23.1]
Not working	-	-	-	12053	77.9	[76.9,78.8]
<b>No. of living children</b>						
1	5056	27.1	[26.2,27.9]	5170	33.4	[32.5,34.4]
2-3	8557	44.8	[43.9,45.6]	7025	45.4	[44.4,46.3]
4+	5331	28.2	[27.2,29.2]	3266	21.2	[20.3,22.1]
<b>Religion</b>						
Hindu	4524	23.9	[22.3,25.5]	3986	25.8	[24.6,27.0]
Christian	10154	54.1	[52.3,55.9]	8254	53.5	[52.1,54.9]
Others	4266	22.0	[20.7,23.3]	3221	20.7	[19.4,22.1]
<b>Caste</b>						
Schedule Caste	863	4.5	[3.9,5.1]	937	6.0	[5.3,6.8]
Schedule Tribe	13633	72.4	[70.5,74.1]	11385	73.7	[72.2,75.2]
Other Backward Classes	2233	11.7	[10.7,12.7]	1014	6.5	[5.8,7.2]
Others	2215	11.5	[10.5,12.6]	2125	13.8	[12.7,15.0]
<b>Place of residence</b>						
Rural	14543	77.0	[70.1,82.6]	11985	77.7	[70.8,83.3]
Urban	4401	23.0	[17.4,29.9]	3476	22.3	[16.7,29.2]
<b>Wealth Quintile</b>						
Poorest	3996	21.6	[19.3,24.1]	3927	25.3	[23.4,27.3]
Poorer	3593	19.2	[17.9,20.6]	2266	14.6	[13.8,15.4]
Middle	3785	20.1	[18.9,21.4]	3490	22.7	[21.8,23.7]
Richer	3784	19.7	[18.3,21.2]	2991	19.3	[18.3,20.4]
Richest	3786	19.4	[17.3,21.8]	2787	18.0	[16.3,19.9]
<b>States</b>						
Sikkim	1234	6.4	[5.8,7.2]	987	6.4	[5.9,6.9]
Arunachal Pradesh	5206	26.9	[25.5,28.3]	4680	30.1	[28.5,31.7]
Nagaland	2331	12.4	[11.5,13.3]	1351	8.7	[8.0,9.4]
Manipur	3604	19.1	[17.7,20.7]	2484	16.1	[15.2,17.1]
Mizoram	3069	16.4	[14.9,17.9]	2956	19.2	[17.9,20.5]
Tripura	875	4.7	[4.3,5.1]	1238	8.0	[7.3,8.7]
Meghalaya	2625	14.1	[12.8,15.6]	1765	11.5	[10.5,12.6]

Sources: Based on author's computation. Note: (-) means data not available.

The proportion of woman who utilized the service of at least 3ANC visits increased by 14.6% points from a level of 44.4% during 2002-04 to 59.9% during 2012-13 while, nearly 56% points increase in full ANC from a level of 13.4% during 2002-04 to 20.9% during 2012-13 in Northeast state of India. A considerable growth of the utilization of ANC was observed among the woman of age category 34-49. Woman who belongs to the illiterate category also proves a substantial increase in the utilization of services during pregnancy, which grew by 47.5% points for 3ANC and 117.3% points for full ANC. The utilization of ANC shows a gradual increase among other religion category woman apart from Hindu and Christian, 25% points for 3ANC and 87.1% points for full ANC. During a span of 10years, woman of Schedule Tribe category was increased where as full utilization of ANC service was highest among the respondents of Other Backward Classes. A considerable increase of availing both services of ANC was observed among the woman of poorest (Relative change= 38.4% for 3ANC and 87.5% for full ANC) and poorer wealth quintile (Relative change= 53.1% for 3ANC and 123.7% for full ANC). In both survey rounds of DLHS, increasing trend for the utilization of both ANC Services was highest among the respondents living in northeast state- Sikkim, the prevalence was grew up by 41.2% for 3ANC and 178.7% for full ANC in a span of 10years of time period.

**Table 2:** Differential in utilization of antenatal care among who had childbirth during the five years preceding the survey by selected background characteristics, Northeast, India

BACKGROUND CHARACTERISTICS	3ANC (%)			FULL ANC (%)		
	DLHS-2 (2002-04)	DLHS-4 (2012-13)	RELATIVE CHANGE	DLHS-2 (2002-04)	DLHS-4 (2012-13)	RELATIVE CHANGE
<b>Maternal Age</b>						
15-19	39.7	50.4	27.0	11.7	19.2	64.1
20-34	49.0	52.1	6.3	15.0	21.3	42.0
35-49	32.1	42.1	31.2	9.6	19.5	103.1
$\chi^2$	201.3 (0.000)	58.2 (0.000)		51.8 (0.00)	5.6 (0.050)	
<b>Mother's education</b>						
Illiterate	28.2	41.6	47.5	7.5	16.3	117.3
Less than 5 years	49.4	31.9	-35.4	14.8	10.9	-26.4
5-9 years	66.6	54.0	-18.9	21.9	21.3	-2.7
10 or more years	87.0	69.8	-19.8	30.5	32.6	6.9
$\chi^2$	2179.6 (0.000)	1381.9 (0.00)		657.2 (0.0)	665.9 (0.00)	
<b>Husband's education</b>						
Illiterate	27.0	30.3	12.2	8.0	10.0	25.0
Less than 5 years	43.8	41.8	-4.6	12.5	17.3	38.4
5-9 years	55.8	51.0	-8.6	16.5	20.7	25.5
10 or more years	76.5	64.7	-15.4	27.6	28.3	2.5
$\chi^2$	1724.2 (0.000)	967.0 (0.000)		502.2 (0.0)	405.1 (0.00)	
<b>Religion</b>						
Hindu	61.9	65.8	6.3	19.1	26.6	39.3
Christian	39.7	45.4	14.4	12.6	19.5	54.8
Others	37.2	46.5	25.0	9.3	17.4	87.1
$\chi^2$	741.9 (0.000)	479.1 (0.000)		194.6 (0.0)	109.5 (0.00)	
<b>Caste</b>						
Schedule Caste	55.9	63.9	14.3	16.0	25.6	60.0
Schedule Tribe	38.0	45.3	19.2	11.6	18.3	57.8
Other Backward Classes	66.5	68.9	3.6	17.9	29.7	65.9
Others	58.3	66.5	14.1	19.4	28.9	49.0
$\chi^2$	879.8 (0.000)	544.2 (0.000)		148.8 (0.0)	188.9 (0.00)	
<b>Occupation</b>						
Working	-	48.6		-	21.1	
Not working	-	51.5		-	20.9	
$\chi^2$		9.0 (0.021)			0.1 (0.837)	
<b>Place of residence</b>						
Rural	37.9	45.0	18.7	11.1	17.2	55.0
Urban	66.3	71.1	7.2	21.3	33.8	58.7
$\chi^2$	1095.2 (0.000)	728.4 (0.000)		300 (0.00)	446.7 (0.00)	
<b>Number of living children</b>						
1	56.4	60.3	6.9	18.1	26.9	48.6
2-3	45.9	51.3	11.8	13.3	20.4	53.4
4+	30.6	35.1	14.7	9.2	12.7	38.0
$\chi^2$	718.8 (0.000)	508.5 (0.00)		175.7 (0.0)	243.9 (0.00)	
<b>Wealth Quintile</b>						
Poorest	20.3	28.1	38.4	4.8	9.0	87.5
Poorer	30.5	46.7	53.1	7.6	17.0	123.7
Middle	42.8	51.6	20.6	12.2	20.1	64.8
Richer	58.7	61.9	5.5	17.6	25.2	43.2
Richest	72.3	73.4	1.5	25.9	37.3	44.0
$\chi^2$	2720.4 (0.000)	1533.1 (0.00)		921.9 (0.0)	839.8 (0.00)	
<b>States</b>						
Sikkim	59.5	84.0	41.2	20.2	56.3	178.7
Arunachal Pradesh	37.6	41.7	10.9	10.1	8.4	-16.8
Nagaland	29.4	25.7	-12.6	8.5	9.1	7.1
Manipur	48.0	59.5	24.0	8.3	22.0	165.1
Mizoram	54.7	57.3	4.8	21.7	30.5	40.6
Tripura	66.7	62.1	-6.9	23.8	24.0	0.8
Meghalaya	39.7	44.8	12.8	14.9	23.3	56.4
$\chi^2$	774.9 (0.000)	1143.1 (0.00)		495.3 (0.0)	1473.4 (0.0)	
<b>Total</b>	44.4	50.9	14.6	13.4	20.9	55.9

Source: Based on author's computation; Note: value in parenthesis is p-value, (-) means data not available.

In both the outcomes of delivery care, shows a gradual rise in the utilization of services. Growth of 56% was seen in institutional delivery whereas 37% in SBA. The maximum increase of the utilization of delivery care services can be seen in the woman of age category 15-19 years. Woman belonging to illiterate category shows a substantial increase in the utilization of delivery care services at the time of birth, which grew by 112.2% points for institutional delivery and 80.6% points for SBA. A considerable growth was seen among the woman of poorest (Relative change= 92.3% for institutional delivery; 64.9% for SBA) and poorer wealth quintile (Relative change= 135.5% for institutional delivery; 92.5% for SBA). Maximum growth for availing institutional delivery was observed in state-Nagaland whereas SBA was observed in Meghalaya. The association between individual,

household, community and district level factors and the utilization of maternal health care services covering two aspects of antenatal care and delivery care were examined in the present study. The analysis of the present study shows a considerable growth of 14.6%, 55.9%, 55.0% and 37.0% in 3ANC, full ANC, institutional delivery and SBA respectively. The study shows that Sikkim have a gradual rise in percentage change of 3ANC and full ANC whereas, a rise can be seen in Arunachal Pradesh in case of institutional delivery and Meghalaya in case of SBA.

**Table 3:** Differential in utilization of delivery care by woman who had childbirth during the five years preceding the survey by selected background characteristics, Northeast, India

BACKGROUND CHARACTERISTICS	Institutional Delivery (%)			Skilled Birth Attendant (%)		
	DLHS-2 (2002-04)	DLHS-4 (2012-13)	RELATIVE CHANGE	DLHS-2 (2002-04)	DLHS-4 (2012-13)	RELATIVE CHANGE
<b>Maternal Age</b>						
15-19	28.7	57.7	101.0	34.8	59.8	71.8
20-34	40.7	56.2	38.1	49.4	59.8	21.1
35-49	31.5	43.7	38.7	37.0	47.9	29.5
$\chi^2$	291.4 (0.000)	95.4 (0.000)		403.0 (0.000)	84.8 (0.000)	
<b>Mother's education</b>						
Illiterate	19.7	41.8	112.2	25.2	45.5	80.6
Less than 5 years	38.3	31.9	-16.7	47.2	34.5	-26.9
5-9 years	59.5	58.5	-1.7	68.3	62.4	-8.6
10 or more years	77.3	78.6	1.7	89.7	82.7	-7.8
$\chi^2$	2347.7 (0.000)	95.4 (0.000)		2684.2 (0.00)	2286.6 (0.0)	
<b>Husband's education</b>						
Illiterate	18.5	33.3	80.0	23.0	35.4	53.9
Less than 5 years	33.1	38.4	16.0	41.3	41.3	0.0
5-9 years	47.9	54.1	12.9	57.1	58.4	2.3
10 or more years	67.7	72.4	6.9	77.8	76.1	-2.2
$\chi^2$	1899.5 (0.000)	1385.4 (0.00)		2241.4 (0.00)	1507.2 (0.0)	
<b>Religion</b>						
Hindu	53.3	70.5	32.3	60.0	73.6	22.7
Christian	29.2	50.1	71.6	38.2	54.2	41.9
Others	30.6	48.4	58.2	35.1	50.7	44.4
$\chi^2$	846.0 (0.000)	521.9 (0.000)		734.9 (0.000)	515.7 (0.00)	
<b>Caste</b>						
Schedule Caste	49.9	72.1	44.5	58.3	75.9	30.2
Schedule Tribe	29.0	49.3	70.0	36.6	52.7	44.0
Other Backward Classes	55.3	71.3	28.9	63.3	74.0	16.9
Others	48.8	70.1	43.6	54.5	74.4	36.5
$\chi^2$	882.4 (0.000)	559.6 (0.000)		803.2 (0.000)	587.4 (0.00)	
<b>Occupation</b>						
Working	-	49.2		-	52.8	
Not working	-	56.6		-	60.1	
$\chi^2$		59.7 (0.000)			59.3 (0.000)	
<b>Place of residence</b>						
Rural	27.0	47.1	74.4	34.7	50.6	4.2
Urban	62.7	82.3	31.3	69.6	86.0	1.8
$\chi^2$	1867.8 (0.000)	1336.3 (0.00)		1676.1 (0.00)	1372.1 (0.0)	
<b>Number of living children</b>						
1	51.6	70.0	35.7	58.6	72.7	24.1
2-3	35.6	53.1	49.2	43.6	57.0	30.7
4+	19.0	35.4	86.3	26.0	39.3	51.2
$\chi^2$	1214.5 (0.000)	983.9 (0.000)		1139.2 (0.00)	926.7 (0.00)	
<b>Wealth Quintile</b>						
Poorest	14.3	27.5	92.3	18.5	30.5	64.9
Poorer	20.0	47.1	135.5	26.7	51.4	92.5
Middle	27.6	54.5	97.5	36.6	58.4	59.6
Richer	49.2	69.1	40.4	58.5	72.9	24.6
Richest	67.4	85.4	26.7	75.7	88.2	16.5
$\chi^2$	3246.9 (0.000)	2526.1 (0.00)		3432.1 (0.00)	2559.7 (0.0)	
<b>States</b>						
Sikkim	50.9	81.9	60.9	54.9	85.0	54.8
Arunachal Pradesh	32.5	46.8	44.0	35.5	47.9	34.9
Nagaland	14.5	28.8	98.6	26.4	38.2	44.7
Manipur	36.5	59.2	62.2	50.0	68.3	36.6
Mizoram	49.6	66.9	34.9	59.4	69.9	17.7
Tripura	62.3	70.4	13.0	65.0	70.5	8.5
Meghalaya	24.3	44.5	83.1	28.7	45.8	59.6
$\chi^2$	1295.8 (0.000)	1171.1 (0.00)		1267.2 (0.00)	1170.1 (0.0)	
<b>Total</b>	35.3	55.0	55.8	42.7	58.5	37.0

Source: Based on author's computation; Note: value in parenthesis is p-value, (-) means data not available.

Table 4 demonstrate the results of multilevel logistic regression which was carried out in DLHS-4. Intra-class Correlation (ICC) within the districts for 3ANC, full ANC, institutional delivery and SBA were 2.07, 2.12, 2.56 and 2.43 respectively. The result of multilevel modeling showed that the likelihood of 3ANC and full ANC was

39% and 65% higher among the woman who had done schooling of 10 years and above as compared to the illiterate woman. The likelihood of availing ANC services decreases with the increase in the number of living children, higher among the woman having 2-3 children (O.R=0.88 for 3ANC and O.R=0.89 for full ANC) as compared to woman who have 4 and above children (O.R=0.80 for 3ANC and O.R=0.81 for full ANC). The odds of 3ANC and full ANC (O.R=1.42 for 3ANC and O.R=2.75 for full ANC) were higher among the woman in richest wealth quintile as compared to the woman who belong to poorest wealth quintile. Woman living in urban areas were more likely to utilize the service (O.R=1.23 for 3ANC and O.R=1.32 for full ANC) as compared to rural areas. While, with the percentage increase in the tribal population, the likelihood of utilizing services of ANC decreases (O.R=0.49 for >50% of tribal population). In the case of delivery care, woman from the highest level of education had 2.4 and 2.9 times more likely to utilize the service of institutional delivery and SBA at the time of delivery as compared to the illiterate category woman. Also, woman from the richest wealth quintile had 4.5 and 4.8 times more likely to utilize delivery care services. The odds report 2.7 times in case of institutional delivery and 2.8 times in case of SBA of the woman who belongs to urban areas are higher as compare to the rural region. Percentage proportion of woman in category of 26-50% of tribal population was 2.5 times and 1.3 times more likely to utilize the service of institutional delivery and SBA respectively. The multilevel analysis has shown that individual and household level, community level and district level factors were associated with the use of maternal health care services in northeast region, India. Many studies found an association between socio-economic status and maternal health services. The results of our study showed positive influence of higher household socio-economic status (wealth-quintile) on the use of maternal services. Moreover, previous studies have found that urban women were more likely to utilize antenatal and delivery care than rural areas [13, 14]. There was increased in the likelihood of women belongs to urban area as compared to rural areas. Several other studies show an association between communities with maternal health outcome [15]. Increase in the percentage of illiterate population was less likely to utilize the maternal health care services.

**Table 4** Results of multilevel analysis of the variables related to the use of Antenatal Care Services and Delivery care in Northeast State

BACKGROUND CHARACTERISTICS	3ANC Adjusted OR [C.I]	Full ANC Adjusted OR [C.I]	Institutional Delivery Adjusted OR [C.I]	Skilled Birth Attendant Adjusted OR [C.I]
<b>Individual- household level variables</b>				
<b>Maternal Age</b>				
15-19	Ref	Ref	Ref	Ref
20-34	1.05 [0.86, 1.28]	1.22 [1.02, 1.45]	1.21 [1.03, 1.43]	1.25 [1.06, 1.47]
35-49	1.21 [0.92, 1.59]	1.39 [1.10, 1.77]	1.24 [0.99, 1.55]	1.33 [1.06, 1.67]
<b>Mother's education</b>				
Illiterate	Ref	Ref	Ref	Ref
Less than 5 years	1.07 [0.53, 2.16]	0.95 [0.46, 1.95]	0.85 [0.48, 1.52]	0.96 [0.54, 1.70]
5-9 years	1.17 [0.58, 2.36]	1.23 [0.60, 2.52]	1.51 [0.85, 2.68]	1.66 [0.94, 2.95]
10 or more years	1.39 [0.68, 2.84]	1.65 [0.80, 3.38]	2.41 [1.35, 4.30]	2.88 [1.61, 5.16]
<b>Husband's education</b>				
Illiterate	Ref	Ref	Ref	Ref
Less than 5 years	0.84 [0.67, 1.06]	1.25 [1.00, 1.57]	0.92 [0.76, 1.11]	0.95 [0.79, 1.15]
5-9 years	0.83 [0.69, 1.00]	1.27 [1.05, 1.52]	1.09 [0.95, 1.28]	1.17 [1.00, 1.36]
10 or more years	0.76 [0.62, 0.94]	1.39 [1.14, 1.70]	1.51 [1.27, 1.79]	1.54 [1.30, 1.83]
<b>Religion</b>				
Hindu	Ref	Ref	Ref	Ref
Christian	0.95 [0.76, 1.18]	1.10 [0.90, 1.35]	0.69 [0.57, 0.84]	0.74 [0.61, 0.90]
Others	1.09 [0.89, 1.36]	0.93 [0.77, 1.13]	0.75 [0.63, 0.91]	0.72 [0.60, 0.87]
<b>Caste</b>				
Schedule Caste	Ref	Ref	Ref	Ref
Schedule Tribe	1.24 [0.93, 1.65]	0.71[0.55, 0.91]	0.68 [0.53, 0.89]	0.66 [0.51, 0.86]
Other Backward Classes	1.10 [0.80, 1.52]	0.83 [0.64, 1.09]	0.78 [0.59, 1.05]	0.77 [0.57, 1.03]
Others	1.01 [0.76, 1.35]	0.90 [0.71, 1.15]	0.80 [0.62, 1.05]	0.83 [0.63, 1.09]
<b>Occupation</b>				
Not Working	Ref	Ref	Ref	Ref
Working	1.03 [0.90, 1.19]	1.08 [0.97, 1.23]	0.88 [0.79, 1.00]	0.91 [0.81, 1.02]
<b>No. of living children</b>				
1	Ref	Ref	Ref	Ref
2-3	0.88 [0.52, 1.50]	0.88 [0.58, 1.36]	0.65 [0.44, 0.99]	0.64 [0.43, 0.98]
4+	0.81 [0.42, 1.55]	0.81 [0.46, 1.42]	0.64 [0.38, 1.08]	0.62 [0.37, 1.05]
<b>Wealth Quintile</b>				
Poorest	Ref	Ref	Ref	Ref
Poorer	0.96 [0.81, 1.16]	1.27 [1.06, 1.53]	1.59 [1.37, 1.85]	1.59 [1.37, 1.84]
Middle	0.93 [0.79, 1.10]	1.56 [1.32, 1.84]	1.89 [1.65, 2.18]	1.91 [1.67, 2.20]
Richer	1.02 [0.84, 1.23]	1.76 [1.47, 2.10]	2.57 [2.20, 3.01]	2.62 [2.24, 3.07]
Richest	1.42 [1.13, 1.78]	2.75 [2.27, 3.32]	4.52 [3.74, 5.46]	4.81 [3.95, 5.85]

Source: Based on author's computation.

**Table 4** Results of multilevel analysis of the variables related to the use of Antenatal Care Services and Delivery care in Northeast State

BACKGROUND CHARACTERISTICS	3ANC Adjusted OR [C.I]	Full ANC Adjusted OR [C.I]	Institutional Delivery Adjusted OR [C.I]	Skilled Birth Attendant Adjusted OR [C.I]
<b>Community and District Level variables</b>				
<b>Place of residence</b>				
Rural	Ref	Ref	Ref	Ref
Urban	1.23 [1.00, 1.52]	1.32 [1.10, 1.58]	2.69 [2.19, 3.32]	2.76 [2.24, 3.41]
<b>Percentage of illiterate women in PSU's</b>				
0-25	Ref	Ref	Ref	Ref
26-50	0.94 [0.66, 0.99]	0.75 [0.61, 0.93]	0.75 [0.61, 0.93]	0.68 [0.56, 0.83]
>50	0.81 [0.74, 1.21]	0.58 [0.44, 0.77]	0.64 [0.50, 0.81]	0.56 [0.44, 0.71]
<b>Percentage of Tribal Population</b>				
0-25	Ref	Ref	Ref	Ref
26-50	0.68 [0.33, 0.73]	1.91 [1.34, 2.72]	2.47 [1.62, 3.77]	1.32 [0.85, 2.03]
>50	0.49 [0.47, 1.00]	1.11 [0.79, 1.55]	0.95 [0.66, 1.40]	0.59 [0.40, 0.88]
<b>Urbanization</b>				
0-25	Ref	Ref	Ref	Ref
26-50	0.86 [0.69, 1.07]	2.04 [1.64, 2.53]	2.62 [2.07, 3.31]	2.61 [2.07, 3.29]
>50	1.41 [1.11, 1.81]	4.38 [3.50, 5.49]	3.30 [2.57, 4.24]	3.64 [2.84, 4.68]

Source: Based on author's computation.

#### IV. Conclusion

The purpose behind this study was to determine the factors influencing maternal health care services utilization among the woman in northeast, India. The results found that there is a significant association of factors influencing maternal health care services with the household socio-economic status and women living in urban areas. Also, the maximum proportions of women who belong to maximum proportion of illiterate and tribal population were less likely to utilize any maternal health care services. Thus, promoting women education will yield greater results in promoting the utilization of maternal health care services in order to reduce the rate of maternal mortality. Among all the northeastern states of India, higher proportion of women in Sikkim and Manipur utilize the antenatal care services whereas women in Nagaland and Meghalaya utilize the delivery care services. Hence to achieve goal, women has to utilize the services provided by the government along with having knowledge of each phase faced by them during pregnancy and child-birth.

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