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Factors Influencing Antenatal Care Services Utilization in Empowered Action Group (EAG) States, India: A Spatial and Multilevel Analysis

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Abstract

The study investigated individual-household, community and district level factors associated with antenatal care services utilization in Empowered Action Group states, India. Nationally-representative data, drawn from the District Level Household Survey (2007-08), were used. A sample of 116,973 currently married women, aged 15-49 years, who delivered a child during the three years preceding the survey was considered for analysis. Both descriptive and multivariate analysis were used to analyze the data generated and level of significance was set at 5

Index terms— antenatal care services, spatial and multilevel analysis, EAG states.

1 Introduction

he maternal mortality ratio (MMR) has registered a decline rate from 212 per 1000,000 births in the period 2007-09 to 178 in 2010-12 [1]. It has declined further to 167 per 100,000 live births in the period 2011-13 [2]. This means an estimated 44,000 maternal deaths (death of a woman during pregnancy or within 42 days of termination of pregnancy) occur in the country every year. The MDG 5 set target to reduce MMR by 75 per cent between 1990 and 2015. Based on the United Nation's Inter-Agency Expert Group's MMR estimates in the publication, Trends in Maternal Mortality: 1990 to 2013, India's target of MMR is 140 per 100,000 live births by 2105, taking a baseline of 560 per 100,000 live births in 1990 [3].

The government of India has introduced specific health plans, such as the National Rural Health Mission (NRHM), for decentralized areas based on the needs assessment in the 10 th Five-Year Plan for improving the conditions of rural areas and rural population focusing on maternal and child health. NRHM was launched in April 2005 throughout the country with special focus on 18 states, including eight Empowered Action Group (EAG) states, the northeastern states, Jammu and Kashmir and Himachal Pradesh with the objective to provide accessible, affordable and quality health care services to rural population, especially the vulnerable sections [4]. However, the progress is below national average in all the Empowered Action Group (EAG) states. One of the key determinants in reducing maternal mortality is access to quality health care services for antenatal and natal care. Antenatal care is one of the component of maternal health care services, it is a systemic supervision of women during pregnancy to monitor the progress of foetal growth and to ascertain the well-being of the mother and the foetus [5]. A proper antenatal check-up provides necessary care to the mother and helps identify any complications of pregnancy such as anaemia, pre-eclampsia and hypertension etc., and slow/inadequate growth of the foetus. A number of studies have shown that lack of antenatal care services has been identified as one of the risk factors for maternal mortality [6][7]. Moreover, many studies have demonstrated the association between lack of antenatal care and perinatal mortality, low birth weight, premature delivery, pre-eclampsia, and anaemia [8][9]. Every pregnant woman should get a regular check-up as an integral part of maternity care and the care that is given to an expectant mother from the time that conception is confirmed until the beginning of labor [10]. It offers pregnant woman for the timely management of complications through referral to an appropriate facility for further treatment and an opportunity to get different services which alerts the woman to the risks associated with pregnancy, provides opportunity to prepare a birth plan and identify the facility for delivery and for discussion

her options for safe delivery [11,12]. Antenatal care (ANC) is an important determinant of safe delivery [13] and may have a positive impact on the utilization of postnatal healthcare services [14]. During antenatal care visits, essential services such as tetanus toxoid immunization, iron and folic acid tablets, and nutrition education are also provided [15]. One of the most important functions of ANC is to offer health information and services that can significantly improve the health of women and their infants [16]. For women with normal pregnancies, WHO recommends a T Kh. Jitenkumar Singh ? , H.K. Chaturvedi ? & Arvind Pandey ? minimum of four ANC visits, ideally at 16, 24-28, 32, and 36 weeks [17].

The Government of India (GOI) has prepared a list of eight states which are very poor in respect of demographic as well as the socioeconomic indicators and given a name to these eight states as Empowered Action Groups or EAG states. Empowered Action Group (EAG) states comprised of eight socioeconomically backward states of Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Orissa, Rajasthan, Uttarakhand and Uttar Pradesh [18]. Table 1 shows the sociodemographic profiles of the eight EAG states. The present study was conducted to assess the utilization pattern of antenatal care services and to identify factors affecting the utilization of antenatal care among currently married women of reproductive age (15-49 years) with a focus on individual, household, community and district level characteristics in EAG states of India. II.

2 Methods a) Data, sampling design and study size

The data was derived from the District Level Household and Facility Survey (DLHS-3) conducted during 2007-08. The DLHS is a nationally representative and one of largest ever demographic surveys conducted in India to obtained reproductive and child health outcome indicators [19]. DLHS-3 adopted a multi-stage stratified systematic sampling design. The survey interviews 643,944 ever-married women aged 15-49 years from 720,320 sampled household (about 78% from rural and 22% from urban areas) spanning 601 districts of India. The overall response rate for evermarried women at the national level is 89%. Out of these 643,944 ever-married women, a total of 215,048 have had a still or live birth during three years preceding the survey [19]. For the analysis reported in this paper, a total of 116,973 currently married women aged 15-49 years in EAG states who delivered a child during the three years preceding the survey were derived. Thus, 116973 currently married women from 13250 cluster (PSU) units in 265 districts were included in this study. In addition to using the individual data from DLHS-3, district level census data published by the Registrar General of India were also collected and included in the analysis.

3 b) Outcome variables

Three outcome variables were considered for this analysis: (a) Any antenatal care service, (b) Four or more antenatal care and (c) Full antenatal care. Any antenatal care variable was coded as 1 if the woman received antenatal care service from a health professional at least once during her most recent pregnancy in the last three years preceding the survey and 0 if otherwise, based on 116,973 women. A measure of whether a woman had received antenatal care four or more times during her most recent pregnancy was constructed on the number of antenatal care visits who received any antenatal care (sample, N=73,839) during pregnancy. All values of four or higher ANC visits were recoded as 1 (N=15,555), while all other valid codes were relabelled as 0 (N=58,284). Full antenatal care has been defined as at least three antenatal care checkup, consumed 90+ Iron and Folic Acid tables and two or more tetanus toxoid injections taken and it indicates whether a woman received all the recommended antenatal care, coded as 1 (sample, N=8,704) and if care was not received, it is coded as zero (N=65,135) for the women who received any antenatal care (N=73,839).

4 c) Independent variables i. Individual and household level characteristics

Mother's age at last birth was recoded as into three categories: under 20 years, 20-34 years and 35 years or older. Under 20 years is the reference category. Rather than use years of completed schooling, this study looked at two educational attainment levels: non literate and literate. Non-literate is taking as the reference category. Social status of the women was categories into four categories: scheduled caste, scheduled tribe, other backward classes and others. Others is taking as reference category. The total number of living children was recorded into three categories: no living children, 1-3, and ?4 ANC. The reference category is no living children. Women's working status was classified as working who engaged in any work in the last twelve months and those not engaged in any work as not working. The reference category is does not work. Exposure to antenatal care messages is categorized as no exposed, only through mass media (newspaper, radio, television and cinema, etc.), only through interpersonal communication (ANM/Doctor /Health worker Drama etc.) and both. The reference category is no exposure to ANC messages. Household's economic status which has been captured in wealth quintile was categorized into poorest, poorer, middle, richer and richest. The reference category is poorest wealth quintile. Religion is categories as Hindu and non-Hindu. The reference category is non-Hindu.

ii

5 . Community and District level characteristics

Five community level indicators such as type of residence, proportion of illiterate women in PSU (or community), proportion of women from belonging to the poorest wealth quintile in PUS, mean number of children ever born per woman in the PSU and mean age at marriage among respondent in the PSU were considered. Place of residence was defined as urban or rural. The reference category is urban areas. Proportion of illiterate women in the PSU was defined as percentage of illiterate women in the PSU categorized as 0-25% (reference category), 26-50% and >50%. And proportion of women from lowest wealth quintile is defined as percentage of women in the PSU belonged to the lowest wealth quintile and categorized as 0-25% (reference category), 26-50% and >50%. Three district level variables which may have more influence on outcome variable like percentage of scheduled caste and schedule tribe population, percentage of urban population and female literacy in the district of residence, were included.

iii. Analytical approach The analysis included descriptive, spatial visualization, spatial autocorrelation and multilevel logistic. Descriptive analysis was done to show the use of antenatal care by place of residence and selected background characteristics. In spatial analysis, Moran's I is commonly used statistic to assess global spatial auto correlation for a given variable. The value of this statistics ranges from -1 to 1, where positive values indicate observations with similar values being close to each other and negative values suggest observations with high values are near those with low values, or viceversa. The Local Indicator of Spatial Association (LISA) [20] effectively decomposes a global measure of spatial autocorrelation for each spatial unit, enabling assessment of statistical significance for each unit. This study used the ArcGIS 10.1 software [21] to generate choropleth maps for use of antenatal care services and assessed the spatial dependence in district level characteristics using Moran's I Index (Global) value and LISA **??**21]. The spatial pattern of antenatal care services across sample districts were analyzed using rook's weight (uses common boundaries to defined neighbour) in GeoDa software.

Women experiencing the outcomes of study are not independent because they share common psu/community and district characteristic. 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 that accommodates the hierarchical nature of the data and corrects the estimated standard errors to allow for the clustering of observations within units [22][23][24][25]. This study examined factors influencing utilization of antenatal care with a focus on individual, household, community and district level. Thus, a multilevel logistic regression model with three levels, individual and household (level 1), nested within communities (level 2), and communities nested within districts (level 3), was fitted to assess the influences of measured individual, community and district factors (fixed effects) on antenatal care services utilization [26]. Variance inflation factor (VIF) of all the variables are computed to check collinearity prior to inclusion in multilevel logistic regression. Problem of collinearity among independent variables not found (highest VIF, 2.73). The results of multilevel logistic regression are presented in the form of estimated oddsratios with 95% CI. The R-CRAN version 3.2.2 with survey and R2MLwin library package was used for analysis DLHS-3 survey data.

6 iv. Ethical statement

The study is based on data available in public domain, therefore no ethical issue is involved.

7 III.

8 RESULTS AND DISCUSSION

The socio-demographic characteristics of the women are presented in table 2. The minimum age of respondents was 15 years while the maximum age was 59.2% for non literate and literate (40.8%). 48.4% of the respondent were from other backward classes. 65.5% of women having 1-3 living children and 89.9% of women was not engaged in any work in the last twelve months. Household's economic status which has been captured in wealth quintile was categorized into poorest (29.3%), poorer (26%), middle (18.3%), richer (15.1%) and richest (11.3%). Majority of the respondents were Hindu (84.6%) and not working (90%), and majority of the respondents 86.3% were living in the rural areas. Utilization pattern of antenatal care among currently married women is presented in table 3. Of the total sample 116,717 of women 63.1 % received at least once antenatal care during pregnancy from a health professional. Rural women were less likely to receive the care (60.8%) as compared to urban women 77.6% received antenatal care service from health professional. Out of 73,659 women who received at least once Urban women were more than two times more likely to receive ?4 ANC care (38.3%) as compared to rural women (17.6%). Full antenatal care service received from health professional during pregnancy were 19.5% women living in urban areas and less likely to women living in rural areas (10.2%).

About 65% of women 20-34 years age group received at least once antenatal care service as compared to others age groups, women who received ?4 ANC care was 22.1% and full antenatal care was 12.4% for 20-34 years age group as compared to others age group among the women who received any ANC during her most recent pregnancy (Table 4). 77.3% of women with literate in education used at least once ANC service as compared to women with no education (53.5%). Literate women had higher percentage of received ANC (30.7%) and full ANC (18%) when compared to those women who had no education, ?4 ANC(11.5%) and full ANC(5.6%). This was also seen in the distribution of social status by components of antenatal care that scheduled caste, scheduled

tribe and other backward class women were less likely to use ANC care service compared with other social status women. About 73% of others women received at least once ANC care service compare with others social status group women. 32% and 19% of others women received ?4 ANC and full ANC compared to scheduled caste women, 15.7% and 8.4% for ?4 ANC and full ANC. Women having 1-3 living children received relatively higher percentage of any ANC (69.4%), ?4 ANC (25.1%) and full ANC (14.1%) as compared to those women having four or more living children, 51.2%, 10.5% and 5.7% for any ANC, ?4 ANC and full ANC. Women with exposure to ANC messages had received higher percentage of any ANC care (79.1%), ?4 ANC (33.5%) and full ANC (18.9%) when compared to those women who had no exposure to ANC messages, any ANC(37.8%), ?4 ANC(10.2% and full ANC(4.9%). About 64% of Hindu women received at least once ANC care service, 21.8% received ?4 ANC and 12.3% received full ANC as compared to non-Hindu, 17.5% and 9.1% for ?4 ANC and full ANC. It is also seen that a relatively higher percentage of use of ANC care service by higher socio-economic group compared to those who are in lower socio-economic group. 87.6% of women in the richest wealth quintile category received higher percentage of any ANC while only 51.1% of those in the poorest category used the service. Women the richest wealth quintile had higher percentage of received ?4 ANC (43.3%) and full ANC (24.5%) when compared to those women in the poorest quintile ?4 ANC (11.5%) and full ANC (7.2%).

This study also concerned with exploring and better understanding factors that determine the use of antenatal care services, especially, the influence of geographical factors. Figure **??**.1 based on all women, 2.1 and 3.1 based on those women who reported using any antenatal care shows the mapping of proportion of women received any ANC, ?4 ANC and full ANC in each district and components of antenatal care received among currently married women were shown varied substantially across the districts. Throughout the EAG districts, most women received antenatal care, although, the proportion less than 50 percent were showed in some districts of Bihar, Uttar Pradesh, Madhya Pradesh, Rajasthan and Uttarakhand. Almost all districts of Odisha, Chhattisgarh and some districts in eastern parts and northern parts of Uttar Pradesh, central parts of Rajasthan, and southern parts of Madhya Pradesh women received 60 to 70 percent and 70 percent above ANC. 60 percent and above of women received ?4 ANC only in few districts in Odisha, Chhattisgarh and Madhya Pradesh. Figure **??**.1 shows the levels of use of full ANC, proportion of women who received full ANC were less than 30 percent in almost all districts. In the eastern region, central region, western region had the lowest levels of use of full ANC, whereas most of the district in the southern region and south eastern region, women received higher full ANC. In the figures 1.1, 2.1 and 3.1, the mapping of proportion of use of antenatal care i.e., any ANC, ?4 ANC and full ANC reveals clear pattern of spatial clustering of among districts. To measure the extent of this neighborhood clustering in the use of antenatal care across 265 districts, Global Moran'sIand Local Indicator Spatial Autocorrelation (LISA) has been computed using rook's weight matrix and 999 permutations for bivariate clustering (that is liking two variables, like proportion urban percentage in the district with corresponding district's proportion of use of antenatal care separately). The overall Global Moran's spatial autocorrelation index is computed 0.167 ($p<0.05$) implying a slight but significant positive autocorrelation in the proportion of use of antenatal care at least once in the district level and ?4 ANC (Moran's I=0.169, $p<0.05$) and full ANC (Moran's I=0.119, $p<0.05$).

9 Spatial autocorrelation a)

LISA maps of spatial clustering and their significance map has been generated using the GeoDa univariate LISA maps. Figures 1.2, 2.2 and 3.2 illustrate the spatial outliers, high-high clustering (in red color), low-low clustering (in blue color) which is greatly helpful in identifying the district with significant neighborhood clustering. Thus, from the cluster map and corresponding significance may (map not shown), we found that one district in Bihar and one district in MP (in red color) have high proportion of use of ANC at least once surrounded by high value neighbors. The low-low clustering is noticed the six districts as district having low proportion of use of ANC at least once surrounded by other low value neighbors (at 5% level of significance). For ?4 ANC, two districts (in red color) have high-high clustering and six districts (in blue color) have low-low clustering at 5% level of significance (significance map not shown). The low-low clustering at 5% level of significance (significance map not shown) is noticed in eight districts for full ANC. Moran's I index affirms the significance positive association between the like value neighboring districts in all the components of antenatal care services and hence it indicate that whether proximity to urban percentage has adverse impact on the proportion of ANC care service in the district clustered together on the map. The bivariate Moran statistic taking urban percentage in the district gives a high positive spatial autocorrelation of 0.025 ($p<0.05$) for women received at least once ANC, ?4 ANC (I=0.028, $p<0.05$) and (I=0.05, $p<0.05$) implying that districts with higher urban percentage and higher proportion of use of antenatal care services were clustered together in the space and low-urban percentage-low proportion of use of antenatal care services were clustered.

In table 5 below the multilevel logistic regression results are presented. Maternal age, women's education, number of living children, exposure to ANC messages/information's, household wealth, religion, social status significantly predicated received any ANC, ?4 ANC and full ANC (Table 5). . Community/psu variance partition coefficient (VPC) for random effect for the multilevel model (random intercept only model, without covariates) for any anc, ? 4 ANC and full ANC were computed 15.7%, 15.1% and 11.3% and district VPC for anc, ? 4 ANC and full ANC were 6.5%, 6.7% and 3.1%. The variable working status in not included in the final model as not showing any significant difference. Study in south India found that mothers under age 18 years were less likely to receive antenatal care [27], but first-order pregnancies were more likely to receive antenatal care. Women

are generally considered at greater obstetric risk when they give birth before age 18 year or after age 35 years and older [28][29]. The present study is shows that likelihood of women availing themselves of any ANC, ?4 ANC and full ANC were 24%, 11% and 17% higher among 20-34 years maternal age group compared to women with 15-19 years, but among women of 35-49 year age group were 9% for an ANC, 10% for ?4 ANC and 9% for full ANC respectively, lower compared with women 15-19 year maternal age group. Many studies found an association between education and use of antenatal care after controlling for others covariates [30][31][32][33]. Further, women's education is an important predictor of the use of antenatal care services [34][35][36]. Rather than use years of completed schooling, this study looked at two educational attainment levels: non literate and literate. The odds of receives any ANC, ?4 ANC and full ANC were 15%, 42% and 42% higher among literate women compared to women with non-literate. Older women and women with higher number of living children may not seek antenatal care because of their experience with pregnancy-related matters. In India, women having their first child were more likely to receive antenatal care [18,37]. The likelihood of receiving any ANC and ?4 ANC were 39% and 51% higher among those women having 1-3 living children than women who had no living children and those women having 4+ living children had 14% and 4% lower compared with women who had no living children. Women having 1-3 living children are more likely to use any ANC and ?4 ANC. Electronic media can be an important source of information regarding the benefits of preventive care for maternal health [33,37] and suggested that exposure to electronic media can influence cultural barriers to using modern health care. Women with higher living standards may also have better access to mass media informing them of the benefits of antenatal care [38]. The odds of any ANC, ?4 ANC and full ANC were 25%, 34% and 16% higher among women who had exposure to ANC messages/information through mass media, 19%, 25% and 20% higher among women who had exposure to ANC messages/information through mass media and interpersonal communication both than women who had no exposure. This study results shows that utilization of antenatal care services are more likely higher among those women with exposure to ANC messages/information through mass media and through interpersonal communication and both. The use of antenatal care services in a given population depend not only the availability and accessibility of services but randomization to observe univariate clustering and Factors associated with utilization of antenatal care services b) also the socio-economic status of the household [39]. Economic status of the household also may help determine the use of health services insofar as it reflects the ability of the household to pay for health care costs.

Usually families belonging to a higher economic class are more aware of and have easier access to sources of health care [40]. Several studies have shown a relationship between the use of health care services and wealth quintile as compared with women belongs to poorest wealth quintile. The likelihood of utilization of ?4 ANC and full ANC were 2.2 times and 2.4 times higher among women belongs to richest wealth quintile as compared with women belongs to poorest wealth quintile. A strong association of the caste system with the utilization of maternal health care services was documented [39] and also shown from a comparative study on reproductive and child health status of the scheduled castes and scheduled tribes of West Bengal [43]. Scheduled caste women (15%), scheduled tribe (17%) and other backward classes (13%) were less likely to receives any ANC, and SC(21%), ST(31%) and OBC(35%) were less likely to utilizes ?4 ANC and SC(4%) and ST(13%) were less likely to utilizes full ANC compared with women from other social groups. Significant difference was also observed between [1] [2] [3]

[1]years with mean age of 26.55 (95% CI=26.51-26.60)) years. The majority of the mother's age at last birth were 20-34 years (82.8%).Educational attainment levels was

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Figure 1: Figure 1 . 1 :Figure 1 . 2 :Figure 2 . 1 :Figure 2 . 2 :Figure 3 . 2 :

1

Demographic characteristics	Uttar Pradesh	Uttarakhand	Bihar	Jharkhand	Odisha	Chhattisgarh	Madhya Pradesh	Ra
Land Ares (sq.km.) 1	240928	53483	94163	79716	155707	135192	308252	342
Total population in million 1	199.58	10.11	103.80	32.97	41.95	25.54	72.60	68.
Population size-% of national population 1	16.5	0.83	806	2.72	3.47	2.11	6.00	5.6
Population density 1	828	189	1102	414	269	189	236	201
Urban percentage 1	22.3	30.6	11.3	24.0	16.7	23.2	27.6	24.
Female literacy rate (%) 1	59.26	70.70	53.33	56.21	64.36	60.59	60.02	52.
Schedule Caste (%) 1	20.7	17.9	15.7	23.2	22.8	30.6	21.1	13.
Schedule Tribe (%) 1	0.6	2.9	1.3	26.2	22.8	30.6	21.1	13.
Sex ratio-Females per 100 males 1	912	963	918	948	979	991	931	928
Birth rate 2	27.2	18.2	27.6	24.6	19.6	24.4	26.3	25.
Death rate 2	7.7	6.1	6.6	6.8	8.4	7.9	8.0	6.5
Natural growth rate 2	19.5	12.1	21.0	17.8	11.3	16.5	18.4	19.
Infant mortality rate 2	50	32	42	37	51	46	54	47

Sources: 1-Census of India, 2011, 2-Sample Registration System, vol. 49 No.1. 2014.

Figure 2: Table 1 :

2

Background Characteristics (N=116717)	Nominal categories	Weighted Sample	Weighted proportion of sam estimate (95%CI)
Individual characteristics			
	15-19	7869	6.7 (6.5-7.0)
	20-34	96600	82.8 (82.4-83.1)
	35-49	12248	10.5 (10.3-10.7)
Women's education	Non-literate	69072	59.2 (57.6-60.8)
	Literate	47645	40.8(39.2-42.4)
Number of living children	0	458	0.4 (0.3-0.4)
	1 -3	76487	65.5 (64.9-66.2)
	4 +	39773	34.1 (33.4-34.7)
Working status	Working	11815	10.1 (9.7-10.6)
	Not working	104902	89.9 (89.4-90.3)
Exposure to ANC messages	No exposure	21444	18.4 (17.6-19.2)
	Through mass media	7216	6.2 (5.7-6.7)
	Through interpersonal comm.	59232	50.7 (49.5-51.9)
	Both	28824	24.7 (23.3-26.1)
Household characteristics			
Wealth quintile	Poorest	34194	29.3 (27.8-30.8)
	Poorer	30395	26.0 (25.0-27.1)
	Middle	21410	18.3 (18.0-18.7)
	Richer	17542	15.0 (14.4-15.7)
	Richest	13175	11.3 (9.4-13.5)
Religion	Hindu	98702	84.6 (83.8-85.4)
	Non-Hindu	18015	15.4 (14.6-16.3)
Social status	Scheduled caste	22822	19.6 (18.8-20.4)
	Scheduled tribe	16467	14.1 (13.3-14.9)
	Other backward class	56442	48.4 (47.6-49.1)
	Other	20986	18.0 (17.1-18.8)
Place of residence	Urban	16020	13.7 (9.3-19.8)
	Rural	100697	86.3 (80.2-90.7)

Sources: Based on author's computation from DLHS-3 (2007-08).

Figure 3: Table 2 :

3

Variables Description (N=116717)		Total Sample	%	Urban Sample	%	Rural Sample	%
Received antenatal care service from health professional at least once during pregnancy	Yes	73659	63.1	12436	77.6	61223	60.8
	No	43058	36.9	3584	22.4	39474	39.2
Total		116717	100	16020	100	100697	100
Received four or more antenatal care service from health professional during pregnancy	Yes	15529	21.1	4757	38.3	10772	17.6
	No	58130	78.9	7679	61.7	50451	82.4
Received Full antenatal care service from health professional during pregnancy	Yes	8683	11.8	2428	19.5	6255	10.2
	No	64976	88.2	10008	80.5	54968	89.8
Total		73659	100	12436	100	61223	100

Sources: Based on author's computation from DLHS-3 (2007-08).

Figure 4: Table 3 :

4

Background Characteristics		Women who received antenatal care		
	Nominal categories	Any ANC	? 4 ANC	Full ANC
		63.1%	21.1% (N=15529)	11.8%
		(N=73659)		(N=8683)
Individual-household Level variables				
	15-19	66.0 (5195)	16.5 (855)	8.0 (414)
	20-34	64.7 (62589)	22.1 (13821)	12.4 (7765)
	35-49	48.7 (5965)	14.3 (854)	8.4 (504)
Education	Non-literate	53.3 (36826)	11.4 (4215)	5.6 (2064)
	Literate	77.3(36833)	30.7(11314)	18.0(6619)
Number of living children	0	64.6 (296)	22.8 (68)	11.6 (34)
	1 -3	69.4 (53068)	25.1 (13335)	14.1 (7494)
	4 +	51.0 (20295)	10.5 (2127)	5.7 (1155)
Working status	Working	61.3 (7244)	14.6 (1056)	8.9 (645)
	Not working	63.3 (66415)	21.8 (14473)	12.1 (8038)
Exposure to ANC messages	No exposure	37.7 (8089)	10.1 (819)	4.9 (392)
	Through mass media	74.2 (5353)	32.4 (1735)	17.4 (933)
	Through interpersonal communication	63.2 (37431)	14.9 (5585)	8.2 (3055)
	Both	79.1 (22786)	32.4 (7390)	18.9 (4303)
Wealth quintile	Poorest	50.9 (17416)	11.5 (1999)	7.2 (1250)
	Poorer	58.2 (17687)	13.8 (2441)	7.6 (1343)
	Middle	65.3 (13983)	19.2 (2687)	9.9 (1391)
	Richer	74.3 (13039)	26.1 (3410)	14.4 (1876)
	Richest	87.5 (11533)	43.3 (4994)	24.5 (2824)
Religion	Hindu	63.7 (62874)	21.7 (13647)	12.3 (7707)
	Non-Hindu	59.9 (10785)	17.5 (1882)	9.0 (976)
Social status	Scheduled caste	58.5 (13354)	15.7 (2096)	8.3 (1114)
	Scheduled tribe	55.5 (9142)	17.7 (1621)	12.5 (1144)
	Other backward class	63.5 (35857)	19.3 (6915)	9.9 (3541)
	Other	72.9 (15306)	32.0 (4898)	18.8 (2884)
Community Level variables				
Place of residence	Urban	77.6 (12436)	38.3 (4757)	19.5 (2428)
	Rural	60.8 (61223)	17.6 (10772)	10.2 (6255)
Proportion of illiterate women in the PSU	0-25%	81.1 (13824)	40.9 (5660)	24.4 (3369)
	26-50%	70.0 (17887)	23.4 (4178)	12.9 (2308)

5

Background Characteristics	Nominal categories	Any ANC Adjusted OR (95%CI)	?? 4 A N C Adjusted OR (95%CI)	Full ANC Adjusted OR (95%CI)
Individual-household Level variables				
	15-19 (ref)	1.000	1.000	1.000
	20-34	1.240 (1.185-1.297)	1.112 (1.020-1.212)	1.169 (1.144-1.194)
	35-49	0.914 (0.86-0.965)	0.897 (0.827-0.972)	0.989 (0.966-1.013)
Women's education	Non-literate (ref)	1.000	1.000	1.000
	Literate	1.151 (1.114-1.190)	1.423 (1.353-1.498)	1.416 (1.394-1.439)
Number of living children	0 (ref)	1.000	1.000 ()	1.000
	1 -3	1.388 (1.345-1.432)	1.514 (1.431-1.603)	0.982 (0.967-0.998)
	4 +	1.145 (0.930-1.409)	0.856 (0.641-1.145)	0.957 (0.874-1.047)
Exposure to ANC messages	No exposure (ref)	1.000	1.000	1.000
	Through mass media	1.247 (1.199-1.297)	1.344 (1.280-1.412)	1.156 (1.140-1.172)
	Through interper. comm.	1.098 (1.032-1.170)	1.226 (1.138-1.321)	1.142 (1.116-1.169)
	Both	1.186 (1.139-1.236)	1.245 (1.135-1.365)	1.203 (1.178-1.229)
Wealth quintile	Poorest (ref)	1.000	1.000	1.000
	Poorer	1.267 (1.207-1.331)	1.139 (1.070-1.213)	0.966 (0.948-0.986)
	Middle	1.476 (1.406-1.551)	1.622 (1.524-1.728)	1.131 (1.107-1.156)
	Richer	1.723 (1.606-1.849)	1.838 (1.697-1.992)	1.578 (1.541-1.615)
	Richest	1.733 (1.644-1.827)	2.153 (2.014-2.302)	2.366 (2.320-2.412)
Religion	Hindu	1.176 (1.122-1.232)	1.129 (1.058-1.204)	1.015 (0.997-1.033)
	Non-Hindu (ref)	1.000	1.000	1.000
Social status	Scheduled caste	0.850 (0.813-0.890)	0.788 (0.749-0.829)	0.963 (0.948-0.978)
	Scheduled tribe	0.825 (0.784-0.868)	0.694 (0.650-0.743)	0.958 (0.939-0.977)
	Other backward class	0.875 (0.820-0.933)	0.647 (0.592-0.706)	0.878 (0.859-0.900)

Figure 6: Table 5 :

the social status and antenatal care services utilization.

.1 Maternal Age

Women living in urban areas may not need additional costs for transportation and other costs related to distance to access health care services. Many studies have found that urban women were more likely to use antenatal care services than rural women [44][45]. At community level, residence in urban area was consistently associated with increased likelihood of the antenatal care services utilization [46]. The result of this study is also found sufficient amount of variation of antenatal care services utilization at community of residence.

Association between contextual/neighbourhood (or shared community) with maternal health outcome has been shown in several studies [47][48][49]. The contextual variables proportion of illiterate women in the psu, proportion of women belonging to poorest wealth quintile in the psu and SC & ST percentage, seem to provide a better overall explanation for the variation of antenatal care services utilization. The adjusted model show that the place of residence, community education, community impoverishment, urban percentages, SC & ST percentages were significant factors associated with utilization of any ANC, ?4 ANC and full ANC IV.

.2 CONCLUSION

The purpose of this study was to determine the factors influencing antenatal care services utilization among currently married women in EAG states. The significance of the results of this study is that household socio-economic status and mother's education were the most important factors associated with antenatal care services utilization. Therefore empowering women and promoting mother's education would yield greater results in increasing the use of antenatal care services in order to achieve the Millennium Development Goal 5 of reducing maternal mortality.

V.

.3 Additional Information and Declarations a) Acknowledgements

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.4 b) Competing interests

The authors declare that they have no competing interests.

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