Original article

Inequalities in Use of Antenatal Care and Its Service Components in India

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Abstract

Objectives: This study was performed to evaluate the use of individual components of antenatal care (ANC) services by pregnant women across India in addition to counting of ANC visits and then analyze differences according to state, socioeconomic condition, and access to health care services.

Methods: The study used a nationally representative sample of 36,850 women from the National Family Health Survey (2005–2006) of India. Outcome measurements were medication, number of ANC visits, and components of ANC, including physical examination and measurements, laboratory examination, and advice about pregnancy. Differences in these outcomes according to 29 states, socioeconomic conditions, and access to health care services were examined. Independent associations between outcome measures and social and health care factors were analyzed.

Results: The percentages of women who used ANC at least once and four times or more were 81.5% (ranges by states: 38.0–99.9%) and 46.1% (15.2–97.9%), respectively. Among those who used ANC four times or more, 86.4% (54.2–98.9%) received a blood examination, and 85.8% (70.3–96.3%) were advised to deliver in a hospital. Greater wealth (OR=3.38; 95%CI 2.58–4.42) and higher education level (OR=3.19; 95%CI 2.49–4.14) were associated with receiving a blood examination during ANC. Rural residence was negatively associated with using ANC four times or more (OR=0.64; 95%CI 0.59–0.67) and receiving a blood examination (OR=0.67; 95%CI 0.59–0.76). Those who received ANC at community health centers were less likely to receive a blood pressure examination, blood and urine examination, and advice to deliver in a hospital compared with those who received ANC at public hospitals.

Conclusion: This study showed substantial inequalities in use of

ANC and service components of ANC received in India across geographic areas, socioeconomic conditions, and levels of access to health care services. In addition to reducing socioeconomic inequalities, it is necessary to provide quality services to those with limited access to health care services.

Key words: India, antenatal care, inequality, quality of care, socioeconomic conditions, access to health care services

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Introduction

Antenatal care (ANC) is a key maternal service in improving a wide range of health outcomes for women and children¹. Based on a review of the effectiveness of maternal health care services delivered², the World Health Organization (WHO) recommends that all pregnant women should have at least four ANC assessments³. Essential elements include pregnancy surveillance, prevention of adverse conditions, recognition and management of pregnancy-related complications, advice and support regarding birth, and health education and promotion.

The Indian Public Health Standards⁴ and the Guidelines for Antenatal Care and Skilled Attendance at Birth of India⁵ recommend a minimum of four ANC visits covering service components, including general examination of height and weight, abdominal examination, measurement of blood pressure, blood tests to estimate hemoglobin, urine tests for albumin and sugar, iron and folic acid supplementation, and tetanus toxoid vaccination. There is concern regarding whether ANC actually provides the necessary service components according to these recommendations.

Studies have demonstrated the effectiveness of ANC in reducing perinatal complications in general¹, neonatal tetanus⁶, low birth weight⁷, and perinatal mortality⁸ and

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in increasing professional assistance at delivery⁹). Other studies have addressed concerns regarding the quality of services^{10–12}). The effectiveness is strengthened when the facilities and professionals are reasonably equipped. It should be noted that completion of four ANC visits does not necessarily correspond to receiving all of the recommended ANC service components.

Educational level of women and household economic status are known to be social determinants of ANC utilization^{10, 13}). However, there is some concern regarding whether the contents of ANC are similar regardless of socioeconomic level. There have been limited opportunities to address the inequalities in maternal health care and use of services by women in India across states according to potential determinants of health.

The present study was performed to examine the service components of ANC received by women according to a National Family Health Survey conducted across India. The objectives of this study were to evaluate the use of individual components of ANC services by pregnant women across India in addition to numeration of ANC visits, and then analyze differences according to state, socioeconomic condition, and access to health care services.

Methods

Data source

The analysis was performed using self-reported data from the National Family Health Survey-3 (NFHS-3) conducted in India during 2005–2006¹⁴). Representative samples were drawn from each of the 29 states using a multistage, self-weighted sampling procedure. Three types of questionnaires were used in the NFHS-3: one for women who had ever been married within households, one for households, and one for villages. Selected variables from the household and village questionnaires were merged into an individual data file for women of childbearing age. A five-year retrospective pregnancy history was obtained from married women, aged 15–49 years, who gave birth in the five years prior to the survey. The Ethics Review Board of the International Institute of Population Sciences (IIPS) reviewed and approved the survey protocol and storage of anonymous data¹⁴). The overall household response rate was 97.7%, ranging from 95.9% in Maharashtra (West) to 99.6% in Uttar Pradesh (Central). The overall response rate of eligible women was 94.5%, ranging from 89.5% in Maharashtra (West) to 98.8% in Madhya Pradesh (Central)¹⁴). The data from a total of 36,850 women who gave birth in the last five years were utilized as the dataset of analysis. Data concerning ANC service use pertaining to their last delivery was used in the present analysis. Openly available data from the IIPS, which

did not contain information that could specifically identify individuals, were used for the research analysis.

Outcome variables

Based on the report of the number of ANC visits during the last delivery, two groups were created: “use of ANC at least once” and “use of ANC four times or more.” A report concerning tetanus toxoid injections before delivery was used as a variable for history of anti-tetanus vaccination, and a report concerning given or purchased iron tablets or syrup during pregnancy was used as a variable for history of iron supplementation.

Various service components of ANC were reported and used as outcome variables. Physical examination of the abdomen in a prone position and check for fundal height, determination of weight, and measurement of blood pressure were reported. With regard to laboratory examination, blood and urine sampling for laboratory analysis were reported separately. Advice on pregnancy consisting of receiving advice regarding the expected date of delivery, receiving advice regarding nutrition during pregnancy, and receiving advice to deliver in a hospital were reported.

Demographic and social variables

The following demographic variables were collected and used for the analysis: age of women, state of residence (29 states in India), and area of residence (rural, urban).

With regard to social variables, wealth quintiles according to household wealth index (poorest, poor, middle, rich, richest), education according to the highest level of education completed (none, primary school, secondary school, post-secondary education), and caste (“scheduled caste” or “scheduled tribe,” other “backward” caste, none of these) were used for the analysis. Caste is based on the head of a household’s self-identification as belonging to a specific social category in India; “scheduled castes” are the lowest castes in the traditional Hindu caste hierarchy, and “scheduled tribes” consist of approximately 700 tribes that tend to be geographically isolated and have limited economic and social interactions with the rest of the population¹⁵).

Health care access variables

In relation to access to health care services, information on perception of problems in obtaining medical services, place of delivery, and place of provision of ANC services was reported. Perception of problems (yes or no) in obtaining medical services was reported individually with regard to the following aspects: financial difficulties, distance to health facilities, availability of transport to health facilities, obtaining permission to go to health facilities, concerns regarding lack of health care providers in the area, and concerns regarding

lack of medications in the area. A health care access score was calculated by counting the number of items in which no problems were perceived. The highest score was 6, which indicated that none of the problems were perceived, and the lowest score was 0, which indicated that problems were perceived for all 6 aspects. Place of delivery was divided into 3 categories: public institution, private institution, and home. Place of provision of ANC services was reported for those who used ANC at least once and divided into 6 categories: public hospital (government or municipal hospital), private hospital, NGO/trust hospital, two or more types of hospital, rural community health center, and other place(s).

Analysis

The following indicators were calculated individually for demographic, social, and health care access categories: percentage of women receiving tetanus toxoid among all women; percentage of women who received iron supplementation among all women; percentage of women who used ANC at least once among all women; percentage of women who used ANC four times or more among all women and that among women receiving ANC at least once; and percentage of women who received individual components of ANC among women receiving ANC four times or more.

Multivariate logistic regression analyses were carried out to estimate the associations between outcome measures and demographic, socioeconomic, and health care access factors. Independent variables included in the analysis were rural/urban residence, wealth index quintile, type of caste or tribe of the head of the household, highest educational level, health care access score, place of provision of ANC services, and women's age. Odds ratios and 95% confidence intervals (CIs) adjusted for all variables, including state, were calculated.

Results

Table 1 shows the percentages of women who received medication, made ANC visits, and received individual components of ANC during ANC visits according to the 29 Indian states. The mean age of the subjects was 27.0 (SD=5.6) years. Among all subjects, 85.0% received tetanus toxoid and 68.2% received iron supplementation, while the percentage of women who used ANC four times or more was 46.1%. The percentage of women receiving tetanus toxoid among all women by state ranged from 53.8% in Arunachal Pradesh (North East) to 99.1% in Tamil Nadu (South). The percentage of women receiving iron supplementation ranged from 31.2% in Nagaland (North East) to 97.0% in Kerala (South).

Among the women who used ANC four times or more, 97.9% received tetanus toxoid, while only 76.0% reported

receiving advice about nutrition during pregnancy. The percentages of women who used ANC at least once and four times or more among all women ranged from 38.0% in Bihar (East) to 99.9% in Kerala (South) and from 15.2% in Bihar (East) to 97.9% in Kerala (South), respectively. The percentage of women who used ANC four times or more among those who used ANC at least once ranged from 25.9% in Uttar Pradesh (Central) to 98.1% in Kerala (South). The percentages of women who received individual components of ANC among those who used ANC four times or more ranged from 54.2% in Mizoram (North) to 98.9% in Kerala (South) for blood sampling and from 70.3% in Arunachal Pradesh (North East) to 96.3% in Tamil Nadu (South) for advice to deliver in a hospital.

Table 2 shows the percentages of women who received medication, made ANC visits, and received individual components of ANC during ANC visits according to social characteristics and access to health care services. The percentages of women who used ANC four times or more among all women and among those who used ANC at least once, and the percentages of use of service components of ANC among women who used ANC four times or more were high among women who were not living in countryside, in women from households of the higher wealth quintile, in women from households from nonscheduled castes or scheduled tribes, and in women who had completed post-secondary education. The percentages of use of ANC among those who did not have problems in obtaining medical services were high, while those among ANC users in nonhospital settings were low.

Table 3 shows the independent associations between received medication or ANC visits and social characteristics and access to health care obtained by logistic regression analyses. The influences of variation by state were adjusted. The unadjusted odds ratios of rural vs. urban, richest vs. poorest, non-caste vs. scheduled caste or tribe, and secondary education vs. no education for the use of ANC four times or more were 0.27, 27.16, 2.81, and 6.25. Rural living was negatively associated with receipt of tetanus toxoid and iron supplementation, and use of ANC at least once or four times or more. Higher wealth index quintile, higher educational level, and level of health care access were positively associated with receipt of tetanus toxoid and iron supplementation, and use of ANC at least once or four times or more. Tetanus toxoid, iron supplementation, and use of ANC at least once were marginally associated with caste. There was a positive association between use of ANC four times or more and nonscheduled caste or tribe.

Table 4 shows independent associations of use of ANC four times or more and receipt of individual components of ANC with social characteristics and access to health care ob-

Table 1. Percentages of women in Indian states who received medication, made antenatal care (ANC) visits, and received individual components of ANC during ANC visits

Region	State	Number of subjects	Mean age mean $\pm$ SD	Medication		ANC visits			Physical exam and measurements				Lab exam		Advice on pregnancy		
				Tetanus toxoid	Iron supplement	≥ 1	≥ 4	≥ 4	Abdomen	Weight	Blood pressure	Blood	Urine	Expected date of delivery	Nutrition	Advised to deliver in hospital	
a)	a)	a)	b)	c)	c)	c)	c)	c)	c)	c)	c)	c)	c)				
ALL		36,850	27.0 $\pm$ 5.6	85.0	68.2	81.5	46.1	56.5	92.5	86.6	90.9	86.4	86.9	83.2	76.0	85.8	
East																	
	[BH] Bihar	1,550	26.8 $\pm$ 6.1	80.2	32.9	38.0	15.2	40.1	86.9	78.8	93.2	89.4	90.3	77.5	78.8	83.5	
	[WB] West Bengal	1,823	25.5 $\pm$ 5.4	96.3	83.2	93.2	47.2	50.7	92.5	94.5	93.8	87.1	84.8	88.5	81.5	90.5	
	[JH] Jharkhand	1,151	26.1 $\pm$ 5.8	79.4	51.6	62.5	22.2	35.6	85.2	76.6	87.5	78.9	78.1	66.8	60.9	81.6	
	[OR] Orissa	1,323	26.7 $\pm$ 5.5	88.5	83.4	88.1	40.3	45.7	88.4	81.2	77.7	72.4	74.1	74.9	73.0	86.1	
North East																	
	[SK] Sikkim	518	27.0 $\pm$ 5.7	94.0	88.2	91.5	62.7	68.6	96.3	95.1	95.4	91.4	93.9	93.2	90.8	90.8	
	[AR] Arunachal Pradesh	595	27.8 $\pm$ 6.6	53.8	49.1	58.2	27.7	47.7	85.5	83.6	86.1	78.2	77.0	78.8	59.4	70.3	
	[NA] Nagaland	1,336	29.1 $\pm$ 6.3	68.5	31.2	64.8	16.9	26.1	92.0	66.4	89.4	64.2	69.5	83.2	61.5	72.6	
	[MN] Manipur	1,443	29.6 $\pm$ 5.9	90.3	67.7	87.9	56.8	64.6	98.1	93.3	97.6	82.2	84.4	95.0	74.5	75.3	
	[MZ] Mizoram	609	28.3 $\pm$ 6.1	82.8	61.5	74.4	45.5	61.1	89.5	91.0	87.7	54.2	59.9	93.1	57.4	74.0	
	[TR] Tripura	517	26.0 $\pm$ 6.0	81.8	70.2	79.5	52.4	65.9	86.0	81.9	93.7	80.8	79.7	86.0	66.8	85.2	
	[MG] Meghalaya	748	29.4 $\pm$ 7.0	68.3	58.1	72.3	47.6	65.8	93.0	89.9	88.2	69.7	65.2	73.3	76.4	83.7	
	[AS] Assam	1,199	26.9 $\pm$ 5.8	76.6	63.9	74.1	28.4	38.3	86.2	76.8	84.7	71.5	74.4	86.8	81.2	85.0	
North																	
	[JM] Jammu and Kashmir	874	28.4 $\pm$ 5.4	86.9	68.2	85.7	61.7	72.0	87.9	30.1	89.6	94.3	95.2	55.1	53.6	78.3	
	[HP] Himachal Pradesh	740	27.3 $\pm$ 4.5	93.4	85.8	90.4	52.4	58.0	93.3	90.2	92.0	91.8	92.0	91.0	78.1	86.3	
	[PJ] Punjab	928	26.3 $\pm$ 4.5	90.2	66.4	90.2	61.4	68.1	89.1	72.3	85.1	85.6	86.7	73.7	71.2	82.6	
	[UC] Uttaranchal	871	27.2 $\pm$ 4.8	77.3	63.3	74.6	39.8	53.4	78.1	68.6	72.1	72.3	74.9	72.1	66.6	70.9	
	[HR] Haryana	873	26.4 $\pm$ 5.3	90.1	61.8	89.7	42.6	47.5	78.8	74.2	72.6	74.5	73.4	59.4	65.3	73.7	
	[DL] Delhi	897	27.3 $\pm$ 5.0	92.9	74.8	88.9	60.9	68.5	89.0	93.8	92.7	90.1	92.1	85.9	85.9	90.1	
	[RJ] Rajasthan	1,374	26.5 $\pm$ 5.7	75.1	58.7	75.9	25.5	33.7	92.0	75.5	83.5	84.6	83.2	70.9	74.4	81.8	
Central																	
	[UP] Uttar Pradesh	4,644	27.4 $\pm$ 5.9	73.8	55.0	68.9	17.8	25.9	88.5	71.9	82.6	74.6	77.7	69.8	69.2	86.8	
	[CH] Chhattisgarh	1,161	26.3 $\pm$ 5.4	88.4	75.5	89.6	32.0	35.8	88.4	77.2	73.1	64.3	65.3	63.7	64.0	79.6	
	[MP] Madhya Pradesh	2,070	26.8 $\pm$ 5.4	86.5	68.8	84.7	36.7	43.4	93.8	91.1	86.8	86.5	84.9	76.8	78.6	85.0	
West																	
	[GJ] Gujarat	1,089	26.4 $\pm$ 4.9	88.7	82.4	87.3	50.9	58.3	92.2	85.2	89.5	83.2	80.5	74.7	74.2	88.3	
	[MH] Maharashtra	2,290	26.0 $\pm$ 4.7	95.1	83.4	94.8	66.7	70.3	96.4	97.5	96.9	95.6	95.6	88.3	79.9	86.5	
	[GO] Goa	799	29.7 $\pm$ 5.0	97.0	89.4	98.6	93.2	94.5	98.1	98.1	98.5	97.2	97.3	93.4	69.5	85.0	
South																	
	[AP] Andhra Pradesh	1,686	25.3 $\pm$ 4.8	94.4	79.4	95.3	78.9	82.8	95.7	95.9	95.7	94.9	95.7	92.9	87.7	90.8	
	[KA] Karnataka	1,577	25.4 $\pm$ 5.0	87.4	74.4	90.4	68.4	75.6	93.1	86.6	93.2	91.2	91.2	82.8	78.1	91.6	
	[KE] Kerala	827	27.9 $\pm$ 4.8	98.9	97.0	99.9	97.9	98.1	99.0	95.9	98.9	98.9	99.6	96.2	74.4	90.7	
	[TN] Tamil Nadu	1,338	26.6 $\pm$ 4.8	99.1	92.6	99.0	89.7	90.6	97.5	98.9	97.3	95.5	95.6	95.9	89.6	96.3	

a) Percentage among all women; b) percentage among women receiving ANC at least once; c) percentage among women receiving ANC 4 times or more.

Table 2. Percentages of women who received medication, made antenatal care (ANC) visits, and received individual components of ANC during ANC visits according to social characteristics and access to health services in India

Social characteristics and access to health services	Number of subjects	Components of ANC									
		Medication		ANC visits			Physical exam and measurements			Lab exam	
		Tetanus toxoid	Iron supplement	≥ 1	≥ 4	≥ 4	Abdomen	Weight	Blood pressure	Blood	Urine
		a)	a)	a)	b)	c)	c)	c)	c)	c)	c)
All	N	85.0	68.2	80.5	45.6	56.1	93.2	87.2	91.5	87.1	87.5
Residence											
Countryside	22,323	79.9	62.8 p	75.3	33.6	44.6	89.8	80.8	86.3	80.6	80.6
Town	5,700	91.0	73.2	88.6	60.4	68.2	94.9	88.7	94.1	88.8	89.9
Small city	2,361	93.4	75.8	91.5	65.4	71.4	95.0	90.5	95.5	91.8	92.2
Large city	6,466	94.4	79.9	93.1	70.2	75.4	97.0	95.2	96.8	94.7	95.3
Wealth											
Poorest	6,154	66.9	49.2	59.6	13.7	23.0	77.0	72.4	67.6	62.8	59.5
Poor	6,468	75.0	55.9	70.0	23.6	33.7	85.1	76.1	80.7	72.3	70.1
Middle	7,418	85.1	65.7	80.9	39.9	49.4	90.5	80.2	87.4	80.6	81.7
Rich	8,136	93.0	74.5	90.7	57.2	63.0	93.9	87.2	93.1	88.4	89.5
Richest	8,674	97.9	87.3	97.5	81.2	83.2	97.5	94.1	97.3	94.8	95.5
Caste											
Scheduled caste or tribe	12,101	78.5	61.9	75.7	34.7	45.7	90.2	84.2	86.3	77.8	77.4
Other "backward" class	12,028	85.4	66.3	79.8	43.6	54.6	93.7	87.6	91.9	88.2	89.0
None of above	11,056	91.0	76.3	88.7	59.9	67.5	95.0	91.0	94.2	91.3	91.8
Education											
None	14,094	71.6	50.4	65.6	21.7	33.1	83.3	71.5	77.8	73.2	73.9
Primary	5,251	86.2	68.5	82.3	39.0	47.4	91.0	82.5	87.4	80.7	80.8
Secondary	14,215	94.6	80.1	93.0	63.4	68.2	85.3	90.2	94.7	90.1	90.5
Post-secondary	3,289	99.5	93.2	99.0	88.4	89.3	98.4	97.1	98.6	96.3	96.6
Problems in obtaining medical services											
Financial	15,700	78.2	58.1	87.3	56.2	42.9	88.7	80.7	85.7	78.7	78.7
Distance to health facility	18,916	79.1	60.3	74.0	32.3	43.6	89.7	80.5	86.8	81.0	81.2
Having transport	17,530	78.4	59.4	73.1	31.1	42.6	89.3	79.9	86.1	80.7	80.9
Obtaining permission to go	8,260	79.7	58.8	75.1	32.9	43.8	87.6	78.1	85.3	81.3	81.7
Concerns regarding lack of providers	16,287	80.3	62.0	74.8	35.0	46.8	90.1	81.2	87.7	82.5	82.6
Concerns regarding lack of medicine	16,481	79.6	61.5	74.0	34.1	46.1	90.0	81.5	87.4	82.1	82.3
None of above	10,202	93.5	80.3	92.0	66.9	72.7	96.3	93.2	96.0	93.1	93.6
Delivery place											
Public institution	9,122	96.0	83.7	95.9	69.6	72.6	95.3	89.6	95.3	91.5	91.4
Private institution	8,673	96.8	84.5	95.9	77.8	81.1	97.2	93.9	97.0	94.5	95.0
Home	19,035	74.5	53.5	67.7	19.5	28.8	82.5	70.8	75.3	66.0	67.0
Place of ANC services received											
Public hospital	7,215				65.2		94.6	89.9	93.7	91.0	91.2
Private hospital	11,058				70.4		96.2	90.8	96.1	91.5	92.4
NGO/Trust hospital	262				67.4		94.3	93.1	95.4	89.7	90.8
Two or more hospitals	928				78.0		97.1	90.9	96.0	93.8	94.0
Rural community health center	3,164				36.6		89.5	68.4	82.5	74.0	75.2
Other places	7,242				30.3		80.4	76.8	73.5	67.1	65.8

a) Percentage among all women; b) percentage among women receiving ANC at least once; c) percentage among women receiving ANC 4 times or more.

Table 3 Associations of individual social characteristics and access to health services with received medication and antenatal care (ANC) visits

Social characteristics	Medication						ANC visits					
	Tetanus toxoid			Iron supplement			≥ 1			≥ 4		
	OR	a)	95% CI	OR	a)	95% CI	OR	a)	95% CI	OR	a)	95% CI
Rural (vs. urban)	0.89	(0.81, 0.97)	*	0.57	(0.53, 0.61)	***	0.85	(0.78, 0.92)	***	0.63	(0.59, 0.67)	***
Wealth index quintile (vs. poorest)												
Poor	1.40	(1.28, 1.53)	***	1.29	(1.15, 1.44)	***	1.48	(1.36, 1.62)	***	1.45	(1.30, 1.62)	***
Middle	2.12	(1.92, 2.35)	***	1.76	(1.57, 1.96)	***	2.05	(1.86, 2.25)	***	2.15	(1.93, 2.40)	***
Rich	3.57	(3.13, 4.06)	***	2.86	(2.53, 3.23)	***	3.33	(2.96, 3.74)	***	3.46	(3.08, 3.88)	***
Richest	6.86	(5.64, 8.36)	***	5.85	(5.04, 6.78)	***	5.68	(4.82, 6.69)	***	7.51	(6.57, 8.59)	***
Type of caste or tribe of the head of the household (vs. scheduled caste or tribe)												
Other 'backward' class	1.16	(1.07, 1.26)	***	1.08	(1.00, 1.17)	ns	1.12	(1.04, 1.21)	**	1.14	(1.05, 1.22)	***
None of above	1.06	(0.96, 1.16)	ns	1.27	(1.17, 1.39)	***	1.04	(0.95, 1.13)	ns	1.25	(1.16, 1.35)	***
Highest educational level (vs. none)												
Primary	1.85	(1.67, 2.04)	***	1.41	(1.29, 1.55)	***	1.66	(1.51, 1.82)	***	1.47	(1.35, 1.61)	***
Secondary	3.11	(2.81, 3.45)	***	2.14	(1.97, 2.32)	***	2.83	(2.59, 3.10)	***	2.40	(2.23, 2.58)	***
Higher	19.70	(11.45, 33.89)	***	5.44	(4.55, 6.51)	***	5.83	(4.50, 7.55)	***	6.16	(5.34, 7.11)	***
Health-care access score (vs. score=0)												
1	1.00	(0.89, 1.12)	ns	1.16	(1.02, 1.31)	*	0.96	(0.86, 1.07)	ns	1.17	(1.03, 1.32)	*
2	1.15	(1.03, 1.28)	*	1.10	(0.97, 1.24)	ns	1.14	(1.02, 1.27)	*	1.23	(1.09, 1.38)	***
3	1.37	(1.21, 1.55)	***	1.16	(1.02, 1.31)	*	1.20	(1.07, 1.35)	**	1.24	(1.10, 1.40)	***
4	1.45	(1.28, 1.64)	***	1.29	(1.14, 1.45)	***	1.25	(1.12, 1.41)	***	1.33	(1.19, 1.50)	***
5	1.27	(1.09, 1.48)	**	1.33	(1.16, 1.53)	***	1.33	(1.15, 1.53)	***	1.45	(1.28, 1.65)	***
6	1.46	(1.29, 1.66)	***	1.58	(1.40, 1.77)	***	1.34	(1.19, 1.50)	***	1.56	(1.40, 1.75)	***
Women's younger age in years	1.04	(1.03, 1.04)	***	1.02	(1.01, 1.02)	***	1.04	(1.03, 1.04)	***	1.01	(1.01, 1.02)	***

Adjustments were made for all variables listed and states by logistic regression analyses. a) Percentage among all women. * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

Table 4 Associations of social characteristics and access to health care with components of antenatal care (ANC) received

Social characteristics	ANC visits										Components of ANC																			
	Physical examination and measurements										Laboratory examination																			
	≥ 4		Abdomen		Weight		Blood pressure		Urine		Blood		Urine		Expected date of delivery		Nutrition		Advised to deliver in hospital											
	b)	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI										
Rural (vs. urban)	0.71	(0.66, 0.76)	***	0.84	(0.71, 1.00)	*	0.84	(0.74, 0.97)	*	0.71	(0.60, 0.83)	***	0.67	(0.59, 0.76)	***	0.65	(0.57, 0.75)	***	0.93	(0.82, 1.05)	ns	0.89	(0.81, 0.98)	*						
Wealth index quintile (vs. poorest)		***		***		***		***		***		***		***		***		***		***		***		***						
Poor	1.22	(1.08, 1.37)	***	1.22	(0.95, 1.57)	ns	1.04	(0.82, 1.31)	ns	1.29	(1.02, 1.63)	*	1.11	(0.89, 1.38)	ns	1.18	(0.95, 1.47)	ns	1.35	(1.10, 1.67)	**	1.23	(0.99, 1.54)	ns	1.09	(0.90, 1.33)	ns	1.45	(1.20, 1.75)	ns
Middle	1.58	(1.40, 1.77)	***	1.81	(1.40, 2.34)	***	1.23	(0.98, 1.55)	ns	1.52	(1.20, 1.93)	**	1.40	(1.12, 1.74)	**	1.82	(1.47, 2.27)	***	1.75	(1.42, 2.15)	***	1.45	(1.17, 1.79)	**	1.45	(1.20, 1.75)	ns	1.73	(1.42, 2.10)	***
Rich	2.23	(1.97, 2.53)	***	2.21	(1.67, 2.92)	***	1.82	(1.42, 2.33)	***	2.34	(1.80, 3.04)	***	1.98	(1.57, 2.49)	***	2.71	(2.14, 3.42)	***	2.81	(2.26, 3.51)	***	1.78	(1.42, 2.24)	***	1.78	(1.42, 2.24)	***	1.73	(1.42, 2.10)	***
Rehest	4.27	(3.70, 4.94)	***	4.46	(3.18, 6.25)	***	3.28	(2.47, 4.36)	***	4.38	(3.20, 6.00)	***	3.38	(2.58, 4.42)	***	4.84	(3.68, 6.37)	***	5.50	(4.27, 7.09)	***	2.43	(1.88, 3.13)	***	2.39	(1.93, 2.96)	***	2.39	(1.93, 2.96)	***
Type of caste or tribe of the head of the household (vs. scheduled caste or tribe)		***		ns		ns		ns				***		***		***		*		*		ns		*		*		*		*
Other 'backward' class	1.09	(1.01, 1.18)	*	1.02	(0.85, 1.23)	ns	0.93	(0.80, 1.08)	ns	1.15	(0.97, 1.37)	ns	1.16	(1.01, 1.34)	*	1.30	(1.12, 1.50)	***	1.11	(0.97, 1.27)	ns	1.07	(0.94, 1.23)	ns	1.08	(0.97, 1.21)	ns	1.08	(0.97, 1.21)	ns
None of above	1.22	(1.13, 1.32)	***	1.08	(0.90, 1.30)	ns	1.10	(0.94, 1.28)	ns	1.14	(0.96, 1.36)	ns	1.35	(1.17, 1.56)	***	1.43	(1.24, 1.66)	***	1.21	(1.06, 1.39)	**	1.05	(0.92, 1.20)	ns	1.15	(1.03, 1.29)	*	1.15	(1.03, 1.29)	*
Highest educational level (vs. none)		***		***		***		***		***		***		***		***		***		***		***		***		***		***		***
Primary	1.26	(1.15, 1.38)	***	1.45	(1.18, 1.78)	***	1.19	(1.00, 1.42)	*	1.42	(1.18, 1.71)	***	1.25	(1.06, 1.48)	**	1.17	(0.99, 1.39)	ns	1.33	(1.14, 1.55)	***	1.18	(1.01, 1.38)	*	1.23	(1.08, 1.42)	***	1.23	(1.08, 1.42)	***
Secondary	1.85	(1.71, 2.00)	***	1.83	(1.53, 2.19)	***	1.78	(1.53, 2.07)	***	2.18	(1.84, 2.58)	***	1.78	(1.54, 2.06)	***	1.55	(1.34, 1.80)	***	2.24	(1.96, 2.55)	***	1.89	(1.65, 2.17)	***	1.63	(1.45, 1.84)	***	1.63	(1.45, 1.84)	***
Post-secondary	4.18	(3.60, 4.85)	***	3.43	(2.36, 4.98)	***	4.88	(3.64, 6.54)	***	4.98	(3.42, 7.26)	***	3.19	(2.46, 4.14)	***	2.56	(1.95, 3.35)	***	6.13	(4.64, 8.12)	***	3.21	(2.57, 4.02)	***	2.06	(1.74, 2.45)	***	2.06	(1.74, 2.45)	***
Health care access score (vs. score=0)		***		*		**		**				ns		***		***		**		***		***		ns		***		***		***
1	1.18	(1.03, 1.35)	*	1.15	(0.87, 1.54)	ns	1.28	(0.99, 1.66)	ns	0.99	(0.75, 1.29)	ns	1.08	(0.85, 1.39)	ns	0.92	(0.72, 1.18)	ns	1.15	(0.91, 1.45)	ns	1.00	(0.79, 1.28)	ns	1.21	(0.98, 1.49)	ns	1.21	(0.98, 1.49)	ns
2	1.15	(1.02, 1.31)	*	1.10	(0.85, 1.44)	ns	1.04	(0.82, 1.31)	ns	0.98	(0.76, 1.27)	ns	0.91	(0.73, 1.15)	ns	0.98	(0.78, 1.24)	ns	1.03	(0.83, 1.27)	ns	1.10	(0.88, 1.38)	ns	1.13	(0.94, 1.37)	ns	1.13	(0.94, 1.37)	ns
3	1.14	(1.00, 1.30)	*	1.31	(0.99, 1.75)	ns	0.91	(0.71, 1.16)	ns	1.12	(0.85, 1.47)	ns	0.95	(0.75, 1.21)	ns	1.02	(0.80, 1.30)	ns	0.89	(0.71, 1.11)	ns	1.01	(0.80, 1.27)	ns	0.95	(0.78, 1.15)	ns	0.95	(0.78, 1.15)	ns
4	1.2	(1.07, 1.36)	**	1.33	(1.01, 1.74)	*	1.00	(0.80, 1.26)	ns	1.04	(0.81, 1.35)	ns	1.03	(0.82, 1.29)	ns	0.99	(0.78, 1.24)	ns	1.04	(0.85, 1.29)	ns	1.02	(0.82, 1.27)	ns	1.25	(1.04, 1.50)	*	1.25	(1.04, 1.50)	*
5	1.33	(1.16, 1.53)	***	1.39	(1.03, 1.89)	*	1.12	(0.87, 1.45)	ns	0.97	(0.73, 1.29)	ns	1.00	(0.78, 1.27)	ns	0.97	(0.75, 1.25)	ns	1.23	(0.98, 1.56)	ns	1.03	(0.82, 1.30)	ns	1.07	(0.88, 1.30)	ns	1.07	(0.88, 1.30)	ns
6	1.45	(1.29, 1.63)	***	1.50	(1.16, 1.94)	**	1.26	(1.01, 1.58)	*	1.32	(1.03, 1.70)	*	1.40	(1.13, 1.75)	**	1.37	(1.09, 1.71)	**	1.40	(1.14, 1.71)	**	1.22	(0.99, 1.50)	ns	1.25	(1.05, 1.48)	*	1.25	(1.05, 1.48)	*
Women's younger age in years	1.00	(1.00, 1.01)	ns	1.01	(1.00, 1.02)	ns	0.99	(0.98, 1.01)	ns	1.00	(0.98, 1.01)	ns	1.01	(1.00, 1.02)	ns	1.02	(1.00, 1.03)	**	1.00	(0.99, 1.01)	ns	1.01	(1.00, 1.02)	ns	1	(0.99, 1.00)	ns	1	(0.99, 1.00)	ns
Place of ANC services received (vs. public hospital)		***		***		***		***		***		***		***		***		***		***		***		***		***		***		***
Private hospital	1.23	(1.14, 1.34)	***	1.23	(1.01, 1.50)	*	1.10	(0.94, 1.28)	ns	1.40	(1.16, 1.69)	***	0.86	(0.74, 1.00)	*	0.96	(0.82, 1.12)	ns	1.48	(1.29, 1.69)	***	1.19	(1.05, 1.36)	**	1.08	(0.97, 1.20)	ns	1.08	(0.97, 1.20)	ns
NGO/trust hospital	1.09	(0.79, 1.49)	ns	0.98	(0.48, 2.03)	ns	1.66	(0.85, 3.24)	ns	1.23	(0.57, 2.63)	ns	0.89	(0.51, 1.55)	ns	1.15	(0.63, 2.10)	ns	1.37	(0.80, 2.35)	ns	0.97	(0.59, 1.59)	ns	1.05	(0.70, 1.57)	ns	1.05	(0.70, 1.57)	ns
Two or more hospitals	1.70	(1.40, 2.05)	***	1.43	(0.90, 2.29)	ns	1.30	(0.91, 1.84)	ns	1.48	(0.97, 2.27)	ns	1.32	(0.93, 1.86)	ns	1.36	(0.95, 1.93)	ns	1.19	(0.90, 1.58)	ns	0.86	(0.66, 1.11)	ns	0.91	(0.73, 1.12)	ns	0.91	(0.73, 1.12)	ns
Rural community	0.65	(0.58, 0.73)	***	0.91	(0.69, 1.20)	ns	0.57	(0.46, 0.70)	***	0.61	(0.48, 0.77)	***	0.50	(0.41, 0.60)	***	0.57	(0.47, 0.69)	***	0.92	(0.76, 1.11)	ns	0.83	(0.68, 1.00)	ns	0.75	(0.64, 0.88)	***	0.75	(0.64, 0.88)	***
Health center																														
Other places	0.52	(0.47, 0.57)	***	0.37	(0.31, 0.45)	***	0.57	(0.48, 0.67)	***	0.32	(0.26, 0.38)	***	0.30	(0.26, 0.35)	***	0.28	(0.24, 0.33)	***	0.53	(0.46, 0.62)	***	0.64	(0.55, 0.74)	***	0.60	(0.53, 0.68)	***	0.60	(0.53, 0.68)	***

Adjustments were made for all variables listed and states by logistic regression analyses. b) Percentage among women receiving ANC at least once; c) percentage among women receiving ANC 4 times or more. * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

tained from logistic regression analyses. The influences of variation by state were adjusted. The unadjusted odds ratios of rural vs. urban, richest vs. poorest, non-caste vs. scheduled caste or tribe, and secondary education vs. no education for blood pressure examination were 0.30, 17.27, 2.58, and 5.10. Rural residence showed strong negative correlations with use of ANC four times or more, blood pressure examination, blood sampling for laboratory examination, and urine sampling for laboratory examination. Wealth and education showed strong positive correlations with use of ANC four times or more and all components of ANC. Caste was correlated with use of ANC four times or more and blood sampling for laboratory examination. Health care access was positively correlated with use of ANC four times or more but showed no relations with components of ANC. Those receiving ANC at private hospitals were more likely to use ANC four times or more, have a blood pressure examination, receive advice about their expected date of delivery, and receive advice about nutrition during pregnancy than those receiving ANC at a public hospital. Women receiving ANC at rural community health centers were less likely to use ANC four times or more, to have their weight determined, to have a blood pressure examination, to have blood and urine sampled for laboratory examination, and to receive advice to deliver in a hospital. Those receiving ANC at places other than hospitals or health centers were less likely to use ANC four times or more or to receive individual components of ANC.

Discussion

A nationally representative sample of 36,850 women across India showed disparities in use of ANC by state. Even among those who used ANC four times or more — 46.1% of all pregnant women, ranging from 15.2% to 97.9% by state — the percentages of those who received individual components of ANC varied substantially by state. Household wealth and education of women were independently associated with use of ANC and receipt of individual components of ANC, after excluding the influence of differences between states. Nonscheduled caste or tribe showed a marginal association with use of ANC and receipt of individual components of ANC, after excluding the influence of differences between states. Rural residence was negatively associated with use of ANC and marginally associated with receipt of individual components of ANC, after excluding the influence of differences between states. Good access to health care services was positively associated with use of ANC, but there were few differences in receipt of individual components of ANC according to access to health care among those who used ANC four times or more. Place of provision of ANC services was associated with use of ANC four times or more

and receipt of individual components of ANC. Women using private hospitals showed advantages over those using public hospitals, who in turn showed advantages over women using rural community health centers and those receiving ANC outside of hospitals or health centers.

While comparisons of the use of maternal health services between countries have encouraged individual countries to achieve the United Nations Millennium Development Goals (MDGs) 4 (reduce child mortality) and 5 (improve maternal health)^{16, 17}, less attention has been given to differences within countries. While social gradients in use of health services according to differences in economic status and education have been investigated^{13, 18}, there has been little research regarding differences according to geographic or administrative boundaries. In some states, such as Kerala and Goa, more than 93% of women used ANC four times or more, while in Bihar and Nagaland, this figure was less than 17%. Even limiting the investigation to those who used ANC four times or more, there were disparities between states in the components of ANC that the women received.

Use of ANC, tetanus toxoid vaccination, and iron supplementation were strongly related to higher level of household wealth and higher level of education among women. These social gradients in use of maternal health services were consistent with evidence from other countries and specific regions^{19–22}. Further, this study addressed social gradients in the receipt of components of ANC, i.e., whether the women were examined for blood pressure, if blood or urine samples were taken for laboratory examination, if they were advised regarding the expected date of delivery, etc. For monitoring of ANC services, not only the number of times women used ANC, but also if the recommended components of ANC were provided to the participants should be assessed to make ANC as a comprehensive service equally available regardless of socioeconomic status. Previous qualitative studies suggested that people may refrain from using health care services if they perceive the quality of care to be insufficient^{23, 24}.

There were associations between caste and the use of ANC as well as service components of ANC provided, although they were marginal as indicated in previous studies^{10, 20}. Significant independent associations were shown in relation to blood and urine sampling for examination, although associations for other variables were marginal or nonexistent. Crude odds ratios by caste still show significant associations between caste and use of ANC, although the public legitimacy of the caste system in India is diminishing¹⁵. Therefore caste still matters in India for the use of critical maternal health services. Women belonging to a “scheduled caste” or “scheduled tribe” account for 34% of the population, and this issue will require careful attention.

There are a number of concerns regarding the function-

ing of health services in rural areas, such as absenteeism of doctors and other health providers, low of skill levels of health care professionals, shortage of medicines, inadequate supervision/monitoring and callous attitude²⁵). However, a previous study on the use of ANC in southern states in India did not indicate a rural-urban gap²⁰. The activities of multipurpose health workers that service rural communities where the health infrastructure and transportation facilities are underdeveloped were estimated to fill such gap²⁰. The present study indicated significant differences between rural and urban women in receiving recommended ANC, suggesting that interventions are needed to alleviate the rural-urban gap function in selected states, but there are still such gaps in other states. The relatively low availability of ANC service components to poor and illiterate women and low availability of ANC in rural areas highlight the “inverse health care law”²⁶, which states that those who need it the most get the least health care.

Access to health care services was reported to be associated with the use of ANC^{27, 28}. The results of the present study clearly indicated that access to health care was associated with ANC use itself. For women making use of ANC at least four times, the components of services provided were similar regardless of accessibility of services. However, there were differences in use of ANC and its components between public or private hospitals and rural community centers. ANC users at rural community health centers and users of nonhospital and non-health center services received fewer components of ANC services. Therefore, further attention should be paid to those areas where access to public or private hospitals is limited and to households with difficulties in accessing such facilities.

Provision of required individual service components, differed according to the places where women receive ANC. Women who received ANC at private hospitals were more likely to have a blood pressure examination but less likely to have a blood examination than women receiving care at public hospitals. These results may be related to the difference in the cost of provision of individual service components. Systematic evaluation of completion of required components of ANC will contribute to quality control of services.

The disparities in use of service components of ANC according to socioeconomic class and access to health facilities suggest a need for expansion of health care services, universal health coverage, and development of means to provide information and services to those who need it the most. Previous studies identified the deployment of services and health workers to the areas with the greatest needs, task shifting, reduction of financial barriers to access services, and conditional cash transfers as approaches to reduce disparities according to socioeconomic class^{17, 29}.

The Government of India supports restructuring of the health care delivery mechanism so that services target underserved population³⁰. Use of information and communication technology (ICT) could potentially enable provision of services to distant places and across different strata of society³¹, at relatively low cost. There are efforts to gain benefits of the use of ICT to improve ANC service delivery in resource-constraint countries.

The results of this study should be interpreted within the context of the limitations of the data. The data only reflect whether an ANC service component was or was not utilized and not the actual quality of the service component. The self-reported questionnaire used in this study may have been affected by recall bias. To reduce the degree of this potential source of bias, only the components of ANC service for women pertaining to their last birth were addressed in the present study. Influence of parity on the use of ANC and its service components could be discussed when parity is examined and included in the analyses³². Some women may have utilized the services of Indian traditional medical systems, and care-seeking behavior in this sector was not accounted for in this study.

There has been a great deal of progress in the national average statistics of maternal health care in India¹⁶. However, there is still a large degree of variation in use of ANC and its service components among states, urban-rural differences, and sociodemographic characteristics. Therefore, a mechanism for regular monitoring of sociodemographic and geographic differences in maternal health care in this country is urgently required.

In conclusion, this study provided systematic evidence of substantial inequalities in use of ANC and its service components by women in India across geographic areas, socioeconomic conditions, and levels of access to health care services. The relationships between individual required components of ANC and places where ANC services were provided differed according to the components. Systematic evaluation of completion of required components of ANC will contribute to quality control of services. In addition to reducing socioeconomic inequalities, it is necessary to develop programs to ensure the provision of quality services to those with limited access to health care services. Continuous monitoring of differences across states and socioeconomic classes in use of ANC will be critical to create an evidence base to distinguish which population subgroups require special attention in this area.

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