Prospective Comparative Study on the Relationship Between Adverse Maternal and Fetal Outcomes and the Total Number of Antenatal Visits: Evaluating the Focused Ante Natal Care Model and Assessment of Prenatal Care Utilization Index

Jesmitha Vijayan[1]*, Nitu Mishra[2], Aruna Kumar[3] and Avani Ahuja[4]

[1]Department of Obstetrics and Gynecology, Kannur Medical College, Anjarakandy, Kerala, India

[2]Department of Obstetrics and Gynaecology, All India Institute of Medical Sciences Bhopal, India

[3]Department of Obstetrics and Gynaecology, Gandhi Medical College, Bhopal, India

[4]Department of Obsterics and Gyanecology, Gandhi Medical College, Bhopal, India

Received: 28 May 2025

Accepted: 8 December 2025

*Corresponding author: nitumishra07@gmail.com

DOI 10.5001/omj.2025.109

Abstract

Objectives: Antenatal care (ANC) visits during pregnancy aim to identify and address factors associated with unsafe pregnancy while educating pregnant women on the nuances of pregnancy and motherhood. The recommended number of visits varies across different countries. We compared the adverse maternal and fetal outcomes in participants with adequate ANC visits as per Focused ANC (FANC) model of World Health Organization with adequate and adequate plus categories of Adequacy of antenatal care utilization index (APNCU) to evaluate if the number of visits had any influence on these outcomes.

Methods: This was a prospective observational study conducted among consenting participants who had received one or more antenatal visits elsewhere before presenting to our hospital for further care. We collected details related to previous pregnancy, prior ANC visits, adverse maternal and fetal outcomes after delivery, and statistically analysed the data using SPSS version 21 (IBM Corp., Armonk, NY). Categorical variables were analysed using Chi-Square and level of significant was set at $p = \leq 0.05$ at confidence interval of 95%.

Results: A total of 500 participants were included. 2.0%, 13.4%, 46.6% and 38.0% of participants received adequate plus, adequate, intermediate, and inadequate prenatal care respectively. There was statistically significant difference between participants with adequate visits as per FANC model and those with Adequate and Adequate plus as per APNCU index in the distribution of high-risk factors in index pregnancy like anaemia, hypertensive disorder, and gestational diabetes mellitus. Similarly, statistically significant differences were found between adverse maternal outcomes like post-partum hemorrhage (PPH), and ICU admission, and adverse neonatal outcomes like preterm birth, low birth weight (LBW), birth asphyxia, neonatal hypoglycemia, meconium aspiration, NICU admission, and still birth.

Conclusions: Although the number participants receiving adequate ANC based on FANC model is greater than those who were categorized to have Adequate and Adequate plus categories of APNCU index, the frequency of adverse maternal and fetal outcomes is higher in the FANC model. This most likely indicate that less frequent ANC visits are probably inadequate in timely identifying issues of concern and therefore in preventing adverse outcomes.

Keywords: APNCU index, FANC model, Maternal complications.

Introduction

The concept of prenatal care (PNC) for safe pregnancy is believed to have begun in the early 1900s. The term Ante Natal Care (ANC) is often used interchangeably with PNC. World health Organization (WHO) uses the term ANC.[1] ANC visits aim to bring pregnant women in contact with healthcare providers at regular intervals.[1-7] Identification and education are considered as the two primary aspects of such visits. Identification aspect focusses on monitoring the health of both the pregnant woman and fetus for timely identification and addressal of potential concerns or issues. Education aspect focusses on preparing the expectant woman for childbirth, encouraging healthy behaviors, and thus, attempting to reduce maternal and neonatal morbidity and mortality. A deficiency in prenatal care can have adverse consequences for both the mother and the fetus.[8-10]

Several methods and indices have been used for assessing whether the care received by a pregnant women is sufficient or not.[11] Adequacy of prenatal care utilization (APNCU) index, described by Kotelchuck is one such index.[12,13] For assigning a woman into one of the four APNCU index categories, a ratio of the actual ANC visits undertaken to the expected number of visits for that woman is calculated (this is based on the American College of Obstetricians and Gynaecologists (ACOG) recommendations). ACOG recommends that, a woman with an uncomplicated pregnancy should have one ANC visit every four weeks during the initial 28 weeks of gestation, then every two weeks till 36 weeks of gestation, and thereafter every week till delivery.[14] A woman who delivers at completed 40 weeks of gestation would thus receive fourteen ANC visits. This is in contrast to the four ANC visits as per the WHO Focused ANC (FANC) model[7] that Ministry of Health and Family Welfare (MOHFW) currently recommends in India with the first visit being in the 1st trimester.[4] ANC is considered as adequate if the first visit takes place before 12th week of pregnancy and at least four visits were undertaken in the entire pregnancy.

There is a significant variation in the number of ANC visits being in India. While many women visit frequently, a large population is unable to do so consequent to many factors. Also, it is not uncommon for pregnant women in India to have visited one or more Centre for initial care and then finally visit another Centre/hospital for delivery.

There is limited available literature studying the effect of the number of ANC visits on maternal and fetal outcomes.[15-17] In this study, we evaluated those pregnant women who visited our Centre after having undertaken one or more ANC visits elsewhere. We assessed the ANC received based on the total number of visits, described the maternal and fetal outcomes of the current pregnancy, and then compared the adverse maternal and fetal outcomes in women receiving adequate visits as per the FANC model with those in the adequate and adequate plus categories of the APNCU index, with an intent to compare the four-visit FANC model with those models that mandate higher number of visits.

Methods

We conducted this prospective, observational study after obtaining ethical approval (27103/MC/IEC/2021) at our institute that is a tertiary care teaching hospital located in central India. Pregnant women visiting the hospital for delivery, who had their initial ANC visit(s) elsewhere but had presented to us for further care and delivery, and who had the details of previous ANC visits available with them were considered for inclusion in the study. Those with incomplete ANC records and those who did not consent were excluded. Women who were registered with us from their initial visit were excluded too. Based on the number of around 800 deliveries per month being conducted at our institute with approximately 50% of them being those who have their initial ANC elsewhere, a sample size of 376 was calculated if the study was conducted for a period of one and half years. However, we planned to include as many participants as possible who could be enrolled between January 2021 and September 2022.

After enrolment we collected details that included basic demographic data, those related to the previous pregnancy (if any), total number of ANC visits, and any previous maternal health condition of concern. The management of each woman was as per the departmental protocol, and no new management protocol was introduced for study purposes. After delivery/ termination of pregnancy details related to fetal outcomes in terms of birth weight, 5-minute APGAR score, any meconium aspiration, perinatal mortality was recorded. Maternal outcomes primarily post-partum haemorrhage (PPH), sepsis, maternal mortality and any other complications were recorded. All the data was recorded in physical form on pre-designed data collection sheets.

We calculated the adequacy of prenatal care based on the number of ANC visits and categorized the women into one of the four APNCU index categories - inadequate (less than 50% of expected visits), intermediate (50%-79%), adequate (80%-109%), and adequate plus (110%). Further, we divided them into adequate (if at least four visits were undertaken and with two doses of tetanus toxoid, and at least 100 days of iron/folic acid supplementation) or inadequate (less than four visits) FANC categories. The data was compiled on a Microsoft Excel spreadsheet and subsequently statistically analysed. SPSS version 21 (IBM Corp., Armonk, NY) was used for statistical analysis. Results related to categorical measurements were presented in numbers (%) and were compared using Chi-Square test. A 'p' value of ≤0.05 was considered as statistically significant.

Results

Five hundred and ninety patients were eligible to be a part of the study. Of these, five hundred women were included after applying the exclusion criteria. Table 1 summarizes the socio-demographic details of the participants and the distribution of the same in terms of different categories of APNCU index. It can be noted that 2.0%, 13.4%, 46.6% and 38.0% of the participants were categorized into adequate plus, adequate, intermediate and inadequate categories, respectively based on the APNCU index.

Table 1: Distribution of adequacy of prenatal care utilization index according to sociodemographic details.

		Adequacy of Prenatal Care Utilization index [no. (%)]					
Parameters		**Adequate plus 10(2.0)**	**Adequate 67(13.4)**	**Intermediate 233(46.6)**	**Inadequate 190(38.0)**	**Total 500(100.0)**	***p*-value***
Age	<20 Years	0(0.0)	12(9.6)	38(30.4)	75(60.0)	125 (25.0)	< 0.0001
	20-35 Years	10(3.0)	48(14.5)	186(56.4)	86(26.1)	330 (66.0)	
	>35 Years	0(0.0)	7(15.6)	9(20.0)	29(64.4)	45 (9.0)	
Education Level	With no formal education	0(0.0)	20(16.4)	20 (16.4)	82(67.2)	122 (24.4)	< 0.0001
	Primary education	0(0.0)	23(11.7)	76(38.8)	97(49.5)	196 (39.2)	
	Secondary education	0(0.0)	24(22.4)	72(67.3)	11(10.3)	107 (21.4)	
	Graduate and above	10(13.3)	0(0.0)	65(86.7)	0(0.0)	75 (15.0)	
Socio economic status[18]	Lower	0(0.0)	33(16.5)	44(22.0)	123(61.5)	200 (40.0)	< 0.0001
	Upper Lower	0(0.0)	12(24.0)	30(60.0)	8(16.0)	50 (10.0)	
	Lower middle	10(6.7)	13(8.7)	79(52.7)	48(32.0)	150 (30.0)	
	Upper Middle	0(0.0)	9(12.0)	55(73.3)	11(14.6)	75 (15.0)	
	Upper	0(0.0)	0(0.0)	25(100.0)	0(0.0)	25 (5.0)	
Residencial Type	Rural	0 (0.0)	30(15.8)	59(31.1)	101(53.2)	190 (38.0)	< 0.0001
	Urban	10 (3.2)	37(11.9)	174(56.1)	89(28.7)	310 (62.0)	
Occupation	Housewife	7(1.9)	46(12.3)	172(45.9)	150(40.0)	375 (75.0)	0.2699
	Laborer	2(8.0)	6(24.0)	11(44.0)	6(24.0)	25 (5.0)	
	Private sector/self employed	1(1.1)	13(14.9)	42(48.3)	31(35.6)	87 (17.4)	
	Governmen t employee	0(0.0)	2(15.4)	8(61.5)	3(23.1)	13 (2.6)	

*Socio-economic status was estimated using Revised Kuppuswamy scale[18], *Chi square test*

It was observed that 66% of participants were between 20-35 years, and they were most frequently in the intermediate APNCU index. A statistically significant association between the APNCU categories and maternal age was noted (p= <0.001). 82% of participants of lower and upper lower socio-economic status were in the inadequate and intermediate categories. All the 25 women who belonged to upper socio-economic strata were in the intermediate APNCU category showing that even those with adequate economic means did not seek frequent visits. The distribution of APNCU index with respect to education level, socio-economic status and residence type showed statistically significant difference (p<0.001).

Table 2 shows the distribution of APNCU index categories in relation to maternal, reproductive and neonatal characteristics of the participants. There was a statistically significant difference between the APNCU index category and parity of the participants (p=<0.001). Most of the participants presented to our center after 34 weeks of gestation. 68 of them had pre-existing medical conditions. 42 of the 68 were in the inadequate APNCU category, indicating that even those with medical condition did not seek frequent ANC. 296 participants had a history of previous childbirth. Of these, 38.5% had an adverse event in the previous pregnancy (pregnancy induced hypertension, anaemia, and post-partum haemorrhage). There was no statistically significant difference between the APNCU index categories and high-risk factors in the previous pregnancy (p=0.3381) whereas obstetric outcome of previous pregnancy showed statistically significant difference (p<0.001).

Table 2: Distribution of adequacy of prenatal care utilization index in relation to various Obstetric parameters of the included participants.

Parameters		**Adequacy of Prenatal Care Utilization index [No. (%)]**					***p*-value***
		Adequate plus	**Adequate**	**Intermediate**	**Inadequate**	**Total**	
Gravida	Primi	10(4.9)	26(12.7)	106(52.0)	62(30.4)	204(40.8)	< 0.0001
	Multi	0(0.0)	38(14.0)	123(45.4)	110(40.6)	271(54.2)	
	Grand multi	0(0.0)	3(12.0)	4(16.0)	18(72.0)	25(5.0)	
Gestational age at first presentation to our hospital	<34 Weeks	0(0.0)	11(44.0)	5(20.0)	9(36.0)	25(5.0)	< 0.0001
	34-37 Weeks	0(0.0)	41(23.4)	44(25.1)	90(51.4)	175(35.0)	
	37-40 Weeks	10(3.6)	15(5.5)	166(60.4)	84(30.5)	275(55.0)	
	>40 Weeks	0(0.0)	0(0.0)	18(72.0)	7(28.0)	25(5.0)	
Preexisting Medical conditions	Hypertension	0 (0.0)	4 (6.0)	8 (3.4)	27 (14.2)	39 (7.8)	0.0007
	Pulmonary tuberculosis	0 (0.0)	1 (1.5)	13 (5.6)	15 (7.9)	29 (5.8)	
High Risk events in Previous Pregnancy	Pregnancy induced hypertension	0(0.0)	11(16.4)	13 (5.6)	13(6.8)	37(7.4)	0.1024
	Anemia	1(10.0)	9 (13.4)	25(10.7)	24(12.6)	59(11.8)	
	Post partum hemorrhage	0(0.0)	2(3.0)	11 (4.7)	5 (2.6)	18(3.6)	
Previous Obstetric Outcome (of those who are multi/ grand multi parous)	Still births	0(0.0)	9(36.0)	5(20.0)	11(44.0)	25	< 0.0001
	Caesarean section	0(0.0)	21(14.9)	34(24.1)	86(61.0)	141	
	Normal vaginal delivery	0(0.0)	11(8.5)	88(67.7)	31(23.8)	130	
Obstetric outcome in	Vaginal Delivery	7 (70.0)	48 (71.6)	152 (65.2)	114 (60.0)	321 (64.2)	0.3438

present pregnancy	Caesarean section	3 (30.0)	19 (28.4)	81 (34.8)	76 (40.0)	179 (35.8)

**Chi square test*

Table 3 summarizes the distribution of high-risk factors, and adverse maternal and neonatal outcomes in the present pregnancy across different APNCU index categories. Anaemia requiring blood transfusion was the most common high-risk factor. PPH (14.8%) and intensive care unit admission were the commonest adverse maternal outcomes, which is common among participants with inadequate and intermediate APNCU index categories, and this is statistically significant(p=0.0484). Neonatal intensive care unit admission (17.8%), hypoglycemia (12.2%) and low birth weight infants (11.0%) were the commonest adverse neonatal outcomes, which was common among participants with inadequate and intermediate APNCU index categories, and this is statistically significant (p=<0.0001).

Table 3: Distribution of high-risk factors, adverse maternal and neonatal outcomes in the present pregnancy across the different APNCU categories.

Variables		**Adequacy of Prenatal Care Utilization index [No. (%)]**					
		Adequate plus 10(2.0)	**Adequate 67(13.4)**	**Intermediate 233(46.6)**	**Inadequate 190(38.0)**	**Total 500(100.0)**	***p*- value***
High Risk factors in present Pregnancy	Anemia requiring blood transfusion	2 (20.0)	15 (22.4)	52 (22.3)	44 (23.2)	113 (22.6)	0.3381
	Hypertensive disorder of Pregnancy	1 (10.0)	16 (23.9)	33 (14.2)	30 (15.8)	80 (16.0)	
	Gestational Diabetes Mellitus	0 (0.0)	10 (14.9)	17 (7.3)	18 (9.5)	45 (9.0)	
Adverse Maternal Outcomes	Post partum hemorrhage	4 (40.0)	7 (10.4)	40 (17.2)	23 (12.1)	74 (14.8)	0.0484
	Acute Kidney Injury	0 (0.0)	0 (0.0)	2 (0.9)	0 (0.0)	2 (0.4)	
	Multi organ dysfunction	0 (0.0)	0 (0.0)	2 (0.9)	0(0.0)	2 (0.4)	
	Pulmonary Oedema	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.5)	1 (0.2)	
	Pulmonary embolism	0 (0.0)	0 (0.0)	1 (0.4)	1(0.5)	2 (0.4)	
	ICU Admission	0 (0.0)	7 (10.4)	12 (5.2)	31 (16.3)	50 (10.0)	
	Mortality	0 (0.0)	0(0.0)	2 (0.9)	1 (0.5)	3 (0.6)	
Adverse Neonatal Outcome in present pregnancy	Preterm birth	0 (0.0)	7 (10.4)	3 (1.3)	7(3.7)	17 (3.4)	< 0.0001
	Low birth weight	1 (10.0)	5 (7.5)	41 (17.6)	8 (4.2)	55 (11.0)	
	Birth asphyxia	0 (0.0)	4 (6.0)	10 (4.3)	4 (2.1)	18 (3.6)	
	Meconium aspiration	0 (0.0)	0 (0.0)	8 (3.4)	10 (5.3)	18 (3.6)	
	Still birth	0 (0.0)	2 (3.0)	5 (2.1)	13 (6.8)	20 (4.0)	
	NICU admission	0 (0.0)	28 (41.8)	23 (9.9)	38 (20.0)	89 (17.8)	
	Congenital anomaly	0 (0.0)	0 (0.0)	0 (0.0)	4 (2.1)	4 (0.8)	
	Hypoglycemia	0 (0.0)	0 (0.0)	28 (12.0)	33 (17.4)	61 (12.2)	
	Neonatal jaundice	0 (0.0)	0 (0.0)	2 (0.9)	23 (12.1)	25 (5.0)	

**Chi square test*

Table 4 presents the distribution of high-risk factors, and adverse maternal and neonatal outcome in the present pregnancy in women who were categorized according to the FANC model. No statistically significant difference was observed between women with adequate and inadequate visits as per FANC model in terms of distribution of the different high-risk factors in pregnancy (p=0.2613) and adverse maternal outcomes (p=0.1102). However, we did observe a statistically significant difference in adverse neonatal outcome between the groups (p=<0.0001).

Table 4: Distribution of high-risk factors, adverse maternal and neonatal outcome in the present pregnancy as per the FANC model.

Variables		As per FANC model [No. (%)]			*p*-value*
		Adequate 342(68.4)	**Inadequate 158 (31.6)**	**Total 500 (100.0)**	
High Risk factors in Present pregnancy	Anemia requiring transfusion	78 (22.8)	35 (22.2)	113 (22.6)	0.2613
	Hypertensive disorder of Pregnancy	53 (15.5)	27 (17.1)	80 (16.0)	
	Gestational Diabetes Mellitus	30 (8.8)	15 (9.5)	45 (9.0)	
Adverse maternal outcome	Post partum hemorrhage	55 (16.1)	19 (12.0)	74 (14.8)	0.1102
	Acute Kidney Injury	2 (0.6)	0 (0.0)	2 (0.4)	
	Multi organ dysfunction	2 (0.6)	0 (0.0)	2 (0.4)	
	Pulmonary Oedema	0 (0.0)	1 (0.6)	1 (0.2)	
	Pulmonary Embolism	1 (0.3)	1 (0.6)	2 (0.4)	
	ICU Admission	27 (7.9)	23 (14.6)	50 (10.0)	
	Mortality	2 (0.6)	1 (0.6)	3 (0.6)	
Adverse neonatal outcome	Preterm birth	14 (4.1)	3 (1.9)	17 (3.4)	< 0.0001
	Low birth weight baby	50 (14.6)	5 (3.2)	55 (11.0)	
	Birth asphyxia	20 (5.8)	3 (1.9)	23 (4.6)	
	Congenital anomaly	0 (0.0)	4 (2.5)	4 (0.8)	
	Hypoglycaemia	28 (8.2)	33 (20.9)	61 (12.2)	
	Meconium aspirations	8 (2.3)	10 (6.3)	18 (3.6)	
	Neonatal jaundice	2 (0.6)	23 (14.6)	25 (5.0)	
	Neonatal ICU admission	49 (14.3)	20 (12.7)	69 (13.8)	
	Still birth	8 (2.3)	17 (10.8)	25 (5.0)	

**Chi square test*

Table 5 presents a comparison of the FANC model (Adequate category) and APNCU index categories (Adequate and Adequate plus categories). We noted a statistically significant difference between the two in the distribution of high-risk factors of pregnancy. Further, adverse maternal outcomes, namely post-partum haemorrhage (PPH), and ICU admission (p=< 0.0001) had statistically significant difference too. All adverse neonatal outcomes other than neonatal jaundice had statistically significant differences too as can be seen in Table 5.

Table 5: Comparison of Antenatal Care as per FANC Model (Adequate) and APNCU index (Adequate and Adequate Plus taken together).

		FANC Model (Adequate visits)	**APNCU index (Adequate and Adequate plus)**	***p*-value**
High Risk factor in	Anemia requiring	78	17	< 0.0001

Present pregnancy	transfusion			
	Hypertensive disorders of pregnancy	53	17	< 0.0001
	Gestational diabetes mellitus	30	10	< 0.0001
Adverse maternal outcome	Post partum hemorrhage	55	11	< 0.0001
	Acute kidney injury	2	0	0.5000
	Multiple organ dysfunction	2	0	0.5000
	Pulmonary Embolism	1	0	1.0000
	ICU Admission	27	7	< 0.0001
	Mortality	2	0	0.5000
Adverse neonatal outcome	Preterm birth	14	7	0.0156
	Low birth weight baby	50	6	< 0.0001
	Birth asphyxia	20	4	0.0005
	Hypoglycaemia	28	0	< 0.0001
	Meconium aspirations	8	0	0.0078
	Neonatal jaundice	2	0	0.5000
	Neonatal ICU admission	49	28	< 0.0001
	Still birth	8	2	0.0313

Discussion

Appropriate antenatal care provided in a timely manner is considered as the cornerstone for a pregnancy that is not only safe for the mother but for the newborn too.[1,2,5] Effective ANC should include timely identification and intervention in case any complication develops during pregnancy, and it should be able to prepare the expectant woman for childbirth and perinatal events. Acknowledging the importance of ANC, guidelines for the same have been formulated and are diligently implemented in many countries. A number of different methods/ indices have been devised for evaluating the effectiveness of ANC.[19-22] However, recognizing the poor penetration of ANC services, and that frequent visits might not be possible in many developing and relatively poor countries, the WHO proposed the concept of FANC that for an otherwise normal pregnancy necessitates four visits during the entire pregnancy.[7] This is in contrast to the ACOG guidelines that recommend at least 14 visits for a normal pregnancy that continues till term.[14] Vogel et al[8] performed an analysis of antenatal care packages with reduced visits and studied perinatal mortality in such packages. They reported an increased overall adjusted relative risk of fetal death and concluded that it was plausible that the increased risk of fetal death between 32- and 36-weeks of gestation could be due to reduced number of antenatal visits. Based on this and other studies, the latest WHO recommendation is of at least eight visits during the entire period of pregnancy.[1] While it is universally agreed that both the frequency and the quality of ANC visits contribute to its effectiveness, an assessment of the same is often challenging in countries that have large populations but have inadequate monitoring mechanisms. There are several variables that can influence the effectiveness of ANC being received by the pregnant women.

In India, it is not uncommon for women to receive their initial ANC usually at a private clinic or other health facilities (primary health centers and community health centers) but then visit tertiary care institutes in the later part of pregnancy primarily due to financial reasons or with an intention to obtain better care. An assessment of the quality of care being received can be done if the same is either observed directly or with the help of feedback/ response from educated mothers.[22] While both these aspects are difficult to implement, we believe that the number of ANC visits can be used as an indirect indicator with an assumption that reasonable care is being provided at each visit. We conceptualized this study to examine the distribution of pregnant women seeking care from our institute into APNCU index categories. This index has found widespread use in other countries and is based on the ACOG guideline, that has frequent visits at its core. Based on the results of this study, one can infer that only about 15% of participants undertook >80% of the visits recommended to them. Those who were younger than 20 years or older than 35 years were most frequently in the inadequate and

intermediate categories. A significant association between age and adequate utilization of antenatal care was noted suggesting that older participants were more likely to adequately utilize antenatal care compared to younger women. One can attribute this pattern to the younger participants lack experience/ awareness in pregnancy care. Only 13.5% of participants with primary or lower level of education had adequate APNCU index. This figure suggests that education level might be a factor influencing the number of ANC visits being undertaken. Similar findings were reported by Jogiya et al.[3] who found that illiterate women (those with no formal education) had significantly lower rates of ANC utilization compared to those with secondary education. Similarly, Pandey et al.[23] reported that women from high-income families were three times more likely to receive appropriate ANC services compared to women from low-income families, and women with higher education were twice as likely to receive antenatal care compared to those who did not receive any antenatal care. All the participants of upper socio-economic status were in the inadequate APNCU index category. This finding is corroborates to the report by Islam et al.,[24] who noted that women in the richest group, compared to those in the poorest group, were 1.5 times more likely to receive the components of ANC content (OR = 1.513; 95% CI: 1.299-1.763). 15.2% of participants with urban residence, and 15.8% participants with rural residence were in the adequate and adequate plus categories. This almost similar distribution suggests that the residential area did not influence the possibility of seeking more frequent visits. Additionally, 52% of participants with rural residence were in the inadequate category as compared to 28% of those with urban residence suggesting that those with rural residence had a greater tendency of not seeking minimum number of required visits. Yaya et al.,[25]in their study on Ethiopian women reported the residence type to be associated with delayed initiation of ANC visits, with rural women having higher odds of delayed initiation of ANC visits. Among the 204 primigravida women, 17.6% were in the adequate and adequate plus APNCU categories as compared to 13.8% multigravida women. This distribution is similar to the finding reported by Ali et al.[26] that nulliparous women were more likely to utilize antenatal care compared to multiparous women, even after adjusting for other factors.

In the FANC model a pregnant woman must undertake first ANC visit before 12 weeks of gestation and the next three visits before delivery. It is not clearly defined as to when these three visits must be undertaken.[4,7] The APNCU index, however, requires frequent visits spread across the entire pregnancy and adequacy of visits is calculated individually for each woman. If we consider two scenarios, one in which a woman has ANC in 12th week, then once in second, and two times after that and another one in which a woman has first ANC in 12th week but rest all visits after 28 weeks, then both would be categorized in the Adequate category of FANC model. However, to be categorized as adequate under the APNCU index a woman must have undertaken at least 80% of visits recommended to her. Thus, a woman who has first visit in 12th week would need at least nine visits till 40 weeks of gestation to be categorized in adequate APNCU index category. Consequently, the women with highest category of APNCU index and FANC model may not be comparable. In this study, one can infer that the number of adverse maternal and fetal outcomes in the adequate FANC model group is statistically higher than in the adequate and adequate plus categories of APNCU index. This indirectly suggests that the higher number of antenatal visits might contribute to a greater possibility of identification of any deviation from expected course of pregnancy and timely intervention. The results suggest that although the four-visit FANC model ensures minimum ANC for pregnant women, it may not significantly increase the number of successful, uneventful pregnancies. The fact that a model requiring higher number of visits might be successful in doing so has been acknowledged by the WHO recommendation for a positive pregnancy experience as it now recommends a minimum of eight visits.[8]

This study has a few important limitations. It evaluates the adequacy of ANC solely based on the number of visits undertaken, without assessing the content and quality of each visit. Additionally, the effect of time of initiation of ANC on pregnancy outcomes was not assessed too. The expertise of the care provider, especially of care received before enrolling with our hospital, could not be evaluated. Finally, the data is derived from a single tertiary care center only. While the statistical analysis aspect has been deliberately kept simple for understanding by majority of readers, an in-depth statistical analysis could have been performed.

Conclusion

Based on the more frequent adverse maternal and fetal outcomes identified in the model that necessitates less visits (four visits), one can infer that probably a higher number of ANC visits might be better in timely identifying issues of possible concern thereby resulting in a pregnancy that is safe for both the mother and the newborn. Thus, it might be prudent to modify the current recommendations of four visits per pregnancy and adopt an ANC model that recommends higher number of visits not only in India but in other countries who are still following the WHO four visit model.

Disclosure

The authors declared no conflicts of interest. No funding was received for this study.

References

1. Messages K, Recommendations G, Care RA. WHO Recommendations on Antenatal Care for a Positive Pregnancy Experience : Summary Highlights and Key Messages from the World Health Organization's 2016 Global Recommendations for Routine Antenatal Care. 2018;10:1-10. doi:10.1186/1742-4755-10-19.5. Last accessed on 15th September 2025.

2. Girotra S, Malik M, Roy S, Basu S. Utilization and determinants of adequate quality antenatal care services in India: evidence from the National Family Health Survey (NFHS-5) (2019-21). BMC Pregnancy Childbirth 2023;23(1):800. doi:10.1186/s12884-023-06117-z.

3. Jogia PD, Lodhiya KK. Antenatal care utilisation among low-risk and high-risk pregnant women & its effects on pregnancy outcome. Obs Gyne Review: Journal of Obstetric and Gynecology, 4(4), 82-88. https://doi.org/10.17511/joog.2018.i04.03

4. Maternal Health Program. Chapter 4. Annual report 2012-13, Minisatry of health and family welfare. Government of India. Available at https://www.mohfw.gov.in/sites/default/files/CHAPTER%204.pdf. Last accessed on 16th September 2025.

5. Lattof SR, Moran AC, Kidula N, Moller AB, Jayathilaka CA, Diaz T, et al. Implementation of the new WHO antenatal care model for a positive pregnancy experience: a monitoring framework. BMJ Glob Health 2020;5(6):e002605. doi:10.1136/bmjgh-2020-002605.

6. Heaman MI, Newburn-Cook CV, Green CG, Elliott LJ, Helewa ME. Inadequate prenatal care and its association with adverse pregnancy outcomes: a comparison of indices. BMC Pregnancy Childbirth 2008;8:15. doi:10.1186/1471-2393-8-15.

7. Oshinyemi TE, Aluko JO, Oluwatosin OA. Focused antenatal care: Re-appraisal of current practices. Int J Nurs Midwifery 2018;10(8):90-98. https://academicjournals.org/journal/IJNM/article-full-text-pdf/40AE2D758078. Accessed 16th Sep 2025.

8. Vogel JP, Habib NA, Souza JP, Gülmezoglu AM, Dowswell T, Carroli G, et al. Antenatal care packages with reduced visits and perinatal mortality: a secondary analysis of the WHO Antenatal Care Trial. Reprod Health 2013;10:19. doi:10.1186/1742-4755-10-19.

9. Rustagi R, Basu S, Garg S, Singh MM, Mala YM. Utilization of antenatal care services and its sociodemographic correlates in urban and rural areas in Delhi, India. Eur J Midwifery 2021;5:40. doi:10.18332/ejm/140459.

10. Singh A, Pallikadavath S, Ram F, Alagarajan M. Do antenatal care interventions improve neonatal survival in India? Health Policy Plan 2014;29(7):842-848. doi:10.1093/heapol/czt066. Published online 13 Sep 2013.

11. Rowe S, Karkhaneh Z, MacDonald I, Chambers T, Amjad S, Osornio-Vargas A, et al. Systematic review of the measurement properties of indices of prenatal care utilization. BMC Pregnancy Childbirth 2020;20(1):171. doi:10.1186/s12884-020-2822-5.

12. Kotelchuck M. An evaluation of the Kessner Adequacy of Prenatal Care Index and a proposed Adequacy of Prenatal Care Utilization Index. Am J Public Health 1994;84(9):1414-1420. doi:10.2105/ajph.84.9.1414.

13. Kotelchuck M. The Adequacy of Prenatal Care Utilization Index: its US distribution and association with low birthweight. Am J Public Health 1994;84(9):1486-1489. doi:10.2105/ajph.84.9.1486.

14. Peahl AF, Howell JD. The evolution of prenatal care delivery guidelines in the United States. Am J Obstet Gynecol 2021;224(4):339-347. doi:10.1016/j.ajog.2020.12.016. Published online 13 Dec 2020.

15. Kumar H, Chacko IV, Mane S, Govindan NN, Prasanth S. Study of utilization of antenatal care services and its determinants among pregnant women admitted in a tertiary care hospital in Mangaluru, Karnataka, India. Int J Community Med Public Health 2020;7(5):1960-1967.

16. Motappa R, Shetty P, Acharya S. Evaluation of antenatal care utilization and its effects on obstetric and newborn outcomes at a public and private hospital of Karnataka: A comparative study. J Educ Health Promot 2024;13(1):161. doi:10.4103/jehp.jehp_1071_23.

17. Kamil A, Khorshid E. Maternal perceptions of antenatal care provision at a tertiary level hospital, riyadh. Oman Med J 2013 Jan;28(1):33-35. doi:10.5001/omj.2013.07.

18. Ananthan VA. Modified Kuppuswamy scale for socioeconomic status of the Indian family- Update based on New CPI (IW) series from September 2020. J Family Med Prim Care 2021;10(5):2048-2049. doi:10.4103/jfmpc.jfmpc_2242_20. Published online 31 May 2021.

19. Tayebi T, Zahrani ST, Mohammadpour R. Relationship between adequacy of prenatal care utilization index and pregnancy outcomes. Iran J Nurs Midwifery Res 2013;18(5):360-366.

20. Foghaha MH, Yazdanpanahi Z, Babaei AH. Assessment of adequacy of prenatal care utilization index and its affecting factors. Pak J Med Health Sci 2018;12(2):924-929.

21. Rosenberg D, Handler A, Furner S. A new method for classifying patterns of prenatal care utilization using cluster analysis. Matern Child Health J . 2004;8(1):19-30. DoI: 10.1023/B:MACI.0000019845.04353.78

22. Kamil A, Khorshid E. Maternal perceptions of antenatal care provision at a tertiary level hospital, Riyadh. Oman. Med J. 2013 Jan;28(1):33-35. doi:10.5001/omj.2013.07.

23. Pandey S, Karki S. Socio-economic and Demographic Determinants of Antenatal Care Services Utilization in Central Nepal. Int J MCH AIDS 2013;2(2):212-219. doi:10.21106/ijma.27.

24. Islam MM, Masud MS. Determinants of frequency and contents of antenatal care visits in Bangladesh: Assessing the extent of compliance with the WHO recommendations. PLoS One 2018;13(9). doi:10.1371/journal.pone.0204752.

25. Yaya S, Bishwajit G, Ekholuenetale M, Shah V, Kadio B, Udenigwe O. Timing and adequate attendance of antenatal care visits among women in Ethiopia. PLoS One 2017;12(9). doi:10.1371/journal.pone.0184934.

26. Aziz Ali S, Aziz Ali S, Feroz A, Saleem S, Fatmai Z, Kadir MM. Factors affecting the utilization of antenatal care among married women of reproductive age in the rural Thatta, Pakistan: findings from a community-based case-control study. BMC Pregnancy Childbirth 2020 Jun;20(1):355. doi:10.1186/s12884-020-03009-4.