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

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ARTICLE INFO

Article history:
Received: 28 May 2025
Accepted: 8 December 2025

Online:
DOI 10.5001/omj.2025.109

Keywords:
Pregnancy; Pregnant Women; Prenatal Care.

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 to the Focused ANC (FANC) model by the World Health Organization with those in the adequate and adequate plus categories of the Adequacy of the Prenatal Care Utilization (APNCU) index, to evaluate if the number of visits had any influence on these outcomes. ***Methods***: We conducted a prospective observational study among consenting participants who had received one or more antenatal visits elsewhere before presenting to our hospital for further care between January 2021 and September 2022. We collected details on previous pregnancy, prior ANC visits, adverse maternal, and fetal outcomes after delivery, and then statistically analyzed the data. Categorical variables were analyzed using the chi-square test, and the level of significance was set at $p \leq 0.05$ with a confidence interval of 95%. ***Results:*** A total of 500 participants were included. Of these, 2.0%, 13.4%, 46.6%, and 38.0% received adequate plus, adequate, intermediate, and inadequate prenatal care, respectively. There was a statistically significant difference between participants with adequate visits as per the FANC model and those with adequate and adequate plus visits as per the APNCU index in the distribution of high-risk factors in the index pregnancy, such as anemia, hypertensive disorder, and gestational diabetes mellitus. Similarly, statistically significant differences were found between adverse maternal outcomes like post-partum hemorrhage and intensive care unit admission, and adverse neonatal outcomes like preterm birth, low birth weight, birth asphyxia, neonatal hypoglycemia, meconium aspiration, neonatal intensive care unit admission, and stillbirth. ***Conclusions:*** Although the number of participants receiving adequate ANC based on the FANC model was greater than those in the adequate and adequate plus categories according to the APNCU index, the frequency of adverse maternal and fetal outcomes was higher in the FANC model. This most likely indicates that less frequent ANC visits are probably inadequate for the timely identification of issues of concern, and therefore for preventing adverse outcomes.

The concept of prenatal care (PNC) for safe pregnancy is believed to have begun in the early 1900s. The term antenatal care (ANC) is often used interchangeably with PNC. The 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 the two primary aspects of such visits. The identification aspect focuses on monitoring the health of both the pregnant woman and fetus for timely identification and addressing of potential concerns or

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issues. The education aspect focuses 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 fetus.[8–10]

Several methods and indices have been used for assessing whether the care received by a pregnant women is sufficient.[11] Adequacy of prenatal care utilization (APNCU) index, described by Kotelchuck is one such index.[12,13] To assign a woman into one of the four APNCU index categories, a ratio of the actual ANC visits attended to the expected number of visits for that woman is calculated (based on the American College of Obstetricians and Gynaecologists (ACOG) recommendations). The 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 until 36 weeks of gestation, and every week thereafter until delivery.[14] A woman who delivers at 40 weeks of gestation would attend 14 ANC visits. This is in contrast to the four ANC visits as per the WHO Focused ANC (FANC) model that Ministry of Health and Family Welfare currently recommends in India with the first visit being in the first trimester.[4,7] ANC is considered adequate if the first visit takes place before the12th week of pregnancy and at least four visits were attended in the entire pregnancy.

In India, there is a significant variation in the number of ANC visits women attend. While many women visit frequently, a large population is unable to do due to many factors. Also, it is not uncommon for pregnant women in India to have visited one or more centers for initial care and then present to another center or hospital for delivery.

There is limited available literature examining 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 center 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 the aim of comparing the four-visit FANC model with models mandating a higher number of visits.

METHODS

We conducted this prospective, observational study after obtaining ethical approval (27103/MC/IEC/2021) from our institute, a tertiary care teaching hospital in central India. Pregnant women visiting the hospital for delivery, who had their initial ANC visit(s) elsewhere but presented to us for further care and delivery, and who had the details of previous ANC visits available, were considered for inclusion. 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 had their initial ANC elsewhere, a sample size of 376 was calculated if the study was conducted for a period of one and a half years. However, we planned to include as many participants as possible who could be enrolled between January 2021 and September 2022.

We collected basic demographic data, those related to the previous pregnancy (if any), the total number of ANC visits, and any previous maternal health conditions 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, and perinatal mortality were recorded. Maternal outcomes, primarily post-partum hemorrhage (PPH), sepsis, maternal mortality, and any other complications were recorded. All the data were 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 (> 50% of expected visits), intermediate (50–79%), adequate (80–109%), and adequate plus (≥ 110%). Additionally, participants were classified according to the FANC model as having adequate care (at least four visits, two doses of tetanus toxoid, and ≥ 100 days of iron–folic acid supplementation) or inadequate care (fewer than four visits). Data were analyzed using SPSS Statistics (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.). Categorical variables were presented as numbers and percentages and compared using the chi-square test. A p-value of ≤ 0.05 was considered statistically significant.

RESULTS

A total of 519 patients were initially included in the study, with 500 remaining after applying the exclusion criteria. Table 1 summarizes the sociodemographic details of the participants and the distribution of the same in terms of different categories of the 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.

It was observed that 66.0% 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 ($p < 0.001$). The majority (82.0%) of participants with lower and upper lower socioeconomic status were in the inadequate and intermediate categories. All the 25 women who belonged to upper socioeconomic 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, socioeconomic 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 had pre-existing medical conditions, 42 of them were in the inadequate APNCU category, indicating that even those with medical conditions did not seek frequent ANC. Two hundred and ninety-six participants had a history of previous childbirth. Of these, 38.5% had an adverse event in the previous pregnancy (pregnancy-

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

Parameters	APNCU index, n (%)					
	Adequate plus 10 (2.0)	Adequate 67(13.4)	Intermediate 233(46.6)	Inadequate 190(38.0)	Total 500(100)	*p*-value*
Age, years						
< 20	0 (0.0)	12 (9.6)	38 (30.4)	75 (60.0)	125 (25.0)	< 0.001
20–35	10 (3.0)	48 (14.5)	186 (56.4)	86 (26.1)	330 (66.0)	
> 35	0 (0.0)	7 (15.6)	9 (20.0)	29 (64.4)	45 (9.0)	
Educational level						
No formal education	0 (0.0)	20 (16.4)	20 (16.4)	82 (67.2)	122 (24.4)	< 0.001
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)	< 0.001
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 (14.7)	75 (15.0)	
Upper	0 (0.0)	0 (0.0)	25 (100)	0 (0.0)	25 (5.0)	
Residential type						
Rural	0 (0.0)	30 (15.8)	59 (31.1)	101 (53.2)	190 (38.0)	< 0.001
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)	0.269
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)	
Government employee	0 (0.0)	2 (15.4)	8 (61.5)	3 (23.1)	13 (2.6)	

Socioeconomic status was estimated using Revised Kuppuswamy scale.[18]
**Chi-square test.*

Table 2: Distribution of adequacy of prenatal care utilization (APNCU) index in relation to various obstetric parameters of the included participants.

Parameters	APNCU index, n (%)					*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)	< 0.001
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, weeks						
< 34	0 (0.0)	11 (44.0)	5 (20.0)	9 (36.0)	25 (5.0)	< 0.001
34–37	0 (0.0)	41 (23.4)	44 (25.1)	90 (51.4)	175 (35.0)	
37–40	10 (3.6)	15 (5.5)	166 (60.4)	84 (30.5)	275 (55.0)	
> 40	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)	< 0.001
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)	0.102
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 (5.0)	< 0.001
Cesarean section	0 (0.0)	21 (14.9)	34 (24.1)	86 (61.0)	141 (28.2)	
Normal vaginal delivery	0 (0.0)	11 (8.5)	88 (67.7)	31 (23.8)	130 (26.0)	
Obstetric outcome in present pregnancy						
Vaginal delivery	7 (70.0)	48 (71.6)	152 (65.2)	114 (60.0)	321 (64.2)	0.343
Caesarean section	3 (30.0)	19 (28.4)	81 (34.8)	76 (40.0)	179 (35.8)	

**Chi-square test.*

induced hypertension, anemia, and post-partum hemorrhage). There was no statistically significant difference between the APNCU index categories and high-risk factors in the previous pregnancy ($p = 0.102$), whereas the obstetric outcome of the previous pregnancy showed a statistically significant difference ($p < 0.001$).

Table 3 summarizes the distribution of high-risk factors, and adverse maternal and neonatal outcomes in the present pregnancy across different APNCU index categories. Anemia requiring blood transfusion was the most common high-risk factor. PPH (14.8%) and intensive care unit (ICU) admission (10.0%) were the most common adverse maternal outcomes, which was common among participants with inadequate and intermediate APNCU index categories ($p = 0.048$). Neonatal ICU admission (17.8%), hypoglycemia (12.2%), and low birth weight infants (11.0%) were the commonest adverse neonatal outcomes, which were common among participants with inadequate and intermediate APNCU index categories ($p < 0.001$).

Table 4 presents the distribution of high-risk factors, and adverse maternal and neonatal outcomes 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 the FANC model in terms of distribution of the different high-risk factors in pregnancy ($p = 0.261$) and adverse maternal outcomes ($p = 0.110$). However, we observed a statistically significant difference in adverse neonatal outcomes between the groups ($p < 0.001$).

Table 5 presents a comparison between the FANC model (adequate category), and the APNCU index categories (adequate and adequate plus categories). We noted a statistically significant difference between

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

Variables	APNCU index, n (%)					*p*- value*
	Adequate plus 10 (2.0)	Adequate 67 (13.4)	Intermediate 233 (46.6)	Inadequate 190 (38.0)	Total 500 (100)	
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)	0.338
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)	0.048
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 odema	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)	< 0.001
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)	

*APNCU: adequacy of prenatal care utilization; ICU: intensive care unit. *Chi-square test.*

the two in the distribution of high-risk factors of pregnancy. Further, adverse maternal outcomes, namely PPH, and ICU admission ($p < 0.001$) had statistically significant differences too. All adverse neonatal outcomes other than neonatal jaundice had statistically significant differences as can be seen in Table 5.

DISCUSSION

Appropriate ANC provided in a timely manner is considered the cornerstone for a safe pregnancy for both the mother and infant.[1,2,5] Effective ANC should include timely identification and intervention if any complication develops during pregnancy, and it should 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 methods/indices have been devised to evaluate the effectiveness of ANC.[17,19–21] However, recognizing that frequent visits might not be possible in many developing and relatively poor countries, the WHO proposed the concept of FANC, which for an otherwise normal pregnancy necessitates four visits during the entire pregnancy.[7] This is in contrast to the ACOG guidelines that recommend ≥ 14 visits for a normal pregnancy that continues until 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 a reduced number of ANC visits. Based on this and other studies, the latest WHO recommendation is at

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, n (%)			*p*- value*
	Adequate 342(68.4)	Inadequate 158 (31.6)	Total 500 (100)	
High risk factors in present pregnancy				
Anemia requiring transfusion	78 (22.8)	35 (22.2)	113 (22.6)	0.261
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)	0.110
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 edema	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)	< 0.001
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)	
Hypoglycemia	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)	

*FANC: focused antenatal care; ICU: intensive care unit. *Chi-square test.*

least eight visits throughout 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 the intention to obtain better care. An assessment of the quality of care received can be done either observed directly or through feedback/responses from educated mothers.[17,22] 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 the APNCU index categories. This index has found widespread use in other countries and is based on the ACOG guideline, which emphasizes frequent visits. Based on the results of this study, only about 15.4% of participants undertook > 80.0% of the recommended visits. Those 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 ANC was noted suggesting that older participants were more likely to adequately utilize ANC compared to younger women. One can attribute this pattern to the younger participants lack of experience/awareness in pregnancy care. Only 28.1% of participants with primary or lower level of education had an adequate APNCU index. This figure suggests that education level might be a factor influencing the number of ANC

Table 5: Comparison of antenatal care as per FANC model (adequate) and APNCU index (adequate and adequate plus taken together).

Variables	FANC model (adequate visits)	APNCU index (adequate and adequate plus)	*p*-value
High risk factor in present pregnancy			
Anemia requiring transfusion	78	17	< 0.001
Hypertensive disorders of pregnancy	53	17	< 0.001
Gestational diabetes mellitus	30	10	< 0.001
Adverse maternal outcome			
Post partum hemorrhage	55	11	< 0.001
Acute kidney injury	2	0	0.500
Multiple organ dysfunction	2	0	0.500
Pulmonary embolism	1	0	1.000
ICU admission	27	7	< 0.001
Mortality	2	0	0.500
Adverse neonatal outcome			
Preterm birth	14	7	0.015
Low birth weight baby	50	6	< 0.001
Birth asphyxia	20	4	< 0.001
Hypoglycemia	28	0	< 0.001
Meconium aspirations	8	0	0.007
Neonatal jaundice	2	0	0.500
Neonatal ICU admission	49	28	< 0.001
Still birth	8	2	0.031

FANC: focused antenatal care; APNCU: adequacy of prenatal care utilization; ICU: intensive care unit.

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,[22] reported that women from high-income families were three-time 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 ANC compared to those who did not receive primary level education. All the participants of upper socioeconomic status were in the inadequate APNCU index category. This finding corroborates the report by Islam et al,[23] who noted that women in the richest group were 1.5 times more likely to receive the components of ANC content compared to those in the poorest group (odds ratio = 1.513; 95% CI: 1.299–1.763). When considering residential areas, 15.2% of participants with urban residence and 15.8% with rural residence were in the adequate and adequate plus categories, respectively. This similar distribution suggests that the residential area did not influence the possibility of seeking more frequent visits. Additionally, 53.2% of participants with rural residence were in the inadequate category compared to 28.7% of those with urban residences, suggesting that those with rural residence had a greater tendency to not seek the minimum number of required visits. Yaya et al.,[24] 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.

Among the 204 primigravida women, 17.6% were in the adequate and adequate plus APNCU categories compared with 14.0% of multigravida women. This distribution is similar to the finding reported by Aziz et al,[25] that nulliparous women were more likely to utilize ANC compared to multiparous women, even after adjusting for other factors.

In the FANC model, a pregnant woman must undertake their 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] However, the APNCU

index requires frequent visits spread across the entire pregnancy and the adequacy of visits is calculated individually for each woman. If we consider two scenarios, one in which a woman attends an ANC in the twelfth week, then once in the second trimester, and two times in the third and another one in which a woman has her first ANC in the 12th week but the remaining visits after 28 weeks, then both would be categorized in the adequate category of the FANC model. However, to be categorized as adequate under the APNCU index, a woman must have undertaken ≥ 80.0% of the visits recommended to her. Thus, a woman who has her first visit in 12th week would need at least nine visits up to 40 weeks of gestation to be categorized in the adequate APNCU index category. As a result of the above difference in calculating the adequacy of ANC, the women categorized under the adequate category of the APNCU index may not be comparable to those categorized as adequate under FANC model. 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 the 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 a 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, without assessing the content and quality of each visit. Additionally, the effect of the time of initiation of ANC on pregnancy outcomes was not assessed either. The expertise of the care provider, especially of care received before enrolling with our hospital, could not be evaluated. Finally, the data are derived from a single tertiary care center. 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 necessitating fewer visits (four visits), it can be inferred that a higher number of ANC visits may be more effective in timely identification of potential concerns, thereby contributing to safer pregnancies for both mother and newborn. It may therefore be prudent to reconsider the current recommendation of four ANC visits per pregnancy and adopt models that recommend a higher number of visits, not only in India but also in other countries that still follow the WHO four-visit model.

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

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