Original Article

Effect of Late Antenatal Booking on Maternal Anemia and Fetus Birth Weight on Parturients in Enugu, Nigeria: An Analytical Cross-Sectional Study

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Abstract

Background: The benefits of antenatal care are maximized when women book early for care. However, despite these resounding benefits, women still book late, while others do not book at all, resulting in dire feto–maternal consequences. **Aim:** Determine the effect of late prenatal booking on maternal anemia and birth weight in babies of women who delivered in public health facilities in Enugu and deduce the reasons for booking late. **Patients and Methods:** A cross-sectional study of two groups of women (235 participants in each group) who delivered in 4 randomly selected hospitals in Enugu. Descriptive statistics were obtained for continuous variables, and frequency and percentages were used for categorical variables. Degree of associations was determined using the Chi-square, the student's *t*-test, and 2 x 2 table. **Results:** The prevalence of anemia among women that booked late and early were (69.7%; n = 147) and (50.7%; n = 107) respectively. Women who booked late were two times more likely to have anemia than those who booked early (OR = odds ratio, p = p-value, CI = confidence interval,). Those who booked late were six times more likely to deliver low birth weight babies than those who booked early (OR = 5.934, 95% CI = 1.299–27.119, P = 0.022). **Conclusions:** Late prenatal booking is associated with a high prevalence of maternal anemia in labor, low mean maternal hemoglobin, and low birth weight compared to those of women who booked early and the reasons for booking late are multifactorial.

Keywords: *Birth weight, early booking, late booking, maternal anemia, pregnant women*

Introduction

Antenatal care (ANC) is defined as care provided to pregnant women in pregnancy to ensure good outcomes for themselves and their babies.[1] It is generally recognized as an effective means of preventing deleterious outcomes in pregnant women and their babies.[2,3] Traditionally, it is recommended that ANC commences by the second missed period and women are seen every 4 weeks until 28 weeks gestation, then 2 weekly until 36 weeks, and then weekly until delivery. This traditional method is still being practiced in most parts of the developing and developed world. However, in 2002, the World Health Organization (WHO) introduced focused antenatal care (FANC), where only four visits are allowed. The FANC aims to promote the health of mothers and their babies through evaluations of pregnant women and to provide holistic and personalized care to each woman to help maintain normal pregnancy progress through timely guidance and advice.[1] The recommended schedule of visits in the FANC is that the first visit will be between 12 and 16 weeks, then the second visit at 24–28 weeks, then the third visit at 32 weeks, while the fourth and last visit

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will be at 36 weeks.[4] This, however, did not gain wide acceptance. In 2016, the WHO introduced the revised focused antenatal care to address the shortcomings of FANC. They, therefore, recommended 8 visits and the first visit should be at less than or equal to 12 weeks.[5]

However, whichever method of ANC a provider practices, it is expected that the patient should enjoy the benefits inherent in ANC, especially when it is commenced early. The benefits of early antenatal booking as enumerated by Ebeigbe and Igberase[6] include but are not limited to, prompt initiation of health education, counseling on anticipated changes in the body, helps initial documentation of baseline physiological and laboratory results for comparison later, provides an avenue for preventive health care services and prompt diagnosis of some remediable illnesses that may affect the course and outcome of pregnancy.

Despite these resounding benefits of early antenatal booking, many women still book late for ANC, and some women do not book at all. The National Demographic and Health Survey 2018 reported that only 61% of women received ANC from a skilled provider, 36% of births in Nigeria are delivered in a health facility while 63% of births occur at home. In Enugu, south-east Nigeria, the study area, a considerable proportion of deliveries (85.5%) occur in a health facility. Compared to other studies, only 13.1% of deliveries occur at home,[6] however, 34.2% of women did not receive ANC at all, and only 18% of women had their first antenatal visit in the first trimester.[7]

Antenatal care from a trained provider is important to monitor pregnancy and reduce the risks of morbidity for mother and child during pregnancy and delivery.[7] One of the key objectives of ANC is the prevention of diseases through immunization and micronutrient supplementation. These benefits are lost when ANC is not started early or is omitted entirely. They could lead to fetal and maternal consequences such as maternal and fetal anaemia, poor maternal weight gain, neonatal tetanus, intrauterine growth restriction, and intrauterine fetal deaths (IUFD).

In pregnancy, anemia has a significant impact on the health of the fetus, and that of the mother.[8] Complications are numerous and 20 percent of maternal deaths in Africa have been attributed to anemia.[9] Other complications include low pregnancy weight gain and intrauterine growth retardation, followed by low birth weight and higher perinatal mortality rates.[9] Furthermore, fetuses of mothers with anemia in pregnancy are at risk of preterm deliveries, low birth weight, morbidities, and mortality due to impaired oxygen delivery to the placenta and fetus.[10]

Previous studies have focused attention on studying the effect of late antenatal booking on certain parameters like maternal anemia, birth weight, etc., No previous study has done a comparative study with a controlled group of people that booked early.[3,6] Some studies only identified the factors that predict late initiation of ANC,[1-3] whereas others determined the reasons for late booking among women presenting at the antenatal clinic.[6] To our knowledge, no single study has compared the effect of late antenatal booking on maternal hemoglobin concentration and fetal birth weight with those of women who booked early and also deduced the reason for late antenatal booking among pregnant women. Therefore, this comparison and the deduction of the reasons for late booking incorporated in one study will provide integrated background knowledge and also help to design an intervention or protocol.

Methodology

Setting

The study was conducted in Enugu, Enugu State, one of the five states in the southeast geopolitical zone of Nigeria. All major hospitals that offer antenatal services in the city of Enugu were included in the study. They include the University of Nigeria Teaching Hospital, Ituku-Ozalla, Enugu State University Teaching (ESUTH-Parklane), Mother of Christ Specialist Hospital, Enugu, and Poly General Hospital. The study took place between 20th May and 19th November 2019, over six months.

The University of Nigeria Teaching Hospital is the pioneering teaching hospital in Southeastern Nigeria, owned by the federal government of Nigeria. The hospital offers ANC, delivery, and postnatal care services to pregnant women in Enugu state and manages 1000 deliveries annually.

The ESUTH-Parklane is a tertiary health care institution owned by the Enugu State government and is located in the center of the Enugu metropolis. The hospital manages an average of 2800 deliveries annually.

Mother of Christ Specialist Hospital is a catholic mission hospital located in Enugu. Mother of Christ Specialist Hospital oversees an average of 2000 deliveries annually.

Polyclinic Enugu is a government-owned general hospital in the local government area of Enugu North of Enugu State, Nigeria. She cares for the health care needs of the majority of the people in Enugu urban, especially the low and middle class. The Polyclinic oversees an average of 2440 deliveries per year.

Study population

The study population consisted of 235 cohorts of women who attended the antenatal clinic after 18 weeks of gestation and delivered in the labor wards of the four study centers. In contrast, the comparison group consisted of another cohort of women who registered, attended the antenatal clinic at or before 18 weeks of gestation, and delivered in the labor wards of the four study centers. The eligibility criteria are all pregnant women who registered for, attended ANC, and delivered in the four health facilities that gave consent for the study. Exclusion criteria are all pregnant women with known medical and obstetric conditions (such as hypertensive disorders of pregnancy: preeclampsia, eclampsia; diabetes mellitus, cardiac diseases in pregnancy, sickle cell disease in pregnancy, thyroid diseases in pregnancy, placenta previa, abruptio placenta, etc.) that could cause maternal anemia and low birth weight.

Definition of terms

Anemia was defined as hemoglobin concentration of <11 g/dl. Mild anemia was defined as Hb concentration of between 10 and 10.9 g/dl. Moderate anemia was defined as Hb concentration of between 7 and 9.9 g/dl while severe anemia was defined as Hb concentration <7 g/dl. Late booking was defined as booking at >18 weeks of gestational age. Many developing countries including Nigeria do not have national guidelines on ANC but commencement of ANC within the first 14–18 weeks of gestation is widely accepted as early.[4] Normal birth weight was defined as birth weight between 2.5 kg and 4.0 kg. Low birth weight was defined as birth weight below 2.5 kg.

Study design and subject selection

This was an analytical cross-sectional comparative study of two groups of women that delivered at the labor wards of the four hospitals, in Enugu. The participants were recruited consecutively at 36 weeks gestational age after informed consent was obtained. They were either assigned to the study group or the comparison group at the presentation depending on the gestational age they booked for ANC. They were matched in age and parity. The reasons for the late booking were sought from women who booked at more than 18 weeks of gestational age using a proforma. Both groups were followed up until delivery. Prior to delivery, two milliliters of blood was drawn for Hb estimation (described in the laboratory method section) by the trained research assistants (house officers on rotation in the labor wards and medical officers) in the different study centers and the baby's anthropometric measurement were also taken at birth. The birth weight was obtained using a standard infant weighing scale RGZ-20 (Wincom company ltd; 2018, China) with an accuracy of 0.1 kg. The scale was set at zero before the newborn was put on it immediately after cleaning and while the newborn was still naked. The weighing was repeated twice by the attending midwife. A third measurement was obtained if the weight measurements varied by more than 0.2 kg by the researcher. An average of the two closest readings was taken. The weighing scale was calibrated using a standard weight of 5 kg every morning. The results of maternal Hb and birth weight were recorded in the proforma.

Sample size determination

The sample size (n) was determined using the formula for comparing two proportions by Bolarinwa[11] and also using the proportion of booked antenatal women in a previous study in Enugu by Dim and Onah[12] = 0.404.

At 95% CI, the minimum sample size to adequately power the study was determined to be 196 and giving an attrition rate of 20% takes the minimum sample size to 235 in each group.

Sampling technique

The stratified random sampling technique was used to select samples for the study. The four (4) randomly selected hospitals formed the strata, and the sample size was allocated proportionately to each stratum (hospital). Thereafter, the allocated samples were selected consecutively. Both groups were selected from each stratum (hospital); that is, dividing the samples into two. Therefore, 57 were allocated to the University of Nigeria Teaching Hospital (UNTH) Ituku-Ozalla, 160 for the ESUTH-Parklane, 114 for Mother of Christ Specialist Hospital Enugu, and 139 for Poly Clinic Hospital Enugu.

Ethical clearance

Ethical approval for this study was obtained from the Ethics Committee of the University of Nigeria Teaching Hospital, Ituku-Ozalla. The same was presented to the Ethics Committees of the ESUTH-Parklane, Mother of Christ Specialist Hospital Enugu, and Poly Clinic, Enugu.

Consent from study participants

Written informed consent was obtained from each participant from the four study centers before enrolment in the study.

Data collection

Sociodemographic data and clinical characteristics were obtained from participants by asking both groups of women some direct questions and filling the same in the proforma. In contrast, the reasons for booking late were only obtained from the study group of women alone. The feto–maternal characteristics, including the

Hb estimation, the weight of the baby were obtained as previously explained and recorded in the proforma.

Laboratory methods

After presentation in the labor ward, in any of the four study centers, the hemoglobin concentration of the delivering mothers was measured using HemoCue Hb 301 (manufactured in Sweden). The attendants wear protective gloves. We made sure that the patient's hand was warm and relaxed. We used the middle or ring finger for sampling and avoided fingers with rings. We cleaned the fingertip with disinfectant and allowed it to dry. We used our thumb to lightly press the finger from the top of the knuckle toward the fingertip to stimulate blood flow, and we sampled at the side of the fingertip for best blood flow and comfort. We pressed gently toward the fingertip and punctured it with a lancet. We wiped away the first two or three drops of blood and then pressed lightly toward the fingertip until another drop of blood appeared. When the blood drop was large enough, we filled the microcuvette in one step. We did not refill. If a second sample was taken, it was done after the measurement of the first sample was complete. We wiped off the sample from the outside of the microcuvette and ensured that no sample was drawn from the open end. We visually inspected the microcuvette. If the microcuvette was not completely filled with blood or air bubbles, we discarded and filled a new microcuvette. We placed the microcuvette in the cuvette holder, measured it gently, sliding the cuvette holder to the measuring position. We did not let more than 40 seconds pass between the step filling of the microcuvette and starting the measurement. The result is usually displayed on the screen in three seconds and the same is documented in the proforma.

Data analysis

Data were analyzed using the International Business Machines Statistical Package for Social Sciences (IBM – SPSS) version 22. Descriptive statistics, which include means and standard deviation, were obtained for continuous variables, while frequency and percentage were used to summarize categorical variables. Associations between categorical variables were made using a 2 × 2 table and Chi-square, while the student's *t*-test was used to compare the means of continuous variables. *P*-value < 0.05 was regarded as significant, and results were presented in tables.

Result

A total of 470 eligible participants were recruited for the study, 235 in each subject and comparison group. Two hundred and eleven (211) participants in each group, however, had their proforma rightly filled while twenty-four (24) participants in each group had incompletely filled proforma and were not included finally.

Table 1: Sociodemographic characteristics of women

	Booking		χ^2	*P*
	Late (>18) *n* (%)	Early (≤18) *n* (%)		
Age group				
<20	12 (54.5)	10 (45.5)	7.019	0.219
20–24	26 (39.4)	40 (60.6)		
25–29	74 (47.7)	81 (52.3)		
30–34	59 (52.2)	54 (47.8)		
35–39	29 (63.0)	17 (37.0)		
≥40	11 (55.0)	9 (45.0)		
Parity group				
0	12 (57.1)	9 (42.9)	2.105	0.349
1–4	171 (48.4)	182 (51.6)		
≥ 5	28 (58.3)	20 (41.7)		
Marital Status				
Single	18 (66.7)	9 (33.3)	3.588	0.166
Married	191 (48.7)	201 (51.3)		
Widowed	2 (66.7)	1 (33.3)		
Religion				
Christianity	206 (49.8)	208 (50.2)	1.153	0.562
Islam	4 (57.1)	3 (42.9)		
Others	1 (100.0)	0 (0.0)		
Ethnic				
Igbo	194 (48.7)	204 (51.3)	6.585	0.160
Hausa	7 (58.3)	5 (41.7)		
Yoruba	6 (75.0)	2 (25.0)		
Idoma	3 (100.0)	0 (0.0)		
Efik	1 (100.0)	0 (0.0)		
Educational level				
No formal	6 (85.7)	1 (14.3)	4.562	0.207
Primary	13 (56.5)	10 (43.5)		
Secondary	111 (50.5)	109 (49.5)		
Tertiary	81 (47.1)	91 (52.9)		
Employment				
Government employed	34 (38.2)	55 (61.8)	9.763	0.045
Self-employed	100 (52.9)	89 (47.1)		
Private employed	24 (53.3)	21 (46.7)		
Unemployed	52 (55.9)	41 (44.1)		
Others	1 (16.7)	5 (83.3)		
Husband Education				
No formal	15 (68.2)	7 (31.8)	4.870	0.301
Primary	9 (50.0)	9 (50.0)		
Secondary	96 (51.1)	92 (48.9)		
Tertiary	90 (46.6)	103 (53.4)		
Others	1 (100.0)	0 (0.0)		
Husband Occupation				
Government employed	60 (42.3)	82 (57.7)	7.808	0.099
Self-employed	120 (53.1)	106 (46.9)		
Private employed	26 (55.3)	21 (44.7)		
Unemployed	2 (50.0)	2 (50.0)		
Others	3 (100.0)	0 (0.0)		

Table 2: Clinical characteristics of the women

	Booking		χ^2	*P*
	Late *n* (%)	Early *n* (%)		
Number of living children				
0	8 (44.4)	10 (55.6)	2.934	0.710
1	52 (46.8)	59 (53.2)		
2	53 (46.5)	61 (53.5)		
3	50 (55.6)	40 (44.4)		
4	27 (52.9)	24 (47.1)		
≥5	21 (55.3)	17 (44.7)		
Any previous Stillbirth				
Yes	13 (44.8)	16 (55.2)	0.333	0.564
No	198 (50.4)	195 (49.6)		
Any previous miscarriage				
Yes	23 (34.8)	43 (65.2)	7.184	0.007
No	188 (52.8)	168 (47.2)		
The outcome of the last pregnancy				
Live birth	195 (50.4)	192 (49.6)	7.946	0.047
Miscarriage	2 (15.4)	11 (84.6)		
Still birth	8 (61.5)	5 (38.5)		
Early neonatal death	6 (66.7)	3 (33.3)		
Mode of delivery of previous pregnancy				
C/S	39 (47.6)	43 (52.4)	0.242	0.623
SVD	172 (50.6)	168 (49.4)		
Sex of the last baby				
Male	83 (44.6)	103 (55.4)	3.845	0.050
Female	128 (54.2)	108 (45.8)		

Table 3: Association between anemia, birth weight, and ANC booking

	Booking		OR	95% CI for OR	*P*
	Late *n* (%)	Early *n* (%)			
Anemia					
Normal	64 (30.3)	104 (49.3)			
Mild	94 (44.5)	90 (42.7)	1.697	1.110–2.596	0.015
Moderate	53 (25.1)	17 (8.1)	5.066	2.701–9.501	<0.001
Birth weight					
Normal	190 (90.0)	205 (97.2)			
Low	11 (5.2)	2 (0.9)	5.934	1.299–27.119	0.022
Macrosomia	10 (4.7)	4 (1.9)	2.697	0.832–8.745	0.098

Table 1 shows that pregnant women who are government workers booked late compared to other women with other occupations. (χ^2 = 9.763, *P* = 0.045). The rest of the demographic characteristics were matched for both groups.

Table 2 shows that more women who had previous miscarriages booked early (55.2%) compared to those who booked late (44.8%), (χ^2 = 7.184, *P* = 0.007). Late booking was more associated with women who had a live birth (50.4%), stillbirth (61.5%), and early neonatal death (66.7%) (χ^2 = 7.946, *P* = 0.047).

Results show that 69.7% of the women who booked late had anemia while 50.7% of those who booked early had anemia. Women who booked late were two times more likely to have anemia than those who booked early (*P* < 0.001, OR = 2.232, 95% CI = 1.498–3.326).

Table 3 shows a significant association between ANC booking and anemia. Women who booked late were two times more likely to have mild anemia than those who booked early (*P* = 0.015, OR = 1.697, 95% CI = 1.110–2.596). Similarly, women who booked late were five times more likely to have moderate anemia than those who booked early (*P* < 0.001, OR = 5.066, 95% CI = 2.701–9.501).

A significant association was found between ANC booking and low birth weight (*P* = 0.022). Women who booked late were six times more likely to give birth to low birth weight babies than those who booked early (OR = 5.934, 95% CI = 1.299–27.119). There was a significantly lower mean birth weight for babies delivered by women who booked late (*t* = 4.061, *P* < 0.001).

Table 4 shows that the major reasons for the respondents' late booking were: Registered in a maternity home (42.7%), felt it was the right time (34.1%), did not have any serious problems (21.3%), did not have money to register for ANC (10.9%), and "Not my portion" to have any problem in the first four months of pregnancy (10.0%).

Discussion

The prevalence rate of anemia in women (both early and late bookers) was 60.2%. This was higher than the findings of 40.4% by Dim,[12] who studied the prevalence of anemia in pregnancy in booked women in UNTH, one of the four hospitals randomly selected for this study. The difference in the prevalence may be explained by the fact that the four hospitals cut across the Enugu metropolis, are more population-based, and may be more representative of anemia in pregnancy in Enugu. Our findings are consistent with other studies of anemia in pregnancy among antenatal women in the region.[13–15]

Our study found a higher prevalence of mild and moderate anemia in women that booked late compared to those that booked early in the four different hospitals studied. No case of severe anemia was reported. These findings are consistent with the findings of Dim[12] and Onoh,[13] who found milder and moderate anemia and no severe anemia in booked antenatal women in Enugu

Table 4: Reasons for late booking

	Frequency	Percent (%)
I did not have money to register for ANC	23	10.9
My husband refused to allow me to register early	5	2.4
I did not want the pregnancy public yet	10	4.7
I did not want those who did not wish me well to know of the pregnancy earlier	4	1.9
I did not have any serious problems or expect to have them in the first four months	45	21.3
Women generally do not have problems that need a doctor's intervention	22	10.4
I do not think there is any benefit in booking in the first four months	25	11.8
"Not my portion" to have any problem in the first four months	21	10.0
Felt weak and sick most of the time and wanted to feel stronger before registering for ANC	8	3.8
No reason felt that it was the right time to book	72	34.1
Was seeing a nurse at home	21	10.0
Registered in a maternity home	90	42.7

and Abakaliki, respectively. The clinical implication of this higher prevalence of mild and moderate anemia in pregnancy in women that booked late compared to women that booked early is that late booking more likely may lead to late commencement of iron supplementation. This might, in turn, limit the benefit of iron supplementation in this population of women. However, it is important to be aware that this study did not explore compliance with prescribed hematinics, neither among later nor early bookers. Furthermore, their nutritional circumstances were not assessed. These are important limitations to the design of our study.

We found a statistically significant association between late ANC booking and low birth weight. Women who booked late were six times more likely to give birth to low birth weight babies than those who booked early. It also shows a significantly lower mean birth weight for babies delivered by women who booked late. This study corroborates the findings of Branco da Fonseca *et al*.[16] that inadequate ANC visits could be associated with low birth weight. Furthermore, the findings of lower mean birth weight in women who book late are similar to the findings of Onwuhafua[17] that the mean birth weight was significantly lower in the unregistered and low-frequency groups than in the moderate group. The links between early antenatal uptake and favorable birthweights could have been mediated by antenatal interventions like health promotion messages in pregnancy, early initiation of malaria prevention, prompt diagnosis, and treatment of some remediable illnesses that may affect the course and outcome of pregnancy such as hypertension and diabetes mellitus, and even human immunodeficiency virus (HIV) prevention interventions.[16,17]

According to our findings, the reasons why women book late are multifactorial. For the majority of the study subjects, the reason was registration in a maternity home, which in most cases, especially in our environment provides substandard care to these pregnant women. This finding was much greater than the findings of Ebeigbe[6] in the Niger delta, Nigeria, where only 15.2% of respondents acknowledged registering in maternity homes. The sociodemographic characteristics of the pregnant women in the two regions may have contributed to the wide difference. The proximity of the maternity homes may contribute to this observation.

About one-fifth of the subjects booked late because they believed they did not have any serious problems, and therefore did not see the need to book early. This finding was similar to those of Nwaneri *et al*.[18] who found that 43.1 percent of the respondents were ignorant of the correct timing of registration and 31.4 percent of the respondents in their study had poor knowledge of the benefits of early registration. It also corroborates the findings of Nwagha *et al*.[19] that ignorance and the absence of any problem in the current pregnancy are factors that can influence pregnant women's decision to book late for ANC. These observations suggest that it remains pertinent to deal with ignorance and misconceptions of the benefits of timely ANC to the mother and her unborn child. Women need to be aware that ANC is primarily aimed to detect and treat or prevent any condition that could lead to adverse outcomes for pregnant women and their unborn babies.

For 10.9 percent of the respondents, the reason for booking late was lack of money to register for ANC. This observation was similar to other studies that found finances could constrain timely antenatal booking.[6,18,19] This is not unexpected, especially in a resource-poor setting like ours, where the majority of women are of low social class and health care financing is done out of pocket. The average cost of ANC per visit in three out of the four facilities used in the study is about two thousand five hundred naira (N2500). This emphasizes the need for an ANC model that is low cost and meets purpose. In this regard, it is reasonable to consider mainstreaming ANC into the National Health Insurance Service so that it could be affordable and accessible to all women.

Some of the women that booked late based it on their faith stating that it is not their portion to have any

problem in the first four months of their pregnancy. This is now a trending phrase that is causing a lot of havoc in our health care system with the potential to cause a lot of damage to our women and unborn children. These women think that because they believe in "God," they are covered by the blood of Jesus, and no harm, nor affliction of the enemy shall befall them and their babies. Health education to our women on the goals and objectives of ANC and the need to register early may go a long way in averting this dangerous trend.

This study showed that pregnant women who are government workers booked late compared to other women with other occupations. The pressure of work and the inability to obtain permission to go to ANC early until pregnancy becomes evident and may have contributed to the late booking of this group of women.

The study also showed that more women who had previous miscarriages booked early compared to those who booked late. They probably did so to avert a repeat episode. However, these observations have not been collaboratively performed by previous studies.

Overall, the study has shown that there is still pervasive ignorance about the benefits of booking early for ANC. Findings such as this further suggest the need for more information about ANC and its benefits. Social media presents a spectacular opportunity to develop and disseminate information about the benefits of ANC as well as deal with any misconceptions. It is also important to develop innovative approaches to work with women and families in the community to present information in a way that they could relate to. Moreso, it is long overdue to develop and implement locally relevant guidelines and protocols on ANC in particular and obstetric care in general. This needs to be pursued with more vigor.

Strength of the study

This study was a comparative study. No previous study has compared the effect of late prenatal booking on maternal hemoglobin concentration and birth weight with those of women that booked early. Moreso, both groups of women recruited for this study were matched for age and parity, thereby reducing the effects of co-founders.

Limitations of the study

This was a hospital-based study and not population based. Hence, the findings may not be generalizable. Furthermore, the study participants comprised a self-selected population of women which may have introduced some bias. Study participants health behavior like compliance with antenatal hematinics and advice as well as their nutritional intake were omitted. The occurrence of any ill health during pregnancy was also not covered. Furthermore, it would have been interesting to capture other outcomes like IUFD, deaths, perinatal mortality, and newborn admission. Despite these, this study provides useful information into the problems of late antenatal booking and its consequences. We recommend further prospective studies including qualitative designs to gain a deeper understanding of this matter.

Conclusions

Based on our findings, late antenatal booking is associated with a high prevalence of maternal anemia in labor, low mean maternal hemoglobin, and low birth weight compared to those of women who booked early. The reasons for booking late are multifactorial.

Recommendations

Advocacy and education on the benefits of early ANC booking should be improved so that our women can use the service effectively and maximize the benefits.

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Conflicts of interest

There are no conflicts of interest.

References

1. Konlan KD, Saah JA, Amoah RM, Doat AR, Mohammed I, Abdulai JA, *et al*. Factors influencing the utilization of Focused antenatal care services during pregnancy, a study among postnatal women in a tertiary healthcare facility, Ghana. Nurs Open 2020;7:1822-32.
2. Solnes Miltenburg A, van der Eem L, Nyanza EC, van Pelt S, Ndaki P, Basinda N, *et al*. Antenatal care and opportunities for quality improvement of service provision in resource limited settings: A mixed methods study. PLoS One 2017;12:e0188279. doi: 10.1371/journal.pone. 0188279.
3. van der Wal R, Taleh M, Mulinda L. Antenatal Care: A success story? The (in) effectiveness of antenatal care in reducing maternal mortality and promoting maternal health in developing countries. The Prognosis. Vol. 5. Updated September 3, 2020. Available on https://mghjournal.com/2020/09/03/antenatal-care-a-success-story-the-ineffectiveness-of-antenatal-care-in-reducing-maternal-mortality-and-promoting-maternal-health-in-developing-countries/.
4. Lattof SR, Moran AC, Kidula N, Moller A, Jayathilaka CA, Diazi T, *et al*. Implementation of the new WHO antenatal care model for a positive pregnancy experience: A monitoring framework. BMJ Global Health 2020;5:e002605.
5. Anumba DO, Jayasooriya SM. Global Antenatal Care Coverage and Content. In: Anumba, D.O., Jayasooriya, S.M. (eds) Evidence Based Global Health Manual for Preterm Birth Risk Assessment.

Springer, Cham. 2022;1-5. https://doi.org/10.1007/978-3-031-04462-5_1.
6. Ebeigbe PN, Igberase GO. Reasons given by pregnant women for late initiation of antenatal care in the Niger Delta, Nigeria. Ghana Med J 2011;44:47-51.
7. National Population Commission (NPC) [Nigeria] and ICF. Nigeria Demographic and Health Survey 2018. Abuja, Nigeria, and Rockville, Maryland, USA: NPC and ICF. Available from: https://www.dhsprogram.com/pubs/pdf/FR359/FR359.pdf.
8. Gaoussou S, Attaher O, Swihart B, Traore M, Diarra S, Soumbounou IH, *et al*. Pregnancy outcomes in a malaria-exposed Malian cohort of women of child-bearing age. Front Med (Lausanne) 2022;9:1061538.
9. Hailu T, Kassa S, Abera B, Mulu W, Genanew A. Determinant factors of anaemia among pregnant women attending antenatal care clinic in Northwest Ethiopia. Trop Dis Travel Med Vaccines 2019;5:13.
10. Figueiredo AC, Gomes-Filho IS, Batista JE, Orrico GS, Porto EC, Cruz PR, *et al*. Maternal anemia and birth weight: A prospective cohort study. PLoS One 2019;14:e0212817. doi: 10.1371/journal.pone. 0212817.
11. Bolarinwa OA. Sample size estimation for health and social science researchers: The principles and considerations for different study designs. Niger Postgrad Med J 2020;27:67-75.
12. Dim CC, Onah HE. The prevalence of anemia among pregnant women at booking in Enugu, Southeastern Nigeria. MedGenMed 2007;9:11.
13. Onoh R, Lawani O, Ezeonu P, Nkwo P, Onoh T, Ajah L. Predictors of anemia in pregnancy among pregnant women accessing antenatal care in a poor resource setting in South-Eastern Nigeria. Sahel Med J 2015;18:182.
14. Olatunbosun OA, Abasiattai AM, Bassey EA, James RS, Ibanga G, Morgan A. Prevalence of anaemia among pregnant women at booking in the University of Uyo Teaching Hospital, Uyo, Nigeria. BioMed Res Int 2014;2014:849080.
15. Esike C, Anozie O, Onoh R, Sunday U, Nwokpor O, Umeora O. The prevalence of anemia in pregnancy at booking in Abakaliki, Nigeria. Trop J Obstet Gynaecol 2016;33:332–6.
16. Branco da Fonseca CR, Strufaldi MWL, de Carvalho LR. Adequacy of antenatal care and its relationship with low birth weight in Botucatu, São Paulo, Brazil: A case-control study. BMC Pregnancy Childbirth 2014;14:255.
17. Onwuhafua P, Ozed Williams I, Kolawole A, Adze J. The effect of frequency of antenatal visits on pregnancy outcome in Kaduna, Northern Nigeria. Trop J Obstet Gynaecol 2016;33:317.
18. Nwaneri AC, Ndubuisi I, Okoronkwo IL, Ezike O, Umebuani N. Determinants of late booking for antenatal care among pregnant women in selected hospitals in South-East Nigeria. Int J Nurs Midwifery 2018;10:74–80.
19. Nwagha UI, Ugwu OV, Nwagha TU, Anyaehi US. The influence of parity on the gestational age at booking among pregnant women in Enugu, South East Nigeria. Nig J Physiol Sci. 2008;23:67-70. https://doi.org/10.4314/njps.v23i1-2.54928.