# Predictors and Clinical Correlates of Gestational Age at Booking: A Multicenter Survey

## Ekpenyong, Christopher Edet[1*]

[1]*Department of Physiology, Faculty of Basic Medical Sciences, University of Uyo, Uyo, Nigeria.*

*Author's contribution*

*The sole author designed, analysed, interpreted and prepared the manuscript.*

*Original Research Article*

## ABSTRACT

**Background:** Although several factors are known to influence the gestational age at booking, current knowledge indicates that the distribution of these factors could vary from one country to the other, and even within countries, the variation could exist between states. This study aimed to assess the prevalence, predictors and clinical correlates of gestational age at booking in southern Nigeria.

**Materials and Methods:** One hundred and fifty pregnant women who visited the study centres within the study period were evaluated for socio-demographic, clinical and biochemical characteristics associated with early and late ANC initiation using standard instruments and procedures.

**Results:** Fifty-six per cent (56%) of the pregnant women initiated ANC within the first thirteen weeks of gestation according to the WHO recommendation. Fewer numbers of previous pregnancies and births were significantly associated with early ANC initiation. Being of older age, (OR=1.52, C.I=1.318-1.956), fewer number of previous pregnancies (OR=2.2. C.I=1.923-2.511), low parity (OR=2.05, C.I=1.884-2.264), public servant (OR=1.52, C.I=1.316-1.753), higher educational attainment (OR=2.21, C.I=1.043-3.498) significantly increased the likelihood of early ANC initiation. Also, pregnant women who booked early had a lower incidence of anaemia, hypertension and gestational diabetes and better biochemical endpoints.

_____

*\*Corresponding author: E-mail: chrisvon300@yahoo.com, chrisvon200@yahoo.com;*

**Conclusion:** Some demographic variables and fewer numbers of pregnancies and births were significantly associated with a higher likelihood of early ANC initiation and vice versa. These factors should be considered in designing interventions to improve gestational age at booking among pregnant women in Nigeria and globally.

## 1. INTRODUCTION

Early initiation of antenatal care (ANC) and adequate follow-up care are essential for better pregnancy outcomes. Consequently, the World Health Organization (WHO) and the United Kingdom's National Institute for Health and Clinical Excellence (NICE) recommended the initiation of ANC before the end of the first trimester of each pregnancy [1,2] and addition of at least 4 visits within each pregnancy.

Early initiation of ANC has several benefits including baseline examination, investigations, detection and management of pregnancy and non-pregnancy related disorders which may affect the progress and/or outcome of the pregnancy. For instance, early detection of anaemia in pregnancy provides adequate time for the use of corrective measures other than blood transfusion which could be associated with some complications.

Also, early detection of high-risk pregnancy (pregnancy-induced hypertension, gestational diabetes mellitus, multiple pregnancies, elderly primigravidae, and pregnancy co-existing with uterine pathology) consequents upon early initiation of ANC gives adequate time for the appropriate management protocols to be instituted.

Similarly, early detection of maternal diseases (viral, bacterial or protozoan) infections which can be transferred to the fetus during the pregnancy and childbirth or newborn will enable adequate preventive/precautionary measures to be adopted to prevent transmission.

There is also the benefit of instituting other ancillary care such as immunization, health education on family planning, improved personal hygiene, physical activity level during pregnancy, and other lifestyle-related habits (diets, adequate sleep, alcohol intake and smoking) which can adversely affect the outcome of the pregnancy.

Despite the aforementioned benefits, a growing number of multilevel studies have found that the majority of pregnant women, especially in developing countries, do not adhere to WHO recommendations. High proportions of pregnant women in developing countries are found to initiate their first ANC appointments late in pregnancy.

Several risk factors for late ANC initiation have been identified by previous investigators including socio-demographic factors such as age, socioeconomic status, race, ethnicity, education level, travel time, place of residence, place of birth, high parity, unwanted pregnancies and cultural factors [3,4].

The influence of these factors varies across nations, and even within nations and states variation still exists. In Uyo Metropolis, for instance, little has been done in terms of conducting studies to evaluate the socio-demographic factors and the clinical correlates of early and late ANC initiation in most of our primary health centres. Given the fact that care should be taken to avoid the selection/ targeting of unfounded factors in designing interventions to improve the gestational age at booking among our pregnant women to avoid waste of resources, and in view of the fact that the selection of factors should be based on empirical evidence that shows the effect size (odds ratios), the present study was conducted to determine the socio-demographic and clinical characteristics of pregnant women who initiated early or late ANC in some primary care centers in Uyo Metropolis, Nigeria.

## 2. SUBJECTS AND METHODS

This multicenter cross-sectional survey was conducted in three primary health care centres in Uyo Metropolist, Akwa Ibom State, Nigeria, between January 2018 and February 2019. All pregnant women aged 18 years and above attending ANC within this period at the selected centres and met the inclusion criteria were included in the survey.

Exclusion criteria included decline participation, inappropriate completion of the questionnaire,

mental impairment, forgotten last menstrual period (LMP) and without ultrasound evidence of LMP. Participation was free and voluntary and participants were free to withdraw from the study at any time during the survey.

Written informed consent was obtained from all participants and study protocols were approved by the Institutional Research Ethics Committee and the study was conducted according to the guidelines laid down in the declaration of Helsinki of 1975, as revised in 2000 for the conduct of the human experiment.

## 2.1 Survey Methods

Two survey instruments were used to assess the timing for ANC initiation and clinical characteristics of 150 participants selected by cluster sampling technique. These included a semi-structured questionnaire adapted from previous studies [5] on timing for ANC initiation. The questionnaire consisted of two sections. The first section contained open-ended questions exploring socio-demographic variables of the participants including age, race, occupation, educational attainment and area of residence. The second section contained questions about participants past and present obstetric history including history of last childbirth such as where, when and how the last child was delivered, last childbirth weight, pregnancy spacing, parity, number of pregnancies and timing of the present pregnancy ANC booking.

## 2.2 Assessment of Clinical Indices

Clinical indices measured were weight (kg), height ($m^2$), blood pressure (BP) at booking, hemoglobin concentration (Hb conc.) (g/dl), blood sugar (mg/dL), screening for HIV, malaria, hepatitis B & C infections, blood group and rhesus factor determination using standard methods. Presence of leg swelling, abdominal pain and excessive nausea and vomiting were also noted.

Gestational hypertension was defined as systolic BP >140 mmHg and diastolic BP >90 mmHg, and classified as follows: Mild: systolic BP = 140-149 and Diastolic BP 90-99 mmHg, Moderate: systolic BP = 150-159mmHg and Diastolic BP = 100-109 mmHg and Severe: systolic BP = ≥160 mmHg Diastolic BP = ≥110 mmHg [6]. Anaemia in pregnancy at booking was diagnosed if Hb conc. was <11g/dl. However, anaemia in pregnancy among participants was classified as

follows: mild if Hb conc. was 9.0-10.9 g/dl, moderate if Hb conc. was 7.0-8.9 g/dl and severe if Hb conc. was <7 g/dl [7,8]. Gestational diabetes mellitus was diagnosed using 2013 WHO criteria of fasting blood sugar (FBS) equal to or greater than 5.1 mmol/L a nd /or equal to or greater than 8.5 mmol/L for 2-h postprandial plasma glucose level [9].

## 2.3 Statistical Analysis

Data were analyzed using frequencies, percentages, chi-square test and multiple logistic regressions. Associations between categorical variables were examined using chi-square at 5% level of significance, while multiple logistic regressions were used to determine the association between demographic, clinical and obstetric variables and gestational age at booking. Hence, odds ratios and corresponding 95% confidence interval were estimated. Data analysis was obtained using the Statistical Package for Social Sciences (SPSS version 20.0).

## 3. RESULTS

This study comprised of 150 participants classified as early initiators of ANC (n=84) and late initiators of ANC (n=66). The socio-demographic variables that showed significant differences between the two groups were: age (P=0.010) and occupation (P=0.001) (Table1).

Pregnant women who booked early had a lower incidence of anaemia, hypertension and gestational diabetes (Table2).

Table 3 shows that fewer number of pregnancies (gravida) (P=0.001) and low parity (P=0.001) were significantly associated with early ANC registration and vice versa. Also, planned pregnancy was significantly (P=0.010) associated with early ANC registration, while unplanned pregnancy was significantly associated with late ANC initiation.

Results of multiple logistic regression revealed that older age, (31-36yrs) (OR=1.52, C.I=1.318-1.956, P=0.000), civil servant (OR=1.52, C.I=1.316-1.753, P=0.000), teacher (OR=1.67, C.I=1.043-2.398, P=0.012), and higher educational attainment including B.Sc/HND (OR=2.21, C.I=1.043-3.498, P=0.011) and M.Sc (OR=1.84, C.I=1.826-6.327, P=0.000) were significantly associated with higher odds of early ANC initiation (Table 4).

**Table 1. Sociodemographic characteristics of study participants**

| Demographic Characteristics | Early Booking (n= 84) | Late Booking (n= 66) | $X^2$ | P-value |
|---|---|---|---|---|
| **Age (Years)** | | | | |
| 18-25 | 15 (17.9) | 23 (34.8) | | |
| 26-30 | 22 (26.2) | 18 (27.2) | 11.37 | 0.010[*] |
| 31-36 | 38 (45.2) | 38 (45.2) | | |
| 37-40 | 09 (10.7) | 09 (10.7) | | |
| **Race** | | | | |
| Oron | 12 (14.3) | 08 (12.1) | | |
| Ibibio | 45(53.6) | 35 (53.0) | 3.99 | 0.263 |
| Annang | 27 (32.1) | 20 (30.3) | | |
| Yoruba | 0 (0.0) | 03 (4.5) | | |
| **Occupation** | | | | |
| Civil servant | 24 (27.3) | 10 (15.2) | | |
| Legal practitioner | 10 (11.4) | 28 (42.4) | | |
| Teaching | 23 (26.1) | 15 (22.7) | | |
| Student | 04 (4.5) | 03 (4.5) | 23.20 | 0.001[**] |
| Trading | 05 (5.7) | 01 (1.5) | | |
| Housewife | 14 (15.9) | 08 (12.1) | | |
| Corp member | 08 (9.1) | 01 (1.5) | | |
| **Education** | | | | |
| Senior Sec. School | 9 (10.7) | 6 (24.2) | | |
| National Certificate of Education | 15 (17.9) | 18 (27.3) | | |
| Ordinary National Diploma | 29 (34.5) | 14 (21.2) | 9.32 | 0.054 |
| Bachelor of Science | 25 (29.8) | 13 (19.7) | | |
| Masters of Science | 06 (7.1) | 05 (7.6) | | |
| **Area of residence** | | | | |
| Urban | 56 (66.7) | 38 (59.4) | 0.459 | 0.459 |
| Rural | 28 (33.3) | 26 (40.6) | | |

*\*Significant at 1% (P<0.01); \*\*Significant at 5% (P<0.05)*

**Table 2. Clinical variables of study participants**

| Clinical Variables | Early booking (n=84) | Late booking (n=66) | $X^2$ | P-value |
|---|---|---|---|---|
| **Blood pressure (mmHg)** | | | | |
| Normal | 82(97.6) | 62(93.9) | 7.298 | 0.063 |
| Hypertensive | 2(2.4) | 4(6.1) | | |
| **Pulse (beats/minute)** | | | | |
| 60-80 | 63 (75.0) | 48 (72.7) | | |
| 81-101 | 19 (22.6) | 6 (9.1) | 35.45 | 0.001[**] |
| 102-122 | 2 (2.4) | 12 (18.2) | | |
| **Hemoglobin Concentration(g/dl)** | | | | |
| Severe anemia | 2 (2.4) | 6 (9.1) | | |
| Moderate anemia | 26 (31.0) | 48 (72.7) | 35.45 | 0.0000[**] |
| Mild anemia | 49 (58.3) | 10 (15.2) | | |
| Normal | 07 (8.3) | 02 (3.0) | | |
| **Fasting blood sugar (g/dL)** | | | | |
| Normal | 81 (96.4) | 58 (87.9) | 2.82 | 0.093 |
| Diabetic | 03 (3.6) | 08 (12.1) | | |

*\*\*Significant at 5% (P<0.05)*

**Table 3. Obstetrics history of study participants**

| Obstetric History | Early booking (n=84) | Late booking (n=66) | $X^2$ | P-value |
|---|---|---|---|---|
| **Gravidarity** | | | | |
| 1 | 22 (26.2) | 19 (28.8) | | |
| 2 | 37 (44.0) | 10 (15.2) | | |
| 3 | 19 (22.6) | 22 (33.3) | 17.97 | 0.001[**] |
| 4 | 02 (2.4) | 06 (9.1) | | |
| > 4 | 04 (4.8) | 09 (13.6) | | |
| **Parity** | | | | |
| 1 | 32 (38.1) | 26 (39.4) | | |
| 2 | 34 (40.5) | 08 (12.1) | | |
| 3 | 12 (14.3) | 18 (27.3) | 19.37 | 0.001[**] |
| 4 | 02 (2.4) | 06 (9.1) | | |
| > 4 | 04 (4.8) | 08 (12.1) | | |
| **Last child birth** | | | | |
| 1-2 years | 55 (65.5) | 49 (74.2) | | |
| 3-4 years | 19 (22. 6) | 06 (9.1) | 4.94 | 0.084 |
| > 4 years | 10 (11.9) | 11 (16.7) | | |
| **Where the last child was delivered** | | | | |
| Hospital | 60 (71.4) | 48 (72.7) | | |
| Traditional Birth Attendance | 19 (22.6) | 15 (22.7) | 0.146 | 0.930 |
| Church | 05 (6.9) | 03 (4.5) | | |
| **Mode of delivery of the last child** | | | | |
| Normal  Delivery | 77 (91.7) | 57 (86.4) | | |
| Operative Delivery | 05 (6.0) | 07 (10.6) | 1.175 | 0.556 |
| Assisted | 02 (2.4) | 02 (3.0) | | |
| **Timing of present pregnancy** | | | | |
| Planned | 70 (83.3) | 42 (63.6) | 6.575 | 0.010[*] |
| Unplanned | 14 (16.7) | 24 (36.4) | | |
| **Last child birth weight** | | | | |
| 2-3.5 | 50 (59.5) | 39 (59.1) | | |
| > 3.5 | 10 (11.9) | 09 (13.6) | 0.111 | 0.946 |
| Unknown | 24 (28.6) | 18 (27.3) | | |

*** Significant at 1% (P<0.01); * Significant at 5% (P<0.05)*

Results also revealed that early ANC registration was significantly associated with a higher likelihood of having normal BP, blood sugar level and Hb conc. compared to late initiators (Table5).

Table 6 shows that fewer number of pregnancies (1&2) were significantly associated with the higher likelihood (OR=1.94, P=0.000) and (OR=2.20, P=0.000) respectively of early ANC initiation.    Likewise, the fewer number of surviving children (parity) (1&2) were significantly associated with the higher likelihood (OR=2.09, P=0.000) and (OR=2.05, P=0.005) respectively of early ANC registration.

## 4. DISCUSSION

Findings of the present survey showed that about 56% of respondents had ANC booking for the current pregnancy within the first trimester of the pregnancy. It could be said that majority of the respondents met the WHO recommendation for early initiation of ANC within the first 13 weeks of each pregnancy [10]. This value is in line with the proportion of early ANC initiation in a study conducted in Addis Ababa Ethiopia where 58% were found to have initiated ANC within the first 12 weeks of gestation [11]. However, discrepant proportions have been reported in other studies conducted in Nigeria and other geographic regions. Some studies reported lower values than the present one including studies by Belayneh et al., [12] (47.4%), Gebreamlak et al., [13] (41%), Abuka et al. [14] (35.4%) and Gudayu et al.[15].

A study in Abakaliki Ebonyi State, Nigeria, conducted by Onoh et al., [16] found that only 16.9% of the pregnant women who participated

in the study booked for ANC within the first 13weeks of gestation as recommended by the WHO. Ifenne and Utoo [17] conducted a similar study in a tertiary health facility in north-central Nigeria and found that the average gestational age at booking was 19.1 ± 7.8.

Furthermore, a cross-sectional study of women attending the booking clinic in the University of Uyo Teaching Hospital, Akwa Ibom State, southern Nigeria, over 3 months showed that about 27.6% of respondents booked within the first 13 weeks of gestation [18].

Studies in other developing countries followed a similar pattern. For instance, in Ethiopia, a Mini-Ethiopia demographic and health survey 2014 found that only 17% of pregnant women who participated in that survey initiated ANC on time [19]. In South-Eastern Tanzania, Gross et al., [20] reported the prevalence of 29% and in

Kampala Uganda, 27.9% was reported by Kisuule et al., [21].

In contradistinction, studies in other geographic regions especially those conducted in developed countries showed that higher proportions of pregnant women initiated ANC within the first trimester of gestation as recommended by WHO than the present study value. For instance, in Nepal, Paudel et al., [22] found that 70% of the pregnant women who participated in their study had their ANC booked within the WHO recommended period. A similar study in England found that 86% of the pregnant women who participated in the study initiated ANC by 12 completed weeks of gestation [23]. These findings support the notion that timing of ANC initiation varies across different geographic regions, countries and even within states, variations still exist due to the influence of several confounding factors such as differences

**Table 4. Multiple logistic regression analysis showing the association between demographic variables and early ANC Booking**

| Demographic Characteristics | OR | 95% C.I | P-value |
|---|---|---|---|
| **Age (years)** | | | |
| 18-25 | 1.00 | Reference group | |
| 26-30 | 1.02 | 0.913-1.099 | 0.973 |
| 31-36 | 1.52 | 1.318-1.756 | 0.000 |
| 37-40 | 1.18 | 0.949-1.572 | 0.063 |
| **Race** | | | |
| Oron | 1.00 | References | |
| Ibibio | 0.79 | 0.507-1.215 | 0.277 |
| Annang | 1.10 | 0.873-1.377 | 0.429 |
| Yoruba | 1.25 | 0.988-1.574 | 0.065 |
| **Occupation** | | | |
| Civil servants | 1.52 | 1.316-1.753 | 0.0000 |
| Legal practitioners | 1.22 | 0.482-3.086 | 0.657 |
| Teaching | 1.67 | 1.043-2.398 | 0.012 |
| Student | 1.41 | 0.464-4.272 | 0.546 |
| Trading | 0.94 | 0.389-2.267 | 0.889 |
| Housewife | 0.57 | 0.298-1.088 | 0.88 |
| Corp member | 1.00 | Reference | |
| **Education** | | | |
| SSCE | 1.00 | Reference | |
| NCE | 0.95 | 0.867-1.047 | 0.311 |
| OND | 1.04 | 0.936-1.161 | 0.446 |
| BS.C/HND | 2.21 | 1.043-3.498 | 0.011 |
| M.Sc | 1.84 | 1.826-6.327 | 0.000 |
| **Area of Residence** | | | |
| Urban | 1.00 | | |
| Rural | 0.89 | 0.830-1.953 | 0.876 |

*\* Significant at 1% (P<0.01); \*\* Significant at 5% (P<0.05)*

in cultures, ethnicity, race, educational attainment, place of residence and conditions surrounding the current pregnancy.

The higher proportion of pregnant women who initiated ANC within WHO-recommended period in our study centres compared to the proportions in other centres in Nigeria and other developing countries could be attributed to the effect of the above-mentioned factors.

Majority of the study participants who met the WHO recommended period for early ANC initiation were civil servants, had higher educational attainment and resided in urban areas. These demographic attributes suggest they were of a high socio-economic class which is associated with higher odds for early initiation of ANC in previous studies, probably due to better knowledge, awareness, accessibility, and affordability of care [24,25].

Early initiation of ANC was also associated with having a better clinical profile including normal BP, Hb conc. and plasma glucose level. These findings are consistent with previous studies that showed that early initiation of ANC was associated with a reduction in risk of pregnancy-associated problems including anaemia, pregnancy-induced hypertension, gestational diabetes mellitus and sexually transmitted diseases [8,1]. Past obstetric experiences including fewer numbers of previous pregnancies and deliveries were associated with higher odds for early/timely initiation of ANC among our study participants as previously observed by Michell et al.,[26]. This could be because most pregnant women in the present study were young and educated and probably might have been more enlightened and aware of the advantages of early ANC initiation.

This assertion is strengthened by results of previous studies that showed that older women and those with high parity and many previous pregnancies failed to initiate their ANC as recommended by WHO probably because of their self-confidence and acclaimed experiences and leading to the assumption that early ANC initiation was unnecessary waste of time and resources [27,26]. The proportion of early ANC booking was significantly higher among participants with planned pregnancy than an unplanned pregnancy, a finding that is consistent with results of studies by other investigators and is probably because planned pregnancy is more valued and cared for than unplanned pregnancy [28,24,29].

Few limitations worth noting in the interpretation of results of the present study, especially those related to the study design (Cluster sampling technique), including the sample size and population specificity. Also, self-reported information could suffer from over-and underestimation. However, the method is more economical, reduces variability, more feasible approach within a single community, multiple communities, or multiple demographics.

**Table 5. Multiple logistic regression analysis showing the association between clinical variables and early gestational age at booking**

| Clinical variables | OR | 95% C.I | P-value |
|---|---|---|---|
| **Blood pressure (mmHg)** | | | |
| Normal | 2.103 | 1.012-2.203 | 0.026 |
| Hypertensive | 1.00 | Reference | |
| **Pulse rate (beats/minute)** | | | |
| 60-80 | 1.67 | 1.371-2.023 | 0.000** |
| 81-101 | 1.20 | 1.054-1.373 | 0.006** |
| 102-122 | 1.00 | Reference | |
| **Hemoglobin (g/dl)** | | | |
| Severe anemia | 1.00 | Reference | |
| Moderate anemia | 1.07 | 0.941-1.210 | 0.310 |
| Mild anemia | 2.81 | 1.377-4.885 | 0.000 |
| Normal | 1.03 | 0.777-1.306 | 0.982 |
| **Fasting blood sugar (g/dl)** | | | |
| Normal | 1.00 | Reference | |
| Diabetic | 0.957 | 0.843-1.086 | 0.494 |

*** Significant at 5% (P<0.05)*

**Table 6. Multiple logistic regression analysis showing the association between obstetric history and early gestational age at booking**

| Obstetric history | OR | 95% C.I | P-value |
|---|---|---|---|
| **Gravidarity** | | | |
| 1 | 1.94 | 1.535-2.476 | 0.000 |
| 2 | 2.20 | 1.923-2.511 | 0.000 |
| 3 | 0.85 | 0.763-1.940 | 0.772 |
| 4 | 1.06 | 0.885-1.266 | 0.536 |
| > 4 | 1.00 | Reference | |
| **Parity** | | | |
| 1 | 2.09 | 1.648-2.650 | 0.000 |
| 2 | 2.05 | 1.884-2.264 | 0.005 |
| 3 | 0.902 | 0.584-1.394 | 0.643 |
| 4 | 0.86 | 0.716-1.036 | 0.114 |
| > 4 | 1.00 | References | |
| **Last child birth** | | | |
| 1-2 years | 1.00 | Reference | |
| 3-4 years | 0.89 | 0.576-1.371 | 0.887 |
| > 4 | 1.05 | 0.877-1.250 | 0.662 |
| **Where the last child was delivered** | | | |
| Hospital | 1.00 | Reference | |
| Traditional Birth Attendance | 0.48 | 0.190-1.229 | 0.895 |
| Church | 0.89 | 0.711-1.125 | 0.447 |
| **Method of delivery of the last Child** | | | |
| Normal delivery | 1.00 | Reference | |
| Operative delivery | 0.99 | 0.689-1.437 | 0.979 |
| Assisted | 0.95 | 0.188-1.288 | 0.609 |
| **Timing of present pregnancy** | | | |
| Planned | 1.00 | Reference | |
| Unplanned | 0.36 | 0.143-0.906 | 0.030 |
| **Last child birth weight** | | | |
| 2-3.5 | 1.00 | Reference | |
| > 3.5 | 0.82 | 0.681-1.695 | 0.340 |
| Unknown | 1.05 | 0.878-1.251 | 0.603 |

## 5. CONCLUSION

Some demographic attributes, present/past obstetrics experiences were significantly associated with higher odds for early timely ANC booking among the present study participants. These factors should be considered in designing intervention programs to improve gestational age at booking among pregnant women in Nigeria and elsewhere.

## CONSENT AND ETHICAL APPROVAL

Written informed consent was obtained from all participants and study protocols were approved by the Institutional Research Ethics Committee and the study was conducted according to the guidelines laid down in the declaration of Helsinki of 1975, as revised in 2000 for the conduct of the human experiment.

## COMPETING INTERESTS

The author has declared that no competing interests exist.

## REFERENCES

1. Ejeta E, Babsu R, Zewdie O, Merdassa E. Factors determining late antenatal care booking and the content of care among pregnant mother attending antenatal care services in East Wollega administrative zone, West Ethiopia. Afr. Med. J. 2017;27: 184.
DOI:10.11604/pamj.2017.27.184.10926
2. Alemu Y, Aragaw A. Early initiation of first antenatal acre visit and associated factor among mothers who gave birth in the last six months preceding birth in Bahir Dar Zuria Woreda North West Ethiopia. Rep. Health. 2018;15:203.

Available:https://doi.org/10.1186/s12978-018-0646-9

3. Adekunle DA, Isawami AI. Late antenatal care booking and its predictors among women in South Western Nigeria. Online J. Health Allied Sci. 2008;7:4.

4. Ndidi EP, Oseremem IG, Reasons given by women for late initiation of antenatal care in the Niger Delta, Nigeria. Ghana Med. J. 2010;44:47-51.
PMID. 23393530.

5. Ejeta E, Dabsu R, Zewdie O, Merdassa E. Factors determining late antenatal care booking and the content of care among pregnant mothers attending antenatal care services in East Wollege administrative Zone, West Ethiopia. Pan Afri. Med. J. 2017;27:180.
DIO:10.11604/pamj/2017:27:184.10926

6. Visintin C, Mugglestone MA, Almerie MQ, Nherera LM, James D, Walkinshaw S. Management of hypertensive disorders during pregnancy: summary of NICE guidance. B.M.J. 2010;341:c2207.

7. Stephen G, Mgongo Melina, Hashim TH, Katanga J, Pederson BS. Msuya SE. Anemia in pregnancy: prevalence, risk factors, and adverse prinatal outcomes in northern outcomes in northern Tanzania, Anemia; 2018.
Available:https://doi.org/10.1155/2018/1846280

8. World Health Organization. Iron deficiency anemia: Assessment, prevention and control: A guide for program manager; 2001.

9. World Health Organization. Diagnostic criteria and classification of hyperglycemia first detected in pregnancy: a world health organization guideline. Diabetes Res. Clin. Pract. 2014;103:341.

10. World Health Organization (WHO). In: M.A.R Health editor. Maternal Mortality, Global Health Observation Data; 2016.

11. Gulema H, Berhane Y. Timing of first antenatal care visit and its associated factors among pregnant women attending public health facilities in Addis Ababa, Ethiopia. Ethiop. J. Health Sci. 2017; 27(2):139-146.

12. Belayneh T, Adefris M, Andargie G. Previous early antenatal service utilization improves timely booking: a cross-sectional study at the University of Gondar Hospital, north West. Ethiop. J. Preg; 2014.

13. Gebresilassie, Tilahun B, Weyzer T, Betell B, Senait G. Timing of first focused antenatal care booking and associated factors among pregnant mothers who attend antenatal care in central zone, Tigray, Ethiopia. B.M.C Res. Notes. 2017; 10(1):608.

14. Abuka T, Alemu A, Birhanu B. Assessment of timing of first antenatal care booking and associated factors among pregnant women who attend antenatal Care at Health Facilities in Dilla town, Gedeo zone, southern nations, nationalities and peoples region, Ethiopia, 2014. J. Preg. Child Health. 2016;3(258):2.

15. Gudayu TW, Woldeyohannes SM, Abdo AA. Timing and factors associated with first antenatal care booking among pregnant mothers in Gondar Town; North West Ethiopia. B.M.C Pregnancy Childbirth 2014;14:287-94.

16. Onoh RC, Umeora O, Agwu UM, Ezeqwui HU, Ezeonu PO, Onyebuchi AK. Pattern and determinants of antenatal booking at Abakaliki Southern Nigeria. Ann. Med. Health Sci. Res. 2012;2:169-175.

17. Ifenne DI, Utoo BT, Gestational age at booking for antenatal care in a tertiary health facility in north Nigeria. Nig. Med. J. 2012;53(4):236-239.

18. Utuk NM, Ekanem A, Abasiattai AM. Timing and reasons for antenatal care booking among women in a tertiary health care center in southern Nigeria. Int. J. Resprod. Contracept. Obstet. Gynecol. 2017;6(9):3731-3736.

19. Central Statistical Authority (Ethiopia), ICF international. Mini-Ethiopia Demographic and Health Survey, 2014. Addis Ababa: Ethiopia and Calverton; Central Statistical Authority (Ethiopia) and ICF Inter. 2014; 37–42.

20. Gross K, Alba S, Glass TR, Schellenberg JA, Obrist B. Timing of antenatal care for adolescent and adult pregnant women in south eastern Tanzania. BMC Pregnancy Childbirth. 2012;12:16.
Available:http://www.biomedcentral.com/1471-2393/12/16/prepub

21. Ivan K, Dan KK, Florence N, Stephen KS, Anita A, Gloria N et al. Timing and reasons for coming late for the first antenatal care visit by pregnant women at Mulago hospital, Kampala Uganda. BMC Pregnancy Childbirth. 2013;13:121.
Available:https://doi.org/10.1186/1471-2393-13-121

22. Paudel YR, Jha T, Mehata S. Timing of first antenatal care (ANC) and inequalities in early initiation of ANC in Nepal. Front Pub. Health. 2017;5:242.

23. Redshaw M, Heikkila K. Delivered with care: A national survey of women's experience of maternity care. National Prenatal Epidemiology Unity. Oxford; 2010.

24. Gebremeskel F, Dibaba Y, Admassu B. Timing of first antenatal care attendance and associated factors among pregnant women in Arba Minch Town and Arba Minch District, Gamo Gofa Zone, South Ethiopia. J. Environ. Public Health. 2015; 971506.

25. Bbaale E. Factors influencing timing and frequency of antenatal care in Uganda. Australian Med. J. 2011;4(8):431-8.

26. Michell JK, Osterman MHS, Joyce AM. Timing and adequacy of prenatal care in the Unites States. National Vital Statistics. Report 6. 2018; 7:3.
Available:https://www.cdc.gov/nchs/data/nvsr/nvsr67nvsr67_0.3.pdf

27. Chama-Chiliba CM, Koch SF. Utilization of focused antenatal care in Zambia: examining individual and community-level factors using a multi-level analysis. Health Policy and Plan. 2015;30:78-87.

28. Isaac B, Charles M, Alice H. Factors associated with late antenatal care attendance in selected rural and urban communities of the copperbelt province of Zambia. Med. J. Zambia. 2012;39(3).

29. Gebrekkidan K, Worku A. Factors associated with late ANC initiation among pregnant women in select public health centers of AddisAbaba, Ethiopia: unmatched case-control study design. Pragmatic and observational research. 2017;8:223-230.

___