Predictors of Delivery at the Expected Date of Confinement among Women in Yenagoa, Southern Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Author IEH designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Author AA collected the data, managed the analyses and literature searches. Both authors read and approved the final manuscript.

Article Information

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ABSTRACT

Background: The expected date of confinement is calculated using Naegle's rule that is 280 days or 40 weeks of gestation, but it is observed that most women tend to deliver between 38 and 42 weeks. Unfortunately, only a few women deliver exactly on the expected date of confinement, the reason remains mostly unknown.
Objective: The objective of this study is to determine the percentage of women in Yenagoa that can deliver on their expected date of confinement, using the Niger Delta University Teaching Hospital as a case study. It would also determine whether maternal age, parity, tribe, body mass index, birth weight and fetal sex have a significant influence on the date of delivery.
Materials and Methods: A retrospective observational study of 3,420 pregnant women who were admitted in labour, and delivered at term in the delivery suite of the department of obstetrics and

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gynaecology, Niger Delta University Teaching Hospital, in Southern Nigeria. The study was carried out from 1st January 2009 to 31st December 2012. A total of 2380 booked parturients living in Yenagoa, whose last regular menstrual period was documented in their case notes, including those who had an early first-trimester ultrasound scan, were selected. Data concerning their expected dates of confinement and the actual dates of delivery were retrieved. Also retrieved were maternal age, parity, tribe, birth weight, and fetal sex. Others include maternal height and weight at booking; these were used to calculate the body mass index. The data was analyzed after that.

Results: Majority of the women in Yenagoa 85.0% delivered at term, and only a handful 7.4% delivered on the expected date of confinement. Delivery on this date was associated with low body mass index, (BMI of 18.5 kg/m^2) and male babies p = 0.006. Nulliparous women were twice more likely to deliver on the EDC than multiparas, Odds Ratio = 2.44, P = 0.002, and women with average maternal age of 25-29 years were 4 times more likely to deliver on the EDC than women ≥ 35 years, Odds Ratio = 4.93, p =0.0003. Women from Yoruba living in Yenagoa delivered more on the EDC than any other tribe in Nigeria.

Conclusion: From our study, biological variables of the would-be mother and ethnicity stand out as some of the best predictors of delivery on the date of confinement among women living in Yenagoa, Southern Nigeria.

1. INTRODUCTION

One of the first things Obstetricians strive to do on the first contact with antenatal subjects is the establishment of the gestational age (GA) and the expected date of confinement (EDC). While the gestational age is indispensable when taking significant management decisions and interventions, the EDC is essential for the timing of delivery [1].

The age-long traditional method of estimating EDC and GA is the application of Naegle's rule. It assumes that the mean duration of pregnancy is 280 days or 40 weeks from the first day of the last Normal menstrual period (LNMP) [2]. However, it is widely believed that the actual duration of pregnancy is 266 days beginning from the day of ovulation or following an in-vitro fertilisation and embryo transfer [2,3].

For Naegle's rule to be applied appropriately, the menstrual cycle must be regular, with a cycle length of 28 days. Therefore, if a woman's cycle is not exactly 28 days, an adjustment has to be made by adding or subtracting the extra days [3, 4]. However, in circumstances where the woman does not remember her last menstrual period either because she does not keep a menstrual diary or the pregnancy was unplanned, an alternative method of predicting the estimated date of confinement would be an advantage [5].

Various publications have reported that the use of early pregnancy ultrasound scan to determine the EDC and GA is more accurate than Naegle's rule [6,7]. In a study done in Sri Lanka, it was observed that the use of ultrasound scan to estimate the EDC was more in agreement with delivery on the actual date of EDC than that estimated by LMP using Naegle's rule [8]. The author recommended that ultrasound scan should be used as the first line tool to determine EDC.

It is common knowledge by Clinicians worldwide that most women do not deliver on the date of confinement (EDC), yet studies on this subject matter are scanty, and the rate is mostly unknown globally. However, findings from a previous study revealed that only 4.3% of parturients were delivered on their date exact date of EDC [5]. In another study done to validate the accuracy of ultrasound scan in determining EDC, it was discovered that early ultrasound scan could predict accurately 4.5% of the women who would deliver on the exact date of confinement, but using LMP by Naegle's rule, the rate was only 3.9%. However, when delivery within 7 days from the date of confinement (EDC) was considered, the rate increased to 55.2% for Ultrasound assessment and 49.5% by Naegle's rule [1]. Ultrasound scan was therefore recommended as a better and more accurate tool for EDC estimation.

Several factors have been reported in various studies to influence the duration of pregnancy, and the EDC significantly [9]. Studies done in Sweden revealed that women who were older than 35 years tend to give birth 2 days earlier than the calculated EDC. The study also revealed that women with high parity have shorter gestation than primigravidas and that

boys are delivered earlier than girls [10]. In another but similar study, it was observed that mothers with longer gestations were older (P = 0.02), had longer pregnancies in other births (P < 0.0001) and were overweight (P = 0.01) [9].

In a study done in Brigham and Women's Hospital, USA, the most important variables that determine the length of human gestation were reported as maternal age, parity and race. The author reported that multiparous women, women <19 or > 34 years, and black women had shorter gestation length than primiparous women, women aged 19 to 34 years, and whites [11].

It is undeniable from the evidence emanating from the above studies that the reason why most women don't deliver on the date of their EDC resulted from biological and environmental variations. These factors significantly alter the length of gestation, and therefore probably determine why some women deliver preterm, some at term or on the date of EDC, while others deliver postdate. This study intends to critically evaluate the proportion of parturients in Yenagoa who deliver on their date of EDC, and the probable factors influencing it.

1.1 Objective

The objective of this study is to determine the percentage of women in Yenagoa that deliver on their expected date of confinement, using the Niger Delta University Teaching Hospital (NDUTH) as a case study. It would also determine whether maternal age, parity, tribe, body mass index (BMI), birth weight and fetal sex have a significant influence on the date of delivery.

2. METHODOLOGY

2.1 Study Site

The study was carried out in the labour ward, and labour ward theatre, department of obstetrics and gynaecology, Niger Delta University Teaching Hospital, Southern Nigeria. This hospital is located in Yenagoa, the capital of Bayelsa State. It is the apex hospital in the state, and it serves as a referral center for all other health institutions in the state and it environs.

2.2 Study Design

A retrospective observational study of 3,420 pregnant women who were admitted in labour,

and delivered at term in the Department of Obstetrics and Gynaecology, from 1st January 2009 to 31st December 2012. Out of these, a total of 2380 booked parturients who's LNMP were documented in their case notes, including those who had early first-trimester ultrasound scan were selected.

2.3 Inclusion Criteria

Those included in this study were parturients was had antenatal care and delivered at the Niger Delta University Teaching Hospital. Also involved were women who booked elsewhere in Yenagoa, but were referred to NDUTH for delivery.

2.4 Exclusion Criteria

Excluded from this study were women who were unsure of the date of their NLMP, especially where an early pregnancy ultrasound scan was not done. Women who had antenatal complications, and were delivered by elective caesarean section were excluded. Also excluded were: un-booked patients, women who had induction of labour and women who's EDC were wrongly calculated.

2.5 Calculation of Expected Date of Confinement

The case notes of all the women admitted to labour were retrieved, and their expected dates of confinement were recalculated using the Naegle's rule, to ensure accuracy. The Naegle's rule assumes that the mean duration of pregnancy is 280 days or 40 weeks from the first day of the last menstrual period. This is equivalent to 9 calendar months plus 7 days from the first day of the LMP. The EDC was therefore calculated by counting back 3 months and adding 7 days to the first day of the last menstrual period. Since Naegle's rule assumes a regular menstrual cycle of 28 days, the usual practice in NDUTH is to compensate those whose cycles were above or below 28 days, by adding or subtracting the extra days. When the records indicate that a parturient was unsure of her date of LMP, early pregnancy ultrasound scan was relied upon if available.

2.6 Data Collection

A total of 3,420 women were delivered during the period of study. The case notes of these women were retrieved from the hospital medical records department and scrutinised. A total of 2380

women who fulfilled the inclusion criteria were included for this study. Relevant information concerning their maternal age, parity, educational level, tribe, occupation, gestational age at delivery, and gestational age at booking were extracted and analysed. Other variables include maternal weight and height at booking, birth weight and fetal sex. Body mass index was calculated by using the conventional formula: maternal weight in kilograms divided by height in meter square. The NDUTH ethical committee granted an approval for this study.

2.7 Data Analysis

Data collected from each subject was entered into SPSS statistical software version 20 spreadsheet, and EPI info version 7. Data were analysed and presented as mean with standard deviation, rates, and proportions in tables. Test of significance was presented as Odds ratio at 95% confidence interval, and differences were deemed to be statistically significant at P < 0.05.

3. RESULTS

A significant proportion of the women in this study 1038(43.6%) were of average maternal age (25 – 29 years), and only a handful 2.7% were teenagers. Most of the women 616(25.9%) were primiparas, and women from Ijaw ethnic tribe where NDUTH is located were predominant in 1442(60.7%). Only a few women came from the two most predominant tribes in Nigeria, namely Hausa/Fulani and Yoruba, accounting for just 2.8% and 2.1% respectively. Most of the women 1140(47.9%) attained only secondary education, and the unemployment rate was high 873(36.7%).

It was observed from this study that only a handful of the women 267(11.2%) booked early at ≤ 12 weeks gestation. With respect to gestational age at delivery, a total of 2023(85.0%) delivered at term from 37 to 42 weeks. Further analysis revealed that 1071(45%) delivered between 37 and 39 weeks, and only 176(7.4%) of the women delivered on their expected date of confinement at exactly 40 weeks. Thirteen percent had preterm delivery, and 2.0% delivered after 42 week.

Majority of the women in this study 116(6.8%) who delivered exactly on the EDC were aged 25-29 years. They significantly delivered more on the EDC than women aged 20-24 years., OR =

0.38 [0.22, 0.65], p = 0.002, Also, women aged 25 – 29 years were 4 times more likely to deliver on the EDC than women with advanced maternal age (≥ 35years). OR = 4.93 [2.37, 10.25], p = 0.0003.

Low parity seems to have a significant influence on delivery on the EDC. Most of the women 48(2.8%) who delivered on the EDC were nulliparous. They were 2 times more likely to deliver on the EDC than multiparous women (Para 3 and 4). OR= 2.44 [1.35, 4.42], p = 0.002 respectively. It was observed that as the parity exceeds 4, the influence tends to wane; there was no significant difference between nulliparous women and grand multiparous women, p = 0.14, and all the women who were Para 6 and above did not deliver on their date of EDC.

Table 1. Bio-Data of the pregnant women

Bio-Data	Number (n=2380)	Percentage
Age		
≤19 yrs	64	2.7
20-24yrs	343	14.4
25-29yrs	1038	43.6
30-34 yrs	628	26.4
≥ 35yrs	307	12.9
Party		
0	459	19.3
1	616	25.9
2	562	23.7
3	343	14.4
4	162	6.8
≥ 5	236	9.9
Tribe		
Ijaw	1442	60.6
Igbo	566	23.8
Hausa/Fulani	67	2.8
Yoruba	48	2.1
Other tribes	257	10.7
Educational level		
Non formal	5	0.2
Primary	264	11.1
Secondary	1140	47.9
Tertiary	971	40.8
Occupation		
Unemployed	873	36.7
Petty trader/farmer	781	32.8
Civil servant	371	15.6
Student	226	9.5

The mean maternal age was 28.5 ± 4.97years, the minimum age was 15.0 years, and the maximum was 44 years

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Though a majority of the women 100(5.95%) who delivered on their date of EDC were from the Ijaw ethnic nationality where the hospital is located, significantly more Yoruba women (20 out of 36) delivered on their date of EDC than any other tribe in Nigeria. They were 6 times more likely to deliver on the EDC than women from Hausa/Fulani tribe, OR= 6.25 [2.29, 17.06], p = 0.0001. They also significantly delivered on the EDC more than Igbo women, p = 0.0001, OR = 0.09 [0.04, 0.17].

Table 2. Gestational age at booking and delivery

Gestational age	Number(n = 2380)	Percentage
Gestational age at booking		
≤ 12 wks	267	11.2
13-28	1516	63.7
29-40	583	24.5
> 40	17	0.7
Gestational age at delivery	309	13.0
Delivery from 28 – 36 weeks		
Delivery from 37 – 39 weeks	1071	45.0
Delivery on the day of the EDC (at 40 weeks)	176	7.4
Delivery after the day of EDC to 42 week	776	32.6
Delivery after 42 weeks gestation	48	2.0

The mean gestational age at booking was 22.5 $\pm$ 8.3 weeks, and at delivery, it was 38.7±2.16 weeks.

Table 3. Effect of maternal age, parity, tribe, and body mass index on delivery on the date of EDC

Variable	Number (n = 2380)	Delivery on the Date of EDC (n=176)	Odds ratio	P Value
Maternal age				
≤19 years	65(2.7)	-		
20-24years	342(14.4)	16(0.9)		
25-29years	1038(43.6)	116(6.8)	0.38	0.002
30-34 years	628(26.4)	36(2.1)		
≥ 35years	307(12.9)	8(2.1)	4.93	0.0003
Party				
0	45919.3)	48(2.8)		
1	590(24.8)	44(2.6)		0.08
2	590(24.8)	32(1.9)		0.10
3	343(14.4)	16(0.9)	2.44	0.002
4	162(6.8)	16(0.9)	2.44	0.002
5	29(5.4)	20(1.2)		0.14
≥6	107(4.5)	-		
Tribe				
Ijaw	1445(60.7)	100(5.9)		
Igbo	566 (23.8)	40(2.4)		0.99
Yoruba	69(2.9)	20(1.2)	0.09	0.0001
Hausa/Fulani	69 (2.9)	8(0.5)	6.25	0.00004
Other tribes	231(9.7)	8(0.5)		
Body mass index (BMI)				
Underweight (<18.5 kg /m^2)	40(1.8)	12(0.7)		
Normal weight (18.5-24.9 kg/m^2)	971(40.8)	72(4.2)	6.46	0.0001
Overweight (25 -29.9 kg /m^2)	56(3.3)	930(39.1)	8.14	0.00001
Obese (30.0 - 34.9 kg / m^2)	397(16.7)	36(2.1)		0.82
Very obese (≥35 – 39.9 kg /m^2)	38 (1.6)	-		

The mean BMI was 26.47±4.58 kg /m^2, the minimum was 16.2 kg /m,^{2} and the maximum was 40.64 kg /m^2

Table 4. Birth weight, fetal sex and delivery on the EDC

Variable	Number (n = 2380	Delivery on the Date of EDC (n=176)	Odds Ratio	P Value
Birth's weight				
< 1500 grams(very low birth weight)	33 (1.4)	-		
1500-2500 grams (low birth weight)	257(10.8)	20(1.2)		
2501- 4000 grams (normal weight)	2028(85.2)	148(8.7)		0.89
> 400 (fetal macrosomia)	62(2.6)	8(0.5)		0.23
Fetal sex				
Male	1121(47.1)	100(5.9)		
Female	1257(52.8)	76(4.5)	1.47	0.006

Low maternal body mass index (BMI) was associated with delivery on the EDC, as significantly more underweight women (12 out of 28) delivered on their EDC. They were 6 times more likely to deliver on the EDC than women with normal BMI, OR= 6.46[2.94, 14.19], p =0.0001. They were also 8 times more likely to deliver on the EDC than women who were overweight OR = 8.14[3.67, 18.07], p = 0.0001. However, the influence seems to diminish as the BMI rises beyond 30 kg/m.^{2} There was no significant difference in delivery rates between women who were underweight and obese women, p = 0.8.

Though predominantly more babies 148(8.7%) with normal birth weight were delivered on the day of EDC in this study, birth weight does not seem to influence delivery on the EDC significantly. There was no significant difference on delivery on the EDC between babies with normal birth weight and macrosomic babies, P = 0.23. There was also no difference with low birth weight babies, p = 0.89. However, significantly more male babies were delivered on the EDC than female babies. p = 0.006, X^2 = 7.34, Odds Ratio 1.47 [1.13, 2.11].

4. DISCUSSION

If pregnant women were to know their dates of delivery with certainty, it would be been fantastic, especially for the purpose of birth plan; unfortunately, this is far from reality. However, studies from various centers have established the fact that most deliveries take place at term between 37 and 42 weeks gestation, [12,13] and in line with Naegle's rule [14,15]. This fact has been supported by findings in this study, for as much as 85.0% of the women delivered at term; this is very much at par with the 85% reported in University of British Columbia in Vancouver [3].

The mean gestational age at delivery of the subjects in this study was 38.7±2.16 weeks. This was very similar to the 38.0 weeks obtained in previous studies [1], and was in agreement with the 40.0 ± 2.0 weeks stipulated by Naegle's rule. However it was slightly higher than what obtained in Durham where the mean length of gestational was 37 weeks [12]. These differences might have been due to racial differences and variations arising from other predictor variables in human gestational length.

Experience from delivery units has revealed that only a handful of women deliver on their date of EDC. Surprisingly, the rates are mostly unknown, and publications on this issue are very scanty. It seems researchers have not focused their attention on this subject matter. In a study done to determine the accuracy of the Maternity Care Calendar wheel; the likelihood of delivering on the exact date of EDC was 4.0% [3]. In another study, only 4.3% of parturients were reported to deliver on their date of EDC [5]. These findings, however, did not deviate too widely with the 7.4% obtained in this study.

For decades researchers have been trying to find out the predictor variables that determine the duration of pregnancy, as a leeway to explaining why some women deliver preterm, some at term or on the date of EDC, while others deliver postdate. Evidence emanating from various studies has identified biological and environmental variations as such maternal age, [10,11] parity, height, and race as being responsible [4,5]

There was an association between maternal age and length of gestation amongst subjects in this study. The mean maternal age was 28.5 ± 4.97 years. This falls within the range of 19 – 35 years identified as a substantial risk factor that predicts the duration of pregnancy in Brigham and Women's Hospital, USA. [11] However it was

less than the 35 years reported to be associated with preterm birth in Lagos and Ilorin in western Nigeria [15,16], and postdate in other centers [17]. In this study the most favoured age range for delivery on the EDC was 25-29 years, they were four times more likely to deliver on their EDC than women aged ≥ 35 years, Odds Ratio = 4.93, P = 0.0003.

Various studies have also reported parity as strong risks factor that influences the duration of pregnancy [10,15,16]. In this study, it was observed that nulliparous women were twice more likely to deliver on the EDC than multiparas, this was however at variant with the finding in Sweden where significantly more nulliparous women delivered post-term [14].

The length of human gestation has been reported to vary from one individual to the other and from one ethnic group to another within a country [4,6,18]. in a study done in Harvard school of health USA, black women were found to have a shorter gestation than white women [11]. In this study, women from Yoruba ethnic group in Western Nigeria were more likely to deliver on the expected date of confinement than the other ethnic groups studied. The chances were six times higher than the Hausa/Fulani tribe, Odds Ratio = 6.25, p = 0.00004, and they also significantly deliver on the EDC than Igbo women, p = 0.0001, Odds Ratio = 0.09. The reason for this disparity is not very clear, but further studies are advocated.

There are reports from various centers that tend to link obesity with duration of pregnancy, [12, 17] and BMI ≥ 30 kg/m^2 has been identified as a strong risk factor, as it prolongs the duration of pregnancy beyond 41 weeks [17]. It was observed from this study that maternal body mass index seems to influence delivery on the date of EDC significantly. Evidence from this study has also revealed that underweight women were most influential; however as the BMI raises above 30 kg/m,^{2} the effect tends to wane, such that above 35 kg/m^2 delivery on the date of EDC was null. This association is another area that may warrant further studies.

5. CONCLUSION

Although majority of the women in the study delivered at term, only a handful delivered on their date of EDC, therefore the exact date of childbirth was difficult to predict. However, a high index of suspicion can be made from the predictor variables studied. Biological variables of the pregnant mothers and ethnicity are some of the best predictors among women living in Yenagoa, Southern Nigeria.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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