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**Daniel Msuega Chia**
Department of Radiology, College of Health Sciences, Benue State University, Makurdi, Nigeria

**Isaac Terkimbi Annongu**
Department of Radiology, College of Health Sciences, Benue State University, Makurdi, Nigeria

**Mohammad Hameed**
Department of Radiology, College of Health Sciences, Benue State University, Makurdi, Nigeria

**Godwin Ojaare Magaji**
Department of Radiology, Dalhatu Araf Specialist Hospital, Lafia, Nasarawa State, Nigeria

**Alexis Aondoaseer Ugande**
Department of Radiology, Benue State University Teaching Hospital, Makurdi, Nigeria

# Assessment of the baseline pattern of obstetric sonography referrals, indications, and findings at Benue State University Teaching Hospital (BSUTH), Makurdi

## Daniel Msuega Chia, Isaac Terkimbi Annongu, Mohammad Hameed, Godwin Ojaare Magaji and Alexis Aondoaseer Ugande

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**Abstract**
**Background:** In this era of evidence-based medicine and female reproductive health rights, obstetric sonography is the gold standard for diagnosing pregnancies. But despite having the highest rates of perinatal morbidity and mortality, sub-Saharan Africa has yet to fully realize the potential benefits of prenatal ultrasound.
**Objectives:** To assess the baseline pattern of obstetric sonography referrals, indications, and findings at Benue State University Teaching Hospital (BSUTH).
**Methods:** We retrospectively reviewed 827 case-files retrieved from the prenatal ultrasound archives of the radiology department at BSUTH, Makurdi from January to December, 2019. The data was entered into a spreadsheet and analysed using statistical package for social science (SPSS) version 23 and Microsoft Excel 2007. Chi square was used with the statistical significance at $p < 0.05$. The data distribution was displayed in tables, figures, and percentages.
**Results:** Most 315 (38.1%) obstetric referrals were aged 26-30 years. Majority 736(89.0%) were married, and more than half 521(63.0%) had tertiary education. The number of patients referred by physicians, self and healthcare workers were 689 (83.3%), 105 (12.7%), and 33 (4.0%) consecutively, with a statistically significant correlation between the source of referral and educational status ($p = 0.002$). Confirmation of fetal wellbeing was the commonest 224(27.1%) indication for prenatal ultrasound. Majority, 695 (84.0%) of the prenatal sonography findings were negative for the abnormalities suspected by the physicians. Confirmation of PV-bleeding had the highest positive rate of abnormality 18 (13.6%).
**Conclusion:** Physicians were the main source of prenatal referrals at BSUTH, with the referral pattern greatly influenced by biosocial factors. Confirmation of fetal wellbeing was the commonest indication for referral, whereas, majority of findings were negative for the abnormalities the physicians suspected. Thus, establishing the baseline pattern of obstetric sonography referrals, indications, and findings in our environment, which is helpful for planning and future research.

**Keywords:** Makurdi, baseline pattern, findings, indications, obstetric sonography, referrals

## Introduction

Obstetric (prenatal) ultrasonography has become the gold standard for the diagnosis of early to late trimester pregnancy [1]. In Sub-Saharan Africa, the potential benefits of obstetric ultrasound have yet to be completely realized, even though this region bears the brunt of poor perinatal morbidity and mortality [2].

Widely regarded as a cost-effective, non-invasive, safe, and accurate method of examining the foetus, prenatal sonography, since its introduction in the 1950s, has drastically revolutionized the practice of obstetrics by allowing visualization of the foetus and the intrauterine environment [3]. Thus, the technology is now used to assess 40–60% of pregnancies with the percentage of pregnancies that have undergone at least four ultrasound examinations in the second or third trimester on the increase [4, 5].

Although some patients may choose to refer themselves, prenatal ultrasound is usually done at the request of the physicians. A request typically includes information such as the referring physician's name, the patient's name, a provisional diagnosis, and/or clinical data, which assists the sonographer and sonologist to not only interpret the findings, but also to demonstrate and clarify sonographic anomalies in the light of any clinical information and the findings of additional tests [5].

**Corresponding Author:**
**Daniel Msuega Chia**
Department of Radiology, College of Health Sciences, Benue State University, Makurdi, Nigeria

Pregnant women may choose to have a scan for a variety of reasons that may or may not be medically and ethically justifiable, regardless of whether the physician recommends it or not [6]. Ikeako *et al.* reported that more than half of the pregnant women 110(52.9%) felt that they should be able to obtain a scan at any time [7]. The problem with self-referrals in modern prenatal sonography is that crucial clinical information is often missing, which might impair the procedure's accuracy with misinterpretation of data, potentially leading to unjustified diagnosis and treatment of the patient. Similarly, referrals from lower-level health-care workers are fraught with a lot of flaws causing confusion for the attending physician. In general, there is a lack of understanding and awareness about when an ultrasound scan should be performed, who should request one, and the sonographer`s skill in our setting [8].

Obstetric ultrasound is frequently used in antenatal care (ANC) in high-income countries to detect the exact gestational age and screen for possible pregnancy complications. According to reports from the low- and middle-income countries' (LMIC), using ultrasonography during ANC can increase justifiable delivery of referrals and consequently reduce maternal and fetal morbidity and mortality [9].

Based on the above reports, and the relative paucity of literature on this subject matter in our locality, we decided to assess the baseline pattern of obstetric sonography referrals, indications, and findings at BSUTH by identifying the biosocial characteristics of the patients, the main indications for referral, the source of the prenatal obstetric referrals-whether from the physicians, the pregnant woman herself, or other cadres of healthcare professionals-as well as to review the ultrasonography results.

## Methods and Materials

This study retrospectively evaluated the baseline pattern of obstetrics sonography referrals, indications, and findings of 827-patients who underwent prenatal ultrasound scan at the department of radiology, BSUTH, Makurdi for a period of 12months; from January to December, 2019. Makurdi, the capital of Benue State, is situated between latitudes 7.3 and 8.32 degrees, with an estimated population of 365,000 people in 2016 [10].

Inclusion criteria were pregnant women who have had complete records in the prenatal ultrasound archives of the department of radiology, BSUTH, which were well provided with all but mostly the following desired information: biosocial data such as age, education, parity, gestational age and marital status; indication for the scan and/or provisional diagnosis, source of referral (physician, self-referral or by other healthcare workers), and the prenatal sonography findings.

Exclusion criteria were scanty records without the desired information, or use of non-standardized abbreviations. All radiological records, which were not for obstetric scan were also excluded.

All obstetrics sonographic examination was done using Siemens Sonoline G-50 machine fitted with a curvilinear 2.0-5.0MHZ transabdominal transducer.

The data obtained was entered into a spreadsheet and analysed using statistical package for social science (SPSS) version 23 software (IBM Inc., Chicago, Illinois, USA 2015) and Microsoft Excel 2007. Chi square was used as a test of statistics and the statistical significance was determined using a $p < 0.05$ value. The data distribution was displayed using tables, figures, and percentages.

## Ethical consideration

The institutional Health Ethical Committee reviewed and approved the protocols.

## Results

A good number, 736 (89.0%) of the respondents were married, 765(92.5%) were multigravida while 717(86.7%) were multiparous. Majority 380(45.9%) were civil servants, 521(63.0%) had tertiary education, 767(92.7%) were Christianity and 595(71.9%) belonged to the Tiv ethnic tribe. Their ages ranged from 16 to 47 years, with a mean age of 29.7±5.5 years, median age of 30.0 and 30.0 as the modal age. The predominant age range is the 26-30, with 315(38.1%) respondents, followed by the 31-35 age range, with 210(25.4%). The least number, 2(0.2%) was from the 46-50 age range as shown in table 1.

**Table 1:** Distribution of biosocial information of respondents (n=827)

| Variable | Frequency | Percentage (%) |
|---|---|---|
| **Age Group(years)** | | |
| 16-20 | 56 | 6.8 |
| 21-25 | 126 | 15.2 |
| 26-30 | 315 | 38.1 |
| 31-35 | 210 | 25.4 |
| 36-40 | 104 | 12.6 |
| 41-45 | 14 | 1.7 |
| 46-50 | 2 | 0.2 |
| Total | 827 | 100.0 |
| **Marital status** | | |
| Married | 736 | 89.0 |
| Single | 59 | 7.1 |
| Divorced | 32 | 3.9 |
| Total | 827 | 100.0 |
| **Gravidity** | | |
| 1 | 62 | 7.5 |
| $\geq 2$ | 765 | 92.5 |
| Total | 827 | 100.0 |
| **Parity** | | |
| 0-1 | 106 | 12.8 |
| 2-4 | 717 | 86.7 |
| $\geq 5$ | 4 | 0.5 |
| Total | 827 | 100.0 |
| **Occupation** | | |
| Civil servant | 380 | 45.9 |
| Housewife | 157 | 19.0 |
| Business | 149 | 18.0 |
| Farming | 82 | 9.9 |
| Trading | 26 | 3.1 |
| Teacher | 17 | 2.1 |
| Student | 14 | 1.7 |
| Medical Doctor | 2 | 0.2 |
| Total | 827 | 100.0 |
| **Education** | | |
| None | 27 | 3.3 |
| Primary | 39 | 4.7 |
| Secondary | 240 | 29.0 |
| Tertiary | 521 | 63.0 |
| Total | 827 | 100.0 |
| **Religion** | | |
| Christianity | 767 | 92.7 |
| Moslem | 60 | 7.3 |
| Total | 827 | 100.0 |
| **Ethnicity** | | |
| Tiv | 595 | 71.9 |
| Others | 232 | 28.1 |
| Total | 827 | 100.0 |

Figure 1 shows that out of the 827 expectant mothers who had prenatal ultrasound at BSUTH, majority 362(43.8%) presented in the second trimester, followed by 267(32.3%) and 198(23.9%) in the third and first trimesters, respectively.
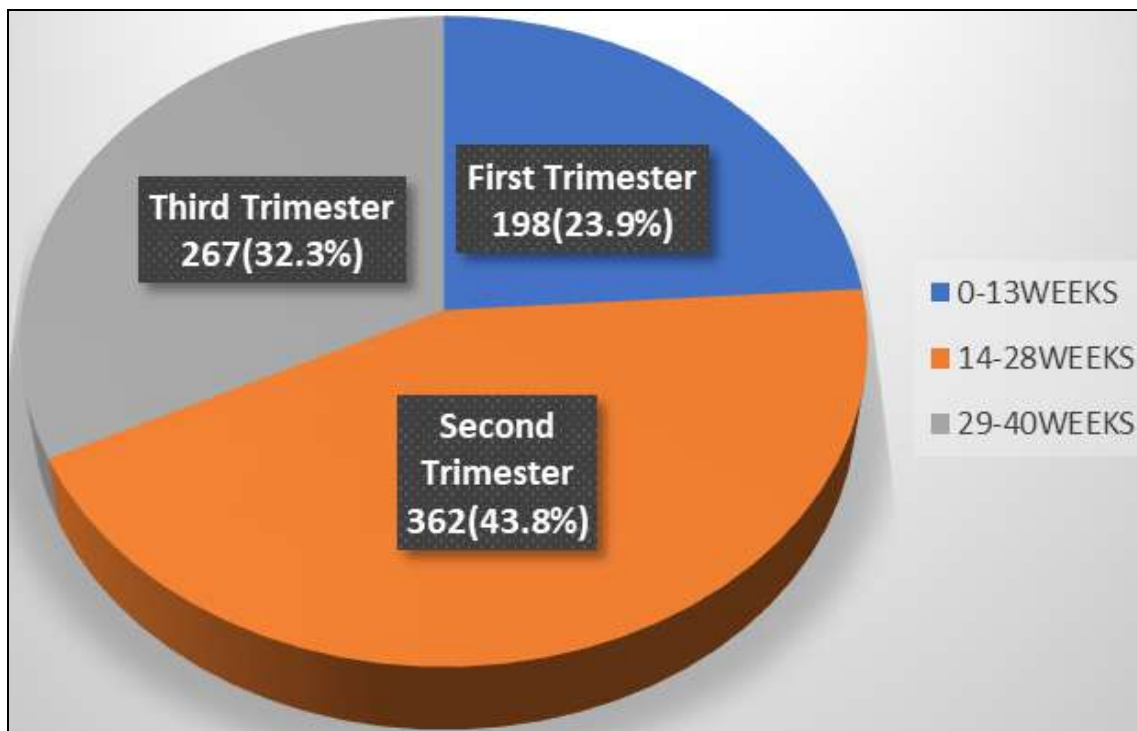


**Fig 1:** Distribution of prenatal sonography based on trimesters of pregnancy

The distribution of source of obstetric sonography referrals at BSUTH shows that the number of patients referred by physicians, 689 (83.3%), were higher than those referred by self, 105 (12.7%), and other healthcare workers, 33 (4.0%) as depicted in table 2. Further analysis showed that 393 (47.5%) married women with degrees were referred by the physicians; 60 (7.3%) were self-referred, while 12 (1.5%) were referred by other healthcare workers. Regression analysis revealed a statistically significant correlation between source of referral and educational status of the pregnant women ($p = 0.002$), but non between source of referral and marital status ($p = 0.930$).

**Table 2:** The distribution of source of referral, marital status and the pregnant women's literacy level (n=827)

| Source of referral | | Educational Attainment | | | | |
|---|---|---|---|---|---|---|
| **Physician-Referred** | Marital status | None | Primary | Secondary | Tertiary | Total |
| | Married | 24(2.9%) | 30(3.6%) | 162(19.6%) | 393(47.5%) | 609(73.6%) |
| | Single | 1(0.1%) | 1(0.1%) | 19(2.3%) | 36(4.4%) | 57(6.9%) |
| | Divorced | 1(0.1%) | 0(0.0%0 | 9(1.1%) | 13(1.6%) | 23(2.8%) |
| | Total | 26(3.1%) | 31(3.8%) | 190(23.0%) | 442(53.5%) | 689(83.3%) |
| **Self-Referred** | | | | | | |
| | Married | 1(0.1%) | 4(0.5%) | 32(3.9%) | 60(7.3%) | 97(11.7%) |
| | Single | 0(0.0%) | 0(0.0%) | 1(0.1%) | 1(0.1%) | 2(0.2%) |
| | Divorced | 0(0.0%) | 0(0.0%) | 3(0.4%) | 3(0.4%) | 6(0.7%) |
| | Total | 1(0.1%) | 4(0.5%) | 36(4.4%) | 64(7.7%) | 105(12.7%) |
| **Other Healthcare-workers' Referred** | | | | | | |
| | Married | 0(0.0%) | 4(0.5%) | 14(1.7%) | 12(1.5%) | 30(3.6%) |
| | Single | 0(0.0%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 0(0.0%) |
| | Divorced | 0(0.0%) | 0(0.0%) | 0(0.0%) | 3(0.4%) | 3(0.4%) |
| | Total | 0(0.0%) | 4(0.5%) | 14(1.7%) | 15(1.8%) | 33(4.0%) |

The most frequent indication for prenatal ultrasound was confirmation of fetal wellbeing 224(27.1%), while the rarest indications included malpresentation, prolonged labour and cervical incompetence, each with a frequency of 5(0.6%) as indicated in figure 2.

**Fig 2:** Distribution of clinical indications for obstetric sonographic referrals

Table 3, shows that as much as 31(3.7%) pregnant women, majority 26(3.1%) of whom were self-referred, did not have specified indications on their referral forms.

**Table 3:** Distribution of clinical indications based on Source of referral

|  | Clinical indications | | |
| --- | --- | --- | --- |
|  | **Specified Indications** | **None** | **Total** |
| **Source of referral** | | | |
| Physicians | 689(83.3%) | 0 | 689(83.3%) |
| Self | 79(9.6%) | 26(3.1%) | 105(12.7%) |
| Healthcare workers | 28(3.4%) | 5(0.6%) | 33(4.0%) |
| Total | 796(96.3%) | 31(3.7%) | 827(100.0%) |

Women who have had less than two pregnancies 9(69.0%) were more likely to request for fetal sex determination during prenatal ultrasonography, as illustrated in figure 3.
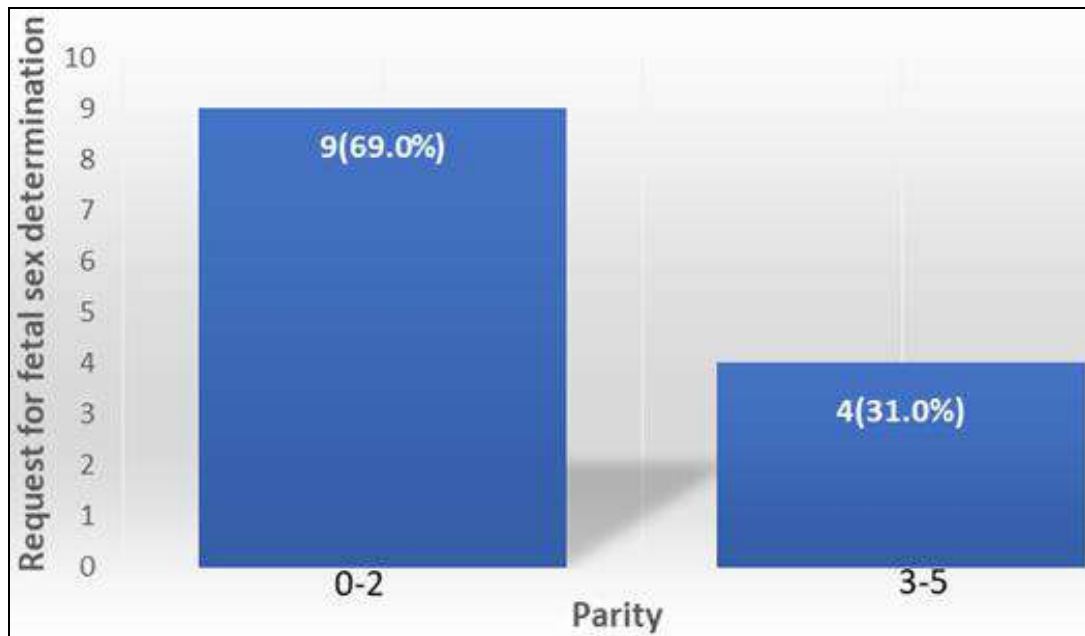
**Fig 3:** Distribution of Parity with prenatal requests for fetal sex determination

Table 4 shows that 132(16.0%) pregnant women were positive for the abnormalities suspected by physicians prior to requesting sonographic evaluation whereas, 695(84.0%) were negative. A total of 12 (9.1%) positive cases (incidentalomas) were found as a result of routine antennal (ANC) scanning for general maternal reassurance.

Regression analysis showed that the level of confirmation of abnormalities suspected during prenatal ultrasonography was statistically significant and well correlated with findings (r=0.510, p=0.011). Confirmation of PV-bleeding recorded the highest positive rate 18(13.6%).

**Table 4:** The distribution of clinical Indications with prenatal ultrasound findings

| Clinical Indications | Ultrasound Findings | | |
|---|---|---|---|
| | Negative | Positive | Total |
| Fetal well being | 207(29.8%) | 17(12.9%) | 224(27.1%) |
| Routine ANC Scan | 120(17.3%) | 12(9.1%) | 132(16.0%) |
| Dating | 89(12.8%) | 8(6.1%) | 97(11.7%) |
| Fetal Viability | 63(9.1%) | 10(7.6%) | 73(8.8%) |
| Placenta Localization | 32(4.6%) | 3(2.3%) | 35(4.2%) |
| PV Bleeding | 15(2.2%) | 18(13.6%) | 33(4.0%) |
| Expected fetal weight (EFW) | 26(3.7%) | 6(4.6%) | 32(3.9%) |
| None | 27(3.9%) | 4(3.0%) | 31(3.7%) |
| Biophysical Profile (BPP) | 16(2.3%) | 6(4.6%) | 22(2.7%) |
| Lower Abdominal Pain (LAP) | 8(1.2%) | 7(5.3%) | 15(1.8%) |
| Anomaly scan | 14(2.0%) | 0(0.0%) | 14(1.7%) |
| Abortion | 7(1.0%) | 6(4.6%) | 13(1.6%) |
| Sex Determination | 11(1.6%) | 2(1.5%) | 13(1.6%) |
| Malaria in Pregnancy | 10(1.4%) | 3(2.3%) | 13(1.6%) |
| Amenorrhoea | 8(1.2%) | 2(1.5%) | 10(1.2%) |
| Intrauterine Growth Retardation (IUGR) | 4(0.6%) | 6(4.6%) | 10(1.2%) |
| UTI in Pregnancy | 5(0.7%) | 4(3.0%) | 9(1.1%) |
| Fetal Macrosomia | 6(0.9%) | 2(1.5%) | 8(1.0%) |
| Premature rupture of membranes | 6(0.9%) | 2(1.5%) | 8(1.0%) |
| Absent fetal movements | 1(0.1%) | 6(4.6%) | 7(0.8%) |
| Multiple Pregnancy | 6(0.9%) | 1(0.8%) | 7(0.8%) |
| Intrauterine Fetal death (IUFD) | 4(0.6%) | 2(1.5%) | 6(0.7%) |
| Cervical Incompetence | 4(0.6%) | 1(0.8%) | 5(0.6%) |
| Prolonged Labour | 5(0.7%) | 0(0.0%) | 5(0.6%) |
| Malpresentation | 1(0.1%) | 4(3.0%) | 5(0.6%) |
| Total | 695(84.0%) | 132(16.0%) | 827(100.0%) |

Figure 4 demonstrates the distribution of prenatal obstetrics findings in which there was particularly notable percentage differences in the positive findings between patients referred

by physicians 93(11.3%), Self 13(1.6%) and other low-cadre healthcare workers 20(2.4%).
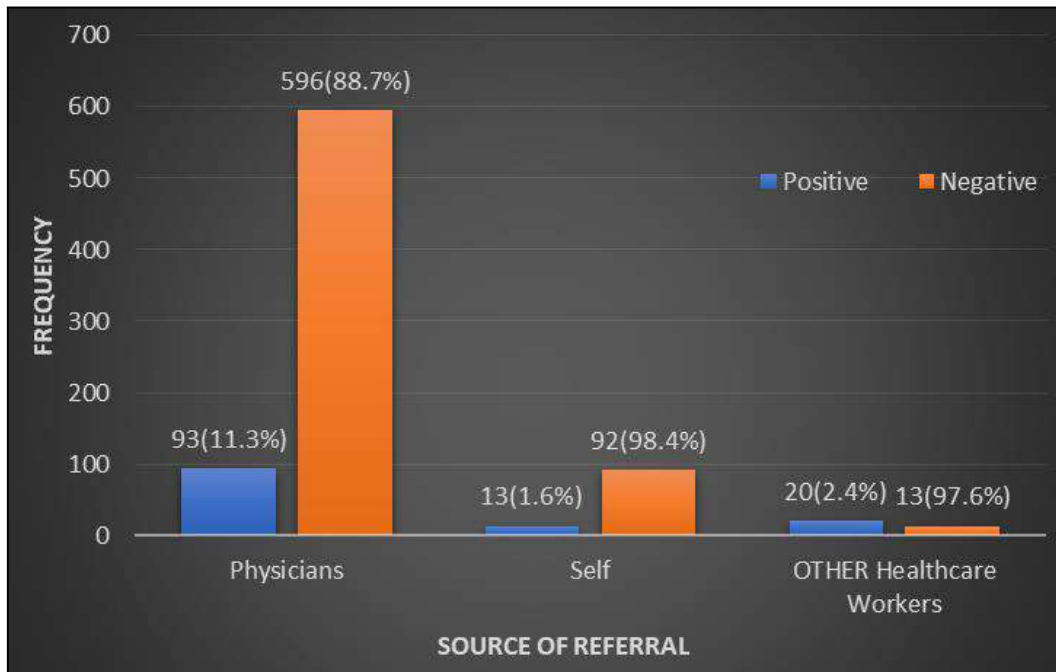
**Fig 4:** Distribution of Prenatal obstetrics findings based on source of referral

Whereas there was a statistically significant positive correlation between both clinical indications (r=0.354, $p$ = 0.000) and prenatal ultrasound findings (r=0.149, $p$ = 0.000) with source of referral, the relationship was a negative one with both educational status (r= -0.106, $p$ = 0.002) and parity (r= -0.080, $p$ = 0.021). The relationship between age ($p$ = 0.475) and marital status ($p$ = 0.930) with source of referral was not statistically significant. However, a statistically significant co-relation existed between clinical indications and prenatal ultrasound findings (r=0.179, $p$ = 0.000) as illustrated in table 5.

**Table 5:** The distribution of Pearson's correlation (r) between selected variables (n=827)

| Variable | Pearson's correlation (r) | P-Value |
|---|---|---|
| Source of referral vs Clinical indications | 0.354 | 0.000 |
| Clinical indications vs Findings | 0.179 | 0.000 |
| Source of referral vs Findings | 0.149 | 0.000 |
| Source of referral vs Marital status | 0.003 | 0.930 |
| Source of referral vs Education | -0.106 | 0.002 |
| Source of referral vs Parity | -0.080 | 0.021 |
| Source of referral vs Age | -0.025 | 0.475 |

**Discussion**

The age range in our study is 16-47 years, with a mean age of 29.7±5.5years. Our mean age was slightly lower than the reported mean age of 30.1±4.5 years from western Nigeria [6], however it was higher than the 22.4±3.2 and 26.9±4.8 years respectively reported in eastern [7] and northern [11] Nigeria. Our reported mean age represents the average age of marriage in our region and also corresponds to the reproductive age at which most women marry and hope to complete their reproductive careers [8]. The reported regional mean age variations may be due to religious and other biosocial differences. The Nigerian Child Rights Act of 2003, statutorily set the legal age of marriage at 18 years and above, however, not all of the country's 36 states have ratified this act as at the time of compiling this report, as such, different states have different laws guiding the

minimum age of marriage [12, 13].

Majority, 736 (89.0%) of our expectant mothers were married. This corroborated with the findings of similar studies [14, 15], in which 6264(85.2%) and 845(91.5%) pregnant women, respectively had husbands. Women who are married are more likely to complete their routine antenatal care (ANC) visits with resultant prenatal ultrasound scans. Certain cultures, particularly in Africa, frown at extramarital pregnancy and even consider pregnant women without a husband as a disgrace. Consequently, unmarried pregnant women frequently conceal their pregnancies due to social pressures, resulting in fewer ANC visits [14, 15].

In our study, 765 (92.5%) multigravida and 717 (86.7%) multiparous women willingly participated in the study after being referred for it, indicating that gravidity and parity of the pregnant women most likely did influence their desire for prenatal US scan. This is consistent with previous reports [6, 16], even though it is somewhat absurd, given that high-parity women may feel more confident and self-assured, with heavy reliance on previous pregnancy experiences, and thus disregard the need for prenatal healthcare due to their greater level of experience. [17]. However, things may be changing for the better for this category of women in our environment.

More than half of our expectant mothers, 521 (63.0%), were degree holders. This is most likely, among other things, attributable to the location of two universities; one state and one federal, at our study centre, Makurdi. This is to be expected, as the level of education determines the woman`s occupation, her degree of utilization of ultrasound technology, and how well informed she is about her rights regarding reproductive health as well as gender equality [18, 19].

Our study shows that pregnant women were referred for prenatal scan at different stages of pregnancy, with the majority 362(43.8%) presenting at the second trimester. This was in agreement with the findings by Ikeako *et al.* [7] in which the majority of respondents, 111(53.3%) had their prenatal ultrasound scan at the second trimester. Firth *et al.*

[20], however reported that no pregnant woman attended her first ANC appointment before the age of 12 weeks in Tanzania! Other studies have found a consistent pattern of late booking for ANC in developing countries, which has been attributed to socio-cultural factors, illiteracy, ignorance and poverty [21, 22], making accurate gestational age determination difficult [23]. Prenatal ultrasound is essential during the first trimester and includes at least four types of scans, namely a dating and viability scan at 6-9 weeks, a nuchal translucency scan to evaluate birth defects or congenital abnormalities such as Down syndrome at 11-13 weeks, a transvaginal scan (TVS) to obtain clearer fetal images and a trans abdominal scan (TAS) at 10 weeks [24]. It is best to abort therapeutically at this point rather than in the second or third trimester, if a serious foetal malformation is present. During the third trimester, physicians would like to assess foetal well-being, localize the placenta, and determine foetal presentation and lie in order to choose the best method of delivery [5].

Majority of our patients 689(83.3%) were referred by a physician, with self-referrals accounting for a smaller proportion 105(12.7%) of all requests evaluated. Our findings were in agreement with previous reports [5, 8] where most scans were requested by physicians. This clearly shows that physicians were concerned about the safety of the mother's pregnancy and the complications that could endanger the mother, foetus, or both [5]. The proportion of patients who self-refer shows that, as long as they have the financial means to do so, they are willing to forgo the traditional patient-physician relationship in order to obtain a scan. This frequently puts physicians under pressure to order an ultrasound scan for indulgence rather than necessity [5, 25]. Even though, the involvement of other lower-cadre healthcare workers in the referral of pregnant women for prenatal ultrasound scan is in the minority 33(4.0%), this raises concerns about whether these categories of caregivers possess the right clinical expertise necessary to guarantee a reasonable request, or even an appropriate referral protocol [8]. Pregnant women who were married and had attained tertiary education were by far more likely to get a referral from the physician. Table 2 shows that 393 (47.5%) of 442 (53.5%) married women with degrees were referred by a physician; of the remaining 64 (7.7%) women, 60 (7.3%) were self-referred, while 12 (1.5%) of the other 15 (1.8%) were referred by lower-cadre healthcare workers. A statistically significant correlation exited between source of referral and educational status of our pregnant women (p=0.002), however no statistically significant correlation was found between source of referral and marital status (p=0.930).

Our commonest indication for prenatal sonography, as shown in figure 2, is confirmation of fetal wellbeing, followed by routine ANC scan and then dating. These findings were consistent with previous reports [1, 8]. There was, particularly room for agreement with Utoo et al. [8], in that both studies were carried out in the same middle-belt region of Nigeria, even though ours was conducted at a public health facility. But contradictory to our findings, other researchers [5-7] reported that the most common indications for prenatal US were confirmation of cyesis, fetal viability, and fetal observation, in that order. The general apprehension and enthusiasm of the expectant mother and her immediate family members is the motivation factor for the desire to have confirmation of fetal wellbeing

in a community like ours, where matrimonial success is based on conception and the eventual delivery of a healthy, live baby [6]. All the pregnant women 689(83.3%) that were referred by physician at our center had specified indications on their referral forms. However, 31(3.7%) women, 26(3.14%) of whom were self-referred and 5(0.60%) referred by other low-cadre healthcare workers, did not have specified indications on their referral forms, as indicated on table 3. Another study [8], however, reported that more than half 261 (52.2%) of their pregnant women without explicit indication on their referral forms were successively referred by low-cadre healthcare workers 116(44.4%), self-113 (43.3%), and 32(12.3%) physicians. These figures are disturbing and unacceptable, even though the study was conducted at a private healthcare facility, where there is more emphasis on profit-making. When the indication is explicitly stated, the sonographer is more focused during the procedure and produces a report that is more insightful to the referring physician, thus dispelling the rumour surrounding the misconception of overestimating the diagnostic capabilities of ultrasound machine [8].

Despite the fact that fetal gender disclosure is an ethically unjustifiable and non-medical indication for prenatal US [26] a minority 13 (1.6%) of our pregnant women still used the technology to determine the sex of their unborn child. Women who have had fewer than two pregnancies 9(69.0%) were by far more likely to request gender disclosure as shown in figure 3. The low numbers of pregnant women desirous of fetal gender disclosure during our research may just be coincidental; however, they compared favourably with the findings by Utoo et al. [8], in which 13(2.6%) women had prenatal US for gender disclosure. Apart from the fact that both studies were conducted in the middle-belt region of Nigeria, there is the assumption that our women are beginning to accept the gender of their babies as a gift from God and prefer to be content with the gender that they were given [7,26]. Ikeako et al. [7], however, reported that a much higher number of women 37 (17.8%) desired fetal gender disclosure from south-eastern Nigeria, suggesting that the sex of the child is still a major concern in other communities. The desire to know the gender of the unborn foetus has been cited as one of the disadvantages of prenatal US, which has led to sex-selective abortions, especially when the undesired fetal sex is disclosed in certain societies with strong gender preferences [26-28].

As depicted on table 4, 132 (16.0%) pregnant women were positive for the abnormalities that physicians suspected before requesting sonographic evaluation, while 695 (84.0%) were negative. This is indicative that some clinical indications did not match-up with the prenatal US findings [5]. Furthermore, our abnormality rate was much lower when compared to the findings of other researchers [29, 30], both of whom reported nearly twice as high abnormality rate in percentage terms. Routine antenatal (ANC) scan on table 4 contributed 12(9.1%) positive cases (incidentalomas) to the overall positive rate, suggesting that the pre-scan clinical assessments in our index study were mainly unreliable. This is not intended to imply that US should entirely replace clinical examinations. Furthermore, notable percentage variations in the level of positive findings were also found between patients referred by physicians 93(11.3%), Self 13(1.6%) and other low-cadre healthcare workers 20(2.4%), as shown in figure 4, suggestive of indiscriminate referrals, especially by expectant mothers and the healthcare workers.

This calls for adequate provision of information on ultrasound to meet the requirements of informed choice for our pregnant mothers as well as continuous training of the healthcare workers. In contrast, Mills *et al.* [30] asserted that the incidence of abnormalities was not significantly different between sources of referrals. The degree of confirmation of abnormalities suspected during prenatal ultrasonography in our index study was, however statistically significant and correlated well with findings (r = 0.510, *p* = 0.011). Confirmation of PV-bleeding recorded the highest positive rate 18(13.6%).

**Limitation of the study**
Typical of a retrospective study, our research was constrained by a number of factors. Chief among them was the finding of non-standardized abbreviations, omission of useful data and the scanty archival records on certain patients without the desired information. Furthermore, because our study was conducted as a single-centre study at BSUTH, we were constrained from drawing comparisons and ultimately discovering any differences in the baseline pattern of obstetric sonography referrals, indications, and findings from other healthcare centres. As a result, the findings should be interpreted cautiously because they may not be generalizable to other locations or populations.

**Conclusion**
Our index study indicates that pregnant Nigerian women in our community desire prenatal ultrasonography mostly for fetal wellbeing, which in our case was largely influenced by their biosocial characteristics. Those who were married and had attained tertiary education were by far more likely to get a referral from the physician. There was also significant difference in the pattern of requests and prenatal ultrasound findings among the three trimesters of pregnancy. These differences may be due to the varying needs of physicians and patients at different stages of pregnancy. Therefore, in order to maximize the benefits of pregnancy, it is advisable that expecting mothers should receive adequate information on the timing of prenatal sonography, its role in obstetric care, and its limitations. Unfortunately, women are frequently disregarded when it comes to issues that affect their rights to reproductive health, especially in developing countries. This study has therefore, established the pattern of obstetric sonography referrals, indications, and findings in our locality to provide the baseline data for planning and further research. This will be of immense benefit to healthcare providers to better direct their efforts in our environment.

**Recommendations**
The recommendations, are to an extent, influenced by previous research by Ohagwu *et al.* [31]. They are aimed at womenfolk, governments, physicians and other healthcare workers, as well as health institutions.

**Womenfolk and education:** A well-known African adage go thus, `You are educating only an individual when you educate a man, however educating a woman educates a nation`. This has long inspired people all over the world to work towards universal access to education. For us, a woman's level of education is the most important factor that will enable her to not only fully exercise her rights to reproductive health but also to participate in the struggle for gender equality.

**Governments**
To relieve the expecting mothers of enormous financial burden that come with prenatal care, the government should find a way to subsidise the cost of paying for US scans.

**Physicians and other healthcare workers**
Before referring expectant mothers for a scan, physicians and other healthcare workers should properly inform them of the value of prenatal ultrasound in the antenatal clinic. Sonographers should augment this with additional prenatal antenatal instructions before, during, and after the scan.

**Health institutions**
Health institutions should build more ultrasound scanning centers as integral parts of the antenatal clinics to improve access to prenatal ultrasound and eliminate the long distance between the antenatal clinic and the ultrasound center. Institutions should also train more clinical staff to operate the US machine and ensure prompt and effective prenatal ultrasound service.

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