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Screening for Gestational Diabetes Mellitus: Findings from a Resource Limited Setting of Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author RNO conceived the study and wrote the first draft of the manuscript. Author COJ supervised the data collection and literature search. Author OM performed the statistical analysis and results. Author SC reviewed the protocol and manuscript. All authors meet the ICMJE authorship criteria. All authors read and approved the final manuscript.

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ABSTRACT

Diabetes is a growing non communicable disease (NCD) epidemic. Current international guidelines dictate that in pregnancy, universal screening for GDM for early detection is essential to improve feto-maternal outcomes. However in resource limited settings, risk based screening is still in practice. We undertook records-based review of 837 women who accessed antenatal care between November 2014 and October 2015. The aim was to evaluate the pattern of screening and clinical outcomes of GDM in a resource limited setting of the Niger Delta region of Nigeria.
Only 3.7% of the study population representing 31 women was screened for GDM, giving the

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overall prevalence of GDM among study participants as 3.3% (28 women). A comparison of fetomaternal outcomes between women screened for GDM and those not screened for GDM showed comparable proportions for gestational age at delivery, mode of delivery and fetal outcome relating to hypoglycaemia, respiratory distress and neonatal jaundice. Also, a significantly higher proportion of babies born to mothers who were screened for GDM were admitted into the Special Care Baby Unit (SCBU). There was no significant difference between the prevalence of stillbirths, neonatal jaundice, hypoglycaemia and respiratory distress in babies born to women diagnosed with GDM compared with babies born to women not screened for GDM. Selective risk based screening for GDM may be leading to missed cases of GDM. The need for universal screening is hereby reiterated.

Keywords: Gestational diabetes mellitus; universal screening; selective screening; fetomaternal outcomes; Nigeria.

1. INTRODUCTION

Diabetes affects about 415 million adults worldwide with an estimated 318 million people living with impaired glucose tolerance [1]. The associated economic implications are enormous; 12% of global health expenditure is expended in the treatment of diabetes [1]. Diabetes mellitus (DM) has huge social and economic impact thus any intervention for halting its escalation must be pursued. Gestational diabetes mellitus (GDM) is defined as glucose intolerance with onset or first recognition during pregnancy that is not clearly overt diabetes [2]. GDM is becoming more common as the epidemic of obesity and type 2 diabetes continues [1,3]. GDM provides a unique opportunity to screen for, identify and manage diabetes and potential diabetes whilst at the same time, halt the escalation of diabetes that emerges as a result of the offspring born to a woman with gestational diabetes [3,4] and ensuring the next generation born to women with gestational diabetes are spared from this medical condition.

Although there are few reports on the prevalence of GDM in sub-Saharan Africa, [5] in Nigeria, the reported prevalence among antenatal attendees shows a rise from 0.3% in the 1980s to as high as 15.3% in 2014 [6–10]. This translates to an absolute figure of about half a million women with GDM in Nigeria [10].

Women with hyperglycaemia detected during pregnancy are at greater risk of adverse pregnancy outcomes: these include very high blood pressure and fetal macrosomia (birth weight greater than 4 kg), which can make vaginal birth difficult and risky; a higher risk of developing gestational diabetes in subsequent pregnancies; and type 2 diabetes later in life. Babies born to mothers with gestational diabetes also have a higher risk of developing type 2 diabetes in their teens or early adulthood [11]. There is a tenfold increased perinatal mortality rate in pregnancies complicated by GDM. These poor outcomes and the findings from various studies on the benefits conferred by diagnosis and treatment make universal screening imperative for all pregnant women as soon as they present at health care facilities [12–14].

Screening for GDM in UPTH is currently based on selective criteria: booking weight above 90kg; family history of DM; previous GDM; previous macrosomic babies; history of congenital abnormalities; intrauterine fetal deaths; recurrent miscarriages; or previous unexplained stillbirths are eligible for 75 grams oral glucose tolerance test (OGTT) which is done at booking and repeated at 28 weeks.

It is crucial for health workers to understand that the absence of GDM risk factors is not protective against GDM. This knowledge will inform an improvement in the patient care practices. Learning from this study may also be relevant to patient care practices in other health facilities.

We present here a record based review of all eligible women who received antenatal care and delivered at our center; with a view to providing evidence based indicators for auditing practice aimed at aiding the design of a diabetes registry and implementing GDM management protocols that are in line with international best practices.

2. METHODS

A records-based survey of all women, who had antenatal care and delivered at the University of Port Harcourt Teaching Hospital (UPTH), Nigeria between November 2014 and October 2015, was conducted in December 2015. UPTH is an 882-

bed tertiary health facility providing specialist care to the Niger Delta region of Nigeria. Obstetrics and Gynecology occupies 18.6% of bed space in the hospital. The antenatal clinic is open five days a week. It has an average monthly turnover of 3000 attendees with average of 250 new bookings per month. Only about 50% of booked patients deliver in the hospital.

Staff of the records department retrieved all relevant patient folders while trained data extractors reviewed each folder, confirmed eligibility and transferred information onto pre-designed data extraction forms. The sample size for the study was all booked pregnant women who delivered in the hospital and met the criteria for eligibility. Only women who had a minimum of three antenatal care visits and delivered in the teaching hospital were deemed eligible for the study. Data relating to whether screening for GDM was done, maternal characteristics such as age, parity, ethnicity, education, occupation, diagnoses of GDM, maternal & fetal outcomes of gestational age at delivery, mode of delivery, pre-eclampsia, fetal distress, birth weight, Apgar scores, stillbirth, neonatal hypoglycaemia, jaundice and respiratory distress were retrieved.

Data analysis was done using the statistical package for social sciences (SPSS) version 21. Tests of significance were carried out to compare the values of selected variables amongst women screened for GDM and those not screened with p-value of less than 0.05 accepted as significant. Continuous variables were presented using mean ± standard deviation while categorical variables were presented as percentages. Continuous variables were compared using the student's t-test while proportions or categorical variables were compared using the chi-square test. Multiple Logistic regression was used to determine the relationship between socio-demographic and maternal characteristics and the presence and absence of screening for GDM. Primary outcome was percentage screened for GDM while secondary outcome was proportion of pregnancy related fetomaternal complications amongst women screened for GDM compared with women not screened.

3. RESULTS

A total of 1380 booked patients delivered during the period under review. Only 859 folders were seen: of these, 22 were either belonging to males or showed no relationship to ANC or delivery, 837 folders were thus included for data analysis.

The mean age of women whose records were included in the study was 30.67 4.55 years, with a range of 18 to 48 years. Majority of the women (604; 72.2%) were aged between 30 and 39 years, had tertiary education (475; 60.2%). More than half (464; 55.4%) had one or two previous deliveries. Other details are as found in Table 1.

Of the 837 records reviewed only 31 (3.7%) of women who received antenatal care during the year under review were screened for gestational diabetes (GDM) Table 1.

A comparison of the socio-demographic and maternal characteristics of women who were screened and those who were not shows that parity was significantly higher among women screened for GDM than those not screened. ($\chi 2 = 19.84$; p-value = 0.00). Multiple logistic regression analysis showed that for every unit increase in parity, women had a 63% greater odds of being screened for GDM at the antenatal clinic. (Odds ratio = 0.63; p value= 0.00; C.I = 0.50 to 0.79).

Of the 31 women who were screened for GDM, 28 women representing 3.3% of the study population were diagnosed as having GDM using the most recent WHO screening criteria of fasting blood sugar or two-hour postprandial value of 5.1 or 8.5mmol/ respectively. However, using the old classification of GDM, only 15 women representing 1.8% would have been diagnosed as having GDM.

A comparison of fetomaternal outcomes between women screened for GDM and those not screened for GDM showed comparable proportions for gestational age at delivery, mode of delivery and foetal outcome relating to hypoglycaemia, respiratory distress and neonatal jaundice (Table 3). Also, a significantly higher proportion of babies born to mothers who were screened for GDM were admitted into the Special Care Baby Unit (SCBU) ($\chi 2 = 4.79$; p value= 0.02).

A significantly higher proportion of women with family history of DM/GDM and previous history of DM were found to have GDM ($\chi 2 = 44.42; p = 0.00$ and $\chi 2 = 89.21; p = 0.00$ respectively) (Table 2).

Table 1. Socio-demographic and maternal characteristics of study participants

	Frequency	Valid percent
Age groups (n=837)		
18 to 24 years	7	.8
25 to 29 years	98	11.7
30 to 34 years	308	36.8
35 to 39 years	296	35.4
40 to 44 years	98	11.7
45 years and above	30	3.6
Education (n=789)		
No formal education	2	.3
Primary	26	3.3
Secondary	286	36.2
Tertiary	475	60.2
Parity (n=837)		
Para 0	65	7.8
Para 1 and 2	464	55.4
Para 3 and 4	253	30.2
Para 5 and above	55	6.6
Residence (n=830)		
Rural	137	16.5
Urban	693	83.5
Total	830	100.0
Marital status (n= 829)		
Married	820	98.9
Single	8	1.0
Widowed	1	.1
Religion (n=820)		
Christian	812	99.0
Moslem	8	1.0
GDM screening done? (n=837)		
Yes	31	3.7
No	806	96.3

4. DISCUSSION

This study highlights the necessity for universal screening for GDM. Using selective screening for GDM, only 3.7% of our patients were screened and only 3.3% of our patients were diagnosed using the new WHO criteria. In contrast, in our 2014 prospective study, using the new WHO Criteria, 15.2 % of our patients were diagnosed with GDM [9]. This is the corollary of selective screening as the norm. Pregnancy provides a unique opportunity to screen for, diagnose and manage certain clinical conditions. Gestational Diabetes Mellitus (GDM) is one such condition wherein exists an opportunity to educate the women and promote lifestyle modifications for enhanced health of the entire family. Selective risk based screening of pregnant women for GDM miss a lot of cases thus missing the opportunity for early therapeutic intervention [14]. These women are thus never properly managed or educated about their current and future risks. During implementation of their World Diabetes Foundation project, Sobngwi et al. found that 55% of their cases were missed with selective screening and have thus called for universal screening of GDM in antenatal populations [15] Fawole and colleagues similarly found that one third of the antenatal population are mis-diagnosed as normal when selective screening for GDM is done compared to when a checklist of risk factors is employed to screen pregnant women for GDM [16].

The importance of early and appropriate detection of GDM cannot be overstated. Evidence abounds about the benefit of screening all pregnant women; the large-scale (~25,000 pregnant women) multinational epidemiological study, demonstrated that risk of adverse maternal, fetal, and neonatal outcomes continuously increased as a function of maternal glycemia at 24–28 weeks, even within ranges previously considered normal for pregnancy

[17,18]. With the rise in diabetes especially in sub-Saharan Africa, there is thus urgent need to implement universal screening for GDM in antenatal care facilities.

With regards to fetal outcomes, a higher proportion of women not screened for GDM had poorer outcomes of birth asphyxia and stillbirths compared to women screened for GDM (Table 3). A scenario where women diagnosed with GDM had better outcomes with regards birth asphyxia and stillbirths infers that with a certain diagnosis; more attention and care is placed on the cases thus ensuring optimum outcomes. Significant evidence exists that supports a range of interventions to improve diabetes outcomes as well as reduce the perinatal morbidity and mortality to level comparable to non-diabetic women if properly managed [19,20]. The finding of higher stillbirth and asphyxia rates in the unscreened population in this study may well buttress the fact that with selective screening, cases of GDM are being missed and appropriate care is thus not been delivered. This is further reinforced by studies that have severally highlighted the need for universal screening and optimum care [21–24].

Although the established risk factors for GDM such as advanced maternal age and parity, previous gestational diabetes and family history of diabetes are confirmed (Table 2) in this study, it does not preclude the fact that selective screening missed most of our patients with GDM. We reiterate that the sensitivity of selective (risk based) screening is poor leading to missed cases of GDM. The time for universal screening among African women is now.

Table 2. Comparing socio-demographic and maternal characteristics of those screened for GDM with those not screened

	GDM Screening		Chi-square (p-value)
	Yes	No	
Highest education (n=789)			
No formal	0 (0.0)	2 (0.3)	
Primary	0 (0.0)	26 (3.4)	
Secondary	7 (24.1)	279 (36.7)	3.51 (0.32)
Tertiary	22 (75.9)	453 (59.6)	
Residence (n=830)			
Rural	6 (19.4)	131 (16.4)	0.19 (0.66)
Urban	25 (80.6)	668 (83.6)	
Age category (n=837)			
18 to 24 years	0 (0.0)	7 (0.9)	7.96 (0.16)
25 to 29 years	2 (6.5)	96 (11.9)	
30 to 34 years	7 (22.6)	301 (37.3)	
35 to 39 years	16 (51.6)	280 (34.7)	
40 to 44 years	6 (19.4)	92 (11.4)	
45 years and above	0 (0.0)	30 (3.7)	
Parity (n=837)			
Para 0	0 (0.0)	65 (8.1)	
Para 1 and 2	8 (25.8)	456 (56.6)	19.84 (0.00)*
Para 3 and 4	19 (61.3)	234 (29.0)	
Para 5 and above	4 (12.9)	51 (6.3)	
Religion (n=820)			
Christian	31 (100.0)	781 (99.0)	0.32 (0.57)
Moslem	0 (0.0)	8 (1.0)	
Marital status (n=829)			
Married	31 (100.0)	789 (98.9)	
Single	0 (0.0)	8 (1.0)	0.35 (0.84)
Widowed	0 (0.0)	1 (0.1)	

Table 3. GDM and foeto-maternal outcomes for the study population

	GDM	NON-GDM	Chi-square	p-value
Stillbirth (n=813)				
Yes	2 (7.4)	60 (7.6)	0.002	0.965
No	25 (92.6)	726 (92.4)		
Foetal hypoglycaemia (n=814)				
Yes	1 (3.7)	6 (0.8)	2.65	0.104
No	26 (96.3)	781 (99.2)		
Neonatal jaundice (n=817)				
Yes	1 (3.7)	9 (1.1)	1.42	0.233
No	26 (96.3)	781 (98.9)		
Respiratory distress (n=808)				
Yes	2 (7.7)	35 (4.5)	0.60	0.44
No	24 (92.3)	747 (95.5)		
Apgar score 1 minute (n=757)				
Birth Asphyxia	4 (15.4)	143 (19.6)	0.28	0.60
Good Apgar	22 (84.6)	588 (80.4)		
Apgar score 5 minutes (n=756)				
Birth Asphyxia	0 (0)	57 (7.8)	2.20	0.14
Good Apgar	26 (100.0)	673 (92.2)		
Spontaneous vaginal (n=828)				
Yes	8 (28.6)	385 (48.1)	4.15	0.04*
No	20 (71.4)	415 (51.9)		
Induction of labour (n=817)				
Yes	3 (10.7)	94 (11.9)	0.04	0.85
No	25 (3.5)	695 (96.5)		
Caesarean section (n=824)				
Yes	19 (70.4)	371 (46.5)	5.94	0.015*
No	8 (29.60	426 (53.5)		
Episiotomy (n=819)				
Yes	1 (4.0)	107 (15.6)	2.05	0.153
No	25 (96,2)	686 (86.5)		
Pre-eclampsia (n=827)				
Yes	3 (12.5)	75 (9.4)	0.09	0.76
No	24 (88.9)	725 (90.6)		
Hypertension (n=820)				
Yes	5 (22.7)	87 (11.0)	1.49	0.22
No	22 (81.5)	706 (89.0)		
Mean birth weight				
	GDM	**Non-GDM**	**T-test**	**p-value**
	3.58 (0.86)	3.09 (0.72)	2.17	0.000

**Significant at p<0.05*

This study has a limitation in that it is a retrospective records based analysis. Problems with clinical records continue to plague research in Africa [25–27]. Except for prospective surveys where data collection and entry is controlled by the researcher, manual data entry and retrieval always reveal poor data keeping leading to problematic retrieval and less than excellent analysis. Such prospective research is advocated to further confirm findings of our retrospective research. Of the total study population, almost all variables showed incomplete data entry (Tables 1-3). This limitation however does not preclude the fact that selective screening as practiced in this study and the resultant poor fetal outcomes in the unscreened population may be as a result of the misdiagnosed women who were thus inadequately cared for. The time has come for health facilities in resource limited settings to see beyond the perceived economic gains of selective risk based screening and adopt universal screening. The advantages are well worth it.

5. CONCLUSION

Selective risk based screening for GDM missed cases of GDM as only 3.7% of our antenatal population were screened. A call is herein advocated for universal screening for GDM. The knowledge that in utero, certain processes can affect the risk of developing NCDs provides an opportunity to enforce interventions during the antenatal period, when they are likely to have the greatest effect; one intervention is universal screening for GDM in all pregnant women.

CONSENT

It is not applicable.

ETHICAL APPROVAL

Ethical approval was obtained from the hospital Ethical Committee. The data extraction forms did not carry patients' names. The data entered for analysis was pass worded. The forms were kept in the custody of the researchers only.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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