

Prevalence of 4D Sonography and Multifarious Factors Influencing Facility Delivery among Reproductive-Age Women: Inceptive Experience from a Low-Resource Setting

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Abstract

Background: Maternal mortality is a public health issue in developing countries. The use of 4 Dimensional (4D) ultrasound is pertinent and the choice of delivery in a health facility is expertise-based; however, its performance in influencing the choice of delivery in resource-poor settings is poorly understood. This study aims to identify the factors influencing facility delivery among women of reproductive age in a low resource setting.

Materials and Methods: A cross-sectional study was carried out among women of reproductive age (with their last confinement in the past five years) in the Surulere area of Lagos State, Nigeria. A household survey was carried out using a structured questionnaire. Data from information received were analyzed using SPSS version 23 and a p-value less than 5% was used to declare a significant association.

Results: Of the 385 women recruited into the study, 76.9% were between the ages of 25-38 years, the mean age of respondents was 31.52 ± 0.3 years, 87.5% were married and 98.4% had formal education. Most respondents (87.5%) delivered in health facilities in their last confinement. Respondents (59.2%) are insouciant about the availability of modern (4D) ultrasound equipment for obstetric care. The majority of these respondents delivered in a health facility and had attended more than 4 antenatal clinic visits. Respondents' age, occupation, educational status, husband's educational status, parity, ethnicity, and family income substantially affected the choice of place of delivery ($p < 0.05$).

Conclusion: Findings suggest that the availability of 4D ultrasound minimally influenced the majority of the client's choice of facility delivery. The minority of the respondents show poor consistency with ANC attendance. Health authorities and policymakers should provide community-based health education, awareness creation, and improve better access to information for mothers regarding maternal institutional delivery.

Keywords: 4D sonography; Facility delivery; Reproductive-age women; Low-resource setting

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Introduction

In the last decade, the management of obstructed labor, incomplete miscarriage, single or multiple pregnancies,

molar pregnancy, ectopic pregnancy, placenta previa, fetal abnormality, intrauterine growth restriction, and other obstetric complication has been markedly improved with ultrasound [1,2]. Unfortunately, the availability and quality of ultrasound service

in developing countries are generally poor [3,4]. Ultrasound is operator dependent and significantly effective in the provision of exceptional care by trained personnel [5]. However, there is still a lack of standardized training for ultrasound in obstetrics and gynecology [6]. With the advent of modern ultrasound such as 4D imaging, the use of ultrasound as entertainment or for non-medical purposes is alarming; this pattern of use is therefore discouraged by governments and professional bodies [7]. Numerous advantages of 4D (sonographic tomography) over conventional 2D ultrasonography are but not limited to; less dependency on the operator, a reduction in scanning time, and the chance of standardizing the entire process of performing the obstetric examination [8,9]. Although ultrasound has been widely used in the management in obstetrics, uncertainties arise from its safety, increasing calls for its prudent use and strict adherence to the ALARA (As Low As Reasonably Achievable) principle [10,11]. The place of delivery is a decisive factor that affects the health and wellbeing of the mother and newborn. Institutional deliveries essentially help women to access skilled assistance, drugs, equipment, and referral transport [12]. The provision of qualitative care in a woman's approved place of delivery ensures early detection and prompt management of abnormalities thus reducing complications [12]. A newfangled demographic and health survey revealed that living in urban areas, being wealthy, more educated, availability of optimal Antenatal Care (ANC) services, and lower parity strongly predicted where women delivered [13]. Other studies revealed that education, family size, and residence were important predictors of a place of delivery [14,15]. Some of the factors associated with institutional delivery were four or more ANC, birth order, age at last delivery, and duration of labor [16-18]. Most women deliver at home in developing countries and the identified reasons for the non-utilization of obstetric services to include but not limited to: financial constraints, lack of awareness of maternity waiting homes, no perceived need for such services, and preference for home delivery [19,20]. Despite the existing national programs for improving maternal and child health in Nigeria [21], maternal mortality and morbidity are on the increase and studies proposed that the preponderance of maternal deaths can be curbed or reduced if women had access to maternal health facilities during pregnancy, childbirth and the first month after delivery [22,23]. In Nigeria presently, maternal health is incapable of achieving a sustainable development due to poverty, corruption, misplaced priority, and neo-liberal policies currently resulting in socio-economic dislocation of families [23]. The biased distribution pattern of health facilities in favor of urban areas also reflects the utilization rate of health facilities by rural dwellers mostly constrained by distance to urban areas [21,23,24]. The majorities of obstetric complications usually occur at the time of delivery and cannot be predicted [16,25]. Consequently, all pregnant women must have access to a skilled attendant, someone with midwifery skills who can identify and manage obstetric complications, or refer in time if needed [26]. Skilled attendance at delivery is recommended as the single most important factor in preventing maternal deaths, stillbirths and improving newborn survival [26,27].

Material and Methods

Study settings and design

Surulere Local Government Area in Lagos State (mainland of Lagos), is known for its residential and commercial status having a population of 503,975 inhabitants (260,509 males and 242,356 females) in 2006 census. The population of women of the reproductive age group of 15-49 years is 48,020 which make up 10% of the total population [28]. The health facilities available at Surulere Local Government include; General Hospital Randle, Mother and Child Centre, Gbaja; Havana and Parkland Hospitals, and several Primary Healthcare Centers.

Data collection tools and procedure

The survey was conducted between July and November, 2019. The questionnaire was made up of an open and closed-ended question, interviews were granted to extract data from the respondents. Questions were divided into 3 sections. Section A: Socio-demographic data of the respondents, Section B: Reasons for the choice of place of delivery at last pregnancy and Section C: Pattern of the utilization of the places of delivery. The instrument was developed using study objectives and a review of the findings of comparative study [29]. For aptness and explicability of the population studied, a pilot study was done by administering the questionnaire to thirty-eight (38) women of reproductive age who have had at least one delivery, in another local government close by (Coker/Aguda Local Council Development Area). Responses from these were used to make adjustments and corrections before the final data collection was done.

Sample size determination and sampling procedures

Cochran formula $n_0 = z^2pq/d^2$ was used to estimate the sample size, with the following assumptions deduced while calculating the sample size. The degree of accuracy (d) was set at 0.05 with the interval (z) set at 1.96% (z=1.96). The estimated prevalence, $p=0.05$ and $q=0.5$. This gave a sample size of 385. These comprised of women of reproductive age group (15-49 years), who have had at least one delivery, in the last five years and gave consent (inclusion criteria). A multistage sampling technique was adopted to select 385 reproductive-aged women from the study area. Out of 12 wards in Surulere Local Government Area, simple random sampling was used to select five (5) wards. At each selected ward, simple random sampling was equally used to select one street per ward making it a total of five streets. From the streets, the starting point of the houses was determined by balloting. Other houses were selected systematically using an interval of 5. At the houses selected, the administration of questionnaires was done to respondents that fulfill the inclusion criteria.

Data analysis

Information obtained through the questionnaire, and the interview was analyzed using the Statistical Package for Social Sciences (SPSS) version 23. Frequencies and percentages were

presented as tables. Statistically significant differences ($p < 0.05$) were identified using a chi-square test analysis.

Ethical consideration

Ethical approvals were not sought because the standard confidentiality policies were not employed in this research project. Items seeking personal information (name, phone number, address, etc.) were not included in the questionnaire to promote privacy and confidentiality.

Result

Among 385 respondents, the mean age of the respondent was 31.52 ± 0.3 years. Most respondents with a total of 337 (87.5%) were married. The majority 205 (53.2%) had 3-4 children and 86.2% of the household were headed by their husbands, 43.4% of these husbands have tertiary education. The respondents with children of 5 and above (54.3%) were predominant (**Table 1**). Respondents who are Christians made up 54.3%, 26% are Muslims, 14% are traditionalists and 5.7% are worshippers of other beliefs. 87.5% of the respondents were married. 3.4% were single, 3.1% divorced, 2.6% separated and 3.4% widowed. Among the respondents, 49.9% were Yorubas, 24.4% Igbos, 4.7% Hausas and 21% from other minor ethnic groups. The educational qualification of the respondents showed that 1.6% had no formal education, 8.6% had primary education, 44.7% had secondary education and 45.2% had tertiary education (**Table 1**). About 25 women did not attend ANC in their last confinement due to limited time (1.6%), insufficient finance (3.1%), and complaint of proximity to their homes (1.8%). Family income greater than or equal to ₦ 200, 000.00 (550 USD) made up 53.5% of respondents (**Table 1**).

Table 1: Demographic characteristics of the respondents.

Characteristics of Respondents	Frequency n=385	Percentage %
Age group (in years)		
18-24	38	9.9
25-31	151	39.2
32-38	145	37.7
39-45	51	13.2
Religion		
Christianity	209	54.3
Islam	100	26
Traditional	54	14
Others	22	5.7
Marital status		
Married	337	87.5
Single	13	3.4
Divorced	12	3.1
Separated	10	2.6
Widowed	13	3.4
Ethnicity		
Yoruba	192	49.9
Igbo	94	24.4

Characteristics of Respondents	Frequency n=385	Percentage %
Hausa	18	4.7
Others	81	21
Educational level		
No formal education	6	1.6
Primary	33	8.6
Secondary	172	44.7
Tertiary	174	45.2
Number of children		
2	169	43.9
4	205	53.2
5 and above	11	2.9
Parity		
2	140	36.4
4	222	57.7
5	23	6
Head of household		
Myself	53	13.8
Husband	332	86.2
Family size		
2	15	3.9
4	161	41.8
5 and above	209	54.3
Husband's occupation		
Artisan	25	6.5
Business	101	26.2
Civil servant	49	12.7
Professional	38	9.9
Teacher	3	0.8
Trader	119	30.9
Husband's education Level		
No formal education	4	1
Primary	28	7.3
Secondary	136	35.3
Tertiary	167	43.4
Family's income		
≤ ₦ 200, 000.00	179	46.5
≥ ₦ 200, 000.00	206	53.5
Area of residence		
Densely populated	336	87.3
Sparsely populated	49	12.7
Number of ANC visits		
1	17	4.4
3-Feb	83	21.6
≥ 4	260	67.5
None	25	6.5
Age at first pregnancy		
18-24	247	64.2
25-31	111	28.8
32-38	27	7
Age at last pregnancy		
18-24	39	10.1
25-31	229	59.5
32-38	108	28.1

Characteristics of Respondents	Frequency	Percentage
	n=385	%
39-45	9	2.3
Last confinement		
This year	147	38.2
1-3 years ago	129	33.5
4-5 years ago	109	28.3
Planning of last pregnancy		
Planned	44	11.4
Not planned	341	88.6
Registration for ANC in last confinement		
Registered	360	93.5
Not registered	25	6.5
Number of attendance for ANC		
n=360		
1	17	4.4
2-4 times	86	22.3
>4 times	257	66.8
Reasons for non-attendance for ANC		
n=25		
No time	6	1.6
No fund	12	3.1
Far distance	7	1.8

Fewer respondents (40.8%) would choose the place of delivery in the last pregnancy due to the availability of modern 4D ultrasound equipment (Table 2).

Table 2: Respondents' reasons for choosing place of delivery in last pregnancy.

Reasons (n=385)	Yes (%)	No (%)
Adequate knowledge of normal/danger signs	153 (39.7%)	232 (60.3%)
Availability of modern 4D ultrasound equipment	157 (40.8%)	228 (59.2%)
Previous delivery experience	239 (62.1%)	146 (37.9%)
Fear of surgery	240 (62.3%)	145 (37.7%)
Staffs' attitude to clients	307 (79.7%)	78 (20.3%)
Cheap fees and charges	310 (80.5%)	75 (19.5%)
Affordability based on my salary	274 (71.2%)	111 (28.8%)
Affordability based on my husband's salary	282 (73.2%)	103 (26.8%)
Proximity to home	132 (34.3%)	253 (65.7%)
Affordability of transport	328 (85.2%)	57 (14.8%)
Labour started at night	135 (32.5%)	260 (67.5%)
Cultural belief	196 (50.9%)	189 (49.1%)
Religious influence	279 (72.5%)	106 (27.5%)
Relative's/husband's influence	147 (38.2%)	238 (61.8%)
History of obstetric complications	198 (51.4%)	187 (48.6%)
Promptness of care	332 (86.2%)	53 (13.8%)
Presence of specialist care	278 (72.2%)	107 (27.8%)

Respondents mostly delivered in private hospitals, while a few favored the services of traditional birth Attendants and church facilities. Postnatal care was received by 54.5% of respondents and these occurred mostly in the first and trimester (35.6% and 32.7%). Among the 385 women, 67.5% of respondents rated the services rendered in their place of delivery as worse, while 32.5% said the place of delivery was the best. Regarding willingness to utilize the place again, 52.5% were willing, while 47.5% were not willing. Also, 40.3% were willing to recommend the place to their family/friends while 59.7% were not willing (Table 3).

Table 3: Respondents' rate and pattern of utilization.

Variable	Response	Frequency	Percentage
		n=385	
Place of delivery of last child	Home	46	11.9
	Private hospital	204	53
	Primary health care	29	7.5
	Teaching hospital	97	25.2
	Church	2	0.5
	Traditional birth Attendants' home	7	1.8
Number of times used before last delivery	Nil	23	6
	Once	169	43.9
	Twice	112	29.1
	More than twice	81	21
Delivery in more than one place	Yes	198	51.4
	No	187	48.6
Reception of postnatal care at the last place of delivery	Received	210	54.5
	Did not receive	175	45.5
Number of antenatal visits	1	17	4.4
	4-Feb	87	22.6
	>4	256	66.5
Trimester visit occurred	Nil	25	6.5
	1 st	137	35.6
	2 nd	126	32.7
	3 rd	97	25.2
Rate of services	None	25	6.5
	Excellent	35	9.1
	Good	135	32.5
	Fair	169	43.9
The place of delivery is the best	Poor	56	14.5
	Yes	125	32.5
	No	260	67.5
Reasons for not being the best (n=260)	Non availability of drugs and supplies	77	20
	Bad attitude of staff	80	20.8
	Lack of privacy	68	17.7
	Others	33	8.6
	All of the above	2	0.5

Reasons for being the best (n=125)	Availability of facility	8	2.1
	Privacy	11	2.9
	Good attitude of staff	8	2.1
	Neatness	17	4.4
	Affordability	39	10.1
	Backed delivery with prayers	1	3
	Efficiency of service	41	10.6
Willing to utilize the place again	Willing	202	52.5
	Not willing	183	47.5
Willing to recommend it to a friend/family member	Willing	155	40.3
	Not willing	230	59.7

Although the respondents' religion ($p>0.05$) and marital status ($p>0.05$), did not influence their place of delivery. The age of respondents ($p<0.05$), educational status ($p<0.05$), occupation ($p<0.05$), parity ($p<0.05$), ethnicity ($p<0.05$), family income ($p<0.05$), husbands' education ($p<0.05$) and registration for ANC status ($p<0.05$) were associated with their place of delivery (Table 4).

Table 4: Association between socio-demographic characteristics and place of delivery (n=385).

Determinants	Place of Delivery		χ^2 (p-value)
	Health Facility (%)	Non-health Facility (%)	
Age			
18-24	15 (39.5%)	23 (60.5%)	
25-31	135 (89.4%)	16 (10.6%)	75.77 (0.000)
32-38	136 (93.8%)	9 (6.2%)	
39-45	44 (86.3%)	7 (13.7%)	
Religion			
Christianity	180 (86.1%)	29 (13.9%)	
Islam	87 (87%)	13 (13%)	2.28 (0.516)
Traditional	43 (79.6%)	11 (20.4%)	
Others	20 (90.9%)	2 (9.1%)	
Ethnicity			
Yoruba	156 (81.3%)	36 (18.8%)	
Igbo	80 (85.1%)	14 (14.9%)	10.50 (0.015)
Hausa	18 (100%)	0 (0.0%)	
Others	76 (93.8%)	5 (6.2%)	
Education			
No formal	4 (66.7%)	2 (33.3%)	
Primary	17 (51.5%)	16 (48.5%)	49.66 (0.000)
Secondary	142 (82.6%)	30 (17.4%)	

Place of Delivery			
Tertiary	330 (85.7%)	55 (14.3%)	
Marital status			
Married	284 (84.3%)	53 (15.7%)	
Single	13 (100%)	0 (0.0%)	
Divorced	12 (100%)	0 (0.0%)	6.41 (0.170)
Separated	10 (100%)	0 (0.0%)	
Widowed	11 (84.6%)	2 (15.4%)	
Profession			
Artist	15 (53.6%)	13 (46.4%)	
Business	59 (85.5%)	10 (14.5%)	
Civil servant	60 (98.4%)	1 (1.6%)	
Housewife	12 (50%)	12 (50%)	
Professional	34 (100%)	0 (0.0%)	69.74 (0.000)
Student	11 (100%)	0 (0.0%)	
Teacher	67 (91.8%)	6 (8.2%)	
Trader	49 (80.3%)	12 (19.7%)	
Unemployed	23 (95.8%)	1 (4.2%)	
Parity			
2-Jan	133 (78.7%)	36 (21.3%)	
4-Mar	191 (93.2%)	14 (6.8%)	24.82 (0.000)
5 and above	6 (54.5%)	5 (45.5%)	
Family income			
≤ N200,000.00	143 (79.9%)	36 (20.1%)	
≥ N200,000.00	187 (90.8%)	19 (9.2%)	9.27 (0.002)
Husband's education			
No formal education	3 (75%)	1 (25%)	
Primary education	16 (57.1%)	12 (42.9%)	27.29 (0.000)
Secondary education	108 (79.4%)	28 (20.6%)	
Tertiary education	155 (92.8%)	12 (7.2%)	
Registration for ANC in last confinement			
Registered	316 (87.8%)	44 (12.2%)	19.27 (0.000)
Not registered	14 (56.0%)	11 (44.0%)	
p:<0.05 is statistically significant; ANC: Antenatal Clinic			

Discussion

This study highlights important determinants of place of delivery among women of reproductive age. Knowledge of significant determinants may help formulate public health policies geared towards reducing maternal and perinatal mortality. The use of obstetric ultrasound as a surveillance method has been assumed to be the best means of monitoring of the fetus during and before labor. It effectively gives adequate information about fetal wellbeing than the specifically used cardiotocogram [30], or

symphysis-fundal height measurement which is deficient in obese expectant mothers [31]. In comparison to 2D ultrasound, 4D ultrasound provides a real-time assessment of the face, mouth, eyes, swallowing direction of fetal movements, and breathing movements. The pattern of fetal behavior for each trimester of pregnancy can be easily understood after 15-20 minutes of the 4D ultrasound examination [32]. The present study showed that only 40.8% of respondents would choose the place of delivery in the last pregnancy with or without a 4D ultrasound unit. These findings suggest an associated poor satisfactory outcome from the obstetric ultrasound in comparison to 75% in Bauchi [33], and with an average satisfaction in 53% of respondents in Enugu [34]. A cogent explanation to these differences is that the dense population in Lagos might have overburdened the sonographers and radiologists with high patient load, thus increasing the client's waiting time or the effect of poor communication of sonographic findings to clients.

Factors influencing facility delivery

In the present study, marital status and religion had no statistically significant influence on the place of delivery ($p>0.05$), similar to another study in North-west Nigeria [35], on the other hand, a quantitative study by Al-Mujtaba et al. [36], concluded that barriers to the uptake of maternal health services are minimally impacted by religion. We do, however, concede that there is a chance that our study is influenced by the homogeneity of the respondents. Ethnicity in the present study had a significant influence on the place of delivery similar to other studies [18,37-40]. Maternal education is one of the most important determinants for health service use. It is tenable that better-educated women are more aware of health problems, know more about the availability of health care services, and use this information more effectively to maintain or achieve good health status. In this study, the level of education of women was found to be a statistically significant determinant of the place of delivery. These findings are identical to other studies [15,41-44], and surprisingly different from a study by Yahya et al. [45]. A study in Jos, Nigeria found that the majority of the women who had no formal education and those with primary education opted for home delivery [46]. Husband's education and women with husbands who have tertiary education were likely to utilize health facilities than those with a lower level of education, due to their better understanding of the increased risk associated with home delivery. This is in agreement with another study [47] but disagrees with a study in Eritrea [48].

ANC services give opportunities for health experts to promote a specific place of delivery or offer women information on the status of their pregnancy, this condition expedites their decisions on where to deliver. Early booking of ANC is important as it provides health workers with the opportunity of early detection of the maternal problem and corrective measures are taken to obviate them for the benefit of mother and fetus. The present study showed a significant relationship between respondent's registration for ANC and their choice of place of delivery. Although fewer respondents did not utilize the ANC

(6.5%), it is plausible to say that patient's neglect could lead to poor management outcomes. However, these respondents stated the lack of sufficient funds, no time, and far distance as reasons for the non-attendance of ANC, indistinguishable from previous studies [15,18,26]. Women with a combined family income greater than ₦ 200, 000.00 (550 USD) made up 90.8%. The relationship between occupation and a higher combined family income of respondents and health facility delivery was statistically significant. Our findings are consistent with other studies [43,48,49]. Also women with a higher number of children and larger family size were more likely to opt for facility delivery. This is identical to a study by Abimbola et al. [50]. However, a study by Kifle et al. [48]. suggested that women with a higher number of children would have an unmet need of contraception which influenced negatively on their choice of facility delivery

In our study, the majority of the respondents were 25-31 years of age who delivered in a health facility similar to a study in Uganda [51], and incongruent with other studies [29,46]. The respondents who delivered in a health facility within the last five years were 85.7%. This is similar to a percentage of 88.3% described in a community-based cross-sectional Ethiopian study carried out in an urban setting [29,52] in contrast with another study in Ethiopia carried out in a rural setting that reported that 26.9% of deliveries took place in a health facility [19]. A plausible explanation would be that women living in urban settings are more knowledgeable of the benefits of health facility delivery than their rural counterparts. Urban dwellers show an increased probability to be affluent; affluence is an important determinant of facility delivery in developing countries [18]. Further in this study, 54.5% of the women received postnatal care in their last place of delivery. This high level of satisfaction expressed by respondents was majorly due to the efficiency of service rendered (10.6%), affordability (10.1%), and neatness (4.4%) among others. Numerous studies [15,29], however, reported staff attitude, long waiting time, and cost of services as reasons for establishing their place of delivery as the best for delivery, their indices are consistent to this present study. Finally, more than half (52.5%) of the women showed willingness in using the place for delivery again with 40.3% ready to recommend the place to a friend and/or family member.

Study limitations

There is a possibility of recall bias in the study; some of the respondents might have been unable to accurately recall the information needed in the study. The magnitude of these chances of biases could not be directly and easily established.

Conclusion

Maternal health care services provided by well trained and equipped health workers are widely recognized as an important protective factor against maternal morbidity and mortality. The role of advanced ultrasound equipment is indispensable in the management of obstetric complications. Yet, the availability of this 4D ultrasound in hospitals does not influence the majority

of the client's choice. In the Surulere area of Lagos among the study participants, 85.7% utilized health facility and 14.3% non-health facility for deliveries in the last five years. There were statistically significant associations between women's age, education, occupation, parity, family income, husbands' education, ethnicity, and choice of place of delivery. There were no significant associations between marital status, religion,

and choice of place of delivery. Thus, health authorities and policymakers should provide community-based health education, awareness creation, and improve better access to information for mothers regarding maternal institutional delivery. Also, maternal health services need to continuously sensitize the community so that the number of pregnant mothers delivered in a health facility is increased even further.

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