

Obstetric ultrasound screening service utilization among pregnant women in public hospitals of Ethiopia: Barriers and enablers, 2022. A cross-sectional study

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Abstract

Introduction: All pregnant women should receive an obstetric ultrasound scan before 24 weeks gestation, according to the World Health Organization. However, this can be influenced by a number of barriers, particularly in developing countries. This study aimed to assess reasons for utilization of obstetric ultrasound screening services and barriers to its access among pregnant women in public hospitals of Addis Ababa, Ethiopia.

Method: A descriptive cross-sectional study was done on 404 pregnant women from June 21 to September 20, 2022, in public hospitals in Addis Ababa. Simple and systematic random sampling was used to select the study area and eligible individuals, respectively. Bivariate and multivariable logistic regressions were used to identify factors associated with the dependent variables. An odds ratio with a 95% confidence interval with a p-value less than 0.05% was considered statistically significant.

Finding: In this study, 70.3% of pregnant women utilized prenatal ultrasound. The study participants reported different reasons for utilizing ultrasound services: pregnancy complications; to assess the health status of the baby; to determine the age of the pregnancy and fetal position, and fetal sex determination were the main reasons. The main barriers to utilizing ultrasound were identified as waiting time, financial cost, being attended by students, distance to the service, and lack of privacy.

Conclusion: In the current study, the number of pregnant women utilizing obstetric ultrasound was lower than the World Health Organization recommendation, and diverse barriers influenced utilization of this service. By reducing the cost and patients' waiting time, and increasing awareness of the value of the service, utilization of ultrasound can be improved.

INTRODUCTION

Ultrasound is a diagnostic imaging technique that uses ultrasound waves to detect the cause of a disease or rule out pathology (1). Obstetric ultrasound covers all ultrasound imaging tests carried out throughout pregnancy for a variety of reasons (2). Since the 1950s, ultrasound (US) has been utilized in obstetrics and has become an essential part of current prenatal care (3). Ultrasonography during pregnancy provides critical information that can be used to predict infant outcomes and aid in the detection of abnormalities and chromosomal anomalies (4).

Routine obstetric ultrasound has been one of the most significant advancements in antenatal care globally (5–7). It is helpful for determining multiple pregnancies and gestational age, and it may be associated with a lower likelihood of inductions after 42 weeks (8). The World Health Organization (WHO) recommends that all pregnant women get at least one obstetric ultrasound before 24 weeks of gestational age (GA)(8). The International Federation of Gynecology and Obstetrics (FIGO) recommends that all pregnant women have two US screenings during the first and second trimesters to reduce the risk of unfavorable perinatal outcomes (9).

In addition, the Society of Obstetricians and Gynecologists of Canada (SOGC) currently recommends that all pregnant women be offered an ultrasound between 18 and 22 weeks post-conception to check for fetal anomalies and provide information about the placenta, gestational age, and number of fetuses. In addition, between 11 and 14 weeks of pregnancy, all pregnant women should be offered an ultrasound to confirm gestational age and viability, as well as to study the number of fetuses, early anatomical assessment, and nuchal translucency. However, the use of ultrasound scan services by pregnant women remains a global challenge (1), frequently influenced by socioeconomic, health worker, and health facility variables (10), as well as women's literacy levels (11).

The use of ultrasound scans by pregnant women varies widely across the globe. In western medicine, it has nearly universal coverage in obstetrics, where routine screening is an integral part of the prenatal examination (12,13). The use of obstetric ultrasound was found to be relatively high in rural eastern China, impacted by diverse socio-demographic and clinical

factors such as the availability and accessibility of services as well as access to information (14).

In Sub-Saharan Africa, the use of ultrasound scans by pregnant women also varies (10), its use limited by several factors (12). In Lagos State, Nigeria, there was an increase in the use of ultrasound scans by pregnant women (15), whereas in Kano, Northern Nigeria, there was a decrease in the use of ultrasound scans (16). In eastern Africa, the use of obstetric ultrasound by pregnant women also varies (17). In Nairobi, Kenya, the use of ultrasound scans by pregnant women is influenced by women's awareness of the services and their benefits, the availability of services, customer care, the availability of support, and the quality of the services offered (17). In Uganda, the services are more popular in towns and urban centers than in rural areas, which was linked to poverty, education level, lengthy distance to health facilities, lack of services, and perceived poor quality of services (18).

In addition to a lack of standardized obstetric ultrasonography training guidelines for health professionals in Sub-Saharan Africa (SSA), pregnant women's lack of knowledge about the utility of obstetric ultrasound has contributed to low service uptake (19). Mixed cultural and societal opinions of sonography services in developing countries, as well as a lack of effective communication between caregivers and pregnant women, are believed to influence service uptake (20). The limitations of adequate technology and a lack of trained staff further inhibit service utilization (21). There are only a few studies that assess barriers and enablers that influence utilization of obstetric ultrasound screening services in public hospitals in Ethiopia, and no studies have been conducted in Addis Ababa. This study therefore aimed to assess barriers and enablers that influence utilization of obstetric ultrasound screening services among antenatal women in public hospitals in Addis Ababa, Ethiopia.

Method

Study design, setting and period

A descriptive cross-sectional study was undertaken among pregnant women in public hospitals in Addis Ababa from June 21-September 20, 2022. Addis Ababa is Ethiopia's capital and largest city, with eleven sub-cities and a population of 2,739,551 people according to the 2007 census (22). There are fifty four governmental and private hospitals in Addis

Ababa (23). Among the governmental hospitals, thirteen hospitals provide antenatal care services.

Source and study Populations

All pregnant women attending antenatal care (ANC) services in public hospitals in Addis Ababa during the study period and selected pregnant women attending their regular ANC at the time of data collection and fulfilling the inclusion criteria were the source and study populations respectively.

Inclusion and exclusion criteria

Pregnant women who presented for antenatal care within the study period were included in the study. Pregnant women who were acutely and severely ill at the time of data collection.

Sample Size Determination and Sampling Technique

Sample size determination: the sample size was calculated based on a single population proportion formula using the following assumptions: The obstetric ultrasonography screening service was used 60.7% of the time (24).

$$n = (Z_{\alpha/2})^2 p(-p) / d^2$$

$Z_{\alpha/2}$ is the standardized normal distribution value at the 95% confidence interval level, p is the proportion of obstetric ultrasound utilization, and d is the margin of error, which was set to 5%. After adding a 10% non-response rate, the total sample size was 404.

Sampling Techniques: By using a simple random sampling technique, four public hospitals providing ANC were chosen: Zewditu Memorial Hospital, Tirunesh Beijing Hospital, Gandhi Memorial Hospital, and Abebech Gobena MCH Hospital. The sample was assigned to health facilities proportionally based on the average number of clients receiving ANC at each hospital, and the previous month's performance report was used as a reference to estimate the client load (ANC load) in each hospital. Accordingly, there were 1950 pregnant women on ANC in Zewditu Memorial hospital, 1750 pregnant women in Abebech Gobena MCH Hospital, 1200 pregnant women in Gandhi Memorial Hospital, and 1500 pregnant women in Tirunesh Beijing Hospital.

As a result, Zewditu Memorial Hospital received 112 of the sample size, Abebech Gobena MCH Hospital received 106, Gandhi Memorial Hospital received 105, and Tirunesh Beijing Hospital received 81. A systematic random sampling technique was used to select study participants and every sixteenth pregnant mother was selected for an interview. The respondent was selected in the order in which they came to

health facilities and the first study participant was determined randomly.

Data Collection Methods and Instruments

The data were collected using structured questionnaires. A data collection tool was adopted from previous investigations (24,25) and contextualized to the study setting. Information was collected about socio-demographic factors, ultrasound utilization services, barriers to utilization, the willingness of women for exams, and other associated data using an interviewer-administered questionnaire. The tool was first prepared in English and then translated into Amharic. After the collection the data were translated into English using language expertise. After participating in the study participants received antenatal care services.

Data quality assurance and management

To improve data quality, it was collected by trained data collectors and supervisors who had Bachelor of Science in midwifery using an interviewer-administered questionnaire. They were given two days of training on the overall procedure of the study. Data quality was ensured prior to data collection, during data collection, and after data collection. Before data collection, the questionnaires were translated into Amharic, and a pretest was conducted on 5% of the sample size. Supervisors and the principal investigator conducted close follow-up during data collection. After collection, data were checked for completeness, and using Epi data aids in automatically detecting errors that occur during data entry. Data editing was done by the data collectors, supervisors, and the principal investigator in the field, followed by further coding and entry on the computer.

Data entry and analysis

Data was input into Epi Data version 7.2.31 software after coding and confirming completeness and exported to the Statistical Package for Social Science (SPSS) version 23.0 once the question number in the questionnaire was recognized and the proper variable name was given by data coding. Binary logistic regression was used to determine the association between the dependent and independent variables. All variables with p value less than 0.2 in the bivariate analysis were transported to multiple logistic regression analysis to identify independent variables associated with the dependent variable. The significance of the association in multiple logistic regression analysis was declared at a p -value less than 0.05 and presented using an adjusted odds ratio.

The 95% confidence level and p-value of less than 0.05 were considered significant. An odds ratio at a 95% confidence interval was used to assess the strength of the association, and a p-value less than 0.05 was considered significant. The model's fitness test was checked by Hosmer and Lemeshow. Multicollinearity was checked using the variance inflation factor (VIF) and tolerance test. Generally regression result shows VIF of less than two and tolerance of greater than 0.3. Finally, the results were presented in the form of texts, tables, and graphs.

Result

Socio-demographic characteristics of the study participants

This study included a total of 404 pregnant women, with a mean age of 23.8 (Standard deviation (SD): ± 4.56). The majority of the respondents (85.4%) were married, 43.1% of them had completed high school, 40.1% were government employees, and few of them were housewives (**Table 1**).

Table 1: Socio-demographic characteristics of pregnant women in public hospitals of Addis Ababa, Ethiopia, 2022

Variables	Category	Frequency	Percentage
Age	15-19	42	10.4
	20-24	212	52.5
	25-29	117	29.0
	≥ 30	33	8.2
Marital status	Single	17	4.2
	Married	345	85.4
	Divorced	25	6.2
	Widowed	17	4.2
Educational level of the participant	No formal education	11	2.7
	Elementary (1-8)	87	21.5
	High school (9- 12)	180	44.6
	Diploma	100	24.8
Educational level of the parent/husband	Degree and above	26	6.4
	No formal education	5	1.2
	Elementary (1-8)	80	19.8
	High school (9-12)	174	43.1
Occupation	Diploma	37	9.2
	Degree and above	100	26.7
	Housewife	33	8.2
	Government Employed	162	40.1
	Self-employed	147	36.4
Household income per month	Student	45	11.1
	Other	17	4.2
	<1000	21	5.2
	1000-5000	208	51.5
	>5000	175	43.3

Obstetric History of the Study Participants

From a total of 404 pregnant women, three hundred twenty-eight responders (81.2%) were multigravida. Twenty-nine (7.2%) of those interviewed had a history of congenital abnor-

malities at birth, while eighty-one (20.0%) had had an abortion. The details of the obstetric history of the study participants are presented in **Table 2**.

Table 2: Obstetric history of pregnant women in public hospitals of Addis Ababa, Ethiopia, 2022

Variable		Frequency	Percentage
Gravida	Multigravida	328	81.2
	Primigravida	76	18.8
Gestational age of the current pregnancy	1 st Trimester(<3months)	34	8.4
	2 nd Trimester(3-6months))	175	43.3
	3 rd Trimester(>6months)	183	45.3
	unknown gestational age	12	3.0
Number of ANC visits	One	50	12.4
	Two	94	23.3
	Three	233	57.7
	Four and above	27	6.7
Weeks of ANC Initiation	<16	153	37.9
	≥16	251	62.1
History of congenital anomalies at birth	Yes	29	7.2
	No	375	92.8
History of Abortion	Yes	81	20.0
	No	323	80.0

Information and exposure of pregnant women toward ultrasound

Out of 404 pregnant women, 99% had heard of obstetrical ultrasonography. More than half, 207 (51.2%) of participants mentioned health care providers as their primary source of information about obstetric US; 99 (24.5%) claimed their information came from social media, 43 (10.6%) heard about US from family and friends, 31 (7.7%) from TV or radio, and the remaining had heard about US from other sources.

Two hundred twenty-one (54.7%) of pregnant women had an obstetric ultrasound scan during their previous pregnancy, and 262 (64.9%) women had an ultrasound exposure for reasons other than pregnancy.

Utilization of Obstetric ultrasound Screening Services by Women

The majority of respondents (70.3%) had undergone obstetric

ultrasound screening in their current pregnancy. Of these, 36.1% of those screened were scanned once, 25.5% twice, and 8.7% three or more times. More than half (51.0%) of the study participants consider two ultrasound examinations to be ideal during their pregnancy, 26.5% claimed three times is ideal, 15.1% claimed one, 5% claimed four and above; and 2.5% do not know what number of ultrasound examinations are ideal during pregnancy.

Enablers for utilizing ultrasound services

According to this study, different reasons were listed for utilizing ultrasound services. Overall, 93.3% went for the services to know the health status of the fetus, and 90.3% utilized the service if there were complications of pregnancy. (Table 3).

Table 3: Enablers pregnant women utilize ultrasound services in public hospitals of Addis Ababa, Ethiopia, 2022.

Characteristics	Yes	Percentage
If there are complications of pregnancy	365	90.3
To determine the age of pregnancy	353	87.4
To assess health status of the baby	377	93.3
Discover fetal position	330	81.7
Know expected date of delivery	152	37.6
Know fetal Sex	277	68.6
Visualize image of the baby	94	23.3
To confirm pregnancy	320	79.2

Barriers to Accessing Ultrasound Screening

Study results showed that 322 respondents (79.7%) reported long waiting times, followed by (58.4%) who reported being

attended by students, as the major barriers to utilizing ultrasound services (**Table 4**).

Table 4: Barriers in accessing ultrasound services by pregnant women in public hospitals of Addis Ababa, Ethiopia, 2022.

Characteristics	Yes	Percentage
Long waiting time	322	79.7
Lack of privacy	145	35.9
Financial problem/lack of money	222	55.0
Rough handling by health workers	177	43.8
Being attended by students	236	58.4
Previous ultrasound experience	79	19.6
Sex/gender of service provider	72	17.8
Fear of side effects associated with ultrasound	175	43.3
The long distance from my residence to the health facility	206	51.0

Factors associated with the Utilization of obstetric ultrasound

In the bivariate logistic regression analysis, educational status, marital status, occupation of pregnant women, monthly household income, gravida, gestational age of current pregnancy, number of ANC visits, and previous ultrasound exposure for reasons other than pregnancy were associated with the utilization of obstetric ultrasound.

Pregnant women whose educational status was limited to primary schools were nearly four times more likely to utilize obstetric ultrasound compared to those with no formal education. Similarly, compared to women who identified as housewives, government-employed women were 4.3 times more likely to use obstetric ultrasound, and self-employed women were nearly six times more likely. In multivariate analysis, the educational status of pregnant women, occupation, and previous ultrasound exposure were each significantly associated with the utilization of obstetric ultrasound (**Table 5**).

Table 5: Bivariate and Multivariate Analysis of Factors associated with utilization of obstetric ultrasound among pregnant women in public hospitals of Addis Ababa, Ethiopia, 2022.

Variable		Utilization of Obstetric US		COR (95%CI)	AOR(95%CI)	P value
		Yes	No			
Educational status of women	No formal education	9	8	1	1	
	Elementary(1-8)	66	19	3.91(1.0-15.2)	5.33(1.18-23.9)	.029*
	High school(9-12)	117	61	1.26(.42-3.79)	1.09(.32-3.63)	.883
	Diploma	70	27	2.29(.82-6.35)	2.21(.70-6.92)	.172
	Degree and above	22	5	1.69(.58-4.930)	1.69(.51-5.62)	.389
Occupation	Housewife	30	3	1	1	
	Government employed	113	49	4.33(1.26-14.88)	4.15(1.16-14.80)	.028*
	Self-employed	94	53	5.63(1.64-19.36)	5.78(1.56-21.36)	.008*
	Student	31	14	4.51(1.17-17.32)	5.35(1.31-21.77)	.019*
	Other	16	1	.62(.06-6.500)	.70(.06-7.84)	.778
GA of current pregnancy	1 st Trimester	29	5	1	1	
	2 nd Trimester	122	53	2.52(.92-6.86)	1.61(.55-4.75)	.382
	3 rd Trimester	123	60	2.82(1.04-7.67)	1.84(.61-5.49)	.275
	Unknown GA	10	2	1.16(.19-6.95)	.91(.13-6.06)	.929
Exposure to US	Yes	198	64	.49(.32-.77)	1.71(1.04-2.82)	.034*
	No	86	56	1	1	
Marital Status	Single	8	9	1	1	
	Married	243	102	.37(.14-.99)	.49(.16-1.14)	.197
	Divorced	19	6	.28(.07-1.050)	.31(.06-1.39)	.127
	Widowed	14	3	.19(.04-.91)	.26(.04-1.45)	.126
Monthly household income	< 1000	17	4	1	1	
	1000-5000	152	56	1.56(.50-4.85)	1.50(.45-5.01)	.507
	>5000	115	60	2.21(.71-6.88)	2.07(.61-6.95)	.238
Gravidity	Multigravida	236	92	.66(.39-1.12)	1.06(.58-1.94)	.827
	Primigravida	48	28	1	1	
Number of ANC visit	Once	38	12	1	1	
	Twice	56	38	2.14(.99-4.63)	2.62(1.13-6.07)	.025
	Three times	169	64	1.19(.59-2.43)	1.61(.74-3.53)	.227
	Four and above	21	6	.90(.29-2.760)	1.03(.32-3.34)	.951

Discussion

The proportion of prenatal ultrasound utilization in this study was 70.3% (95%CI: 1.25-1.34). This finding is higher than those of previous studies in Jimma Town (60.7%) (24) and the southeast of Nigeria (58%) (15). The discrepancy may be due to variation in socio-demographic factors such as living in urban vs. rural areas, and the long distances for rural residents to health facilities with ultrasound that prohibit them from utilizing the examination. This study's findings were lower than those of previous research in Northern Nigeria (83.5%) (26), rural eastern China (96.1%)(14),and the United Kingdom (96%) (27). This variation is most likely related to

health policies toward mother and child health care between countries. It seems that advancement and reform in maternal and child health policies in China and the United Kingdom enables women to utilize diagnostic imaging relatively easily.

The result of this study revealed a strong association between the educational status of women and utilization of obstetric ultrasound. Pregnant women with elementary level education were 5.33 times more likely to utilize prenatal ultrasound than those with no formal education. This may be due to accessing information and understanding the purpose of ultrasound examination during pregnancy.

Women's occupation was another socio-demographic variable associated with utilization of obstetric ultrasound. In this

study, government-employed women were 4.15 times, self-employed women 5.78 times, and women working as a student 5.35 times more likely to utilize obstetric ultrasound than those women working as housewives. This is probably due to the accessibility of better information and awareness about prenatal ultrasound for women working outside the home.

Women's previous exposure to ultrasound was another variable that was significantly associated with the utilization of obstetric ultrasound. Those respondents with previous exposure to ultrasound were 1.71 times more likely to utilize prenatal ultrasound than those who had no previous exposure. This might be because of their understanding of its purposes and benefits, such that they readily go for the examination.

In this study, a variety of barriers to obstetric ultrasound services have been identified. The long waiting time for the examination was the main barrier to utilize obstetric ultrasound service. This finding is in line with a study conducted in Mulago Hospital, Uganda, where 62% of pregnant women reported that long waiting times for the examination were barriers to utilizing ultrasound services. This is primarily due to the scarcity of ultrasound professionals and the scarcity of ultrasound equipment for pregnant women.

In this study, the expense of ultrasound services were also shown to be common barriers to using ultrasound services. This finding is consistent with the study conducted in five low- and middle-income countries, in which 71% of patients referred did not seek to be examined due to the high costs involved, and 16% could not afford bus fare to the referral health facilities that had ultrasound machines (28).

Fear of ultrasound side effects was another deterrent to using ultrasound services. This is most likely due to pregnant women's lack of knowledge about ultrasound. In this study, rough treatment by health workers and attendance by students were also barriers to pregnant women using ultrasound. This finding was in line with a study conducted in Uganda (29).

In a study to examine maternal perceptions of barriers to prenatal ultrasonography utilization in northern Nigeria (2) and Kajiado and Kisii Counties in Kenya (30), respondents identified distance to service, financial cost, waiting time, and satisfaction with service as major issues. The findings are comparable to the results of this study, in which customer service, level of privacy, and waiting time were found to be key factors in ultrasound service utilization.

In this study, the majority of the pregnant women utilized obstetric ultrasound if there were pregnancy complications to determine the health status of the fetus as well as the gestational age of the fetus. This study also shows that women also willingly use ultrasound to determine fetal sex/gender.

Conclusion and Recommendation

Given its demonstrated benefits, ultrasonography remains one of the most significant improvements in prenatal care worldwide. However, long waiting times, cost, fear of side effects associated with ultrasound, long distance to health facilities, and being attended by students are major barriers to utilization of this essential service. Increasing the number of trained ultrasound professionals and ultrasound machines could help to reduce patients' waiting time and possibly cost of the scans. Creating more awareness of the value of ultrasound and allowing students to administer exams only under the supervision of qualified professionals may also help to increase utilization of obstetric ultrasound.

Declaration

Ethical approval and consent to participate

Ethical approval and clearance were obtained from Addis Ababa Research and Emergency Management Directorate's Institutional Review Board. Permission was also obtained from the concerned bodies in the study area. Prior to data collection, oral informed consent was obtained from each study participant, and for those with no formal education, the informed consent was obtained from a legally authorized representative. The study was also carried out following relevant guidelines and regulations according to the Helsinki Declaration.

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Conflicts of interest

The authors declare no conflict of interests.

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Availability of data and materials

All data included in this manuscript can be accessed by the corresponding author upon request through the email address.

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