

Factors associated with obstetric ultrasound screening behavior during antenatal care at public health centers in Palu City

Ketut Suarayasa,¹ Miranti Miranti,¹ Sumarni Sumarni,¹ Elli Yane Bangkele,¹ Andi Nuraspianti²

¹Department of Public Health Community Medicine, Faculty of Medicine, Tadulako University, Palu City; ²Health Office of Palu, Palu City, Indonesia

Abstract

Antenatal screening by general practitioners in primary care using basic obstetric ultrasound aims to identify suspected pathological cases early. Early detection allows for timely intervention,

Correspondence: Ketut Suarayasa, Department of Public Health Community Medicine, Faculty of Medicine, Tadulako University, Palu City, Indonesia.

E-mail: suarayasa@yahoo.com

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potentially preventing complications. This study analyzed factors related to the knowledge, attitudes, and practices of pregnant women utilizing ultrasound for antenatal care in Palu City. A mixed-methods study with a quantitative approach was conducted on 380 pregnant women from 14 public health centers in Palu City using proportional random sampling with pregnant women and Maternal and Child Health (MCH) program officers at the Palu Health Office. Quantitative data were collected using a structured questionnaire that was adapted and modified from existing literature. Researchers visited mothers' homes to obtain information on socio-demographic factors, obstetric history, and knowledge and attitudes towards obstetric ultrasound scans. For the qualitative study, researchers conducted observations and in-depth interviews to explore sources of information about ultrasound, as well as knowledge, attitudes, practices, and barriers related to obstetric ultrasound during antenatal care. Bivariate and multivariate logistic regression were used to identify associated factors. The study found that 70.8% of pregnant women had good knowledge about obstetric ultrasound, and 77% had positive attitudes. Ultrasound was accessed by 55.4% of women on their first visit (K1) and 57.0% on their fifth visit (K5). Significant factors associated with knowledge included having a bachelor's degree or higher (AOR 2.70; 95% CI 0.21-35.23), being a government employee (AOR 3.901; 95% CI 1.92-7.90), and previous exposure to ultrasound (AOR 1.966; 95% CI 1.24-3.12). Factors significantly associated with the practice of ultrasound screening were higher education (AOR 3.17; 95% CI 0.54-21.20), government employment (AOR 4.53; 95% CI 1.17-15.18), good knowledge (AOR 3.71; 95% CI 1.71-11.23), and positive attitudes (AOR 11.07; 95% CI 2.09-17.20). Educational level, occupation, and previous exposure to ultrasound significantly influenced knowledge about obstetric ultrasound. The practice of ultrasound screening was significantly associated with education level, occupation, knowledge, and attitudes.

Introduction

Ultrasound is one of the medical imaging technologies used to monitor fetal development in the womb, alongside its various other applications. The primary objective of ultrasound is to aid in diagnosing fetal development in each trimester.¹ In many countries, ultrasound scanning is considered a standard practice for prenatal diagnosis and has been integrated into antenatal care due to its potential to enhance the quality of antenatal care.^{2,3}

Obstetric ultrasound screening has become an integral component of antenatal care worldwide, offering valuable insights into fetal development and potential complications. However, the utilization of this technology varies significantly across different regions and healthcare settings. In low- and middle-income countries, access to and uptake of obstetric ultrasound screening may be limited due to various factors, including resource constraints,

cultural beliefs, and lack of awareness among pregnant women.⁴

The International Federation of Gynecology and Obstetrics (FIGO) also recommends that all pregnant women undergo ultrasound scanning twice during their pregnancies to mitigate the risk of adverse perinatal outcomes. Nevertheless, this practice carries potential risks to pregnant mothers, including diagnostic errors and potential biological effects.⁵ Several studies have shown that mothers' knowledge and attitudes towards obstetric ultrasonography are crucial, as these influence their decisions to undergo pregnancy investigation.^{6,7} In Palu, the implementation of basic obstetric ultrasound examinations in primary care, particularly at public health centers, has been initiated since 2022. Since the introduction of ultrasound services at public health centers, there has been a notable increase in the enthusiasm of pregnant women for prenatal check-ups. This study aimed to analyze the factors associated with ultrasound screening behavior during antenatal care in primary care settings, including the knowledge, attitudes, and practices of pregnant women regarding the use of ultrasound for pregnancy examinations.

Materials and Methods

This study employed a mixed-methods approach, combining quantitative and qualitative methods. The quantitative method, with a cross-sectional design, was conducted over a four-month (February–May 2024) period at 14 public health centers in Palu City. The study population included all pregnant women who received antenatal care at these health centers in 2023, totaling 7,833 subjects. The sample size was determined using the Slovin formula with a 95% confidence level, resulting in a sample size of 380 pregnant mothers. A proportional random sampling technique was employed, with the sample size for each health center adjusted based on the number of antenatal visits, as detailed in Table 1.

In the quantitative study, the research variables included: i) independent variables: socio-demographic factors (age, respondent's education status, marital status, monthly income, husband's education status, respondent's occupation) and obstetric factors (parity, gestational age, previous obstetric complications, number of antenatal visits); ii) dependent variables: knowledge and atti-

tudes towards obstetric ultrasonography examinations. Knowledge was assessed by measuring the accuracy of respondents' answers to questions regarding ultrasound indications, procedures, and potential benefits. Attitudes were measured by assessing their level of agreement with statements related to their perceptions, feelings, and beliefs about ultrasound examinations.

Quantitative data were collected using a structured questionnaire that was adapted and modified from existing literature. Researchers visited mothers' homes to obtain information on socio-demographic factors, obstetric history, and knowledge and attitudes towards obstetric ultrasound scans. For the qualitative study, researchers conducted observations and in-depth interviews to explore sources of information about ultrasound, as well as knowledge, attitudes, practices, and barriers related to obstetric ultrasound during antenatal care. Interviews were held with 14 pregnant women, each representing one of the 14 public health centers in Palu City, and included one key informant responsible for the Maternal and Child Health (MCH) program at the Palu Health Office. In the quantitative study, researchers used a structured questionnaire adapted and developed from prior literature to collect data. This questionnaire gathered information on socio-demographic factors, obstetric history, and knowledge, attitudes, and practices regarding obstetric ultrasonography. Upon data collection, researchers reviewed the data for completeness and consistency before inputting it into the Statistical Package for the Social Sciences (SPSS) version 26.0. Binary logistic regression was utilized to examine the relationships between dependent and independent variables. Factors with a p-value of less than 0.25 in the bivariate analysis were incorporated into the multivariate logistic regression analysis to identify variables associated with the dependent variable. Significance in the multivariable logistic regression was indicated by a $p < 0.05$, and results were reported using Adjusted Odds Ratios (AOR). A 95% confidence level and a $p < 0.05$ were considered statistically significant. For the qualitative study, researchers conducted in-depth interviews with several informants using structured interview guidelines. The audio recordings of these interviews were transcribed for thematic analysis. Data reliability was ensured throughout the procedure using four key methods: credibility, dependability, confidentiality, and transferability.

Table 1. Sample size based on the public health centers in Palu City.

Public health center	Number of antenatal care visits	Sample size
Singgani	508	25
Talise	894	43
Birobuli	799	39
Kawatuna	726	35
Mabelopura	585	28
Nosarara	485	24
Bulili	501	24
Kamonji	528	26
Sangurara	1067	50
Tipo	229	12
Mamboro	360	17
Tawaeli	321	16
Pantoloan	311	15
Lere	519	26
Total	7.833	380

Ethical approval

All stages of this study were conducted following ethical recommendations from the Health Research Ethics Commission (KEPK) of the Faculty of Medicine, Tadulako University (1277/UN 28.1.30/KL/2024).

Results

Socio-demographic of study participants

A total of 380 pregnant mothers participated in this study. The socio-demographic characteristics of respondents are shown in Table 2, which reveals that the majority of the study participants were aged 20–29 years (48.2%). Most (94.7%) were still with their partners (married) and had at least a high school education (39.7%). The most common occupations were housewives (50.3%), with the majority of households having a monthly income of <1,000,000 IDR (64.2%). This income level affects pregnant mothers' purchasing power for adequate and nutritious food intake.

Obstetric history of respondents

The obstetric history of respondents indicates that a significant majority (72.6%) were multigravida, with more than half (52.4%) having attended three antenatal care visits. Additionally, 73.9% of the study participants initiated antenatal care services at 16 weeks or later. Notably, over half (50.5%) of them had been exposed to information about ultrasound during antenatal care (Table 3).

Knowledge of pregnant women about obstetric ultrasound examinations

Mothers' were asked about their knowledge on the merits of

obstetric ultrasound (Table 4). The findings reveal that 70.8% of the women demonstrated good knowledge about the merits of obstetric ultrasonography, while the remaining 29.2% had limited knowledge. The most commonly known benefits of ultrasound among mothers were its ability to confirm pregnancy (96.6%), determine fetal sex (89.7%), and determine gestational age (89.2%). These advantages (confirming pregnancy, determining fetal sex, and gestational age) were the main reasons for the increased visits of pregnant women to health centers in Palu City, as revealed in interviews with several respondents:

“During my first and second pregnancies, I only attended check-ups at the integrated service posts known as Posyandu. Now, I wish to visit the health center for an ultrasound (US). I want to know my baby's gender, hoping for a boy since my two older children are girls (laughing) ...” (Mrs. BA, 32 years).

“I plan to visit the health center for an ultrasound check-up. I want to monitor my baby's condition. I often experience vomiting and worry that my baby might not be receiving adequate nutrition (laughing) ...” (Mrs. TA, 25 years old).

Attitudes towards obstetric ultrasound examinations

Pregnant women exhibited several compelling attitudes towards undergoing ultrasound scans at health centers. A significant majority believed in the safety of ultrasound during pregnancy (87%), perceived ultrasound as an essential examination during pregnancy (86.7%), and trusted that ultrasound findings were more accurate (79.9%). Furthermore, the most prevalent belief was that ultrasound scans are legally permitted (94.8%). Although the respondents were not familiar with specific regulations, they were confident that ultrasound check-ups were legally compliant (Table 5). The majority of pregnant mothers considered knowing the gender of their baby to be very important (87.7%), yet none supported

Table 2. Socio-demographic characteristics of pregnant women at the Public Health Centers in Palu City.

Variable	Category	n	%
Maternal age (years)	<20	59	15.5
	20-29	183	48.2
	30-35	122	32.1
	>35	16	4.2
Marital status	Married	360	94.7
	Divorced	8	2.1
	Widowed	12	2.2
Maternal education	Illiterate	21	5.5
	Primary	22	5.8
	High school	151	39.7
	Diploma	89	23.4
	Bachelor or higher	97	25.6
Husband's education	Illiterate	9	2.4
	Primary	113	29.7
	Secondary	169	44.5
	Diploma	10	2.6
	Bachelor or higher	79	20.8
Maternal occupation	Housewife	191	50.3
	Government employee	64	16.8
	Private employee	115	30.3
	Entrepreneure	10	2.6
Household monthly income (IDR, Indonesian Rupiah)	<1,000,000	244	64.2
	1,000,000-5,000,000	88	23.1
	>5,000,000	48	12.7

the idea of terminating the pregnancy if the baby's sex differed from their preference. Mrs. RB articulated the significance of knowing the baby's gender:

"... I think it is important so that a name can be prepared, whether it is a boy or a girl. Clothes can also be prepared..."

When questioned about her reaction if the sex of her baby differed from expectations based on an ultrasonography scan, and whether she would consider terminating the pregnancy, Mrs. RB firmly replied:

"Of course not... The baby must be cared for. Accept whatever the gender is. It is a gift from God..."

Pregnant women's practice of obstetric ultrasound

Among the 380 pregnant women, 210 (55.4%) accessed antenatal care with ultrasound at their first visit, while 217 (57.0%) did so by their fifth visit. The highest coverage for both the first (K1 US=93.7%) and fifth (K5 US=88.6%) ultrasound visits was recorded at Mabelopura Health Center. Conversely, Tawaeli Health Center reported the lowest coverage, with 11.2% for the first ultrasonography visit and 11.8% for the fifth ultrasound (Table 6).

Interviews with the person in charge of the Maternal and Child Health program at the Palu City Health Office highlighted several factors influencing the variability in ANC coverage for ultrasonography. These factors include inadequate socialization and information dissemination about ultrasound during pregnancy, the absence

Table 3. Obstetric history of pregnant women at the Public Health Centers in Palu City.

Variable	n	%
Gravidity		
Multigravida	276	72.6
Primigravida	104	27.4
Number of antenatal care visits		
1	56	14.7
2	95	25.0
3	199	52.4
≥ 4	30	7.9
First antenatal care visits timing		
< 16 weeks	99	26.1
≥ 16 weeks	281	73.9
History of abnormal or congenital anomalies		
Yes	17	4.5
No	363	95.5
History of abortion		
Yes	73	19.2
No	307	80.8
Exposure to information on ultrasound		
Yes	192	50.5
No	188	49.5

Table 4. Knowledge about obstetric ultrasound among pregnant women in Palu City.

Knowledge about Ultrasound benefits	Yes	%
Confirm pregnancy	367	96.6
Confirm the presence of multiple pregnancies	322	84.7
Confirm the presence of abnormal pregnancies (ectopic, molar)	241	63.4
Confirm fetal well-being	283	74.5
Detect defects or congenital anomalies during pregnancy	223	58.7
Monitoring of pregnancy complications	200	52.6
Determine the fetal position, cord, and placenta	241	63.4
Detect amniotic fluid volume	215	56.6
Determine fetal sex	341	89.7
Determine gestational age	339	89.2
Provide information about fetal weight	181	47.6
Estimate delivery time	144	37.9
Estimate delivery method (normal/cesarean)	86	22.6
Good knowledge	269	70.8
Poor knowledge	111	29.2

of innovative health centers program targeting pregnant women, and the level of attention health center management gives to maternal health. Mrs. AY (46 years old) explained:

“Some health centers have reached their targets, but others have not. The main reasons include the role of health center leaders in prioritizing programs and the lack of socialization to pregnant mothers and the community. Nowadays, there are many media that can be utilized for information dissemination.”

She further noted:

“In successful health centers, they implement innovative programs such as home visits, which increase coverage rates.”

Factors associated with knowledge of obstetric ultrasound

In the bivariate logistic regression analysis, seven variables were found to be associated with knowledge about obstetric ultrasonography: age, education level of respondents, education level of parents or partners, occupation, number of antenatal visits, congenital anomaly history, exposure to ultrasound for reasons other than pregnancy, experience of pregnancy, and prenatal ultrasound knowledge. However, the multivariate logistic regression analysis revealed that only a few variables remained significantly associated with knowledge of obstetric ultrasonography. Specifically, pregnant women with a bachelor's degree or higher ($p=0.009$, $OR=2.70$), women employed as government employees ($p=0.000$, $OR 3.90$), and those with a history of previous ultrasound exposure ($p=0.004$, $OR=1.96$) (Table 7).

Table 5. Attitudes towards obstetric ultrasound examinations among pregnant women at the Public Health Centers in Palu City.

Variable	Response				
	Strongly disagree (%)	Disagree (%)	Not sure (%)	Agree (%)	Strongly agree (%)
Ultrasound is safe during pregnancy	0.2	0.7	12.1	59.3	27.7
Ultrasound can cause congenital anomalies in the fetus	0.7	49.5	34.4	12.8	2.6
Ultrasonography is an important screening during pregnancy	0.2	13.0	0.0	52.6	34.1
Feel comfortable during the ultrasonography examination	0.7	21.1	2.4	75.8	0.0
Ultrasound can cause cancer	7.8	31.3	53.1	7.8	0.0
Ultrasound examination causes pain	7.6	82.2	0.0	10.2	0.0
Ultrasound examinations are permitted by law	1.2	1.4	2.6	51.9	42.9
Terminate pregnancy if the child's sex is different from the desired	71.8	28.2	0.0	0.0	0.0
Routine ultrasound can be performed	63.7	0.0	0.0	28.2	8.1
Ultrasound findings are more accurate	0.0	17.8	2.4	58.1	21.8
Knowing the child's sex is essential	0.0	12.3	0.0	74.2	13.5

Table 6. Number of first and fifth ultrasound visits (K1 US and K5 US) among pregnant women at the Public Health Centers in Palu City.

Health Center	Number of pregnant mothers	*K1 US		**K5 US	
		Number (n)	Percentage (%)	Number (n)	Percentage (%)
Singgani	25	9	37.8	10	39.0
Talise	43	33	75.7	33	76.0
Birobuli	39	11	27.7	11	28.7
Kawatuna	35	25	71.1	26	73.1
Mabelopura	28	26	93.7	25	88.6
Nosarara	24	14	60.2	11	47.4
Bulili	24	13	53.7	10	40.7
Kamonji	26	23	87.5	22	84.1
Sangurara	50	25	49.9	30	60.0
Tipo	12	8	65.1	10	84.7
Mamboro	17	3	18.3	4	23.3
Tawaeli	16	2	11.2	2	11.8
Pantoloan	15	11	71.1	12	79.7
Lere	26	8	31.0	12	44.7
Total	380	210	55.4	217	57.0

*K1 US, mothers' first visit in the first trimester + ultrasound scan. **K6 US, mothers' fifth visit in the third trimester + ultrasound scan

Factors associated with attitudes towards obstetric ultrasound scan

The bivariate logistic regression analysis identified several variables associated with attitudes towards obstetric ultrasound, including occupation, monthly household income, timing of the first antenatal care visit, abortion history, congenital anomaly history, and ultrasound exposure for reasons other than pregnancy. However, the multivariate logistic regression analysis found that only a few variables were significantly associated with pregnant women's attitudes towards obstetric ultrasonography. These variables were employment as government employees/civil servants ($p=0.000$, $OR=6.83$), household income between IDR 1,000,000 and 5,000,000 ($p=0.001$, $OR=5.31$), and a history of congenital anomalies ($p=0.010$, $OR=21.07$) (Table 8).

Factors associated with the practice of obstetric ultrasound examination

The bivariate logistic regression analysis identified several variables associated with pregnant mothers' practice of antenatal ultrasound check-ups, including age, maternal occupation, knowledge, and attitude. However, in the multivariate logistic regression analysis, only a few variables remained significantly associated

with the practice of accessing obstetric ultrasonography. These variables included having a higher degree ($p=0.019$; $OR=2.70$), being a housewife ($p=0.007$; $OR=6.83$), mothers' knowledge ($p=0.009$; $OR=5.31$), and having positive attitudes towards ultrasound ($p=0.010$; $OR=11.07$) (Table 9).

Discussion

Knowledge of obstetric ultrasound

In this study, 70.8% of participants demonstrated good knowledge regarding the use of ultrasound scanning during pregnancy. A significant majority recognized the importance of scans in antenatal care for confirming pregnancy. Modern obstetrics acknowledges that pregnancy and childbirth inherently carry the risks of complications. These complications can be mild or severe, and may lead to maternal and/or infant mortality, morbidity, and disability. Therefore, proactive preventive measures during pregnancy, such as early detection of risks through ultrasound investigation, are essential. Ultrasound technology enables imaging inside the body, allowing for the timely and effective management of identified complications.⁸ In research by Molla *et al.* (2022), it shows that pregnant

Table 7. Factors associated with knowledge of obstetric ultrasonography among pregnant women at the Public Health Centers in Palu City.

Variable	Knowledge		COR (95%CI)	AOR (95%CI)	Sig.
	Poor	Good			
Age					
< 20	28	31	1	1	
20-29	99	84	0.75 (0.43-1.30)	0.68 (0.35-1.31)	0.248
30-35	53	69	1.14 (0.63-2.06)	0.95 (0.47-1.92)	0.893
> 35	4	12	2.30 (0.73-7.19)*	2.45 (0.68-8.76)	0.169
Maternal education					
Illiterate	2	19	1	1	
Primary	11	11	0.10 (0.02-0.47)*	0.094 (0.016-0.555)	0.448
High school	82	69	0.07 (0.017-0.32)*	0.76 (0.09-6.21)	0.803
Diploma	47	42	0.079 (0.018-0.35)*	0.35 (0.04-2.81)	0.322
Bachelor or higher	44	53	0.087 (0.016-0.46)*	2.70 (0.21-35.23)	0.009*
Husband's education level					
Illiterate	4	5	1	1	
Primary	42	71	1.145 (0.30-4.27)	1.46 (0.26-8.03)	0.661
High school	96	73	0.49 (0.14-1.81)	0.99 (0.17-5.49)	0.989
Diploma	8	2	0.148 (0.02-1.08)*	0.155 (0.007-3.39)	0.236
Bachelor or higher	34	45	0.087 (0.23-3.33)	2.13 (0.28-16.03)	0.463
Maternal occupation					
Housewife	61	130	1.145 (0.30-4.27)	1.46 (0.26-8.03)	0.751
Government employee	20	44	3.25 (1.86-5.67)*	3.90 (1.92-7.90)	0.000*
Private employee	78	37	0.72 (0.39-1.32)	0.68 (0.32-1.41)	0.306
Entrepreneur	6	4	0.87 (0.23-3.27)	0.63 (0.15-2.66)	0.537
Number of antenatal care visits					
1	18	38	1	1	
2	49	46	0.84 (0.33-2.14)	1.26 (0.44-3.61)	0.656
3	109	90	0.36 (0.15-0.85)*	0.58 (0.22-1.58)	0.296
≥ 4	8	22	0.32 (0.14-0.73)*	0.47 (0.18-1.19)	0.111
History of congenital anomalies					
Yes	13	4	1	1	
No	170	193	4.2 (1.37-12.88)*	2.68 (0.70-10.25)	0.149
Ultrasound exposure for reasons other than pregnancy					
Yes	103	89	1	1	
No	80	108	0.64 (0.44-0.94)*	1.96 (1.24-3.12)	0.004*

1, reference group; COR, crude odd ratio; CI, confidence interval; * $p<0.05$.

women's knowledge about obstetric ultrasound examinations is (35.3%).⁹ Knowledge about obstetric ultrasound was significantly related to pregnant women's educational status, parity, and place of residence. The high level of knowledge observed in this study can be attributed to several factors. Firstly, the widespread availability of information through healthcare providers and educational programs

likely plays a role. Secondly, the national health insurance program, BPJS, which covers the costs of ultrasound scans, might encourage more women to seek information and understand the benefits of the procedure. Moreover, the importance of ultrasound in detecting and managing potential pregnancy complications is well-publicized, contributing to the overall awareness among pregnant women.

Table 8. Factors associated with attitudes towards obstetric ultrasonography among pregnant mothers at the Public Health Center in Palu City.

Variable	Attitude		COR (95% CI)	AOR (95% CI)	p
	Negative	Positive			
Occupation					
Housewife	61	130	1	1	
Government employee	9	55	2.90 (1.54-5.45)*	6.83 (2.43-19.18)	0.000*
Private employee	55	60	0.45 (0.24-0.82)*	0.091 (0.03-0.25)	0.070
Entrepreneure	6	4	0.27 (0.07-1.03)*	0.10 (0.016-0.63)	0.051
Household monthly income (IDR)					
<1.000.000	66	178	1	1	
1.000.000-5.000.000	19	69	1.25 (0.72-2.16)	5.31 (2.01-14.03)	0.001*
>5.000.000	28	20	0.25 (0.13-0.45)*	1.47 (0.56-3.86)	0.426
First antenatal visits timing					
<16 weeks	68	31	1	1	
≥16 weeks	45	236	11.71 (7.06-19.4)*	33.89 (13.8-83.27)	0.060
Exposure of ultrasound					
Yes	46	146	1	1	
No	68	120	1.77 (1.16-2.71)*	1.55 (0.86-2.80)	0.140
History of abortion					
Yes	15	58	1	1	
No	113	194	0.56 (0.13-1.01)*	0.92 (0.40-2.12)	0.858
History of congenital anomaly					
Yes	2	15	1	1	
No	112	251	0.12 (0.016-0.93)*	21.07 (2.09-21.21)	0.010*

1, reference group; CO, crude odd ratio; AOR, adjusted odd ratio; CI, confidence interval; *IDR-Indonesian Rupiah; *p<0.05

Table 9. Factors associated with the obstetric ultrasound practice among pregnant mothers at the Public Health Centers in Palu City.

Variable	Practices		COR (95% CI)	AOR (95% CI)	p
	Poor	Well			
Age					
< 20	28	31	1	1	
20-29	99	84	0.75 (0.43-1.30)	1.1 (0.81-1.63)	0.448
30-35	53	69	1.14 (0.63-2.06)	0.95 (0.77-2.92)	0.993
> 35	4	12	2.30 (0.73-7.19)*	2.55 (0.68-8.76)	0.269
Maternal education					
Illiterate	2	19	1	1	
Primary	11	11	0.10 (0.02-0.47)	0.074 (0.02-0.56)	0,330
High school	82	69	0.07 (0.017-0.32)*	0.76 (0.09-6.21)	0,558
Diploma	47	42	0.07 (0.018-0.35)	0.35 (0.04-2.81)	0,322
Bachelor or higher	44	53	0.08 (0.016-0.46)*	3.17 (0.54-21.20)	0.019*
Maternal occupation					
Housewife	61	130	1	1	
Government employee	20	44	2.90 (1.54-5.45)*	4.53 (1.17-15.18)	0.007*
Private employee	78	37	0.45 (0.24-0.82)*	0.091 (0.03-0.25)	0,118
Entrepreneure	6	4	0.27 (0.07-1.03)	0.10 (0.016-0.63)	0.061
Knowledge					
Well	67	202	1.25 (0.72-2.16)*	3.71 (1.71-11.23)	0.009*
Poor	71	40	0.25 (0.13-0.45)	1.47 (0.56-3.86)	0.426
Attitude					
Positive	32	301	0.12 (0.016-0.93)*	11.07 (2.09-17.21)	0.010*
Negative	26	21	0.56 (0.13-1.01)	0.92 (0.40-2.12)	0.858

COR, crude odd ratio; AOR,adjusted odd ratio; CI, confidence interval; *IDR-Indonesian Rupiah. *p<0.05.

Attitudes towards obstetric ultrasound examinations

The majority of respondents (77.0%) believed that ultrasound check-ups were safe for pregnant mothers, aligning with findings from studies in Jeddah (78.9%), Tanzania, and India. This perception likely stems from the belief that the examination is safe for both the fetus and the mother. Additionally, 89.8% of participants disagreed that ultrasound causes pain during the scan, reinforcing the positive outlook towards the procedure. A study by Maryam in Tulungagung found that 56% of women had a positive attitude towards ultrasonography.¹⁰ Overall, our findings indicate a general trend of positive attitudes towards obstetric ultrasound examinations. Several factors contribute to this positive attitude. The comfort experienced during the scanning process and the coverage of its costs by the national health insurance program, BPJS, play significant roles. Maniragena *et al.* (2021). reported that study participants were motivated to undergo more screenings due to friendly health worker responses, satisfaction with the examinations, and relatively low costs.¹¹ Additionally, the desire to know the baby's gender, estimated delivery date, and the baby's well-being further influenced their attitudes towards obstetric ultrasonography. These positive attitudes are also evident as some pregnant women proactively request ultrasound scans on their own initiative.

Attitude, defined as a person's internal response to a specific stimulus or object involving opinions and emotions, plays a crucial role in health behaviors. The results of our study showed that the majority of women (86.7%) agreed that obstetric ultrasound is an important pregnancy screening, consistent with findings from Kano, Nigeria (93.8%), and Puducherry, India (88.0%).¹² This percentage was higher than that found in a study conducted in Kenya (71.8%), likely because most respondents understand the benefits of the examination for both the fetus and the mother during pregnancy. Several studies have shown that patients' attitudes towards health programs, including ultrasound scans, are influenced by the friendliness of health workers and the affordability of examination costs.

Practice of obstetric ultrasound examinations

The findings reveal that 210 respondents (55.4%) underwent an obstetric ultrasound scan during their first visit (K5) and 217 women (57.0%) did so by their fifth visit (K5). Health centers with high coverage rates often implemented innovative programs, such as home visits, and provided education on obstetric ultrasonography at the health center. Basic health research results indicated that some pregnant women still initiate antenatal care in the second trimester. This study highlights that barriers to utilizing antenatal services are multifactorial. These barriers include not only individual obstacles but also issues related to maternal health service providers, support systems, cultural factors, and religious factors. Effective improvement of the timely and regular use of antenatal care services requires a multisectoral approach.¹³ By addressing these various factors collectively, interventions can be more comprehensive and effective, ultimately improving maternal and fetal health outcomes.

This study indicates that maternal education level, working status, and ultrasound exposure for non-pregnancy-related reasons were significantly associated with their knowledge about obstetric ultrasonography. Education is the most significant factor influencing knowledge. Higher education enables individuals to respond more rationally to information and to evaluate its benefits for personal development and goal achievement.¹⁴ Occupation is closely linked to education level; individuals with higher education are more likely to hold better positions, such as government or private sector jobs. Good knowledge can form motivation and positive

attitudes in pregnant women, encouraging them to undergo routine ultrasound screening during pregnancy.⁹ Regarding attitudes, this study demonstrates that mothers with a history of congenital anomalies, as well as those with specific occupations and household incomes, exhibit significant associations with their attitudes towards obstetric ultrasound.

Income level is a factor that reflects a family's economic condition and is closely linked to the ability to access education and health services.¹⁵ This correlation arises from the fact that most activities in life, such as schooling and healthcare access, entail financial costs. Pregnant women's attitudes toward obstetric ultrasound were significantly associated with women's occupation, monthly household income, and history of births with congenital anomalies.¹⁶ Attitude plays an important role in influencing a person's actions within their environment, although behavior is also affected by various factors, such as stimuli, individual background, motivation, and personality. Enhanced knowledge about the importance of a pregnancy exam and the merits of ultrasound correlates with a more positive attitude.¹⁷ Attitude has three main components: belief or confidence in an object, emotional evaluation of the object, and a tendency to act towards it.¹⁸ The health of individuals or communities is shaped by two primary factors: behavioral and non-behavioral causes.¹⁹ Behavioral factors are further influenced by three key elements: predisposing factors, enabling factors, and reinforcing factors. Predisposing factors, such as age, occupation, education, knowledge, and attitudes, play a crucial role in shaping pregnant women's behavior in accessing obstetric ultrasound examinations during antenatal care.

Conclusions

The findings reveal that a majority of participants (70.8%) demonstrated good knowledge of obstetric ultrasound, with a significant proportion recognizing its importance in antenatal care. Positive attitudes towards ultrasound examinations were prevalent, with 77.0% of respondents believing in their safety and 86.7% acknowledging their importance as a pregnancy screening tool. The study identified several factors significantly associated with knowledge and attitudes towards obstetric ultrasound. Educational attainment, occupation, and prior exposure to ultrasound were found to be significantly related to knowledge levels. Attitudes were significantly influenced by maternal occupation, monthly household income, and history of congenital anomalies. Regarding practices, the study revealed that 55.4% of respondents underwent an obstetric ultrasound scan during their first antenatal visit, while 57.0% did so by their fifth visit. This highlights the need for continued efforts to improve timely and regular utilization of antenatal care services, including ultrasound examinations.

The findings underscore the importance of a multisectoral approach in addressing barriers to antenatal care utilization, considering individual, provider-related, cultural, and religious factors. Furthermore, the study emphasizes the role of education, income, and previous experiences in shaping knowledge, attitudes, and practices related to obstetric ultrasound. These results provide valuable information for healthcare providers and policymakers to develop targeted interventions aimed at improving knowledge, attitudes, and utilization of obstetric ultrasound examinations, ultimately contributing to better maternal and fetal health outcomes.

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