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Determinants of Obstetric Ultrasound Utilization Among Pregnant Women in Efforts to Prevent the Infant Mortality Rate in Tulang Bawang Regency

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ABSTRACT

Background: Low utilization of ultrasonography (USG) examinations among pregnant women, at only 16.1% during the first antenatal care (ANC) visit and 18.7% during the last ANC visit, may hinder the early detection of pregnancy complications and contribute to the high infant mortality rate (IMR), which reached 34 cases in 2024 in Tulang Bawang Regency. This study aimed to analyze the determinants of USG examination utilization among pregnant women in Tulang Bawang Regency in 2025. **Methods:** This quantitative analytic study employed a cross-sectional design. From a population of 2,694 pregnant women in Tulang Bawang Regency in 2025, a sample of 267 respondents was selected using stratified random sampling from six primary health centers. Data were collected using questionnaires and secondary data sources. Data analysis included univariate, bivariate (Chi-square), and multivariate analyses using multiple logistic regression. **Results:** Of the 267 respondents, 141 (52.8%) adhered to ultrasound examinations. Knowledge (p=0.000), attitude (p=0.008), age (p=0.000), service availability (p=0.008), accessibility (p=0.000), and perception (p=0.013) were significantly associated with ultrasound examination adherence, whereas pregnancy risk status was not significantly associated (p=0.643). Age was identified as the dominant factor influencing ultrasound examination adherence (p=0.001; OR=3.660; 95% CI: 1.751–7.650). **Conclusions:** Ultrasound utilization among pregnant women was primarily influenced by age, accessibility, and knowledge. To improve ultrasound utilization as an innovation to strengthen ANC services, we recommend prioritizing screening among pregnant women aged <20 and >35 years, providing structured ultrasound education, implementing written scheduling systems, tiered reminders, and active follow-up for missed appointments. These efforts should be supported by flexible service hours and improved accessibility through scheduled transportation and mobile ultrasound services, subject to resource availability.

Keywords: Ultrasound utilization; Pregnant women; mothers age; knowledge; accessibility

1. INTRODUCTION

Utilization of obstetric ultrasound among pregnant women refers to receiving ultrasound examinations at least twice during pregnancy, once in the first trimester and once in the third trimester of antenatal care (ANC).[(1)] Ultrasound in obstetric use is safe, relatively inexpensive, and non-invasive real-time imaging modality that uses high-frequency

sound waves to visualize maternal pelvic structures and fetal development.[2] The World Health Organization (WHO) recommends at least one routine obstetric ultrasound before 24 weeks' gestation as part of ANC, because this examination improves gestational age assessment and supports early identification of maternal–fetal problems. Beyond pregnancy dating, obstetric ultrasound plays a critical role in detecting conditions associated with adverse perinatal outcomes, including low birth weight, preterm birth, fetal growth restriction, intrauterine fetal death, congenital anomalies, and infant death.[3]

In Indonesia, the uptake of maternal health services has generally improved, reflected by increasing coverage of complete ANC visits across provinces.[4] In practice, more complete ANC utilization is commonly linked to better access to pregnancy examinations, including ultrasound in facilities equipped with trained staff and appropriate equipment. However, service uptake at the system level does not automatically translate into adequate adherence to recommended ultrasound examinations, particularly in areas where access and service readiness remain uneven. In this context, Tulang Bawang Regency faces a clear programmatic gap. Based on routine ANC service data from the District Health Office, the first semester report in 2025 indicated very low ultrasound utility among pregnant women at only 16.1% on first ANC contact and 18.7% at last ANC visits.[5] This condition implies that many pregnant women may not receive the full benefit of early screening and monitoring through ultrasound technology. The consequences of low ultrasound adherence are clinically relevant. Evidence suggests that ultrasound during pregnancy is essential for early detection of fetal growth restriction (FGR), a condition associated with higher risk of perinatal morbidity and mortality.[6] Failure to perform timely ultrasound examinations can delay recognition of growth and placental problems, which may lead to delayed or missed interventions and, ultimately, increased risks of perinatal asphyxia, hypothermia, hypoglycemia, respiratory disorders, intraventricular hemorrhage, and long-term complications such as neurodevelopmental impairment and later metabolic disease.[6]

Reducing maternal and infant mortality remains a national priority in Indonesia. A high infant mortality rate (IMR) often reflects inequities in access and the quality of maternal and child health services. In Tulang Bawang Regency, infant deaths were reported to reach 34 cases in 2024,[5] making prevention efforts urgent and directly linked to strengthening high-impact ANC components, including ultrasound. Nevertheless, determinants of ultrasound utilization in this regency have not been clearly established. Several studies have shown that maternal knowledge and education are important determinants of obstetric ultrasound utilization. Significant association between pregnant women's knowledge of ultrasonography and their ultrasound-use behavior reported that lower knowledge linked to underutilization.[7] While others found that higher maternal education is associated with better understanding of the benefits and safety of ultrasound during pregnancy and with more positive attitudes toward its use.[8,9] From an access perspective noted that ultrasound examinations are often perceived as costly among lower-income groups, limiting service access and potentially reducing utilization.[10] Consistently, barriers to antenatal ultrasound uptake, including financial constraints, limited availability of ultrasound services in rural areas, low awareness of its benefits, fears about side effects, and cultural or local belief factors.[11]

Conceptually, this study is grounded in Andersen's behavioral model, which explains health service utilization as a function of predisposing factors (e.g., age, knowledge, attitudes), enabling factors (e.g., availability of services and accessibility), and need factors (e.g., perceived need and evaluated need such as clinical risk).[12] Applying this framework to ultrasound utilization is important to determine which factors should be prioritized for practical interventions so that ultrasound can function effectively as an early detection tool within ANC. Based on the problem identification in the thesis, potential determinants include maternal knowledge, maternal attitude, maternal age, availability of ultrasound services, accessibility of health facilities, perceived need for ultrasound, and pregnancy risk status. Therefore, this study aimed to analyze determinants of obstetric ultrasound utilization among pregnant women in Tulang Bawang Regency in 2025 based on predisposing, enabling, and need factors, and to identify the dominant determinant influencing utilization.

This study aims to determine factors associated with obstetric ultrasound utilization among pregnant women in Tulang Bawang Regency in 2025 and to identify the dominant determinant influencing utilization. This study is important to provide evidence-based information for improving antenatal care services, particularly in increasing the appropriate use of

ultrasound examinations. The findings are expected to support health policymakers and practitioners in designing targeted interventions to enhance early detection of maternal and fetal complications, improve service accessibility, and ultimately contribute to the reduction of infant mortality rates.

2. METHODS

2.1 Design and Setting

This study employed an analytical quantitative approach using a cross-sectional design. The study was conducted in Tulang Bawang Regency, Indonesia, covering six primary health centers (*puskesmas*), namely Puskesmas Gedung Karya Jitu, Puskesmas Rawajitu, Puskesmas Rawajitu Timur, Puskesmas Sidoharjo, Puskesmas Lebuh Dalem, and Puskesmas Banjar Baru. These health centers were selected to represent variations in service availability and accessibility within the regency. The study was carried out in 2025 during the antenatal care (ANC) service period.

2.2 Population and Sample

The study population consisted of all pregnant women registered in Tulang Bawang Regency in 2025, with a total population of approximately 2,694 individuals. The sample size was determined using a proportional calculation and resulted in 267 respondents. A stratified random sampling technique was applied to ensure representation from each selected health center. The strata were based on the distribution of pregnant women across the six *puskesmas*. Eligible participants were pregnant women who were registered in the maternal cohort and willing to participate in the study. Respondents who had incomplete data or were not available during the data collection period were excluded.

2.3 Variables

Dependent: ultrasound utilization (use vs not use). Independent: knowledge, attitude, maternal age category, service availability, accessibility, perceived need, pregnancy risk status.

2.4 Operational Definitions

Knowledge: Individual knowledge and understanding of health, illness, and medical care are key determinants of health-service utilization, as they shape perceived benefits, risk appraisal, and the ability to navigate available services and follow recommended care.[25] Individual knowledge about prenatal ultrasound was assessed using a set of knowledge-determining statements (items) administered to the participants.[8]

Attitude: Responses related to health-service utilization include the belief that medical care can facilitate recovery or prevent further illness.[12]

Service availability: Facility availability encompasses the infrastructure and professional workforce required to deliver health services18. in this study, it refers to the availability of pregnancy ultrasound services, including the availability of ultrasound equipment, service schedules, physician availability, and the ease of accessing the service.

Accessibility: Access to health care refers to an individual's ability to seek and obtain needed health services. In this study, it was indicated by distance to the ultrasound service facility, travel time to the facility, availability of transportation, and barriers encountered during travel.[18]

Perceived need: An individual's subjective appraisal of the need for health examinations/services, based on their own judgment, influences their behavior in utilizing health services19. This appraisal includes perceptions of severity, the urgency to seek examination, and confidence in the benefits and effectiveness of available services.[12]

Pregnancy risk status: Indicators reflecting the mother's health status and the development of the fetus she is carrying.[21]

2.5 Data Collection

Data collection was conducted using both primary and secondary data sources. Primary data were obtained through structured questionnaires administered directly to respondents by trained data collectors. The questionnaire included sections on socio-demographic characteristics, knowledge, attitudes, perceived need, and accessibility factors. Secondary data were obtained from maternal cohort records, pregnancy registers, and the Maternal and Child Health (MCH) Book (Buku KIA) to validate information related to pregnancy status and ultrasound utilization. Data collection was conducted after obtaining permission from the relevant health authorities.

2.6 Data Analysis

Data analysis was performed using Statistical Package for the Social Sciences (SPSS) version 26. The

analysis consisted of three stages: Univariate analysis was conducted to describe the characteristics of respondents and the distribution of each variable using frequencies and percentages. Bivariate analysis was performed using the Chi-square test to examine the association between independent variables and ultrasound utilization. Variables with a *p*-value < 0.05 were considered statistically significant. Multivariate analysis was conducted using multiple logistic regression to identify the dominant factors influencing ultrasound utilization. Variables with p-value < 0.25 in the bivariate analysis were included in the multivariate model. The results were presented as adjusted odds ratios (AOR) with 95% confidence intervals (CI).

2.7 Ethical Practices

This study was conducted in accordance with ethical principles for research involving human subjects. Ethical approval was obtained from the Health Research Ethical approval was obtained from the Health Research Ethics Committee, Faculty of Health, Universitas Mitra Indonesia, with ethical clearance number: S.25/020/FKES10/2026. Prior to data collection, informed consent was obtained from all respondents after explaining the purpose, procedures, risks, and benefits of the study. Participation was voluntary, and respondents had the right to withdraw at any time without any consequences. Confidentiality and anonymity of all participant data were strictly maintained throughout the study.

3. RESULTS

3.1 Socio-Demographic Characteristics of the Study Participants

A total 267 pregnant women participated in this study. Among respondents, 46 (17.2%) were in the high-risk maternal age group (<20 years or >35 years), while the majority, 221 (82.8%), were in the low risk age range for pregnancy (20–35 years). Regarding occupation, most respondents were unemployed/housewives (234; 87.6%), followed by self-employed workers (19; 7.1%), farmers (6; 2.2%), civil servants (6; 2.2%), and teachers (2; 0.7%). In terms of education, 38 respondents (14.2%) had completed primary school, 89 (33.2%) junior high school, 119 (44.6%) senior high school (the largest proportion), and 21 (7.9%) post graduate. The remaining socio-demographic characteristics are listed in Table 1.

One hundred fourty one (52.8%) of respondents used prenatal ultrasound as recommended ultrasound examinations, while 126 (47.2%) were non adherent. Utilization of ultrasound screening services as shown in Table 2.

Table 1. Socio-demographic characteristics of pregnant women

Variables	Frequency (n)	Percentage (%)
Age		
High risk (<20 and >35 years)	46	17.2
Low risk (20 - 35 years)	221	82.8
Occupation		
Housewives	234	87.6
Self-employed workers	19	7.1
Farmers	6	2.2
Civil servants	6	2.2
Teachers	2	0.7
Education		
Primary school	38	14.2
Junior high school	89	33.2
Senior high school	119	44.6
Post graduate	21	7.9

Tabel 2. Utilization of ultrasound screening services

Ultrasound utility	Frequency (n)	Percentage (%)
Use prenatal ultrasound	141	52.8
Non-use prenatal ultrasound	126	47.2
Total	267	100

3.2 Bivariate Analysis of Association Between Different Variables and Ultrasound Utilization

Based on the analysis presented in Table 3, among 161 respondents with good knowledge, 100 respondents (62.1%) used ultrasound examinations. In contrast, among 106 respondents with poor knowledge, 65 (61.3%) did not use. The Chi-square test showed a statistically significant association between knowledge and ultrasound utilization ($p < 0.05$; $p=0.000$). The odds ratio was 2.599 (95% CI: 1.570–4.303), indicating that respondents with good knowledge had 2.599 times higher odds of being adherent to ultrasound examinations than those with poor knowledge.

Based on the analysis presented in Table 3, among 150 respondents with good attitude, 90 respondents

Table 3. Association between different variables (knowledge, attitude, mothers age, service availability, accessibility, perceived need, pregnancy risk status) and ultrasound utilization

Variables	Ultrasound Utilization				Total		*p*-value	OR (95% CI)
	Use		Not Use					
	n	%	n	%	n	%		
Knowledge								
Good	100	62.1	61	37.9	161	100.0	0.000	2.599 (1.570-4.303)
Poor	41	38.7	65	61.3	106	100.0		
Attitude								
Good	90	60.0	60	40.0	150	100.0	0.008	1.941 (1.189-3.169)
Poor	51	43.6	66	56.4	117	100.0		
Mothers age								
Low risk (20 - 35 years)	129	58.4	92	41.6	221	100.0	0.000	3.973 (1.952-8.084)
High risk (<20 and >35 years)	12	26.1	34	73.9	46	100.0		
Service Availability								
Good	116	57.4	86	42.6	202	100.0	0.008	2.158 (1.218-3.825)
Poor	25	38.5	40	61.5	65	100.0		
Accessibility								
Easy	126	58.3	90	41.7	216	100.0	0.000	3.360 (1.736-6.503)
Difficult	15	29.4	36	70.6	51	100.0		
Perceived need								
High	109	57.7	80	42.3	189	100.0	0.013	1.959 (1.146-3.346)
Low	32	41	46	59	78	100.0		
Pregnancy risk status								
Yes	27	50.0	27	50.0	54	100.0	0.643	0.868 (0.478-1.578)
No	114	53.5	99	46.5	213	100.0		

(60%) used ultrasound examinations. In contrast, among 117 respondents with poor attitude, 66 respondents (56.4%) did not use. The Chi-square test showed a statistically significant association between attitude and ultrasound utilization ($p < 0.05$; $p = 0.008$). The odds ratio was 1.941 (95% CI: 1189-3169), indicating that respondents with good attitude had 1,941 times higher odds of being adherent to ultrasound examinations than those with poor attitude.

Based on the analysis presented in Table 3, among 221 respondents with low-risk age (aged 20-35 years), 129 respondents (58.5%) used ultrasound examinations. In contrast, among 46 respondents with high-risk age (less than 20th and over 35 years old), 34 respondents (73.9%) did not use. The Chi-square test showed a statistically significant association between mothers age and ultrasound utilization ($p < 0.05$; $p = 0.000$). The odds ratio was 3.973 (95% CI: 1.952-8.084), indicating that respondents with low-risk age had 1,941 times higher odds of being adherent to ultrasound examinations than those with high-risk age.

Based on the analysis presented in Table 3, among 202 respondents with good service availability, 116 respondents (57.4%) used ultrasound examinations. In contrast, among 65 respondents with service availability, 40 respondents (61.5%) did not use. The Chi-square test showed a statistically significant association between service availability and ultrasound utilization ($p < 0.05$; $p = 0.008$). The odds ratio was 2.158 (95% CI: 1.218-3.825), indicating that respondents with good service availability 2,158 times higher odds of being adherent to ultrasound examinations than those with poor service availability.

Based on the analysis presented in Table 3, among 216 respondents with good easy accessibility, 126 respondents (58.3%) used ultrasound examinations. In contrast, among 51 respondents with difficult, 36 respondents (70.6%) did not use. The Chi-square test showed a statistically significant association between service availability and ultrasound utilization ($p < 0.05$; $p = 0.000$). The odds ratio was 3.360 (95% CI: 1.736-6.503), indicating that respondents with easy accessibility 3,360 times higher odds of being adherent to ultrasound examinations than those with difficult accessibility.

Based on the analysis presented in Table 3, among 189 respondents with higher perceived need, 109 respondents (57.7%) used ultrasound examinations. In

contrast, among 78 respondents with lower perceived need, 46 respondents (59%) did not use. The Chi-square test showed a statistically significant association between perceived need and ultrasound utilization ($p < 0.05$; $p = 0.013$). The odds ratio was 1.959 (95% CI: 1.146-3.346), indicating that respondents with higher perceived need 3,360 times higher odds of being adherent to ultrasound examinations than those with lower perceived need.

Based on the analysis presented in Table 3, among 54 respondents with pregnancy risk status, 27 respondents (50%) used ultrasound examinations. In contrast, among 213 respondents with no pregnancy risk status, 99 respondents (46.5%) did not use. The Chi-square test showed no statistically significant association between pregnancy risk status and ultrasound utilization ($p < 0.05$; $p = 0.643$).

3.3 Multivariate Analysis

Based on the analysis presented in Table 4, The analysis identified maternal age as the dominant factor associated with ultrasound utilization. An odds ratio (OR) of 3.660 indicates that respondents with low-risk age (20 -35 years) had 3.6 times higher odds of adherence to antenatal ultrasound examinations compared with those high-risk age (<20 years or >35 years), after controlling for healthcare facility accessibility and knowledge.

Table 4. Dominant determinant factors

Variable	B	S.E.	*p-value*	OR	(95% CI)
Age	1.297	0.376	0.001	3.660	1.751-7.650
Knowledge	0.647	0.277	0.020	1.910	1.109-3.290
Accessibility	0.992	0.355	0.005	2.696	1.345-5.405
Perception	0.515	0.296	0.081	1.674	0.938-2.990

4. DISCUSSION

The result showed that more than half of the respondents (52.8%) use obstetric ultrasound examinations; however, a substantial proportion remained not use. In the bivariate analysis, knowledge, attitudes, maternal age, service availability, health-facility accessibility, and perceived need were significantly associated with ultrasound utilization. These results are consistent with Andersen's behavioral model, which posits that health-service utilization is shaped by predisposing factors (e.g., age, knowledge, and attitudes), enabling factors (service availability and accessibility), and need factors (perceived need).

Knowledge, defined as an individual's understanding derived from sensory experience and learning, influences health-related decision making, including the use of medical services. In this study, bivariate analysis demonstrated a significant association between knowledge and compliance with standard ultrasound examination. As we know that knowledge, which in Andersen's health service utilization framework functions as a predisposing factor that shapes pregnant women's willingness to attend antenatal care and undergo ultrasound examinations.[12]

These findings are consistent with previous evidence. A study reported that knowledge was a strong determinant of prenatal ultrasound utilization among pregnant women attending public ANC services in Jimma Town, Ethiopia, with markedly higher utilization among those with good knowledge (AOR = 15.77; 95% CI: 6.39–38.92).[13] A significant and strong positive relationship between low knowledge and lower ultrasound utilization, suggesting that insufficient knowledge is linked to reduced uptake of ultrasound examinations.[7] Additional support that repeated education during ANC is crucial to strengthen knowledge, thereby improving attitudes and practices related to obstetric ultrasound.[9]

Overall, the results support the view that knowledge guides pregnant women in understanding the purpose, benefits, recommended schedule, and potential consequences of not undergoing ultrasound examinations according to standards. Women with limited knowledge may perceive ultrasound as merely an optional add-on rather than an essential component of ANC, leading to weaker decision-making and reduced compliance. Therefore, structured and consistent education at each ANC visit is recommended to address knowledge gaps and promote adherence to recommended ultrasound examinations.

Attitude refers to an individual's emotional response toward a stimulus or object. Although it does not constitute an action in itself, attitude serves as a behavioral predisposition that influences how a person is

likely to behave. Within Andersen's health service utilization framework, attitude functions as a predisposing factor that can motivate pregnant women to comply with recommended antenatal ultrasound examinations.[14]

This study showed a significant association between attitude and utilization ultrasound examinations. This finding aligns with prior research highlighting attitude as an important psychological determinant of ultrasound uptake. Similar study reported that while most pregnant women in Addis Ababa expressed positive attitudes toward obstetric ultrasound, a substantial proportion still held negative views, which may increase the likelihood of refusal and ultimately affect pregnancy outcomes.[15] Concerns about perceived effects, discomfort, or other misconceptions of ultrasound utility can act as internal barriers for utilization.

Overall, positive attitudes (e.g., confidence that ultrasound is safe and important) are likely to enhance readiness and willingness to undergo ultrasound as recommended. Conversely, negative attitudes often driven by misperceptions, discomfort, or doubt that may hinder utilization and contribute to not use ultrasound. Because negative attitudes are modifiable, strengthening compliance requires targeted strategies to foster positive attitudes, particularly among women who remain hesitant despite adequate access to services.

Maternal age is commonly classified as ideal between 20–35 years, whereas ages <20 years and >35 years are considered higher-risk due to increased obstetric and neonatal complications.[16] In this study, bivariate analysis showed a significant association between age and utilization ultrasound examinations. These findings are consistent with prior evidence showing that most women accessing pregnancy care tend to be in the productive age range (20–35 years). Reduced attendance and compliance among younger pregnant women may be related to limited psychological readiness, higher stress, inadequate social support, and greater dependence on family decision-making, whereas women aged >35 years may perceive themselves as more experienced, potentially lowering perceived need for routine examinations.[17]

Accordingly, high-risk age groups may require tailored interventions beyond general education, including more intensive accompaniment, involvement of husbands/families, and strengthened follow-up for missed ultrasound schedules. Targeted counseling platforms such as adolescent health posts (Posyandu Remaja) may be particularly useful to deliver risk-focused counseling and promote informed decision-making, ideally beginning preconception, to complement (not replace) standard ANC services.

Ultrasound service availability encompasses the readiness of service infrastructure, including the presence and functionality of ultrasound equipment and supporting resources, the availability of physicians, and alignment of service schedules with patient needs.[18] In this study, bivariate analysis demonstrated a significant association between service availability and utilization of ultrasound examinations.

These findings support evidence that service side constraints are a major determinant of ultrasound utilization; a scoping review identified limited access to ultrasound devices and services as a frequently reported barrier. Accordingly, non-compliance should not be attributed solely to individual factors, as it may reflect system-level limitations such as equipment shortages or breakdowns, restricted access, maintenance costs, unstable electricity supply, and suboptimal operational arrangements (e.g., limited service schedules). Such constraints can directly reduce the likelihood that pregnant women receive ultrasound examinations according to the recommended timetable.

Access to health services refers to an individual's ability to obtain needed care. In this context, facility accessibility primarily denotes physical access, including geographic barriers, travel time to health facilities, and transportation availability.[18] In this study, bivariate analysis showed a significant association between facility accessibility and utilization of ultrasound examinations. These results are consistent with study which demonstrated that physical accessibility, measured by distance to the nearest ultrasound facility, was associated with ultrasound utilization during pregnancy; distance and transportation difficulties are widely documented barriers, particularly in low- and middle-income settings.[11]

From a service and household perspective, distance, travel time, transportation costs, and vehicle availability are not merely technical constraints but determinants that shape household priorities, especially for women who depend on family support for mobility. Under difficult access conditions, compliance may remain low even when knowledge and attitudes are favorable, because physical barriers limit the ability to align ultrasound schedules with daily activities, spouse

availability, and transport arrangements. Therefore, interventions to improve utilization should address enabling factors directly, such as bringing services closer to communities, strengthening transport/referral arrangements, and offering more flexible scheduling from nearest primary health care.

Perceived need refers to an individual's subjective appraisal of the necessity of health care, which influences service utilization. It includes perceived need for services, chronic illness conditions, and self-rated health.[19] In this study, bivariate analysis indicated a significant association between perceived need and utilization of ultrasound examinations. Conceptually, perceived need may be understood as a pregnant woman's belief that ultrasound is necessary because it provides meaningful benefits for her and her pregnancy. A study reported that most pregnant women (95%) wanted information about abnormal findings on ultrasound to support deliberation and preparedness, emphasizing ultrasound as a source of knowledge and planning rather than solely a trigger for extreme decisions.[20] Accordingly, perceived need for ultrasound can be framed as informational needs (knowing fetal condition), psychological needs (reducing uncertainty), and preparatory needs (planning for potential abnormal results). As perceived value and relevance of ultrasound increase, perceived need strengthens and may contribute to improved adherence to recommended ultrasound schedules.

Pregnancy risk status is an indicator reflecting maternal condition and fetal development.[21] As an evaluated need factor, it represents a clinically assessed need determined by qualified health professionals. In Andersen's health service utilization framework, pregnancy risk status is categorized as a need factor that, in principle, may increase the likelihood of utilizing health services, including ultrasound utilization.[19]

However, in this study, bivariate analysis showed no significant association between pregnancy risk status and utilization of ultrasound examinations. This non-significant finding suggests that evaluated need such as clinical risk classification may not automatically translate into perceived need which mother's understood and felt need, consistent to Andersen's framework. Compliance among women classified as high-risk may depend more on the clarity and personalization of risk communication during ANC and the extent to which mothers understand the implications of their risk status. Moreover, enabling factors such as ultrasound service availability, physical accessibility (e.g distance, travel time, transportation), and scheduling convenience may constitute more dominant barriers, potentially leading high-risk women to remain non-compliant despite greater clinical need. Therefore, improving ultrasound utilization among high-risk pregnancies likely requires not only risk identification but also strengthened, individualized risk communication to enhance perceived need, alongside practical interventions that secure access and facilitate timely ultrasound appointments.

Dominant Factors. The analysis showed that age was the dominant factor (OR=3.660). Pregnant women aged 20–35 years tended to attend ultrasound examinations more regularly than those aged <20 years or ≥35 years. Among adolescents, suboptimal psychological readiness for pregnancy may generate stress and reduced concern for antenatal care, resulting in irregular visits. Conversely, women aged ≥35 years may feel more confident due to prior pregnancy and childbirth experience, which can reduce motivation to attend routine ANC and USG examinations.[22]

These age-related differences have implications beyond the regularity of ultrasound utilization. Delayed ultrasound examinations may postpone early detection of pregnancy risks such as fetal growth restriction, miscarriage risk, or obstetric complications, thereby increasing the likelihood of adverse outcomes including low birth weight (LBW) and contributing to maternal and neonatal mortality. Evidence from a case–control study in Mesuji District showed that maternal age at risk (<20 or >35 years) was associated with LBW (p=0.035), with higher odds among at-risk mothers compared with those aged 21–34 years.[23] Similarly, others study reported that women in the at-risk age groups (<20 or >35 years) had a six-fold higher risk of maternal mortality than women aged 20–35 years, plausibly reflecting biological immaturity at younger ages and declining reproductive function at older ages.[24]

Therefore, interventions to improve ultrasound utilization should prioritize women of non-ideal reproductive age through more intensive, group-specific approaches, including adolescent pregnancy accompaniment with family support and strengthened risk communication for women aged ≥35 years to increase perceived need and sustained attendance. In adolescents, compliance is often shaped not only by knowledge but also by social dynamics such as stigma, limited autonomy, and dependence on family support for service access. In this context, Posyandu Remaja may serve as an entry point to strengthen predisposing factors through

reproductive health education, perceived-need formation, communication skills, and visit planning, alongside linkage with service networks to ensure timely referral to ANC and a clear USG schedule with reminder and follow-up mechanisms for missed appointments.

Strength and Limitations of the Study

This study's main strength is that it is the first to assess the situation in Tulang Bawang, Indonesia, particularly in the study area. Regarding limitations, the study used a cross-sectional design, which limits causal inference and potentially introducing prevalence/incidence bias. Moreover, such designs do not capture disease trajectories, incidence, or prognosis and may require larger samples when multiple variables are assessed. Furthermore, the sample was restricted to pregnant women attending ANC services in health facilities within the study area, which may limit representativeness and generalizability beyond the local context.

5. CONCLUSION

Ultrasound utilization among pregnant women in Tulang Bawang Regency remains suboptimal, with maternal age identified as the dominant factor influencing its use. Several factors, including knowledge, attitude, service availability, accessibility, and perceived need, were also significantly associated with utilization. Strengthening health education and improving access to ultrasound services, particularly for women in non-ideal age groups, are recommended to enhance utilization and support early detection of maternal and fetal complications.

5.1 Future Recommendation

Programs to improve ultrasound compliance in Tulang Bawang should prioritize women at non-ideal maternal ages by implementing clear targeting mechanisms with nominative lists at all primary health centers, structured and proactive follow-up systems with written ultrasound plans from the first ANC visit, tiered reminders and active tracing of missed appointments, and more flexible service delivery such as extended ultrasound hours or appointment-based quotas. To address geographic barriers, district and facility managers should strengthen field-access support through scheduled referral transport such as village ambulance pick-up points and consider periodic outreach/mobile ultrasound services for remote villages where portable equipment is available. Standardized ultrasound education materials (benefits, objectives, recommended timing, danger signs, and myth–fact clarification) should be institutionalized, supported by brief provider training on risk communication and focused counseling integrated into routine ANC starting at the first visit. Integration of ultrasound education into adolescent reproductive health programming and youth health center (*posyandu remaja*) activities is recommended to strengthen early perception and readiness, complemented by routine monitoring and evaluation using agreed indicators. Future research should use designs capable of assessing temporality and causal pathways to better elucidate determinants of ultrasound utilization.

Ethical Approval

Ethical approval was obtained from the Health Research Ethics Committee, Faculty of Health, Universitas Mitra Indonesia, with ethical clearance number: S.25/020/FKES10/2026.

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Competing Interests

All the authors declare that there are no conflicts of interest.

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Underlying Data

Derived data supporting the findings of this study are available from the corresponding author on request.

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