Original Article

Factors Associated with Knowledge of Pregnancy Danger Signs and Antenatal Care Compliance: A Cross-Sectional Study

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ABSTRACT

Background: Adequate knowledge of pregnancy danger signs plays a critical role in promoting antenatal care (ANC) compliance. Poor adherence to ANC visits remains a significant contributor to preventable maternal complications. Research aimed to analyze the association between maternal knowledge of pregnancy danger signs and ANC compliance and to identify the most dominant predictors.

Methods: An analytical cross-sectional study was conducted among 249 pregnant women. Participants were selected using purposive sampling. Data were collected through structured questionnaire-based interviews and verification of ANC visits using medical records and Maternal and Child Health (MCH) books. Bivariate associations were tested using the Chi-square test. Variables with $p < 0.25$ were included in a multiple logistic regression analysis. Statistical significance was set at $p < 0.05$.

Results: Of the respondents, 55.0% were aged <27 years, 57.0% had education below junior high school, 56.6% were primigravida, and 55.4% lived within 5 km of a health facility. ANC compliance was observed in 55.8% of participants, while 55.8% demonstrated low knowledge of pregnancy danger signs. Bivariate analysis showed significant associations between ANC compliance and maternal age, educational methods, motivation, attitude, parity, distance to health facility, and knowledge (all $p = 0.001$). Multivariate analysis identified knowledge as the strongest predictor of ANC compliance ($p = 0.019$; OR = 3.380; 95% CI: 1.222–9.348), adjusted for maternal age ($p = 0.048$).

Conclusion: Maternal knowledge of pregnancy danger signs is the most influential factor associated with ANC compliance. Strengthening targeted health education strategies may improve maternal service utilization.

Keywords: Pregnancy Danger Signs, Antenatal Care, Knowledge, Maternal Health, Compliance.

Implications for Practice:

- Clinical practice should prioritize routine screening of maternal knowledge regarding pregnancy danger signs during antenatal care visits and integrate structured counseling to improve adherence to recommended ANC schedules.

Implications for Practice:

- Health policy should strengthen community-based maternal health education programs and ensure the consistent use of Maternal and Child Health books and other educational media to enhance pregnant women's awareness and timely utilization of antenatal

Implications for Practice:

services.

- Midwifery education should emphasize competency in health communication and culturally sensitive counseling strategies to support effective maternal education, particularly in Low- and Middle-Income Countries (LMICs) and other resource-limited settings where gaps in maternal knowledge remain a major barrier to optimal antenatal care utilization.

Introduction

Pregnant women's knowledge regarding danger signs of pregnancy is a crucial determinant of early complication detection and antenatal care (ANC) compliance. Women who are knowledgeable about obstetric danger signs are more likely to attend ANC visits regularly and seek timely care when complications arise. Conversely, limited knowledge may delay care-seeking behavior and increase the risk of maternal morbidity and mortality (Fikre & Demissie, 2012a; Finlayson & Downe, 2013). Studies indicate that awareness of danger signs significantly improves birth preparedness and healthcare utilization (Gross et al., 2012). Antenatal care plays an essential role in providing comprehensive maternal services, including health promotion, screening, early diagnosis, and prevention of complications. Quality ANC has been associated with improved maternal and perinatal outcomes (Carroli et al., 2001; Tunçalp et al., 2015). The World Health Organization (2016) emphasizes that ANC should focus on evidence-based interventions that enhance positive pregnancy experiences and reduce maternal mortality.

In Indonesia, maternal mortality remains a major public health concern. Despite ongoing health sector reforms, maternal mortality reduction continues to be a national development priority. The underutilization of ANC services contributes significantly to preventable maternal deaths (Titaley et al., 2010). Research shows that inadequate ANC attendance is associated with increased risk of complications such as hemorrhage, hypertensive disorders, and infection (Berhan & Berhan, 2014). Maternal risk factors such as age (<20 years or >35 years), high parity (>3 pregnancies), and short birth intervals (<2 years) are well-documented contributors to obstetric complications (Ganchimeg et al., 2014). Additionally, delays in seeking care are often linked to insufficient knowledge of pregnancy danger signsremain a critical determinant of maternal mortality (Fikre & Demissie, 2012b; Finlayson & Downe, 2013). Evidence demonstrates that ANC utilization is influenced by socioeconomic and demographic factors, including education, employment, and household income (Simkhada et al., 2008; Titaley et al., 2010). Furthermore, maternal knowledge and perception of risk strongly influence compliance with recommended ANC visits (Gross et al., 2012). Women who recognize symptoms such as vaginal bleeding, severe headache, reduced fetal movement, or swelling are more likely to seek immediate healthcare services (Fikre & Demissie, 2012b).

Midwives and frontline health workers play a strategic role in improving maternal knowledge and promoting regular ANC attendance. Effective counseling during ANC visits can positively influence maternal attitudes and health-seeking behavior (Tunçalp et al., 2015; WHO, 2016). Family and partner support also significantly affects ANC compliance. Male involvement during pregnancy has been associated with improved maternal health service utilization and better pregnancy outcomes (Kaye et al., 2014). Emotional, informational, and practical support from husbands enhances maternal motivation and adherence to scheduled visits

(Fagbamigbe & Idemudia, 2015; Kaye et al., 2014). Multiple factors, including knowledge, parity, age, education, motivation, attitude, access to information, distance to health facilities, and family support, contribute to early detection of pregnancy danger signs and timely decision-making (Finlayson & Downe, 2013; Simkhada et al., 2008). Strengthening these determinants is essential to improving maternal health outcomes.

Given the persistently high maternal mortality rate and suboptimal ANC compliance, it is important to investigate the factors influencing pregnant women's knowledge of pregnancy danger signs and their compliance with ANC visits at Romauli Marelan Clinic.

Methods

Study Design

This study employed an analytical cross-sectional design to examine the association between pregnant women's knowledge of danger signs in pregnancy and their adherence to antenatal care (ANC) visits. A cross-sectional approach was selected because it enables simultaneous measurement of exposure and outcome variables within a defined population at a single point in time, allowing estimation of prevalence and identification of associated factors. This study was conducted and reported in accordance with the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines.

Participants

The study was conducted at Romauli Marelan Clinic from February to May 2025. The target population consisted of all pregnant women who attended the clinic during the study period (N = 301). A total of 249 respondents were selected using purposive sampling.

Instruments

The data collection instruments used in this study consisted of structured questionnaires and document verification forms designed to measure the study variables. The questionnaires were developed based on relevant literature and maternal health guidelines related to pregnancy danger signs and antenatal care (ANC) utilization.

Knowledge of pregnancy danger signs was measured using the Pregnancy Danger Signs Knowledge Questionnaire, which consisted of 15 multiple-choice questions covering key obstetric warning signs during pregnancy, including vaginal bleeding, severe headache, blurred vision, decreased fetal movement, swelling of the face or hands, persistent abdominal pain, high fever, and convulsions. Each correct answer was scored 1, and each incorrect answer was scored 0, with a total possible score ranging from 0 to 15. Knowledge levels were categorized as adequate (≥75% of the total score) and poor (<75% of the total score).

Maternal motivation toward ANC attendance was assessed using the Maternal Motivation toward ANC Scale, consisting of 10 statements measured on a 4-point Likert scale ranging from strongly disagree (1) to agree (4) strongly. The total score ranged from 10 to 40, with motivation categorized into high and low based on the mean score.

Maternal attitudes toward ANC services were measured using the Maternal Attitude toward ANC Questionnaire, which included 10 Likert-scale items. Positive statements were scored from 1 to 4, while negative statements were reverse-scored. The total score was categorized into positive and negative attitudes using the mean score as the cut-off point.

Family support related to ANC visits was assessed using the Family Support for ANC Scale, consisting of 8 statements evaluating emotional, informational, and

instrumental support provided by family members during pregnancy. Each item was rated on a 4-point Likert scale, and the total score was categorized into support present and no support based on the mean score.

In addition to the questionnaires, ANC compliance was verified through a review of medical records and Maternal and Child Health (MCH) books to confirm the number of antenatal visits attended by each respondent according to national standards.

Before data collection, the instruments were tested for validity and reliability. Three maternal health experts evaluated content validity to ensure item relevance and clarity. Construct validity was assessed using Pearson product–moment correlation. Reliability was tested using Cronbach's alpha, with a coefficient of $\alpha \geq 0.70$ considered acceptable for internal consistency.

Data Collection

Data collection was conducted from February to May 2025 at Romauli Marelan Clinic. Prior to the data collection process, respondents who met the eligibility criteria were informed about the objectives and procedures of the study. Pregnant women who agreed to participate were asked to sign a written informed consent form.

Primary data were collected through face-to-face interviews using structured questionnaires administered by trained researchers. The questionnaires included items assessing maternal knowledge of pregnancy danger signs, motivation toward antenatal care (ANC), maternal attitudes toward ANC services, and family support during pregnancy.

To ensure data accuracy, ANC compliance data were verified through documentation review, including maternal medical records and Maternal and Child Health (MCH) books. The number of ANC visits recorded in these documents was compared with the recommended national ANC standards to determine whether the respondents were categorized as compliant or non-compliant.

All interviews were conducted in a private setting within the clinic to ensure participant comfort and confidentiality. Each interview lasted approximately 15–20 minutes. After completion, the questionnaires were checked for completeness and consistency before being entered into the database for analysis.

Data Analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 20.0. Descriptive statistics were first performed to summarize respondent characteristics and study variables. Categorical variables were presented as frequency distributions and percentages to describe the profile of participants and the distribution of independent and dependent variables. Bivariate analysis was conducted to examine the association between each independent variable (knowledge of pregnancy danger signs, age, parity, education, employment status, income, motivation, attitude, source of information, distance to health facility, and family support) and the dependent variable (ANC compliance). The Chi-square test was applied because the variables were categorical. Statistical significance was determined at $p < 0.05$. Variables with a p-value < 0.25 in the bivariate analysis were entered into the multivariate model. Multiple logistic regression analysis was then performed to identify independent predictors of ANC compliance while controlling for potential confounding variables. The strength of associations was expressed as Adjusted Odds Ratios (AORs) with 95% Confidence Intervals (CIs). All p-values were reported to three decimal places, and the level of statistical significance was set at $\alpha = 0.05$.

Ethical Considerations

This research has received an ethics approval letter from the ethics committee of the Santa Elisabeth Medan College of Health Sciences with number 009/KEPK-SE/PE-DT/II/2025. This research also considered the principles of research ethics, including respect for persons, beneficence, and justice. Relevant ethical issues in this research include the involvement of pregnant women as research subjects, the use of questionnaires to assess pregnant women's knowledge about the danger signs of pregnancy and ANC compliance, and data collection through observation and interviews with pregnant women. Researchers obtained written consent from pregnant women themselves. This research does not pose any physical or psychological risks to the research subjects because this research is an interview using a simple questionnaire and involves daily activities that are safe and appropriate to the condition of pregnant women. All respondent data is kept confidential and is only used for scientific purposes.

Results

Table 1. Distribution of Respondent Frequencies by Characteristics

Variable	Frequency	Percentage (%)
Mother's Age		
< 27 years old	137	55
> 27 years old	112	45
Mother's Education		
< junior high school	142	57
High School - PT	107	43
Mother's Work		
Work	134	53,8
Not Working	115	46,2
Educational Methods		
Hardfile	139	55,8
Softfile	110	44,2
Motivation of Pregnant Women		
There	145	58,2
None	104	41,8
Attitude of Pregnant Women		
Positive	139	55,8
Negatives	110	44,2
Resources		
Offline	144	57,8
Online	105	42,2
Number of Pregnancies		
Primigravida	141	56,6
Multigravity	108	43,4
Family Support		
There	141	56,6
None	108	43,4
Distance to Health Places		
< 5 KM	138	55,4
> 5 KM	111	44,6
ANC Compliance		
Obedient	139	55,8
Non-compliant	110	44,2
Knowledge		
Less	139	55,8
Enough	110	44,2

Based on the data obtained from **table 1,** it can be explained that the majority of pregnant women are aged < 27 years, education < junior high school, employment and non-employment, hard file education method, number of primigravida pregnancies, motivation to check for pregnancy is there, attitude of pregnant women is positive, source of information obtained by pregnant women is offline, family support for routine pregnancy checks is available, support is provided for ANC with compliant results and lack of knowledge of danger signs.

Table 2. Cross-Distribution of Respondent Frequencies

Variable	ANC Compliance		Total	P -Value
	Obedient	Non-compliant		
Mother's Age				
< 27 years old	134	3	37	0,001
> 27 years old	5	107	112	
Total	139	110	249	
Educational Methods				
Hardfile	133	6	139	0,001
Softfile	6	104	110	
Total	139	110	249	
Motivation of Pregnant Women				
There	134	11	145	0,001
None	5	99	104	
Total	139	110	249	
Attitude of Pregnant Women				
Positive	138	3	139	0,001
Negatives	3	107	110	
Total	139	110	249	
Number of Pregnancies				
Primigravida	128	13	141	0,001
Multigravity	11	97	108	
Total	139	110	249	
Distance of Checkpoint				
< 5 KM	138	0	138	0,001
> 5 KM	1	110	111	
Total	139	110	249	
Knowledge				
Less	138	3	139	0,001
Enough	3	107	110	
Total	139	110	249	

Based on the data obtained from **table 2**, it can be explained that of the 11 variables crossed (crosstab), 7 variables are related to ANC compliance, namely the age of pregnant women, number of pregnancies, motivation, attitude of pregnant women, distance to examination places, educational methods and knowledge of pregnant women which have a significant relationship with a p-value of 0.000.

Table. 3 Multivariate with *Logistic Regression Test*

Variable	P *Value*	OR	95.0% CI
Knowledge of pregnant women	0,019	3,380	1,222 – 9,348
Age of pregnant women	0,048	0,172	0,030 – 0,988

From **table 3,** the results of the multivariate analysis show that the most dominant variable with ANC compliance is the variable knowledge of pregnant women, P value = 0.019, OR value = 3.380 and is controlled by the age of the pregnant mother as a confounding factor.

Discussion

A statistically significant relationship between maternal age, parity, motivation, maternal attitude, distance to health facilities, educational methods, and maternal knowledge regarding pregnancy danger signs with ANC compliance (α = 0.05; p = 0.001). Thus, H_0 is rejected, and H_a

is accepted. These findings are consistent with previous studies demonstrating that maternal knowledge and sociodemographic factors significantly influence ANC utilization (Simkhada et al., 2008; Titaley et al., 2010). This study descriptively shows that the majority of pregnant women with high knowledge levels tend to be compliant with ANC visits, which aligns with evidence indicating that awareness of obstetric danger signs improves healthcare-seeking behavior (Fikre & Demissie, 2012b).

Table 3 shows that the most dominant variable associated with ANC compliance is maternal knowledge (p = 0.019; OR = 3.380), controlled by maternal age as a confounding factor. This suggests that mothers with good knowledge are more than three times likely to comply with ANC visits compared to those with low knowledge. Similar findings were reported by Gross et al. (2012), who identified maternal knowledge as a strong predictor of timely ANC attendance. The results of this study are consistent with research conducted by Erty Hikma & Mustikawati (2023; Pratitis & Kamidah, 2014), which reported a significant relationship between compliance with ANC visits and maternal knowledge of pregnancy danger signs. These findings are supported by (Fikre & Demissie, 2012b), who found that women with better knowledge of obstetric danger signs were significantly more likely to utilize maternal health services. This illustrates that improving knowledge regarding pregnancy danger signs increases the likelihood of ANC compliance. Maternal education also plays an important role in shaping knowledge and health behavior. Higher educational attainment enhances a mother's ability to receive, process, and understand health information related to pregnancy danger signs. Research indicates that women with higher education levels are significantly more likely to have adequate knowledge of pregnancy complications and utilize ANC services appropriately (Fagbamigbe & Idemudia, 2015; Simkhada et al., 2008). Kusumastut (2018)similarly reported that pregnant women with higher education were substantially more likely to demonstrate good knowledge of danger signs.

According to the compliance theory proposed by Sackett (1976, as cited in Niven, 2012), compliance refers to the extent to which a patient's behavior corresponds with healthcare providers' recommendations. Compliance with ANC visits is influenced not only by knowledge but also by supporting factors such as education, social support, environmental conditions, and the quality of interaction between health professionals and patients. Poor compliance may result from inadequate understanding of instructions, weak patient-provider communication, social isolation, and unsupportive family environments (Fagbamigbe & Idemudia, 2015; Kaye et al., 2014). Therefore, effective communication and counseling regarding pregnancy danger signs are essential to enhance maternal understanding of the benefits of regular ANC visits.

The findings of this study confirm that improving ANC compliance requires more than simply providing healthcare facilities. A holistic approach is necessary, involving maternal age considerations, family support, social environment, and the quality of maternal health services (Tunçalp et al., 2015). Strengthening health education through tailored counseling methods, increasing community awareness, involving husbands in maternal health programs, and improving the quality of maternal services through respectful and patient-centered care are critical strategies to enhance ANC compliance and reduce maternal and infant morbidity and mortality (WHO, 2016).

Implications and limitations

This study contributes to the conceptual and scientific understanding of factors influencing antenatal care (ANC) compliance by highlighting maternal knowledge of pregnancy danger signs as a key determinant within the broader framework of maternal health behavior. The findings support existing theoretical perspectives that emphasize the role of cognitive factors, such as knowledge and awareness, in shaping health-seeking behavior and adherence to recommended maternal health services. By identifying knowledge as the most dominant predictor of ANC compliance, this study enriches the body of literature on maternal health utilization. It provides empirical evidence that strengthens theoretical models linking health knowledge with preventive care behavior during pregnancy. However, several limitations should be acknowledged. The cross-sectional design limits the ability to establish causal relationships between variables.

Additionally, the use of purposive sampling from a single clinic may restrict the generalizability of the findings to other populations or healthcare settings. Self-reported questionnaire responses may also introduce response bias. Future research using longitudinal designs and broader multi-center samples is recommended to validate further and expand these findings.

Relevance to Practice

The findings of this study have practical relevance for maternal health services, particularly in low- and middle-income countries (LMICs) where limited resources often affect access to antenatal care (ANC). Since maternal knowledge of pregnancy danger signs was identified as the most dominant factor influencing ANC compliance, healthcare providers, especially nurses and midwives, can integrate structured health education on pregnancy danger signs into routine ANC counseling sessions. Simple and low-cost strategies such as brief educational discussions during clinic visits, the use of Maternal and Child Health (MCH) books as educational tools, and community-based health promotion activities can be implemented to improve maternal awareness. Health institutions can also strengthen counseling protocols to ensure that danger sign education is consistently delivered during each ANC visit. At the policy level, local health authorities may incorporate targeted maternal education programs into existing maternal health initiatives to improve ANC utilization. These practical strategies are feasible in resource-limited settings and can contribute to improving maternal health service adherence and early recognition of pregnancy complications.

Conclusion

This study demonstrates that maternal knowledge of pregnancy danger signs is the most significant factor associated with antenatal care (ANC) compliance among pregnant women attending Romauli Marelan Clinic. Although several variables, including maternal age, parity, motivation, attitude, educational methods, and distance to health facilities, showed significant associations with ANC compliance in bivariate analysis, multivariate logistic regression identified maternal knowledge as the strongest independent predictor. Pregnant women with adequate knowledge of pregnancy danger signs were more likely to comply with recommended ANC visits compared to those with lower knowledge levels. These findings highlight the importance of strengthening maternal knowledge as a key component in improving ANC utilization and promoting early detection of pregnancy complications. Enhancing awareness and understanding of pregnancy danger signs may contribute to

improved maternal health behaviors and support efforts to reduce preventable maternal risks.

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CrediT Authorship Contributions Statement

R. Oktaviance S.: Conceptualization, Methodology, Supervision, Writing - Original Draft

Seri Rayani: Software, Validation, Formal Analysis,

Desriati Sinaga: Investigation, Resources, Data Curation

Anita Veronika: Writing - Original Draft, Visualization, Funding Acquisition

Sri Martini: Project Administration, Review & Editing

Herlina J. EL- Matury: Writing, Review, and Editing

Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper

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Supplementary Materials

Supplementary File S1: Research Instrument contains the full questionnaire used for data collection.

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