



Maternal Health Literacy and Continuity of Antenatal Care Among Pregnant Women in Primary Healthcare Settings

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Abstract

Purpose - This study examined the association between maternal health literacy and continuity of antenatal care among pregnant women receiving services in primary healthcare settings.

Methodology - A quantitative cross-sectional study included 180 pregnant women attending three community health centres in Depok City, West Java, Indonesia. Maternal health literacy was assessed across accessing, understanding, appraising, and applying information, while continuity of antenatal care covered relational, management, and informational continuity. Data were analyzed using descriptive statistics, Pearson correlation, and multiple linear regression.

Findings - Maternal health literacy was positively correlated with continuity of antenatal care ($r = 0.52$, $p < 0.001$). In the adjusted model, maternal health literacy remained the strongest predictor of continuity ($\beta = 0.44$, $p < 0.001$). Higher education was positively associated with continuity, while travel time exceeding 30 minutes was negatively associated. The model explained 38.5% of the variance.

Implications - Primary healthcare facilities should strengthen health-literacy-responsive communication, consistent follow-up, information continuity, and accessibility throughout antenatal care.

Originality - This study extends prior evidence by examining maternal health literacy against a multidimensional concept of antenatal care continuity rather than focusing only on visit frequency or adherence.

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Introduction

Maternal health remains an important public health concern because preventable complications during pregnancy continue to contribute to maternal and neonatal morbidity and mortality, particularly in low- and middle-income countries. Antenatal care (ANC) provides a structured opportunity to identify pregnancy risks, screen for complications, deliver preventive interventions, and improve women's capacity to make appropriate health decisions. A recent systematic review and meta-analysis estimated that 85.0% of women in low- and middle-income countries received at least one ANC contact, yet only 50.8% completed at least four contacts, showing a substantial decline as care requirements become more intensive (Baten et al., 2025a). Continuity is therefore important because maternal healthcare cannot achieve its

expected benefits when women enter care but fail to maintain meaningful contact throughout pregnancy.

Optimal ANC use also varies sharply across settings and population groups. Cross-national evidence from countries with high maternal mortality shows that education, household wealth, media exposure, residence, employment, and reproductive characteristics shape whether women obtain adequate ANC ([Chilot et al., 2023](#)). These patterns indicate that continuity is influenced by both individual capacity and the conditions under which women reach and use health services.

Indonesia has expanded maternal healthcare coverage, but adequate service use remains uneven. Analysis of Riskesdas 2018 found that 73.7% of women obtained the recommended number of ANC visits under the applicable standard, while only 65.2% achieved optimal utilization when service content was considered ([Aryastami & Mubasyiroh, 2023](#)). Another national analysis reported that 75.2% of women completed ANC and identified education, insurance, employment, parity, pregnancy characteristics, travel conditions, and place of care as relevant determinants ([Idris & Sari, 2023](#)).

Regional inequalities also remain important. An analysis of the 2023 Indonesia Health Survey showed that approximately 5% of mothers in eastern Indonesia did not use ANC, with non-use concentrated among women facing economic and geographical disadvantage ([Titaley et al., 2025](#)). This finding suggests that broad service coverage can coexist with persistent gaps in access and continuity.

The quality and organization of ANC also influence women's ability to remain engaged with care. Research in rural Indonesia found that adequate ANC was associated with education, knowledge, motivation, social support, and perceived health service quality ([Indriyani et al., 2024](#)). Facility-based evidence from Bantul further showed that ANC visit characteristics, insurance ownership, and maternal education were associated with the quality of integrated ANC delivered in public health centres ([Iskandar et al., 2025](#)).

Maternal health literacy offers a plausible individual-level explanation for differences in sustained engagement with antenatal services. Prenatal health literacy includes the ability to access, understand, appraise, and apply health information in decisions that affect maternal and fetal health. A systematic review found substantial variation in prenatal health literacy and linked lower literacy to socioeconomic disadvantage, education, employment, ethnicity, and age ([Meldgaard et al., 2022](#)). Indonesian qualitative evidence similarly identified understanding, information seeking, appraisal, and application as central dimensions of maternal health literacy ([Putri et al., 2023a](#)).

Recent evidence shows that health literacy can influence health information seeking and pregnancy-related decisions. [Sabetghadam et al. \(2023\)](#) found that maternal health literacy was associated with health information-seeking behavior and pregnancy outcomes among Iranian pregnant women. [Şahin et al. \(2024\)](#) also showed that health literacy was related to women's knowledge of prenatal diagnosis and antenatal care. These findings suggest that literacy may shape how pregnant women interpret clinical advice and act on recommendations between ANC contacts.

Health literacy is not only an individual attribute. A systematic review focusing on low-income pregnant women emphasized that effective maternal health literacy interventions require empowerment, active involvement of midwives, and organizational responsiveness ([Ningrum et al., 2024](#)). This perspective is highly relevant to primary healthcare because repeated provider-patient interaction can either strengthen or weaken women's ability to understand and use health information.

Continuity of antenatal care extends beyond visit frequency. Baart et al. (2025) describe perinatal continuity through relational, management, and informational dimensions. These dimensions capture the consistency of the care relationship, coordination of clinical management, and transfer of relevant information across successive encounters. A study of maternal and child healthcare in Indonesia also found that service continuity declined across successive stages of care and varied according to socioeconomic and demographic characteristics (Rammohan et al., 2024).

Regional evidence from South and Southeast Asia similarly shows that continuity is stronger among women with higher education, better economic resources, early ANC initiation, and easier access to maternal healthcare (Rahut et al., 2024). However, continuity studies often emphasize structural and demographic determinants rather than maternal health literacy as a central explanatory factor.

Direct Indonesian evidence indicates that maternal health literacy is positively associated with adherence to recommended ANC contacts (Putri et al., 2023b). Yet adherence to the number of recommended contacts does not fully capture relational, management, and informational continuity. Research on high-risk pregnancy in Indonesia has also demonstrated benefits of continuity-oriented care, but continuity was treated mainly as an intervention rather than an outcome that may be influenced by women's health literacy (Sholikhah et al., 2025).

This study therefore examines the association between maternal health literacy and continuity of antenatal care among pregnant women receiving services in primary healthcare settings. The study asks whether maternal health literacy is significantly associated with continuity of antenatal care after relevant maternal and healthcare-access characteristics are considered. The study contributes by integrating a multidimensional continuity framework with a pregnancy-specific health literacy perspective in the context of Indonesian primary healthcare.

Literature Review

Maternal Health Literacy

Maternal health literacy is a pregnancy-specific application of health literacy that reflects women's competence in managing information required for maternal and fetal health. It includes finding appropriate information, understanding its meaning, evaluating its credibility and relevance, and using it in health-related decisions. Bello et al. (2022) showed that maternal health literacy was associated with utilization of maternal healthcare services, supporting its behavioral relevance beyond factual knowledge.

Maternal health literacy develops within social and organizational contexts. Pregnant women from ethnic minority groups can experience lower health literacy because language, socioeconomic disadvantage, fragmented communication, and limited access to appropriate information interact with one another (Feldman et al., 2024). These factors can affect how women communicate with providers and navigate antenatal services.

Recent cross-sectional evidence also shows that limited health literacy is patterned by socioeconomic vulnerability. Ferreira et al. (2025) found that limited health literacy among pregnant women was more common among migrants, women with lower education, women in lower-skilled occupations, and those facing financial difficulties. This suggests that literacy-responsive ANC should be designed to reduce rather than reproduce existing inequalities.

Communication design is also critical. A systematic review of interventions for pregnant women with limited language proficiency found very few evaluated interventions, despite a clear need for culturally and linguistically appropriate information (Khan et al., 2024). Health

literacy support therefore requires information that women can understand and use within their own social and linguistic context.

The consequences of limited health literacy may extend to pregnancy outcomes. [Kim et al. \(2025\)](#) concluded that health literacy may contribute to differences in pregnancy outcomes among socioeconomically disadvantaged and ethnic minority populations. This supports the inclusion of health literacy within efforts to improve equity in maternal care.

Maternal health literacy also relates to psychological and behavioral aspects of pregnancy. [Ugurlu and Kul Uctu \(2023\)](#) found associations among prenatal distress, health literacy, and health perception. This indicates that women's capacity to interpret health information can coexist with emotional and perceptual factors that shape healthcare behavior.

ANC serves as both a clinical service and an information platform. [Karyadi et al. \(2023\)](#) found that antenatal care attendance was associated with adherence to iron supplementation across several low- and middle-income settings. This illustrates how repeated ANC contact can translate health information into concrete preventive behavior.

Continuity of Antenatal Care

Continuity of antenatal care describes whether successive healthcare encounters remain connected, coordinated, and responsive to women's needs. [Baten et al. \(2025b\)](#) showed that the broader continuum of maternal healthcare remains incomplete in many low- and middle-income countries and that education, wealth, residence, distance, employment, decision-making power, and media exposure influence completion.

Continuity is also shaped by the organization of maternity services. A scoping review covering low- and middle-income countries found persistent interest in midwifery continuity models and highlighted their potential contribution to access, trust, and sustained engagement with maternity services ([Adnani et al., 2025](#)).

Continuity may improve the quality of women's experience when care is delivered through stable and coordinated relationships. [Lundborg et al. \(2025\)](#) reported favorable outcomes associated with midwifery continuity across pregnancy, birth, and the postpartum period. The relational dimension is therefore relevant to how women perceive and sustain contact with services.

Management continuity becomes especially important when women interact with several providers or move between levels of care. [Anggraeni et al. \(2023\)](#) documented challenges to ANC delivery in rural Indonesia during the COVID-19 pandemic, showing how service disruption and local constraints can weaken access and continuity even when the need for care remains.

Health-system organization also affects maternal outcomes. [Wenang et al. \(2024\)](#) showed that maternal mortality and stillbirth in Indonesia are associated with broader obstetric care determinants, reinforcing the importance of coordinated systems rather than isolated clinical encounters.

Informational continuity requires that essential screening, counselling, and prior findings remain available and meaningful across contacts. [Nihal and Shekhar \(2024\)](#) found that adequate-quality ANC is shaped by both individual and service-level determinants, indicating that contact frequency alone cannot represent care quality.

Continuity across the broader maternal-newborn-child pathway remains low in several settings. [Andriani et al. \(2022\)](#) found that only a minority of women across six lower-middle-income Southeast Asian countries completed all four levels of continuing maternal, newborn,

and child health services. This regional evidence supports attention to dropout and care transitions.

Studies from other low-resource settings show similar inequalities. [Gebremedhin et al. \(2023\)](#) found that education, residence, socioeconomic status, perceived distance, pregnancy intention, parity, and early ANC initiation influenced continuity of maternal and child health services in Ethiopia. These determinants support the need for adjusted analyses when testing the independent role of maternal health literacy.

Community-based evidence also confirms that continuity is affected by multiple conditions. [Alemayehu et al. \(2024\)](#) identified predictors of maternity continuum completion in southern Ethiopia, emphasizing that continuity reflects both women's characteristics and healthcare access.

Nigerian evidence similarly shows that maternity continuum completion varies according to socioeconomic position and healthcare factors. [Oyedele et al. \(2023\)](#) reported important gaps in continuum coverage and highlighted the relevance of targeted maternal, newborn, and child health programming.

Other analyses show that adequate maternal service utilization is closely tied to social and economic conditions. [Adedokun et al. \(2023\)](#) identified determinants of partial and adequate maternal health service utilization in Nigeria, reinforcing the importance of considering confounding factors when evaluating individual-level predictors.

Research Gap and Conceptual Framework

Indonesian maternal healthcare use is also shaped by local context. [Damayanti et al. \(2023\)](#) showed that utilization behavior differs across urban and rural environments and is influenced by local and individual conditions. This means that literacy should be studied within the service environment where women actually obtain ANC.

Evidence syntheses from developing countries identify knowledge, access, social support, and health-system factors as recurring influences on antenatal care utilization. [Yunitasari et al. \(2023\)](#) concluded that ANC utilization reflects a combination of individual and service-related determinants rather than a single factor.

The broader value of continuity is supported by evidence linking connected maternal health services with improved maternal and neonatal outcomes. [Zelka et al. \(2023\)](#) found that continuum-oriented maternal health services can contribute to reductions in adverse maternal and neonatal outcomes. This supports the public health relevance of studying continuity as an outcome in its own right.

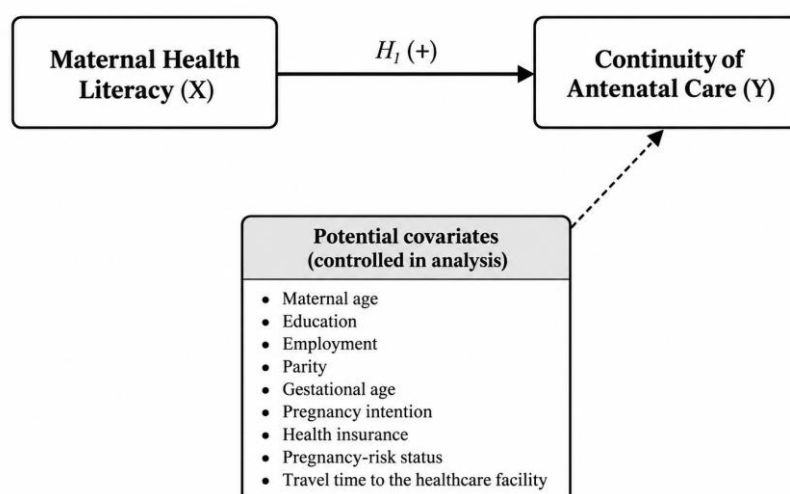
Barriers to obstetric service utilization also arise from structural and system-level constraints. [Singh and Rajak \(2024\)](#) identified financial, geographical, sociocultural, and service-related barriers across the obstetric care pathway. These constraints may limit continuity even among women with adequate health knowledge.

Measurement quality is central when maternal health literacy is treated as a quantitative predictor. [Altuntas and Kilic Ucar \(2024\)](#) provided recent evidence for the validity and reliability of a pregnancy-specific maternal health literacy instrument, supporting multidimensional measurement rather than reliance on educational attainment as a proxy.

Taken together, the literature follows two partly separate pathways. One examines maternal health literacy and its association with knowledge, information seeking, behavior, and ANC attendance. The other examines ANC adequacy and continuity through demographic, socioeconomic, accessibility, and health-system determinants. The current study integrates these

pathways by positioning maternal health literacy as the primary predictor of multidimensional continuity of antenatal care in primary healthcare settings.

The conceptual framework positions maternal health literacy as the independent variable and continuity of antenatal care as the dependent variable, while maternal and healthcare-access characteristics are treated as potential covariates. The proposed relationship is illustrated in Figure 1.



Source: Developed by the authors (2026).

Figure 1. Conceptual Model of Maternal Health Literacy and Continuity of Antenatal Care

Hypothesis Development

Maternal Health Literacy and Continuity of Antenatal Care

Maternal health literacy can influence continuity of antenatal care through cognitive, communicative, and behavioral mechanisms. Pregnant women first need to access relevant information about ANC schedules, maternal risks, laboratory examinations, nutrition, referrals, and follow-up. They must then understand and appraise that information before applying it to healthcare decisions. Higher literacy therefore increases the likelihood that recommendations received during one encounter are translated into actions before the next encounter.

The proposed relationship is particularly relevant to informational continuity. Successive ANC contacts require women to remember recommendations, communicate changes, understand test results, and follow instructions. Group antenatal care research indicates that repeated education and interaction can strengthen women's preparedness and engagement with health information (Kukula et al., 2024).

Interactive care may also improve the mechanisms through which women interpret and use antenatal information. Mehay et al. (2024) found that group ANC can work through participation, peer support, learning, and strengthened relationships with providers. These mechanisms are consistent with the expectation that greater maternal health literacy supports continuity.

Evidence also suggests that health literacy can be improved through structured ANC. Lori et al. (2024) found that group antenatal care improved health literacy in a cluster randomized trial in Ghana. This relationship also implies a possible reinforcing process in which literacy supports engagement and repeated engagement increases exposure to understandable information.

Based on the theoretical mechanism and the available evidence, the study proposes the following hypothesis:

H1: Maternal health literacy has a positive and significant association with continuity of antenatal care among pregnant women in primary healthcare settings.

Research Methods

Research Design and Setting

This study employed a quantitative analytic cross-sectional design to examine the association between maternal health literacy and continuity of antenatal care among pregnant women receiving services in primary healthcare settings. The study was conducted at three community health centres (Puskesmas) in Depok City, West Java, Indonesia, from January to March 2026. A facility-based approach was selected because the study focused on women who were actively engaged with ANC services.

Population, Eligibility Criteria, and Sampling

The target population consisted of pregnant women receiving antenatal care at the selected community health centres. Participants were eligible when they were aged 18 years or older, were currently pregnant, had completed at least two ANC contacts during the current pregnancy, could communicate in Indonesian, and voluntarily agreed to participate. Women requiring immediate emergency referral during recruitment or unable to complete the questionnaire because of conditions that substantially impaired communication were excluded. Consecutive sampling was applied until the recruitment target was achieved.

Sample Size

The minimum sample size was calculated using an a priori power approach for multiple linear regression. The calculation assumed an effect size of $f^2 = 0.10$, a significance level of $\alpha = 0.05$, statistical power of 80%, and a model containing the primary predictor and relevant covariates. The estimated minimum analytical sample was approximately 166 participants. To account for incomplete questionnaires and potential exclusions, the recruitment target was increased to 185 pregnant women.

Study Variables and Operational Definitions

The independent variable was maternal health literacy, operationally defined as the participant's ability to access, understand, appraise, and apply maternal health information during pregnancy. The dependent variable was continuity of antenatal care, defined as the participant's perception that successive ANC encounters were connected, consistent, coordinated, and informed by previous care. Potential covariates included maternal age, education, employment, parity, gestational age, pregnancy intention, health insurance ownership, pregnancy-risk status, and travel time to the healthcare facility.

Research Instruments

Maternal health literacy was measured using an adapted pregnancy-specific questionnaire covering accessing, understanding, appraising, and applying maternal health information. Responses used a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). The dimensions were consistent with pregnancy-specific health literacy frameworks and recent instrument validation evidence ([Altuntas & Kilic Ucar, 2024](#)).

Continuity of antenatal care was assessed through an adapted questionnaire covering relational continuity, management continuity, and informational continuity. Relational items assessed communication, trust, and familiarity with care. Management items assessed coordination of examinations, follow-up, recommendations, and referrals. Informational items assessed whether information from previous contacts was communicated and used during subsequent care. Each item used a five-point Likert response, and higher scores indicated stronger continuity.

Instrument Adaptation, Validity, and Reliability

The questionnaires underwent content and linguistic adaptation before the main study. Five experts participated in the content review: two midwifery academics, one maternal nursing academic, one public health researcher, and one quantitative health research methodologist. Where items originated from English-language instruments, adaptation followed forward translation, reconciliation, backward translation, and expert comparison. Content validity was evaluated using the Item-Level Content Validity Index and Scale-Level Content Validity Index.

A pilot test was conducted among 30 pregnant women receiving ANC at a community health centre outside the main study sites. Pilot participants were excluded from the main analysis. Cronbach's alpha values of at least 0.70 were considered acceptable. Construct performance was evaluated using item-factor relationships, composite reliability, and average variance extracted.

Data Collection Procedure

Data were collected from January to March 2026 during routine ANC service hours. Trained research assistants approached eligible women after clinical registration and provided standardized information concerning the study purpose, confidentiality, voluntary participation, and the right to withdraw. Participants completed a paper-based self-administered questionnaire in a designated private area. Completion required approximately 15 to 20 minutes.

Each participant received a unique study identification code. Direct identifiers were excluded from the analytical dataset. Study codes were checked against the recruitment log to prevent duplicate participation. Completed questionnaires were reviewed on the same day. Questionnaires with more than 10% missing responses on either primary construct were excluded from the primary analysis.

Data Analysis

Data were entered, cleaned, and analyzed using IBM SPSS Statistics version 29.0. Categorical variables were summarized using frequencies and percentages. Continuous variables were summarized using means and standard deviations when approximately normally distributed, while medians and interquartile ranges were used when distributions were substantially skewed. Pearson's correlation coefficient assessed the initial bivariate association between maternal health literacy and continuity when parametric assumptions were satisfied.

The primary hypothesis was tested using multiple linear regression. Continuity of antenatal care was entered as the dependent variable and maternal health literacy as the primary independent variable. Maternal age, education, employment, parity, gestational age, pregnancy intention, health insurance, pregnancy-risk status, and travel time were considered potential covariates. Model assumptions included linearity, homoscedasticity, approximate normality of residuals, and absence of problematic multicollinearity. A variance inflation factor below 5.0 was considered acceptable. Statistical significance was set at $p < 0.05$.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k + \varepsilon$$

where Y represents the continuity of antenatal care score, β_0 is the intercept, X_1 represents maternal health literacy, X_2 to X_k represent the covariates, β_1 to β_k are regression coefficients, and ε represents the error term.

Ethical Considerations

The study followed ethical principles for research involving human participants. Ethical approval was obtained from the Health Research Ethics Committee, Faculty of Public Health, Universitas Indonesia, before data collection. Administrative permission was obtained from the relevant local health authority and participating community health centres. All participants received study information and provided written informed consent. Participation was voluntary, and

withdrawal did not affect access to antenatal care. Study data were anonymized before analysis and reported only in aggregate form.

Results and Discussion

Participant Characteristics

A total of 185 pregnant women were recruited from three community health centres in Depok City, West Java. Five questionnaires were excluded because more than 10% of responses on the primary variables were missing. The final analysis included 180 participants, corresponding to a usable response rate of 97.3%. The mean age was 28.9 ± 5.1 years. Most participants were aged 25 to 34 years, were not formally employed, were multiparous, and were in the third trimester. Table 1 summarizes the study participants.

Table 1. Characteristics of the Study Participants (n = 180)

Characteristics	n	%
Maternal age		
20-24 years	39	21.7
25-29 years	58	32.2
30-34 years	53	29.4
≥35 years	30	16.7
Educational attainment		
Secondary education or lower	94	52.2
Diploma/university	86	47.8
Employment status		
Not formally employed	108	60.0
Employed	72	40.0
Parity		
Primigravida	74	41.1
Multiparous	106	58.9
Gestational period		
Second trimester	67	37.2
Third trimester	113	62.8
Pregnancy intention		
Planned	145	80.6
Unplanned	35	19.4
Health insurance		
Insured	164	91.1
Uninsured	16	8.9
Pregnancy-risk status		
Low risk	139	77.2
High risk	41	22.8
Travel time to healthcare facility		

≤30 minutes	150	83.3
>30 minutes	30	16.7

Source: Primary data processed by the researchers (2026).

Maternal Health Literacy and Continuity of Antenatal Care

The overall mean maternal health literacy score was 3.84 ± 0.47 on a five-point scale. Understanding health information had the highest mean score (3.91 ± 0.53), while appraising health information had the lowest (3.67 ± 0.59). The mean continuity of antenatal care score was 3.72 ± 0.49 . Relational continuity had the highest mean (3.78 ± 0.55), while informational continuity had the lowest (3.63 ± 0.58). Table 2 presents the descriptive statistics.

Table 2. Descriptive Statistics of the Main Study Variables

Variable/Dimension	Mean	SD	Minimum	Maximum
Maternal health literacy	3.84	0.47	2.35	4.85
Accessing information	3.88	0.56	2.20	5.00
Understanding information	3.91	0.53	2.40	5.00
Appraising information	3.67	0.59	2.00	5.00
Applying information	3.89	0.51	2.40	5.00
Continuity of antenatal care	3.72	0.49	2.27	4.87
Relational continuity	3.78	0.55	2.20	5.00
Management continuity	3.74	0.52	2.17	5.00
Informational continuity	3.63	0.58	2.00	5.00

Source: Primary data processed by the researchers (2026).

Reliability and Construct Performance

The instruments demonstrated satisfactory internal consistency. Cronbach's alpha was 0.89 for maternal health literacy and 0.91 for continuity of antenatal care. Dimension-level alpha coefficients ranged from 0.78 to 0.86. Standardized item loadings ranged from 0.61 to 0.84 for maternal health literacy and from 0.64 to 0.86 for continuity. Composite reliability values were 0.91 and 0.92, while average variance extracted values were 0.57 and 0.60, respectively.

Bivariate Association

Pearson correlation analysis showed a positive and statistically significant association between maternal health literacy and continuity of antenatal care ($r = 0.52$, $p < 0.001$). At the dimensional level, applying information showed the strongest correlation with overall continuity, followed by understanding, accessing, and appraising information. Table 3 presents the correlation results.

Table 3. Correlation Between Maternal Health Literacy and Continuity of Antenatal Care

Maternal health literacy variable	r with continuity of ANC	p-value
Overall maternal health literacy	0.52	<0.001
Accessing information	0.41	<0.001
Understanding information	0.46	<0.001
Appraising information	0.38	<0.001

Applying information

0.49

<0.001

Source: Primary data processed by the researchers (2026).

Multiple Linear Regression

The multiple linear regression model was statistically significant, $F(10,169) = 10.58$, $p < 0.001$, with $R^2 = 0.385$ and adjusted $R^2 = 0.349$. Maternal health literacy was the strongest predictor of continuity. A one-point increase in maternal health literacy was associated with a 0.46-point increase in continuity after adjustment ($B = 0.46$, $SE = 0.067$, $\beta = 0.44$, $t = 6.87$, $p < 0.001$, 95% CI [0.33, 0.59]). Higher education was positively associated with continuity, while travel time greater than 30 minutes was negatively associated. Table 4 presents the adjusted model.

Table 4. Multiple Linear Regression Predicting Continuity of Antenatal Care

Predictor	B	SE	β	t	95% CI	p-value
Maternal health literacy	0.46	0.067	0.44	6.87	0.33 to 0.59	<0.001
Maternal age	0.005	0.006	0.05	0.83	-0.007 to 0.017	0.409
Diploma/university education	0.17	0.066	0.16	2.58	0.04 to 0.30	0.011
Employed	0.05	0.065	0.05	0.77	-0.08 to 0.18	0.443
Multiparous	-0.03	0.066	-0.03	-0.45	-0.16 to 0.10	0.651
Gestational age	0.003	0.004	0.05	0.75	-0.005 to 0.011	0.454
Planned pregnancy	0.09	0.084	0.07	1.07	-0.08 to 0.26	0.285
Health insurance ownership	0.14	0.110	0.08	1.27	-0.08 to 0.36	0.205
High-risk pregnancy	0.10	0.076	0.08	1.31	-0.05 to 0.25	0.190
Travel time >30 minutes	-0.22	0.091	-0.15	-2.42	-0.40 to -0.04	0.017

Source: Primary data processed by the researchers using IBM SPSS Statistics version 29.0 (2026).

Regression diagnostics indicated no serious violations of model assumptions. Variance inflation factor values ranged from 1.08 to 1.74, indicating no problematic multicollinearity. Residual plots showed no substantial heteroscedasticity, and standardized residuals were approximately normally distributed. H1 was therefore supported.

Discussion

The principal finding of this study was that maternal health literacy had a positive and significant association with continuity of antenatal care. The association remained significant after maternal sociodemographic characteristics, obstetric factors, insurance coverage, and healthcare accessibility were controlled. The standardized coefficient of $\beta = 0.44$ indicates that maternal health literacy contributed meaningfully to variation in continuity beyond conventional demographic and access-related determinants.

This result extends previous Indonesian evidence showing that women with higher maternal health literacy demonstrate greater adherence to recommended ANC contacts (Putri et al., 2023b). The present study adds a broader conceptualization of continuity because the outcome included relational, management, and informational components rather than contact count alone.

The finding can be explained by the functional role of maternal health literacy throughout pregnancy. Women repeatedly receive information about examination schedules, laboratory results, nutrition, medication, fetal development, danger signs, referrals, and birth preparation. Indonesian qualitative evidence shows that maternal health literacy involves both evaluating

information and translating it into health decisions (Putri et al., 2023a). Women with stronger literacy may therefore be better able to connect recommendations from one encounter with actions required before the next.

The positive relationship is also consistent with evidence that maternal health literacy is related to maternal healthcare utilization (Bello et al., 2022). This supports the interpretation that health literacy has behavioral consequences and does not simply reflect knowledge.

The applying-information dimension showed the strongest dimensional correlation with continuity. This pattern is plausible because access to information alone does not ensure continued care. Women need to convert recommendations into concrete behavior, including attending follow-up, completing tests, following treatment advice, and seeking help when needed. Sabetghadam et al. (2023) similarly showed that maternal health literacy is related to information-seeking behavior and pregnancy outcomes.

Relational continuity had the highest average score, while informational continuity had the lowest. This suggests that participants generally experienced satisfactory interaction with healthcare professionals but perceived weaker consistency in the transfer and use of information across encounters. Baart et al. (2025) emphasize informational continuity as a distinct element because findings and recommendations from one encounter should remain available and meaningful during subsequent care.

This weakness is especially relevant in Puskesmas settings where women may interact with different midwives, physicians, laboratory personnel, or referral providers. Health literacy may help women ask questions and communicate prior recommendations, but responsibility for continuity should not be transferred to patients alone. Ningrum et al. (2024) argue that maternal health literacy improvement requires both women's empowerment and organizational responsiveness.

Higher educational attainment remained positively associated with continuity after adjustment. This result is consistent with evidence from rural Indonesia that education and knowledge influence adequate ANC use (Indriyani et al., 2024). However, maternal health literacy remained independently significant, indicating that formal education and pregnancy-specific health literacy should not be treated as equivalent constructs.

Travel time greater than 30 minutes was negatively associated with continuity. This demonstrates that knowledge and literacy cannot remove structural barriers to care. Fajarina et al. (2024) likewise found that distance to healthcare services contributed to delayed ANC among women in Aceh.

The broader Indonesian context supports this interpretation. Damayanti et al. (2023) showed that maternal healthcare utilization varies with local and contextual conditions across urban and rural settings. Interventions that improve literacy should therefore be combined with efforts to reduce access barriers.

Several covariates, including maternal age, employment, parity, pregnancy intention, insurance, and pregnancy-risk status, were not significant in the adjusted model. This does not mean that these factors are unimportant. Their effects may operate through literacy, access, socioeconomic position, or prior healthcare experience. Aryastami and Mubasyiroh (2023) similarly show that optimal utilization reflects multiple interacting determinants.

The regression model explained 38.5% of total variance and 34.9% after adjustment. This indicates that the selected predictors account for a meaningful but incomplete proportion of continuity. Broader evidence from continuum studies also shows that women's education,

household resources, residence, autonomy, and healthcare access influence completion of maternal services ([Andriani et al., 2022](#)).

The unexplained variance may include provider workload, continuity with the same professional, appointment availability, communication quality, partner support, perceived quality of care, digital information access, referral complexity, and trust. Evidence from continuity studies in other settings likewise shows that care completion depends on both individual and system characteristics ([Gebremedhin et al., 2023](#)).

Primary healthcare facilities should therefore treat maternal health literacy as part of routine ANC quality improvement. Providers can use plain language, concise written instructions, visual aids, and confirmation of understanding. Interactive approaches may be particularly useful because group ANC has been shown to strengthen preparedness and engagement ([Kukula et al., 2024](#)).

Repeated educational contact may also strengthen health literacy itself. [Lori et al. \(2024\)](#) demonstrated that group antenatal care improved health literacy, indicating that continuity and literacy can reinforce each other over time.

At the service level, information from each ANC encounter should be documented and communicated consistently so that subsequent providers can continue care without unnecessary repetition or contradictory advice. Evidence from midwifery continuity models supports the importance of sustained relationships and coordinated care across maternity stages ([Lundborg et al., 2025](#)).

The study also supports broader efforts to improve continuity in maternal healthcare. [Adnani et al. \(2025\)](#) highlight longstanding interest in continuity models in low- and middle-income countries, while [Baten et al. \(2025b\)](#) show that maternal service continuity remains incomplete across many settings. These findings place the present results within a wider health-system challenge.

Nevertheless, several limitations should be considered. The cross-sectional design identifies association but cannot establish temporal causality. Maternal health literacy may improve continuity, but repeated ANC engagement may also increase exposure to health information. Self-reported measures may introduce recall or social desirability bias. The study was limited to three primary healthcare facilities in one urban area, which restricts generalization to rural, remote, or culturally different populations.

Future studies should use longitudinal designs beginning in early pregnancy, include rural and remote populations, and combine patient-level literacy with provider-level and facility-level determinants. Mixed-method research could also examine how women experience information continuity and how provider communication influences their ability to remain engaged with ANC.

Conclusion

This study found that maternal health literacy had a positive and significant association with continuity of antenatal care among pregnant women receiving services in primary healthcare settings. Maternal health literacy remained the strongest predictor in the adjusted model ($\beta = 0.44$, $p < 0.001$), while higher education was positively associated with continuity and travel time of more than 30 minutes was negatively associated. The model explained 38.5% of the variance in continuity. These findings support the study hypothesis and indicate that the ability to access, understand, appraise, and apply maternal health information contributes to more consistent and connected antenatal care.

The findings support practical improvements in primary healthcare, including health-literacy-responsive communication, clear follow-up instructions, consistent documentation, and improved

accessibility for women who face longer travel times. The cross-sectional design, self-reported measures, and single-city setting limit causal interpretation and broader generalization. Future research should use longitudinal and multicentre designs, include rural and remote populations, and examine provider-level and facility-level factors that may interact with maternal health literacy in shaping continuity of antenatal care.

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Conflict of Interest

The authors declare no conflict of interest related to the conduct, reporting, or publication of this study.

Statement on the Use of Artificial Intelligence

During the preparation of this manuscript, the authors used ChatGPT (OpenAI) to support language refinement, manuscript organization, and formatting. The tool was not used as a substitute for scientific judgment. All AI-assisted content was reviewed, edited, and verified by the authors, who take full responsibility for the accuracy, integrity, and final content of the manuscript.

References

- Adedokun, S. T., Uthman, O. A., & Bisiriyu, L. A. (2023). Determinants of partial and adequate maternal health services utilization in Nigeria: Analysis of cross-sectional survey. *BMC Pregnancy and Childbirth*, 23, 457. <https://doi.org/10.1186/s12884-023-05712-4>
- Adnani, Q. E. S., Nurfitriyani, E., Merida, Y., Khuzaiyah, S., Okinarum, G. Y., Susanti, A. I., Adepoju, V. A., & Hashim, S. H. (2025). Ninety-one years of midwifery continuity of care in low and middle-income countries: A scoping review. *BMC Health Services Research*, 25, 463. <https://doi.org/10.1186/s12913-025-12612-0>
- Alemayehu, G., Birhanu, S., Alemayehu, A., & Mulatu, T. (2024). Completion and predictors of maternity continuum of care among women in the post-partum period in Gedeb district, southern Ethiopia: A community based cross-sectional study. *PLOS ONE*, 19(6), e0303380. <https://doi.org/10.1371/journal.pone.0303380>

- Altuntas, Y., & Kilic Ucar, A. (2024). Validity and reliability of the Turkish version of the Maternal Health Literacy Inventory in Pregnancy scale: A methodological study. *Women's Health Nursing*, 30(4), 330-339. <https://doi.org/10.4069/whn.2024.10.18>
- Andriani, H., Rahmawati, N. D., Fauzia, S., & Kosasih, R. I. (2022). Population-based study on the maternal-newborn-child health continuum of care: Evidence from lower-middle-income countries in Southeast Asia. *Asia-Pacific Journal of Public Health*, 34(5), 547-556. <https://doi.org/10.1177/10105395221088615>
- Anggraeni, M. D., Setiyani, R., Triyanto, E., Iskandar, A., Nani, D., & Fatoni, A. (2023). Exploring the antenatal care challenges faced during the COVID-19 pandemic in rural areas of Indonesia: A qualitative study. *BMC Pregnancy and Childbirth*, 23, 179. <https://doi.org/10.1186/s12884-023-05495-8>
- Aryastami, N. K., & Mubasyiroh, R. (2023). Optimal utilization of maternal health service in Indonesia: A cross-sectional study of Riskesdas 2018. *BMJ Open*, 13(9), e067959. <https://doi.org/10.1136/bmjopen-2022-067959>
- Baart, A., Brunsveld Reinders, A. H., Pijnappel, L., de Haan, M., & de Man-van Ginkel, J. M. (2025). Continuity of care as central theme in perinatal care: A systematic review. *Midwifery*, 141, 104273. <https://doi.org/10.1016/j.midw.2024.104273>
- Baten, A., Biswas, R. K., Kendal, E. S., & Bhowmik, J. L. (2025). Utilization of maternal healthcare services in low- and middle-income countries: A systematic review and meta-analysis. *Systematic Reviews*, 14, 88. <https://doi.org/10.1186/s13643-025-02832-0>
- Baten, A., Biswas, R. K., Kendal, E., & Bhowmik, J. (2025). Continuum of maternal healthcare services utilization in low- and middle-income countries: A multi-level analysis. *Midwifery*, 149, 104549. <https://doi.org/10.1016/j.midw.2025.104549>
- Bello, C. B., Esan, D. T., Akerele, S. A., & Fadare, R. I. (2022). Maternal health literacy, utilisation of maternal healthcare services and pregnancy outcomes among newly delivered mothers: A cross-sectional study in Nigeria. *Public Health in Practice*, 3, 100266. <https://doi.org/10.1016/j.puhip.2022.100266>
- Chilot, D., Belay, D. G., Ferede, T. A., Shitu, K., Asratie, M. H., Ambachew, S., Shibabaw, Y. Y., Geberu, D. M., Deresse, M., & Alem, A. Z. (2023). Pooled prevalence and determinants of antenatal care visits in countries with high maternal mortality: A multi-country analysis. *Frontiers in Public Health*, 11, 1035759. <https://doi.org/10.3389/fpubh.2023.1035759>
- Damayanti, N. A., Wulandari, R. D., & Ridlo, I. A. (2023). Maternal health care utilization behavior, local wisdom, and associated factors among women in urban and rural areas, Indonesia. *International Journal of Women's Health*, 15, 665-677. <https://doi.org/10.2147/IJWH.S379749>
- Fajarina, M., Terathongkum, S., & Lininger, J. (2024). Factors influencing late antenatal care of Muslim pregnant women: A predictive correlational study in Aceh, Indonesia. *Belitung Nursing Journal*, 10(3), 360-367. <https://doi.org/10.33546/bnj.3339>
- Feldman, S. E., Lennox, L., Dsouza, N., & Armani, K. (2024). Exploring the impact of health literacy on pregnant women from ethnic minority groups: A scoping review. *PLOS ONE*, 19(12), e0312515. <https://doi.org/10.1371/journal.pone.0312515>
- Ferreira, N. C., Ferreira, M., Santos, E., Ferreira, S., Arriaga, M., & Costa, A. (2025). Health literacy and its determinants among pregnant women in Portugal. *BMC Public Health*, 25. <https://doi.org/10.1186/s12889-025-24225-7>
- Gebremedhin, A. F., Dawson, A., & Hayen, A. (2023). Determinants of continuum of care for maternal, newborn, and child health services in Ethiopia: Analysis of the modified composite

- coverage index using a quantile regression approach. *PLOS ONE*, 18(1), e0280629. <https://doi.org/10.1371/journal.pone.0280629>
- Idris, H., & Sari, I. (2023). Factors associated with the completion of antenatal care in Indonesia: A cross-sectional data analysis based on the 2018 Indonesian Basic Health Survey. *Belitung Nursing Journal*, 9(1), 79-85. <https://doi.org/10.33546/bnj.2380>
- Indriyani, D., Yunitasari, E., & Efendi, F. (2024). Factors associated with adequate antenatal care among pregnant women in rural Indonesia. *Africa Journal of Nursing and Midwifery*, 26. <https://doi.org/10.25159/2520-5293/14232>
- Iskandar, S. I., Aryanto, S., Prawitasari, S., & Wiratama, B. S. (2025). Strengthening the first antenatal visit to improve maternal health: Results from a cross-sectional study in Bantul, Indonesia. *BMC Pregnancy and Childbirth*, 25, 911. <https://doi.org/10.1186/s12884-025-08038-5>
- Karyadi, E., Reddy, J. C., Dearden, K. A., Purwanti, T., Mardewi, Asri, E., Roquero, L. B., Juguan, J. A., Sapitula-Evidente, A., Anand, B., Warvadekar, K., Bhardwaj, A., Alam, M. K., Das, S., Nair, G. K., Srivastava, A., & Raut, M. K. (2023). Antenatal care is associated with adherence to iron supplementation among pregnant women in selected low-middle-income countries of Asia, Africa, and Latin America and the Caribbean regions: Insights from Demographic and Health Surveys. *Maternal & Child Nutrition*, 19(2), e13477. <https://doi.org/10.1111/mcn.13477>
- Khan, M., Dave, A., Benton, M., Moss, N., & Kaler, M. K. (2024). Health literacy interventions for pregnant women with limited language proficiency in the country they live in: A systematic review. *BMC Public Health*, 24, 3287. <https://doi.org/10.1186/s12889-024-20747-8>
- Kim, J., Heazell, A. E. P., Whittaker, M., Stacey, T., & Watson, K. (2025). Impact of health literacy on pregnancy outcomes in socioeconomically disadvantaged and ethnic minority populations: A scoping review. *International Journal of Gynecology & Obstetrics*, 168(1), 69-81. <https://doi.org/10.1002/ijgo.15852>
- Kukula, V. A., Awini, E., Ghosh, B., Apetorgbor, V., Zielinski, R., Amankwah, G., Ofosu, W. K., James, K., Williams, J. E. O., Lori, J. R., & Moyer, C. A. (2024). Effect of group antenatal care versus individualized antenatal care on birth preparedness and complication readiness: A cluster randomized controlled study among pregnant women in Eastern Region of Ghana. *BMC Pregnancy and Childbirth*, 24, 546. <https://doi.org/10.1186/s12884-024-06743-1>
- Lori, J. R., Kukula, V. A., Liu, L., Apetorgbor, V. E. A., Ghosh, B., Awini, E., Lockhart, N., Amankwah, G., Zielinski, R., Moyer, C. A., & Williams, J. (2024). Improving health literacy through group antenatal care: Results from a cluster randomized controlled trial in Ghana. *BMC Pregnancy and Childbirth*, 24, 37. <https://doi.org/10.1186/s12884-023-06224-x>
- Lundborg, L., Åberg, K., Liu, X., Norman, M., Stephansson, O., Pettersson, K., Ekborn, M., Cnattingius, S., & Ahlberg, M. (2025). Midwifery continuity of care during pregnancy, birth, and the postpartum period: A matched cohort study. *Birth*, 52(1), 146-156. <https://doi.org/10.1111/birt.12875>
- Meldgaard, M., Gamborg, M., & Maindal, H. T. (2022). Health literacy in the prenatal phase: A systematic review. *Sexual & Reproductive Healthcare*, 34, 100796. <https://doi.org/10.1016/j.srhc.2022.100796>
- Mehay, A., Da Motta, G., Hunter, L., Rayment, J., Wiggins, M., Haora, P., & McCourt, C. (2024). What are the mechanisms of effect of group antenatal care? A systematic realist review and synthesis of the literature. *BMC Pregnancy and Childbirth*, 24, 625. <https://doi.org/10.1186/s12884-024-06792-6>

- Nihal, S., & Shekhar, C. (2024). An assessment of adequate quality antenatal care and its determinants in India. *BMC Pregnancy and Childbirth*, 24, 698. <https://doi.org/10.1186/s12884-024-06806-3>
- Ningrum, E. W., Lusmilasari, L., Huriyati, E., Marthias, T., & Hasanbasri, M. (2024). Improving maternal health literacy among low-income pregnant women: A systematic review. *Narra J*, 4(2), e886. <https://doi.org/10.52225/narra.v4i2.886>
- Oyedeke, O. K., Fagbamigbe, A. F., Akinyemi, O. J., & Adebawale, A. S. (2023). Coverage-level and predictors of maternity continuum of care in Nigeria: Implications for maternal, newborn and child health programming. *BMC Pregnancy and Childbirth*, 23, 36. <https://doi.org/10.1186/s12884-023-05372-4>
- Putri, A. P., Hanifah, L., Irawan, A. M., & Lu, Y. Y. (2023). Maternal health literacy among pregnant women in Indonesia: A qualitative study. *International Journal of Nursing and Health Services*, 6(6), 354-364. <https://doi.org/10.35654/ijnhs.v6i6.763>
- Putri, A. P., Irawan, A. M., Hanifah, L., Wati, S. E., & Lu, Y. Y. (2023). Maternal health literacy and adherence to recommended ANC contact among pregnant women in Indonesian. *South East Asia Nursing Research*, 5(2), 1-11. <https://doi.org/10.26714/seanr.5.2.2023.1-11>
- Rammohan, A., Goli, S., & Chu, H. (2024). Continuum of care in maternal and child health in Indonesia. *Primary Health Care Research & Development*, 25, e17. <https://doi.org/10.1017/S1463423624000094>
- Rahut, D. B., Singh, A., & Sonobe, T. (2024). Continuum of maternal and new-natal health care: Empirical evidence from 10 developing countries in South and South East Asia. *Journal of Population Research*, 41. <https://doi.org/10.1007/s12546-024-09327-0>
- Sabetghadam, S., Keramat, A., Goli, S., Malary, M., & Rezaie Chamani, S. (2023). Maternal health literacy, health information-seeking behavior and pregnancy outcomes among Iranian pregnant women: A cross-sectional study. *International Quarterly of Community Health Education*, 44(1), 77-87. <https://doi.org/10.1177/0272684X221095659>
- Şahin, S., Arıöz Düzgün, A., Ünsal, A., İnan Kırmızıgül, E., & Sarıkaya, E. (2024). Assessment of relationship between health literacy and level of knowledge on prenatal diagnosis and antenatal care in pregnant women. *Lokman Hekim Health Sciences*, 4(2), 80-89. <https://doi.org/10.14744/lhhs.2024.1003>
- Sholikah, S. M., Nurwulansari, F., Aini, E. N., Wardoyo, S., & Pramudita, J. J. (2025). The role of continuity of care in high-risk pregnant women in Indonesia. *European Journal of Midwifery*, 9. <https://doi.org/10.18332/ejm/195831>
- Singh, S., & Rajak, R. (2024). Barriers in utilization and provisioning of obstetric care services in India: A mixed-methods systematic review. *BMC Pregnancy and Childbirth*, 24, 16. <https://doi.org/10.1186/s12884-023-06189-x>
- Titaley, C. R., Tjandrarini, D. H., Malakauseya, M. L. V., Ariawan, I., Iwan, R. F., Istia, S. S., & Dibley, M. J. (2025). Determinants of non-use of antenatal care services in eastern Indonesia: Analysis of the 2023 Indonesia Health Survey. *Frontiers in Global Women's Health*, 6, 1649276. <https://doi.org/10.3389/fgwh.2025.1649276>
- Ugurlu, M., & Kul Uctu, A. (2023). The relationship of prenatal distress with health literacy and health perception of pregnant women. *Iranian Journal of Public Health*, 52(9), 1917-1924. <https://doi.org/10.18502/ijph.v52i9.13573>
- Wenang, S., Emilia, O., Wahyuni, A., Afdal, A., & Haier, J. (2024). Obstetrics care in Indonesia: Determinants of maternal mortality and stillbirth rates. *PLOS ONE*, 19(7), e0303590. <https://doi.org/10.1371/journal.pone.0303590>

- Yunitasari, E., Putri, D. U. W., Armini, N. K. A., Sudarsiwi, N. P., & Ramoo, V. (2023). Analysis of factors that affect the utilization of antenatal care in developing countries: A systematic review. *Journal of the Pakistan Medical Association*, 73(Suppl. 2), S162-S169. <https://doi.org/10.47391/JPMA.Ind-S2-37>
- Zelka, M. A., Yalew, A. W., & Debelew, G. T. (2023). Effectiveness of a continuum of care in maternal health services on the reduction of maternal and neonatal mortality: Systematic review and meta-analysis. *Heliyon*, 9(6), e17559. <https://doi.org/10.1016/j.heliyon.2023.e17559>