

Integrating Maternal Health Literacy and the Health Belief Model for Predicting Preeclampsia Screening Adherence

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Abstract: Preeclampsia remains one of the leading causes of maternal morbidity and mortality, highlighting the importance of improving pregnant women's adherence to early screening and timely clinical decision-making. **Objective:** This study aims to examine the integrated role of Maternal Health Literacy (MHL) and the Health Belief Model (HBM) in predicting preeclampsia screening adherence and mitigating delays in medical decision-making among pregnant women. **Methods:** A quantitative predictive study with a cross-sectional design was conducted involving 64 pregnant women at the Sarfina Sembiring Primary Clinic selected through purposive sampling. Data were collected using validated questionnaires measuring MHL and HBM constructs and analyzed using multiple logistic regression. **Findings:** The results showed that both MHL and HBM significantly predicted preeclampsia screening adherence and mitigation of delay in decision-making. HBM was identified as the strongest predictor of screening adherence (OR = 6.52), whereas MHL demonstrated the greatest influence on reducing delays in clinical decision-making (OR = 8.21). These findings indicate that psychological beliefs and cognitive health literacy play complementary roles in improving maternal preventive health behavior. **Implications:** The findings support the development of integrated maternal health education programs that combine health literacy enhancement with behavior-based interventions, including digital health education and counseling, to strengthen screening adherence and maternal self-efficacy in primary healthcare settings. **Originality:** This study proposes and empirically validates an integrated predictive framework combining Maternal Health Literacy and the Health Belief Model. Unlike previous studies that examined these constructs separately, this research demonstrates their complementary roles in improving preeclampsia prevention strategies and reducing delays in maternal healthcare decision-making.

Keywords: Maternal Health Literacy; Health Belief Model; Preeclampsia; Screening Adherence; Delay in Decision-Making.

INTRODUCTION

Preeclampsia remains a serious threat to maternal safety, with global prevalence rates estimated to reach 2% to 8% of all pregnancies worldwide. Nationally, Indonesian Health Profile reports consistently place hypertensive disorders in pregnancy primarily

preeclampsia and eclampsia as contributors of approximately 25% to 30% of the total Maternal Mortality Rate (MMR) ([Kementerian Kesehatan, 2024](#)). A similar epidemiological pattern occurs at the regional level, where official records show that preeclampsia closely rivals hemorrhage as the largest contributor to maternal mortality in North Sumatra, accounting for more than 30% of cases ([Dinas Kesehatan Kota, 2024](#)). This condition is specifically reflected in the city of Medan, where municipal health data confirms that preeclampsia continues to dominate obstetric morbidity records and constitutes the highest cause of obstetric emergency referrals from primary care facilities to referral hospitals ([Dinas Kesehatan Provinsi Sumatera, 2024](#)).

Preeclampsia is a major contributor to maternal morbidity and mortality that urgently requires vigilance and the ability of pregnant women and their families to conduct early detection of danger signs. However, these early detection and monitoring efforts are frequently hampered by limited maternal health literacy among pregnant women, leading to difficulties in processing health information, recognizing adverse impacts on their conditions, and adopting essential behaviors during pregnancy. This low level of health literacy also correlates with poor utilization of health services, making individuals vulnerable to delays in seeking care or making decisions ([Ningrum, 2024](#)). On the other hand, pregnant women's behaviors in recognizing and detecting preeclampsia danger signs heavily rely on their health belief factors (Health Belief Model), where perceptions of susceptibility, severity, benefits, barriers, threats, and self-efficacy exert a direct influence on detection actions. Therefore, a maternal health literacy approach integrated with the Health Belief Model framework is crucial to study as a comprehensive strategy to predict pregnant women's compliance with preeclampsia screening while mitigating delays of decision making during the critical period of pregnancy ([Santi & Suminar, 2023](#)).

Maternal health behavior during pregnancy, including adherence to antenatal care and disease prevention measures, is a critical determinant for maternal safety and health outcomes. However, a mother's ability to navigate the pregnancy process safely and make appropriate decisions heavily depends on health literacy, which is the ability to access, comprehend, and apply health information. Inadequate health literacy levels consistently contribute to delayed initiation of prenatal care, limited maternal involvement in clinical decision-making, and high risks of obstetric complications such as hypertension. Conversely, conventional one-way health services and education often prove insufficient to encourage compliance and sustainable behavioral change if they fail to touch upon the

mother's cognitive and motivational factors ([Vicente-Díaz & Alvariñas-Villaverde, 2025](#)). In this regard, the Health Belief Model (HBM) framework has been recognized as highly effective in modifying health behavior because it directly targets perceptions of susceptibility, severity, benefits, barriers, and self-efficacy. Considering that prenatal strategies must be tailored to individual health literacy capacities to encourage informed decision-making, integrating maternal health literacy with the behavioral pillars of HBM becomes essential. The synergy of these two approaches offers a strong rationale to be investigated as a comprehensive predictor in enhancing pregnant women's compliance with preeclampsia screening while mitigating delays of decision-making during the critical pregnancy period ([Liberato et al., 2026](#)).

Based on the description above, the researcher conducted a study entitled "The Integration of Maternal Health Literacy and the Health Belief Model Approach as a Predictor of Preeclampsia Screening Compliance and Mitigation of Delay of Decision Making Among Pregnant Women at Sarfina Sembiring Primary Clinic".

RESEARCH METHOD

This study uses a predictive quantitative approach with a cross-sectional design which was carried out in April-June 2026 at the Sarfina Sembiring Primary Clinic, Medan. A sample of 60 pregnant women was selected using purposive sampling techniques to participate in this study. The research framework integrates Maternal Health Literacy (MHL) and Health Belief Model (HBM) to predict preeclampsia screening adherence and evaluate mitigation of delay of decision making.

Data collection was carried out using a validated questionnaire developed by the researcher. The instrument consists of 20 Likert scale items to measure MHL (ability to access, understand, and apply health information) and 24 Likert scale items for HBM constructs (susceptibility, severity, benefits, barriers, cues of action, and self-efficacy). Both instruments showed high reliability with Cronbach's Alpha values of 0.83 and 0.86, respectively. Compliance and decision-making delays were assessed using a structured clinical checklist based on the first phase of the Three Delays Model.

For analysis purposes, the raw score was converted to a percentage and classified into High (76%–100%), Medium (56%–75%), and Low (<56%) categories based on Bloom's modified criteria. After going through the data normality test, the analysis was carried out using Multiple Logistic Regression through SPSS software at a 95% confidence level to

determine the predictive significance of the integrated framework (MHL and HBM) on the clinical behavior of pregnant women

RESULTS

Research Data Analysis

Table 1. Frequency Distribution of Respondent Demographic Characteristics at Sarfina Sembiring Primary Clinic

Characteristics	Categories	Frequency (n)	Percentage (%)
Age	< 20 Years	5	7.8
	20 - 35 years (low risk)	48	75.0
	> 35 years old (high risk)	11	17.2
Education	Elementary (Elementary/Junior High)	12	18.8
	Intermediate (High School/Equivalent)	36	56.3
	Height (D3/S1)	16	25.0
Jobs	Housewives (IRT)	41	64.1
	Work (Private/Civil Servant)	23	35.9
Trimester of Pregnancy	1st Trimester (1-12 Weeks)	20	31.3
	2nd Trimester (13-27 Weeks)	26	40.6
	Trimester 3 (28-40 Weeks)	18	28.1
Total		64	100.0

Table 2. Variable Frequency Distribution Research on *Maternal Health Literacy* (MHL), *Health Belief Model* (HBM), Adherence, and Delay Mitigation.

Variable	Categories	Frequency (n)	Percentage (%)
Maternal Health Literacy (MHL)	High (76% - 100%)	38	59.4
	Medium (56% - 75%)	18	28.1
	Low (< 56%)	8	12.5
Health Belief Model (HBM)	High (76% - 100%)	40	62.5
	Medium (56% - 75%)	15	23.4
	Low (< 56%)	9	14.1
Preeclampsia Screening Compliance	Obedient (Score 3-4)	45	70.3
	Non-Compliance (Score 0-2)	19	29.7
Mitigating Delays of Decision Making	Good/No Delay (Score 4)	42	65.6
	At Risk of Delay (Score < 4)	22	34.4

Table 3. Data Normality Test Results (Shapiro-Wilk)

Variables (Raw Total Score)	Statistic	df	Sig. (p-value)	Remarks
Total MHL Score	0.965	64	0.082	Normal Distribution ($p > 0.05$)
Total HBM Score	0.971	64	0.124	Normal Distribution ($p > 0.05$)

Table 4. Results of the Double Logistics Regression Test: Predictors of Preeclampsia Screening Compliance

Independent Variables	B	S.E.	Wald	df	Sig. (p-value)	Exp(B) / OR	95% C.I. for Exp(B)
<i>Maternal Health Literacy</i>	1.452	0.612	5.624	1	0.018*	4.271	1.285 - 14.192
<i>Health Belief Model</i>	1.875	0.645	8.450	1	0.004*	6.520	1.842 - 23.080
Constant	-4.120	1.240	11.035	1	0.001	0.016	

Significance: MHL ($p = 0.018$) and HBM ($p = 0.004$) were < 0.05 , meaning both partially and simultaneously significantly predicted screening adherence. Exp(B) / Odds Ratio (OR): Pregnant women with a *high* Health Belief Model are 6.5 times more likely to be compliant than those with low ones. Meanwhile, mothers with *high Maternal Health Literacy* have a 4.2 times greater chance of being compliant.

Table 5. Results of Multiple Logistics Regression Test: Predictors of Delay of Decision Making Mitigation

Independent Variables	B	S.E.	Wald	df	Sig. (p-value)	Exp(B) / OR	95% C.I. for Exp(B)
<i>Maternal Health Literacy</i>	2.105	0.680	9.582	1	0.002	8.207	2.164 - 31.125
<i>Health Belief Model</i>	1.340	0.595	5.071	1	0.024	3.819	1.190 - 12.254
Constant	-3.550	1.150	9.530	1	0.002	0.028	

Significance: MHL ($p = 0.002$) and HBM ($p = 0.024$) were valued < 0.05 , proving that social hypotheses related to decision-making were accepted. Exp(B) / Odds Ratio (OR): In the context of decision-making, literacy (*Maternal Health Literacy*) has the strongest predictive role. Mothers with high Maternal Health Literacy were 8.2 times better at mitigating clinical decision *making delays* than mothers with low Maternal Health Literacy.

DISCUSSION

Prevention and management efforts for preeclampsia in pregnant women require a comprehensive approach integrating literacy capacity, psychological encouragement, and digital technology utilization. The synergistic integration of Maternal Health Literacy (MHL) and the Health Belief Model (HBM) proves crucial; HBM serves as the primary emotional driver for pregnant women's compliance in undergoing preeclampsia screening, whereas MHL plays the strongest cognitive role in mitigating clinical decision-making delays (delay of decision making) ([Al Joeffie et al., 2026](#)). Although this cognitive awareness is important, early detection implementation in the field is frequently hindered by factors such as minimal baseline knowledge, financial constraints, societal misconceptions, and systemic barriers in health facilities; thus, family social support interventions and medical guidance are essential to encourage early health-seeking behavior ([Muhindo, 2025](#)). As a solution to bridge access and educational barriers, the use of mobile health (mHealth) applications has proven effective as a digital health instrument; these applications not only facilitate flexible educational delivery but also support early detection and independent blood pressure monitoring, which ultimately significantly enhances pregnant women's engagement and independence in mitigating preeclampsia complication risks ([Gelaw et al., 2024](#)).

Aligning with the importance of health comprehension, a study by Mustary found that low health literacy levels ([Mustary, 2025](#)), non-ideal age, history of preeclampsia, and low motivation in undergoing antenatal care (ANC) are key determinants increasing the risk of preeclampsia among pregnant women ([Mustary, 2025](#)). Furthermore, barriers to healthcare-seeking were reinforced by findings from Gelaw et al. (2024), who noted high rates of initial decision-making delays among mothers in rural areas due to factors such as unemployment status, husbands' lack of formal education, and negative attitudes toward healthcare facility utilization ([Gelaw et al., 2024](#)).

Based on analytical discussions regarding Antenatal Care (ANC) visit compliance and the mitigation of pregnancy complication risks, maternal knowledge and Health Belief Model (HBM) dimensions specifically perceived benefits, perceived barriers, and self-efficacy play crucial roles as primary predictors of health compliance behavior ([Sihombing, 2025](#)). These findings are reinforced by Haryanti et al. (2024), stating that the HBM approach is effective in enhancing understanding and motivating preventive actions against maternal complications ([Haryanti et al., 2024](#)). Additionally, Gerdes added that positive

motivation and subjective norm support from the social environment further strengthen pregnant women's participation intensity in prenatal health screening programs ; therefore, structured educational interventions grounded in behavioral theory are highly recommended to reduce maternal morbidity and mortality ([Behnke Gerdes et al., 2023](#)).

The results indicate that enhanced pregnant women compliance and healthcare intervention effectiveness are heavily influenced by the combination of health literacy, individual beliefs, and family support integrated digitally or non-pharmacologically. This aligns with a study by Fauzianty which demonstrated that a Family-Centered Empowerment Model (FCEM)-based digital pocketbook significantly improves self-efficacy and iron supplementation adherence among pregnant women ([Fauzianty, 2025](#)). This educational reinforcement is supported by the utilization of artificial intelligence technology and expert systems for early anemia detection to bridge limited medical access in primary health facilities ([Bakara et al., 2025](#)). Moreover, comprehensive care approaches to address pregnancy complications can be optimized through safe non-pharmacological therapy alternatives, such as warm foot-soaking therapy using lemongrass decoction, which has proven effective in reducing blood pressure among pregnant women with mild hypertension through vasodilation and autonomic relaxation mechanisms ([Situmorang & Fauzianty, 2025](#)).

The discussion of this study confirms that the integration of Maternal Health Literacy (MHL) and the Health Belief Model (HBM) holds a crucial and complementary role in predicting preeclampsia screening compliance and mitigating delays of decision making among pregnant women in primary health facilities. These findings align with studies proposed by ([Tahira & Fatima, 2024](#)) and ([Dafroyati, 2024](#)) stating that adequate health literacy comprehension alongside HBM psychological dimensions such as perceived benefits, barriers, and cues to action drive internal maternal motivation to consistently adhere to antenatal care services to prevent life-threatening maternal complications ([Dafroyati, 2024](#); [Tahira & Fatima, 2024](#)). Furthermore, reinforcing cognitive capacity through literacy serves as a primary foundation for processing clinical information rapidly and rationally, effectively suppressing the risk of obstetric emergency handling delays as supported by related literature in the context of pregnancy risk mitigation ([Liberato et al., 2026](#)).

CONCLUSION

This study demonstrates that the integration of Maternal Health Literacy (MHL) and the Health Belief Model (HBM) is a significant predictor of both preeclampsia screening compliance and the mitigation of delay of decision making among pregnant women at the Sarfina Sembiring Primary Clinic. The findings indicate that the two constructs perform complementary functions. The Health Belief Model serves as the strongest psychological determinant influencing pregnant women's adherence to preeclampsia screening, whereas Maternal Health Literacy provides the strongest cognitive foundation for enabling timely, rational, and appropriate clinical decision-making when danger signs occur. These findings emphasize that improving maternal health outcomes requires not only increasing health knowledge but also strengthening positive health beliefs that encourage preventive behavior.

The main scientific contribution of this study lies in proposing an integrated predictive framework combining Maternal Health Literacy and the Health Belief Model to explain maternal compliance and decision-making behavior related to preeclampsia. Unlike previous studies that generally examined these variables independently, this research demonstrates their complementary predictive roles within a single analytical model. The findings provide empirical evidence that can support the development of behavioral-based maternal health education programs, strengthen antenatal care interventions, and guide primary healthcare providers in designing strategies to improve early detection and prevention of preeclampsia.

This study has several limitations. First, the research employed a cross-sectional design, which does not allow causal relationships to be established between the studied variables. Second, the sample was limited to pregnant women attending a single primary healthcare clinic, thereby restricting the generalizability of the findings to broader populations. Third, behavioral data were collected using self-reported questionnaires, which may be subject to response bias. Future research is recommended to employ longitudinal or multicenter study designs with larger and more diverse populations, while incorporating additional variables such as family support, socioeconomic status, digital health utilization, and clinical risk factors to develop a more comprehensive predictive model for preeclampsia prevention and maternal decision-making.

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