Diversity: Disease Preventive of Research Integrity
Volume 6, Issue 1, 2025
Page 40-48
doi: 10.24252/diversity.v6i1.56952

p-ISSN : 2774-9649
e-ISSN : 2775-0035

Determinants of Early Detection Service Utilization for Hepatitis B among Pregnant Women: A Study from Semarang City, Indonesia

Faktor Penentu Pemanfaatan Layanan Deteksi Dini Hepatitis B pada Ibu Hamil: Studi di Kota Semarang, Indonesia

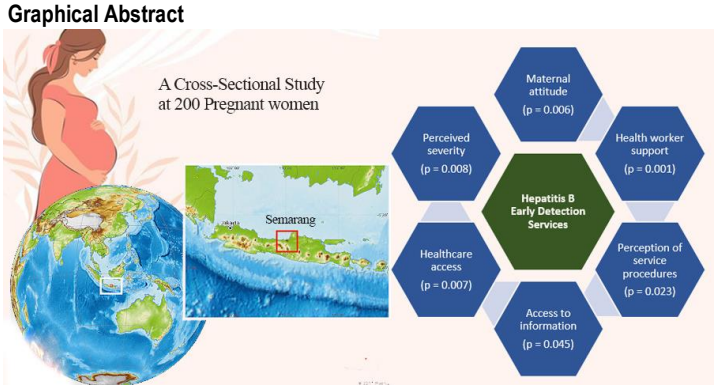
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Abstract
Hepatitis B remains a major global health challenge, with mother-to-child transmission contributing significantly to chronic infection and severe complications. In Indonesia, despite national targets of 95% coverage, screening rates among pregnant women in Semarang City remain suboptimal, with limited evidence on the determinants of service utilization. This study aimed to identify factors associated with the utilization of hepatitis B early detection services among pregnant women in Semarang City. A quantitative cross-sectional design was employed, using primary data collected through structured interviews with 200 respondents selected purposively. Data analysis was conducted using chi-square tests to examine associations between independent variables and screening utilization. The findings revealed that maternal attitude (p=0.006), health worker support (p=0.001), perception of service procedures (p=0.023), access to information (p=0.045), healthcare access (p=0.007), and perceived severity (p=0.008) were significantly associated with service utilization. In contrast, maternal education, employment status, knowledge, family support, and perceived susceptibility showed no significant association. These findings highlight the importance of behavioral and system-level factors in improving screening coverage through strengthened counseling, better service delivery, expanded information access, and equitable healthcare. Moreover, early detection aligns with Islamic values of *Hifz an-nasl* by protecting maternal and child health, where faith-based and community-centered strategies can enhance family health and accelerate hepatitis B elimination.

Abstrak
Hepatitis B tetap menjadi tantangan kesehatan global utama, dengan penularan dari ibu ke anak yang berkontribusi secara signifikan terhadap infeksi kronis dan komplikasi serius. Di Indonesia, meskipun terdapat target nasional sebesar 95% cakupan, tingkat skrining pada ibu hamil di Kota Semarang masih belum optimal, dengan bukti yang terbatas terkait determinan pemanfaatan layanan. Penelitian ini bertujuan untuk mengidentifikasi faktor-faktor yang berhubungan dengan pemanfaatan pelayanan deteksi dini hepatitis B pada ibu hamil di Kota Semarang. Penelitian ini menggunakan desain kuantitatif dengan pendekatan potong lintang, menggunakan data primer yang dikumpulkan melalui wawancara terstruktur terhadap 200 responden yang dipilih secara purposive. Analisis data dilakukan dengan uji chi-square untuk melihat hubungan antara variabel independen dan pemanfaatan layanan. Hasil penelitian menunjukkan bahwa sikap ibu (p=0,006), dukungan tenaga kesehatan (p=0,001), persepsi terhadap prosedur layanan (p=0,023), akses informasi (p=0,045), akses pelayanan kesehatan (p=0,007), dan persepsi keparahan (p=0,008) berhubungan signifikan dengan pemanfaatan layanan. Sebaliknya, tingkat pendidikan, status pekerjaan, pengetahuan, dukungan keluarga, dan persepsi kerentanan tidak menunjukkan hubungan yang signifikan. Temuan ini menekankan pentingnya faktor perilaku dan sistem dalam meningkatkan cakupan skrining melalui penguatan konseling, perbaikan layanan, perluasan akses informasi, dan pemerataan akses kesehatan. Selain itu, deteksi dini sejalan dengan nilai Islam *Hifz an-nasl* dalam melindungi kesehatan ibu dan anak, dimana strategi berbasis agama dan komunitas dapat meningkatkan kesehatan keluarga serta mempercepat eliminasi hepatitis B.

Graphical Abstract



Keyword
access to information; health services accessibility; hepatitis b; perception; pregnant women

Artikel History
Submited : 03 August 2025
In Reviewed : 06 August 2025
Accepted : 14 August 2025
Published : 31 August 2025

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INTRODUCTION

Hepatitis B virus (HBV) infection remains a significant global public health burden, with approximately 296 million people worldwide living with chronic HBV infection and nearly 820,000 deaths annually attributed to its complications, including cirrhosis and hepatocellular carcinoma (Hsu et al., 2023; World Health Organization, 2024). Mother-to-child transmission represents the predominant route of infection in highly endemic countries, where prevention through antenatal screening and timely immunization is considered a cornerstone of public health interventions (Terrault et al., 2021). These efforts directly contribute to the Sustainable Development Goals (SDGs), particularly Goal 3, which seeks to ensure healthy lives and promote well-being for all at all ages by reducing the burden of communicable diseases. Within this global framework, addressing HBV transmission during pregnancy is crucial for safeguarding maternal and child health and ensuring intergenerational protection (United Nations, 2025).

In Indonesia, HBV remains one of the highest-prevalence infectious diseases in Southeast Asia, where vertical transmission from mother to child continues to present a serious challenge for national health programs (Bello et al., 2023; Irekeola et al., 2023). Preventive measures, including mandatory antenatal HBV screening, align not only with national public health priorities but also with Islamic values, particularly the principle of *Hifz al-Nasl* (protection of lineage), which underscores the responsibility to safeguard the health and continuity of future generations. As such, strengthening early detection of HBV among pregnant women serves a dual purpose of meeting international health targets while fostering religiously grounded practices in maternal and child health in Indonesia.

Despite the adoption of national guidelines mandating universal HBV screening during pregnancy, coverage in several regions of Indonesia, including Semarang City, has consistently fallen below the 95% target set by the Ministry of Health (Central Java Provincial Health Office, 2024; Semarang City Health Office, 2024). Declining screening rates in recent years threaten the effectiveness of HBV prevention programs and elevate the risk of undetected maternal infection, thereby perpetuating vertical transmission. Addressing this problem requires identifying determinants of early detection service utilization and developing tailored interventions that strengthen both health system performance and community participation.

Previous studies underscore that successful prevention of HBV transmission from mother to child requires a multifaceted approach, involving maternal education, healthcare provider support, and accessibility of antenatal services (Alege et al., 2025; Peliganga et al., 2022; Yeo et al., 2021). Research conducted in sub-Saharan Africa, for example, has demonstrated that inadequate maternal knowledge regarding HBV transmission serves as a major barrier to screening utilization during pregnancy (Kwadzokpui et al., 2020). In Asia, while widespread immunization programs have effectively reduced HBV prevalence, insufficient antenatal detection continues to contribute significantly to vertical transmission, highlighting the persistent gap between vaccination efforts and maternal screening uptake (Al-Busafi & Alwassief, 2024; Chilaka & Konje, 2021; Kaewdech et al., 2024). These findings emphasize the critical need for integrating HBV screening within routine antenatal care to ensure comprehensive prevention strategies.

Additionally, evidence shows that effective health worker communication and counseling play a central role in improving compliance with screening protocols. Belopolskaya et al. (2021) found that counseling interventions that clearly outline the risks of vertical transmission and the benefits of early detection significantly increased maternal participation in HBV screening. Furthermore, the inclusion of family support systems in counseling and health education has been identified as a culturally appropriate strategy in collectivist societies, where family influence strongly shapes health-seeking behaviors (Adjei et al., 2024; Kwadzokpui et al., 2020). These findings suggest that holistic, community-centered, and system-based interventions are essential to increase HBV screening coverage among pregnant women.

Despite global and national recommendations for universal HBV screening during pregnancy, disparities in implementation remain evident across regions in Indonesia. In Semarang City, for instance, coverage of HBV screening between 2021 and 2023 has not only fluctuated but also shown a declining trend, falling short of the national target (Semarang City Health Office, 2024). Previous studies have largely concentrated on clinical outcomes of HBV infection and the effectiveness of vaccination programs, yet relatively few have examined the behavioral, socio-demographic, and systemic determinants that influence pregnant women's utilization of early detection services in the Indonesian context (Akbar et al., 2021; Lestari et al., 2023; Machmud et al., 2023; Wibowo et al., 2025). This gap suggests that barriers to maternal HBV screening extend beyond biomedical interventions and involve complex social and health system dynamics.

The present study aims to fill this gap by analyzing the determinants of early detection service utilization for HBV among pregnant women in Semarang City. By exploring factors such as maternal attitudes, knowledge, healthcare access, health worker support, and family involvement, this study seeks to generate novel insights into the challenges and opportunities for strengthening antenatal HBV screening programs. The findings are expected to provide evidence-based recommendations for improving maternal health services, advancing HBV elimination efforts, and informing context-specific strategies to enhance antenatal care coverage in Indonesia.

Table 1
Respondent Characteristics

Characteristic	Frequency	Percentage (%)
Age		
Not at Risk	179	89.50%
At Risk	21	10.50%
Gestational Age		
Second Trimester	85	42.50%
Third Trimester	115	57.50%
Parity		
Low	139	69.50%
High	61	30.50%
Income Level		
< Regional Minimum Wage (RMW)	73	36.50%
≥ Regional Minimum Wage (RMW)	127	63.50%

METHODS

This study employed a quantitative approach with a cross-sectional design. The research was conducted between May and December 2024 in Semarang City, Indonesia. The study locations were selected using purposive sampling based on criteria of community health center with both high and low coverage of early detection of hepatitis B, as well as health centers located at varying distances from the city center. A subsequent random selection determined five study sites: Community Health Center of Tlogosari Wetan, Community Health Center of Pegandan, Community Health Center of Rowosari, Community Health Center of Karangayu, and Community Health Center of Halmahera.

The independent variables included maternal education level, employment status, knowledge, attitudes, family support, health worker support, perceived service procedures, access to information, healthcare access, perceived susceptibility, and perceived severity. The dependent variable was the utilization of early detection services for hepatitis B among pregnant women. The study population consisted of all pregnant women residing in Semarang City during the study period, with a total sample of 200 respondents selected through accidental sampling. Recruitment was carried out by visiting pregnant women in their households using a door-to-door approach.

Data collection was performed through face-to-face interviews using a structured questionnaire developed based on previous studies and adapted to the local context. The questionnaire covered socio-demographic characteristics, perceptions, and service utilization behaviors. Data quality was ensured through pre-testing and supervision during data collection. Informed consent was obtained from all participants prior to interviews, and confidentiality was strictly maintained throughout the study.

Data were processed and analyzed using statistical software. Descriptive statistics were applied to summarize respondents' characteristics and study variables. Bivariate analysis using the chi-square test was performed to determine the association between independent variables and the utilization of early detection services for hepatitis B. Results were presented in tabular and narrative form to highlight significant relationships. Ethical approval was obtained from the appropriate institutional review board prior to the commencement of the study.

RESULTS

Table 1 presents the demographic and reproductive characteristics of the study respondents. The majority of participants (89.5%) were categorized as being in the non-risk age group for pregnancy, while only 10.5% were considered at-risk based on age. In terms of gestational age, more than half of the respondents (57.5%) were in their third trimester, with the remaining 42.5% in their second trimester.

Regarding parity, 69.5% of the women had low parity, indicating they had given birth fewer times, whereas 30.5% had high parity. In terms of economic status, based on the regional minimum wage (RMW) threshold, 63.5% of the respondents had an income equal to or above the RMW, while 36.5% earned below the RMW. These demographic distributions provide an essential contextual foundation for interpreting subsequent analyses and may influence health outcomes and behaviors examined in the study.

Table 2 outlines the distribution of respondents based on several key psychosocial, knowledge, and access-related variables. A significant majority of respondents had a high level of education (86.0%) and were not employed (58.0%). In terms of knowledge, 64.0% of respondents demonstrated a high level of health-related knowledge. Regarding attitudes toward health service utilization, most respondents (88.5%) displayed supportive attitudes. Support from both family (57.5%) and health workers (55.5%) was also reported to be generally positive. The perception of service procedures was largely favorable, with 67.0% of respondents reporting a positive view.

Access-related indicators revealed that 51.5% found it easy to access information, and a larger proportion (78.5%) reported ease in accessing health services. In terms of health beliefs, 51.0% perceived themselves as highly vulnerable to health risks, and 69.5% perceived health conditions as severe. Finally, a substantial majority

Table 2
Distribution of Respondents Based on Psychosocial, Knowledge, and Access-Related Characteristics

Variable	Frequency	Percentage (%)
Education Level		
Low	28	14.00%
High	172	86.00%
Employment Status		
Unemployed	116	58.00%
Employed	84	42.00%
Knowledge		
Low	72	36.00%
High	128	64.00%
Attitude		
Unsupportive	23	11.50%
Supportive	177	88.50%
Family Support		
Unsupportive	85	42.50%
Supportive	115	57.50%
Health Worker Support		
Unsupportive	90	45.50%
Supportive	110	55.50%
Perception of Service Procedures		
Negative	66	33.00%
Positive	134	67.00%
Access to Information		
Difficult	97	48.50%
Easy	103	51.50%
Access to Health Services		
Difficult	43	21.50%
Easy	157	78.50%
Perceived Vulnerability		
Low	98	49.00%
High	102	51.00%
Perceived Severity		
Low	61	30.50%
High	139	69.50%
Service Utilization		
Not Utilizing Services	28	14.00%
Utilizing Services	172	86.00%

(86.0%) reported actively utilizing available health services. These characteristics provide important context for analyzing determinants of service utilization and identifying potential barriers to health access and behavior change interventions.

Table 3 presents the results of a bivariate analysis examining the relationship between various factors and the utilization of early detection services for Hepatitis B. Several variables demonstrated statistically significant associations with service utilization. Respondents with a supportive attitude were significantly more likely to utilize services compared to those with an unsupportive attitude ($p = 0.006$). Similarly, support from healthcare workers showed a strong relationship with utilization, with only 6.4% of supported individuals not utilizing the services ($p = 0.001$).

A positive perception of service procedures was also significantly associated with higher utilization rates ($p = 0.023$), as was easier access to information ($p = 0.045$) and easier access to health services ($p = 0.007$). In addition, respondents who perceived Hepatitis B as severe were significantly more likely to utilize detection services compared to those with a lower perception of severity ($p = 0.008$). In contrast, variables such as education level, employment status, family support, knowledge level, and perceived vulnerability did not show statistically significant associations with utilization of early detection services ($p > 0.05$). These findings underscore the importance of improving perceptions, access, and interpersonal support mechanisms to increase early detection uptake for Hepatitis B.

DISCUSSION

The findings of this study indicate no significant relationship between maternal education level and the utilization of early detection services for Hepatitis B during pregnancy. Although higher educational attainment is typically associated with increased health literacy and improved access to health-related information, education alone may not be sufficient to influence health-seeking behavior. This aligns with previous studies, including one conducted in Bangladesh, which reported no association between maternal education and antenatal care (ANC) visits (Pervin et al., 2021), and another study that found no significant link between education level and health service utilization (Shahid et al., 2022). In the current digital era,

Table 3
Bivariate Analysis of Factors Associated with Utilization of Hepatitis B Early Detection Services

Variable	Utilization of Hepatitis B Early Detection Services		p-value
	Did Not Utilize	Utilized	
Education Level			
Low	4 (14.3%)	24 (85.7%)	1.000
High	24 (14.0%)	148 (86.0%)	
Employment Status			
Unemployed	19 (16.4%)	97 (83.6%)	0.351
Employed	8 (10.7%)	75 (89.3%)	
Knowledge			
Low	15 (20.8%)	57 (79.2%)	0.061
High	13 (10.2%)	115 (89.8%)	
Attitude			
Unsupportive	8 (34.8%)	15 (65.2%)	0.006*
Supportive	20 (11.3%)	157 (88.7%)	
Family Support			
Unsupportive	14 (16.5%)	71 (83.5%)	0.510
Supportive	14 (12.2%)	101 (87.8%)	
Health Worker Support			
Unsupportive	21 (23.3%)	69 (76.7%)	0.001*
Supportive	7 (6.4%)	103 (93.6%)	
Perception of Procedures			
Negative	15 (22.7%)	51 (77.3%)	0.023*
Positive	13 (9.7%)	121 (90.3%)	
Access to Information			
Difficult	19 (19.6%)	78 (80.4%)	0.045*
Easy	9 (8.7%)	94 (91.3%)	
Access to Health Services			
Difficult	12 (27.9%)	31 (72.1%)	0.007*
Easy	16 (10.2%)	141 (89.8%)	
Perceived Vulnerability			
Low	16 (16.3%)	82 (83.7%)	0.468
High	12 (11.8%)	90 (88.2%)	
Perceived Severity			
Low	15 (24.6%)	46 (75.4%)	0.008*
High	13 (9.4%)	126 (90.6%)	

Note: *p-value < 0.05 indicates statistical significance.

formal education is no longer the sole avenue for acquiring health information. Women with lower education levels may still gain access to health knowledge through various media and digital platforms, thereby compensating for limited formal education.

Similarly, maternal employment status was not significantly associated with the utilization of early detection services. Although employed women may face time constraints that limit their access to healthcare services, this study suggests that both employed and unemployed women have comparable opportunities to access screening. This may be attributed to the availability of services under the national health insurance scheme (BPJS Kesehatan) and the operational schedules of Community Health Center (Puskesmas), which offer services on Saturdays to accommodate working women. This finding corroborates prior studies showing no significant relationship between employment status and ANC attendance (Pervin et al., 2021; Tolossa et al., 2024).

The analysis also revealed no significant relationship between maternal knowledge and service utilization. While knowledge plays a foundational role in shaping health perceptions, its influence on actual behavior appears limited in this context. Knowledge serves as a predisposing factor but requires reinforcement through enabling conditions and provider encouragement (Deng et al., 2025). The role of healthcare workers in conducting home visits and providing counseling may be more instrumental than knowledge alone, as supported by previous findings (Shahid et al., 2022).

In contrast, maternal attitudes showed a significant association with screening utilization. Attitudes reflect cognitive and emotional orientations toward a health service and are shaped by past experiences, environmental cues, media exposure, and social influence. As a predisposing factor in Andersen's model, attitude can strongly motivate behavior when positive. Prior studies affirm that favorable attitudes toward health services are associated with higher utilization (Ssekamatte et al., 2021).

This underscores the potential of attitude-focused interventions in improving maternal health behaviors.

Despite the common assumption that family support plays a critical role in health decision-making, this study found no significant relationship between family support and the use of early detection services. Although family members can provide emotional, financial, and informational support, their role may be secondary when healthcare provider support and service accessibility are robust. This is supported by evidence from Ethiopia, where peer influence and provider interventions had a more pronounced effect than family support on ANC utilization (Gebrekirstos et al., 2021). This highlights the compensatory role of professional support systems in contexts of limited familial involvement.

Healthcare provider support emerged as a critical determinant of service utilization. The presence of engaged, knowledgeable, and empathetic providers significantly influences maternal decisions to access screening. These findings are in line with systematic reviews (Lazar et al., 2021; Tolossa et al., 2024) that emphasize provider interaction as a central component in maternal healthcare uptake. This underlines the importance of strengthening provider capacity and ensuring supportive working conditions to enhance maternal health outcomes.

Perceptions of service quality—measured by procedural simplicity, waiting time, provider professionalism, equipment hygiene, and punctuality—also significantly influenced utilization. Positive perceptions of service environments enhance trust and engagement, echoing prior research on patient satisfaction and service uptake (Meesala & Paul, 2018; Woo & Choi, 2021). Interventions aimed at improving waiting times and implementing digital registration systems could further improve perceived service quality and utilization rates.

Access to information was another significant factor. The availability, clarity, and sufficiency of health-related information through multiple platforms—including print, digital media, and health personnel—facilitated increased service uptake. These findings support prior literature demonstrating that effective information dissemination is a critical enabler of health service utilization (Banke-Thomas et al., 2017; Kazibwe et al., 2025). As noted by Dam et al. (2025), accessible information enhances awareness and motivation, thereby bridging the gap between knowledge and behavior.

Furthermore, healthcare access—evaluated through affordability, proximity, transportation, and travel time—showed a strong association with screening utilization. Women facing fewer logistical barriers were more likely to use early detection services. This reinforces evidence from other contexts highlighting the impact of healthcare access on service uptake (Aji et al., 2022; Brandão et al., 2022; Mweemba et al., 2021). Establishing Sub-Community Health Center in remote areas and equipping them with essential diagnostic tools can enhance equity in service delivery.

Interestingly, perceived susceptibility did not significantly influence screening behavior. Despite its theoretical importance in the Health Belief Model, low perceived vulnerability did not deter women from utilizing services. This suggests that other factors, such as healthcare provider encouragement, accessible services, and widespread information, may override individual perceptions of risk (Esther et al., 2024; Lazar et al., 2021).

Conversely, perceived severity was significantly associated with service utilization. Women who recognized the serious implications of Hepatitis B for maternal and infant health were more motivated to seek screening (Afolabi et al., 2022; Sabin et al., 2024). This highlights the importance of framing health communication in terms of potential consequences. In this context, social media platforms can serve as powerful tools to amplify awareness and encourage preventive behavior (Ali et al., 2025).

The study also explored religious dimensions, contextualizing hepatitis B screening within the framework of *Maqāṣid al-Sharīʿah*, particularly *Hifz al-Nasl* (protection of lineage) by preventing harm to the unborn and safeguarding generational continuity (Muhsin et al., 2024). Screening and timely management thus become acts of preserving family health and communal welfare, ensuring that future generations are protected from preventable diseases. This perspective is reinforced by the Qur'anic principle in Al-An'ām/6:151, which states:

> *"... And do not kill your children out of poverty; We provide for you and them..."*

This verse emphasizes the responsibility of parents and society to safeguard the well-being of children. Protecting unborn and newborn children from hepatitis B transmission aligns directly with this principle of preservation.

According to Yang and Olive (2025), faith-aligned health promotion has been shown to improve the acceptance of health services, particularly when messages resonate with community values, including those related to maternal and child health. By explicitly aligning hepatitis B screening with *Hifz al-Nasl*, community health centers can strengthen motivational salience beyond secular risk frames, complementing evidence on provider support and perceived severity. This integrated approach provides a holistic framework that bridges behavioral, operational, and faith-informed levers, thereby reinforcing the public health agenda while maintaining cultural and religious resonance (Abu-Ras et al., 2024).

Integrating attitude-focused counseling, robust provider support, streamlined procedures, and improved access is likely to enhance screening coverage, reduce mother-to-child transmission, and protect infant and maternal health, key objectives for family health systems. Strengths include a community-based sample across community health center with varied coverage and distance profiles and the use of validated constructs mapped to utilization theory. Limitations include the cross-sectional design (precluding causal inference), potential self-report

bias, and reliance on bivariate associations without multivariable adjustment. Future studies should incorporate longitudinal designs, adjust for confounding, and test multi-component interventions embedded in routine ANC.

CONCLUSIONS

This study identified that maternal attitude, health worker support, perception of service procedures, access to information, healthcare access, and perceived severity were significantly associated with the utilization of hepatitis B early detection services among pregnant women in Semarang City. Conversely, maternal education level, employment status, knowledge, family support, and perceived susceptibility were not found to be significantly related to screening uptake. These findings highlight that service utilization is shaped more by behavioral and system-level determinants than by socio-demographic characteristics alone.

The implications for family health are substantial, as improving attitudes through counseling, strengthening provider support, enhancing service quality, and broadening access to information and healthcare facilities can increase screening coverage and reduce vertical transmission of hepatitis B. Practical recommendations include strengthening family engagement in providing informational and emotional support, equipping healthcare providers with the skills and incentives to deliver high-quality services, and optimizing health information dissemination through digital platforms frequently accessed by the target population. In addition, health centers should expand the use of online registration systems to reduce waiting times and review staffing needs, particularly among midwives, to ensure adequate maternal care coverage. The Semarang City Health Office is advised to provide regular training for healthcare workers and community health cadres, improve workforce welfare, and enhance the role of sub-community health center by equipping them with laboratory facilities. Furthermore, local government initiatives to improve public transportation access to health facilities would support equitable healthcare utilization. Future research should adopt longitudinal and multivariable approaches to clarify causal pathways and test integrated interventions that combine behavioral, structural, and faith-based strategies to enhance maternal health outcomes.

ACKNOWLEDGEMENT
The authors would like to express their sincere gratitude to the Semarang City Health Office and the Central Java Provincial Health Office for their support and facilitation during the study. Special appreciation is extended to the heads and staff of the Community Health Centers of Tlogosari Wetan, Pegandan, Rowosari, Karangayu, and Halmahera for their invaluable cooperation in data collection. The authors are also grateful to the participating pregnant women who generously contributed their time and responses.

FUNDING
The authors declare that no funding was received for this study.

AUTHORS' CONTRIBUTIONS
Annida N. Adilah wrote the manuscript, acquired the data, revised the manuscript, analyzed the data, and performed the field work. Ayun Sriatmi and Nurhasmadiar Nandini designed the study, formulated the concept, and reviewed the manuscript. All authors read and approved the final manuscript.

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COMPETING INTERESTS
The author(s) declare no potential conflict of interest with respect to the research, authorship, and/or publication of this article.

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