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The Role of the Health Belief Model in Antenatal Care Visits among Pregnant Women at Sentru Saude Komunitaria, Baucau Municipality, Timor Leste

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ABSTRACT

Background: Antenatal Care (ANC) visits are an essential intervention for reducing the risk of maternal morbidity and mortality. However, ANC coverage in several regions of Timor-Leste, including Baucau Municipality, remains below the national target. This study aimed to analyze factors influencing pregnant women's compliance with recommended ANC visits according to timing and guidelines using the Health Belief Model (HBM)

Subjects and Method: This cross-sectional study involved 200 pregnant women registered at healthcare facilities in Baucau Municipality, Timor-Leste. Data were collected using a questionnaire based on HBM constructs that had been tested for validity and reliability. Data were analyzed using path analysis with STATA version 13 to identify direct and indirect effects among variables associated with ANC visits.

Results: The results showed that cues to action had a direct and positive effect on ANC visits (b= 0.12; 95% CI= 0.03 to 0.20; p= 0.005). Gestational age had a significant positive effect on ANC visits (b= 0.24; 95% CI= 0.16 to 0.32; p< 0.001). In contrast, distance to healthcare facilities had a significant negative effect (b= -0.70; 95% CI= -0.75 to -0.64; p< 0.001), while parity had a negative but non-significant effect (b= -0.05; 95% CI= -0.14 to 0.03; p= 0.175). Self-efficacy had an indirect effect on ANC visits through perceived benefits (b= 0.15; 95% CI= 0.01 to 0.29; p= 0.040) and perceived benefits also had a significant indirect effect (b= 0.22; 95% CI= 0.08 to 0.37; p= 0.002). Perceived severity indirectly influenced ANC visits as well (b= -0.14; 95% CI= -0.26 to -0.01; p= 0.035).

Conclusion: ANC visits increased with stronger cues to action and advancing gestational age. Conversely, ANC visits decreased with greater parity and longer distance to healthcare facilities. ANC visits were indirectly influenced by perceived susceptibility, perceived severity, perceived barriers, perceived benefits, and self-efficacy.

Keywords: antenatal care, health belief model, pregnant women.

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BACKGROUND

Maternal health remains a global priority in efforts to improve population well-being. High maternal mortality rates (MMR) and infant mortality rates (IMR) continue to represent major public health challenges at the global, regional, and national levels. One of the most effective interventions for reducing the risk of pregnancy-related complications and maternal and neonatal mortality is Antenatal Care (ANC). ANC services aim to facilitate the early detection of pregnancy complications, provide nutritional counseling, and prepare women for safe and healthy childbirth.

According to the guidelines of the World Health Organization (WHO), every pregnant woman is recommended to attend a minimum of four ANC visits. In its updated recommendation issued in 2016, WHO increased the standard to eight contacts in order to improve women's pregnancy experience and reduce the risk of perinatal mortality (Tunçalp et al., 2017). In 2020, approximately 287,000 women died from pregnancy and childbirth-related complications, and nearly 99% of these deaths occurred in low- and middle-income countries. Almost all of these deaths could have been prevented through the provision of high-quality and continuous ANC services (WHO, 2023). Globally, only 65% of pregnant women complete at least four ANC visits according to the recommended schedule (WHO, 2023). Persistent inequalities between developed and developing countries result in a substantial proportion of women not receiving adequate monitoring throughout pregnancy.

In Southeast Asia, considerable disparities in ANC utilization exist across countries. In Indonesia, the coverage of four or more ANC visits reached 88.5% (Basic Health Research/Riskesdas, 2018), whereas coverage in countries such as Myanmar and Laos remains below 70%. The situation in Timor-Leste reflects similar challenges. According to the Timor-Leste Demographic and Health Survey (2016), approximately 84% of women aged 15–49 years received at least one ANC visit from a skilled health provider, while only 57% initiated ANC during the first trimester of pregnancy. The coverage of four or more ANC visits also revealed a substantial disparity between urban areas (87%) and rural areas (72%). Data from the Ministry of Health of Timor-Leste (2023) indicated a significant decline in ANC utilization, particularly in the fourth ANC visit (K4), in Baucau Municipality. This decline was accompanied by an increase in delivery complications and maternal mortality, reflecting low adherence to the recommended ANC schedule among pregnant women.

Poor adherence to ANC recommendations has direct implications for pregnancy outcomes. The incidence of low birth weight (LBW) has increased alongside declining ANC attendance. Several factors contribute to the low utilization of ANC services, including geographical barriers, limited access to healthcare facilities, poor road infrastructure, unequal distribution of healthcare workers, socio-cultural influences, and inadequate maternal knowledge regarding the benefits of ANC. To gain a comprehensive understanding of these health behaviors, the Health Belief Model (HBM) was employed as the theoretical framework for this study.

The HBM is a psychosocial theory that proposes that individual health behaviors are influenced by perceptions of susceptibility, severity, benefits, barriers, cues to action, and self-efficacy (Rosenstock, 1974). Numerous studies have demonstrated the usefulness of the HBM in explaining ANC attendance behavior. Tungaraza and Joho (2022) found that self-

efficacy and cues to action were strong predictors of ANC adherence among pregnant women in Tanzania, with significant indirect effects operating through cues to action. Similarly, a study conducted by Dafroyati et al. (2024) reported a significant association between HBM-related factors and pregnant women's ANC attendance behavior ($p < 0.001$).

This study aimed to analyze the factors influencing pregnant women's adherence to ANC visits according to the recommended schedule. More specifically, the study focused on the role of individual perceptions, as conceptualized by the components of the Health Belief Model, in shaping ANC attendance behavior among pregnant women. The study further sought to assess the influence of each HBM construct on compliance with recommended ANC visits.

SUBJECTS AND METHOD

1. Study Design

This study employed an observational analytic design with a cross-sectional approach, in which both dependent and independent variables were measured simultaneously using primary data collected from healthcare facilities, including Sentru Saude Komunitaria (Community Health Centers) in Baucau Municipality, Timor-Leste.

2. Population and Sample

The study population consisted of all pregnant women residing within the catchment areas of the Sentru Saude Komunitaria (SSK) who were in an active stage of pregnancy and registered in the ANC cohort records. A total of 5,089 pregnant women were identified as the target population.

A sample of 200 pregnant women from nine Sentru Saude Komunitaria facilities was selected to meet the requirements for path analysis. The sample size determination was based on the N ratio guideline for path analysis, where N represents the number of respondents and q represents the number of free parameters estimated in the model. Considering the study model structure, a total of 10 free parameters were estimated.

3. Study Variables

The dependent variable was Antenatal Care (ANC) attendance. The independent variables consisted of all Health Belief Model (HBM) constructs, including perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy. Additional control variables included distance to healthcare facilities, gestational age, and parity.

4. Operational Definition of Variables

Perceived susceptibility refers to the level of a pregnant woman's belief regarding her vulnerability to pregnancy complications if ANC services are not utilized.

Perceived severity refers to a pregnant woman's perception of the seriousness of pregnancy-related complications and their potential consequences.

Perceived benefits refer to a pregnant woman's belief that ANC visits are beneficial for maintaining a healthy pregnancy.

Perceived barriers refer to the obstacles perceived by pregnant women in attending ANC services.

Cues to action refer to internal or external stimuli that encourage pregnant women to attend ANC visits.

Self-efficacy refers to a pregnant woman's confidence in her ability to overcome barriers and successfully attend ANC visits.

Distance to healthcare facilities refers to the travel distance between a pregnant woman's residence and the nearest healthcare facility providing ANC services, measured in kilometers.

Gestational age refers to the duration of pregnancy at the time of data collection, calculated in weeks based on the first day of the last menstrual period or ultrasound

examination results recorded in the Maternal and Child Health (MCH) handbook.

Parity refers to the total number of previous live births or stillbirths experienced by a woman before the current pregnancy.

ANC attendance refers to the frequency of visits made by pregnant women to healthcare facilities during pregnancy.

5. Study Instruments

Data were collected using structured questionnaires consisting of a respondent characteristics questionnaire and an HBM construct questionnaire. Instrument validity was assessed using item-rest correlation values, while reliability was evaluated using Cronbach's alpha coefficients.

6. Data Analysis

Univariate analysis was conducted to obtain frequency distributions and percentages of participants' characteristics. Bivariate analysis was performed to examine the relationships between independent and dependent variables. Path analysis was subsequently conducted through five stages: model specification, model identification, model fit assessment, parameter estimation, and evaluation and interpretation of the results.

7. Research Ethics

This study received ethical approval from the Health Research Ethics Committee of the Instituto Nacional Saude Publica (INSP-TL), Timor-Leste. Ethical clearance was granted under Reference Number 1889/INSP-TL/UEPD-AL/IX/2025, with approval issued on September 8, 2025.

RESULTS

1. Univariate Analysis

Table 1 presents the characteristics of the 200 study participants. On average, respondents were approximately 27 years old and had a mean monthly income of USD 74.4. The average parity was 2.2 children, while the mean distance to the nearest healthcare facility was 2.9 km. The mean gestational age at the time of data collection was 7.7 months (approximately 30 weeks). Pregnant women attended ANC services an average of 3.6 times during pregnancy.

Regarding the Health Belief Model (HBM) constructs, respondents reported mean scores of 37.8 for perceived susceptibility, 33.8 for perceived severity, 40.6 for perceived benefits, 22.1 for perceived barriers, 37.9 for cues to action, and 37.1 for self-efficacy. The average number of ANC visits was 3.6, indicating that the majority of respondents had not yet achieved the recommended level of ANC attendance according to WHO guidelines.

Table 1. Sample Characteristics and Continuous Variables

Variables	Mean	SD	Minimum	Maximum
Age (years)	27.57	6.22	16	44
Income (USD)	74.43	76.53	10	400
Parity (children)	2.28	1.60	0	8
Distance to Health Facility (km)	2.91	2.23	2	9
Gestational Age (months)	7.66	0.59	7	9
Perceived Susceptibility	37.84	3.64	26	47
Perceived Severity	33.81	3.23	20	42
Perceived Benefits	40.57	3.91	21	50
Perceived Barriers	22.14	3.50	13	34

Variables	Mean	SD	Minimum	Maximum
Cues to Action	37.97	3.65	24	46
Self-Efficacy	37.11	3.78	27	48
Number of ANC Visits	3.60	1.22	1	6

Table 2 shows that the majority of respondents were housewives, accounting for 157 participants (78.5%), followed by small business owners with 19 participants (9.5%). Regarding educational attainment, most respondents had completed secondary education (high school), representing 104 participants (52.0%). In contrast, only 19 respondents (9.5%) had attained higher education, including diploma or university degrees. Furthermore, 20.5% of respondents had not completed primary school education.

Table 2. Sample Characteristics: Categorical Variables

Characteristics	Frequency (n)	Percentage (%)
Occupation		
Homemaker	157	78.5
Small Business Owner	19	9.5
Self-Employed	10	5.0
Civil Servant	14	7.0
Educational Attainment		
Did Not Complete Primary School	41	20.5
Primary Education	36	18.0
Secondary Education	104	52.0
Higher Education	19	9.5

The findings indicate that most respondents had relatively low to moderate socioeconomic and educational backgrounds. In addition, the average ANC attendance remained below the current WHO recommendation, suggesting the need for further investigation into factors influencing ANC utilization among pregnant women in Baucau Municipality, Timor-Leste.

2. Bivariate Analysis

The bivariate analysis was conducted using simple linear regression to examine the association between each independent variable and ANC attendance. Table 3 presents the results of the simple linear regression analysis of Health Belief Model (HBM) constructs and other study variables associated with ANC attendance among pregnant women receiving care at health facilities in Timor-Leste.

Table 3. Results of Linear Regression Analysis of Factors Associated with ANC Attendance

Variables	Regression Coefficient (b)	95% CI		p
		Lower Limit	Upper Limit	
Perceived Susceptibility	0.01	-0.04	0.05	0.645
Perceived Severity	0.03	-0.02	0.08	0.262

Variables	Regression Coefficient (b)	95% CI		p
		Lower Limit	Upper Limit	
Perceived Benefits	0.05	0.01	0.09	0.010
Perceived Barriers	0.01	-0.03	0.05	0.692
Cues to Action	0.08	0.04	0.13	<0.001
Self-Efficacy	0.01	-0.04	0.05	0.749
Gestational Age	0.69	0.42	0.97	<0.001
Distance to Health Facility	-0.41	-0.46	-0.36	<0.001
Parity	-0.31	-0.67	0.49	0.091

The results of the simple linear regression analysis showed that perceived susceptibility was not significantly associated with ANC attendance (b= 0.01; 95% CI= -0.04 to 0.05; p= 0.645). This finding indicates that a one-unit increase in the perceived susceptibility score was associated with a 0.01-unit increase in ANC attendance. However, the association was not statistically significant, suggesting that perceived susceptibility did not have a meaningful influence on ANC attendance among pregnant women.

Similarly, perceived severity was not significantly associated with ANC attendance (b= 0.03; 95% CI= -0.02 to 0.08; p= 0.262). A one-unit increase in the perceived severity score was associated with a 0.03-unit increase in ANC attendance. Nevertheless, the effect was not statistically significant, indicating that higher perceptions of the seriousness of pregnancy-related complications did not necessarily lead to increased ANC attendance.

A significant positive association was found between perceived benefits and ANC attendance (b= 0.05; 95% CI= 0.01 to 0.09; p= 0.010). This result suggests that each one-unit increase in the perceived benefits score was associated with a 0.05-unit increase in ANC attendance. Pregnant women who perceived greater benefits from ANC were more likely to attend ANC services.

Perceived barriers were not significantly associated with ANC attendance (b= 0.01; 95% CI= -0.03 to 0.05; p= 0.692). This finding indicates that the barriers perceived by pregnant women did not directly influence ANC attendance behavior in this study.

Cues to action showed a significant positive association with ANC attendance (b= 0.08; 95% CI= 0.04 to 0.13; p< 0.001). Each one-unit increase in the cues-to-action score was associated with a 0.08-unit increase in ANC attendance. This finding suggests that external or internal stimuli encouraging health-seeking behavior play an important role in promoting ANC utilization.

Self-efficacy was not significantly associated with ANC attendance (b= 0.01; 95% CI= -0.04 to 0.05; p= 0.749). This result indicates that confidence in one's ability to access and utilize ANC services was not a significant determinant of ANC attendance in the present study.

Gestational age was positively and significantly associated with ANC attendance (b= 0.69; 95% CI= 0.42 to 0.97; p< 0.001). Each additional month of gestation was associated with a 0.69-unit increase in ANC attendance. This finding suggests that women with more advanced pregnancies were more likely to attend ANC services.

Distance to healthcare facilities was negatively and significantly associated with

ANC attendance (b= -0.41; 95% CI= -0.46 to -0.36; p< 0.001). A one-unit increase in distance was associated with a 0.41-unit decrease in ANC attendance. This finding indicates that greater travel distance constitutes an important barrier to ANC utilization.

Parity was not significantly associated with ANC attendance (b= -0.31; 95% CI= -0.67 to 0.49; p= 0.091). Although the direction of the association was negative, the effect was not statistically significant, suggesting that the number of children a woman had previously delivered did not significantly influence ANC attendance in this study.

4. Path Analysis

The relationships among Health Belief Model constructs, sociodemographic factors, and ANC attendance were further examined using path analysis. The results of the path analysis are presented in Table 4. The model estimated both direct and indirect effects of perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, self-efficacy, gestational age, distance to healthcare facilities, and parity on ANC attendance among pregnant women in Baucau Municipality, Timor-Leste.

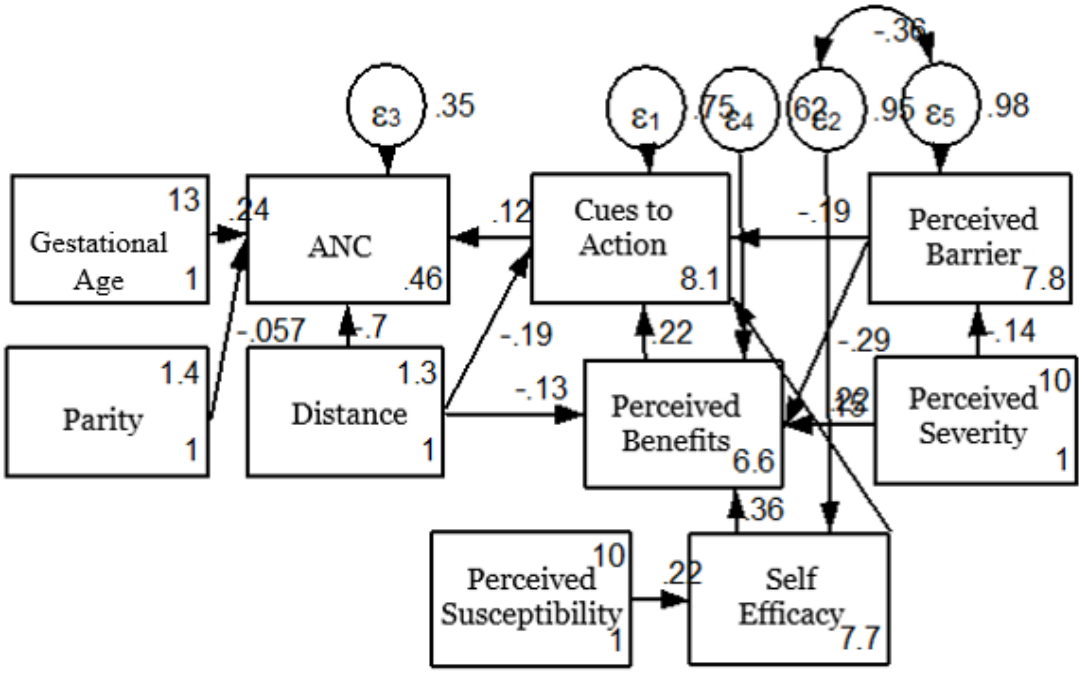

Figure 1. Path Analysis Model of the Relationships Among Health Belief Model Constructs, Maternal Characteristics, and Antenatal Care Attendance Among Pregnant Women

Figure 1 illustrates the application of the Health Belief Model (HBM) in explaining antenatal care (ANC) attendance among pregnant women. The one-directional arrows represent direct effects between variables, while the path coefficients indicate the magnitude and direction of these relationships. ANC attendance was influenced by several variables through both direct and indirect pathways. Distance to healthcare facilities was identified as a variable exerting both direct and indirect effects on ANC attendance. Variables that directly influenced ANC attendance

included cues to action, gestational age, distance to healthcare facilities, and parity. Indirect effects on ANC attendance through cues to action were observed for perceived benefits, perceived barriers, self-efficacy, and distance to healthcare facilities. Furthermore, perceived benefits served as an additional mediating variable through which self-efficacy, perceived barriers, perceived severity, and distance to health-care facilities indirectly influenced ANC attendance. These findings demonstrate the complex interplay between individual perceptions, enabling factors, and access-related barriers in shaping ANC utilization among pregnant women.

Table 4. Results of Path Analysis Showing Direct and Indirect Effects of Health Belief Model Constructs and Maternal Characteristics on Antenatal Care Attendance

Study variables		Path Coef. (b)	95% CI		P
			Lower Limit	Upper Limit	
Direct Effects					
ANC	← Cues To action	0.12	0.03	0.20	0.005
	← Parity	-0.05	-0.14	0.03	0.175
	← Gestational Age	0.24	0.16	0.32	<0.001
	← Distance to Health Facility	-0.70	-0.75	-0.64	<0.001
Indirect Effects					
Cues to Action	←Perceived Benefits	0.22	0.08	0.37	0.002
	← Perceived Barriers	-0.19	-0.33	-0.56	0.006
	← Self-Efficacy	0.15	0.01	0.29	0.040
	← Distance to health Facility	-0.19	-0.31	-0.07	0.002
	← Self-Efficacy	0.36	0.25	0.48	<0.001
Perceived Benefits	← Perceived Barriers	- 0.29	- 0.41	- 0.18	<0.001
	← Perceived Severity	0.22	0.11	0.33	<0.001
	← Distance to Health Facility	- 0.13	- 0.23	- 0.02	0.023
Self-Efficacy	← Perceived Susceptibility	0.22	0.09	0.34	0.001
Perceived Barriers	← Perceived Severity	- 0.14	- 0.26	- 0.01	0.035
N observation = 200					
Log likelihood =-4107.5167					
Chi Square p = 0.2058 (>0.05)					
RSMEA =0.035 (<0.08. CFI=0.988 (>0.90)					
TLI = 0.979 (>0.09). SRMR = 0.041 (<0.05).CD=0.688					

The path analysis showed a positive and statistically significant association between cues to action and ANC visits. An increase of one unit in the cues to action score was associated with a 0.12-unit increase in the ANC visit score (b = 0.12; 95% CI = 0.03 to 0.20; p = 0.005).

There was no statistically significant association between parity and ANC visits (b = -0.05; 95% CI = -0.14 to 0.03; p = 0.175). This finding indicates that the number of children a mother had did not directly influence the frequency of ANC visits.A positive and statistically significant

association was found between gestational age and ANC visits (b = 0.24; 95% CI = 0.16 to 0.32; p < 0.001). Each one-unit increase in gestational age was associated with a 0.24-unit increase in the ANC visit score.

Distance to health facilities was negatively and significantly associated with ANC visits (b = -0.70; 95% CI = -0.75 to -0.64; p < 0.001). This result indicates that each one-kilometer increase in distance to a health facility was associated with a 0.70-unit decrease in the ANC visit score.A positive and statistically significant association was observed between perceived benefits and cues to action (b = 0.22; 95% CI = 0.08 to 0.37; p = 0.002). A one-unit increase in the perceived benefits score was associated with a 0.22-unit increase in the cues to action score.

Perceived barriers showed a significant negative association with cues to action (b= -0.19; 95% CI = -0.33 to -0.06; p= 0.006). Each one-unit increase in the perceived barriers score was associated with a 0.19-unit decrease in the cues to action score.A positive and statistically significant relationship was found between self-efficacy and cues to action (b = 0.15; 95% CI = 0.01 to 0.29; p = 0.040). An increase of one unit in the self-efficacy score was associated with a 0.15-unit increase in the cues to action score.

The analysis also revealed a significant negative association between distance to health facilities and cues to action (b = -0.19; 95% CI = -0.31 to -0.07; p= 0.002). Mothers living farther from health facilities were less likely to have cues that encouraged ANC attendance. A positive and statistically significant association was identified between self-efficacy and perceived benefits (b = 0.36; 95% CI = 0.25 to 0.48; p < 0.001). Each one-unit increase in the self-efficacy score was associated with a 0.36-unit increase in the perceived benefits score.

Perceived barriers were negatively associated with perceived benefits (b = -0.29; 95% CI = -0.41 to -0.18; p < 0.001). A one-unit increase in perceived barriers was associated with a 0.29-unit decrease in the perceived benefits score. A positive and statistically significant relationship was found between perceived severity and perceived benefits (b = 0.22; 95% CI = 0.11 to 0.33; p < 0.001). An increase of one unit in perceived severity was associated with a 0.22-unit increase in the perceived benefits score.

Distance to health facilities was negatively associated with perceived benefits (b= -0.13; 95% CI = -0.23 to -0.02; p = 0.023). Each one-kilometer increase in distance was associated with a 0.13-unit decrease in the perceived benefits score. A positive and statistically significant association was observed between perceived susceptibility and self-efficacy (b = 0.22; 95% CI = 0.09 to 0.34; p = 0.001). A one-unit increase in perceived susceptibility was associated with a 0.22-unit increase in the self-efficacy score.

Perceived severity was negatively associated with perceived barriers (b= -0.14; 95% CI = -0.26 to -0.01; p = 0.035). Each one-unit increase in perceived severity was associated with a 0.14-unit decrease in the perceived barriers score.

Figure 1 illustrates the path model describing the direct and indirect effects of Health Belief Model constructs and other explanatory variables on ANC visits among pregnant women in Municipio Baucau, Timor-Leste. The model demonstrated a good fit to the data, as indicated by the goodness-of-fit indices (Chi-square p = 0.2058; RMSEA = 0.035; CFI = 0.988; TLI = 0.979; SRMR = 0.041; CD = 0.688).

DISCUSSION

Effect of Perceived Susceptibility on ANC Visits

The path analysis showed that perceived susceptibility had a positive indirect effect on ANC visits through increased self-efficacy, and this mediating effect was statistically significant. These findings indicate that when pregnant women perceive themselves as being more vulnerable to pregnancy-related complications, their confidence in managing pregnancy-related challenges increases. In turn, higher self-efficacy contributes to greater adherence to ANC visits.

Although studies directly examining this mediating pathway remain limited, the observed relationship is consistent with the findings of Pormehr-Yabandeh et al. (2025), who reported that self-efficacy was the strongest predictor of preconception care behaviors, while perceived susceptibility significantly enhanced self-efficacy. Therefore, a similar mechanism may also apply in the context of ANC utilization. Haning et al. (2022) reported that perceived susceptibility was the most dominant and significant predictor of ANC attendance compliance, while other HBM constructs, including self-efficacy, were also associated with ANC visits. Likewise, Bayrami et al. (2024), in their study of self-care behaviors among pregnant women during the COVID-19 pandemic, identified self-efficacy and perceived susceptibility as the strongest predictors of preventive behaviors, emphasizing the role of self-efficacy as a key driver of action within the Health Belief Model framework.

Effect of Perceived Severity on ANC Visits

The path analysis demonstrated that perceived severity had a positive indirect effect on ANC visits through perceived benefits, and this relationship was statistically significant. This finding suggests that the greater a pregnant woman perceives pregnancy complications as serious, the greater the perceived benefits of ANC services, which subsequently enhances her intention and compliance with ANC visits.

This finding is supported by previous studies, although these studies did not explicitly examine the pathway from perceived severity to perceived benefits and ANC utilization. Warri and George (2020) found that many pregnant women delayed ANC attendance because they perceived pregnancy as a natural process with minimal risk. Low perceived severity contributed to lower perceived benefits, causing women to seek care only after experiencing severe symptoms. Similarly, Irawati et al. (2024), using the HBM framework in anemia prevention among pregnant women, reported that both perceived severity and perceived benefits significantly influenced preventive behaviors, indicating that increased awareness of pregnancy risks strengthens perceptions of the benefits of preventive healthcare. Dafroyati et al. (2024) further reported that pregnant women who understood pregnancy risks more seriously tended to perceive greater benefits of ANC as an important strategy for preventing maternal mortality.

The path analysis also revealed that perceived severity had an indirect negative effect on ANC visits through perceived barriers. This finding indicates that greater awareness of the seriousness of pregnancy complications reduces the barriers perceived by pregnant women when accessing ANC services.

Effect of Perceived Benefits on ANC Visits

The results showed that perceived benefits indirectly increased ANC visits through cues to action, with a statistically significant mediating effect. This finding indicates that

pregnant women's belief in the benefits of ANC does not merely encourage attendance directly but operates through external and internal triggers, such as encouragement from healthcare providers, family support, and health promotion messages.

These findings are consistent with those reported by Dafroyati et al. (2024), who found that perceived benefits, perceived barriers, and cues to action significantly influenced ANC attendance behavior. The partial analysis conducted in the present study further revealed a more specific relationship among HBM constructs, showing that perceived benefits were positively associated with ANC utilization. This suggests that the stronger a woman's belief in the benefits of pregnancy examinations, the greater her likelihood of adhering to ANC schedules recommended by healthcare providers.

Therefore, it can be assumed that increasing pregnant women's perception of the benefits of ANC does not directly increase ANC attendance but rather works through reminders, social support, and encouragement from healthcare providers that function as cues to action. In other words, stronger beliefs regarding the benefits of ANC enhance the effectiveness of cues to action, such as healthcare messages, family education, and health promotion campaigns, in motivating women to attend ANC services.

Effect of Perceived Barriers on ANC Visits

The path analysis demonstrated that perceived barriers had a negative indirect effect on ANC visits through two important pathways, namely cues to action and perceived benefits, both of which showed statistically significant mediating effects.

First, physical, socioeconomic, and psychological barriers reduced pregnant women's responsiveness to cues to action. This means that the greater the perceived barriers, the less likely women are to respond to reminders from healthcare providers, family support, or health education messages, thereby reducing ANC compliance.

Second, perceived barriers diminished perceived benefits, causing pregnant women to believe that the benefits of ANC were not worth the effort required to obtain these services. Haning et al. (2022) reported that such barriers significantly reduced ANC attendance, particularly when cues to action from family members, healthcare providers, and health campaigns were insufficient to overcome anxiety and fear. Similarly, Penman et al. (2023) identified structural and personal barriers as major obstacles to accessing and utilizing ANC services while simultaneously weakening women's motivation to seek care despite understanding its benefits.

Tungaraza and Joho (2022) also found that economic, social, and logistical barriers reduced both perceived benefits and ANC compliance. Likewise, Pormehr-Yabandeh et al. (2025) reported that perceived barriers had a significant negative effect on perceived benefits and preventive health behaviors among pregnant women. Their findings suggest that the influence of barriers on health behavior is mediated through perceived benefits.

In Municipio Baucau, similar patterns were observed. Major barriers to ANC utilization included long distances to healthcare facilities, inflexible service schedules, and the perception that ANC is unnecessary when pregnancy progresses normally. These barriers may diminish the perceived benefits of routine pregnancy examinations.

Effect of Cues to Action on ANC Visits

The path analysis indicated that cues to action had a direct and positive effect on ANC visits, and this relationship was statis-

tically significant. This finding highlights the important role of cues to action, including recommendations from health-care providers, health education activities, media messages, family support, and appointment reminders, in promoting ANC attendance.

This finding is consistent with the study conducted by Haning et al. (2022), which reported a significant association between cues to action and completion of the fourth ANC visit (ANC K4). The authors explained that cues to action originate from individuals or events that stimulate health-related actions.

Similarly, Tungaraza and Joho (2022) found that cues to action provided by healthcare workers were the strongest factors transforming intention into actual maternal health behaviors. Dafroyati et al. (2024) also reported that health education, family support, healthcare provider encouragement, and health campaigns increased women's motivation and compliance with routine ANC visits.

Furthermore, Nelson et al. (2021) reinforced these findings through a qualitative study in Ghana. They found that women who prepared for childbirth with assistance from healthcare providers had already undertaken concrete actions as a result of cues to action, such as saving money, preparing delivery supplies, and arranging transportation with their spouses.

The positive and significant effect of cues to action on ANC attendance suggests that both interpersonal cues, such as support from husbands, family members, and community health volunteers, and institutional cues, including reminders from healthcare providers, health education sessions, and home visits, serve as powerful motivators for maternal health-seeking behavior.

AUTHORS' CONTRIBUTIONS

NJV contributed to the study conception and design, data collection, data analysis and interpretation, and manuscript preparation. YLRD and BM contributed to the study design, methodology development, data analysis, and critical revision of the manuscript. RGHN and SSR contributed to critical manuscript revision and provided other substantial intellectual contributions.

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CONFLICT OF INTEREST

The authors declare no conflict of interest related to this study.

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