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Determinants of Health Literacy Regarding Breast Cancer Based on the Health Belief Model Framework in North Sumatra

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Abstract

Breast cancer remains a major public health problem among women in Indonesia, including North Sumatra, where limited health literacy may contribute to delayed diagnosis and low participation in early detection. This study aimed to analyze the determinants of breast cancer health literacy based on the Health Belief Model framework among women in North Sumatra. A quantitative cross-sectional study was conducted involving 250 women selected through purposive sampling. Data were collected using a structured questionnaire measuring breast cancer health literacy and Health Belief Model constructs, including perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy. Data were analyzed using descriptive statistics, bivariate analysis, and multivariate logistic regression. The findings showed that most respondents had moderate breast cancer health literacy. All Health Belief Model constructs were significantly associated with health literacy, with self-efficacy identified as the strongest determinant, followed by perceived benefits. Perceived barriers negatively influenced women's ability to access and apply breast cancer-related information. These findings indicate that breast cancer health literacy is shaped not only by knowledge and education but also by psychosocial perceptions and sociocultural conditions. Strengthening women's self-efficacy and reducing perceived barriers should be prioritized in culturally sensitive breast cancer education and early detection programs in North Sumatra.

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Introduction

Breast cancer remains one of the most significant public health problems worldwide and is the leading cause of cancer-related deaths among women. The World Health Organization (WHO) reported that breast cancer accounted for approximately 2.3 million new cases and more than 670,000 deaths globally in 2022, indicating a continuous increase in disease burden, particularly in developing countries (WHO, 2023). In

Indonesia, breast cancer has consistently ranked as the most prevalent cancer among women, with increasing incidence rates reported in several provinces, including North Sumatra. Despite various national campaigns promoting early detection through breast self-examination (BSE), clinical breast examination (CBE), and mammography, many women are still diagnosed at advanced stages due to limited awareness, misconceptions, fear, and inadequate access to accurate health information (Kementerian Kesehatan Republik Indonesia, 2022). This condition reflects the persistent problem of low health literacy regarding breast cancer prevention and early detection.

Health literacy is defined as an individual's ability to access, understand, evaluate, and apply health information to make informed health decisions (Nutbeam, 2008). Adequate health literacy is essential in encouraging preventive health behaviors, increasing participation in cancer screening programs, and reducing delays in diagnosis and treatment. However, health literacy related to breast cancer is influenced not only by educational background but also by psychosocial perceptions, cultural beliefs, socioeconomic conditions, and accessibility of healthcare services. In Indonesia, especially in North Sumatra, sociocultural diversity and disparities in health education may contribute to variations in women's perceptions and responses toward breast cancer risks. Consequently, understanding the psychological determinants underlying health literacy becomes crucial for designing effective interventions tailored to local community characteristics.

The Health Belief Model (HBM) provides a comprehensive theoretical framework for understanding individual health behaviors, grounded in personal beliefs and perceptions. According to Rosenstock et al. (1988), the HBM consists of several key constructs, namely perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy, which collectively influence an individual's willingness to engage in preventive health behaviors. Previous studies have demonstrated that women with higher perceived susceptibility and perceived benefits are more likely to seek breast cancer information and participate in early detection practices. In contrast, perceived barriers such as fear, stigma, financial constraints, and lack of knowledge may hinder preventive actions (Champion & Skinner, 2008). Although numerous studies have investigated breast cancer awareness and screening behaviors in Indonesia, most research has focused primarily on knowledge levels or attitudes without comprehensively examining health literacy through the multidimensional constructs of the Health Belief Model.

The novelty of this study lies in its integrative approach to analyzing breast cancer health literacy using the Health Belief Model framework within the sociocultural context of North Sumatra. Unlike previous studies that mainly measured general awareness or screening practices, this research specifically explores how each HBM construct contributes to the formation of health literacy regarding breast cancer among women in a culturally diverse population. In addition, this study addresses the limited evidence on the psychosocial determinants of breast cancer health literacy in North Sumatra, where cultural beliefs, educational inequalities, and access to healthcare information vary considerably across urban and rural communities. By identifying the most influential determinants within the HBM framework, this study is expected to provide a sharper conceptual contribution and practical recommendations for developing culturally sensitive health promotion programs and targeted breast cancer education strategies in Indonesia.

Therefore, this study aims to analyze the determinants of health literacy regarding breast cancer, based on the Health Belief Model, among women in North Sumatra.

Materials and Methods

Research Design

This study employed a quantitative research design with a cross-sectional approach. This design was used to analyze determinants of health literacy regarding breast cancer, based on the Health Belief Model, among women in North Sumatra. A cross-sectional design was considered appropriate because it enabled the researcher to examine the relationship between Health Belief Model constructs and breast cancer health literacy at a single point in time. The variables assessed in this study included breast cancer health literacy as the dependent variable and Health Belief Model constructs, namely perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy, as independent variables.

Population and Sample

The study population consisted of women residing in North Sumatra who met the inclusion criteria. The inclusion criteria were women aged 18 years and above, willing to participate in the study, able to

communicate effectively, and able to complete the questionnaire independently or with minimal assistance. Women who were unwilling or unable to provide informed consent or to complete the questionnaire were excluded from the study.

The sample size in this study was set at 250 respondents. The sample size was determined based on methodological considerations for quantitative cross-sectional research. The sample size was deemed adequate to describe the characteristics of the target population and to support statistical analyses, including bivariate analyses and multivariate logistic regression. In practice, the sample size may be determined using Slovin's formula when the population size is known, or Lemeshow's formula when the population size is not precisely known. In this study, 250 respondents were considered sufficient because this number met the minimum sample requirement for examining several Health Belief Model constructs simultaneously. The sample size was also determined by considering the accessibility of respondents, the inclusion criteria, and the feasibility of data collection in North Sumatra.

The sampling technique used in this study was purposive sampling. This technique was chosen to ensure that the respondents had characteristics relevant to the research objectives, particularly women eligible to provide information on breast cancer health literacy and perceptions, based on the Health Belief Model framework.

Research Instrument

Data were collected using a structured questionnaire developed based on previous studies on breast cancer health literacy and the Health Belief Model. The questionnaire was adapted from validated instruments used in prior research on breast cancer awareness, health literacy, and breast cancer screening beliefs. The adaptation process involved adjusting the language, item wording, and examples to suit the sociocultural context of women in North Sumatra.

The questionnaire consisted of three main sections. The first section collected respondents' demographic characteristics, including age, educational level, occupation, marital status, and previous exposure to breast cancer information. The second section measured breast cancer health literacy, including respondents' ability to access, understand, evaluate, and apply information on breast cancer symptoms, risk factors, prevention, and early detection. The third section measured Health Belief Model constructs, including perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy.

The instrument contained 42 items. Breast cancer health literacy was measured using 10 items, while the Health Belief Model constructs consisted of 32 items. Perceived susceptibility was measured using 5 items, perceived severity using 5 items, perceived benefits using 5 items, perceived barriers using 6 items, cues to action using 5 items, and self-efficacy using 6 items. Each item was measured using a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. Higher scores indicated stronger perceptions of each construct, except for perceived barriers, where higher scores reflected greater obstacles in accessing and applying breast cancer-related information.

The indicators of each Health Belief Model construct were determined as follows. Perceived susceptibility referred to women's perception of their personal risk of developing breast cancer. Perceived severity assessed women's beliefs regarding the seriousness and consequences of breast cancer. Perceived benefits measured beliefs about the advantages of breast cancer prevention and early detection, including breast self-examination, clinical breast examination, and mammography. Perceived barriers included fear, embarrassment, stigma, cost, lack of time, and limited access to healthcare services. Cues to action referred to internal and external triggers that encouraged women to seek information or perform early detection, such as advice from healthcare workers, family support, health campaigns, social media, and community education. Self-efficacy measured women's confidence in their ability to understand breast cancer information, perform breast self-examination, communicate with healthcare providers, and make decisions related to prevention and early detection.

Validity and Reliability Testing

Before the main data collection, the questionnaire was tested for validity and reliability to ensure that it was appropriate for measuring breast cancer health literacy and Health Belief Model constructs. The validity test was conducted using Pearson's product-moment correlation, correlating each item score with the total score of its respective construct. The pilot test involved 30 respondents with characteristics similar to those of the study population but who were not included in the final sample.

At a 5% significance level, the r-table value for 30 respondents was 0.361. An item was considered valid when the calculated correlation coefficient (r) or r-count was greater than the r-table value, and the significance value was less than 0.05. The validity test results showed that all questionnaire items had item-total correlation values ranging from 0.412 to 0.836. Therefore, all items were declared valid and suitable for use in the main study.

Reliability testing was conducted using Cronbach's alpha to assess the internal consistency of each construct. A construct was considered reliable when Cronbach's alpha was 0.70 or higher. The reliability test showed that all constructs had acceptable to good internal consistency. The Cronbach's alpha value for breast cancer health literacy was 0.872. For the Health Belief Model constructs, Cronbach's alpha values were 0.781 for perceived susceptibility, 0.804 for perceived severity, 0.826 for perceived benefits, 0.793 for perceived barriers, 0.812 for cues to action, and 0.858 for self-efficacy. These results indicated that the questionnaire was valid, reliable, and appropriate for use in this study.

Table 1. Validity and Reliability Test Results of the Research Instrument

Variable / Construct	Number of Items	Item-Total Correlation Range	Cronbach's Alpha	Interpretation
Breast cancer health literacy	10	0.428–0.836	0.872	Valid and reliable
Perceived susceptibility	5	0.441–0.782	0.781	Valid and reliable
Perceived severity	5	0.456–0.801	0.804	Valid and reliable
Perceived benefits	5	0.472–0.815	0.826	Valid and reliable
Perceived barriers	6	0.412–0.774	0.793	Valid and reliable
Cues to action	5	0.463–0.792	0.812	Valid and reliable
Self-efficacy	6	0.487–0.829	0.858	Valid and reliable

Data Collection Procedure

Data collection was conducted using a structured questionnaire distributed both online and offline. The online questionnaire was distributed via digital platforms to reach respondents across various areas, while the offline questionnaire was administered directly to respondents with limited access to digital media. Before completing the questionnaire, respondents were informed of the study's purpose, the voluntary nature of participation, the confidentiality of responses, and their right to withdraw at any time. Respondents who agreed to participate provided informed consent before completing the questionnaire.

The data collection process was carried out by ensuring that each respondent met the inclusion criteria. The researcher and trained assistants provided brief instructions to respondents regarding how to complete the questionnaire. Completed questionnaires were checked for completeness before being included in the analysis.

Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences software. Descriptive statistical analysis was used to describe respondents' demographic characteristics, breast cancer health literacy levels, and the distribution of Health Belief Model constructs. The results were presented as frequencies, percentages, means, and standard deviations, where appropriate.

Bivariate analysis was conducted to examine the relationship between each Health Belief Model construct and breast cancer health literacy. The chi-square test or the correlation test was applied based on the data type and distribution. Variables with significant associations were further analyzed using multivariate logistic regression to identify the dominant determinants of breast cancer health literacy. The level of statistical significance was set at $p < 0.05$. The results of multivariate analysis were presented using adjusted odds ratios, 95% confidence intervals, and p-values.

Ethical Considerations

This study was conducted in accordance with ethical principles in health research. Respondents were informed about the objectives, procedures, benefits, and potential risks of the study before participation. Participation was voluntary, and respondents had the right to refuse or withdraw from the study at any stage without any consequences. Confidentiality and anonymity were maintained by ensuring that no personal identifying information was disclosed in the research report. The data collected were used only for research purposes.

Results and Discussions

Respondent Characteristics

A total of 250 women from several districts and cities in North Sumatra participated in this study. The majority of respondents were aged 20–35 years, accounting for 117 respondents (46.8%), followed by those aged 36–50 years with 86 respondents (34.4%) and those aged above 50 years with 47 respondents (18.8%). Based on educational background, most respondents had completed secondary education (130, 52.0%). In terms of occupation, housewives were the largest group, comprising 103 respondents (41.2%).

Table 1. Demographic Characteristics of Respondents (n = 250)

Characteristics	Frequency (n)	Percentage (%)
Age 20–35 years	117	46.8
Age 36–50 years	86	34.4
Age >50 years	47	18.8
Primary education	44	17.6
Secondary education	130	52.0
Higher education	76	30.4
Housewives	103	41.2
Private employees	72	28.8
Self-employed	45	18.0
Others	30	12.0

The findings indicate that women of productive age were the most represented among respondents with moderate educational backgrounds. This demographic condition may influence access to health information and awareness regarding breast cancer prevention. Women with higher educational attainment generally demonstrate better understanding of health-related information and are more likely to adopt preventive health behaviors.

Breast Cancer Health Literacy

The results showed that most respondents had moderate breast cancer health literacy (146, 58.4%). Meanwhile, 60 respondents (24.0%) had high health literacy, and 44 respondents (17.6%) had low health literacy. These findings indicate that although most women had a basic understanding of breast cancer-related information, gaps remained in the ability to evaluate and apply information related to prevention and early detection.

Table 2. Distribution of Breast Cancer Health Literacy Levels

Health Literacy Level	Frequency (n)	Percentage (%)
Low	44	17.6
Moderate	146	58.4
High	60	24.0
Total	250	100.0

These results suggest that although most women possessed basic knowledge regarding breast cancer, substantial gaps still exist in understanding preventive behaviors and screening practices. Limited health literacy may contribute to delayed diagnosis and low participation in early detection programs.

Relationship Between Health Belief Model Constructs and Health Literacy

Bivariate analysis was conducted to examine the relationship between Health Belief Model constructs and breast cancer health literacy. The results showed that all Health Belief Model constructs were significantly associated with breast cancer health literacy. Perceived susceptibility, perceived severity, perceived benefits, cues to action, and self-efficacy were positively associated with health literacy, whereas perceived barriers were negatively associated.

The strongest statistical associations were found in perceived benefits and self-efficacy, both with $p < 0.001$. These findings indicate that women who perceived greater benefits of early detection and had stronger confidence in their ability to understand and apply breast cancer-related information were more likely to have better health literacy. Conversely, perceived barriers were significantly associated with lower health literacy, suggesting that fear, stigma, cost, embarrassment, and limited access to healthcare services may reduce women's engagement with breast cancer information.

Table 3. Relationship Between HBM Constructs and Breast Cancer Health Literacy

Variables	p-value	Relationship
Perceived susceptibility	0.002	Significant
Perceived severity	0.001	Significant
Perceived benefits	0.000	Significant
Perceived barriers	0.004	Significant
Cues to action	0.001	Significant
Self-efficacy	0.000	Significant

The findings indicate that women who perceived themselves as vulnerable to breast cancer and believed the disease to be serious were more likely to seek health information and understand preventive measures. Similarly, respondents who perceived greater benefits from early detection practices demonstrated better health literacy. Conversely, women experiencing barriers such as fear, embarrassment, financial limitations, and limited healthcare access tended to have lower levels of health literacy.

Dominant Determinants of Breast Cancer Health Literacy

Multivariate logistic regression analysis was performed to identify the dominant determinants of breast cancer health literacy. The results showed that self-efficacy was the strongest determinant, with an adjusted odds ratio of 3.12 (95% confidence interval: 1.88–5.16). This means that women with higher self-efficacy were approximately three times more likely to have adequate breast cancer health literacy compared with those with lower self-efficacy.

Perceived benefits also emerged as a significant determinant, with an adjusted odds ratio of 2.74 and a 95% confidence interval of 1.65–4.55. Perceived susceptibility was also significantly associated with health literacy. Meanwhile, perceived barriers had an adjusted odds ratio below 1, indicating a negative effect on breast cancer health literacy.

Table 4. Multivariate Logistic Regression Analysis

Variables	Adjusted OR	95% CI	p-value
Self-efficacy	3.12	1.88–5.16	0.000
Perceived benefits	2.74	1.65–4.55	0.001
Perceived susceptibility	1.96	1.14–3.38	0.015
Perceived barriers	0.68	0.42–0.91	0.023

Women with high self-efficacy were approximately three times more likely to possess adequate breast cancer health literacy compared to those with low self-efficacy. This finding suggests that confidence in performing preventive behaviors and understanding health information significantly contributes to better literacy outcomes. Perceived benefits also emerged as a strong predictor, indicating that women who recognized the advantages of early detection were more motivated to access and apply breast cancer-related information.

This study found that most women in North Sumatra had moderate breast cancer health literacy. This indicates that although breast cancer information is increasingly accessible through healthcare services, social media, and community campaigns, many women still face difficulties in understanding, evaluating, and applying such information for prevention and early detection. Health literacy is not limited to knowledge acquisition; it also involves the ability to make informed health decisions. Therefore, moderate literacy levels suggest the need for more targeted and culturally appropriate health education strategies.

The findings showed that all Health Belief Model constructs were significantly associated with breast cancer health literacy. Perceived susceptibility and perceived severity were positively related to health literacy, indicating that women who recognized their personal risk and understood the seriousness of breast cancer were more likely to seek and process relevant health information. However, excessive fear or fatalistic beliefs may lead to avoidance rather than preventive action. Thus, health education should emphasize both the seriousness of breast cancer and the possibility of successful treatment when detected early.

Perceived benefits also played an important role in improving breast cancer health literacy. Women who believed that breast self-examination, clinical breast examination, and mammography could support early detection were more motivated to access and apply breast cancer-related information. This finding highlights the importance of communicating the practical value of early detection in health promotion programs. Messages that clearly explain the benefits of screening may encourage women to become more actively involved in preventive behaviors.

In contrast, perceived barriers were negatively associated with breast cancer health literacy. Barriers such as fear of diagnosis, embarrassment, stigma, financial limitations, lack of time, and limited access to healthcare facilities may reduce women's willingness to seek information or participate in early detection practices. In the sociocultural context of North Sumatra, discussions about breast health may still be considered sensitive, which can further limit women's engagement with health information. Therefore, breast cancer education should not only provide information but also address emotional, cultural, and structural barriers that prevent women from using such information effectively.

Self-efficacy was identified as the strongest determinant of breast cancer health literacy. This finding suggests that women who are confident in their ability to understand health information, perform breast self-examination, communicate with healthcare providers, and make preventive decisions are more likely to have adequate health literacy. Self-efficacy strengthens women's capacity to transform information into action. Therefore, interventions should move beyond one-way information delivery and incorporate empowering strategies such as counseling, demonstrations of breast self-examination, peer education, and community-based support.

Cues to action were also significantly associated with breast cancer health literacy. Information from healthcare workers, family encouragement, social media, community campaigns, and health education activities may serve as triggers that encourage women to seek and apply breast cancer information. This finding indicates that repeated exposure to credible and accessible health messages is important for improving women's awareness and literacy. Community-based campaigns involving local health workers and women's groups may be particularly effective in strengthening these cues.

The novelty of this study lies in its comprehensive use of the Health Belief Model to explain breast cancer health literacy among women in North Sumatra. Previous studies have often focused on knowledge, awareness, or screening behavior, whereas this study examines how psychosocial perceptions contribute to the development of health literacy itself. Identifying self-efficacy as the dominant determinant makes an important contribution by showing that women's confidence in using health information is central to improving breast cancer literacy. This finding supports the need for empowerment-based and culturally sensitive health promotion programs.

Overall, the results demonstrate that both cognitive and psychosocial factors influence breast cancer health literacy. Improving women's literacy requires strategies that strengthen perceived benefits and self-efficacy while reducing perceived barriers. Health promotion programs should be designed in ways that are culturally acceptable, community-oriented, and responsive to women's real-life challenges in accessing and applying breast cancer information.

Conclusion

This study found that all Health Belief Model constructs were significantly associated with breast cancer health literacy among women in North Sumatra. Self-efficacy was identified as the strongest determinant, followed by perceived benefits, while perceived barriers negatively influenced women's ability to access, understand, and apply breast cancer-related information. These findings indicate that breast cancer health literacy is shaped not only by knowledge and education but also by psychosocial perceptions and sociocultural factors.

The results highlight the importance of developing culturally sensitive breast cancer education programs that strengthen women's confidence, promote the benefits of early detection, and reduce psychological and structural barriers. Health promotion strategies should include interactive counseling, breast self-examination demonstrations, peer support, and community-based education, particularly in rural and underserved areas.

Future studies are recommended to explore additional factors influencing breast cancer health literacy, such as digital health literacy, family support, cultural beliefs, and healthcare accessibility. Further research using larger samples and mixed-method designs may provide a deeper understanding of women's health literacy and preventive behaviors in different sociocultural settings.

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