INDONESIAN HEALTH JOURNAL
Volume 5 Number 3, November 2026
pp. 1092-1100
E-ISSN: 2963-3036
DOI: 10.58344/ihj.v5i3.1008

Analysis of Risk Factors Related to The Incidence of Breast Cancer at Royal Prima Hospital Medan in 2024-2026

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Keywords:
Breast Cancer; Risk Factors; Age; Case-Control

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Abstract

Breast cancer remains a major public health concern worldwide. However, evidence regarding its associated risk factors among patients in individual hospital settings remains limited. This study aimed to examine the associations between demographic, reproductive, and lifestyle factors and breast cancer case status at Royal Prima Hospital in Medan, Indonesia, during 2024–2026. An analytical observational study with a case-control design was conducted among 90 participants, comprising 45 breast cancer cases and 45 hospital-based controls selected through consecutive sampling. Data on age, family history of breast cancer, age at menarche, age at first childbirth, body mass index (BMI), hormonal contraceptive use, physical activity, and dietary patterns were collected through questionnaires and medical records. Associations were examined using chi-square tests, and crude odds ratios (ORs) with 95% confidence intervals (CIs) were calculated. Age ≥45 years was significantly associated with breast cancer case status ($p = 0.002$; OR = 8.734; 95% CI: 1.840–41.459). No statistically significant associations were observed for family history ($p = 0.134$), age at menarche ($p = 0.525$), age at first childbirth ($p = 0.777$), BMI ($p = 0.090$), hormonal contraceptive use ($p = 0.822$), physical activity ($p = 1.000$), or dietary patterns ($p = 0.126$). Age ≥45 years was associated with higher odds of breast cancer case status in this hospital-based sample. These findings highlight the importance of considering age in local breast cancer screening and early-detection strategies. However, the nonsignificant findings for other factors should not be interpreted as evidence of no association. Given the single-center case-control design and the absence of adjustment for potential confounders, the results should be interpreted cautiously and cannot establish causality or estimate population-level breast cancer incidence.

INTRODUCTION

Cancer develops when genetic and molecular alterations disrupt the normal regulation of cell growth and division, resulting in uncontrolled cell proliferation, invasion of surrounding tissues, and, in some cases, metastasis to distant organs (Brown et al., 2023). These alterations may affect essential cellular processes, including cell cycle regulation, apoptosis, and DNA repair mechanisms (American Cancer Society, 2020). Breast cancer is among the leading contributors to the global cancer burden and is the most frequently diagnosed malignancy among women worldwide (Arnold et al., 2022). According to the World Health Organization,

approximately 2.3 million new breast cancer cases and 670,000 associated deaths have been reported globally (Freihat et al., 2025; World Health Organization, 2025).

The substantial global burden of breast cancer highlights its continuing importance as a public health concern (Arlandi, 2020). According to GLOBOCAN 2022 estimates, breast cancer accounted for approximately 66,271 new cases in Indonesia, representing a substantial proportion of cancers diagnosed among women. During the same year, Indonesia recorded an estimated 408,661 new cancer cases and 242,099 cancer-related deaths across all cancer types (International Agency for Research on Cancer, 2024; Osborne et al., 2025). These figures demonstrate the considerable burden of cancer in Indonesia and underscore the importance of strengthening breast cancer prevention, early detection, and clinical management strategies.

Breast cancer is associated with both nonmodifiable and modifiable risk factors. Nonmodifiable factors include increasing age, family history of breast cancer, inherited pathogenic variants in the BRCA1 and BRCA2 genes, early menarche, late menopause, and a personal history of breast cancer (García-Sancha et al., 2025; Nindrea et al., 2017). Potentially modifiable factors include obesity, alcohol consumption, physical inactivity, certain dietary patterns, and exposure to exogenous hormones, including some hormonal contraceptives (Bu et al., 2023; Łukasiewicz et al., 2021; Sholeha et al., 2025). The associations between these factors and breast cancer risk may vary according to individual characteristics and exposure patterns. Understanding these risk factors is essential for supporting risk assessment, prevention, and early detection, particularly in Indonesia, where delayed diagnosis has been associated with limited awareness, inadequate screening practices, and insufficient knowledge of breast cancer risk factors (Karsid & Kurniawati, 2020).

Preliminary observations and interviews with nurses at the Surgical Oncology Outpatient Clinic of Royal Prima Hospital in Medan indicated that breast cancer accounted for a substantial proportion of oncology visits, with approximately 70 patient visits reported daily. However, these figures reflected preliminary clinical observations rather than systematically verified hospital statistics or population-based incidence estimates. Nevertheless, the reported patient volume highlighted the clinical relevance of investigating breast cancer risk-factor patterns within this hospital setting. Comparing patients diagnosed with breast cancer with hospital-based controls could provide preliminary evidence of associations between selected demographic, reproductive, and lifestyle characteristics and breast cancer case status. Such findings could inform local clinical risk assessment, although their generalizability beyond the hospital population would remain limited.

Previous studies have investigated the associations of hereditary, reproductive, and lifestyle-related factors with breast cancer (Febrianti & Wahidin, 2022; Londero et al., 2024; Łukasiewicz et al., 2021; Nindrea et al., 2017). However, the distribution of these factors and the magnitude of their observed associations may vary across populations, health care settings, and sampling methods. Hospital-specific evidence comparing breast cancer cases with controls recruited from the same clinical setting remains limited in the context of Royal Prima Hospital in Medan. This study therefore sought to address this contextual evidence gap by examining eight demographic, reproductive, and lifestyle-related factors associated with breast cancer case status. Its contribution was to provide preliminary, unadjusted evidence from a hospital-

based case-control comparison rather than to establish causal relationships or estimate breast cancer incidence in the general population.

The objective of this study was to examine the associations between selected risk factors and breast cancer case status among patients at Royal Prima Hospital in Medan, Indonesia, during 2024–2026. Specifically, the study investigated eight factors: age, family history of breast cancer, age at menarche, age at first childbirth, body mass index (BMI), physical activity, hormonal contraceptive use, and dietary patterns. These factors were examined to identify characteristics associated with breast cancer case status within the study population and to provide evidence relevant to local risk assessment and early-detection planning.

Theoretically, this study was expected to contribute to the existing literature on breast cancer risk factors by providing additional evidence from an Indonesian hospital-based population. Practically, the findings could assist Royal Prima Hospital in identifying patient characteristics relevant to risk assessment, health education, and early-detection initiatives. For patients, improved awareness of breast cancer risk factors could support informed health decisions, timely clinical consultation, and participation in appropriate screening and follow-up services. Furthermore, the findings could provide a reference for future researchers investigating breast cancer risk factors using larger samples, different study designs, additional variables, and more representative populations.

METHOD

This analytical observational study employed a case-control design and was conducted at Royal Prima Hospital in Medan, Indonesia, from May to June 2026. The study used clinical data covering January 2024 through June 2026. The case group comprised patients diagnosed with breast cancer who attended the Surgical Oncology Outpatient Clinic, while the control group consisted of patients attending other outpatient clinics at the same hospital. Participants were recruited through consecutive sampling, yielding 90 participants, including 45 cases and 45 controls, at a 1:1 ratio. The sample size was calculated using a case-control sample size formula (Lemeshow, as cited in Djaiman, 2020), based on an expected exposure proportion of 51.3% among cases and a reference odds ratio of 3.509 (Prasetyowati & Katharina, 2017), with an additional allowance for potential nonresponse. Eligible participants were older than 30 years, had previously given birth, and provided informed consent. Patients with severe medical conditions that prevented participation were excluded.

Primary data were collected using a structured questionnaire covering age, family history of breast cancer, age at menarche, age at first childbirth, body mass index (BMI), hormonal contraceptive use, physical activity, and dietary patterns. Dietary information was obtained using a Food Frequency Questionnaire (FFQ) adapted from Nasyar (2020). Medical records were reviewed to obtain supporting clinical information and confirm breast cancer diagnoses. The same exposure variables and measurement categories were applied to both the case and control groups.

Data were summarized using frequencies and percentages. Associations between the eight independent variables and breast cancer case status were examined using chi-square tests, with statistical significance set at p <escape><</escape> 0.05. Crude odds ratios (ORs) and 95% confidence intervals (CIs) were calculated to estimate the strength and precision of the

observed associations. No multivariable adjustment for potential confounding factors was performed. Ethical approval was obtained from the Health Research Ethics Commission of Universitas Prima Indonesia (Approval No. 031/KEPK/UNPRI/III/2026), and informed consent was obtained from all participants.

RESULTS AND DISCUSSION

Respondent Characteristics

Of the 90 respondents, the majority had a high school education (46.7%) and worked as housewives (70.0%) (Table 1).

Table 1. Characteristics of respondents based on last education and occupation

Characteristics	Categories	Frequency (n)	Percentage (%)
Final education	SD	8	8,9
	Junior High School	8	8,9
	High School	42	46,7
	S1	21	23,3
	Others	11	12,2
Jobs	IRT (housewife)	63	70,0
	Retirees	9	10,0
	Merchant	2	2,2
	Others	16	17,8
Total		90	100

Source: Research primary data, 2026.

Univariate Analysis

The majority of respondents were classified as in the higher-exposure category for age (83.3%), physical activity (64.4%), and diet (63.3%), while the majority were not at risk in family history (85.6%), age of first childbirth (83.3%), and use of hormonal contraceptives (67.8%) (Table 2). The median diet score used as a category limit was 5.

Table 2. Distribution of respondents by risk factor category

Variable	Categories	Frequency (n)	Percentage (%)
Age	At Risk (≥45 yrs)	75	83,3
	No risk (<45 yrs)	15	16,7
Family history	Risky (exists)	13	14,4
	No risk (none)	77	85,6
Age menarche	Risky (≤12 yrs)	41	45,6
	No risk (>12 yrs)	49	54,4
Age of first child	Risky (≥30 yrs)	15	16,7
	No risk (<30 yrs)	75	83,3
Obesity	At Risk (BMI ≥25)	40	44,4
	No risk (BMI <25)	50	55,6
Hormonal contraceptives	Risky (≥5 years)	29	32,2
	No risk (<5 yrs)	61	67,8
Physical activity	Risky (<4 hours/week)	58	64,4
	No risk (≥4 hours/week)	32	35,6

Variable	Categories	Frequency (n)	Percentage (%)
Diet	Risky (≥ median)	57	63,3
	No risk (< median)	33	36,7

Source: Research primary data, 2026.

Bivariate Analysis

Of the eight variables tested, only age was significantly associated with breast cancer case status (p = 0.002; OR = 8.734; 95% CI 1.840–41.459). The proportion of respondents aged ≥45 years in the case group was significantly greater than in the control group (95.6% versus 71.1%). The other seven variables showed no significant association (p > 0.05) (Table 3).

Table 3. Results of bivariate analysis of risk factors with breast cancer case status

Variable	Case n (%)	Control n (%)	OR (95% CI)	p-value
Age ≥45 years old	43 (95,6)	32 (71,1)	8,734 (1,840–41,459)	0,002*
Family history (available)	9 (20,0)	4 (8,9)	2,563 (0,727–9,034)	0,134
Menarche ≤12 years old	19 (42,2)	22 (48,9)	0,764 (0,333–1,755)	0,525
Giving birth to the first child ≥30 years old	8 (17,8)	7 (15,6)	1,174 (0,387–3,564)	0,777
Obesity (BMI ≥25)	16 (35,6)	24 (53,3)	0,483 (0,207–1,125)	0,090
Hormonal contraceptives ≥5 years	15 (33,3)	14 (31,1)	1,107 (0,457–2,681)	0,822
Physical activity <4 hours/week	29 (64,4)	29 (64,4)	1,000 (0,422–2,371)	1,000
Median ≥ diet	32 (71,1)	25 (55,6)	1,969 (0,823–4,712)	0,126

*Significant at α = 0.05.

Source: Research primary data, 2026.

Discussion

Age

Age is the only variable that is significantly associated with breast cancer case status. The accumulation of genetic and molecular changes with aging can increase the likelihood of cell transformation into malignant cells (McLennan et al., 2024), while changes in the microenvironment of breast tissue can also support abnormal cell development (Jiang et al., 2022). However, because breast cancer is multifactorial, age should be viewed as one of the related factors, rather than a single explainer.

Family History

Family history was not significantly associated (p = 0.134; OR = 2.563; 95% CI 0.727–9.034). This lack of association can be attributed to the relatively small number of respondents with a family history (13 out of 90 respondents) as well as the absence of family history classification based on degree of kinship and number of members diagnosed. An OR value greater than 1 still indicates a higher unadjusted odds estimate, so family history remains relevant in genetic screening and counseling.

Age Menarche

Menarche age was not significantly associated (*p* = 0.525; OR = 0.764; 95% CI 0.333–1.755). Differences in age category boundaries between studies as well as the retrospective

nature of the data and relying on respondents' memories may undermine the statistical power to detect actual associations.

Age of First Child

No meaningful association was found (p = 0.777; OR = 1.174; 95% CI 0.387–3.564). Length of exposure to estrogen during reproductive life may affect breast cell proliferation (Mao et al., 2023). These results are likely influenced by a very small number of respondents who gave birth to their first child at ≥30 years of age (8 cases and 7 controls). Parity and duration of breastfeeding have also not been analyzed so they need to be considered in subsequent studies.

Body Mass Index

BMI was not significantly associated (p = 0.090; OR = 0.483; 95% CI 0.207–1.125). The direction of this association is contrary to the expected direction and with the meta-analysis of Tzenios et al. (2024). Obesity can affect risk through adipose tissue, estrogen metabolism, and inflammation, especially in postmenopausal women (Tzenios et al., 2024). This difference is likely due to BMI measurements that were only performed once without tracking the history of weight changes, and the respondents' menopausal status had not been analyzed.

Hormonal Contraceptives

The use of hormonal contraceptives for ≥5 years was not significantly associated (p = 0.822; OR = 1.107; 95% CI 0.457–2.681). The almost equal proportion of use in the case (33.3%) and control (31.1%) was one of the reasons for the lack of differences. The risk of hormonal contraception is complex and is influenced by the duration, type, and age of first use (Angela et al., 2023), so the history of use still needs to be recorded and asked about in the anamnesis.

Physical Activity

Physical activity was not significantly associated (p = 1.000; OR = 1.000; 95% CI 0.422–2.371), with identical risk proportions in both groups (64.4%). Biologically, physical activity may be related to breast cancer risk through weight regulation, hormone metabolism, and inflammation. The instrument used in this study is self-reported and only assesses the total duration per week without distinguishing between intensity and type of activity. This limitation may explain why the biologically expected association was not detected.

Diet

Diet was not significantly associated (p = 0.126; OR = 1.969; 95% CI 0.823–4.712), although the proportion of risk scores was higher in the case group (71.1% versus 55.6%). The categorization of FFQ scores by median likely does not yet reflect the variation in the type and amount of food consumed overall. An OR value close to 2 cannot yet be interpreted as evidence of risk, but healthy eating education remains relevant as part of primary prevention.

Implications

Overall, the results of the study answered the research objective: of the eight risk factors studied, only age was significantly associated with breast cancer case status in this sample. These findings do not negate the role of other factors in the etiology of breast cancer, given that a limited number of samples (90 respondents) may not be sufficient to detect a relatively small association. In practical terms, these results support the strengthening of early detection programs, such as clinical breast examinations or periodic mammography, for women aged

≥45 years, as well as a systematic history of risk factors in patients at Royal Prima Medan Hospital.

Research Limitations

Data on menarche age, first childbirth age, hormonal contraception, physical activity, and diet came from questionnaires that relied on respondents' memories, potentially causing recall bias. The case-control design was also susceptible to recall bias and selection bias and did not allow for the drawing of causal conclusions. Control selection from other polyclinics in the same hospital had the potential to cause selection bias. This study involved 90 respondents from one health facility so the generalization of results was limited, and multivariate analysis had not been conducted to control for confounding factors. The short data collection time (May–June 2026) also made case recruitment use retrospective data from January 2024.

Further Research Recommendations

Further research is suggested to involve a larger sample of more than one healthcare facility as well as to use multivariate analysis, such as logistic regression, to simultaneously control for confounding factors. Retrospective variables such as menarche age and first childbirth age should be verified with supporting documents, such as obstetric medical records. Physical activity and diet instruments can be refined with internationally standardized and validated questionnaires, taking into account the intensity and type of activity. Additional variables such as parity, duration of breastfeeding, menopausal status, alcohol consumption, and previous breast examination history also need to be explored.

CONCLUSION

Among the 90 hospital-based participants included in this study during the 2024–2026 period, age was the only factor significantly associated with breast cancer case status. Participants aged 45 years or older had significantly higher crude odds of belonging to the breast cancer case group than those younger than 45 years (OR = 8.734; 95% CI: 1.840–41.459; p = 0.002). No statistically significant associations were observed between breast cancer case status and family history of breast cancer, age at menarche, age at first childbirth, body mass index (BMI), hormonal contraceptive use, physical activity, or dietary patterns. However, these findings did not establish causal relationships, and the absence of statistical significance for the other factors did not rule out potentially meaningful associations, particularly given the limited sample size and lack of adjustment for confounding variables.

Based on these findings, Royal Prima Hospital in Medan should strengthen breast cancer awareness, risk assessment, and early-detection initiatives, particularly among women aged 45 years or older, while continuing to consider other established risk factors. Community education should emphasize breast health awareness, timely medical consultation for suspicious breast changes, participation in age- and risk-appropriate screening, and healthy lifestyle practices. Future research should involve larger and more representative samples across multiple health care facilities, incorporate standardized exposure measurements, and apply multivariable logistic regression to account for potential confounding factors. Longer-term and prospective investigations may also provide stronger evidence regarding the relationships between demographic, reproductive, and lifestyle factors and breast cancer risk.

FUNDING

This research does not receive special funding from government, private, or other organizations.

CONFLICT OF INTEREST

The authors state that there is no conflict of interest in the research, writing, or publication of this article.

AUTHOR'S CONTRIBUTION

All authors contributed to the preparation of this article. Author 1 (Mustika Rani Lubis) played a role in the conceptualization of the research, data collection and analysis, interpretation of results, and preparation of the manuscript, while the other authors contributed to the review, editing, and final approval of the manuscript.

GENERATIVE ARTIFICIAL INTELLIGENCE USAGE STATEMENT

The author states that no generative artificial intelligence was used in the preparation of this article.

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