



ANALYSIS OF RISK FACTORS FOR CERVICAL CANCER OCCURRENCE: A CASE-CONTROL STUDY AT BANGKA BELITUNG

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ABSTRACT

Cervical cancer ranks as the second most common malignancy among women in Indonesia, following breast cancer, and is the second leading cause of cancer-related mortality. Over 70% of cervical cancer cases are diagnosed at an advanced stage, often due to delayed detection and treatment, which significantly affects therapeutic outcomes and increases mortality rates. This study employed an observational analytic approach with a case-control design to examine the association between age at first marriage, parity, smoking habits, hormonal contraceptive use, and family history with cervical cancer incidence. A total of 116 respondents were selected and evenly divided into case and control groups (1:1 ratio). Data were collected from medical records at Dr. (H.C) Ir. Soekarno Regional General Hospital, Bangka Belitung Islands Province, in 2024. The data analysis was conducted using chi-square statistical test and multivariate logistic regression. The findings revealed that age at marriage, parity, and hormonal contraceptive use were significantly associated with cervical cancer incidence ($p < 0.05$). Conversely, no significant associations were observed for smoking and family history ($p > 0.05$). Hormonal contraceptive use and parity emerged as key determinants. These results underscore the need to reinforce cervical cancer prevention programs through targeted education on the long-term risks of hormonal contraceptive use and by enhancing routine screening coverage at the primary healthcare level.

Keywords: cervical cancer, age at marriage, hormonal contraception, parity

INTRODUCTION

The Global Cancer Observatory reported that there were 662,301 new cases and 348,874 deaths in 2022, and cervical cancer ranked as the fourth most common malignancy among women (Ferlay et al., 2022). According to WHO data, low- and middle-income countries account for approximately 94% of deaths due to cervical cancer (Cancer, 2023; World Health Organization (WHO), 2021).

According to the 2023 Indonesia Health Profile data, as many as 3,114,505 women aged between 30 and 50 years, or 14.6% of the target population, underwent early cervical cancer screening during 2021–2023, which helped reduce the morbidity and mortality rates associated with the disease (Global Cancer Observatory, 2022; World Health Organization (WHO), 2021). The highest early detection rate reached 52.1% in West Nusa Tenggara Province, followed by 32.4%

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in the Special Capital Region of Jakarta and 28.7% in the Bangka Belitung Islands Province (Ferlay et al., 2022; Global Cancer Observatory, 2022).

Human Papillomavirus (HPV) infection is the main cause contributing to nearly 99.7% of cervical cancer cases (Cancer, 2023; Filipić et al., 2024). Human Papillomavirus (HPV) types 16 and 18 are types that can infect cervical cells and have the potential to develop into cancer if left untreated (Katiyar, Jahan, and Uddin, 2024; Klyukina and Sosnova, 2023). Although HPV infection is common among sexually active women, not all of these infections progress to cervical cancer (Mkrtchian et al., 2024). Several risk factors, including both genetic and environmental factors, may influence the development of cervical cancer (Fahriani et al., 2023; Lismaniar et al., 2021). In this regard, factors such as parity, age at marriage, use of hormonal contraceptives, smoking habits, and hereditary factors play a role in increasing the risk of cervical cancer (Fahriani et al., 2023; Yuliandari, 2024; Kamal, 2022; Yuliani et al., 2021).

This study differs from previous studies by focusing on more specific risk factors, such as age at marriage and parity, which have not been widely explored in the Bangka Belitung Islands region. In addition, previous studies, such as that conducted by Fahriani et al. (2023), emphasized the use of hormonal contraceptives as the dominant risk factor; however, this study expands the analysis by comparing the relationships among these factors within a more in-depth local context. The study by Irawati Yuliandari (2024) also included hereditary factors as a variable, but did not provide a comprehensive analysis of the interaction between risk factors such as smoking and parity, which is the main emphasis of this study.

New cases of cervical cancer in the Bangka Belitung Islands Province have continued to increase. Based on data from a preliminary study conducted at the local health office, 13 new cases were recorded in 2021. This number increased to 17 cases in 2022 and continued to rise to 28 cases in 2023. A total of 311 cancer patients were recorded from January to December 2024. Breast cancer predominated with 111 patients (35.7%), followed by cervical cancer with 58 patients (18.6%) and lung cancer with 40 patients (12.7%) (Nurtito, 2023; Munira, 2023). These data indicate that cervical cancer was the second most common type of cancer at Dr. (H.C.) Ir. Soekarno Hospital, as well as the highest number of cases in the gynecological cancer category. Delays in identification and treatment are the main reasons for the high mortality rate due to cervical cancer; approximately 95% of patients were diagnosed at stage II.b to advanced stages. This increasing trend indicates the importance of cervical cancer prevention in the region through identifying the causes and risk factors of cervical cancer.

The objective of this study was to analyze the risk factors associated with the incidence of cervical cancer at Dr. (H.C.) Ir. Soekarno Regional General Hospital, Bangka Belitung Islands Province. This study aimed to identify the distribution of risk factors such as age at marriage, parity, smoking habits, use of hormonal contraceptives, and family history among cervical cancer patients, analyze the relationship between these risk factors and the incidence of cervical cancer, and determine the dominant risk factor influencing the incidence of cervical cancer in the region.

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METHODS

This study was an observational analytic study with a case-control design approach aimed at analyzing the relationship between age at marriage, parity, smoking habits, use of hormonal contraceptives, and family history (hereditary factors) with the incidence of cervical cancer by comparing two groups, namely the case group and the control group. This study was conducted at Dr. (H.C.) Ir. Soekarno Regional General Hospital, Bangka Belitung Islands Province, on May 01–13, 2025, after obtaining ethical clearance approval from the Health Research Ethics Committee with number: No. KEPK.BKL/349/05/2025.

The population in this study consisted of all patients recorded at the obstetrics and gynecology outpatient clinic during the period from January to December 2024, with a total of 397 patients. Sample selection began with the case group, namely all patients diagnosed with cervical cancer during that period. A total of 58 patients diagnosed with cervical cancer were selected as the case group using the total sampling technique. After that, for the control group, 58 patients without a diagnosis of cervical cancer were selected using the simple random sampling technique. This selection process was carried out using the RAND and RANK functions in Microsoft Excel to ensure random sample representation. Thus, the total sample in this study was 116 patients, which were equally divided into the case group and the control group. The data collection instrument in this study was patient medical record documents, which were then compiled in the form of tables for analysis purposes. The information collected included patient age, occupation, educational background, and name initials. In addition, information regarding factors related to the incidence of cervical cancer, such as age at marriage, number of children (parity), smoking history, use of hormonal contraceptives, and family history (hereditary factors), was also obtained from medical record data. The analytical tests used in this study were the chi-square test for bivariate analysis and multivariate logistic regression to analyze the dominant risk factors.

RESULTS AND DISCUSSION

1. Univariate Analysis

Table 1. Frequency Distribution of Respondents' Characteristics

Respondent Characteristics	Cases (Cervical Cancer)		Control (Non-Cervical Cancer Cases)	
	(n = 58)	(%)	(n = 58)	(%)
Age				
1. ≥ 35 Years	57	98.3	52	89.7
2. < 35 Years	1	1.7	6	10.3
Education				
1. Low	42	72.4	27	46.6
2. Secondary	13	22.4	17	29.3
3. Higher	3	5.2	14	24.1
Occupation				
1. Housewife	52	89.6	42	72.4
2. Self-Employed	3	5.2	5	8.6
3. Civil Servant	3	5.2	11	19

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Age at Marriage				
1. < 20 Years	34	58.6	15	25.9
2. ≥ 20 Years	24	41.4	43	74.1
Parity				
1. > 3	36	62.1	19	47.4
2. ≤ 3	22	37.9	39	52.6
Smoking Status				
1. Smoker	8	13.8	4	6.9
2. Non-Smoker	50	86.2	54	93.1
Use of Hormonal Contraceptives				
1. Using Hormonal Contraceptives	50	86.2	27	46.6
2. Not Using Hormonal Contraceptives	8	13.8	31	53.4
Family History				
1. Present	15	25.9	9	15.5
2. Absent	43	74.1	49	84.5
TOTAL	58	100.0	58	100.0

Based on Table 1, the majority of respondents were aged over 35 years, accounting for 98.3% of the case group and 89.7% of the control group. Most respondents had a low level of education, representing 72.4% of the case group and 46.6% of the control group. The majority were housewives, comprising 89.6% of the case group and 72.4% of the control group. Regarding age at marriage, 58.6% of respondents in the case group were married before the age of 20 years, whereas 74.1% of respondents in the control group were married at the age of 20 years or older. In terms of parity, 62.1% of women with cervical cancer had more than three children, while the majority of respondents in the control group had a parity of three or fewer children. Most respondents were non-smokers, accounting for 86.2% of the case group and 93.1% of the control group. The use of hormonal contraceptives was more prevalent among women in the case group (86.2%), whereas 53.4% of women in the control group did not use hormonal contraceptives. Furthermore, the majority of respondents reported no family history of cervical cancer, comprising 74.1% of the case group and 84.5% of the control group.

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2. Bivariate Analysis

Table 2. Association between Age at Marriage, Parity, Smoking, Use of Hormonal Contraceptives, and Family History with the Incidence of Cervical Cancer

Risk Factors	Cases (CC)		Controls (Non-CC)		Total		p-value	OR
	(n)	(%)	(n)	(%)	(n)	(%)		
Age at Marriage								
1. < 20 Years	34	58.6	15	25.9	49	42.2	0.001*	4.061
2. ≥ 20 Years	24	41.4	43	74.1	67	57.8		
Parity								
1. > 3	36	62.1	19	47.4	55	47.4	0.003*	3.359
2. ≤ 3	22	37.9	39	52.6	61	52.6		
Smoking Status								
1. Smoker	8	13.8	4	6.9	12	10.3	0.360	2.160
2. Non-Smoker	50	86.2	54	93.1	104	89.7		
Use of Hormonal Contraceptives								
1. Using Hormonal Contraceptives	50	86.2	27	46.6	77	66.4	0.000*	7.176
	8	13.8	31	53.4	39	33.6		
2. Not Using Hormonal Contraceptives								
Family History								
1. Present	15	25.9	9	15.5	24	20,7	0,252	1,899
2. Absent	43	74.1	49	84.5	92	79,3		

Note: Results of the Chi-square test; CI = 95%; parity = number of children; CC = cervical cancer; * = statistically significant.

Based on Table 2, the p-value for age at marriage was 0.001 (< 0.05), parity was p = 0.003, and hormonal contraceptive use was p = 0.000. These three risk factors showed significant differences between the two groups. The odds ratio (OR) values were 4.061, 3.359, and 7.176, respectively, with a 95% confidence interval (CI), indicating that marriage at the age of < 20 years, high parity or having > 3 children, and the use of hormonal contraceptives increased the risk of cervical cancer.

3. Multivariate Analysis

Table 3. Dominant Risk Factors for the Incidence of Cervical Cancer

		B	S.E.	Wald	df	Sig.	Exp (B)
Step 1^a	Age at Marriage	0.704	0.484	2.119	1	0.145	2.022
	Parity	1.070	0.491	4.751	1	0.029*	2.915
	Using Hormonal Contraceptives	1.982	0.504	15.473	1	0.000*	7.255
	Constant	-5.348	1.125	22.589	1	0.000	0.005

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Step 2^a	Parity	1.380	0.442	9.721	1	0.002*	3.973
	Using Hormonal Contraceptives	2.103	0.495	18.037	1	0.000*	8.189
	Constant	-4.871	1.052	21.458	1	0.000	0,008

*Note: Results of the multiple logistic regression analysis; * : statistically significant.*

In Table 3, multivariate modeling using logistic regression in Step 1 showed that age at marriage had a non-significant p-value of 0.145 (p-value > 0.05); therefore, it was excluded from the model. In Step 2, parity and the use of hormonal contraceptives had p-values of < 0.05, indicating that both variables had a significant effect on the incidence of cervical cancer and were included in the final multivariate model. The multivariate analysis showed that these two variables had a strong influence on the incidence of cervical cancer because their p-values were significant (p-value < 0.05). Based on the study findings, the use of hormonal contraceptives had the highest Exp(B) value (8.189), indicating that the risk of cervical cancer was eight times higher among women who used hormonal contraceptives compared with those who did not.

Age at marriage has a significant influence on the risk of cervical cancer. Santoso (2021) showed that marriage before the age of 20 years is associated with an increased risk of cervical cancer. The study found a strong correlation between age at first marriage and the incidence of cervical cancer. Women who marry at a young age are more susceptible to Human Papillomavirus (HPV) infection, which is the main risk factor for cervical cancer, due to the immaturity of cervical cells (Santoso, 2021). A study by Filipić et al. (2024) showed that HPV infection acquired during youth can persist for a long time and potentially progress to cervical cancer, especially if the infection is not treated early (Filipić et al., 2024). The findings of this study support the understanding that marriage at a young age, when cervical cells are still developing, may increase susceptibility to cellular changes that can potentially become cancerous (Istiqomah, 2020; Katiyar, Jahan, and Uddin, 2024; Natelaury, 2023). In addition, sexual intercourse at an early age may also lead to exposure to risk factors such as HPV infection, which contributes to the development of cervical cancer (Mekonnen & Mittiku, 2023).

Furthermore, women with parity ≤ 3 had a lower likelihood of developing cervical cancer compared with women with parity > 3. According to this study, women who have more children are exposed to progesterone and estrogen hormones for a longer period, which may increase their risk of developing cervical cancer (Katiyar, Jahan, and Uddin, 2024; Klyukina, Sosnova, 2023). Long-term hormonal exposure during pregnancy may alter the cervical environment, increase the likelihood of HPV infection, and accelerate the development of cervical cancer (Na et al., 2023; Olofinbiyi et al., 2024). Lismaniar (2021) found a strong correlation between parity and the incidence of cervical cancer. Statistically, women who had more than three children were 11.5 times more likely to develop cervical cancer than women who had three children or fewer (Lismaniar et al., 2021). In addition, similar studies have shown that high parity may increase mechanical damage to the cervix due to childbirth, which also contributes to an

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increased risk of HPV infection and precancerous lesions (Tekalegn et al., 2022; Teklehaimanot et al., 2024).

Active smoking is commonly associated with unhealthy behavior and may be perceived as violating the moral values of Eastern culture (K. Kesehatan & Indonesia, 2024; Tsiman et al., 2024). In this study, smoking did not show a significant association with the incidence of cervical cancer. This finding is in line with the study by Lismaniar et al. (2021), which found that smoking was not statistically proven to be a major risk factor for cervical cancer (Lismaniar et al., 2021; Purnami and Suarmini, 2022). Although this finding contradicts existing theories, it may be explained by several factors, including the possibility of information bias due to the Hawthorne effect. Respondents may not have reported their smoking habits honestly because they felt embarrassed or were afraid of violating local cultural and religious norms, particularly in communities that uphold conservative social values (Pranita et al., 2021; Subnum et al., 2024).

Active smoking is known to damage the immune system, worsen HPV infection (Patel et al., 2018), and impair the body's ability to overcome such infection (Sriram et al., 2024; Subnum et al., 2024). Reduced immune response due to smoking may increase the duration and severity of HPV infection, thereby contributing to the development of cervical cancer (Olofinbiyi et al., 2024; Pranita et al., 2021). Nevertheless, passive smoking was not assessed in this study, although it may play an important role in increasing the risk of cervical cancer among exposed groups.

Furthermore, the use of hormonal contraceptives was statistically identified as the most dominant factor contributing to the occurrence of cervical cancer among women. The use of hormonal contraceptives is associated with an increased risk of cervical cancer (Ramachandran, 2017; Rohayati et al., 2023). Contraceptives containing estrogen and progesterone may affect cervical cells and increase their susceptibility to HPV infection, which is the main cause of cervical cancer (Tekalegn et al., 2022). A study by Shital Yadav (2024) showed that long-term use of hormonal contraceptives increases the risk of cervical cancer in women due to hormonal changes that affect cellular function and immune responses to HPV (Satanova et al., 2023; Yadav and Ahmad, 2024). Hormonal contraceptives may also reduce the effectiveness of the immune system in controlling infection, allowing HPV infection to persist longer and increasing the risk of cervical cancer (Mkrtchian et al., 2024; Natelaury, 2023).

Olofinbiyi et al. (2024) suggested that long-term use may worsen the effects of HPV infection, contributing to the progression of cervical cells into cancerous cells (Olofinbiyi et al., 2024). Similar studies have found a significant association between hormonal contraceptive use and the incidence of cervical cancer, with a 7.131-fold higher risk among users compared with non-users, possibly due to hormonal effects that increase cell proliferation and the risk of precancerous lesions (Ramachandran, 2017; Rohayati et al., 2023; Yuliasuti and Nudhira, 2021). Artificial estrogen stimulation contained in hormonal contraceptives may influence changes in cervical cells and increase their susceptibility to infection and cellular alterations that may progress to cancer (Novalia, 2023). A study by Lidiya showed that the use of hormonal contraceptives



may stimulate the growth of cervical cells, which can aggravate cellular changes caused by HPV infection (Klyukina, Sosnova, 2023; Lismaniar et al., 2021).

One of the risk factors for cervical cancer is family history. According to Yuliastuti, there is a strong correlation between the prevalence of this malignancy and genetic factors. Individuals with a family history of cervical cancer have a higher risk than those without such a history (Armenda, 2023; Yuliastuti and Nudhira, 2021). Genetic factors are thought to increase susceptibility to Human Papillomavirus (HPV) infection and influence the body's immune response to abnormal cells (Tekalegn et al., 2022). The inconsistency between the findings of this study and existing theories indicates the possibility that other risk factors may also contribute to the development of cervical precancerous lesions. This difference may be due to variations in sample characteristics, including genetic composition, environmental exposure, and sexual behavior, which were not analyzed in depth in this study.

Although cervical cancer is closely associated with HPV infection, it is also influenced by genetic factors (Magiera et al., 2024; Natelaury, 2023). Women with a family history of cervical cancer may have a genetic predisposition that affects how their bodies respond to HPV infection. Similar studies have reported that genetic factors may influence the body's ability to overcome HPV infection, thereby increasing the risk of cervical cancer development (American Cancer Society, 2020; Ramachandran, 2017). Nevertheless, in this study, hereditary factors did not contribute significantly to the incidence of cervical cancer, possibly due to the lack of more detailed data regarding the specific genetic factors involved.

It is important to consider several limitations of this study. First, the data available in the medical records only included age at marriage, without information on age at first sexual intercourse. In fact, age at first sexual intercourse is an important risk factor that may influence the incidence of cervical cancer, as early exposure to Human Papillomavirus (HPV) may increase the risk of developing precancerous lesions in the cervix. Second, regarding smoking habits, the available data only included active smokers, without an assessment of passive smoking exposure. Passive smoking may also increase susceptibility to cervical cancer, as exposure to cigarette smoke contains carcinogenic substances that can affect the immune system and increase the likelihood of HPV infection. Therefore, primary data collection using an in-depth interview approach is recommended for future studies.

CONCLUSION AND RECOMMENDATIONS

It can be concluded that risk factors including age at marriage, parity, and the use of hormonal contraceptives had a significant association ($p < 0.05$) with the incidence of cervical cancer. Meanwhile, smoking and family history did not show a significant association ($p > 0.05$). Hormonal contraceptive use and parity were identified as the main determinants of cervical cancer incidence. The implication of these findings for health policy is the need for greater focus on women who use hormonal contraceptives and those with high parity. More intensive screening programs and health education emphasizing the risks of hormonal contraceptive use should be prioritized, particularly among women with more than three children. These health education programs should also educate the public about the importance of routine cervical cancer screening and HPV

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vaccination, which may reduce the risk of HPV infection and the development of cervical cancer.

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