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Short Communication

Factors associated with the incidence of young-onset colorectal cancer: A cross-sectional study

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Abstract

The factors associated with the incidence of young-onset colorectal cancer (YO-CRC) remain uncertain and are continuously being studied. The aim of this study was to investigate the factors associated with the incidence of young-onset colorectal cancer. This cross-sectional study examined multiple factors (demographic status, medical comorbidities, smoking, alcohol intake, nighttime sleep duration, family history of cancer, sedentary behavior, daily consumption of fried foods, fast food, and processed meat) among 171 patients from two cancer referral hospitals in Jakarta, Indonesia. Logistic regression analysis revealed that the low-income group had a higher risk of YO-CRC compared to high-income group (p=0.004). Those with comorbid diseases such as inflammatory bowel disease, diabetes, or high cholesterol were more likely to develop YO-CRC compared to those without these conditions (p=0.002). Frequent consumption of processed meat (vs seldom) (p=0.003) and fried food (vs no consumption) (p=0.001) were associated with higher risk. Those with high sedentary behavior (vs low) (p=0.021) also had higher risk of YO-CRC. Notably, nighttime sleep emerged as the strongest predictor (odds ratio (OR): 10.462). These findings underscore the need for targeted public health interventions promoting adequate sleep, healthy diets, and active lifestyles, particularly among Indonesian youth and low-income groups. Further studies are recommended to investigate these associations in larger and more diverse populations across Indonesia.

Keywords: Young-onset colorectal cancer, nighttime sleep, processed meat, fried food, sedentary behavior

Introduction

Colorectal cancer (CRC) remains a major challenge within the global oncology landscape. In 2020, CRC accounted for approximately 1.9 million new cases and an estimated 900,000 deaths worldwide, making it one of the most frequently diagnosed malignancies [1]. It is the second leading cause of cancer-related mortality [2], with the highest incidence rates reported in North America, Australia, Europe, and South Korea [1].

In recent years, CRC has become increasingly prevalent among young adults [3]. This emerging trend has led to the introduction of the terms “early-onset” or “young-onset” CRC into the nursing and medical literature. Although definitions of young-onset CRC (YO-CRC) vary across studies [4], there is growing consensus within the gastroenterology and oncology communities that the term applies to cases diagnosed before the recommended age for routine

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screening [4]. Over the past decade, individuals diagnosed with CRC before the age of 50 have been collectively classified as the YO-CRC patient population [5].

The rising global incidence of sporadic CRC among individuals under 50 years of age has drawn increasing attention to the phenomenon of YO-CRC [5]. Although the underlying causes of this trend remain unclear [6], it is likely driven by a combination of environmental, lifestyle, and genetic factors [7]. Numerous studies conducted across diverse geographic regions have investigated the determinants of YO-CRC, highlighting the multifactorial nature of its increasing prevalence [4,8,9].

In Indonesia, research exploring the association between youth lifestyle factors and the rising incidence of YO-CRC remains limited and underreported. Existing studies on youth dietary habits have highlighted frequent consumption of high-salt foods—such as salted fish, *pindang* fish, salted eggs, salty snacks, and foods containing shrimp paste, soy sauce, or chili sauce—as well as a high intake of fatty foods, including those rich in margarine [10,11]. Additionally, low levels of physical activity, with most individuals engaging in less than 30 minutes of exercise per day, have also been documented [10]. In addition, it is hypothesized that several lifestyle-related factors among young individuals in Indonesia—such as sedentary behavior, use of electronic cigarettes (vaping), frequent consumption of fried foods, inadequate nighttime sleep, and high intake of fast foods, including instant noodles—may be associated with the development of YO-CRC.

Despite increasing international attention to YO-CRC, the literature remains sparse regarding lifestyle-related risk factors in Southeast Asian populations, particularly in Indonesia. While studies have explored general dietary habits and physical inactivity, few have directly investigated their association with YO-CRC incidence among young adults. This lack of localized, evidence-based data creates a critical gap in understanding region-specific risk profiles. The present study seeks to address this gap by examining a range of lifestyle and behavioral factors within the Indonesian context. Therefore, the aim of this study was to assess the association between these lifestyle factors and the incidence of YO-CRC, and to determine the most dominant factor contributing to its occurrence.

Methods

Study design, setting and sampling strategy

A cross-sectional study was conducted at Persahabatan General Hospital and the Dharmais Cancer Hospital, Jakarta, Indonesia, in 2024. Participants were all CRC patients who had been histologically diagnosed, both those who were still undergoing outpatient treatment and survivors that have completed the treatment. This study used a consecutive sampling method. To determine the sample size, the rule of thumb approach was applied by calculating the number of independent variables studied. This method yielded a minimum sample size of 144 participants, which was then adjusted to 171 participants to account for potential drop-out.

Participants and eligibility criteria

Participants were confirmed cases of CRC, including both those undergoing outpatient treatment and survivors, who met the inclusion and exclusion criteria. The inclusion criteria were: (1) patients diagnosed with CRC; (2) aged over 18 years old; and (3) willingness to participate in the study. The exclusion criteria were: (1) patients with an inability to communicate effectively and (2) patients with secondary CRC, defined as cancer that had metastasized to the colon or rectum from a primary tumor located in another organ.

Data collection and measurement

All data were collected through direct interviews and self-administered questionnaire. YO-CRC was defined as a confirmed diagnosis of colorectal cancer before the age of 50 years. Participants were categorized into two groups: YO-CRC (diagnosed before the age of 50) and non-YO-CRC (diagnosed at age 50 or older). This variable was measured by directly asking participants the year of their colorectal cancer diagnosis and their year of birth, from which the age at diagnosis was calculated.

Several plausible risk factors were assessed in this study. The participants' demographic characteristics included sex, occupation, and income. Occupation was determined using a questionnaire and categorized as employed or unemployed. Income was self-reported as monthly earnings and classified into two groups: low income and high income. Income less than or equal to IDR 5,067,381 was classified as the low-income group.

Additionally, comorbid disease status, smoking, and alcohol intake were investigated. Comorbid disease status was determined by reviewing medical records to identify conditions such as inflammatory bowel disease, diabetes, or high cholesterol. Smoking status was assessed by asking participants whether they currently smoked or not. For smokers, additional information was collected on the number of cigarettes smoked per day and the type (stick or e-cigarette). Alcohol intake measurement was carried out by asking participants whether they consumed alcohol, with responses recorded as yes or no.

Dietary patterns and sedentary behavior were also deemed to be potential factors contributing to YO-CRC. Dietary patterns over one week were assessed using the Food Frequency Questionnaire (FFQ) [12], and sedentary behavior was measured using the Sedentary Behavior Questionnaire (SBQ) [13]. The FFQ used a closed-ended format, meaning only the foods listed in the questionnaire were asked of the respondents. This instrument covered types of foods such as processed meats, fried foods, and fast foods. The measurement results were scored as 0 or 1, with 1 indicating frequent consumption of processed meat, fried food, and fast food [12]. The SBQ was used to measure activities from waking up in the morning until bedtime. The questionnaire consisted of 9 items, divided into two parts: weekdays and weekends, resulting in a total of 18 questions. The data obtained were converted into hours. To calculate the total sedentary behavior score for each category, the total time in hours was computed separately for weekdays and weekends. To estimate the weekly average, the weekday total was multiplied by 5 and the weekend total by 2. These were then summed and divided by 7. The results were then categorized as low sedentary behavior (≤5 hours/day) or high sedentary behavior (>5 hours/day) [13].

Moreover, family history of cancer was also evaluated among participants. Family history of cancer was measured by asking participants whether any family members had a history of cancer. If the answer was yes, participants were asked to specify the kinship relationship and the type of cancer. Responses were recorded as either “history” or “no history”. Lastly, nighttime sleep hours of patients were presumed as important factors in the incidence of YO-CRC. This variable was measured by calculating the average time from bedtime to waking up in the morning each day. A normal sleep pattern was defined as going to bed at or before 10:00 PM with a duration of seven hours per night. If the sleep was started above 10:00 PM, it will be categorized as abnormal.

Study variables

The independent variables in this study were sex, occupation, income, comorbidities, processed meat, body mass index (BMI), smoking, alcohol intake, sedentary behavior, fried foods, fast food, hours of sleep, and family history of cancer. The dependent variable was the occurrence of YO-CRC.

Statistical analysis

Univariate and multivariate analyses were performed to address the study objectives. Univariate analysis was conducted using the Chi-squared test or Fisher’s exact test, as appropriate, to assess the association between each independent variable and the dependent variable. Variables with a $p<0.25$ were subsequently included in the multivariate analysis, which was performed using logistic regression [14]. The enter method was applied in the regression model. All statistical analyses were conducted using SPSS for Windows, version 25.0 (IBM Corp., Armonk, NY, USA).

Results

Patients’ selection

A total of 192 patients with CRC were identified during the data collection period from Persahabatan General Hospital and Dharmais Cancer Hospital. Of these, 171 patients met the

inclusion criteria, and none were excluded. Therefore, 171 patients were included in the final analysis. The patient selection process is illustrated in **Figure 1**.

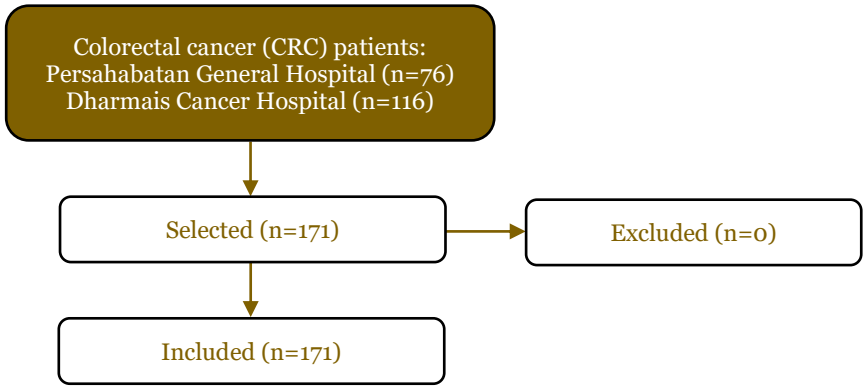

Figure 1. Patients' selection during the study.

Characteristics of respondents and incidence rate of young-onset colorectal cancer (YO-CRC)

A total of 171 CRC patients were included in this study, and their characteristics are presented in **Table 1**. Approximately 60% were males, with the majority belonging to the employed group (62.6%) and the low-income group (84.8%). A total of 88.9% of CRC patients had comorbid conditions, 33.9% reported a family history of cancer, and 15.8% were classified as overweight. Regarding dietary habits, only 8.8% of participants reported high consumption of processed meats and fast foods, while 5.8% reported high consumption of fried foods. Alcohol consumption was reported by 14.6% of participants. Additionally, over one-third of respondents had a highly sedentary lifestyle (36.3%), and 33.3% were smokers. Among all study participants diagnosed with CRC, 84.21% were identified as having YO-CRC, which is defined as a diagnosis before the age of 50 (**Table 1**).

Table 1. Characteristics of respondents and incidence rate of young-onset colorectal cancer (YO-CRC) (n=171)

Characteristic	Frequency (%)
Sex	
Male	101 (59.1)
Female	70 (40.9)
Occupational status	
Employed	107 (62.6)
Unemployed	64 (37.4)
Income status	
High-income	26 (15.2)
Low-income	145 (84.8)
Comorbid disease status	
Yes	19 (11.1)
No	152 (88.9)
Body mass index	
Overweight	27 (15.8)
Normo-weight	144 (84.2)
Processed meat consumption	
Often	15 (8.8)
Seldom	156 (91.2)
Alcohol consumption status	
Yes	25 (14.6)
No	146 (85.4)
Fried food consumption	
Often	10 (5.8)
Seldom	161 (94.2)
Fast food consumption	
Often	15 (8.8)
Seldom	156 (91.2)
Sedentary lifestyle	
High	62 (36.3)

Characteristic	Frequency (%)
Low	109 (63.7)
Smoking status	
Yes	57 (33.3)
No	144 (66.7)
Night-time sleep	
Abnormal	113 (66.1)
Normal	58 (33.9)
Cancer-related family history	
Yes	58 (33.9)
No	113 (66.1)
Incidence of YO-CRC	
YO-CRC	144 (84.2)
Non-YOCRC	27 (15.7)

Factors associated with the incidence of young-onset colorectal cancer (YO-CRC)

Univariate analysis indicated that income status (p=0.008), nighttime sleep (p<0.001), comorbid disease (p=0.015), processed meat consumption (p=0.016), and fried food consumption (p=0.001) were significantly associated with the occurrence of YO-CRC (**Table 2**). There was no significant relationship between sex (p=0.537), occupational status (p=0.546), BMI (p=0.428), smoking status (p=0.505), alcohol consumption (p=0.585), sedentary behavior (p=0.151), fast-food consumption (p=0.194) and cancer-related family history (p=0.289) with the occurrence of YO-CRC (**Table 2**).

Following univariate analysis, multivariate analysis was conducted using logistic regression. All variables that had p<0.25 in univariate analysis were included in this analysis by applying the enter method (**Table 3**). This analysis revealed that six of seven variables were significantly associated with the occurrence of YO-CRC. Individuals with low income were at a significantly higher risk of YO-CRC (odds ratio (OR): 7.79; p=0.004) compared to those with higher income. Individuals without comorbidities had a significantly lower risk of YO-CRC (OR: 0.12; p=0.002). That means having comorbid conditions is a risk factor for YO-CRC. In terms of dietary habits, frequent consumption of processed meat (OR: 0.074; p=0.003) and fried food (OR: 0.054, p=0.001) were both identified as significant risk factors. Additionally, individuals with high sedentary behavior (OR: 5.03; p=0.021) demonstrated a considerably increased incidence of YO-CRC. Fast food consumption did not show a statistically significant association (p=0.119), suggesting that this factor may not independently contribute to YO-CRC risk in this sample. Abnormal nighttime sleep had the most determinant factor contributing to YO-CRC, with tenfold increased risk compared to normal nighttime sleep (OR: 10.46; p<0.001).

Table 2. Univariate analysis showing factors associated with the occurrence of young-onset colorectal cancer (YO-CRC) (n=171)

Variables	YO-CRC (n) (%)	Non-YO-CRC (n) (%)	p-value
Sex			0.537[a]
Male	87 (60.4)	14 (39.6)	
Female	57 (39.6)	13 (48.1)	
Occupational status			0.546[a]
Employed	52 (36.1)	12 (44.4)	
Unemployed	92 (63.9)	15 (55.6)	
Income status			0.008*[b]
Low	127 (88.2)	18 (66.7)	
High	17 (11.8)	9 (33.3)	
Nighttime sleep			0.000*
Abnormal	107 (74.3)	6 (22.2)	
Normal	37 (25.7)	21 (77.8)	
Comorbid disease status			0.015*[b]
Yes	12 (8.3)	7 (25.9)	
No	132 (91.7)	20 (74.1)	
Processed meat consumption			0.016*[b]
Often	9 (6.3)	6 (22.2)	
Seldom	135 (93.8)	21 (77.8)	
Body mass index			0.428[b]

Variables	YO-CRC (n) (%)	Non-YO-CRC (n) (%)	*p*-value
Overweight	22 (15.3)	5 (18.5)	
Normo-weight	122 (84.7)	22 (81.5)	
Smoking status			0.505[a]
Yes	50 (34,7)	7 (25.9)	
No	94 (65.3)	20 (74.1)	
Alcohol consumption status			0.586[b]
Yes	21 (14.6)	4 (14.8)	
No	123 (85.4)	23 (85.2)	
Sedentary behavior			0.151[a]
High	56 (38.9)	6 (22.2)	
Low	88 (61.1)	21 (77.8)	
Fried food consumption			0.001*[b]
Often	4 (2.8)	6 (22.2)	
Seldom	140 (97.2)	21 (77.8)	
Fast food consumption			0.194[b]
Often	11 (7.6)	4 (14.8)	
Seldom	133 (92.4)	23 (85.2)	
Cancer-related family history			0.289[a]
Yes	52 (36.1)	6 (22.2)	
No	92 (63.9)	21 (77.8)	

[a] Analyzed using Chi-squared test
[b] Analyzed using Fisher exact test
*Statistically significant at p=0.05

Table 3. Regression analysis of factors associated with the occurrence of young-onset colorectal cancer (YO-CRC) (n=171)

Variables	Odds ratio	95%CI	*p*-value
Income status (low-income vs high-income)	7.79	1.91–31.66	0.004*
Comorbid disease status (no vs yes)	0.12	0.03–0.48	0.002*
Processed meat consumption (seldom vs often)	0.07	0.01–0.42	0.003*
Fried food consumption (no vs yes)	0.05	0.01–0.31	0.001*
Sedentary behavior (high vs low)	5.03	1.27–19.93	0.021*
Nighttime sleep (abnormal vs normal)	10.46	3.12–35.07	0.000*
Fast food consumption (often vs seldom)	0.29	0.06–1.36	0.119

*Statistically significant at p=0.05

Discussion

This study found that 84.2% of respondents were classified as having YO-CRC, defined as a diagnosis before the age of 50 years [5]. This proportion is markedly higher than global estimates, which report YO-CRC in approximately 10–20% of all CRC cases [15]. Several underlying factors may contribute to this discrepancy. Delayed health screening remains a persistent challenge in Indonesia's healthcare system, particularly in cancer detection and management [16]. Accordingly, these findings underscore the urgent need to promote early screening among individuals at risk of CRC. Moreover, lifestyle changes—such as increased consumption of processed foods, poor sleep quality, and reduced physical activity—are suspected to contribute to the high incidence of YO-CRC [17]. In light of this, the present study investigated multiple variables related to these lifestyle factors.

Regression analysis revealed that income status, comorbidity status, processed meat consumption, fried food consumption, sedentary behavior, and nighttime sleep were significantly associated with the incidence of YO-CRC. Among these, nighttime sleep emerged as the most influential factor. Previous studies have suggested that short sleep duration may increase the risk of colorectal cancer through mechanisms involving circadian rhythm disruption and alterations in endocrine–metabolic pathways [18,19]. While no prior research has specifically demonstrated a significant association between nighttime sleep and YO-CRC, studies in the general CRC population have examined the role of sleep duration. A systematic review by Chen *et al.* [18] reported that short sleep duration increased cancer risk among Asians, whereas long sleep duration was associated with an elevated risk of CRC. Similarly, evidence from the Vietnamese population indicated that short sleep duration may increase CRC risk [19]. These findings collectively suggest that inadequate sleep duration could contribute to CRC incidence. However, to our knowledge, no previous studies directly support the association observed in the present

investigation for YO-CRC. Therefore, further research—particularly longitudinal and mechanistic studies—is warranted to clarify the role of nighttime sleep in YO-CRC pathogenesis.

In addition to nighttime sleep, dietary habits—specifically processed meat and fried food consumption—were also significantly associated with the incidence of YO-CRC. Processed meat has been classified as a Group 1 carcinogen by the International Agency for Research on Cancer (IARC) [20]. The present findings are consistent with those of Carol *et al*. (2022), who reported that processed meat may contribute to YO-CRC development through the formation of N-nitroso compounds [21]. In the broader CRC population, similar associations have been documented; for example, Farvid *et al*. [22] and Bouvard *et al*. [23] demonstrated that processed meat consumption increases CRC risk. Regarding fried food, Carol *et al*. [18] also observed a positive association with YO-CRC risk. Fried food has long been implicated in colorectal carcinogenesis, as high-temperature cooking methods promote the formation of heterocyclic amines (HCAs) and polycyclic aromatic hydrocarbons (PAHs)—potent mutagenic compounds linked to cancer development [24]. The present study reinforces the evidence that such dietary patterns should be recognized as high-risk factors for YO-CRC. Consequently, dietary education aimed at reducing processed meat and fried food consumption should be prioritized as a key strategy in YO-CRC prevention.

Moreover, sedentary behavior was identified as a significant factor associated with YO-CRC incidence. This finding is consistent with previous research demonstrating that prolonged sitting time substantially increases YO-CRC risk; for instance, women reporting more than 14 hours per week of television viewing had a 69% higher risk of developing YO-CRC [25]. Similarly, a Canadian study identified sedentary lifestyle as a contributing factor to YO-CRC [26]. The link between sedentary behavior and CRC risk is thought to arise from its association with low physical activity, which can promote other risk factors such as obesity and hyperglycemia [27,28].

The present study further supports this relationship, as comorbid status emerged as a significant predictor of YO-CRC in regression analysis. Comorbid conditions, including diabetes mellitus, obesity, hypertension, and hyperlipidemia, have been proposed in earlier studies as potential contributors to YO-CRC development [29,30]. These findings suggest that sedentary behavior may influence YO-CRC risk both directly and indirectly through its effect on comorbidities. Consequently, strategies for YO-CRC risk reduction should be integrated with broader preventive measures targeting non-communicable diseases such as diabetes mellitus and hypertension.

Lastly, this study identified income status as a potential contributor to YO-CRC incidence. This finding aligns with prior research suggesting that socioeconomic status may be associated with YO-CRC risk [31-33]. Lower income levels can influence dietary behaviors, such as increased consumption of fast food or processed foods [31], and may limit access to healthier dietary options due to their higher cost [33]. Consequently, income status may represent a more prominent risk factor in low- and middle-income countries than in high-income settings.

Overall, this study confirmed several variables previously reported to be associated with YO-CRC incidence, including income status, comorbidity status, processed meat consumption, fried food consumption, and sedentary behavior. Notably, nighttime sleep—a factor not previously reported in the context of YO-CRC—emerged as the most influential determinant. This novel finding highlights the need for further investigation into sleep-related mechanisms in YO-CRC pathogenesis.

Several variables in the present study were not consistent with previous reports, including smoking status, alcohol consumption, sex, and family history of cancer. These factors have been identified as significant predictors of YO-CRC in earlier studies [27,28]. Differences in cultural background, lifestyle patterns, and the relatively small sample size in this study may have contributed to these discrepancies.

The findings have several important implications for public health policy, particularly for lower- and middle-income populations. The significant association between short nighttime sleep and YO-CRC underscores the need to expand public awareness of sleep hygiene. Educational initiatives should emphasize the importance of adequate and high-quality sleep, especially among young adults. Regarding dietary factors, the high consumption of processed meat and fried food may be linked to affordability and accessibility; therefore, policymakers should promote

programs encouraging the consumption of healthier, minimally processed foods. Public health campaigns that advocate for improved dietary habits and provide affordable alternatives to unhealthy food are especially critical in low-income communities. Addressing sedentary behavior requires social initiatives that promote active lifestyles, such as regular exercise, walking, or cycling to work, which can be integrated into primary healthcare services. Collectively, these approaches highlight the necessity of preventive strategies targeting young adults, particularly those from socioeconomically disadvantaged backgrounds, to achieve long-term reductions in cancer incidence.

Although this study yields important findings, several limitations must be acknowledged. First, its cross-sectional design limits the ability to establish causal relationships between the identified risk factors and the incidence of YO-CRC. The direct associations, particularly for behavioral variables such as sleep duration and sedentary behavior, may therefore not be fully elucidated. Second, recall bias is a potential source of error, particularly in self-reported dietary data. Third, the use of convenience sampling, driven by time constraints, may have reduced the representativeness of the sample. These limitations should be taken into account when interpreting the results. Despite the observed associations between several variables and YO-CRC incidence, further research using longitudinal designs is strongly recommended to validate these findings. Notably, this study did not replicate previously reported associations with established risk factors such as smoking, alcohol consumption, and family history. Cultural differences and the limited sample size may have influenced statistical power and the overall results. Thus, these findings should be considered as preliminary signals warranting further investigation rather than definitive evidence of causality. Regarding generalizability, the results are most applicable to populations with socio-demographic and healthcare system characteristics similar to those in Indonesia and other low- and middle-income countries facing an increasing burden of YO-CRC. For more heterogeneous populations, such as those in high-income countries where cultural and lifestyle factors may differ substantially, caution is warranted when extrapolating these findings.

Conclusion

This study demonstrates a notably high incidence of YO-CRC in Indonesia, surpassing reported global rates. Nighttime sleep duration, income status, comorbidities, sedentary behavior, and dietary patterns—particularly processed meat and fried food consumption—were significantly associated with YO-CRC risk. Among these factors, abnormal nighttime sleep was the most influential (OR: 10.462), highlighting a novel and important domain for future investigation. These findings provide critical evidence to inform public health strategies. Priority should be given to improving sleep hygiene, promoting healthier dietary practices, encouraging regular physical activity, and managing comorbid conditions. Furthermore, raising awareness and implementing early screening initiatives, especially among low-income populations, are essential. In the context of Indonesia's lifestyle patterns, these results offer valuable region-specific insights and emphasize the urgency of developing targeted preventive measures.

Ethics approval

The Ethical approval of the study is issued by the Ethic Committee of Dharmais Cancer Hospital No: DP.04.03/11.5/61/2024 and the Ethic Committee of Persahabatan General Hospital No: 0065/KEPK-RSUPP/03/2024.

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Competing interests

The authors confirm that they have no competing interests to disclose.

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Underlying data

Data or information supporting the findings of this study is available from the corresponding author by request

Declaration of artificial intelligence use

This study used an artificial intelligence (AI) tool for manuscript writing support. AI-based language model, ChatGPT, was employed for language refinement (improving grammar, sentence structure, and readability of the manuscript). We confirm that all AI-assisted processes were critically reviewed by the authors to ensure the integrity and reliability of the results. The final decisions and interpretations presented in this article were solely made by the authors.

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