

ISSN-0973-9122 (Print) • ISSN-0973-9130 (Electronic)

Volume 15 / Number 3 / July-September 2021



Indian Journal of Forensic Medicine & Toxicology

Website: www.ijfmt.com

Official Organ of Indian Association of Medico-Legal Experts (Regd.)

Indian Journal of Forensic Medicine & Toxicology

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Print-ISSN:0973-9122 Electronic - ISSN: 0973-9130

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Editor

Dr. R.K. Sharma
Institute of Medico-legal Publications
Logix Office Tower, Unit No. 1704, Logix City Centre Mall, Sector- 32, Noida
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Printed, published and owned by

Dr. R.K. Sharma
Institute of Medico-legal Publications
Logix Office Tower, Unit No. 1704, Logix City Centre Mall, Sector- 32, Noida
- 201 301 (Uttar Pradesh)

Published at

Institute of Medico-legal Publications
Logix Office Tower, Unit No. 1704, Logix City Centre Mall, Sector- 32, Noida
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Indian Journal of Forensic Medicine & Toxicology

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The Prevalence of Cancer in Indonesia: An Ecological Analysis

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Abstract

Cancer is one of the catastrophic diseases with the most considerable absorption of costs in the National Health Insurance-Indonesian Health Card (JKN-KIS) program. The study aimed at analyzing ecologically the factors related to the prevalence of cancer in Indonesia. The research carried out ecological analysis using secondary data from the Ministry of Health of the Republic of Indonesia in 2018. The study sampled all provinces. Apart from cancer, five other variables analyzed as independent variables were the percentage of preserved meat/chicken/fish, the percentage of fatty/cholesterol/fried foods, the percentage of e-cigarette smokers, the prevalence of diabetes mellitus, the prevalence of hypertension. Data were analyzed using scatter plots. The study results found that the higher the percentage of preserved meat/chicken/fish food consumption habits in a province, the higher the prevalence of cancer. The higher the rate of fatty/cholesterol/fried food consumption in an area, the higher the prevalence of cancer. Likewise, the higher the percentage of e-cigarette smokers in a province, the higher the prevalence of cancer. The higher the prevalence of diabetes mellitus in an area, the higher the prevalence of cancer. Finally, the higher the prevalence of hypertension in a province, the higher the prevalence of cancer. The study concluded that the five independent variables analyzed are related to the majority of cancer in Indonesia.

Keywords: *ecological analysis, consumption habits, cancer, e-cigarette, hypertension, diabetes mellitus.*

Background

Cancer is a group of diseases characterized by uncontrolled growth and the spread of abnormal cells. Cancer cells can spread to other parts of the body through the blood and lymph system. If the distance is uncontrollable, it can result in death. Cancer can affect everyone from children to older people, men, and women. The dominant cancers that occur in women are breast cancer and cervical cancer. For men, the most cancer is lung and colorectal, while in children, the most cancer is leukemia^{1,2}

According to the WHO (World Health Organization), cancer is the second leading cause of death globally,

accounting for an estimated 9.6 million deaths, or one in six deaths, in 2018³. Meanwhile, from the Ministry of Health's data in 2020, cancer is the third leading cause of death in Indonesia after heart disease and stroke¹. According to Globocan, in 2020, Indonesia has reported 396,914 new cancer cases with a death rate of 234,511⁴. The incidence of cancer in Indonesia (136.2/100,000 population) ranks 8th in Southeast Asia, while in Asia, it is 23rd⁵.

Based on BPJS Health data, the cost of cancer treatment for the 2014-2018 period has spent IDR 13.3 trillion (17%) of the total cost of catastrophic diseases of IDR 78.3 trillion⁶. From WHO (World Health Organization) data, the cancer burden in Indonesia with the highest number of cases is breast cancer, and the highest number of deaths is lung cancer. Still, the percentage of cancer in Indonesia reached 18.6% of NCD's premature deaths⁷.

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The risk factors for cancer consists of two, namely those that can be modified (modifiable) and those that cannot be modified (non-modifiable). The flexible examples include smoking behavior, being overweight, drinking alcohol, consuming red meat/processed foods (with preservatives), inadequate physical activity, and low-fiber diets⁸. Meanwhile, non-modifiable risk factors include age, gender, genetics, race, ethnicity, and previous medical history⁹. According to a study from American Cancer Society researchers, about 42% of cancer cases and 45% of cancer deaths in the United States are related to modifiable (preventable) risk factors⁸. Based on the background description above, this study aims to determine the aspects of Indonesia's prevalence of cancer.

Materials and Methods

Study Design

The authors designed the study using an ecological analysis approach. Ecological studies focus on comparisons between groups, not individuals. The data analyzed is aggregate data at a specific group or level, which in this study is the provincial level. An ecological analysis variable can be aggregate measurements, environmental measurements, or global measurements^{10,11}.

Data Source

The authors conduct the study using secondary data from the 2018 Indonesian Basic Health Research report. The Ministry of Health of the Republic of Indonesia

issued the survey report. The unit of analysis in this study is the province. The study analyzed all areas (34 provinces).

Data Analysis

The dependent variable in this study is the prevalence of cancer. This study only records cancer-based on diagnosis by the doctor. Apart from the majority of cancer as the dependent variable, the study analyzed five independent variables. The independent variables consist of behavioral factors (percentage of preserved meat/chicken/fish, percentage of fatty/cholesterol/fried foods, percentage of e-cigarette smokers), and comorbid factors (prevalence of diabetes mellitus, the prevalence of hypertension)¹².

The study performs data analysis using univariate and bivariate methods. Meanwhile, the study employs bivariate analysis using scatter plots. This study uses a linear line of conformity to determine the relationship between cancer prevalence and the independent variable. The entire analysis process utilizes SPSS 21 software.

Results and Discussion

Table 1 provides descriptive statistics on cancer prevalence, and other variables analyzed in this study. The information presented in Table 1 shows very high variation between provinces. The lowest cancer prevalence reached 0.85% (West Nusa Tenggara province), while the highest cancer prevalence was 4.86% in DI Yogyakarta.

Table 1. Descriptive statistics variables of the prevalence of cancer in Indonesia

	Prevalence of Cancer	Percentage of Preserved meat/ chicken/fish	Percentage of Fatty/ cholesterol/ fried foods	Percentage of E-Cigarette Smoker	Prevalence of Diabetes Mellitus	Prevalence of Hyper-tension
N	34	34	34	34	34	34
Mean	1.7591	20,5147	33.3265	2,5029	1.9059	8.1815
Median	1.5650	19,9000	33,2000	2.3500	1.7500	8.2450
Mode	1.32a	18.90a	10.30a	2.70a	1.30a	4.39a
Std. Deviation	0.69747	4.99855	11,15579	1.62602	0.62665	1,87549

Variance	0.486	24,986	124,452	2,644	0.393	3,517
Range	4.01	24.40	48.10	7.20	2.50	8.82
Minimum	0.85	6.70	10.30	0.20	0.90	4.39
Maximum	4.86	31.10	58.40	7.40	3.40	13.21

Source: The 2018 Indonesia Basic Health Research

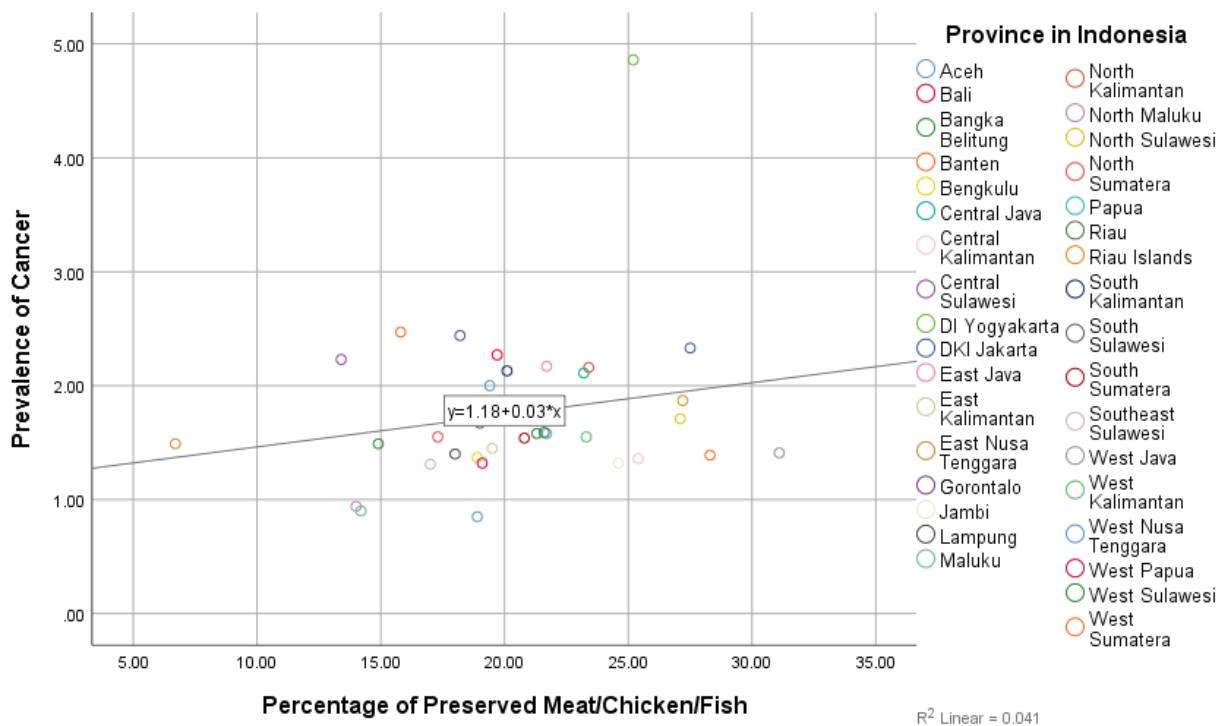


Figure 1. Scatter plot of the Prevalence of Cancer and Percentage of Preserved Meat/Chicken/Fish in Indonesia, 2018

Source: Indonesian Basic Health Research 2018

Figure 1 is a scatter plot between cancer prevalence and the percentage of preserved meat/chicken/fish in Indonesia. This figure shows that the relationship between the two variables shows a positive trend. The results mean that the higher the percentage of preserved meat/chicken/fish in a province, the higher the prevalence of cancer.

Analysis using a scatter plot shows a positive relationship between the percentage of preserved meat/

chicken/fish in a cancer prevalence province. The higher the rate of preserved meat/chicken/fish in a region, the higher the prevalence of cancer in that region too. This study indicates that preserved meat/chicken/fish is a risk factor for cancer. The result is consistent with the research results from the World Cancer Research Fund (2018), which states that consuming processed meat will increase the risk of colorectal cancer, and consuming preserved foods will increase the risk of stomach cancer¹³.

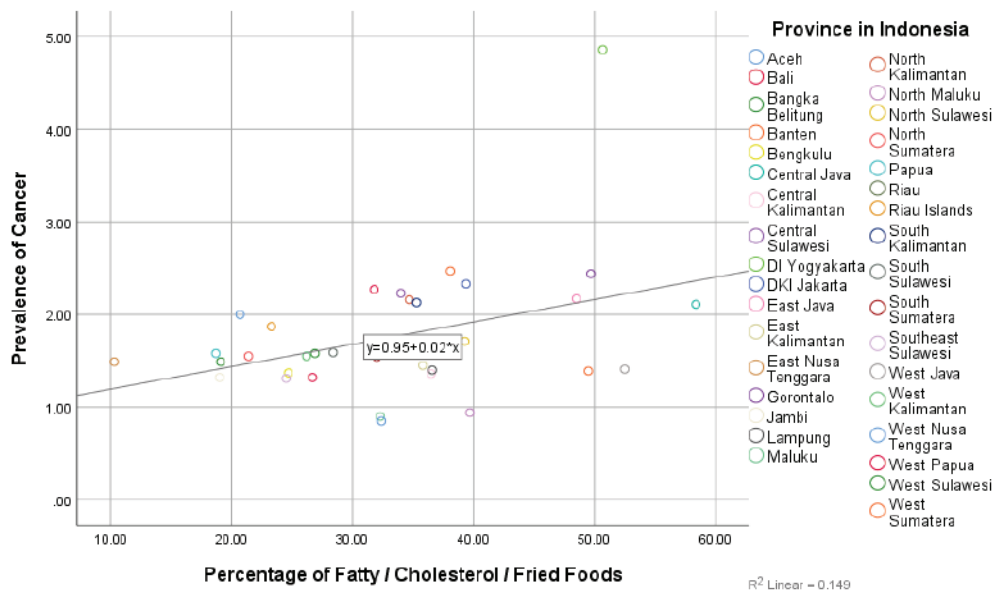


Figure 2. Scatter plot of the Prevalence of Cancer and Percentage of Fatty / Cholesterol / Fried Foods in Indonesia, 2018

Source: Indonesian Basic Health Research 2018

Figure 2 is a scatter plot between cancer prevalence. The figure shows that the relationship between the two variables shows a positive trend. The analysis result means that the higher the percentage of fatty/cholesterol/fried foods in a province, the higher the prevalence of cancer.

Likewise, with the analysis of the percentage of fatty/cholesterol/fried foods with the prevalence of cancer, the higher the rate of people consuming fatty/fried foods in an area, the higher the prevalence of cancer. This result is also stated in Lippi & Mattiuzzi's (2015) research that eating fried foods will increase the risk of prostate cancer 1.3 to 2.3 times¹⁴. In Garcia's study (2019). The study stated that consuming cholesterol foods was associated with an increased risk of breast cancer¹⁵.

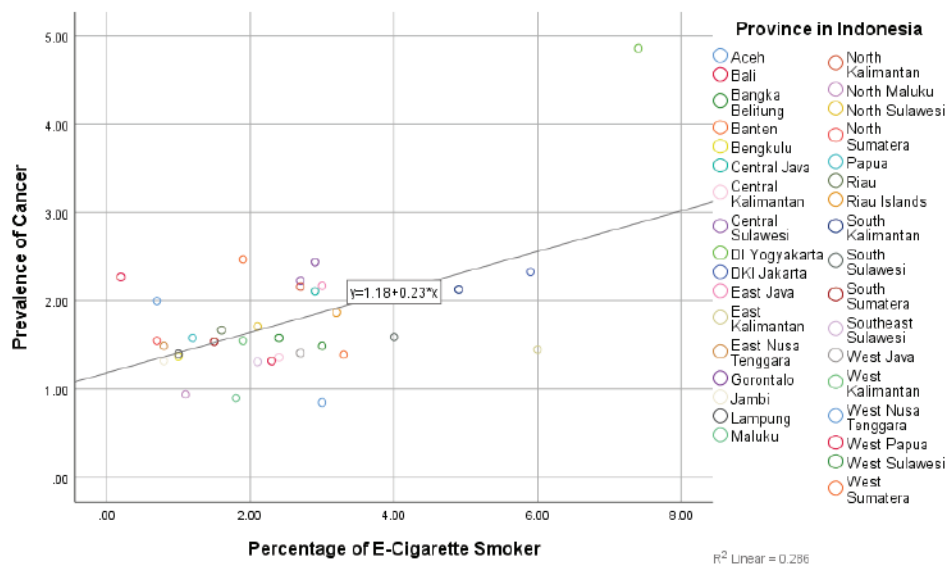


Figure 3. Scatter plot of the Prevalence of Cancer and Percentage of E-Cigarette Smokers in Indonesia, 2018

Source: Indonesian Basic Health Research 2018

Figure 3 is a scatter plot between cancer prevalence and the percentage of e-cigarette smokers in Indonesia. This figure shows that the relationship between the two variables shows a positive trend. The result means that the higher the rate of e-cigarette smokers in a province, the higher the prevalence of cancer.

Many studies have shown that smoking is associated with cancer prevalence, and the results from scatter plot analysis of the percentage of e-cigarette smokers with cancer prevalence. The more e-cigarette smokers in a province, the higher the prevalence of cancer in that province. In Cancer Prevention Research, several studies on the relationship of e-cigarettes with cancer state that e-cigarettes can increase cancer risk in both mice and humans^{16,17}.

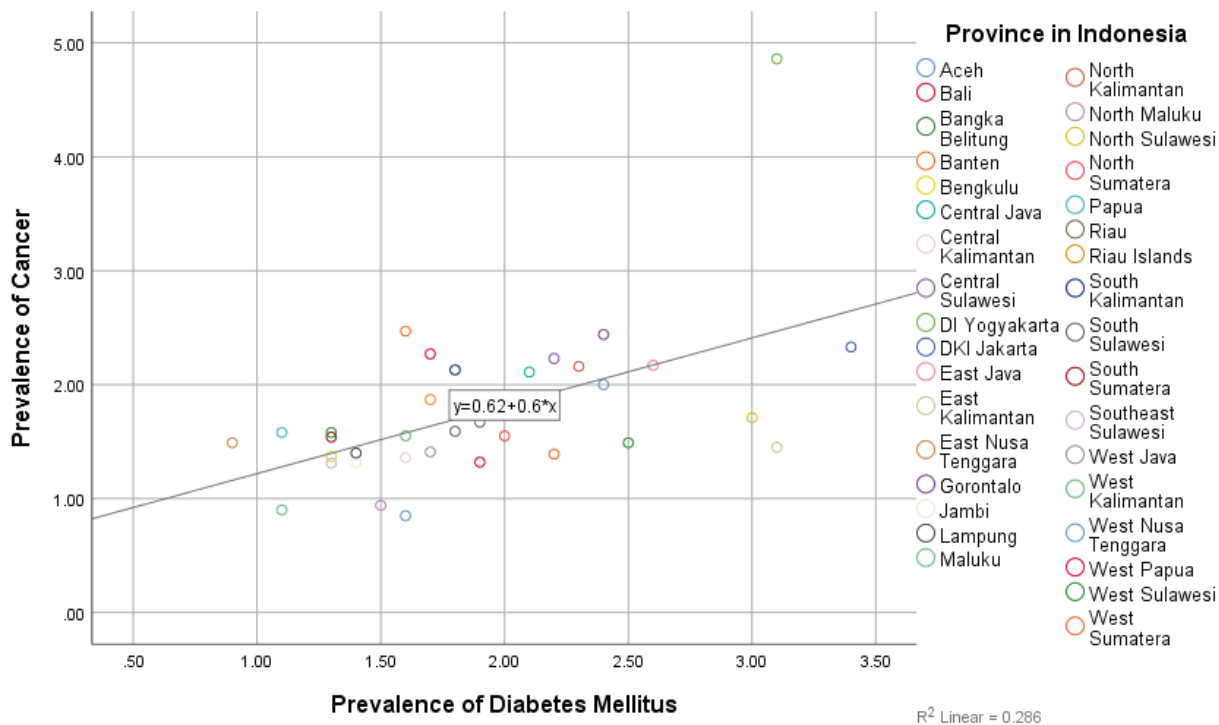


Figure 4. Scatter plot of the Prevalence of Cancer and Prevalence of Diabetes Mellitus in Indonesia, 2018

Source: Indonesia Basic Health Research 2018

Figure 4 is a scatter plot between cancer prevalence and the prevalence of diabetes mellitus in Indonesia. This figure shows that the relationship between the two variables shows a positive trend. The finding means that the higher the prevalence of diabetes mellitus in a province, the higher the prevalence of cancer. In diabetes and cancer, several previous studies show that people with diabetes have an increased risk of developing cancer. Also, in the study, the conclusion was there is a slight increase in the risk of developing breast cancer among women with type 2 diabetes^{18,19}.

Figure 5 is a scatter plot between the prevalence of cancer and the prevalence of hypertension in Indonesia. This figure shows that the relationship between the two

variables shows a positive trend. The analysis result means that the higher the prevalence of hypertension in a province, the higher the prevalence of cancer.

Finally, the analysis shows that the higher the prevalence of hypertension in a province, the higher the cancer prevalence in the region. The finding supported research by Seretis et al. (2019), which states that people with hypertension have a higher risk factor for kidney, colorectal, and breast cancer²⁰. In previous research, two studies concluded a significant association between hypertension and breast cancer risk. It is precisely for postmenopausal hypertensive women^{21,22}.

The research carried out using an approach to ecological analysis has drawbacks in its use as a policy

basis since the data used is aggregated data at the provincial level. More research at the personal level is required to obtain more reliable information on intervention policy decisions^{23,24}.

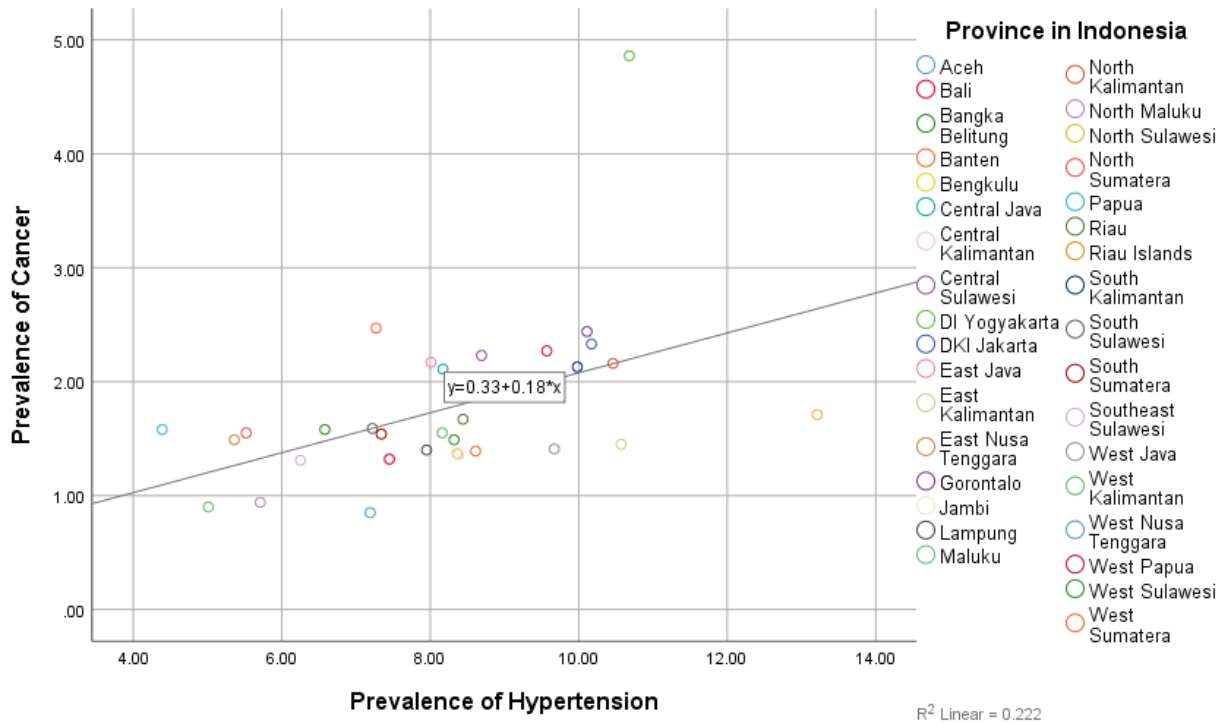


Figure 5. Scatter plot of the Prevalence of Cancer and Prevalence of Hypertension in Indonesia, 2018

Source: Indonesian Basic Health Research 2018

Conclusions

The authors concluded that the five independent variables ecologically analyzed are related to Indonesia’s cancer prevalence based on the research results. The five variables are the percentage of preserved meat/chicken/fish, the percentage of fatty/cholesterol/fried foods, the percentage of e-cigarette smokers, the prevalence of diabetes mellitus, and the majority of hypertension.

Acknowledgments: The author would like to thank the Ministry of Health of the Republic of Indonesia. The institution was providing the report, which was the source of the data in this study.

Source of Funding: Self-funding

Ethical Clearance: The study conducted using secondary data from published reports. Ethical clearance is therefore not required in the conduct of this study.

Conflicting Interests: The authors declared no potential conflicts of interest concerning the research,

authorship, and publication of this article.

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