



# The Relationship between Smoking Habits, Physical Activity, and Drinking Alcohol with Cardiac Disease: A Cross-sectional Study

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## Abstract

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**BACKGROUND:** Cardiac disease is the number one cause of death in the world, including in Indonesia. According to the 2018 Riskesdas data, the prevalence of cardiac disease in Indonesian society based on doctor's diagnosis is 1.5%. This means that out of one hundred Indonesians, 1.5 people suffer from cardiac disease.

**AIM:** The aim of this study was to determine the relationship between smoking habits, physical activity, and drinking alcohol with the cardiac disease in Indonesia.

**METHODS:** This is a further data analysis of BASIC Health Research 2018, a national cross-sectional study in Indonesia. The research samples were all members in selected households. The samples analyzed were household members aged 10 years and over. The data were collected through interview using a structured questionnaire. The analysis was done using the Chi-square and multivariate logistic regression methods with complex sample approach.

**RESULTS:** The results showed that the characteristics of the respondents, which were age, gender, education, occupation, and place of residence, had a significant relationship with cardiac disease ( $p < 0.001$ ). Smoking habits, physical activity, and drinking alcohol also had a significant relationship with cardiac disease ( $p < 0.001$ ). The results of the multivariate test showed that smoking habits and lack of physical activity were the factors that most influence the incidence of cardiovascular disease ( $p < 0.001$ ).

**CONCLUSION:** Smoking habits, physical activity, and drinking alcohol are significantly associated with the cardiac disease in people aged 10 years and over in Indonesia.

## Introduction

Non-communicable diseases (NCDs) are one of the leading causes of death in Indonesia. According to the World Health Organization (WHO), the prevalence of NCDs is increasing globally. In 2018, it was estimated that there were 41 million deaths due to NCDs, accounting for approximately 71% of all deaths worldwide [1]. The results of the Basic Health Research 2018 showed an increase in the prevalence rate of NCDs in Indonesia. Some of the most common types of NCDs include cardiovascular diseases, (CVDs) stroke, hypertension, cancer, chronic respiratory diseases, and diabetes mellitus. There are three main risk factors causing an increase in the prevalence rate of NCDs. The first is related to diet, the second is behavior, and the third is environmental factors, such as air pollution. Unhealthy lifestyle is one of the triggers for the increase in NCDs, which causes 70% of deaths. Risk factors such as smoking, excessive alcohol consumption, poor diet, and lack of physical activity also contribute to the increasing prevalence of NCDs worldwide [1].

Cardiac disease is the number one cause of death in the world, including in Indonesia. CVD is a group of disorders that occur in the cardiac system and blood vessels [2], namely ischemic cardiac disease/coronary heart disease (CHD), cardiac dysrhythmias, cerebrovascular disease, peripheral artery disease, and cardiac failure. The high prevalence of cardiac disease is caused by a number of factors related to the lifestyle and behavior of the people. Based on the data from the Basic Health Research 2018, the prevalence of cardiac disease in Indonesian is 1.5% [3].

According to the WHO in 2013, CHD is the single largest cause of death in developed and developing countries. According to the world statistics there are 9.4 million deaths each year due to CVD, and 45% of these deaths are caused by CHD [4]. CVD is caused by many factors, including smoking habits, physical inactivity, food, obesity, cholesterol, diabetes, and high blood pressure [5]. Smoking is a risk factor for cardiac disease that comes from lifestyle (behavior). According to the WHO (2019), approximately 1.1 billion people in the world are smokers. It was reported that the increase in the prevalence of CHD was due to people's lifestyle

and behavior, such as smoking, drinking alcohol, eating fatty foods, consuming less fruit and vegetables, stress, and physical in activity [6]. Cigarettes are one of the biggest contributors to the cause of death, and it is difficult to prevent them in society. Smoking is one of the causes of diseases in humans, but it can actually be prevented. The nicotine in cigarettes can damage the immune response system and cause constriction of blood vessels. It has been reported that tobacco smoking is a risk factor for several serious diseases, such as lung cancer, myocardial infarction, CVD, chronic ischemic heart disease, and stroke. According to McEvoy *et al.*, smoking can have harmful effects on cardiac disease [7]. Based on the results of the research by Afriyanti *et al.*, it is known that there is a significant relationship between smoking behavior based on smoking duration, types of smoker, and CHD [8]. It was also reported by Salim and Nurrohmah that there was no significant relationship between exercises and CHD, but people who routinely exercise can reduce the risk of having CHD [9].

Based on the Global Status Report on Alcohol and Health, 2014, as many as 1,928,000 people in Indonesia experience health problems due to excessive alcohol consumption [10]. In 2018, the number increased to 2,088,000 people who experienced health problems caused by drinking alcohol [11]. The results of the research by Bell *et al.*, showed that there is a heterogeneous relationship between the level of alcohol consumption and the early incidence of CVD [12].

The aim of the study is to analyze and determine the relationship between smoking habits, physical activity, and drinking alcohol with cardiac disease in Indonesian community from the National Health Survey of Indonesia population.

## Methods

### **Data collection and research design**

This was a further analysis of the Basic Health Research 2018 data on cardiac disease. The Basic Health Research is a periodic national health survey conducted by Ministry of Health, Republic of Indonesia since 2007. This is a cross-sectional study to collect basic data and health indicators. The health indicators are health status and health determinant factors.

The population of the Basic Health Research was all households in the entire of Republic of Indonesia covering 34 provinces, 497 districts/cities and it was conducted in 2018. The research samples were selected using two stage sampling method. Census blocks were selected using probability proportional to size sampling. Households in every census blocks chosen were selected using the simple random sampling. All members

in the chosen household sample became the individual samples. In this further analysis, we only analyzed individual aged 10 years and over because they had information on cardiac disease and behavior status.

Data collection was done using the interview administered questionnaire [3]. The research questionnaire was divided into two sections: The first section consists of household-related questions and the second section asks about individuals. Enumerator training was conducted to train the use of the research questionnaires and apply certain communication strategies before data collection began. Village representatives and health professionals accompanied the enumerators as they visited residences to collect data. The enumerators requested that all chosen family members read and sign the informed consent form before the interviews began. For children's subjects, consent is obtained from their parents."

### **Dependent and independent variables**

The dependent variable in this study is cardiac disease based on doctor's diagnosis according to the respondent's confession, while the independent variables consist of age, gender, level of education, occupation status, place of residence, smoking habits, doing physical activity, and alcohol drinking [Figure 1]. Level of education was defined as high if respondent graduated from senior high school or higher level. Smoking habits was defined as "yes" if respondent smoked in the last 1 months. Physical activity was collected using modified Global Physical Activity Questionnaire from STEPS WHO instrument. Adequate physical activity was defined as doing severe physical activity  $\geq 3$  days a week with MET minute per week  $\geq 1500$  or doing moderate physical activity  $\geq 5$  days a week for  $\geq 150$  min a week or  $\geq 30$  min per day. Alcohol drinking was defined as "yes" if respondent consumed minimal 1 standard size alcohol drinks in the last 1 months.

### **Statistical analysis**

Data analysis was carried out using bivariate and multivariate methods. Bivariate analysis is to see the relationship between the independent variable and the dependent variable. This analysis aims to examine the differences in the proportions of two or more sample groups, while to see the effect of the independent variables together on cardiac disease, a multivariate analysis was done using logistic regression with significance level  $< 0.05$  was performed using SPSS a complex sample approach. Multivariate logistic regression analysis aims to determine the relationship between several independent variables and one dependent variable at the same time. From this multivariate analysis, it can be seen which independent variable has the greatest influence on the dependent variable [13].

## Ethical approval

This research has received ethical approval from the Health Research Ethics, Committee National institute of Health Research and Development the Ministry of Health, Republic of Indonesia (No. LB.02.01/2/KE.024/201, on January 24, 2018). In addition, all respondents were enrolled after providing written informed consent, and the collected data would be kept confidential.

## Results

The number of respondents aged  $\geq 10$  years, who were interviewed, was 713, 783 people consisting of 49.8% male respondents (340,560 people) and 50.2% female respondents (373,223 people). The percentage of the respondents with cardiac disease was 1.8% (13,185 people), and the one with no cardiac disease was 98.2% (700,598 people).

Table 1 shows that age, gender, education, occupation, and residence were all significantly related to cardiac disease ( $p < 0.001$ ) with OR 1.17– 6.81. Those who were older, female, had lower education, did not work, and lived in an urban area had more risks to suffer from cardiac disease. Smoking inadequate physical activity and drinking alcohol were significantly related to cardiac disease, ( $p < 0.001$ ) with OR 0.85, 1.7, and 0.66, respectively. Smoking and drinking alcohol were protective factors to cardiac disease, while the inadequate physical activity was also a risk factor.

In Table 2, it can be seen that most respondents were in the age group of 26–45 years old (41.0%). There were more female respondents (50.2%) than the male ones (49.8%). For education, the respondents with low education (62.9%) were more than those with higher education (37.1%). The respondents who worked (62.6%) were more than those who did not work (37.4%), and the respondents who lived in urban areas (55.3%) were more than those who lived in rural areas (44.7%). The respondents who do not smoke were more than those who smoke, and the respondents who did adequate physical activity were more than those who did inadequate physical activity. Finally, the respondents who did not drink alcohol were more than those who drank alcohol.

From the multivariate test results, 8 variables were included in the logistic regression model, leaving only 6 variables in the final model (Table 3). Table 3 shows the variables of age group, education, occupation, place of residence, smoking, and inadequate physical activity were significantly associated with cardiac disease ( $p < 0.001$ ). Older age, not working, living in an urban area, and having inadequate physical activity were risk factors of cardiac disease, while lower education and smoking habits were protective factors of cardiac disease.

## Discussion

In this study it was known that the prevalence of cardiac disease in people aged  $\geq 10$  years was 1.8%, with the highest percentage in the age group of

**Table 1: Relationship between respondent characteristics and behavior with cardiac disease**

Variable	Cardiac disease				p-value	OR (95%)
	Yes	No				
	n	%	n	%		
Age groups						
10–25 years	1.118	0.7	155.760	99.3	0.0001	
26–45 years	3.318	1.1	289.636	98.9		1.55 (1.40–1.72)
46–65 years	6.293	3.1	203.248	96.9		4.54 (4.12–4.99)
>65 years	2.456	4.6	51.954	95.4		6.81 (6.12–7.57)
Gender						
Male	5.865	1.6	334.695	98.4	0.0001	1.24 (1.17–1.28)
Female	7.320	2.0	365.903	98.0		
Education						
Lower	8.733	1.9	454.425	98.1	0.0001	1.17 (1.11–1.24)
Higher	4.452	1.6	246.173	98.4		
Occupation						
Not work	5.502	2.1	256.988	97.9	0.0001	1.3 (1.24–1.37)
Work	7.683	1.6	443.610	98.4		
Residence						
Urban	6.749	2.0	302.518	98.0	0.0001	1.3 (1.20–1.40)
Rural	6.436	1.6	302.518	98.4		
Smoking						
Yes	4.350	1.6	248.027	98.4	0.0001	0.85 (0.81–0.90)
No	8.835	1.9	452.571	98.1		
Physical activity						
Adequate	10.166	1.6	601.641	98.4	0.0001	1.70 (1.60–1.81)
Inadequate	3.019	2.7	98.957	97.3		
Drinking alcohol						
Yes	408	1.2	32.884	98.8	0.0001	0.66 (0.57–0.78)
No	12.777	1.8	667.714	98.2		

**Table 2: The initial model of factors that influence cardiac disease**

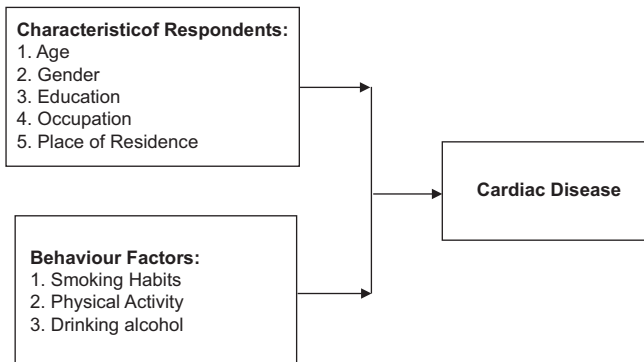
Variable	B	SE	p-value*	OR (95%CI)
Age group				Reference
10–25 years				1.79 (1.61–1.99)
26–45 years	-0.258	0.038	0.0001	5.37 (4.85–5.95)
46–65 years	-1.356	0.045		6.95 (6.21–7.77)
>65 years	-1.939	0.057		
Gender				
Female versus male	-0.041	0.038	0.271	1.04 (0.97–1.12)
Education				
Low versus high	-0.150	0.032	0.0001	0.86 (0.81–0.92)
Occupation				
Not work versus work	0.314	0.032	0.0001	1.37 (1.29–1.46)
Residence				
Urban versus rural	-0.227	0.028	0.0001	1.25 (1.19–1.33)
Smoking				
Yes versus no	-0.071	0.040	0.074	0.93 (0.86–1.01)
Physical activity				
Inadequate versus adequate	0.315	0.033	0.0001	1.37 (1.28–1.46)
Drinking alcohol				
Yes versus no	0.027	0.084	0.743	1.03 (0.87–1.21)

\*Significance level &lt;0.05

**Table 3: Risk factors of cardiac disease in people aged ≥10 years old in Indonesia**

Variable	B	SE	p-value*	Adjusted OR (95%CI)
Age group				Reference
10–25 years				1.80 (1.62–2.01)
26–45 years	-0.256	0.038	0.0001	5.40 (4.88–5.97)
46–65 years	1.352	0.045		6.97 (6.24–7.79)
>65 years	1.942	0.056		
Education				
Low versus high	-0.148	0.031	0.0001	0.86 (0.81–0.92)
Occupation				
Not work versus work	0.323	0.031	0.0001	1.38 (1.30–1.47)
Residence				
Urban versus rural	0.226	0.028	0.0001	1.25 (1.19–1.33)
Smoking				
Yes versus no	0.097	0.030	0.0001	0.91 (0.86–0.96)
Physical activity				
Inadequate versus adequate	0.312	0.033	0.0001	1.37 (1.28–1.46)

\*Significance level &lt;0.05

**Figure 1: Conceptual framework to know the relationship between smoking habits, physical activity, and drinking alcohol with the cardiac disease**

>65 years (4.6%), and the lowest in the age group of 10–25 years (0.7%). Cardiac disease is mostly found in the elderly, namely age  $\geq 65$  years, where the proportion of women (2.0%) is more than that of men (1.6%). The proportion of cardiac disease among those with low education (1.9%) is higher than among those with high education (1.6%), the proportion of cardiac disease among those who do not work (2.1%) is more than among those who work (1.6%) and the proportion of cardiac disease in urban areas (2.0%) is higher than in the rural areas (1.6%) [2].

The factors that play a role in the occurrence of cardiac disease include age, gender, education,

occupation, place of residence, smoking, inadequate physical activity, and drinking alcoholic beverages. The results of research conducted by Ar and Bahrn showed that there was a relationship between age and the incidence of CHD, the increasing age, the higher the risk of suffering from CHD [14]. It was reported by Kusumawaty *et al.*, that men are more likely than women to be at risk of CVD, because it is associated with unhealthy lifestyles, such as smoking and drinking alcohol [15]. The respondents with lower education have more cardiac disease than those with higher education. Health education is all activities to provide and or increase knowledge, attitudes, and behavior of the community in maintaining and improving their own health.

The results of a study in China reported that smoking can increase the risk of all subtypes of CVD [16]. Another study conducted in Nepal also stated that smoking is known to increase the risk of heart artery disease in people in Nepal [17]. This result is in line with the study from Savia *et al.*, (2013) which stated that there is a relationship between smoking and the risk of CVD. It is also in accordance with the research conducted by the influence of the number of cigarettes per day and duration of smoking with the occurrence of CHD [18].

In Table 1, it is shown that there is a significant relationship between smoking, doing physical activity, and drinking alcohol, and cardiac disease, with a  $p < 0.005$ . Reported by Akcay and Yuksel, no association between various smoking habits and risk of cardiac disease was found in women, and this finding is different from the findings of previous studies, which reported that smoking is a major factor contributing to the development of CVD in men and women [19]. In accordance with the results of research from Chagas *et al.*, it is known that patients with coronary artery disease who consume moderate amounts of alcohol have a lower coronary artery disease severity than those who drink heavily [20]. It is reported by Van De Wiel that excessive alcohol intake can increase triglyceride levels [21]. Other researchers asserted that alcohol drinkers who smoked had their triglyceride level increase, unlike non-smokers [22].

Some researchers stated that there is a relationship between physical activity and cardiac disease. The results of the research from Chomistek *et al.*, whose data were from an observational study, show that there is a relationship between physical activity and cardiac disease, where the combination of low physical activity and sitting for long periods of time can increase the risk of CVD [23]. According to Arijia *et al.*, this community-based physical activity program can improve cardiovascular health in the short and medium terms [24]. At least half of the people who do not do physical activity are as likely to experience an incidence of CVD as those who do physical activity [25].

The results of the multivariate analysis test of the 8 variables included in the initial model showed only 6 variables that play a role in cardiac disease; they are age, occupation, education, residence, smoking habits,



and physical activity. There is an influence of age on cardiac disease (OR = 6.97,  $p < 0.001$ ), where people aged >65 years have a risk of suffering from cardiac disease of 6.97 times greater than those outside this age group.

There is an influence of education on cardiac disease (OR = 0.86,  $p < 0.001$ ), where people with low education have a risk of suffering from cardiac disease 0.86 times of those with high education. The high educated people are more at risk than the low educated people. There is an inverse influence of occupational variables on heart disease (OR = 1.38,  $p < 0.001$ ), where people who do not work have a risk of suffering from heart disease 1.38 times higher than the people who work.

There is an inverse influence of the variable of residence on cardiac disease (OR = 1.25,  $p < 0.001$ ), where the people living in urban areas have a risk of suffering from cardiac disease 1.25 times compared to the people living in rural areas. There is an influence of smoking on cardiac disease (OR = 0.91,  $p < 0.001$ ), where the people who smoke have a risk of suffering from cardiac disease 0.91 times of non-smokers. This is in accordance with the findings of Banks *et al.*, which stated that smoking can increase the risk of almost everyone in all types of CVD [26]. There is an inverse influence of the variable physical activity on cardiac disease (OR = 1.37,  $p < 0.001$ ), where people who do inadequate physical activity have a risk of suffering from cardiac disease 1.37 times higher than those who do adequate physical activity.

The strength of this study was that the 2018 Riskesdas data uses a large sample size and nationally representative data, used to achieve the objective of investigating the relationship between various factors related to cardiac disease. In addition, multivariate logistic regression modeling in our analysis can also help minimize bias.

This study had a few limitations. The first limitation of this study is that the 2018 Riskesdas data were implemented in a cross-sectional design that only reported the conclusion of the relationship and did not allow to conclude causality.

The second limitation is the limited availability of data on the variables displayed in the article. The article cannot display other factors that are known to be associated with cardiac disease, such as quintile values (showing differences in household wealth levels), and diets.

## Conclusion

Cardiac disease is mostly found in the respondents aged over 65 years, in the respondents

who do not work, in the respondents with low education, and in those who live in urban areas. Smoking habits, inadequate physical activity, and drinking alcohol are significantly associated with the incidence of cardiac disease in people aged 10 years and over in Indonesia. The people who do inadequate physical activity have a 1.4 times risk of developing cardiac disease than those who do adequate physical activity.

## Recommendations

The results of the study can be used as a reference in disease preventing cardiac from becoming more severe in people in Indonesia.

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## Authors Contributions

Conceptualization, MALS, VS, NP, and DD; methodology, RR, RPH, TP, and AY (Aris Yulianto); software, NN, AY, and AY; validation, MALS., DD, NN, RR, and TP.; formal analysis, DD, NP, NN and RR; investigation, VS, DD, and RHP; resources, MALS, DD, NN, and AY (Aris Yulianto); data curation, RR., NP, TP, and AY (Anni Yulianti); writing-original draft preparation, MALS, VS, DD and RR; writing-review and editing, RHP, NN, TP and AY (Anni Yulianti); visualization, MALS, VS, DD, NP and RR; supervision, MALS, NN, TP, VS and DD; project administration, RHP, AY and AY; funding acquisition, MALS, VS, DD, NP and RR. All authors have read and agreed to the published version of the manuscript.

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