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A structural model of Mapalus culture, health behavior and coronary artery disease incidence in the Minahasa ethnic community in North Sulawesi Province

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ABSTRACT

Introduction: Coronary artery disease (CAD) is a disease that has caused death across the world, including in Indonesia. CAD is a multifactorial disease. Many studies have been conducted to examine the causes of CAD. Based on previous research, the risk factors questioned are fixed and nonfixed risk factors. Fixed risk factors include age, gender and family history. Nonfixed risk factors include smoking habits, blood cholesterol levels, behavioral types, socioeconomic status and cultural factors, among others. The purpose of this study is to find a structural model of the influence of Mapalus culture and health behavior on the incidence of CAD in the Minahasa ethnic group in North Sulawesi Province.
Method: This research is a case-control research type that uses 220 respondents (110 case and 110 control respondents). The variables studied were Mapalus culture (ethos and principles) and health behavior (smoking habits, knowledge of CAD, healthy behavior and sickness behavior) as independent variables and CAD incidence as the dependent variable. Data analysis used pathway analysis by employing GeSCA software.
Result: The results of this study indicate that Mapalus culture and health behavior influence the occurrence of CAD. The influence of Mapalus culture will be stronger/greater if it interacts with health behavior.
Conclusion: Based on the results of this study, control must be exercised on smoking habits, increasing knowledge about CAD and having a healthy lifestyle.

Keywords: *CAD, Mapalus, Health behavior, Minahasa, GeSCA.*
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INTRODUCTION

According to the Indonesian Ministry of Health (2013), coronary artery disease (CAD) is a disorder of artery function due to a heart muscle lack of blood caused by narrowing of the coronary arteries. Clinically, CAD is marked by chest pain or feeling uncomfortable in the chest, or the chest feels severe pressure when climbing, doing heavy work or walking in a hurry on a flat road or for long distances.[1]

Risk factors are all causal factors coupled with epidemiological factors related to the disease. Risk factors are factors that come up before the occurrence of the disease. The occurrence of CAD can be predicted because the risk factors can be measured. If someone has several risk factors, the chances of having CAD are higher than for those with one risk factor. If someone has three risk factors, the chances of suffering from CAD are six times greater than for those who have only one type of risk factor.[2,3]

Etiology and risk factors of CAD are multifactorial. This is the result of interactions between genetics, lifestyle and environmental factors. CAD risk factors are differentiated into two categories: unfixed risk factors and fixed risk factors. Fixed factors, which cannot be modified, include age, sex and family history (heredity). Risk factors, which can be modified, include smoking, obesity, lack of physical activity and high blood pressure or hypertension.[4]

CAD has some risk factors. The most common factors are smoking, family history, hypertension, obesity, diabetes, heavy drinking, lack of exercise, stress, and hyperlipidemia. Smoking is associated with about 54% of obesity cases and 20% of those with CAD. Lack of exercise is associated with 7-12 % cases of CAD.[5,6]

Smoking is one of the most influential behavioral factors of cardiovascular disease. Some studies have found a significant association between smoking habits and the incidence of CAD. Respondents who were heavy smokers (consumption of 20 cigarettes a day) had a double risk of being exposed to CAD. Another study conducted in CAD patients in the Internal Medicine Polyclinic of Palembang MH Hospital found that respondents who smoked were four to five times more likely to experience CAD than nonsmoking patients.[7-9]

The results of research conducted on physical activity show that the risk of CAD

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is lower in individuals with moderate and high physical activity than in individuals with low physical activity. The CAD group tended to have lower physical activity than the non-CAD group, while the tendency for moderate and high physical activity was higher in the non-CAD group than in the CAD group.[10]

Coronary artery disease is still a serious problem in North Sulawesi. According to the results of the 2013 Riskesdas, North Sulawesi has the second highest prevalence in Indonesia at 0.7%. This figure is above the national prevalence of 0.5%. This occurs because of the risk factors of CAD, such as obesity, smoking, diabetes mellitus, and hypertension, have a high prevalence in North Sulawesi.[11]

The results of the 2013 Riskesdas also showed that the prevalence of obesity in North Sulawesi was the highest in Indonesia at 24.0% (national prevalence was 15.4%). Based on the Riskesdas in 2007, 2010 and 2013, the number of smokers in Indonesia increased from 34.2% (2007) to 34.7% (2010) and 36.3% (2013). The prevalence of hypertensive patients in North Sulawesi is 27.1% (national prevalence is 25.8%). The prevalence of DM patients is 3.6% (national prevalence 2.1%).[11]

North Sulawesi is located in the north of Sulawesi Island and is one of the areas located in the north of the equator. The population of North Sulawesi Province in 2010 was approximately 2,270,596 people with a population growth rate of 1.28%/year. Nearly 45% of the population live in urban areas, and the remaining 55% live in rural areas. The school enrollment rate for elementary school level is 96.10%. Physiographically, the area of North Sulawesi Province can be grouped into two zones, namely the southern and northern zones. The southern zone comprises a lowland and highland from Bolaang to North Minahasa and has fertile land. The northern zone stretches from Miangas Island through Sangihe to Siau Island and is an archipelago. North Sulawesi is inhabited by multiethnic communities such as Minahasa, Bolaang Mongondow, Talaud, Siau, Sangihe, Chinese, Bajo, and others. North Sulawesi is dominated by ethnic Minahasa who are generally Christian. One culture that is still sustainable after generations are Mapalus.[11]

Mapalus is also known as the local spirit and local wisdom of the people in Minahasa. Mapalus is the manifestation of the Minahasa lifestyle, which is realized as a system of life-order rules and individual and ancestral community empowerment that is used as a principle of family life because it is a set of behavioral concepts for living and solving common problems. Mapalus culture developed initially in agriculture. But more recently, Mapalus has been embodied in every activity that is social, and almost in all areas of life, such as in traditional ceremonies, building houses, making boats, marriage, death, and so on.[12]

According to research from Nelwan et al. (2017), this culture has changed, starting from the migration of people from villages to cities, so the form of Mapalus has also changed from Mapalus farming to Mapalus money, happiness, sorrows, and others. The results of this study also show that this change has led to a change in the health behavior of the Minahasa people, such as the habit of consuming fish into pork (pork dishes are a luxury dish for the Minahasa people). Also, with so many Thanksgiving events being carried out, eating, drinking and smoking behaviors are starting to lead to unhealthiness. These are predicted to be behavioral changes that can lead to an increase in the prevalence of noncommunicable diseases such as CAD.[12]

From those, efforts are needed to control the incidence of CAD, especially in the Minahasa ethnic community. According to Abdi (2016), disease control efforts can be more easily obtained if it is made in a structural diagram/pathway. Structural diagrams are very useful for showing the flow of causal relationships between exogenous and endogenous variables. Where relationships have existing justifications based on theories and concepts, they are visualized into images, so that they are easier to see and more interesting. If these causal relationships are conceptually not solid yet, then several models can be created, which will be tested by using structural equation modeling (SEM).[13] The purpose of this study is to find a structural model of the interaction between Mapalus cultural factors, health behavior and the incidence of CAD in the Minahasa ethnic group in North Sulawesi Province.

METHODS

This research was a case-control study conducted from August to September 2018. The data were taken from the Installation of Cardio Vascular and Brain Center (CVBC) in Prof. Dr. R.D. Kandou Hospital Manado. Ethical approval of this study was granted by the Ethics Committee, with number 170/EC-KEPK/IX/2018.

Sample size and sampling methods

The target population in the research was all patients in the installation of CVBC as a case and internal information. The sample comprised 220 respondents, and the sample size was determined using the Lemeshow formula, which is suitable for an unknown population. Based on the calculation, the minimum number of cases obtained by the respondents was 90, then 20% was added. This was done to avoid the occurrence of bias so that the number of study samples became 110 respondents for the case group and 110 respondents for the control group, so the total sample taken was 220 respondents.

A purposive sampling method was used because in this case, there were no secondary data concerning the population of children aged under five affected by diarrhea in each subdistrict and determined by inclusion and exclusion criteria. The study participants were determined based on the following inclusion criteria such as willing to be a respondent based on signed informed consent and Treated a maximum of once and had suffered coronary heart disease (CHD) at least six months before the study. The time limit was set to minimize errors in the data with the expectation that respondents would still remember the behaviors and events experienced. The participants were also determined based on the following exclusion criteria such as having a communication disability and suffering from a psychiatric disorder.

Data collection

Data collection was undertaken using questionnaires. The data collection was

carried out in August 2017. The interviews were conducted by the author, assisted by trained personnel, and lecturers and students from the Faculty of Public Health, Universitas Sam Ratulangi, Manado, who were given briefings on the interview procedures and to ensure understanding of each question. The inclusion of others was to ensure valid data collection and did not reduce the validity of the data obtained.

Data analysis

Editing, coding, processing, and cleaning were done to maintain the quality of data. The data obtained were then analyzed using the critical ratio (CR) value in GeSCA software online version to develop structural models. This analysis consists of construct reliability, latent variable measurement indicators, and hypothesis testing. This research hypothesized that Mapalus and health behavior affect CAD.

RESULTS

In this section the model of CAD events is analyzed using general structured component analysis (GSCA) with the GeSCA online software.

The Evaluation of Structural Model Goodness-of-Fit Model

The Goodness-of-fit model is intended to find out whether the construct formed is appropriate (feasible) or not. There are some testing indexes in the GSCA analysis, i.e., Fit. AFit, GFI and SRMR. The criteria in using GFI indicate that if the value of the goodness of fit is ≥ the cutoff value (equal to 0.9), the construct formed is appropriate (good or good fit). The criteria for using SRMR state that if the value of the goodness of fit is ≤ the cutoff value (equal to 0.05), the construct formed is appropriate (good or good fit). The results of construct feasibility tests are summarized in Table 1.

Based on the summary it can be seen that the GFI value of 0.986 indicates that the value is greater than 0.9. This research model is declared feasible. Then the SRMR value of 0.042 indicates that the value is smaller than 0.05. This research model is declared feasible.

Hypothesis Testing

Hypothesis testing is intended to test whether there is a direct relationship between exogenous variables and endogenous variables. Hypothesis testing can be done through the value of the critical ratio (CR). The testing criteria state that if the critical ratio (CR) is marked with a star or the critical ratio (CR) ≥ t-table (t = 2.00, alpha = 5%), then there is a significant relationship between exogenous variables and endogenous variables. The results of the analysis can be found through the summaries in Table 2.

The relationship of Mapalus in the community with health behavior produces a critical ratio (CR) value of 5.030*. This shows that the value of the critical ratio (CR) is asterisked or (CR > t-table = 2.00, (alpha = 5%)). Therefore, it can be interpreted that there is a significant relationship between Mapalus in society and health behavior.

The Conversion Path Charts into Structural Models

The conversion of path diagrams into structural models is used to find out how the exogenous variables influence the endogenous variables as explained in this equation: BSEM = 0.498 MAP. From this equation, it can be seen that the Mapalus coefficient in the community towards healthy living behaviors of 0.498, indicates that Mapalus in society has a positive and significant relationship with the efforts to control CAD. This means that the higher the problem in the community, the healthier living behavior tends to improve.

Simultaneous Hypothesis Testing

Simultaneous hypothesis testing is used to determine whether there is a relationship between health behaviors, community bio-

Table 1. Results of construct feasibility analysis.

Model Fit	
FIT	0.660
GFI	0.986
SRMR	0.042

Table 2. Results of testing other Mapalus variable influences.

Exogen	Endogen	Path Coefficients	SE	CR
Mapalus	Health Behavior	0.498	0.099	5.030*

Table 3. Simultaneous testing results.

	Chi-square	df	Sig.
Full Model	52.498	5	0.000

Table 4. Results of goodness-of-fit test.

Chi-square	df	Sig.
2.462	8	0.963

Table 5. The coefficient of determination result.

Cox & Snell R Square	Nagelkerke R Square
0.712	0.287

Table 6. Results of partial hypothesis testing.

Independent Variables	B	Wald	Sig.	Odds Ratio
Health Behavior	-2.251	17.373	0.000	9.494
Constant	-1.754	-4.691	0.030	0.000

Table 7. Logistic regression empirical model.

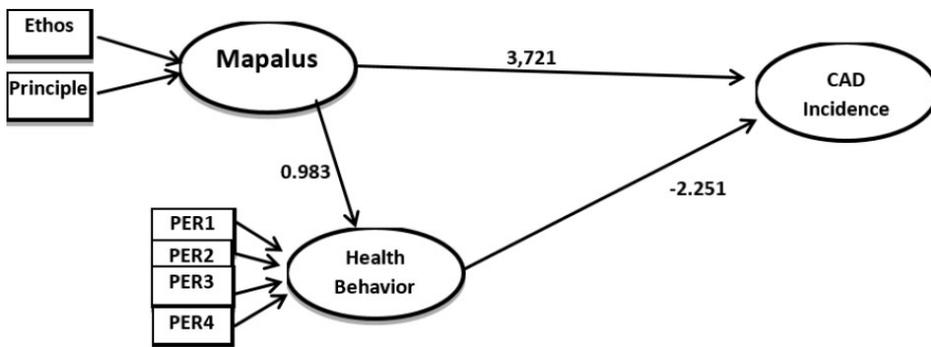| Relation			B	Odds Ratio
Health Behavior	☺	CAD incidence	-2.251	9.494
Constant	☺	CAD incidence	-1.754	0.000

Figure 1. Structural Model of Mapalus Relationships with CAD Incidence.

social-economic factors, health services, Mapalus and efforts to control CAD in the case of CAD events. Testing criteria state that if the probability is < level of significance (á) then there is a simultaneous significant relationship influence of health behavior on the incidence of CAD. The results of simultaneous hypothesis testing can be seen in Table 3.

The significance testing simultaneously produces a Chi-square value = 52.498 with a probability of 0.000. The test results show the probability < level of significance (á = 5%). This means that there is a simultaneous significant relationship between health behavior and the incidence of CAD.

Goodness-of-Fit Model

The goodness-of-fit model is used to determine the suitability of the model with its observational data, namely whether the regression model formed is capable of feasibly being used to predict the relationship between the independent variable and the dependent variable. The test criteria state that if the probability > level of significance (á) then the model is declared to be appropriate with the observation data. The results of the goodness-of-fit test can be seen in Table 4.

The test results listed in the table above obtained Chi-square test statistics of 2.462 with a probability of 0.963. The test results show that probability > level of significance (á = 5%), so that it can be stated that the formed model matches the observational data, and is capable of feasibly predicting the relationship between health behavior and the incidence of CAD.

Coefficient of Determination

The magnitude of contribution relationship between health behavior and the incidence of CAD can be found through its coefficient of determination (Nagelkerke R^2). The results of the coefficient of determination can be seen in Table 5.

The coefficient of determination (Nagelkerke R^2) was obtained at 0.287 or equal to 28.7%. This means that the contribution of the variable health behavior to the incidence of CAD is 28.7%.

Partial Hypothesis Testing

Partial hypothesis testing is used to determine whether there is a relationship between health behavior and the incidence of CAD. The test criteria state that if the probability is < level of significance (á) then there is a significant relationship. The results of partial hypothesis testing can be seen in Table 6.

The partial testing of the health behavior variable partially results in a Wald test statistic value of 17.373 with a probability of 0.000. The test results show the probability < level of significance (á = 5%). This means there is a partially significant relationship between health behavior and the incidence of CAD.

Empirical Model of Logistic Regression

The results of testing the relationship between health behavior and CAD events can be seen in Table 7.

The table above shows the following: The variable coefficient of health behavior is -2.251 with an OR of 9.494, and the results indicate that the variable of health

behavior relates to the negative and significant direction of the incidence of CAD. This means that the better the health behavior, the chance of CAD events is decreased by 9,494 times.

DISCUSSION

The following shows a structural model of the influence of Mapalus on CAD incidents in Minahasa ethnic communities (Figure 1).

The figure 1 explains that health behavior is related to a negative and significant direction of the incidence of CAD. This means that the better the health behavior, the more the chance of CAD incidence will decrease. Then, Mapalus is related to a positive and significant direction of the incidence of CAD. This means that the higher the Mapalus, the greater the chance of CAD incidence. Also, Mapalus in Minahasa ethnic communities is associated with a significant direction of the relationship between health behavior and the incidence of CAD. In addition, B values on the empirical logistic regression model were positive (+), which means Mapalus in Minahasa ethnic communities is able to strengthen the relationship of health behavior with the incidence of CAD.

A research by Nelwan et al. (2018) showed that Mapalus is a collaborative and helpful organization to be 11 such ethos, reciprocity, participation, solidarity, responsibility, cooperation, good leadership, discipline, transparency, equality and trust, and five principles, namely love, plurality, social justice, faith, and consultation. Also, Mapalus also develops from agriculture to other fields, such as social life, economy, government, and health. The Mapalus scope of space related to the health sector is particularly influential with the incidence of CAD based on the 16 values absorbed from ethos and Mapalus principles. Mapalus values still exist and are inherent in the life of the Minahasa community. Mapalus values that originate from the agricultural sector are currently still held by the Minahasa people, even though they have begun to shift along with shifting people's

livelihoods from agriculture to politics, government, social life, community, health, and others. This shift begins to occur when there is a migration of people from villages to the city. This causes the Minahasa people to adapt to the new environment, but these Mapalus values remain inherent in their lives.[14]

Mapalus, which was initially started by working together/cooperating/helping with opening/working on agricultural land, then shifted into cooperation/mutual assistance/helping in the community/ social life such as social gatherings in offices, religious organizations, community social organizations, and others. This is implemented through social gatherings, pain, and suffering. The Minahasa community is a religious society. This is implemented through the thanksgiving that is often carried out, such as thanksgiving for birthdays, weddings, new homes, class increases, promotions, moving home, graduating from kindergarten to college, recovering from illness, death, the third night after death, weekly (1 week after the family dies), 40 days (40 days after death) and others. This means that almost every week in the Minahasa area there is a thanksgiving service on Saturday and Sunday knew as a social work day (attending various thanksgiving events.[12]

The Minahasa community is a community that has high solidarity. It's nice if your brothers/neighbors are happy. So, when there is a Thanksgiving event, attendance at the event has become a necessity. This can even happen by attending two or three thanksgiving events in one day. Thanksgiving events can start at lunchtime and not end until midnight. Activities can include worship, eating together, singing together, dancing together, discussion, drinking together (mineral water, soft drinks, and captikus) and others. These are some examples of the implementation of Mapalus values in life-Minahasa community.[12]

Research results found by Nababan (2008) indicate that a smoker will suffer CAD 2.51 times more than nonsmokers. The results of research by Supriyono (2008) showed that the presence of smoking habits led to a 2.3 times greater occurrence of CAD among those below the age of 45 than among those who did not have a smoking habit. The risk of people with a smoking habit being affected by CAD is higher than for people who do not have a smoking habit.[15] This finding is in line with Kevin's (2012) study, which states that CAD risk is 3.23 times greater in people with a smoking habit than among nonsmokers.[16] This is confirmed by the research of Djunaidi (2014), which states that people with a smoking habit have a four to five times greater risk of getting CAD than people who do not have a smoking habit.[8]

Consuming large amounts of alcohol can damage the heart muscle and worsen other CAD risk factors. Men should not consume more than two alcoholic drinks in a day. Women should not consume more than one drink containing alcohol every day.[17] Whalley et al. (2011) also found that psychological symptoms are closely related to CAD, and many psychological treatments can minimize the incidence of CAD. The results of the study show that psychological thinking plays an important role in the modification of behavior.[18] Albus (2010) suggested that more than six decades of research have shown that social risk factors such as low socioeconomic status, lack of social support, stress in the workplace and family life, depression, anxiety, and hostility contribute both to CAD risk and clinical or prognostic patients. These factors can act as obstacles to medication compliance and efforts to increase living risk in the population. Also, various neurological mechanisms have been identified that are directly involved in the pathogenesis of CAD.[19]

Liu et al. (2012) said that maintaining life as long as the adult period is strongly associated with low cardiovascular disease risk in middle age. Individual efforts by community health organizations are needed to increase adoption and care in the lifestyle of young adults.[20] Also, Kim et al. (2013) said that higher life goals play an important role in protecting against heart attacks among adults who have CAD.[21]

One risk factor for CAD is a lack of physical activity. Based on research conducted by Patryani (2016), a lack of physical activity will increase the risk of CAD by 2.2 times. Regular physical activity or regular exercise can affect increasing blood flow and helping to solve fat metabolism and cholesterol.[22] Along with the research conducted by Ahda (2015), the proportion of physical activity that is lacking in respondents with CAD in Minangkabau ethnicity is higher than in respondents who are diligent in terms of physical activity, at 56% and 44%, respectively.[23] The results of Fajar's (2015) study based on basic health research data analysis (2013) indicated that physical activity could substantially reduce the risk of CAD because regular physical activity can control the risk of CAD caused by other CAD risk factors such as hypertension, high blood sugar levels, high cholesterol, and obesity.[24]

Based on the results of this study, appropriate measures are needed to prevent the occurrence of CAD. One of them is to stop smoking. Smoking is a major risk factor for CAD. Critchley and Capewell (2012) say that stopping smoking is a preventive measure against the occurrence of CAD.[25] Al-Delaimy (2013) suggests that there is a consensus that stopping smoking can reduce CAD risk and chronic respiratory disease from smoking.[26] Choi et al. (2013) suggested that modification of risk factors such as smoking is key to preventing subsequent CAD events after a heart attack.[27] Chow et al. (2010) suggested that adherence to behavioral changes (diet, exercise, and smoking cessation) after symptoms of acute CAD is associated with a lower likelihood of recurrent cardiovascular events. This finding shows that behavior modification must be given priority after the symptoms of CAD.[27]

Mapalus (working together/ cooperating) can reduce the effects of smoking and alcohol consumption by jointly campaigning for a life without cigarette smoke and alcohol. In addition, Mapalus (working together/cooperating) to not provide cigarettes and alcohol at every happy and sad event in Minahasa land. In addition, efforts are generally abbreviated as PATUH (in English COKSA), namely Check health regularly and follow doctor's advice, Overcome disease with proper and regular treatment, Keep a balanced diet, Strive for safe physical activity, and Avoid cigarette smoke, alcohol and carcinogenic substances.[28]

The limitation of this study is the lack of research and theory about mapalus and its relationship to health, especially coronary heart disease. This causes researchers to first conduct exploratory research (qualitative approach) to obtain a basic picture of the relationship between mapalus and health. The results of this study have been published in previous paper research.

CONCLUSION

The results of this study based on the structural model obtained indicate that Mapalus and health behavior are the causing factors of CAD. The higher the Mapalus and health behavior, the greater the chance of CAD occurrence. The impact of Mapalus and poor health behavior among Minahasa ethnic communities can increase the incidence of CAD. Thus, there is a need to take control over health behavior such as smoking habit, consuming alcohol and physical activity, among others.

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DISCLOSURES

Conflict of Interest

There is no conflict of interest in this journal publication between authors and any organizations or person that could influence the objectivity during the study, interpreting the result as well as during the writing of the manuscript.

Ethical Statement

This study was approved by Ethics Commission of the Faculty of Public Health, Universitas Sam Ratulangi, Manado, with number 170/EC-KEPK/IX/2018

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Author Contribution

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