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ORIGINAL ARTICLE

RISK FACTOR PROFILE AND ROLE OF CARDIOVASCULAR DISEASE OUTREACH PROGRAM BY EXPERTS IN RURAL COMMUNITIES: A PILOT STUDY IN MAGETAN REGENCY, INDONESIA

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ABSTRACT

Cardiovascular outreach programs and risk factors profiling have been regarded as key strategy in preventing and controlling cardiovascular diseases as the leading global causes of death worldwide, especially when being conducted by a professional. This pilot study aims to evaluate the effectiveness of a cardiovascular outreach program in Plaosan District, Magetan Regency, to improve knowledge and influence changes in the community's behavior related to cardiovascular risk factors. This study was conducted by providing educational interventions and profiling cardiovascular risk factors on 90 adults using consecutive sampling method. Health education was performed by experts and evaluated by pre-post tests before and after the material delivery. Statistical analysis was used to assess the relationship of risk factors that can contribute to cardiovascular disease. This study showed a significant increase in the participants' knowledge score after the intervention ($p = 0.007$). There were several risk factors for cardiovascular disease in the participants, with the highest risk prevalence being diabetes mellitus (33.33%). Six participants (6.67%) had abnormal electrocardiography results. In conclusion, our study showed a high prevalence of cardiovascular risk factors in rural communities and the importance of cardiovascular outreach programs by experts to improve the understanding of cardiovascular disease in a specific community.

Keywords: *Cardiovascular disease; risk factors; rural communities; socialization*

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INTRODUCTION

Cardiovascular diseases are the global leading cause of death, taking an estimated 17.9 million lives each year, representing 32% of all global deaths. More than three-quarters of CVD deaths occur in low- and middle-income nations (World Health Organization, 2021). Among these countries, Indonesia is the world's fourth most populous country, and it has undergone a rapid epidemiological change in terms of its current and projected illness burden due to improvements in the country's economic development. While the existing burden of communicable diseases is a serious problem in Indonesia, the burden of non-communicable diseases has emerged as a major public health concern (Hussain et al., 2016). Cardiovascular diseases (CVD) accounts for almost one-third of all deaths in Indonesia, with stroke and coronary heart diseases (CHD) being the major causes of death (The Institute for Health Metrics and Evaluation, 2019). The mortality rate of cardiovascular diseases in Indonesia is even the third highest in ASEAN, after Laos and the Philippines (Indonesian Ministry of Health, 2021). Heart diseases also absorb the most budget for this country's health insurance, with 11.5 million cases and a budget of more than Rp. 8.2 trillion or around $488,502 USD (Indonesian Ministry of Health, 2022). Moreover, cardiovascular diseases can also reduce the quality of life due to depression, physical limitations, and poorer physical functioning and general health (Bahall et al., 2020). Therefore, Indonesia became the country with the globe's second-largest decrease in quality of life due to cardiovascular diseases in 2018 (Uli et al., 2020).

Primary care plays an important role in preventing and treating cardiovascular diseases. The Indonesian Ministry of Health calls for strengthening primary care to address the problem of cardiovascular diseases in Indonesia through population education, primary prevention, secondary prevention, and the capacity and capability improvemnet of primary care (Indonesian Ministry of Health, 2022). Primary care may mitigate the negative health effects of economic disparity on health and mortality, particularly in areas with the largest income inequality. However, there are significant inequalities between rural and urban communities regarding health access and utilization (Basu, 2022). These can cause a higher risk and mortality of cardiovascular diseases in rural areas compared to urban areas. In other countries, such as the United States, the prevalence of cardiovascular disease is also 40% higher in rural compared to urban areas, a gap that has grown over the past decade (Harrington et al., 2020).

Magetan Regency is a rural district in Indonesia, located on the slopes of Mount Lawu and near the border between East Java and Central Java. Data from the Magetan Regency Health Office in 2022 found that in just four months, the number of people with hypertension in Magetan reached 211,762. According to the 2020 data, the achievement of health services in Magetan Regency for people with hypertension was just 56%, which was much lower than the target attainment. The low public awareness and the high incidence of cardiovascular diseases in the partner area can reduce the community's productivity (Health Department of Magetan Regency, 2021b, 2021a).

Various lifestyle-related factors trigger the emergence of cardiovascular diseases, including smoking, diabetes mellitus, obesity, and hypertension (Messner & Bernhard, 2014; Wahyuni et al., 2022). When compared to urban areas, rural areas have a much higher prevalence of uncontrolled traditional cardiovascular risk factors. Rural populations are much older than urban and suburban populations. They also have a higher prevalence of diabetes, obesity, and hypertension (Harrington et al., 2020). However, the burden of these risk factors in rural areas in Indonesia remains unknown. Furthermore, health promotion to improve community understanding and socialization programs related to the risk of acquiring cardiovascular disease in rural communities must be promoted and evaluated. A previous study has found that comprehensive programs of cardiovascular disease risk reduction delivered by nurse practitioner/community health worker (NP/CHW) teams were more effective in improving lipids, blood pressure, glycated hemoglobin (HbA1c), and patients' perceptions of the quality of their chronic illness care in urban community health centers compared to enhanced usual care (EUC) (Allen et al., 2011). Several clinics in several countries have also adopted the cardiovascular outreach program principle by enabling cardiologist to counsel to the communities (Columbia University, 2024; Mayo Foundation for Medical Education and Research (MFMER), 2024). A cardiovascular outreach program by a cardiologist could provide earlier diagnosis and treatment as an important determinant of outcomes in various cardiovascular diseases (van Deventer et al., 2017).

Therefore, this pilot study aimed to analyze cardiovascular disease risk and conduct an educational intervention for rural communities in Plaosan District, Magetan Regency, Indonesia through a cardiovascular outreach program performed by a cardiologist and several clinicians. This way, researchers could lower the burden of cardiovascular disease in Indonesia, particularly in high-risk areas.

METHOD

Study design

The study was an analytic observational pilot study assessing the profile of risk factors and the role of cardiovascular outreach programs by experts in rural communities in Plaosan District, Magetan Regency, Indonesia. This study used a combination of cross-sectional and intervention study design. This study was conducted in July 2023. In total, ninety participants of villagers from Plaosan District, Magetan Regency, East Java, Indonesia, were included in this study.

Sample criteria

This study applied consecutive sampling with sample size calculation following the Lemeshow formula (Lwanga & Lemeshow, 1991): $n = \frac{Z^2_{1-\alpha/2} \times P(1-P)}{d^2}$ with Z for 0.05 significance, d = 0.1, and P = 0.29 based on previous research regarding the proportion of high CVD risk in Indonesian population (Maharani et al., 2019). From the equation, researchers obtained 79 as the minimum sample size. Researchers added the sample until 90 to prevent missing data and to add the publication's power.

The inclusion criteria of the samples were villagers in Plaosan District, Magetan Regency, Indonesia, who were: (1) adults (more than 20 years old); (2) reachable by primary health care center; (3) willing to fully participate in the socialization program and attentively listen to the experts' explanations. The exclusion criteria were: (1) Immobile or disabled individuals; (2) Hospitalized or having severe diseases; and (3) having difficulties in writing the answers for knowledge scores.

Intervention program

Two experts in cardiology and metabolic disorders delivered the intervention outreach program. The materials were modified for civilians and adapted to the conditions of the community in the region. Training and counseling were

carried out by clinicians who also acted as the faculty staff of Universitas Airlangga, collaborating with the Head of Plaosan Community Health Center. The materials were given in the local language (Javanese). Each speaker brought a different material. The first speaker brought material on cardiovascular diseases for common people, including an overview of cardiovascular disease, risk factors, early detection, danger signs, and treatment. The second speaker delivered material on metabolic syndrome and how to maintain a healthy lifestyle and diet. This material was disseminated at the same place (Plaosan Health Center) and at a similar time. The duration of the presentation delivered by each speaker was one hour. There were no intersections of the material presented by the two experts. After submitting the entire material, there was a ten-minute discussion and question-and-answer session. The media used by the speaker were lectures, videos, Power Point presentations, and educational books. Before submission of the material, a pre-test was conducted and after submission, a post-test was carried out to measure the participant's knowledge.

Data Collection

The clinicians of Universitas Airlangga collected data involving physicians, nurses, and staff of Plaosan Health Center. Physical examinations were performed on participants to get the following information: weight, height, abdominal circumference, and blood pressure. The blood pressure was measured using a digital sphygmomanometer (Omron, Japan). Body mass index (BMI) was calculated from weight (kg)/height $(m)^2$. Researchers used the World Health Organization (WHO) classification for obesity, which categorized the participant as Obese if the BMI ≧30 kg/m^2, overweight if the BMI ≧ 25 kg/m^2 but < 30 kg/m2, and normal if the BMI is between 18.5-24.9 kg/m^2 (World Health Organization, 2024). Abdominal obesity was defined as abdominal circumference > 80 cm for women and > 90 cm for men (Dhawan & Sharma, 2020). A baseline laboratory examination was performed on a blood sample to measure fasting blood glucose, low-density lipoprotein (LDL), and triacylglycerol (TG). A serum creatinine test was used to measure kidney function. Laboratory measurement was measured in a private laboratory. An electrocardiogram (BTL 08 12 channel) was used to record the electrical activity of the heart, which is useful in detecting arrhythmia, conduction disorders, and ischemia (lack of blood flow to the heart). All the tools to obtain data had been calibrated so that health devices could work accurately and precisely.

Each respondent was provided a questionnaire before and after the intervention to measure their knowledge regarding cardiovascular disease as what had been delivered in the program. The questionnaire consisted of ten questions with a total score of 100. The questionnaire was developed by two experts in cardiology and metabolic disorders. The questions were developed based on the educational source of the Indonesian Ministry of Health regarding cardiovascular diseases (Indonesian Ministry of Health, 2023) and guidelines from the American Heart Association (Virani et al., 2023). The questionnaire had ten questions: (1) Which disease is the most common cause of death worldwide? (2) Which one is the risk factor of coronary heart disease? (3) What is the target of blood pressure control in hypertension? (4) What are the symptoms of coronary heart disease? (5) How can we diagnose coronary heart disease? (6) What should we do first when we face a patient with coronary heart disease? (7) What is the recommended frequency of physical activity daily? (8) Which is the recommended food for preventing cardiovascular disease? (9) Which one is the complication of coronary heart disease? and (10) In which body part is obesity primarily associated with metabolic disease? Researchers also gathered information from the patients, including gender, age, ethnicity, history of diseases (hypertension, diabetes mellitus, and coronary heart disease), family history of diseases, frequency of physical activity, smoking habits, and food consumption. Quality assurance was accomplished by supervising the data collection process, data extraction, data entry to the software, and data analysis.

Data Analysis

Data were analyzed using the SPSS statistics software, version 26 (IBM Corp, Armonk, NY, USA), and GraphPad Prism version 9.1.1 (GraphPad Software, Inc, California, USA). Cardiovascular disease risk factors were analyzed using frequencies and percentages for categorical data, and mean ± standard deviation for numerical data. Correlations between the risk factors were analyzed using the Pearson correlation coefficient test. A Chi-Square test was applied to find significant differences among the risk factors between males and females. Mann-Whitney test determined a significant difference in LDL levels between diabetes mellitus and non-diabetic participants. The knowledge scores (before/pre-test and after/post-test socialization) were analyzed using the Wilcoxon sign-ranked test to evaluate the effectiveness of the socialization program. A p-value of less than 0.05 was considered significant.

Ethical consideration

The ethics committee of Faculty of Medicine, Universitas Airlangga, Indonesia has ethically approved this study, with ethical clearance number 196/EC/KEPK/FKUA/2023. All individuals who agreed to participate in this study were provided a comprehensive explanation of the study before it commenced, and written informed consent was obtained from all subjects who agreed to participate.

RESULT

This study involved 90 participants from the Plaosan District, Magetan Regency, Indonesia. The basic characteristics of the participants are displayed in Table 1. Most of the participants were female (78.9%) and elderly (52.22%). The participants ranged from 29 – 85 years, with a mean age of 60.43±10.35 years. Most participants were at a higher risk of cardiovascular disease, with risk factors including obese/overweight (61.1%), abdominal obesity (80%), hypertension (65.56%), previous history of hypertension (57.8%), family history of hypertension (56.7%), physical activity less than two times in a week (64.5%), fried food consumption (81.1%), and hypertriglyceridemia (55.56%).

Table 1. Categorical data for characteristics of the participants

Characteristics	f (%)
Gender	
Male	19 (21.1)
Female	71 (78.9)
Age (years)	
<60	43 (47.79)
≧60	47 (52.22)
Obesity	
No	35 (38.9)
Overweight	33 (36.7)
Obese	22 (24.4)
Abdominal obesity	
Yes	72 (80)
No	18 (20)

Characteristics	f (%)
Diabetes mellitus	
Yes	30 (33.3)
No	60 (66.7)
Previous history of diabetes mellitus	
Yes	17 (18.9)
No	73 (81.1)
Family history of diabetes mellitus	
Yes	22 (24.4)
No	68 (75.6)
Hypertension	
Yes	59 (65.56)
No	31 (34.44)
Previous history of hypertension	
Yes	52 (57.8)
No	38 (42.2)
Family history of hypertension	
Yes	51 (56.7)
No	39 (43.3)
History of coronary heart disease	
Yes	4 (4.4)
No	86 (95.6)
Family history of coronary heart disease	
Yes	3 (3.3)
No	87 (96.7)
Physical activity more than 30 minutes/day	
Never/Rarely	8 (8.9)
1x/week	50 (55.6)
2 – 3x/week	24 (26.7)
>3x/week	8 (8.9)
Smoking	
Never	81 (90)
2-3 pieces/day	2 (2.22)
>3 pieces/day	7 (7.78)
Fried foods consumption	
Yes	73 (81.1)
No	17 (18.9)
Fruit and vegetable consumption	
Yes	88 (97.8)
No	2 (2.2)
High LDL levels	
Yes	23 (25.56)
No	67 (74.44)
Hypertriglyceridemia	
Yes	50 (55.56)
No	40 (44.44)
High serum creatinine	
Yes	8 (8.89)
No	82 (91.11)
Abnormal ECG	
Yes	6 (6.67)
No	84 (93.33)

There were also several risk factors found in the participants that must be taken into precautions which provided in Table 2, including diabetes mellitus (33.33%), previous history of diabetes mellitus (18.9%), family history of diabetes mellitus (24.4%), history of coronary heart disease (4.4%), family history of coronary heart disease (3.3%), smoking (10%), low fruit and vegetable consumption (2.2%), high LDL levels (25.56%), fried food consumption (81.1%), high serum creatinine (8.89%), and abnormal ECG (6.67%).

Table 2. Numeric data for risk factors of cardiovascular disease of the participants

Risk factors of CVD	Mean ± SD
Age (year)	60.43 (10.35)
BMI	26.64 (4.69)
Fasting blood glucose (mg/dL)	135.66 (56.27)
Systolic BP (mmHg)	148.74 (24.56)
Diastolic BP (mmHg)	86.21 (11.87)
LDL levels (mg/dL)	120.51 (43.26)
TG levels (mg/dL)	196.7 (94.90)
Serum creatinine levels (mg/dL)	0.81 (0.28)

This study found six participants with abnormal ECG, as shown in Table 3. Two participants had right axis deviation, two had complete left bundle branch block, and two had anteroseptal old myocardial infarction. Only one patient had a heart rhythm dysfunction, specifically atrial fibrillation.

Table 3. Abnormal ECG found in the participants

Case number	Abnormal ECG found
1	Right axis deviation, complete right bundle branch block
2	Left axis deviation, slow R wave V1 – V4, complete left bundle branch block
3	Anteroseptal old myocardial infarction, complete left bundle branch block
4	Sinus tachycardia, right axis deviation, inferior anterolateral ischemia
5	Anteroseptal old myocardial infarction
6	Atrial fibrillation

When comparing males and females, some variables with significant differences were provided in Table 4. There was a higher percentage of participants with abdominal obesity in females compared to males (85.92% and 57.90%, respectively, with $p = 0.02$). There was a significantly higher risk of diabetes mellitus in male compared to female participants ($p = 0.045$). Male participants had more history of previous diabetes mellitus (42.1% and 12.67%, respectively, with $p = 0.007$). Almost half of the male participants (44.44%) were smokers, while none of the female participants were smoking ($p < 0.0001$).

Table 4. Comparison between risk factors of CVD between males and females

Risk factors of CVD	Males, n (%)	Females, n (%)	p-value
Obese/overweight	12 (63.16)	43 (60.56)	0.469
Abdominal obesity	11 (57.90)	61 (85.92)	0.02*
Diabetes mellitus	10 (52.63)	20 (28.17)	0.045*
Previous history of diabetes mellitus	8 (42.1)	9 (12.67)	0.007*
Family history of diabetes mellitus	5 (26.32)	17 (23.94)	1.000
Hypertension	9 (50)	50 (70.42)	0.102
Previous history of hypertension	9 (47.37)	43 (60.56)	0.301
Family history of hypertension	11 (57.90)	40 (56.34)	0.903
History of coronary heart disease	2 (10.53)	2 (2.82)	0.195
Family history of coronary heart disease	0 (0)	3 (4.23)	1.000

Risk factors of CVD	Males, n (%)	Females, n (%)	p-value
Smoking	9 (47.37)	0 (0)	< 0.0001*
Fatty foods consumption	17 (89.47)	56 (78.87)	0.509
Fruit and vegetable consumption	19 (100)	69 (97.18)	1.000
High LDL levels	4 (21.05)	19 (26.76)	0.771
Hypertriglyceridemia	12 (63.16)	38 (53.52)	0.453
High serum creatinine	1 (5.26)	7 (9.86)	1.000
Abnormal ECG	1 (5.26)	4 (5.63)	1.000

**significant at p <0.05*

After analyzing the participants' risk factors for cardiovascular diseases, researchers found several significant correlations between those variables, including between LDL and TG, BMI and systolic BP, LDL levels and abdominal circumference, and diastolic BP and abdominal circumference. All of the correlations were in the positive direction and had weak power.

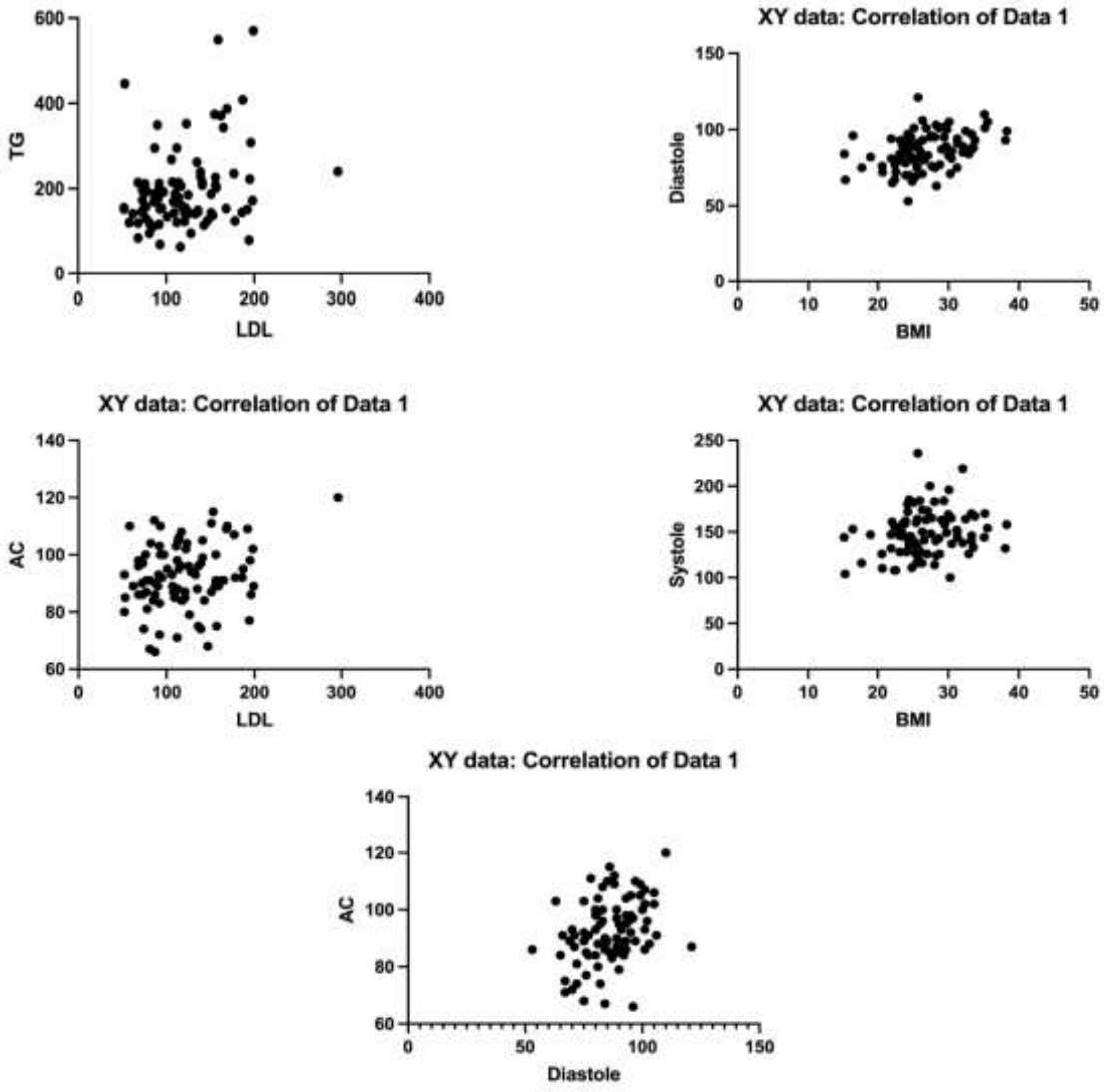

Figure 1. Correlations between risk factors of cardiovascular disease with Pearson analysis between (a) LDL and TG levels; (b) BMI and diastolic BP; (c) BMI and systolic BP; (d) LDL levels and abdominal circumference; (e) diastolic BP and abdominal circumference

Researchers also found higher TG levels in participants with diabetes mellitus (240.63 ± 125.49 mg/dL) compared to participants without diabetes mellitus (174.73 ± 66.13 mg/dL) with a p-value of 0.014.

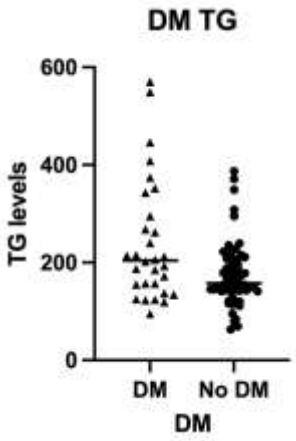

Figure 2. Comparison of TG levels between participants with and without diabetes mellitus

The average knowledge scores of the participants before and after the socialization program shown in Table 5. Overall, there was a significant increase in the post-socialization knowledge score (66.32 ± 18.75) compared to the pre-socialization knowledge score (59.61 ± 23.8), with a p-value of 0.007. The increase in the knowledge score was not different significantly between males and females.

Table 5. Pre-test score and post-test score of coronary heart disease knowledge

Knowledge	Mean ± SD	p-value
Pre-test	59.61 ± 23.8	0.007*
Post-test	66.32 ± 18.75	

**significant at p <0.05*

DISCUSSION

In Indonesia, CVDs account for one-third of all fatalities and are the main cause of morbidity and mortality (Hussain et al., 2016; Maharani et al., 2019). In the present study, researchers conducted research in a rural area of Plaosan District, Magetan Regency, East Java, Indonesia. Researchers discovered that most participants had a higher risk of CVD, defined as the presence of several CVD risk factors in a high percentage, both traditional and non-traditional. Among traditional CVD risk factors, abdominal obesity, hypertension, obesity/overweight, and hypertriglyceridemia were the highest percentage (80%, 65,56%, 61,1%, and 55.56%, respectively).

A prior study conducted in a Malang district, Indonesia, discovered a high incidence of CVD risk factors in rural communities. It is shown that the prevalence of the CVD risk factors is quite high in rural areas (26.2%, CI 25.2-27.2%) (Maharani et al., 2019). Other studies also stated that CVD mortality rate was higher in rural areas (Basu, 2022; Cross et al., 2020; Lindroth et al., 2014). A combination of high incidence of cardiovascular disease risk factors, limited access to healthcare, and demographic shifts are likely contributing to this condition (Cross et al., 2020; Harrington et al., 2020). In our study, abdominal obesity was found in the majority of participants. High waist circumference (WC) as a measure of abdominal obesity, is more accurately reflects visceral fat rather than BMI and is significantly related to CVDs and is predictive of mortality (Powell-Wiley et al., 2021; Sahakyan et al., 2015). Researchers also obtained a high prevalence of fried food consumption habits (81.1%). In Indonesia, fried foods are very widely consumed, such as fried snacks (“gorengan”), fried meat, or even fried rice (UNICEF, 2018). In a meta-analysis, fried foods significantly increase major cardiovascular events, cardiovascular diseases, and mortality (Qin et al., 2021).

Hypertension has a high prevalence of exposure and is associated with the strongest evidence for causation in CVDs (Fuchs & Whelton, 2020; Kjeldsen, 2018). In our study, hypertension was also found in high occurrence, followed by obesity/overweight and hypertriglyceridemia. This finding is accordance with Hussain et al. (2016) that obtained the prevalence of each risk factor specific to sex and to two age categories (<55 and ≥55 years) using summary statistics from a national survey in Indonesia and found that hypertension was the leading risk factor. It counts for one-third of all CHD and half of all strokes in both younger and older age groups and 20% to 25% of all CHD, and 36% to 42% of all strokes in both gender. A similar finding was also found in another study, where hypertension was found to be the most common cardiovascular risk factor (55.8%), followed by obesity (14.4%) (Hussain et al., 2016; Maharani et al., 2019). Intriguingly, the geographical area of this study is mountainous. Magetan district is a part of Lawu Mountain, located between East Java and Middle Java Provinces, Indonesia. The high prevalence of CVD risk factors in this study could be attributed to inconvenient transportation and low socioeconomic status in mountainous area. While the sick stayed home, many disease-free laborers relocated from mountainous to plain areas. Another reason could be that the lower medical and educational standards in mountainous regions resulted in a decreased awareness of CVD risk factors. Therefore, a lesser level of awareness, treatment, and control over CVD risk factors in mountainous areas may make the epidemic of CVD worse (He et al., 2012).

The prevalence of cardiovascular risk factors, such as high blood pressure, high cholesterol, obesity, smoking, and lack of physical activity, are frequently close related to certain lifestyle and environmental factors (Pintaningrum et al., 2020). Some reasons are unhealthy eating patterns, such as eating foods high in saturated fats, added sugar, and sodium can lead to increased blood pressure, high cholesterol, and obesity. Lack of physical activity, like a less active lifestyle, can lead to accumulated fat, decreased heart muscle strength, and increased risk of obesity. All of which are major risk factors for cardiovascular disease. According to Kim et al. (2023), the risk of developing CVD is related to the following risk factors: hypertension (aHR = 1.96 (1.86–2.07)), smoking (aHR = 1.52 (1.45–1.59)), diabetes mellitus (aHR = 1.93 (1.77–2.10)), lack of physical activity (aHR = 1.08 (1.02–1.14)), hypercholesterolemia (aHR = 1.60 (1.51–1.69)), and obesity (BMI ≥25 kg/m2) (aHR = 1.33 (1.28–1.39)) (Kim et al., 2023), all of which were present in our study. Smoking can also cause vascular damage, increased blood pressure, and increased risk of blood clotting, all of which raise the risk of heart disease and stroke. Cigarettes contain detrimental toxins due to the presence of carbon monoxide content in cigarette smoke. Carbon monoxides could enter the bloodstream, further causing blood pressure to rise. Thus, the heart must pump quickly to provide enough oxygen for the body (Marhabatsar & Sijid, 2021). In addition, the harmful substances of cigarettes can cause blood clotting, resulting in the occurrence of hypertension. Moreover, chronic stress can trigger the release of stress hormones such as cortisol and epinephrine, raising blood pressure and disrupting

cardiovascular balance. Stress can also trigger hypertension due to increased sympathetic nerve activity, which can increase blood pressure intermittently (Herawati et al., 2020). This condition requires intervention strategies to reduce cardiovascular risk. Some programs can help raise public awareness of cardiovascular risk factors and change their behavior to start leading a healthier lifestyle (Arumsari et al., 2023). Outreach programs could promote vulnerable populations' health depending on the particulars of the given health project and community through strong connections between health professionals and community residents (Shin et al., 2020).

In this study, there were significant differences in several variables when comparing men and women. In the prevalence of abdominal obesity, women was higher than men (85.92% vs. 57.90%, p = 0.02). In general, there is a tendency for women to have higher levels of abdominal obesity than men, which is consistent with a previous study (Meng-na et al., 2018). A higher prevalence of obesity can be found in women due to the differences in physical activity level and energy intake between men and women. Women have greater risk of central obesity due to post-pregnancy weight gain and hormonal fluctuations during menopause through body fat distribution changes from the periphery to the abdominal area (Azkia & Miko Wahyono, 2019). Men and women have different fat metabolisms, with women have a higher fat mass rate. (Khosama et al., 2016). Furthermore, the elevated risk factors of central obesity in women are linked to lifestyle factors such as the habit of eating meals high in fat and carbohydrates. This finding is supported by research by Ticoalu et al. (Ticoalu, Wongkar, & Pasiak, 2015) that consuming sweetened foods and beverages, high-fat foods, low vegetable and fruit intake can cause degenerative diseases. Sweetened and fatty foods could increase body weight and abdominal circumference. This association is thought to be due to a combination of fatty and sweet foods. Excessive consumption of sweet and fat foods can also contribute to the energy stored as fat in the body, thereby increasing the risk of central obesity (Adwinda & Srimiati, 2019). For day-to-day activities, women tend to do very minimal physical activity and burn only a few calories, which can increase the risk of central obesity. In the countryside, people tend to be more sedentary because of the lack of sports facilities. Women busy with work, household tasks, and caring for children tend to have more limited time to exercise and cook healthy food (Ticoalu, Wongkar, & Pasiak, 2015). There are notable gender disparities in the upstream factors that contribute to obesity, such as the social and biological determinants, notwithstanding the complexity of the problem. Further justifications for the observed gender differences regarding obesity can be influenced by physical activity levels, social views, biological variables, and the extent of urbanization, especially in developing countries (Prasad et al., 2020).

Besides hormonal factors, women tend to have a different response to stress than men, which can affect the tendency to eat emotionally and unhealthy diets. Chronic stress can increase cortisol hormone level, which has been associated with increased fat accumulation in the abdominal area. Stress and depression have been linked to two inclinations that result in uncontrollable eating or binge eating. (Badriyah & Sitepu, 2020; Gluck et al., 2004). In addition, social factors such as social norms, pressure from the media, and traditional gender roles can affect a woman's diet and level of physical activity. Women frequently face pressure to maintain a weight that matches an ideal body image, leading to unhealthy diet practices and a lack of physical activity (Mills et al., 2022). The high risk of central obesity that occurs in women can be overcome and prevented by designing the effective intervention strategies such as health education programs that strengthen an understanding of the importance of healthy lifestyles, including a balanced diet and regular physical activity that can help reduce the risk of central obesity.

On the other hand, men had a significantly higher risk of diabetes mellitus (p = 0.045), and more had a previous history of diabetes mellitus than women (42.1% vs. 12.67%, p = 0.007). This finding could be due to the stronger anti-inflammatory immune profile in women and the presence of Estrogen as an antioxidant and cardioprotector (Peters et al., 2019; Xiang et al., 2021). In our study, most men (44.44%) were smokers, while none of the women smoked (p < 0.0001). In Indonesia, associations between smoking and masculinity are deeply ingrained and can be traced back to the colonial influences of Dutch society in the seventeenth century. Numerous advertising in Indonesia that promote smoking as a socially acceptable habit and a way to build masculinity have exacerbated this issue (Kodriati et al., 2020). In contrast, smoking women in Indonesia are regarded as taboo, naughty, wild, and rogue (Pravitriani et al., 2022).

Our findings showed that there was a correlation between LDL and TG levels. LDL is more vulnerable to oxidation and has a greater endothelial cell adhesion because of its small size. It is also significantly linked to an accelerated progression of atherosclerosis. Although LDL is known to be connected with TG levels, it is not often linked to the development of atherosclerosis. Theoretically, the quantity of LDL particles may rise in tandem with TG levels, especially when LDL levels are elevated (Hori et al., 2021). Researchers also found a correlation between BMI and BP in subgroups of untreated hypertensive patient in China (Linderman et al., 2018). BP may be directly impacted by BMI, regardless of other clinical risk factors (Landi et al., 2018; Wang et al., 2020). Furthermore, researchers have also discovered that abdominal circumference and diastolic BP showed a positive correlation. Taken together, BMI and waist circumference may influence the BP. It has been demonstrated that inflammatory processes are crucial to the pathophysiology of hypertension (Caillon et al., 2019; Landi et al., 2018). Fat cells have the ability to create huge amounts of inflammatory cytokines and are sensitive to lipolysis (Landi et al., 2018).

In this study, as a part of a holistic cardiovascular outreach program, researchers also used local language to socialize with the targeted rural community. There was a significant increase in participants' knowledge scores after attending the socialization program (p = 0.007). Cardiovascular disease (CVD) risk factors are a significant problem in rural Indonesia. There is a demand for community-based interventions and education programs focusing on local situations, tailoring medical guidelines to existing resources, and involving government to address the burden of CVD in Indonesia, especially in resource-limited rural areas. This condition is crucial for reducing CVD risk and improving cardiovascular health in rural regions (Adisasmito et al., 2020). Aside from restricted health access and demography, another likely contributor to the high prevalence of CVD risk factors in rural areas is the level of education. Previous studies have shown that individuals who only have primary school education and live in rural and inland areas have higher CVD risk factors than those who live in urban areas and have higher education levels. Unhealthy lifestyles in rural areas may increase CVD risk factors (Lindroth et al., 2014). To corroborate these findings, lower education in rural areas may inevitably

become a factor that increases or mediates this risk. According to Rosjidi (2018), the prevalence rate of coronary heart disease is higher among people with low levels of education or who do not attend school (Rosjidi et al., 2018). Moreover, researchers depicted that the pre-test results reflecting the participants' knowledge before the socialization program were low. This is directly related to our findings that many residents of the Plaosan District have risk factors for CVD. Therefore, health promotion and prevention are crucial to prevent and reduce the burden of CVD in rural communities. Community-based approaches are important in health promotion and prevention strategies, especially in rural areas (Glenn et al., 2020). Several previous studies had shown the benefits of health education to improve participants' knowledge regarding hypertension in Indonesia (Ulya, Iskandar, and Asih, 2017; Rofacki & Aini, 2015; Yuwono, Ilham, & Hanafi, 2017; Sudiarto, Wijayanti, & Sumedi, 2007). However, in our current study, we did not only involve hypertension but also other CVD risk factors in general.

While the study provides essential insights into CVD risk factors in the rural area of Plaosan District, Magetan Regency, Indonesia, it should be emphasized that aside from the environment, different ethnicity and genetics could also affect cardiovascular disease risk in different populations (Susilo, Pikir, et al., 2022; Susilo, Thaha, et al., 2022). The effectiveness of a community outreach program can also be different according to the population (Lott, 2008). Therefore, socialization and personal approach should also be delivered according with the local language. Overall, the results of this study show the importance of profiling CVD risk factors in rural areas and the benefits of community service programs in rural areas to improve the participants' knowledge regarding CVD. Previously, a study by Arifin et al (2022) described chronic disease risk factors in rural areas in Indonesia. However, in this study researchers analyzed risk factors and performed socialization, diagnosis, and early detection of cardiovascular diseases using cardiovascular outreach program, which specialists delivered. Researchers also adapted the communication strategies using the Javanese language to the community around the Plaosan district, Magetan Regency, Indonesia. Researchers also conducted a pre-test and post-test to determine the effectiveness of the socialization of the given material, which was not performed by the previous study, since the previous was qualitative. Moreover, researchers performed a comprehensive test for early examination and detection of cardiovascular diseases, including blood pressure, weight and height tests to measure BMI, LDL and TG cholesterol, fasting blood sugar, ECG, serum creatinine, and abdominal circumference. Researchers also provided a personal counseling for participants with abnormal ECGs. A cardiologist and several professional clinicians conducted all of the program.

Nevertheless, several limitations should be considered when assessing the data's relevance. Although this current study was conducted in very homogeneous communities, researchers did not perform multivariate analysis in this study. Therefore, it could be a potential source of bias in our research results. all of which potentially increase CVD risk. Conventional risk factors including hypertension, smoking, and diabetes affect women differently than men. (Johnson et al., 2021). In addition, there are risk factors unique to women, such as hypertensive disorders during pregnancy, preeclampsia, gestational diabetes mellitus, a preterm or low-birth-weight infant delivery, and premature menopause (age < 40 years) that should also be considered to refine CVD risk assessment based on gender (Grundy et al., 2019). The prevalence of CVD risk factors and CVD-related deaths in women under the age of 65 years is known to have increased in the last two decades (Ritchey et al., 2020). There are also disparities in diagnosis, treatment, and management of CVD in women in which guideline-directed medical treatment and rehabilitation are underutilized (Johnson et al., 2021). Unrepresentativeness of women in CVD clinical trials regarding novel therapies, devices and other interventions further contribute to these disparities (Steinberg et al., 2021). Age should also be considered in assessing CVD risk factors. The incidence of CAD rises with age, with multiple-vessel CAD more common in those over 75. Race has an impact on the occurrence of CAD as well; the White population has the lowest rate (3.2%), followed by Black men (5.7%), Hispanics (5%), black women (5.2%) and black men (5.7%) (Santos et al., 2023). A 2-year follow-up research conducted by Meadows et al. (2011) shows that the CVD death rate is higher in black people (6.1%) compared with other ethnic/racial groups (3.9%; $p = 0.1$), including Indonesia (Meadows et al., 2011). Nonetheless, there is no data or research results comparing the influence of different ethnic or tribes in Indonesia on CVD risk factors, which could be an upcoming research opportunity. In addition, this study was conducted in only one regency with a mountainous area. Different landscapes such as coastal or lowland areas could bear different results, affected by ethnicity, food consumption habits, or physical activities. However, this study is representative of Indonesian rural areas, and supports previous findings' validity. Moreover, an effective outreach program should be specified and tailored for each community (Rozhkov et al., 2023). Researchers have adopted the delivery method using the local language and personal approach to make it more effective.

CONCLUSION

In conclusion, this study showed that rural communities in Plaosan District, Magetan Regency, Indonesia had a high prevalence of cardiovascular disease risks, including obesity, hypertension, diabetes mellitus, and dyslipidemia. Researchers also discovered that a cardiovascular outreach program by experts could effectively increase participants' knowledge of cardiovascular disease. Hopefully, the results of this pilot research would be a basis for further research to provide a deeper approach of cardiovascular outreach programs from cardiologists and professional clinicians to do case mapping, personalized counseling, and follow-up findings of cardiovascular disease in another ethnicity and population.

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