**Risk Factors Related to Recurrence Rates of Acute Coronary Syndrome in Pakraman and Non-Pakraman Villages in Bali Province**

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**Abstract**  
The prevalence of Acute Coronary Syndrome (ACS) is increasing in both developed and developing countries. Uncontrolled risk factors such as smoking, hypertension, and fewer activities are the main causes of ACS recurrence within 30 days after the acute presentation. This study aims to analyze risk factors related to the recurrence rate of ACS patients in Pakraman and non-Pakraman villages in Buleleng Regency, Bali Province. Observational analytics with Cross-Sectional Study are used in this study involving 130 patients within 1 month. Data is collected through two (2) stages using a questionnaire. The bivariate analysis shows that both smoking groups \((p = 0.003, p = 0.008)\) and hypertension groups \((p = 0.02, p = 0.01)\) are associated with ACS recurrence, while physical activity groups are not related \((p = 0.455, p = 0.565)\). Logistic regression results show that smoking \((5.633)\) is highly associated with ACS recurrence in Pakraman villages, while hypertension \((4.784)\) is highly associated with ACS recurrence in non-Pakraman villages. ACS handling is important in the acute period and in the long-term to prevent the risk of recurrence.

**Introduction**  
The prevalence of Acute Coronary Syndrome (ACS) is increasing in both developed and developing countries. This is related to the latest current trend, where non-communicable diseases are the main cause of death globally (WHO, 2013). In Indonesia, especially in Bali, ACS is increasing every year. Based on the Hospital of Buleleng’s medical records from 2016 to 2018, the number of Coronary Artery Disease (CAD) patients was 963, 993, and 412 patients as of June 2018. In addition to the prevalence of new patients, the recurrence rate of ACS is also high. In 2016, 209 patients out of 963 patients with ACS were sent back to the hospital with the same diagnosis or Acute Myocardial Infarction (IMA) in either STEMI or NSTEMI. This number reflects the low level of public awareness in safeguarding the quality of life post ACS.

ACS is an emergency cardiac condition as an acute manifestation of Coronary Heart Disease (CHD). ACS is associated with inadequate management of risk factors that recurrence happens. ACS recurrence rate is very high within 30 days after the acute presentation. Nearly 20% of men and 26% of women die within one year after experiencing a myocardial infarction (Quiles and Miralles, 2014). As many as 50% of deaths occur in pre-hospitals due to late treatment, and cardiogenic shock is causing lethal left ventricular failure (Rampengan, 2015).

ACS recurrence related to risk factors is also common among people in Pakraman villages. Pakraman villages are community units in Bali’s Province characterized by a unified tradition, Hindu teaching practice inherited from ancestors in Kahyangan Tiga’s bond—they have their territory, assets, and rights to manage...
their household (Peraturan Daerah Provinsi Bali, 2003). In other words, we can say that the people of Pakraman villages are Hindu communities, live in certain areas, have a sacred place to carry out hereditary traditions and activities. In contrast, the non-Pakraman villages are non-Hindu communities that do not participate in the activities in Pakraman villages although living in the same area.

A Pakraman village is a form of local wisdom in Bali based on cooperation and has many traditions related to ACS risk factors. Activities in a Pakraman village include ngelawar, megibung, drinking tuak, using solid fuel, metajen, and smoking; these are mostly done daily, yet some are carried out only during religious ceremonies. Religious ceremonies are often done as a form of gratitude and are based on strong cooperation. The more traditions people hold, the more exposure to ACS risk factors they will face. A post ACS patient must maintain a lifestyle to avoid recurrence. Based on this background, a study of risk factors related to ACS recurrence is conducted in Pakraman and non-Pakraman villages in Buleleng Regency, Bali Province.

**Material and methods**

Observational analytic research was conducted using a cross-sectional design. This study's independent variables were smoking habits, hypertension, and physical activity, while the dependent variable was a recurrence of ACS. Within 1 month, 130 post ACS patients were invited to join the study based on inclusion criteria. Data collection was done through two (2) stages using a questionnaire; the first data was the Buleleng General Hospital patients' medical records. The second data was collected using the Global Physical Activity Questionnaire (GPAQ) to reveal physical activities. The collected data were analyzed using the Chi-Square test, Fisher test, and logistic regression.

**Result and Discussion**

Data were collected from 130 people from 10 Pakraman villages in Buleleng using a questionnaire. The following are the characteristics of respondents based on age:

**Table 1. The Characteristics of Respondents Based on Age**

| Group               | N  | Mean | Median | Min-Max | SD   |
|---------------------|----|------|--------|---------|------|
| Pakraman Villages   | 65 | 59   | 59     | 36-82   | 10.285|
| Non-Pakraman Villages | 65 | 57.62| 56     | 37-85   | 12.394|

Table 1 shows that respondents in Pakraman villages were 59 years old on average, with the youngest being 36 years old and the oldest being 82 years old. Respondents in non-Pakraman villages on average were 58 years old, with the youngest being 37 years old and the oldest being 85 years old.

**Table 2. The Characteristics of Respondents Based on Sex**

| Variable | Category | Pakraman | Non-Pakraman |
|----------|----------|----------|--------------|
|          | F  | %    | f      | %    |
| Sex      | Male | 33   | 50.8   | 41   | 63.1 |
|          | Female| 32   | 49.2   | 24   | 36.9 |

Table 2 shows that the majority of respondents in both groups were male.
Table 3. The Relationship Between Smoking, Hypertension, And Physical Activities Towards ACS Recurrence In Pakraman Villages

| Variable      | Recurrence | OR Value | P Value |
|---------------|------------|----------|---------|
|               | Yes        | No       |         |
| Smoking       | N %        | N %      |         |
| Yes           | 31 47.7    | 6 9.2    | 5.962   | 0.003   |
| No            | 13 20      | 15 23.1  |         |         |
| Hypertension  | N %        | N %      |         |
| Yes           | 35 53.8    | 10 15.4  | 4.278   | 0.02    |
| No            | 9 13.8     | 11 16.9  |         |         |
| Physical activities | N % | N % |         |
| Moderate      | 5 7.7      | 4 6.2    | 0.545   | 0.455   |
| Mild          | 39 60      | 17 26.2  |         |         |

Table 3 shows 56.9% of respondents in Pakraman village were smokers, 69.2% had hypertension, and 86.2% only did mild physical activities. The results of the bivariate analysis show that smoking (p = 0.003) and hypertension (p = 0.02) are associated with ACS recurrence, while physical activities (p = 0.455) are not associated with ACS recurrence.

Table 4. The Relationship Between Smoking, Hypertension, and Physical Activities Towards ACS Recurrence in Non-Pakraman Villages

| Variable      | Recurrence | OR Value | P Value |
|---------------|------------|----------|---------|
|               | Yes        | No       |         |
| Smoking       | N %        | n %      |         |
| Yes           | 29 44.6    | 11 16.9  | 4.687   | 0.008   |
| No            | 9 13.8     | 16 24.6  |         |         |
| Hypertension  | N %        | n %      |         |
| Yes           | 33 50.8    | 15 23.1  | 5.28    | 0.01    |
| No            | 5 7.7      | 12 18.5  |         |         |
| Physical activities | N % | n % |         |
| Moderate      | 18 27.7    | 10 15.4  | 1.53    | 0.565   |
| Mild          | 20 30.8    | 17 26.2  |         |         |

Table 4 shows 61.5% of respondents in the non-Pakraman village were smokers, 73.8% had hypertension, and 56.9% only did mild physical activities. The results of the bivariate analysis show that smoking (p = 0.008) and hypertension (p = 0.01) are associated with ACS recurrence, while physical activities (p = 0.565) are not associated with ACS recurrence.

The respondents' smoking habits in Pakraman villages and non-Pakraman villages had lasted for more than 10 years, with a frequency of approximately 10 cigarettes per day. For hypertension, most respondents in both groups experienced an increase in their systolic blood pressure. Related to physical activities, most respondents had reduced their physical activities after undergoing ACS treatment.
Table 5. The Results of The Multivariate Analysis on The Relationship Between Hypertension and Smoking Habits with The Recurrence Rate of ACS in Pakraman Villages, Buleleng Regency, Bali Province

| Variable   | Coefficient | p Value | Exp(B) | Hosmer & Lemeshow Test |
|------------|-------------|---------|--------|------------------------|
| Step 1     |             |         |        |                        |
| Hypertension | 1.378     | 0.028   | 3.965  | 0.997                  |
| Smoking    | 1.729      | 0.005   | 5.633  |                        |
| Constant   | -1.007     | 0.079   | 0.365  |                        |

The logistic regression test's final results show that the value of \( \text{Exp}(B) \) for the hypertension variable is 3.965 and the \( \text{Exp}(B) \) value for the smoking variable is 5.633. Based on the analysis results, smoking becomes the most influencing independent variable for ACS recurrence; in other words, the smoking habit can cause ACS recurrence 5.633 times compared to the non-smoking pattern after being controlled by the hypertension variable.

Table 6. The Results of the Multivariate Analysis on the Relationship between Hypertension and Smoking Habits with the Recurrence Rate of ACS in Non-Pakraman Villages, Buleleng Regency, Bali Province

| Variable   | Coefficient | p-Value | Exp(B) | Hosmer & Lemeshow Test |
|------------|-------------|---------|--------|------------------------|
| Step 1     |             |         |        |                        |
| Hypertension | 1.458     | 0.011   | 4.299  | 0.852                  |
| Smoking    | 1.565      | 0.016   | 4.784  |                        |
| Constant   | -1.671     | 0.012   | 0.188  |                        |

The logistic regression test's final results show that the value of \( \text{Exp}(B) \) for the hypertension variable is 4.784, and the \( \text{Exp}(B) \) value for the smoking variable is 4.299. Based on the analysis results, hypertension becomes the most influencing independent variable for ACS recurrence; in other words, hypertension can cause ACS recurrence 4.784 times compared to non-hypertension after being controlled by the smoking variable.

The Relationship of Smoking Habits with ACS Recurrence in Pakraman and Non-Pakraman Villages in Buleleng Regency, Bali Province

The results show a correlation between smoking habits and ACS recurrence in Pakraman villages with a p-value of 0.003. The OR value of 5.962 indicates that patients with smoking habit 5.962 times at risk of ACS recurrence compared to non-smokers in Pakraman villages. In non-Pakraman villages, there is a relationship between smoking habits and ACS recurrence with a p-value of 0.008. The OR value of 4.687 indicates that patients with smoking habits 4.687 times at risk of ACS recurrence compared to non-smokers in non-Pakraman villages.

For smoking respondents in Pakraman villages, 31 people experienced ACS recurrence, while 6 did not. For non-smoking respondents in Pakraman villages, 13 people experienced ACS recurrence, while 15 did not. For smoking respondents in non-Pakraman villages, 29 people experienced ACS recurrence, while 11 did not. For non-smoking respondents in non-Pakraman villages, 9 people experienced ACS recurrence, while 16 did not. This shows that the respondents who smoke have a higher rate of recurrence compared to non-smokers. These results are parallel with the previous studies confirming that smoking habits are associated with ACS events, in which smokers have a higher risk of experiencing ACS than non-smokers (Bullock-Palmer, 2015; Krishnan et al., 2016).
Recurrence rates between smoking and non-smoking in Pakraman and non-Pakraman villages indicate that passive ones also have a high recurrence rate in addition to active smokers. Fourteen non-smoking respondents in Pakraman villages and 9 in non-Pakraman villages experienced recurrence. Other studies suggest that 95% of CHD patients who are active smokers and passive smokers have the same risk (Yadav et al., 2010). Trisnaamijaya et al. (2012) also confirm that passive smokers have a higher risk of 20-30% than non-passive smokers.

Besides number, gender can also be associated with smoking habits and ACS recurrence. This study reveals men in Pakraman and non-Pakraman villages smoke more than women, and as such, men have higher ACS recurrence in women. In his study, Torry (2014) writes deaths from CHD are 11% in women and 24% in men due to smoking habits.

The smoking doses also affects risk factors. A person has 2 to 3 times higher risk of experiencing CHD if smoking 20 or more cigarettes a day (Trisnaamijaya et al., 2012). The current study results also illustrate respondents who started more than ten years ago with approximately 10 cigarettes per day had a higher recurrence rate. (Huxley and Woodward, 2011) also reveal that smoking duration has a relationship with the risk of CHD. Still, this condition has decreased by 50% after quitting smoking for a year and becoming normal after quitting smoking for four years.

Smoking is the activity of regularly consuming tobacco of a specific size or irregularly in a day (Bustan, 2007). Smoking habits are the same in Pakraman and non-Pakraman villages. In daily activities, smoking is a necessity for some people, and this becomes increasingly intense when there are traditional activities like *mekemit* in which *krama desa* must be staying up. The smokes affect atherosclerosis through the mechanism of cholesterol metabolism, affect blood clotting, and cause spasm of the arteries. It is dangerous not only for active smokers but also for people around them.

**The Relationship of Hypertension with ACS Recurrence in Pakraman and Non-Pakraman Villages in Buleleng Regency, Bali Province**

The study results show a relationship between risk factors for hypertension and the recurrence rate of ACS in Pakraman villages with a p-value of 0.02. The OR value of 4.728 indicates that patients with hypertension 4.728 times at risk of ACS recurrence compared to those without hypertension in Pakraman villages. In non-Pakraman villages, there is a relationship between hypertension and ACS recurrence with a p-value of 0.001. The OR value of 5.28 indicates that patients with hypertension 5.28 times at risk of ACS recurrence compared to those without hypertension in non-Pakraman villages.

For respondents with hypertension in Pakraman villages, 35 people experienced ACS recurrence, while 10 did not. For respondents without hypertension in Pakraman villages, 9 people experienced ACS recurrence, while 11 did not. For respondents with hypertension in non-Pakraman villages, 33 people experienced ACS recurrence, while 15 did not. For respondents without hypertension in non-Pakraman villages, 5 people experienced ACS recurrence, while 12 did not. This shows that the respondents with hypertension have a higher rate of recurrence compared to those without hypertension.

These results were in line with studies in 2016 and 2014, revealing that hypertension is associated with ACS, where patients with hypertension have a higher risk of developing ACS than those without hypertension (Bundy and He, 2016; Dorobantu et al., 2014). Yuliani et al. (2014) confirm a significant relationship between hypertension and CHD in patients with type 2 diabetes mellitus. Supriyono (2008) has found no relationship between hypertension
and CHD in patients aged ≤45 years with a p-value of 0.87.

In this study, it was found that the majority of patients had systolic pressure ≥140 mmHg in both Pakraman and non-Pakraman villages. Increased systolic pressure of 130 to 139 mmHg and a diastolic pressure of 85 to 89 mmHg can increase CHD risk two times compared to healthy people (Alzo'ubi et al., 2015). Joint National Commission (JNC) VII recommends the target blood pressure is less than 120 mmHg for systolic and less than 80 mmHg for diastolic.

The incidence of hypertension is closely related to dyslipidemia and the use of salt in daily food processing. The extreme eating habits in Pakraman villages affect cholesterol levels, which will later cause hypertension. Hypertension, dyslipidemia, smoking, and diabetes are risk factors that are often documented related to CHD, and it is stated that out of 174 respondents, 53% have hypertension (El-Menyar et al., 2011).

In this study, some respondents without hypertension also experienced recurrence, so hypertension is not a stand-alone risk factor. Tapan (2005) writes that hypertension will increase heart attack several times if accompanied by smoking, obesity, dyslipidemia, and diabetes mellitus.

The Relationship of Physical Activities with ACS Recurrence in Pakraman and Non-Pakraman Villages in Buleleng Regency, Bali Province

The study results do not show a relationship between physical activities and recurrence of ACS in Pakraman villages with a p-value of 0.455; this is also the same in non-pakraman villages with a p value of 0.565.

For respondents with mild physical activities in Pakraman villages, 39 people experienced ACS recurrence, while 17 did not. For respondents with moderate physical activities in Pakraman villages, 5 people experienced ACS recurrence, while 4 did not. For respondents with mild physical activities in non-Pakraman villages, 20 people experienced ACS recurrence, while 17 did not. For respondents with moderate physical activities in non-Pakraman villages, 18 people experienced ACS recurrence, while 10 did not. This shows that the respondents with mild physical activities have a higher recurrence rate than those with moderate physical activities.

The results contradict the previous studies that physical activities have a relationship with ACS where patients with high physical activities have a higher risk of experiencing ACS than those with mild physical activities (Gupta et al., 2016; Krishnan et al., 2016).

Physical activity is a condition where the body moves as part of daily activities (WHO, 2006). Respondents in Pakraman and non-Pakraman villages were on average 59 and 58 years old, and they had experienced treatment with ACS, so the majority had reduced their activities. Most only do activities inside the house and rarely have sports activities. Lack of physical activities can increase the risk of CHD—it starts with low fitness causing a decrease in HDL, hypertension, obesity, and insulin resistance. Aoronson and Ward (2010) mention that moderate to high fitness levels are associated with a reduction in mortality due to CHD by half, whereas regular physical activities could reduce the risk as much as stopping smoking. Physical activities function to control body weight, reduce blood pressure, reduce the risk of type 2 diabetes mellitus, cancer, stroke, heart attack, and reduce osteoporosis and depression, and anxiety (McGuire, 2014).

Physical activities are not a direct factor in ACS occurrence but instead affect cholesterol levels in the body. This study shows that physical activities are not associated with ACS recurrence where many respondents with low or mild physical activities experience ACS. The number of ACS recurrence is influenced by other factors such as consumption of foods high in fat and sodium and smoking habits. Previous
studies indicate that ACS events are caused by lifestyle by consuming foods high in fat, sodium, and smoking habits (Gus et al., 2015; Ravi et al., 2016).

**The Most Affecting Factor to the Recurrence Rate of ACS in Pakraman and Non-Pakraman Villages in Buleleng Regency, Bali Province**

The multivariate analysis results show that smoking is the most influencing risk factor associated with the recurrence rate of ACS in Pakraman villages. Smoking habits can cause ACS recurrence by 5,633 times compared to non-smoking after controlled by the hypertension variable. The most influential risk factors in non-Pakraman villages are hypertension, as it can cause ACS recurrence by 4,784 times compared to non-hypertension after being controlled by the smoking variable.

Smoking is an activity that exists in both Pakraman and non-Pakraman villages, but in Pakraman villages, smoking is the most affecting factor to ACS recurrence. This can be related to traditional activities that make the villagers stay up late (makemit). Staying up late increases the frequency of smoking because it prevents the body from getting drowsy and helps keep the body warm. Most male villagers smoke, so it is not surprising that Coronary Heart Disease (CHD) causes almost 24% of male deaths (Torry, 2014). Smoking is dangerous for passive smokers; they have also been exposed to the same risk of recurrence that the recurrence rate among passive smokers is also high (Yadav et al., 2010).

Hypertension is the most affecting risk factor to ACS recurrence in non-Pakraman villages. This is related to the villagers' daily habits in which they consume much cholesterol, not to exclude the excessive use of salt and preservative. Besides, patients who previously suffered from ACS and did not undergo further treatment for their hypertension tend to experience recurrence easily.

**Conclusion and Suggestion**

Smoking habits and hypertension are risk factors related to ACS recurrence in Pakraman and non-Pakraman villages, while physical activities have no significant effect toward ACS recurrence. Smoking is the most influencing risk factor in Pakraman village and hypertension is the most influencing risk factor in non-Pakraman villages.

Maintaining the quality of life of post ACS patients in Pakraman and non-Pakraman villages can be done by modifying their activities. Informal leaders in Pakraman villages need to be involved in raising awareness on activities related to risk factors; thus, traditional ceremonies or activities can still be done, but the risk of recurrence can be controlled.

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