

THE IMPACT OF COMORBIDITIES IN STABLE ANGINA PECTORIS CLASS I PATIENTS ON MEDICATION COSTS: A CASE STUDY

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ABSTRAK

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Abstract:

Stable angina pectoris class I is a cardiovascular condition requiring long-term therapy, significantly contributing to medication costs for patients and the National Health Insurance (JKN). This study, titled “The Impact of Comorbidities in Stable Angina Pectoris Class I Patients on Medication Costs: A Case Study at Hasan Sadikin Hospital, Bandung, December 2023,” aims to analyze drug cost distribution based on therapeutic regimens (preventive, first-line, and second-line treatments) among patients with and without comorbidities such as hypertension, diabetes mellitus, and hypercholesterolemia. Using a quantitative cross-sectional design with retrospective data from medical records, 300 outpatients diagnosed with stable angina pectoris class I were selected through purposive sampling according to specific criteria. Data collected included demographics, comorbidity profiles, therapeutic regimens, and drug costs. Multiple linear regression was applied to determine the effect of comorbidities on medication expenses. The findings are expected to describe medication cost distribution across therapeutic lines and reveal the impact of comorbidities on outpatient treatment costs. Results may serve as input for BPJS Kesehatan and hospitals in evaluating cost efficiency and highlight the importance of preventing comorbid conditions to reduce treatment expenses.

Abstrak:

Angina pektoris stabil kelas I merupakan kondisi kardiovaskular yang memerlukan terapi jangka panjang dan berkontribusi signifikan terhadap biaya obat yang ditanggung pasien maupun Jaminan Kesehatan Nasional (JKN). Penelitian berjudul “Dampak Komorbiditas pada Pasien Angina Pektoris Stabil Kelas I terhadap Biaya Obat: Studi Kasus di RS Hasan Sadikin Bandung, Desember 2023” ini bertujuan menganalisis distribusi biaya obat berdasarkan rejimen terapi, meliputi terapi preventif, lini pertama, dan lini kedua, pada pasien dengan dan tanpa komorbiditas seperti hipertensi, diabetes melitus, dan hiperkolesterolemia. Penelitian ini menggunakan desain kuantitatif dengan pendekatan potong lintang melalui data retrospektif dari rekam medis. Sebanyak 300 pasien rawat jalan dengan diagnosis angina pektoris stabil kelas I dipilih menggunakan metode purposive sampling sesuai kriteria inklusi dan eksklusi. Data yang dikumpulkan mencakup karakteristik demografis, jenis komorbiditas, rejimen terapi, dan biaya obat. Analisis regresi linier berganda digunakan untuk menilai pengaruh komorbiditas terhadap biaya pengobatan. Hasil penelitian diharapkan memberikan gambaran menyeluruh mengenai distribusi biaya obat menurut lini terapi serta menunjukkan dampak komorbiditas terhadap biaya rawat jalan. Temuan ini dapat menjadi masukan bagi BPJS Kesehatan dan rumah sakit dalam evaluasi efisiensi biaya serta meningkatkan kesadaran masyarakat akan pentingnya pencegahan penyakit.



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INTRODUCTION

Angina pectoris is a clinical manifestation of coronary artery disease (CAD), characterized by chest pain and shortness of breath resulting from thrombus formation or atherosclerosis in the coronary arteries [3]. Based on severity, angina pectoris can be classified into stable angina pectoris (SAP) and unstable angina pectoris. SAP is further categorized into three types: typical angina, atypical angina, and non-anginal chest pain, distinguished by three primary criteria: substernal chest discomfort, provocation by physical exertion or emotional stress, and relief with rest or sublingual nitroglycerin. Typical angina meets all three criteria, atypical angina meets two, and non-anginal pain meets one or none [2].

This study was conducted at Hasan Sadikin General Hospital (RSHS) in Bandung, a Class A tertiary referral center for West Java province, particularly for managing complex angina cases including those with comorbidities [12]. Stable angina pectoris is considered a catastrophic illness due to its high treatment costs, which are covered by the National Health Insurance (JKN) through the Indonesian Case-Based Groups (INA-CBGs) reimbursement system [18]. However, uninsured patients bear the full treatment cost, adding to their financial burden [14].

Comorbidities such as diabetes mellitus can exacerbate ischemic heart conditions by inducing silent myocardial ischemia due to autonomic neuropathy, impairing pain perception [4]. Hypertension contributes to vascular damage, accelerates atherosclerosis, increases cardiac workload, and may lead to left ventricular hypertrophy and subsequent myocardial infarction or heart failure [16]. Dyslipidemia promotes atherosclerotic plaque formation, elevating the risk of SAP events [21]. Additionally, chronic kidney disease (CKD) worsens cardiovascular outcomes through accelerated atherosclerosis, electrolyte imbalances, and anemia, while heart failure

(HF) significantly reduces functional capacity and quality of life in angina patients. Peripheral artery disease (PAD) indicates systemic atherosclerosis and correlates with more severe coronary involvement. Other critical comorbidities include anemia (hemoglobin <8 g/dL), which reduces oxygen-carrying capacity and triggers ischemia, atrial fibrillation that increases myocardial oxygen demand through tachycardia, and anxiety/depression disorders that impair pain perception and treatment adherence. Obesity and metabolic syndrome further amplify risks through inflammatory pathways and increased cardiac demand. These comorbidities collectively contribute to a higher burden of symptoms, increased healthcare utilization, and poorer prognosis in stable angina patients.

National data from the BPJS Kesehatan study (2021-2022) shows that the total healthcare costs for cardiovascular diseases in Indonesia increased by 11% from IDR 34.4 trillion in 2021 to IDR 42.9 trillion in 2022. Inpatient costs account for 69% of the total expenses. The treatment costs for angina pectoris with comorbidities such as hypertension, diabetes, or heart failure face significantly higher costs due to increased hospitalization rates and complex pharmacotherapy. Analysis of BPJS claims reveals that non-subsidized members (BP, PBPU, PPU) have higher claim costs for ischemic heart disease and stroke compared to the subsidized group (PBI APBN), reflecting disparities in the cost burden. Other studies show that patients with angina and comorbidities face average hospitalization costs related to coronary heart disease of \$9,536 compared to \$2,169 for those without angina, while the total annual costs associated with coronary heart disease reach \$14,851 versus \$4,449. This finding highlights the critical impact of comorbidities on healthcare spending for angina pectoris in Indonesia, which requires targeted cost management strategies and more inclusive health policies. The cost of angina pectoris

treatment is significantly influenced by medication expenses, which account for a major portion of overall treatment costs. Prior studies have emphasized that medications such as antiplatelets, anticoagulants, and statins are substantial cost drivers. Additional factors like length of stay, use of adjunctive therapies, and presence of comorbidities also affect the total expenditure [6].

A study conducted at Dr. Hasan Sadikin General Hospital (2022) demonstrated that patients with Acute Coronary Syndrome (ACS) and comorbid cerebrovascular disease faced a significantly higher in-hospital mortality risk and incurred 40% higher treatment costs due to neurological complications and prolonged hospitalization. Additionally, comorbid diabetes in angina patients increased annual costs by 25–30%, attributable to the need for glycemic monitoring, antidiabetic medications, and management of microvascular complications. Although specific data for angina pectoris has not been detailed separately, these findings confirm the substantial economic burden imposed by comorbidities in the management of angina pectoris in Indonesia. Further studies specifically dissecting the costs of angina pectoris based on Canadian Cardiovascular Society (CCS) classification and comorbidity types are essential for accurate health resource planning and policy formulation.

Based on the classification of the Canadian Cardiovascular Society (CCS), Class 1 APS is the earliest stage of coronary heart disease but is often undiagnosed because symptoms only appear during heavy activity. This condition represents a critical window for pharmacological intervention and lifestyle modification, which have been proven effective in slowing disease progression, preventing complications, and reducing long-term cost burdens. Low patient awareness and limited early detection result in optimal secondary prevention therapies

being unachieved, thereby increasing the risk of progression to more severe classes that require higher costs. Currently, specific prevalence data for Class 1 APS in Indonesia is still limited; moreover, pharmacoeconomic analyses that separate Class 1 APS from more severe classes need to be conducted for efficient healthcare resource allocation planning and to fill the still minimal research gaps.

Despite extensive international literature on SAP treatment strategies and costs, research specific to Class I SAP in Indonesia (particularly concerning medication cost differentiation by comorbidity status) remains scarce. This study aims to provide a descriptive analysis of medication costs for SAP Class I patients at RSHS Bandung and to determine the effect of comorbidities on these costs. The results are expected to inform policy decisions by hospitals and BPJS Kesehatan and promote greater public understanding of the cost implications of comorbidity in chronic disease management.

RESEARCH METHOD

This study employed a cross-sectional design with a retrospective quantitative approach to analyze medication costs associated with stable angina pectoris (SAP) Class I. A cross-sectional method is commonly applied to observe relationships between variables at a single point in time, while a retrospective approach allows the use of existing medical record data without direct intervention in patient care [26], [24]. The research was conducted in December 2023 at Hasan Sadikin General Hospital (RSHS), Bandung, a tertiary referral hospital with comprehensive documentation systems.

Data were collected from medical records, including patient demographic characteristics (age, sex, employment status), insurance coverage (such as National Health Insurance/BPJS), presence of comorbidities (hypertension, diabetes mellitus, and hypercholesterolemia), as

well as medication usage and costs. Medications were grouped according to therapeutic regimens (preventive therapy, first-line therapy, and second-line therapy) based on standard pharmacological management guidelines for coronary artery disease [18]. This study utilized medical record data collected via a Google Forms questionnaire in December 2023 from outpatients at Hasan Sadikin Hospital, Bandung.

The inclusion criteria were: (1) patients diagnosed with stable angina pectoris class I according to the Canadian Cardiovascular Society (CCS) classification; (2) patients without any comorbid conditions who were undergoing treatment for stable angina class I; and (3) patients with any single comorbidity from the specified list, including hypertension, diabetes mellitus, or hypercholesterolemia. The exclusion criteria comprised: (1) patients with incomplete medical record data in the questionnaire; and (2) patients with APS class I who had multiple comorbidities (e.g., both hypertension and diabetes mellitus concurrently) to ensure homogeneity in analyzing the impact of specific individual comorbidities. This approach allows for a clearer examination of how single comorbidities influence treatment outcomes and healthcare resource utilization in this patient population.

The study population comprised all outpatients diagnosed with SAP Class I during the study period. A total of 300 patients were selected using purposive sampling according to predefined inclusion and exclusion criteria. Data analysis consisted of descriptive statistics to summarize patient characteristics, drug utilization, and cost distributions, as well as simple linear regression to examine the effect of comorbidities on medication costs. No modification of standard analytical methods was applied in this study. Additional datasets and other relevant materials that cannot be described in the main text will be provided as supplementary files during submission.

RESULT AND ANALYSIS

This study utilized retrospective data collected from the medical records of 84 patients diagnosed with stable angina pectoris (SAP) class I at the Outpatient Cardiology Clinic of Hasan Sadikin General Hospital (RSHS), Bandung, in December 2023. Patient demographic and clinical characteristics are presented in Figure 2.

Table 1.
Demographic Characteristics of SAP Class I Patients at RSHS Bandung

Variable	n	%
Gender		
Male	74	88.1%
Female	10	11.9%
Age		
≤40 years	2	2.4%
41–45 years	7	8.3%
45–55 years	28	33.3%
56–67 years	47	56%
Payment Type		
Insurance	76	90.5%
Self-payment	8	9.5%
Occupation		
Professional	42	50%
Unemployed	35	41.7%
Others	5	6%
Student	2	2.4%
Comorbidity		
Hypertension	39	46.4%
Hypercholesterolemia	10	11.9%
Diabetes Mellitus	11	13.1%
No comorbidity	24	28.6%
Total	84	100%

The majority of patients were male, accounting for 74 individuals (88.10%), while female patients represented only 10 individuals (11.90%). In terms of age distribution, the largest proportion of patients was in the 56–70-year age group (47 patients; 55.95%), followed by those aged 41–55 years (28 patients; 33.33%). Patients aged 25–40 years and over 70 years were relatively few, with 3 (4.76%) and 4 (5.95%) individuals, respectively. Regarding the payment system, most patients paid for their treatment out-of-

pocket (76 patients; 90.48%), while only 8 patients (9.52%) were covered by health insurance. In terms of occupation, half of the patients (42 individuals; 50%) were professionals, followed by unemployed individuals (35 patients; 41.67%). Other occupational groups included 4 patients (4.76%) in other job categories and 3 patients (3.57%) engaged in manual labor. Clinically, 60 patients (71.43%) were found to have comorbidities. Hypertension was the most prevalent comorbidity, affecting 39 patients (46.43%), followed by diabetes mellitus in 11 patients (13.10%) and hypercholesterolemia in 10 patients (11.90%). Meanwhile, 24 patients (28.57%) had no reported comorbidities. The presence of comorbidities may complicate clinical management, as patients with concurrent diseases typically require additional therapies beyond the primary angina regimen. This has the potential to increase treatment costs and place a greater financial burden on both patients and healthcare systems.

Table 2.
Drug Class Utilization in Therapeutic Regimens for Stable Angina Pectoris (SAP) Class I

Regimen	Drug Class	Number of Patients Using
Preventive	Antiplatelet	102
	Statin	80
	ACEI	38
	ARB	14
	Short-acting nitrate	4
First-line	Calcium channel blocker (DHP)	26
	Beta-blocker	71
	Long-acting nitrate	18
Second-line	Ranolazine	1
	Trimetazidine	17

Source: Processed from Medical Records, RSHS Bandung, 2023

Drug utilization among SAP class I patients in this study was categorized into three therapeutic regimens: preventive therapy, first-line therapy, and second-line therapy. Details of drug usage and average

medication costs by comorbidity status are presented in Table 2 and Table 3.

The use of medications in patients with stable angina pectoris (SAP) Class I in this study was grouped into three therapeutic regimens: preventive, first-line, and second-line therapy. In the preventive regimen, antiplatelets were the most frequently used drug class, prescribed to 102 patients, followed by statins in 80 patients, ACE inhibitors (ACEIs) in 38 patients, and angiotensin receptor blockers (ARBs) in 14 patients. For first-line therapy, beta-blockers were the most commonly prescribed (71 patients), followed by dihydropyridine calcium channel blockers (26 patients) and short-acting nitrates (4 patients). In second-line therapy, long-acting nitrates were used in 18 patients, trimetazidine in 17 patients, and ranolazine in only 1 patient. Overall, antiplatelets were the most dominant drug class in the management of SAP Class I, highlighting their pivotal role in preventing recurrent cardiovascular events.

Table 3.
Average Drug Costs by Comorbidity in SAP Class I Patients at the RSHS Outpatient Cardiology Clinic, December 2023

Regimen	SAP I no-comorbid (n=24)	SAP I		
		HT (n=39)	DM (n=11)	HC (n=10)
Preventive	36k	127,3k	0	51k
1st-line	94,1k	119,5k	182,7k	94,4k
2nd-line	270,6k	283,3k	228,9k	291,9k
Add. drugs	58,1k	74,1k	984,2k	6,5k

Source: Processed from Medical Records, RSHS Bandung, 2023

Table 3 presents the average medication costs for patients with stable angina pectoris (SAP) Class I, categorized by the presence of comorbidities and therapeutic regimens. The analysis includes cost distributions for preventive therapy, first-line therapy, second-line therapy, and additional medications. The average cost per regimen was calculated based on the data summarized in Supplementary File 3, by dividing the total medication cost for each regimen by the number of patients

receiving that regimen within each comorbidity group.

Multiple Linear Regression Analysis

A multiple linear regression was performed to examine the relationship between comorbidities (independent variable) and medication costs (dependent variable). The regression equation obtained was:

$$Y = 7,270 + 0,285X + \varepsilon$$

The intercept value of 7.270 indicates that, on average, patients without comorbidities incur a medication cost of IDR 7,270. The regression coefficient of 0.285 suggests that the presence of comorbidity increases the medication cost by approximately IDR 285.

Coefficient of Determination

The Adjusted R^2 value was 0.048, meaning that 4.8% of the variation in medication costs can be explained by the presence of comorbidities. The remaining 95.2% is attributable to other unmeasured factors.

CONCLUSION

This study provides empirical evidence that comorbidities significantly impact the medication costs of patients with stable angina pectoris (SAP) Class I at Hasan Sadikin General Hospital, Bandung. The patient population was predominantly male, aged 56–70 years, and professionally employed, with the majority enrolled in the national health insurance program (JKN). Hypertension was the most prevalent comorbidity, followed by diabetes mellitus and hypercholesterolemia. Antiplatelets and beta-blockers were the most commonly prescribed drug classes.

Patients with comorbidities consistently incurred higher medication costs, particularly within first- and second-line therapies, reflecting increased treatment complexity and resource utilization. Classical assumption testing confirmed that the regression model met

the requirements for normality (after transformation), homoscedasticity, and linearity. Simple linear regression revealed that comorbidity was a statistically significant positive predictor of medication costs ($\beta = 0.285$; $p < 0.05$), though the model's explanatory power was modest (adjusted $R^2 = 0.048$).

These findings underscore the economic burden imposed by comorbid conditions in chronic cardiovascular care. They highlight the need for integrated disease management strategies and cost-containment policies targeting multimorbidity in outpatient settings. Further research is warranted to explore additional predictors of treatment costs and to inform more efficient health financing models.

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