Journal of Health Economic and Policy Research
JHEPR Vol. 2 No. 2 2024
ISSN 3025-5198

Cost of Illness in Diabetic Patients with Hypertension in Inpatients at Sleman Regional Hospital

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Article Information:

- ***Submitted*** : *October 26th 2023*
- ***Revised*** : *November 13th 2023*
- ***Accepted*** : *January 30th 2024*

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DOI: https://doi.org/10.30595/jhepr.v2i2.119

Abstract

Background: In 2017, Indonesia identified diabetes as one of the three diseases that caused high mortality rates. Uncontrolled diabetes has a negative impact on nearly every system of the human body, thereby increasing the burden of disease. Diabetics had a 1.5–2.0 times higher risk of developing hypertension compared to non-diabetics, and approximately a third of hypertensive sufferers also had diabetes. This research aimed to identify and calculate the direct costs for patients with diabetes and hypertension at Sleman District Hospital.

Methods: The study, a cross-sectional analysis, was conducted descriptively, and data were collected over a 3-month period from medical records using purposive non-random sampling. The study focused on diabetic patients with hypertension who regularly used antidiabetic and antihypertensive drugs, according to the study's inclusion criteria.

Result: Fifty-three patients met the inclusion criteria, comprising 22 (41.51%) male patients and 31 (58.49%) female patients, primarily within the 51–60 age group (32.08%), with 94.34% financing their treatment through BPJS in class 3 (56.60%). The average cost for the longest length of stay is class 1 (IDR 33,313,600); this could be due to the larger difference in room costs compared to other classes. The average cost for class 2 (IDR 15,768,117) length of stay is the lowest because it is caused by the patient's length of stay being the shortest compared to the others. The average cost of length of stay in class 3 (IDR 25,807,092) is still less than the average cost of length of stay in class 1, even though it has the longest length of stay.

Conclusion: Factors such as the presence of other comorbidities during treatment, the treatment duration, and differences in treatment classes among patients were identified as influencing the overall costs in this study.

Keywords: *Diabetes, Hypertension, The Cost of Illness*.

Introduction

Diabetes is a rapidly growing disease, causing significant mortality and economic impact. The International Diabetic Foundation (IDF) reports that approximately 537 million people are affected by diabetes, projected to increase to 643 million by 2030[1,2]. Hypertension coexists in 73.6% of diabetic adults aged 18 and older, making it a key risk factor for cardiovascular diseases associated with diabetes. Hence, managing blood pressure is crucial to comprehensive diabetes care[3]. These conditions are escalating in developing nations, amplifying vascular complications in diabetic individuals[4,5]. Compared to those with normal blood pressure, hypertensive individuals face higher risks of developing diabetes, and vice versa. Studies show elevated blood pressure is an independent predictor of new diabetes diagnoses. Roughly 50% of diabetes patients also experience hypertension, raising the cardiovascular disease risk fourfold compared to those with normal blood pressure[6].

The economic burden of diabetes amounts to 4%–14% of health expenditures, utilizing 2–6 times more resources than other chronic conditions of similar demographics. In Spain, annual costs per diabetic patient range from €758 to €4348, significantly influenced by DM2 prevalence. Costs surge 5 to 12 times in patients with macrovascular complications[7]. Diabetes treatment extensively drains healthcare budgets. In the United States, the estimated 2012 expenditure stands at USD 245 billion, accounting for escalated health expenses and productivity loss caused by diabetes[8]. In Indonesia, the six-month hospital-based cost reached IDR 1.204 billion, encompassing outpatient and inpatient visits[9].

National Health Insurance (JKN) initiated a mixed payment system from 2016 onwards. Primary healthcare functions on capitalized/non-capitalized payment modes, while secondary/tertiary services integrate payment models like INA-CBGs and non-CBGs. BPJS Health adopted Prolanis in 2014 to control diabetes and hypertension. BPJS ensures the management of these diseases through programs

like the Referral Program (PRB)[10]. Drug expenses for chronic conditions are government-covered in Indonesia, and comorbidities often elevate medication needs and treatment costs. Facilities serving BPJS patients must allocate costs, including drugs, guided by pharmacoeconomic analyses for rational decision-making in therapy selection and fund allocation. The study's focus was on identifying and computing the direct costs of diabetes patients with hypertension hospitalized at Sleman Regional Hospital, employing pharmacoeconomic analyses to gauge the diseases' impact on individuals and communities.

Methods

The research design employed was a cross-sectional approach based on the perspective of the service provider. Data collection spanned 3 months and utilized purposive non-random sampling from the medical records of diabetic patients with hypertension who regularly use antidiabetic and antihypertensive medications. Sampling took place during the 2019 period at Sleman Hospital, Yogyakarta. The inclusion criteria comprised individuals aged ≥18 years diagnosed with both diabetes and hypertension who were hospitalized. The study excluded patients with incomplete data. Medical record documentation encompassed patient identifiers such as medical record number, date of birth, gender, therapy details, including duration, length of stay, comorbidities, pertinent laboratory findings supporting the research, and associated costs. The cost analysis encompassed direct expenses, including medical treatment, hospitalization, ancillary examinations, and consultation fees. Data collection involved a retrospective approach, and the analysis was conducted descriptively.

Result

The results showed that out of a total of 70 patients, 53 met the specified inclusion Most patients were man (41.51%) and aged 51–60 years (32.08%). As for class treatment, most patients were in class 3 (56.60%). BPJS dominated the assurance used by patients (94.34%).

Table 1. Characteristics of Inpatients with a Diagnosis of Diabetes Mellitus and Hypertension

Characteristics		Total (N = 53)	%
Gender	Male	22	41.51
	Female	31	58.49
Age	21-30	1	1.89
	31-40	1	1.89
	41-50	7	13.21
	51-60	17	32.08
	61-70	16	30.19
	≥71	11	20.75
Class treatment	1	17	32.08
	2	6	11.32
	3	30	56.60
Assurance	BPJS	50	94.34
	BPJD	1	1.89
	General	1	1.89
	PBI	1	1.89

Insulin was the most commonly used diabetes therapy among the subjects, with 21 patients receiving it, making up 67.74% of the cohort. Complementary pharmacotherapies for diabetes included acarbose, glicazid, and metformin. It's worth mentioning that four patients (12.90%) received combined diabetes treatment. One patient took metformin along with glicazid, another took metformin with glimepiride, and a third took a three-drug regimen comprising metformin, glimepiride, and acarbose. For the management of hypertension, 5 patients (16.70%) received amlodipine as the most common therapeutic option, while 2 patients (6.70%) received candesartan.

Table 2. Therapy for Inpatients with a Diagnosis of Diabetes Mellitus and Hypertension

Types of Therapy	Therapy	Total (N = 53)	%
Diabetes Therapy	Acarbose	2	6.45
	Glicazid	1	3.23
	Metformin	3	9.68
	Insulin	21	67.74
	Combination	4	12.90
Hypertension Therapy	Amlodipine	5	16.70
	Valsartan	1	3.30
	Candesartan	2	6.70
	Propanolol	1	3.30
	Clonidine	1	3.30
	Rapimil	1	3.30
	Verapamil	1	3.30
	Combination	18	59.90

A substantial majority, constituting 18 patients (59.90%), resorted to combination therapies to address hypertension. The frequently administered combinations comprised amlodipine paired with candesartan in 9 patients (30.00%), amlodipine coupled with valsartan in 3 patients (10.00%), and amlodipine in conjunction with irbesartan in 2 patients (6.70%). Other diagnoses in this study were dyslipedemia in 8 patients (15.09%); there were 3 patients with other diagnoses, namely dengue fever, stroke, vertigo, or CKD. There were 30 patients (56.60%) with other diagnoses, namely

bronchitis, hyperkalemia, hypernatremia, uremia syndrome, urinary tract infection, HAD, IHD, unstable angina pectoris, renal anemia, susp. Pneumonia, or hyperuricemia.

Table 3. Therapy for Inpatients with a Diagnosis of Diabetes Mellitus and Hypertension

Other Diagnoses	Total	%
Dengue fever	3	5.66
HHD	1	1.89
Dyspesia	2	3.77
Dysplipemia	8	15.09
Stroke	3	5.66
Vertigo	3	5.66
CKD	3	5.66
Other	30	56.60

Based on table 4, the average length of stay for Class 1 is 5 days, Class 2 is 4.5 days, and Class 3 is 6 days. The total cost of treating diabetes and hypertension includes drug costs, laboratory expenses, treatment fees, doctor's fees, and other administrative expenses. The average total cost of therapy per day for diabetes treatment is highest in Class 1, reaching IDR 2,957,591, followed by Class 3 at IDR 2,463,497, and Class 2 at IDR 1,219,075. The highest average cost for hypertension is IDR 3,705,129 in Class 1, followed by IDR 2,284,951 in Class 2, and IDR 1,837,685 in Class 3. The average total therapy cost in Class 1 amounts to IDR 33,313,600, while Class 3 totals IDR 25,807,092, and Class 2 totals IDR 15,768,117.

Table 4. Average Cost of Inpatients with a Diagnosis of Diabetes Mellitus and Hypertension

Class	Average length of stay	Average total cost of therapy per day		Total Average Cost of Therapy
		Diabetes	Hypertension	
Class 1	5 days	IDR 2,957,591	IDR 3,705.129	IDR 33,313,600
Class 2	4.5 days	IDR 1,219,075	IDR 2,284.951	IDR 15,768,117
Class 3	6 days	IDR 2,463,497	IDR 1,837.685	IDR 25,807,092

Discussion

The majority of the sample comprised female patients, consistent with existing research indicating that women face a higher risk of developing diabetes. Men and women have different cholesterol levels, and type 2 diabetes mellitus is more common in women. Men have an average body fat percentage of 15-20%, compared to 20–25% for women. Because women's fat levels increase faster than men's, women are more likely to develop diabetes mellitus than men, which is 2-3 times more common[11,12]. The prevalence of patients over 50 years of age in this study was quite high. This is in line with other research showing that a higher risk of developing diabetes exists in 75% of individuals aged between 39 and 70 years living in middle- and low-income countries. Age is a factor in the cardiovascular and cerebral consequences of type 2 diabetes. Age-related metabolic decline leads to increased blood sugar levels, body mass index, dyslipidemia, and levels of blood pressure control indirectly, which may increase the risk of cardiovascular disease. The incidence of cardiovascular disease can increase significantly in diabetes sufferers due to high blood pressure, especially increased systolic blood pressure. In diabetes patients, there are changes in the structure and function of blood vessels as a result of abnormal metabolism and an increase in systolic blood pressure, which encourages and accelerates pathogenic changes in diabetes[5,13]. Patients belonging to class 3 dominated the treatment class in this study. BPJS class 3 is the lowest class, with a contribution of IDR 35,000 per month for independent or individual BPJS membership. Meanwhile, contributions from Penerima Bantuan Iuran (PBI) participants will be paid by the state. There are no significant differences in services between classes 1, 2, and 3. For treatment, in general, the facilities provided are the same; only the number of patients per inpatient room and the facilities provided are different. The most common type of financing in this research is BPJS. There is a program JKN, which began to be implemented comprehensively in 2016. BPJS covers most types of public health financing. BPJS Health has adopted Prolanis, a health service system for controlling type 2 diabetes mellitus and hypertension, since 2014. In addition, management of chronic diseases such as diabetes and hypertension in Indonesia is guaranteed by BPJS with several other programs such as the Program Rujuk Balik (PRB)[10].

The most widely used therapy is insulin, while the oral therapy that is often used is metformin, acarbose, and the sulfonylurea group, such as glicazid and glimepiride. The main goal of diabetes management is the prevention of long-term complications. An important way to achieve this goal is to improve and control blood sugar well over time. This is a challenge in itself because of the progressive nature of the disease, which requires timely optimization of treatment. In the majority of cases, insulin therapy is required. It is important that a

patient-centred approach be used for therapy selection. Factors to consider include effectiveness, cost, potential side effects, comorbidities, the risk of hypoglycemia, and patient preference. If HbA1C levels increase to 7.5% while on treatment or if initial HbA1C is ≥9%, combination therapy with two oral medications or with insulin may be considered[14]. This is what can increase the burden of medical costs. Insulin resistance and hypertension are components of the metabolic syndrome and often occur together. A clinical study shows that around 50% of people with hypertension experience hyperinsulinemia or glucose intolerance, while 80% of diabetes patients suffer from hypertension[15,16]. Short-term studies comparing insulin show that most people with type 2 diabetes who are not well controlled with oral therapy can achieve blood glucose control on target and without high rates of hypoglycemia using insulin. Another challenge that can occur is the type of insulin that will be chosen, so it is necessary to consider the need for optimization of treatment[17,18].

Diabetes patients have long used angiotensin-converting enzyme inhibitors (ACEI) and angiotensin receptor blockers (ARB) as their primary antihypertensive treatments. Renin-angiotensin-aldosterone system (RAAS) inhibitors, like ACEIs and ARBs, have been linked to keeping hypertensive patients from getting the new onset of DM, and they work especially well for those who have albuminuria. CCB is considered a potential first-line treatment for hypertensive diabetics, especially in the elderly with isolated systolic hypertension. The use of beta blockers is not recommended in diabetic patients due to potential adverse metabolic effects, including increased triglyceride levels, decreased HDL cholesterol levels, weight gain, masking hypoglycemia, and impairing insulin sensitivity. Additionally, the use of beta blockers in non-diabetic individuals, especially those who are overweight or obese, is thought to increase the risk of developing diabetes compared with alternative medications[19–22]. Table 4 reveals that the average cost of therapy in class 1 surpasses that of other classes. The total cost of therapy calculated in this study includes drug costs, laboratory costs, treatment costs, doctor's fees, and other administrative costs. Diabetes management is associated with rising costs and increasing healthcare expenditures. According to research, the complications and macrovascular disease frequently caused by type 2 diabetes account for a large amount of the costs associated with the disease[1]. The average cost for the longest length of stay is in class 1. This could be due to the larger difference in room costs compared to other classes. The average cost for class 2 length of stay is the lowest because it is caused by the patient's length of stay being the shortest compared to the others. The average cost of the length of stay in class 3 is still less than the average cost of the length of stay in class 1, even though it has the longest length of stay. This difference could be due to different room costs. In class 3, each treatment room will be occupied by 6 patients; in class 2, treatment rooms will be occupied by 4 patients; and in class 1, only 2 patients will be occupied, so the costs will vary. However, the study has certain limitations. It solely focuses on cost analysis without considering other potential factors influencing expenses, such as treatment types, additional services provided, or patient demographics. Moreover, the study restricts its scope to room costs and length of stay, ignoring broader healthcare system intricacies that could influence overall expenditure. Nevertheless, its strength lies in highlighting the correlation between patient class, length of stay, and associated costs, shedding light on potential cost-saving measures based on occupancy rates and room utilization strategies within different classes of patients.

Conclusions

Research indicates a predominance of female patients aged 51–60 with diabetes and hypertension. Generally, these patients utilize BPJS Class 3 insurance for treatment financing. Treatment primarily involves insulin therapy and a combination of antihypertensive medications, potentially elevating treatment expenses due to the use of multiple hypertension drugs. Factors such as additional comorbidities, treatment duration, and variations in treatment classes can impact overall costs in this study.

Acknowledgment

We acknowledge support from LPPM UNIMMA for funding this research under the Program Revitalisasi Visi Institusi (PRVI) scheme.

Author Contribution

Study design	:	FY, WSH
Data acquisition	:	FY, NDK
Data analysis	:	FY, WSH, NDK
Manuscript writing	:	FY, WSH, NDK RKM, KMH

Competing Interests

We declare no competing interests associated with this research.

Abbreviation

ACEI inhibitors	:	Angiotensin-Converting Enzyme Inhibitors
ARB	:	Angiotensin Receptor Blockers
BPJS	:	Badan Penyelenggara Jaminan Sosial (Social Health Insurance Administration Body)
CKD	:	Chronic Kidney Diseases
HHD	:	Hypertensive Heart Disease
INA-CBGs	:	Indonesian - Case Based Groups
JKN	:	Jaminan Kesehatan Nasional (National Health Insurance)

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