Analysis of Direct Medical Cost of Insulin Treatment in Outpatient with Type 2 Diabetes Mellitus on Payer Perspective

Wahyudi Wahyudi[1] , Ade Risma[2] , Feby Ayu Putri [3] , Munanda Andin[4], Juhri Panjaitan[5], Sultan Faqih[6]

[1,2,3,4,5,6]Faculty of Public Health, Universitas Islam Negeri Sumatera Utara, Sumatera Utara, Indonesia

ABSTRACT: Type 2 diabetes mellitus (T2DM) is a global health issue that affect around 643 million people in 2030. Estimated prevalence of T2DM in adults aged 20–79 years has more than tripled, from an estimated 151 million (4.6% of the global population at the time) to 537 million (10.5%) today. This study analyze direct medical costs of insulin treatment with in T2DM outpatients. This retrospective descriptive economic evaluation was conducted in April 2023 on the basis of payer (called as Badan Penyelenggara Jaminan Sosial abbreviated as BPJS) perspective, then only direct costs were included in this study. Component of direct medical cost of this research include drug acquisition costs, physician service, laboratory examination, medical execution and administration. 58 T2DM outpatients met inclusion criteria in Universitas Sumatera Utara was recruited by simple random sampling. Result of this study show that most of respondent were aged 56-65 years (58.89%). Cost/year/patient of drug acquisition costs was Rp.4,7228,970.14; physician service was Rp.1,865,172.41; laboratory examination was Rp.443,379.31; and medical execution was Rp.31,030.48 and administration was Rp.300,000.00, respectively. Drug acquisition costs was the largest cost in treating T2DM patients with insulin treatment.

KEYWORDS: Direct medical costs, insulin treatment, T2DM, outpatients

INTRODUCTION

T2DM is a chronic disease that has many complications, decreased quality of life, premature death, and significant economic burden. Patients living in low- and middle-income countries are most often affected by the disease (Nedyalkova et al., 2020). Type 2 diabetes mellitus (T2DM) is one of the degenerative diseases that become a risk factor for cardiovascular diseases such as stroke, ischemic heart disease, and chronic kidney diseases. (Larasanty et al., 2018). Chronic hyperglycemia caused by changes in insulin secretion or actions performed is a sign of diabetes mellitus (DM). The incidence and development of type 2 diabetes mellitus can be caused by a modern lifestyle, which includes an unhealthy diet, sedentary lifestyle, and stress. (Novita et al., 2022).

About 90% of diabetes cases are type 2 diabetes mellitus. There is a decrease in insulin's ability to stimulate glucose uptake by peri in people with type 2 diabetes (T2DM). Pheral tissue and stops the liver from producing glucose, known as insulin resistance.1. Causes of slurry resistance: obesity, lack of physical activity, and aging are the main factors that cause slurry resistance. Pancreatic cell dysfunction is an additional factor that causes T2DM. In the first phase of insulin secretion, the cells undergo bank-disordered. It occurs when secreted insulin fails to compensate for insulin resistance. If not treated properly, pancreatic cells will be damaged. It will increase gradually and lead to insulin deficiency; As a result, the patient will need exogenous insulin. In cases where pancreatic cells cannot produce insulin instantly and quickly to compensate for insulin resistance, fasting hyperglycemia. (Triyaniarta et al., 2022).

In 2019, Indonesia had 10.7 million people with diabetes, which is the highest absolute prevalence worldwide.1 This number is expected to increase to 16.6 million by 2045, with uncontrolled diabetes being one of the top 3 causes of death in Indonesia in 2017.A global DISCOVER study found that people with type 2 mellitus diabetes (T2DM) who received second-line glucose-lowering therapy on average in Indonesia had hemoglobin The second highest A1C Level (HbA1c) at 8.7% among the countries studied, the highest after Oman at 8.8%. (Hidayat et al., 2022).

As diabetes prevalence and costs per person increase, the economic costs of diabetes increased by 26 percent from 2012 to 2017. (Nedyalkova et al., 2020). Since diabetes is a chronic condition, it requires ongoing clinical care and treatment, which adds significantly to the cost of healthcare. Hospital and prescription expenses paid for by people, families, governments, and private insurers are among the direct costs of managing type 2 diabetes and providing care for diabetic sequelae such as kidney failure, blindness, and amputations. (Erzse et al., 2019).

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However, no more extensive epidemiological study has been carried out that focuses on diabetes patients in the general population, including death. Patients were put on a regular schedule upon receiving a diabetes diagnosis, during which time their weight, blood pressure, and fasting plasma glucose (FPG) were tested and their therapy was modified as necessary. The intervals between these visits varied. (Byberg et al., 2020). Among the antidiabetic medications available to treat people with type 2 diabetes mellitus (T2DM) is insulin. There are various formulations of insulin, and each has its own cost and efficacy. (Larasanty et al., 2018).

It is even more important to consider this when analyzing the overall cost of diagnostic tests, new drugs, or standard treatment protocols in low- and middle-income countries with limited resources. Randomized controlled trials are an ideal place to collect data on the cost and outcome of a therapy or intervention, making it an ideal tool for assessing efficacy or effectiveness. (Gupta et al., 2020). The purpose of this study was to analyze the direct medical costs of insulin therapy for outpatient millitus type 2 diabetes patients.

METHOD

This quantitative research includes retrospective data collection with a descriptive approach. This study collected data on patients with type 2 diabetes who used insulin at the University of North Sumatra Medan General Hospital, this included costs for drugs, doctors, medical actions, and administration. This research takes the perspective of BPJS with data collection in February-July 2023.

1. The inclusion standards in this study are as follows:
a. Type 2 Diabetes Mellitus patients.
b. Is a BPJS patient.
c. Using insulin therapy.
d. Over 18 years old.
e. Ready to be a respondent.
2. The exclusion criteria in this study are as follows:
a. Patients seek treatment not routinely during the data collection timeline.
b. The patient is not taking insulin.

RESULT

Table I. Characteristics of Respondents Based on Age

Characteristic	Amount	Percentage N=58
Age		
25-35	2	3.44%
36-45	2	3.44%
46-55	8	13.79%
56-65	33	56.89%
66-75	9	15.51%
76-85	1	1.72%
Types of Kelamim		
Man	32	55.17%
Woman	26	44.82%

Table 1 shows that the most common age of type 2 DM patients taking insulin treatment is between the ages of 56 and 65 years, with a percentage of 58.89%. The character of type 2 DM sufferers based on gender, more type 2 DM sufferers who use insulin are men, with a percentage of 55.17. While female patients amounted to 44.82%.

**Table II. Direct Medical Costs of T2 DM Insulin Therapy Per Year**

Types of Fees	Total/year	Average/Patient
Drug Acquisition Costs	274.280.268,00	4,728.970.14
Physician Service	108.180.000,00	1,865.172.41
Laboratory Examination	25.716.000,00	443,379.31

Medical Execution	1.800.000,00	31,030.48
Administration	17.400.000,00	300,000.00
Total	**427.376.268,00**	**7,368,556.34**

Based on Table II, the total cost of insulin therapy for a year from each patient is Rp.7,368,556.34 with details of drug costs of Rp.4,7228,970.14, doctor costs of Rp.1,865,172.41, laboratory costs of Rp.443,379.31, medical action costs of Rp.31,030.48, and administrative costs of Rp.300,000.00.

Further analysis is carried out by the creation of brought curves I

Direct Medical Cost/month/patient
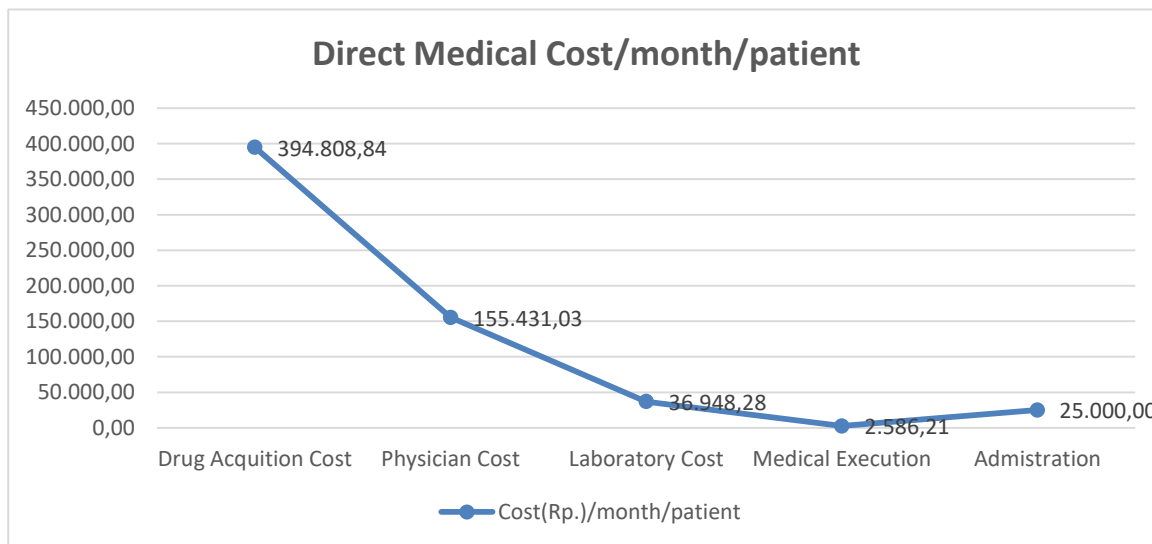
Based on the curve above, it can be seen that the order of the average direct medical costs is from highest to lowest. The highest cost is the cost of drugs which is Rp.394,808.84 after that is the doctor's fee of Rp.155,431.03 then laboratory costs of Rp.36,948.28 administrative costs of Rp.25,000.00 and finally the cost of medical actions of Rp.2,586.21.

Tabel III. Drug Use

IT/ IT+ADO Therapy provided	*n*	Percentage
Novorapid + Lantus	33	56.9%
Novomix	6	10.3%
Novorapid + Levemir	6	10.3%
Apidra + Lantus	4	6.9%
Ryzodeg	3	5.2%
Apidra + Levemir	2	3.5%
Ryzodeg + Metformin*	2	3.5%
Novomix + Acarbose*	1	1.7%
Novomix + Glimepirid*	1	1.7%
Total	**58**	**100%**

Table III of drug use data, that this treatment is most widely shared is a combination of Novorapid and lantus treatment, which is 33 patients and the treatment is a combination of Novomix and Gllimepyrid.

DISCUSSION

Patients were grouped according to their age to give a clearer picture of the risk of diabetes mellitus, grouped into 26-35 years, 36-45 years, 46-55 years, 56-65 years, and >65 years. Research conducted by (Nanayakkara et al., 2021) regarding Impact of age at type 2 diabetes mellitus diagnosis on mortality and vascular complications: systematic review and meta-analyses said them Advanced age is a strong predictor of vascular complications, so individuals with diabetes diagnosed at a younger age tend to have a lower absolute risk of events compared to individuals with diabetes diagnosed at an older age. However, the impact of aging and disease duration may increase over time, resulting in premature complications and death at a younger age. Based on the

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data that has been analyzed, the most dominant age affected by type 2 diabetes using insulin therapy is the age of 56-65 with a percentage of 58.89%. Age (45-69 years), marital status, hypertension, obesity, and family history of diabetes are the most important risk factors for diabetes. (Chawla et al., 2020). Shrinkage of mitochondrial activity in muscle cells by 35% in older people is associated with an increase in muscle fat by 30% and causes insulin resistance. (Arvita, 2024).

Based on gender, more people with type 2 diabetes taking insulin were men 55.17% while female patients were 44.82%. This research is in line with research conducted (Ciarambino et al., 2022) in a Influence of Gender in Diabetes Mellitus and Its Complication which states that The prevalence of type 2 diabetes is also characterized by gender differences. The overall global prevalence of diabetes is higher in men, but there are more women with type 2 diabetes than men. Gender plays a fundamental role in the genesis of diabetes and the development of various complications. Meanwhile, (Tseng et al., 2022) research suggests that Men reported better psychosocial features than women except health literacy. According to the literature, women with diabetes tend to seek information about their condition and pay more attention to the symptoms. However, they often do not utilize this knowledge to fully manage their condition.

Based on Table II, the highest direct medical costs of inspian therapy for patients with type 2 DM for a year are drug costs, which are Rp. 4,728,970.14, followed by doctor fees of Rp. 1,865,172.41, then laboratory costs of Rp. 443,379.31 as well as administrative costs of 300,000.00 and finally the lowest costs are medical costs of Rp. 31,030.48. The total direct medical cost of inpatient type 2 DM patients for a year is Rp.7,368,556.34. BPJS claim fees include INA-CBG package rates and non-INA-CBG rates (chronic disease claim fees), while administrative costs, medical services, medical support, and medicines are included in direct medical costs. (Fitria et al., 2023). Analysis of health outcome data for T2DM with costs incurred during the treatment cycle is useful to keep patients at the lowest risk of complications and provides improved data to make better decisions on how to provide optimal healthcare services in the vicinity, as well as patient self-management education. (Doyle et al., 2022). In curve 1 it can also be seen that the highest cost of each patient per month is the cost of drugs, which is Rp.394,808.84 followed by doctor fees of Rp.155,431.03 laboratory costs of Rp.36,948.28 then Rp.25,000.00 and the lowest cost is the cost of medical action which is Rp.2,586.21. The size of the total direct medical costs incurred by patients is determined by the amount of drug costs. (Udayani & Adnyani, 2022).

Based on table III of drug use data, the most widely shared therapy is the combination therapy of Novorapid and Lantus, which is 56.9% or 33 patients. Then followed by the administration of novomic therapy and combination therapy Novorapid with Levemir which both have a percentage of 10.34% or as many as 6 patients who use it. In line with research by (Udayani et al., 2021) regarding risk analysis using a combination of Insulin in Type 2 DM Outpatients at One of the Denpasar City Hospitals, where patient work profiles are used to select insulin combinations to mimic the body's normal insulin secretion patterns. The combination of novorapid insulin with levemir and lantus has a rapid onset of action and a longer duration of action. This combination makes it possible to mimic the body's normal insulin profile. Faster aspart IAsp trademarked (NovoRapid®/NovoLog®) is an IAsp in a new formulation developed to achieve accelerated initial absorption after subcutaneous administration compared to Previously developed fast-acting insulin. (Haahr & Heise, 2020). Insulin glargine, which was first developed by Sanofi and has the registered trademark Lantus®, was approved in 2000 by the US FDA and EMA to improve glycemic control in adults and children with type 1 diabetes mellitus (T1DM) and type 2 diabetes mellitus (T2DM). (Wang et al., 2022).

CONCLUSIONS

Based on the results of the study, it can be concluded that the direct medical costs of insulin therapy in type 2 DM patients at RSU USU Medan are the highest drug costs and the lowest is administrative costs. the total cost of insulin therapy for a year from each patient is Rp.7,368,556.34 with details of drug costs of Rp.4,7228,970.14, doctor costs of Rp.1,865,172.41, laboratory costs of Rp.443,379.31, medical action costs of Rp.31,030.48, and administrative costs of Rp.300,000.00. The most widely given therapy is combination therapy Novorapid with Lantus was 56.9% or 33 patients. The cost of the drug determines the total direct medical cost of the patient.

THANK YOU NOTE

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