

CHAPTER I

INTRODUCTION

1.1 Research Background

Noncommunicable diseases (NCDs), commonly known as degenerative diseases, are one of the major public health challenges of the 21st century due to their high morbidity and mortality rates, making them a global concern¹. The World Health Organization (WHO) states that NCDs are the leading cause of death worldwide, especially chronic diseases such as cardiovascular disease, diabetes, cancer, and chronic respiratory disease. These diseases account for 7 of the 10 leading causes of death, equivalent to 74% of total deaths globally. More than 15 million people die each year from major noncommunicable diseases, with ages ranging from 30 to 69 years. A total of 85% of these premature deaths occur in low- and middle-income countries.

Data and statistics on diabetes reveal a rapidly growing global burden on individuals, families, and countries. According to data from the IDF Diabetes Atlas (2021), 10.5% of the adult population aged 20 to 79 years live with diabetes. Diabetes mellitus contributes to high morbidity and mortality rates in both developed and developing countries, as diabetes itself is a chronic disease that is considered catastrophic². According to the IDF, diabetes will cause 3.4 million deaths in 2024, which is equivalent to one death every 9 seconds³.

According to official data from the International Diabetes Federation (IDF), Indonesia ranks fifth among countries with the highest number of diabetes sufferers, with 20.4 million adults, and this number is expected to increase to 28.6 million adults by 2050, contributing to an increase in treatment costs and a decline in the quality of human resources. As reported by the Yogyakarta City Government

¹ Elpira Asmin et al., "Penyuluhan Penyakit Tidak Menular Pada Masyarakat," *Community Development Journal : Jurnal Pengabdian Masyarakat* 2, no. 3 (November 16, 2021): 940–44, <https://doi.org/10.31004/cdj.v2i3.2769>.

² Pomantow A L Roeroe, Bisuk P Sedli, and Octavianus Umboh, "Faktor Risiko Terjadinya Coronavirus Disease 2019 (Covid-19) Pada Penyandang Diabetes Melitus Tipe 2," n.d., <https://doi.org/10.35790/ec1.9.1.2021.32301>.

³ Dianna J. Magliano and Edward J. Boyko, "Atlas Diabetes IDF," *National Library Of Medicine* 10 (2021).

(2025), DIY is one of the provinces with the highest prevalence of diabetes mellitus at 4.5%. Based on data from the Bantul District Health Office (Dinkes), there has been an increase in the number of diabetes cases each year. In 2022, there were 15,727 cases and in 2023 it increased to 18,294 cases. From January to September 2024, the number of cases reached 18,520, compared to the same period in the previous year. As a referral hospital located in the southern part of the Special Region of Yogyakarta, PKU Muhammadiyah Hospital Bantul receives many visits from type 2 DM patients every year. This hospital is a type A hospital that provides services and several antidiabetic therapy regimens, especially for patients with type 2 DM.

In the treatment of type 2 DM, patients are advised to undergo combination therapy. This combination generally consists of metformin as the first line and other antidiabetic drugs that have different mechanisms of action⁴. Based on their mechanism of action, oral antidiabetic drugs are divided into five groups, such as sulfonylureas, glinides, thiazolidinediones, alpha-glucosidase inhibitors, and biguanides⁵. The success of antidiabetic therapy depends not only on assessing drug combinations but also on patient compliance in taking medication regularly, which is crucial for achieving the expected effectiveness targets⁶.

One of the fundamental problems is that it is not yet known which combination of oral antidiabetic therapy is the most effective and efficient between metformin-sulfonylurea and metformin-DPP-4 inhibitor in lowering blood glucose levels in type 2 DM patients at PKU Muhammadiyah Hospital in Bantul. Citing a recent study by Nuring Novita (2024), the combination of metformin-DPP-4 inhibitor is more cost-effective than metformin-sulfonylurea due to the lower risk of hypoglycemia and improved quality of life for patients, but it is relatively

⁴ Perkumpulan Endokrinologi Indonesia., "Pedoman Pengelolaan Dan Pencegahan Diabetes Melitus Tipe 2 Dewasa Di Indonesia 2021," *Global Initiative for Asthma*, 2021.

⁵ Fatimah Eliana, "Penatalaksanaan DM Sesuai Konsensus Perkeni 2015," *Satelit Simposium 6.1 DM Update Dan Hb1C*, 2015.

⁶ Like Efriani, "Hubungan Karakteristik Dengan Kepatuhan Minum Obat Antidiabetes Pasien Diabetes Melitus Di Pelayanan Kesehatan Kota Cirebon," *Borneo Journal of Pharmascientech* 6, no. 2 (2022), <https://doi.org/10.51817/bjp.v6i2.425>.

expensive⁷. Meanwhile, a study at the Kulon Progo Community Health Center (2023) found that metformin and sulfonylurea are the most commonly used combination of antidiabetic drugs because it is more economical and affordable⁸. This illustrates a preference for economic conditions. DIY is one of the regions with a low minimum wage. According to the DIY Statistics Agency (2025), Yogyakarta has a high population density of 3.78 million people with a distinctive socioeconomic profile⁹. This inconsistency is reinforced by the lack of a comparative evaluation that combines clinical outcomes and direct medical costs at PKU Muhammadiyah Bantul Hospital, which has elderly patients and a specific INA-CBG's tariff policy.

Healthcare facilities must continue to provide the best services even with limited budgets, necessitating appropriate strategies to balance resources¹⁰. Therefore, a cost-effectiveness analysis is required at PKU Muhammadiyah Hospital in Bantul to recommend the most affordable and effective antidiabetic therapy that achieves the same treatment goals by comparing clinical outcomes with the costs incurred by patients¹¹.

⁷ Nuring Novita Kusumawati and Tri Murti Andayani, "Review: Cost-Effectiveness Analysis Metformin Dan Dipeptidyl Peptidase-4 Inhibitor Dibandingkan Dengan Metformin Dan Sulfonilurea Pada Pasien Diabetes Melitus Tipe 2," *JPSCR: Journal of Pharmaceutical Science and Clinical Research* 9, no. 2 (December 9, 2024): 325, <https://doi.org/10.20961/jpscr.v9i2.91911>.

⁸ Sulastri, Dyah Aryani Perwitasari, and Woro Supadmi, "Analisis Efektivitas Biaya Penggunaan Metformin Dan Metformin-Glimepirid Pada Pasien Diabetes Melitus Tipe 2 Di Dua Puskesmas Kulon Progo Yogyakarta," *Indonesian Journal of Pharmacy and Natural Product* 6 (September 2023), file:///C:/Users/Administrator/Downloads/5+IJNP+Sept+2023.pdf.

⁹ BPS Provinsi D.I. Yogyakarta, *Provinsi Daerah Istimewa Yogyakarta Dalam Angka 2025* (Yogyakarta: BPS Provinsi D.I. Yogyakarta, 2025), <https://yogyakarta.bps.go.id/id/publication/2025/02/28/62dc9b4620317fb350b9ba3e/provinsi-daerah-istimewa-yogyakarta-dalam-angka-2025.html>.

¹⁰ Yusransyah Yusransyah Et Al., "Analisis Efektivitas Biaya Pasien Covid-19 Menggunakan Terapi Oksigen Dan Remdesivir Di Rsud Kabupaten Tangerang," *Jfionline | Print Issn 1412-1107 | E-Issn 2355-696x* 14, No. 1 (2022), <https://doi.org/10.35617/Jfionline.V14i1.75>.

¹¹ I Made Agus Sunadi Putra, Ni Nyoman Wahyu Udayani, And Herleeyana Meriyani, "Analisis Efektivitas Biaya Penggunaan Terapi Insulin Dan Insulin Kombinasi Pada Pasien Diabetes Mellitus Tipe Ii Rawat Jalan Di Rsup Sanglah," *Jurnal Ilmiah Medicamento* 3, No. 2 (September 29, 2017), <https://doi.org/10.36733/Medicamento.V3i2.907>.

1.2 Research Problems

The research problems are based on the background of the above issues, namely:

1. What are the patient profiles and costs associated with the use of metformin-sulfonylurea and metformin-DPP-4 inhibitor combination therapies to achieve treatment effectiveness targets?
2. How does the effectiveness of metformin-sulfonylurea combination therapy compare to metformin-DPP-4 inhibitor combination therapy in patients with type 2 DM in the inpatient ward of PKU Muhammadiyah Bantul Hospital?
3. How does the Cost-Effectiveness Analysis (CEA) compare between metformin-sulfonylurea combination therapy and metformin-DPP-4 inhibitor combination therapy?

1.3 Research Objectives

The objectives of this study are as follows:

1. To evaluate the patient profile and costs of combination therapy with metformin-sulfonylurea and metformin-DPP-4 inhibitor in an effort to achieve treatment effectiveness targets.
2. To determine the comparative effectiveness of combination therapy between metformin-sulfonylurea and metformin-DPP-4 inhibitor.
3. To compare the Cost-Effectiveness Analysis (CEA) between the combination of metformin-sulfonylurea and metformin-DPP-4 inhibitor to determine the more effective and economically efficient therapy.

1.4 Research Benefits

The results of this study are expected to serve as a source of information for further research, particularly the development of combination therapy using metformin-sulfonylurea and metformin-DPP-4 inhibitor in patients with type 2 DM.

1.5 Authenticity of Research

This study concerns a cost-effectiveness analysis that has been conducted by several researchers, as shown in Table 1 below.

Table 1 Authenticity of Research

Research Title	Type of Research	Variables	Results	Research Differences
Cost-Effectiveness Analysis of Metformin+Dipeptidyl Peptidase-4 inhibitors compared to Metformin+Sulfonylurea for Treatment of Type 2 Diabetes ¹²	Non-Experimental	Dependent: Cost-effectiveness of combination therapy Independent: Types of combination therapy: Metformin-sulfonylurea and metformin-DPP-4 inhibitor	Combination therapy with metformin and a DPP-4 inhibitor is more cost-effective than the combination of metformin and sulfonylurea, which has a quality-of-life score of 0.61 and an ICER of \$19,420.	This study was conducted in the United States using a Markov model and sensitivity analysis. The effectiveness of this study was monitored through life-years gained.
Review: Cost-Effectiveness Analysis of Metformin and Dipeptidyl Peptidase-4 Inhibitors Compared to Metformin and Sulfonylureas in Patients with Type 2 Diabetes Mellitus ¹³	Non-Experimental	Dependent: Cost-Effectiveness Analysis (CEA) Independent: Combination therapy with oral antidiabetic drugs, namely metformin-sulfonylurea and metformin-DPP-4 inhibitor	Research conducted in various countries has shown that metformin and DPP-4 inhibitor are more cost-effective than metformin-sulfonylurea. One study in the United States found an ICER of \$19,420 and a quality-of-life score of 0.61.	This study used a systematic review of various online journals that met the criteria related to the cost-effectiveness of metformin and DPP-4 inhibitor therapy compared to metformin and sulfonylurea and assessed the clinical effectiveness that can be measured by QALY.
Comparison of the Effectiveness of Metformin-Glimepiride Versus Metformin-Vildagliptin on Blood Sugar Levels in Type 2	Non-Experimental	Dependent: Changes in blood glucose levels after undergoing therapy Independent:	There was no difference in effectiveness between the two combinations in terms of Random Blood Glucose and HbA1c measurements	This study employed a prospective cohort analysis method. The research was conducted in an outpatient setting with clinical monitoring of

¹² Christina S. Kwon, Enrique Seoane-Vazquez, And Rosa Rodriguez-Monguio, "Cost-Effectiveness Analysis Of Metformin+Dipeptidyl Peptidase-4 Inhibitors Compared To Metformin+Sulfonylureas For Treatment Of Type 2 Diabetes," *Bmc Health Services Research* 18, No. 1 (2018), <https://doi.org/10.1186/S12913-018-2860-0>.

¹³ Nuring Novita Kusumawati And Tri Murti Andayani, "Review: Cost-Effectiveness Analysis Metformin Dan Dipeptidyl Peptidase-4 Inhibitor Dibandingkan Dengan Metformin Dan Sulfonilurea Pada Pasien Diabetes Melitus Tipe 2," *Jpscr: Journal Of Pharmaceutical Science And Clinical Research* 9, No. 2 (December 9, 2024): 325, <https://doi.org/10.20961/Jpscr.V9i2.91911>.

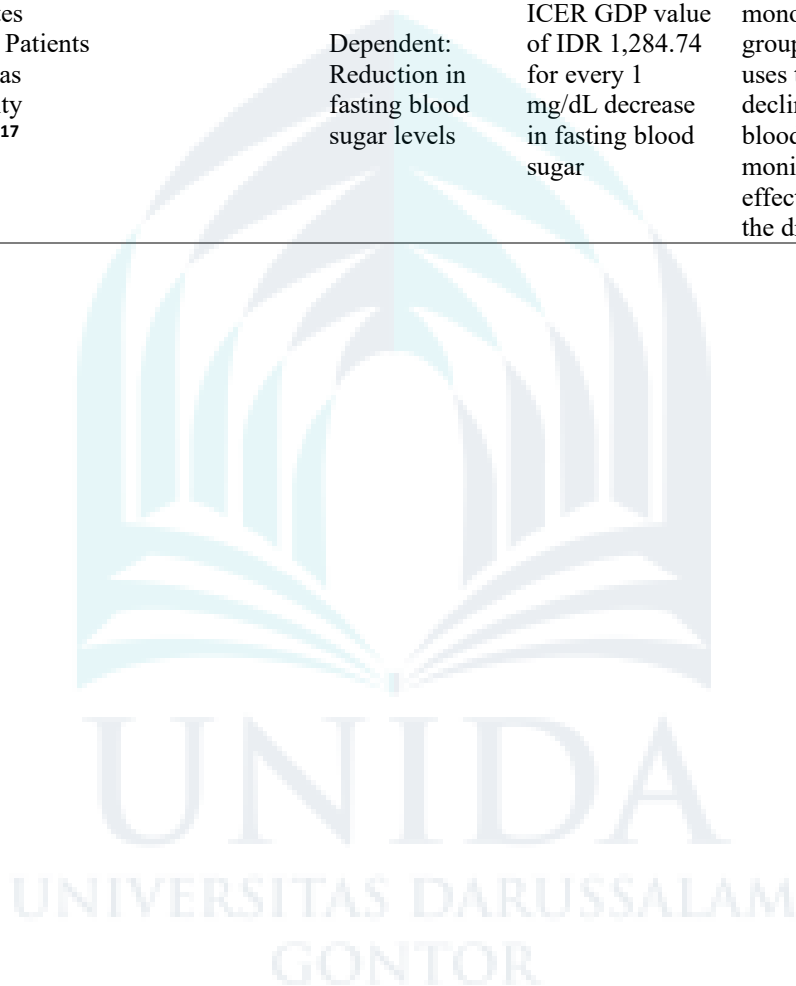
Research Title	Type of Research	Variables	Results	Research Differences
Diabetes Mellitus at Sultan Agung Islamic Hospital, Semarang, 2022 ¹⁴		Combination therapy with metformin-glimepiride versus metformin-vildagliptin		HbA1c and Random Blood Glucose (RBG) values
Cost Analysis of Type 2 Diabetes Mellitus Treatment at PKU Muhammadiyah Hospital in Bantul, Yogyakarta ¹⁵	Non-Experimental	Dependent: Cost-Effectiveness Analysis (CEA) Independent: Type 2 diabetes mellitus therapy	The highest average total cost of therapy for DM without complications is IDR 3,853,084 for Novorapid-decudin therapy. Meanwhile, the highest average total cost of therapy for DM with complications is IDR 9,499,936 for Novorapid-onglyza therapy for coronary heart disease complications	This study used a descriptive method and combined oral antidiabetic therapy with insulin, analyzing only the cost of medication without considering the clinical effectiveness of the drug
Cost-Effectiveness Analysis of the Use of Combination Oral Antidiabetic Drugs in Outpatients with Type II Diabetes Mellitus at Dr. H. Moch. Ansari Saleh Regional General Hospital, Banjarmasin ¹⁶	Non-Experimental	Dependent: Cost-Effectiveness Analysis (CEA) Independent: Use of combination oral antidiabetic drugs	The most widely used and most cost-effective combination of oral antidiabetic drugs in this study was glimepiride and metformin, with a percentage of 46% based on Random Blood Glucose tests and an ACER	This study was conducted in outpatient facilities during the period 2014-2017

¹⁴ Willi Wahyu Timur, Amalia Ayu Rizkiani, And Naniek Widyaningrum, "Perbandingan Efektivitas Metformun-Glimepirid Versus Metformin-Vildagliptin Terhadap Kadar Gula Darah Pasien Dm Tipe 2 Di Rumah Sakit Islam Sultan Agung Semarang 2022," *Cendekia Journal Of Pharmacy* 6, No. 2 (2022), <https://doi.org/10.31596/Cjp.V6i2.215>.

¹⁵ Faridah Baroroh, Wahyu Yuliana Solikah, and Qarriy Aina Urfiyya, "Analisis Biaya Terapi Diabetes Melitus Tipe 2 Di Rumah Sakit Pku Muhammadiyah Bantul Yogyakarta," *Jurnal Farmasi Sains Dan Praktis* I, no. 2 (2016).

¹⁶ Nazhipah Isnani Et Al., "Analisis Efektivitas Biaya (Cost-Effectiveness) Penggunaan Antidabetes Oral Kombinasi Pada Pasien Diabetes Melitus Tipe Ii Rawat Jalan Di Rsud Dr. H. Moch. Ansari Saleh Banjarmasin," *Jurnal Insan Farmasi Indonesia* 4, No. 1 (2021), <https://doi.org/10.36387/Jifi.V4i1.683>.

Research Title	Type of Research	Variables	Results	Research Differences
Cost-Effectiveness of Metformin-Glimepiride Use on Fasting Blood Sugar Level Reduction in Type 2 Diabetes Mellitus Patients at Andalas University Hospital ¹⁷	Non-Experimental	Dependent: Analysis of the cost-effectiveness of metformin-glimepiride use. Dependent: Reduction in fasting blood sugar levels	value of \pm IDR 1,252.00. Metformin-glimepiride has a higher total cost and better effect compared to metformin alone, which has an ICER GDP value of IDR 1,284.74 for every 1 mg/dL decrease in fasting blood sugar	This study compares the intervention and control groups, namely the combination therapy and monotherapy groups. This study uses the average decline in fasting blood sugar to monitor the effectiveness of the drug



¹⁷ Najmiatul Fitria Et Al., "Analisis Efektivitas Biaya Penggunaan Metformin-Glimepirideterhadap Penurunan Kadar Gula Darah Puasa Pada Pasien Diabetes Mellitus Tipe 2 Di RS Universitas Andalas," *Jurnal Sains Farmasi & Klinis* 9, No. Sup (2023), <https://doi.org/10.25077/jsfk.9.Sup.202-207.2022>.